A FEASIBILITY STUDY FOR THE MADAOUELA URANIUM PROJECT, NIGER

Prepared For

GoviEx Uranium Inc.

Qualified Persons

Robert Bowell, PhD, P.Geo, E.Geol, C.Chem., C.Geol., Corporate Consultant (Geochemistry)

Guy Dishaw, P.Geo., Principal Consultant (Mining Geology)

Jurgen Fuykschot, MSc, MBA, MAusIMM CP, Principal Consultant (Mining Engineering)

Colleen MacDougall, PEng., Principal Consultant (Mining Engineer)

Effective Date – November 01, 2022

SRK Consulting (UK) Limited
31342

SRK Legal Entity:		SRK Consulting (UK) Limited
SRK Address:		5th Floor Churchill House 17 Churchill Way Cardiff, CF10 2HH Wales, United Kingdom.
Date:		November, 2022
Project Number:		31342
SRK Project Director:	Robert Bowell	Corporate Consultant (Geochemistry)
SRK Project Manager:	John Merry	Principal Consultant (ESG)
Client Legal Entity:		GoviEx Uranium Inc.
Client Address:		PO Box 805 Road Town Tortola, British Virgin Islands

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CERTIFICATE OF QUALIFIED PERSON

Robert John Bowell

Corporate Consultant (Geochemist)

SRK Consulting (UK) Ltd

Email: rbowell@srk.co.uk

To accompany the report entitled: **A FEASIBILITY STUDY FOR THE MADAOUELA URANIUM PROJECT, NIGER.**

I, Robert J Bowell, a Chartered Professional Chemist, Chartered Geologist and a Certified Professional European Geologist, do hereby certify that:

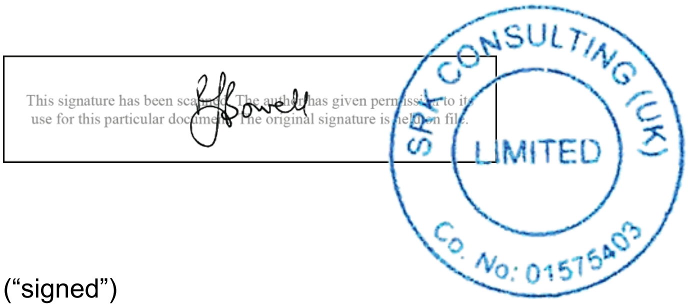
1. I am responsible for the preparation of the technical report titled, "A Feasibility Study for the Madaouela Uranium Project, Niger" and dated effective November 01, 2022 (the "Technical Report") relating to GoviEx Uranium Inc. Madaouela Uranium Project (the "Project"). In particular, Sections 1 to 6, 13 and 15 to 26.
2. I visited the Project site in March and September 2009, March 2011, April 2012 and June to July 2012.
3. I am currently employed as a consulting geochemist to the mining and mineral exploration industry, as a Corporate Consultant Geochemist with SRK Consulting (UK) Ltd, with an office address of 5th Floor Churchill House, 17 Churchill Way, Cardiff, CF10 2HH, UK.
4. I graduated with a Bachelor of Science Degree, First Class Honours in Geochemistry from Owen's College, Manchester University, Manchester UK, June 1988.
5. I graduated with a Doctorate in Geochemistry from Southampton University, Southampton, UK in June 1991.
6. I am a Chartered Chemist of the Royal Society of Chemistry, London, UK and have been since 1997. Membership number 332782.
7. I am a chartered Professional Geologist for the province of Newfoundland and Labrador. Registration number 10809.
8. I am a Chartered Geologist and Certified Professional European Geologist through the Geological Society of London since 1997 and European Association of Professional Geologists since 2000. Registration number 1007245.
9. I am a Fellow of the Institute of Mining, Metallurgy and Materials and have been since 2010.
10. I have been employed as a geochemist in the mining and mineral exploration business and in applied academia, for the past 34 years, since my graduation from university.
11. I have read the definition of "qualified person" set out in National Instrument 43-101 of the *Standards of Disclosure for Mineral Projects* (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-

101. The Technical Report is based upon my personal review of the information provided by the Issuer. My relevant experience for the purpose of the Technical Report is:

- Geochemist, SRK Consulting from 1995 to date;
- Exploration Geochemist with BHP Minerals, Hammersmith, London, 1991-1994;
- Exploration Geologist, Ashanti Goldfields, Ghana, 1988
- Uranium exploration experience as a geochemist and geometallurgical consultant, from 1998-1999; 2005-2006; 2007-current
- Experience in the above positions working with and reviewing uranium mineralogy and geology, uranium analysis, resource estimation methodologies, geometallurgical testwork for uranium, uranium metallurgy, geochemical data quality, assurance and quality control in concert with resource estimation geologists and engineers.
- As a consultant, I have been involved in several previous competent person's reports for uranium projects including NI 43-101 technical reports, 2002; 2006-08, 2009, 2010, 2013-15, 2017-18, 2021.

12. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
13. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, for which the omission to disclose would make the Technical Report misleading.
14. I am independent of GoviEx Uranium Inc. applying the test in section 1.5 of NI 43-101.
15. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them or GoviEx Uranium Inc. for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public.

Dated in Cardiff, United Kingdom, November 01, 2022



("signed") ("sealed")

Eur.Geol. **Robert Bowell PhD C.Chem. C.Geol**
Corporate Consultant (Geochemist)
#332782, Chemist; #1007245, Geologist; 10809 PEGNFL

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CERTIFICATE OF QUALIFIED PERSON

Guy Robert Dishaw

Principal Consultant (Mining Geology)

SRK Consulting (UK) Ltd

Email: gdishaw@srk.co.uk

To accompany the report entitled: **A FEASIBILITY STUDY FOR THE MADAOUELA URANIUM PROJECT, NIGER.**

I, Guy R. Dishaw, a Professional Geoscientist, do hereby certify that:

1. I am currently employed as a consulting geologist to the mining and mineral exploration industry, as a Principal Consultant (Mining Geology) with SRK Consulting (UK) Ltd, with an office address of 5th Floor Churchill House, 17 Churchill Way, Cardiff, CF10 2HH, UK.
2. I graduated with a Bachelors of Science Degree, First Class Honours in Geology from the University of Manitoba, Winnipeg, Canada, 1999.
3. I completed a Citation Program in Applied Geostatistics (CPAG), University of Alberta, Canada, 2012.
4. I am a Professional Geoscientist (P.Geo) of the Association of Professional Engineers and Geoscientists of Saskatchewan, and have been since 2009 (Membership #12720).
5. I have been employed as a geologist in the mining and mineral exploration business for the past 23 years, since my graduation from university.
6. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101. The Technical Report is based upon my personal review of the information provided by the issuer. My relevant experience for the purpose of the Technical Report is:
   - Mining Geology Consultant, SRK Consulting from 2011 to date.
   - Uranium mining and exploration experience as a mine geologist for Cameco Corporation from 2002 to 2007, and from 2009 to 2011.
   - Experience in the preparation and review of mineral resource estimates, geological mapping and modelling, uranium analysis, and assurance and quality control of resource data from 2002 to date.
   - As a consultant, I have been involved in the preparation of a number of NI 43-101 Technical reports, 2011 to date.
7. I am responsible for the preparation of the technical report titled, "A Feasibility Study for the Madaouela Uranium Project, Niger" and dated effective November 01, 2022 (the "Technical Report") relating to GoviEx Uranium Inc. Madaouela Uranium Project (the "Project"). In particular,

Sections 7 to 12 and 14.

8. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
9. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, for which the omission to disclose would make the Technical Report misleading.
10. I am independent of the issuer applying all of the tests in Item 1.4 of National Instrument 43-101.
11. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.
12. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them, including electronic publication in the public company files on their websites accessible to the public, of the Technical Report.

Dated in Cardiff, United Kingdom, November 01, 2022

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SRK CONSULTING (UK) LIMITED Co. No: 01575403

("signed") ("sealed")

Guy Dishaw, P.Geo.
Principal Consultant (Mining Geology)
P.Geo. #12720

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CERTIFICATE OF QUALIFIED PERSON

Jurgen Jan Fuykschot

Director Mining and Resources - Project Emili

Imerys SA

Email: jurgen.fuijkschot@imerys.com

To accompany the report entitled: **A FEASIBILITY STUDY FOR THE MADAOUELA URANIUM PROJECT, NIGER.**

I, Jurgen Fuykschot, a Mining Engineer, do hereby certify that:

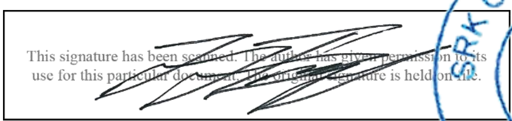
1. I am currently employed as a mining engineer to the mining and mineral exploration industry, as a Director Mining and Resources - Project Emili with Imerys SA, with an office address of 43 Quai de Grenelle, 75015 Paris, France.
2. I graduated with a Master of Science degree in Mining Engineering from the Delft University of Technology, the Netherlands, in 1991.
3. I am a Member of the Australasian Institute of Mining and Metallurgy (AUSIMM). Membership number 306269.
4. I have been a Chartered Professional Mining (AUSIMM) since 2011.
5. I own the Western Australian First Class Mine Managers Certificate of Competency No. 709.
6. I have been employed as a Mining Engineer in the mining industry for the past 26 years since my graduation from university.
7. I have read the definition of "qualified person" set out in National Instrument 43-101 of the *Standards of Disclosure for Mineral Projects* ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a "qualified person" for the purposes of NI 43-101. The Technical Report is based upon my personal review of the information provided by the issuer. My relevant experience for the purpose of the Technical Report is:
   - Mining engineer, Imerys from July 2022 to date.
   - Mining engineer, SRK Consulting from September 2006 to June 2022.
   - Mining Engineer (Operations)
     a. Jan 2006 - Aug 2006 Paulsens gold mine, Australia – Nustar, Alternate UG manager.
     b. Jul 2005 - Dec 2005 Kanowna Belle gold mine, Australia – Placer Dome, Contract mining engineer.
     c. Jan 2005 - Jun 2005 Wallaby gold mine, Australia – Placer Dome, Contract Senior mining engineer.
     d. Oct 2004 - Jan 2005 Blair nickel mine, Australia – Australian Mines, Contract mining engineer.

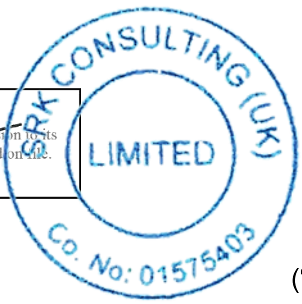
   e. Jul 2002 - Jun 2004 Gidgee gold mine, Australia – Abelle, Senior mining engineer/Alternate manager.
   f. Nov 2000 - Oct 2001 Lero operations, Guinea (West-Africa) – SMD, OP mine planning engineer.
   g. Dec 1997 - Aug 1999 Forrestania nickel mines, Australia – Outokumpu, UG mining engineer.
   h. Oct 1996 - Nov 1997 Youanmi gold mine, Australia - Scomac mining, UG mining engineer.

- Experience in the above positions involved: design and planning of underground mining operations; management of underground mine construction and mining. Working with and reviewing assurance and quality control with owners, executive management, mine technical and operating staff, contractors and third party stakeholders.
- As a consultant, I have participated in the authoring of several multi-disciplinary mining studies, including NI 43-101 Technical Reports.

8. I have contributed to the preparation and review of the of the Technical Report titled, “An Feasibility Study for the Madaouela Uranium Project, Niger” and dated effective November 01, 2022 (the “Technical Report”) relating to GoviEx Uranium Inc. Madaouela Uranium Project (the “Project”); in particular the content of Section 16.3 to 16.22 (Underground Mining) as an employee of SRK Consulting at the time.
9. I have not personally visited the project site for this Technical Report, and this was primarily due to current travel restrictions related to the global COVID-19 pandemic.
10. As of the effective date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
11. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, for which the omission to disclose would make the Technical Report misleading.
12. I am independent of GoviEx Uranium Inc. applying the test in Section 1.5 of NI 43-101.
13. I have read NI 43-101, Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance with that instrument and form.
14. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them or GoviEx Uranium Inc. for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public.

Dated in Cardiff, United Kingdom, November 01, 2022.





(“signed”) (“sealed”)

Jurgen Fuykschot,
Director Mining and Resources - Project Emili
AUSIMM Membership Number 306269

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CERTIFICATE OF QUALIFIED PERSON

Colleen MacDougall
Principal Consultant (Mining Engineer)
SRK Consulting (Canada) Inc
Email: cmacdougall@srk.com

To accompany the report entitled: **A FEASIBILITY STUDY FOR THE MADAOUELA URANIUM PROJECT, NIGER.**

I, Colleen MacDougall, PEng, do hereby certify that:

1. I am a Principal Consultant (Mining Engineering) with SRK Consulting (Canada) Inc. (SRK) with an office at Suite 1500, 155 University Avenue, Toronto, Ontario, Canada.
2. I am a graduate of McGill University in Montreal, Quebec, Canada with a BEng in Mining in 2006. I have practiced my profession continuously since 2006. I focus on open pit mining engineering projects worldwide. I have been directly involved in technical reviews, audits, and technical studies for precious metal, base metal, bulk commodities, and industrial mineral projects and operations.
3. I am a Professional Engineer registered with the Professional Engineers Ontario (PEO#100530936).
4. I have contributed to the preparation and review of the of the Technical Report titled, “A Feasibility Study for the Madaouela Uranium Project, Niger” and dated effective November 01, 2022 (the “Technical Report”) relating to GoviEx Uranium Inc. Madaouela Uranium Project (the “Project”). I am responsible for Section 16.1 and accept professional responsibility for those sections of this technical report.
5. I have not personally visited the project site for this Technical Report, and this was primarily due to current travel restrictions related to the global COVID-19 pandemic.
6. I have had no prior involvement with the subject property.
7. I have read the definition of Qualified Person set out in National Instrument 43-101 and certify that by virtue of my education, affiliation to a professional association, and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purposes of National Instrument 43-101 and this technical report has been prepared in compliance with National Instrument 43-101 and Form 43-101F1.
8. I, as a Qualified Person, am independent of GoviEx Uranium Inc as defined in Section 1.5 of National Instrument 43-101.
9. I have read National Instrument 43-101 and confirm that this technical report has been prepared in compliance therewith.
10. That, as of the date of the Technical Report, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be

disclosed to make the technical report not misleading.

11. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, for which the omission to disclose would make the Technical Report misleading.
12. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them or GoviEx Uranium Inc. for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public.

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SRK CONSULTING (UK) LIMITED Co. No: 01575403

Toronto, Ontario	**Colleen MacDougall, PEng, (PEO#100530936)**
November 01, 2022	**Principal Consultant (Mining Engineering)**

srk consulting

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CONSENT OF QUALIFIED PERSON

TO: British Columbia Securities Commission
Alberta Securities Commission
Ontario Securities Commission
TSX Venture Exchange
AND TO: GoviEx Uranium Inc.

Dear Sirs/Mesdames:

RE: GoviEx Uranium Inc. (the "Company")

I, the undersigned, am an author of the technical report prepared in accordance with National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* titled, "A Feasibility Study for the Madaouela Uranium Project, Niger" dated effective November 01, 2022 (the "**Report**"), which supports the disclosure in the Company's news release dated September 20, 2022 (the "**News Release**").

I hereby consent to the public filing of the Report, and the use of extracts from, or a summary of, the Report in the News Release.

I hereby confirm that I have read the News Release and that the News Release fairly and accurately represents the information in the sections of the Report for which I am responsible.

Dated: November 01, 2022

Yours truly,

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SRK CONSULTING (UK) LIMITED Co. No: 01575403

***Eur.Geol.* Robert Bowell PhD C.Chem. C.Geol**
Corporate Consultant (Geochemist)
#332782, Chemist; #1007245, Geologist; 10809 PEGNFL

("Signed") ("Sealed")

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Alberta Securities Commission
Ontario Securities Commission
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AND TO: GoviEx Uranium Inc.

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Guy Dishaw, P.Geo.
Principal Consultant (Mining Geology)
P.Geo. #12720

("Signed") ("Sealed")

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SRK CONSULTING (UK) LIMITED Co. No: 01575403

Jurgen Fuykschot,
Director Mining and Resources - Project Emili
AUSIMM Membership Number 306269

("Signed") ("Sealed")

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Yours truly,

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SRK CONSULTING (UK) LIMITED Co. No: 01575403

Colleen MacDougall, PEng, (PEO#100530936)
Principal Consultant (Mining Engineering)

("Signed") ("Sealed")

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A FEASIBILITY STUDY FOR THE MADAOUELA URANIUM PROJECT, NIGER

1 EXECUTIVE SUMMARY

1.1 Introduction

The Madaouela Uranium Project (the Project) is located near Arlit, in north central Niger, in one of the most significant areas of producing sandstone-hosted uranium deposits in the world. The Project is controlled 100 % by the Nigerien mining company, Compagnie Miniere Madaouela SA (COMIMA), owned 80 % by GoviEx Uranium Inc., a public company listed in Canada; and 20 % by the Government of the Republic of Niger.

SRK (UK) Limited, SGS-Bateman and Cresco have completed technical studies to a feasibility level of confidence for the Miriam open pit project, process plant and associated infrastructure. Additional work and mine modelling has been carried out on the two underground mines updating previous pre-feasibility studies. This report has been prepared in accordance with the Canadian Securities Administrators' National Instrument 43-101 and Form 43-101F1, collectively referred to as National Instrument (NI) 43-101.

1.2 Reliance on other Experts

The Qualified Persons (QP's) for this Technical Report, Robert Bowell, Guy Dishaw, Jurgen Fuykschot and Colleen MacDougall, have examined the historical and current data for the Project provided by GoviEx with respect to Mineral Resources, metallurgical test work, and other project information, and have relied upon that data to support the statements and opinions presented in this Technical Report. Several other technical specialists, including GoviEx staff members, are also contributors of information in sections of this report. These contributions have been supervised and reviewed by the QPs and the QPs have taken reasonable measures to confirm the information provided by others.

1.3 Project Description and Location

The Project extends over an area of approximately 234.86 km^2 of granted tenements and 1,788.86 km^2 of area under application for a potential area of 2,023.72 km^2 of exploration and mining tenements. The Project is located in the Agadez region (Arlit Department), in the Northern central part of Niger (Western Africa), southeast from the town of Arlit and west of the Aïr Mountain. Arlit is located approximately 800 km north-east by air from the capital city Niamey. There is no commercial flight direct from Niamey to Arlit, but there is a direct flight from Niamey to Agadez (Agadez to Arlit is approximately 250 km by road). The driving distance from Niamey to Arlit is ~1,200 km.

1.3.1 Niger Primary Mining Legislation

Niger's mining sector was until recently governed by the Mining Code which was implemented by the associated Decree No. 2006-265/PRN/MM/E of August 18, 2006, and the Project's mining permit was issued under the 2006 Mining Code. A new Mining Code has recently been adopted (June 29, 2022) by the parliament and was promulgated on July 05, 2022 by the President. Stability clauses in the Madaouela Mining Convention means there should be no direct legal implications of the new law for the project. At present, the project follows all the requirements of the 2006 Code, however, this Feasibility Study takes into account changes in the 2022 Code, including the 7 % Royalty, a training fee of 5 % of salaries, and commitments on local labour and local procurement.

1.3.2 Mine Titles

The Project consists of a large-scale exploitation (mining) permit for Madaouela I (Mad I Permit), granted in January 2016 for 10 years; exploration licence for Eralral, renewed in 2019 and five exploration permits Madaouela II, III, IV, Anou Melle and Aokare - which are under application with the State.

The Mining Code, revised in 2006, raised the potential State participation in mining company capital from 30 to 40 %, with 10 % of free shares. On June 13, 2018, the State made an election to hold its statutory 10 % free-carried interest in a Nigerien operating company, that would be formed to become the operating entity for the project and to hold the Mad I Permit.

Under the Mining Code (2006) any application for a title involves the payment of an annual area royalty, which varies with the phase (prospection, exploration or exploitation) and the period of validity. In early 2019, the State requested the payment of annual area taxes of CFA 1,216,000,000 from 2016 to 2018 for the Mad I Permit. In July 2019, the Company signed definitive agreements with the State whereby the State agreed to convert the final € 7,000,000 acquisition payable pursuant to the Madaouela I Mining Convention Side-Agreement (MIMC-SA), as well as the three years (2016-2018) of contested area taxes into an additional 10 % working interest in the new Nigerien operating company that would hold the Mad I Permit.

The definitive agreements with the State allowed the Project to progress, based on the Mad I Permit. To give effect to the various agreements, the Nigerien operating company, Compagnie Minière Madaouela SA (COMIMA), was incorporated in Niger. COMIMA is owned 80 % by GoviEx Holdings Niger Ltd (GNH) and 20 % by the Government of the Republic of Niger. The State also agreed to defer annual area tax payments related to the Madaouela Project for three years starting 2019. As part of the definitive agreements, GoviEx is also required to finance the relocation of the Madaouela military base (forecast to occur in 2032); contribute to the financing of the construction of a new mining cadastre building (USD 514,000) and provide financial support for a solar electrification programme, agricultural and pastoral programme and the sinking of pastoral wells and boreholes in the impacted area. The latter items are covered by GoviEx's ongoing CSR programmes.

The 2019 Definitive Agreement also confirmed that GoviEx would be granted renewed 9-year permit terms for its Madaouela II, III and IV, and Anou Melle exploration permits, which had reached the end of their exploration periods under the 2006 Niger mining code.

In September 2019, the State approved the revision to the shape of the Mad I Permit to include additional mineral resources associated with the Miriam deposit occurring within the Agaliouk exploration license. The remaining area has been converted to the Aokare exploration licence and GNH submitted an application for that permit in March 2022.

The Mad I Mining Permit is currently held by GNH. This permit initially expires in 2026 and the Mining Convention expires in 2027. The intention is for the Mad I Mining Permit to be regularised and associated with COMIMA as soon as practical. A request for this process to be completed was submitted to the Ministry of mines on July 28, 2022. A new Mining Convention will then be signed between COMIMA and the State at the time of renewal in 2027.

1.3.3 Mining Conventions

The purpose of the Convention is to set out the legal, financial, fiscal, social and environmental conditions under which a company will carry out exploration work within the area defined in the mine title. GNH Ltd signed five mining conventions with the State that covered the Mad I, II, III, IV and Anou Melle exploration licences area. The Madaouela I Mining Convention (MIMC) together with its Side-Agreement (MIMC-SA) were given legal status on May 26, 2007. GNH also signed a mining convention for Eralral in March 2017. These conventions have a validity of 20 years depending on exploration or exploitation permit validities.

1.3.4 Regional Law Influencing Mining and Environmental and Social Obligations

The 2006 Mining Code for Niger includes environmental and social provisions of mineral rights holders relating to the protection of the environment; sustainable development; local procurement and employment; and health and safety. These provisions are largely consistent with the obligations stipulated in GNH’s mining conventions.

Niger’s Mining Code has recently been reviewed to better align with regional mining codes; Economic Community of West African States (ECOWAS) and West African Economic and Monetary Union (WAEMU) directives which prevail over the domestic law of their member states and are directly enforceable.

1.3.5 Location of Mineralisation

As of June 2019, the mineralised deposits on the Madaouela I licence are shown on Figure ES 1. The deposits on the Madaouela I licence targeted for developing uranium resources and their estimation, and for inclusion in the study are; Miriam, Marilyn and Marianne (M&M) and MSNE. The Mad South Central East (MSCE) and Mad South Extreme East (MSEE) deposits, have Inferred mineral resources, and are excluded from the economic assessment subject to further work.

1.3.6 Encumbrances

The definite agreements between GoviEx and the State have formalised the State participation at 20 % for the project. In addition, there is a 5.5 % to 12 % sliding scale royalty payable to the State based on the commercial value of exported minerals (note the new Mining Code has a flat rate of 7 %).

GoviEx has negotiated separate permission to operate within the existing military camp boundaries and has committed to assisting with the financing of the relocation as required when this facility is impacted by the M&M underground mine anticipated in 2032.

1.3.7 Environmental Liabilities

The only apparent environmental liabilities are associated with exploration drill core that may require appropriate disposal should the project not proceed.

1.3.8 Required Permits and Status

The primary approvals required by GoviEx to develop the Project are regulated by the legislation relevant to mining, environmental and social management and water and radioactive material usages.

Environmental and Social Impact Assessment (ESIA)

An ESIA was approved for the Project by the Minister in charge of the environment on July 31, 2015 and an environmental compliance certificate was granted. Subsequent to the environmental study carried out for the Madaouela Project, the legal framework governing the execution of an environmental assessment was updated by Law 2018-28. The project does however already have a valid environmental certificate and is not required to address these updates retrospectively. In 2022 Labogec, updated some of the environmental and social baseline data as part of this FS (Section 5 and Section 20).

Water Code

Water usage in Niger is regulated by the Water Code (Ordinance No. 2010-09 of April 01, 2010). The project will be applying for a water abstraction and water use permit; the current authorisation is for a limited number of water holes. A detailed hydrogeology study and water balance have been developed to support the application which will occur prior to construction.

Radiation Legislation

Nuclear safety and security, and protection against the dangers of ionizing radiation are regulated by the Nuclear Regulation and Safety Authority (Autorité de Régulation et de Sûreté Nucléaire – “ARSN”). Production, usage, transportation and waste management of radioactive materials or ionizing radiation sources cannot take place without prior authorisations issued by ARSN which will be obtained prior to construction.

Cultural heritage legislation

Heritage sites in Niger are protected by Article 41 of the Constitution of the 7th Republic (November 25, 2010) and are the property of the State. 147 funeral sites have been identified within the wider Project area. The project infrastructure has been designed to avoid all identified sites. There are two ancient burial sites adjacent to the underground infrastructure that may require relocation in the future.

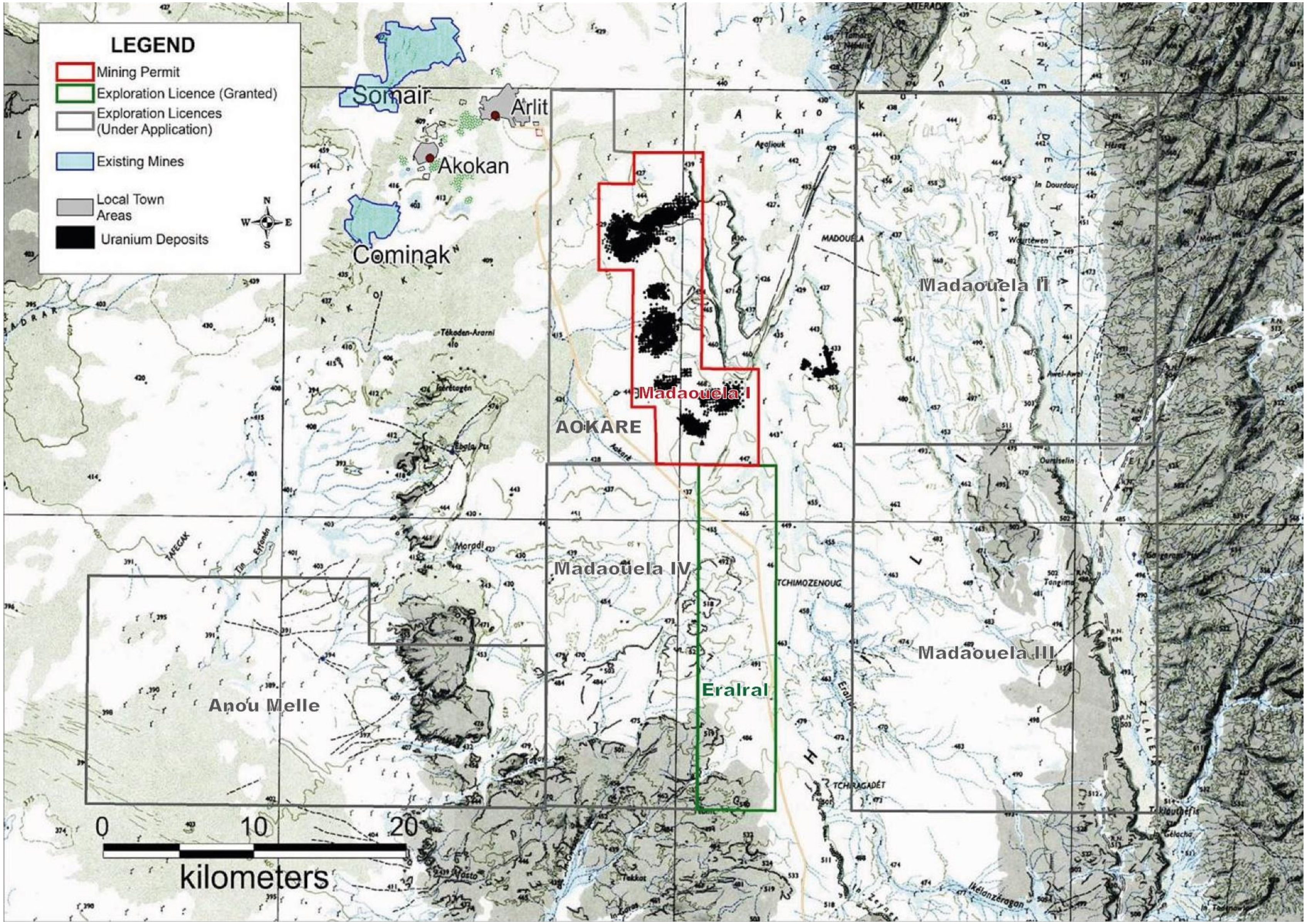

Figure ES 1: GoviEx Land Holdings – Madaouela Uranium Project

1.4 Accessibility, Climate, Local Resources, Infrastructure and Physiography

1.4.1 Access to Property

The proposed Miriam open pit is approximately 25 km south-east of Arlit with the M&M and MSNE underground mines 14 km north of Miriam. There is a national road from Niamey to Arlit via Agadez. The Miriam infrastructure will be located approximately 1 km from the national road.

An airstrip belonging to SOMAÏR Mine, a subsidiary of Orano, was constructed at the start of their mining operation. Subject to the owner's agreement and the payment of a landing fee, the airstrip can be used by charter companies. No commercial flights are available to Arlit. A commercial airstrip exists in Agadez.

1.4.2 Climate and Climate Change

Average annual temperature ranges between approximately 21°C and 36°C, with a mean of 29.6°C. There are three seasons: a relatively cold season, September to February, a hot season, March to June, and a humid season, June to September. In the hot season temperatures can exceed 40°C and in the cold season nights are generally cool with temperatures below 20°C.

Local precipitation data for analysis has been obtained from SOMAÏR meteorological station and supplemented with data from regional meteorological stations. The analysis confirms a wet season period (June – October) and a dry season period (November – May) with an average annual precipitation of 69 mm. Potential evaporation has been estimated using a variety of different methods, with annual averages ranging between 2,016 and 2,178 mm.

With respect to climate change, it is expected that MAP will increase as a median close to 29 % with respect to baseline conditions (1985 to 2014) by the year 2100. Inter-annual variation will occur with projected increases in excess of 90 % for the months July to September. Temperatures are forecast to increase up to 1.5°C (short-term) and 4.9°C (long-term).

1.4.3 Economic, Political Climate and Administrative Setting

Niger's economy is dominated by activities in the rural sector; agriculture is the main source of income for over 80 % of the population and in 2018, accounted for 28.5 % of GDP. However, frequent climatic shocks impact agricultural productivity and cause food insecurity. The extractives industry is another important sector but its contribution to GDP has been relatively low, estimated at 4.4 % as of 2018.

Niger is divided into seven regions including Agadez (where the Project is located) and one capital district, Niamey. Each region is subdivided into departments, communes, cantons and groupements. Niger has both state and traditional political regimes.

1.4.4 Physical Setting

Topographic relief in the Project area is minimal, ranging between 350 and 560 m above sea level (masl). Areas of drilling are at approximately 420 m elevations and over much of the areas drilled, relief is less than 40 m from low ridges of sandstone outcrops to flat sand covered plains.

The Project properties are located in the Tim Mersoi Basin. The Project is situated in a region where surface water is scarce and the drainage network consists of ephemeral rivers also referred to as wadis.

In the vicinity of Arlit, carboniferous sandstone formations host underground water tables that have been exploited since the start of the uranium mining operations in the 1960's. The human concentration that has accumulated over the years in the Arlit area has contributed to reducing the underground water resources; however, water reserves in the region are considered to be large. In general, the water quality is poorer in the vicinity of the ore bodies and should not be used for drinking water purposes without treatment.

Levels of dust showed a strong seasonal trend, increasing as expected during the dry season. Naturally occurring levels of fine dust in the air are above international guidelines and levels of dust fallout are also high.

The Project area is located in a region of elevated background radiation due to the natural presence of high concentrations of uranium in the earth.

1.4.5 Biological Setting

Approximately 40 % of the Project area is covered by South Saharan Steppe and Woodlands ecoregion in the northwest and with 60 % covered by the Sahelian Acacia Savanna ecoregion in the southeast. The Southern Steppe and Woodlands ecoregion used to attract large herds of arid-adapted migratory herbivores after the rains but the area has been overgrazed by herds of domestic livestock and habitat degradation is widespread.

During the baseline data collection a total of 20 plant species were identified on the Project area during the rainy season. The only endemic faunal species occurring in the two ecoregions on the Project area are small, arid adapted rodents.

The soils in the desert tend to be poorly developed and undergo limited physical or chemical reactions. The evolution of soil is principally controlled by the actions of wind erosion. Elevated levels of arsenic, lead and copper were found in soils within the Project area. Land capability is low across most of Niger.

1.4.6 Social Setting

The nearest communities to the Project are located in the towns of Arlit, Akokan, and Teslem, in the commune of Arlit, 13 km North West of the Marianne deposit. Arlit Commune has a multi-ethnic population estimated at 200,000 inhabitants, mainly associated with Orano's uranium mining operations. The population is young, 50 % are between 0 and 14 years of age; unemployment is high.

A new community was established in March 2017 called 'Guidan Daka', located 12 km South of Arlit town. This community has been established by the Arlit regional office of Mines and is a gold processing site. With an estimated population of 10,000 relatively young people (5 % are women providing auxiliary services), this community has grown significantly over the years and largely comprises of artisanal gold miners who bring ore from gold sites in the North and near the border with Algeria and go on to trade the gold produced. The community is multi-ethnic and comprised of individuals from different nationalities organised under a head who ensures collaboration with the defence and security forces.

1.4.7 Surface Rights and Access to Power, Water and Mining Personnel

The proximity of the town of Arlit and Akokan are an asset for the Madaouela Uranium Project. The towns have electricity and potable water, health facilities including one district hospital and two private hospitals (operated by SOMAÏR and COMINAK), filling stations, bus transportation and repair shops. A power line connects the town to the Sonichar coal-fired power station located north of Agadez.

Land access for the exploration programmes has typically been negotiated without problem. Land use related to any future exploration or/and mine development scheme is allowed under the mining convention provisions, including rights to use any portion of the tenement land and/or any of neighbouring lands, so long as there is consent from the head of the relevant administrative unit.

Considering the essentially flat landscape and terrain of the Madaouela tenement, there should be no issues in identifying the surface areas necessary for any mine layout requirements for future facilities however, pastoral groups may mobilise to restrict access for the project or to negotiate compensation for any potential loss of access to land and natural resources (Section 20).

Manpower requirements would be sourced as skilled, semi-skilled and unskilled labour from the Arlit area which benefits from a workforce that has been trained for mining related skills. The neighbouring COMINAK mine which closed in 2021 has the potential to provide a pool of labour for GoviEx.

1.5 History

The French Commissariat à l'Energie Atomique (CEA) conducted drilling operations using drilling grids of 800 m over large areas, and down to 100 m over two contiguous mineralised zones termed Marianne and Marilyn. The discovery of the Marilyn deposit was then drilled locally at 50 m and less spacing, and an underground mining test was implemented for detailed sampling for mineralogical studies, processing tests and investigations into the global rock quality from a mining perspective. CEA also discovered the other deposits that are the current active mines in the area (the SOMAÏR and COMINAK operations), and subsequently ceased exploration work on Madaouela in 1967.

The Japanese Power and Nuclear Fuel Development Corporation (PNC) conducted additional uranium exploration work up to 1992 and reported on the feasibility of the Madaouela deposit in 1993, which was later updated in 1999. Historical mineral resources/reserves were stated between 5 and 15 Mlb eU_3O_8 depending upon the cut-off grade used.

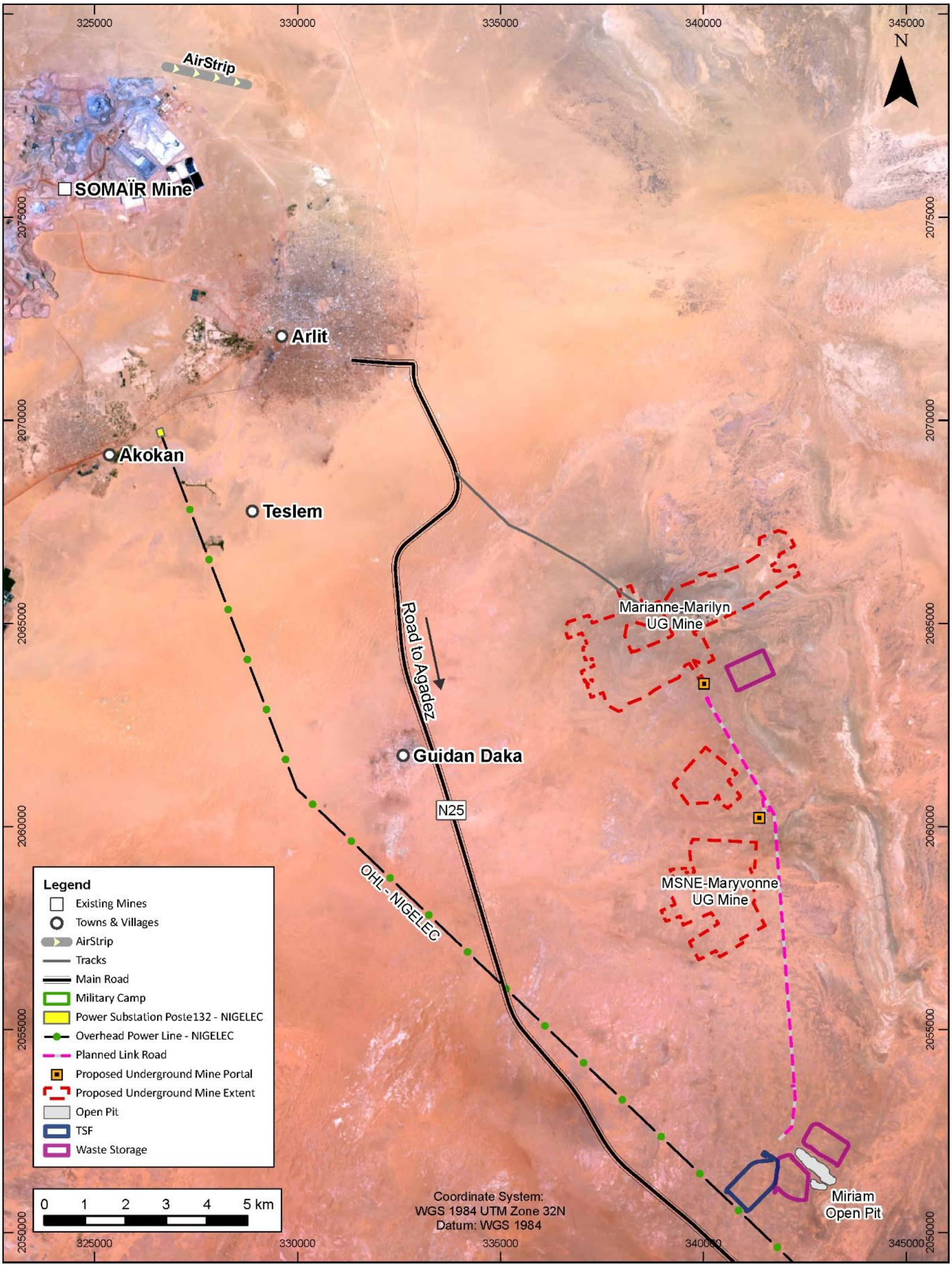

Figure ES 2: Madaouela Uranium Project - access map

1.6 Geological Setting And Mineralisation

1.6.1 Regional Geology

The Project properties are located in the Tim Mersoi Basin. This basin covers most of the western part of the Republic of Niger with extensions in Algeria, Mali, Benin and Nigeria. It opens and deepens toward the south and west. In early Paleozoic, an open gulf developed to the south of the Central Saharan Massif and fed continental sediments to the developing basin. During the Mesozoic and Tertiary, the area was mainly continental, periodically invaded by marine transgressions diminishing in thickness to the south and passing laterally into continental series. Uplift movements beginning in the Middle Eocene gave the basin its present aspect.

The Paleozoic sediments are outcropping between Arlit and the Algerian boundary. Pre-Carboniferous sedimentation consists of Cambro-Ordovician sandstones and graptolite shales. The Carboniferous formations are of major interest because they host the major reduced uranium deposit in the Arlit area. The stratigraphic sequence begins by the grey-black shale Talak Visean argillites.

This is followed by the Akokan unit (UA) is a transitional term between the marine clay of the Talak and the fluvio deltaic sedimentation of the Guezouman and Tarat. It consists of several lenticular fine grained silty clay units.

The Guezouman formation includes a lower and an upper member. It is composed of fine to coarse-grained cross-bedded sandstone units with minor conglomerates (Teleflak) at the base. These contain quartz, phosphatic siltstone gravels, more or less deformed silty shale debris, metaquartzite, granite and rhyolite pebbles. The upper member, flowing southwest to south, consists of fine to medium grained sandstone, with minor siltstone and thin argillaceous intercalations.

1.6.2 Regional Geological Structures

The structure of the Tim Mersoi basin is marked by the westward dip of the units. The deformation of the sedimentary body resulted from basement fault activities located between the Air Massif and the Azaoua lineament. Several large faults systems cut the sediments and have played a major role during the sedimentation since the Upper Paleozoic.

Mineralisation

The Madaouela deposits exhibit classic characteristics of uranium sandstone deposits commonly found (Cuney, 2009).

The mineralogy of uranium in the deposit is dominated by pitchblende and coffinite. The overall paragenesis can be divided in three stages: (1) early sulfides; (2) uranium on organic matter such as wood fragments; (3) carbonates and barite. The uranium minerals largely occur on the surface of minerals, or as infillings between the grains. Some brannerite may also occur in the deposit. Mineralogists never identified brannerite, and in the Ti-U diagram of SEM analysis, high values of uranium are independent of titanium whereas low values of uranium are associated with Ti minerals. The major carriers of uranium are therefore uranium oxide and not brannerite.

It is important to note that pyrite may have developed on large areas but is now preserved only in the halo of the large redox front. Molybdenum is associated with pyrite as a trace element.

1.6.3 Geological Controls on Mineralisation

The Guezouman sandstone at the Guezouman-Talak contact in the primary locus of mineralisation, as controlled by the reducing environment and lesser permeability of the Talak argillites below mineralisation, and the regional paleo-groundwater redox boundary in the Guezouman sandstone, down gradient from outcrops. Other relevant geological controls are the N70E structural, which represent older faults, and edges of paleo-channels. Low-amplitude domal features in the sedimentary units are related to the structural environment and are therefore relevant exploration guides.

1.6.4 Type, Character and Distribution of Mineralisation

The uranium mineralisation is all reduced uranium minerals (uranium (IV) minerals), uraninite and coffinite. The uranium minerals occur as disseminations in the matrix of the sandstone, with nearly all the mineralisation occurring in one tabular horizon. “Redox front” uranium mineralisation in the Guezouman may occur at several levels, as it is the case in the Miriam deposit. The Akouta “front” was the best example of this type of concentration. In the Miriam case a close relationship with structural features is very likely. Mineralisation can sometimes be present at the contact of the Guezouman and the UA formation, in the Talak, and in the UA where the UA is preserved against a N70E fault; however, that mineralisation is also relatively insignificant to the main basal Guezouman sandstone tabular lens of mineralisation.

1.7 Deposit Types

Sandstone-hosted uranium deposits are defined as epigenetic concentrations of uranium minerals occurring as impregnations and replacements primarily in fluvial, lacustrine, and deltaic sandstone formations. They occur in permeable medium to coarse-grained sandstone, usually deposited in continental fluvial or marginal marine sedimentary environments. Impermeable shale or mudstone are inter-bedded in the sedimentary sequence, and often occur above and below the mineralisation.

The source of uranium is usually igneous or volcanic rocks (alkaline tuffs, granitic intrusion) either in close proximity to or inter-bedded with the sandstone units. The uranium mineralisation typically precipitates from oxidizing fluids, under reducing conditions caused by a variety of reducing agents including: carbonaceous material (detrital plant debris and amorphous humate), sulfides accompanying organic matter decay, hydrocarbon, and inter-bedded mafic volcanic rock with abundant ferro-magnesian minerals. The reducing agent for Madaouela is most likely in-situ organic material (lignite), primarily within the Talak, or hydrocarbons transported along major faults.

The primary uranium minerals are uraninite and coffinite with minor secondary uranium minerals being noted in exposed (weathered) mineralisation.

Sandstone deposits are an important source of uranium representing approximately 28 % of the world's known uranium resources and accounting for a significant percentage of the African uranium deposits. This style of uranium deposit typically yields small to medium size deposits (10,000 to approximately 50,000 t of U_3O_8) characterized by low to medium grade (0.05 to 0.5 % U_3O_8). The deposits typically occur in clusters within a broad redox front.

1.8 Exploration

Extensive surface and sub-surface exploration has been conducted by GoviEx at Madaouela using industry best practice for the style and extent of mineralisation, which occurs here. The detailed and regular spaced drilling has allowed the deposits to be outlined with a high degree of confidence, and coupled with the field mapping, structural, hydrographic and remote sensing analysis, has enabled the identification of additional potential.

The main exploration tool used by GoviEx on the Madaouela Uranium Project has been by drilling on a defined grid pattern and interpreting the presence of redox fronts or anomalous uranium intercepts to justify further drilling. Other exploration work completed on the Project includes; field mapping at MAD I in 2009-10. In addition, strip mapping along drill lines was completed at MAD I, MAD II and MAD III in 2011; MAD IV in 2012; and Anou Melle in 2014.

Remote sensing analysis by MIR Teledetection was completed over the whole project in 2009 and has greatly assisted in understanding the structural complexity of the area. This included obtaining quality SRTM satellite imagery for topography, Landsat and Aster imagery for spectral analysis and photo interpretations.

As noted above, between 2010 and 2012, strip mapping along regular spaced lines was completed by GoviEx over MAD I, MAD II, MAD III and MAD IV. The main purpose of the exercise was to validate the regional geological map data, followed by measuring the direction of paleo-flow to determine channel development and help in defining drill sites. The reading of radioactivity using a SPP2 spectrometer help identified potential target horizons. The geologist's primary task was recording the lithology, stratigraphy, bedding orientation, presence of faults and fractures. Further to this once drilling was completed, it helped in the interpretation of drill sections.

In 2014, GoviEx completed field verifications on the Anou Melle licence. The main aim of the mapping programme was to confirm; the presence of faults interpreted by MIR Teledetection in 2009; previous work by CEA undertaken in the 1960's; to confirm the stratigraphy and to verify several surface radiometric anomalies.

A radon survey was carried out over the Madaouela I mining permit in 2016. The survey covered two areas. Initially around the Miriam deposit, to see if the signature of Miriam could be used to find other anomalous areas nearby. The second area was west of the Marianne deposit, to look for radon extensions beyond the drilled areas.

1.9 Drilling

The GoviEx exploration program commenced in August 2008, following property acquisition in 2007. Between 2008 and 2010 the majority of the drilling undertaken was focused on the Mad I property and was a combination of exploration and in-fill resource definition drilling. Drilling is primarily by mud-rotary drill rigs that drill 120.65 mm diameter holes, with some localized diamond drilling programs (specifically at M&M and Miriam).

Table ES 1 summarises GoviEx's exploration drilling program for the period August 2008 to October 2021.

Table ES 1: Summary of Mad I drilling program metres for the period August 2008 to October 2021

	Year	2008	2009	2010	2011	2012	2013	2017	2021	Total
Deposits	**Type**	**(m)**	**(m)**	**(m)**	**(m)**	**(m)**	**(m)**	**(m)**		**(m)**
MAD I CUMUL	Water well	84	0	561		745	403	0		1,793
	RDH	57,162	90,204	96,717	59,637	153,690	57,186	3,574	367	518,537
	mixed RDH-DDH	316	179	0	1,189	6,344	3,424		15,539	26,991
	Reopening historical DH	5,086	15,452	7,592	4,488	5,049	0			37,667

Note: Mad I Cumul includes Madaouela I and Agaliouk licenses (Agaliouk was relinquished October 2021)

Between 2008 and the end of 2017 a total of 518,170 m were drilled on the Mad I and Agaliouk licenses with 4,890 holes.

In 2021, GoviEx carried out a diamond drilling program over the Miriam and Marianne deposits, in order to obtain samples for chemical assay to enable the modelling of molybdenum resources as well as confirming eU grades derived from downhole radiometric surveys.

In addition to the diamond drilling program, six holes were completed for geotechnical purposes within the proposed Miriam open pit area, 14 short diamond holes were also completed for the civil engineering of the process plant area, and a further 5 mud rotary holes were drilled over the planned process plant area for sterilisation purposes. No significant mineralisation was found in the sterilisation holes. Initially exploration on the Madaouela II, III, IV, Eralral and Anou Melle properties started in April 2010 and continued until 2013 except at Anou Melle where it ended in July 2010.

The subsequent exploration activity then was concentrated east of the Madaouela fault on Mad II, Mad III, Mad IV and Eralral from August 2010 to January 2013. The exploration was conducted at 3,200 m grid on EW profiles and following redox interpretation profiles at a 1,600 m grid were drilled on the northern part of Mad IV and Mad III.

Table ES 2: Summary drilling activities by tenement

	Metres (m)
Mad II	12,629
Mad III	16,716
Mad IV	25,272
Anou Melle	3,263
Total	57,880

Surveying

Surveying is done with precision, care and crosschecking in the field, using the DGPS equipment; thus providing collar locations to centimetre accuracy. Surveying uses a network of permanent survey monuments for base stations and is tied to real-world coordinates using WGS 84 as a format.

Logging

Logging is done using; three SEMM designed logging units, with probes modified for GoviEx. Internal QA/QC of intersections greater than 100 raw c/s (GM probe) is conducted using one Mount Sopris logging unit (GHN owned) equipped with DHT27 reference probe. For each drillhole logging unit, two probes are used;

- a resistivity and natural gamma (scintillation (PM)) probe,
- and a probe containing natural gamma (by Geiger tube GM) and by scintillation counter (PM) and deviation (magnetic/inclinometer) instrumentation. GM logs are used to define in-situ uranium grades for the drillhole database.

The procedure used by GoviEx at Madaouela is to convert CPS per anomalous interval by means of a correlation curve developed by comparing core intervals with gamma-log intervals for the 46 core hole intervals drilled at Marianne. The process involves re-positioning the core pieces for the whole-core interval of mineralisation and determining the contacts and peak radiometric reading with a hand-held scintillometer on the core. This is then matched with the radiometric curve developed from a down-hole plot of CPS. The core is cut and analysed for uranium content for the same interval as the radiometric indicate. A best fit line defines the relationship of GT as follows:

$$GT_{core} = U_{core} \times T_{core} = (\text{Factor} \times CPS \times T_{probe}) = GT_{probe}$$

The same can be done on composited grade (U%) versus (CPS) at a given composite interval for each; the relationships have been found to be similar to that for GT. The factor is then used to convert CPS to eU grade.

1.10 Sample Preparation, Analysis and Security

GoviEx's sample preparation, methods of analysis, and sample and data gathering have been implemented with an appropriate degree of care in data collection, data transfer, data conversion, and gamma probe QA/QC. QA/QC data from the chemical analyses for uranium in the 2021 program demonstrated that the uranium information has been collected with no bias and no evidence of contamination. Where the occasional result differs by more than two standard deviations, these can be explained as sample swaps as they plot where other certified reference materials (CRMs) are expected. Although a molybdenum CRM was not implemented in the 2021 program, the results obtained from the CRM used indicate that the analyses are reasonable and that there is no reason to suspect any bias being introduced. The methods are acceptable by industry-standard procedures and are applicable to the uranium deposits at the Madaouela Uranium Project. SRK has completed an independent verification of the eU results obtained from downhole radiometric probing.

1.11 Data Verification

Data verification supporting the MRE for the Madaouela Project has been completed by both GoviEx and SRK Consulting. GoviEx has in place QA/QC and database verification procedures to render the drillhole database consistent, verifiable, and appropriate for use in resource estimation. SRK has independently verified key aspects of the data collection procedures used for the Madaouela project and are confident that the database on which the MRE is based is informed by data of suitable quality. Most importantly, the chemical assays of uranium have demonstrated that the derivation of eU from downhole radiometric surveys (probing) has been completed to an appropriate standard by GoviEx and that the data can be relied upon for Mineral Resource estimation of uranium.

1.12 Mineral Processing and Metallurgical Testing

The feasibility phase metallurgical testwork has been completed through SGS, VeRo (fre-e-tec), Vietti Slurrytec and Mintek. This testwork has comprised of comminution investigations, bottle roll and two stage acid leaching, uranium recovery assessment by precipitation, ion exchange and solvent extraction (SX) as well as batch-continuous runs covering the entire flowsheet and assaying of yellowcake product. Molybdenum precipitation work, tails thickening and filtration test work were also completed.

Comprehensive geometallurgical work done during the Pre-Feasibility Study (SRK, 2021) has defined uranium mineralisation present as coffinite (60 %) and uraninite (40 %) with negligible other phases such as autunite and becquerelite at Miriam and rarely silica-mix-TiO_2 minerals. Uranium minerals occur with interstitial clays and carbonate in the cement of the Guezouman sandstones. Grain size is bi-modal with coarse and fine grained uranium minerals. Uranium minerals are dominantly present as fine grained, typically less than 30 µm size phases with occasional grains up to 100 µm in size. The most abundant uranium-bearing minerals in the sample are "pitchblende/silica-mix-TiO_2", "Mo-coffinite-mix-TiO_2" and coffinite. Uranite and autunite are less abundant. The "pitchblende/silica-mix-TiO_2" and "coffinite-mix-TiO_2" phase contribute 65 % of the total uranium. The uranium-bearing minerals in the high-grade ore mostly report to the 10 - 25 µm size fraction.

Molybdenum occurs in the ores largely as a trace element in coffinite and pyrite with only minor molybdenite identified. In samples from the ore stockpile from M&M, powellite ($CaMoO_4$) was also identified.

All metallurgical test work completed at Mintek for the Feasibility Study has been conducted on drill core from the Miriam deposit. Comminution work used both Miriam (~1,000 kg) and M&M stockpile (~110 kg) samples. Test work carried out on M&M samples is reported in the previous PFS reports.

Drop weight tests show that the Miriam and the M&M stockpile samples are classified as very soft based on the classification using the obtained A*b values. The parameter ta, as a useful indicator of the resistance to abrasion of the ore, gave values ranging between 0.38 and 0.45. The Bond ball work index (BBWI) test was conducted on the Miriam sample at 150 µm limiting screen. The BBWI tests results showed that the sample was classified as being hard with the work index of 11.4 kWh/t. Typical hardness classification based on crushability work index indicate that most of the specimens tested can be categorised as being very soft to soft.

A composite sample (100 % passing 30 mm) comprising low grade (30 %), high grade (35 %) and waste rock (35 %) were prepared for ore sorting testwork. In addition to the RADOS testwork (equivalent to radiometric sorting), Mintek also conducted scrubber and flotation testwork to assess the effectiveness of this process in upgrading the concentrated uranium feed.

Radiometric sorting proved successful with 98.5 % of uranium recovered into a 56 % mass pull with rejection of 40 % of the material. Based on the operations of radiometric sorting at a uranium mine in Ukraine it is established that 93 % of uranium recovered in a mass pull of 40 % with resue ore or 98 % in a mass pull of 56 % in non-resue ore can be applied as potential targets for Madaouela ore. However due to collection of fines calcite was also concentrated by this approach.

The VeRo Liberator® unit showed good performance on a substitute sandstone ore (with increased hardness relative to Miriam ore) with a specific energy requirement at 4.5 kWh/t and an expected 20 % recirculating load during operation. It was also noted that the VeRo Liberator® unit could likely crush the Madaouela ore in a single pass, reducing the feed solid load to each unit even further during operation. Dust and noise emissions were no issue during the tests.

In the Feasibility Study phase the leach conditions were further optimised and the performance of a 2-stage leach circuit was further examined. The optimal grind selected for leach was, milling to P80 -300 µm. High grade sample with a 2-stage leach showed maximal >90 % uranium extraction. From this, 80-84 % can be extracted at pH 1.4-1.5, additional 10 % require higher acid (pH ≤1) and oxidant. Particle size in the range between 80 % -300 µm and 80 % -150 µm did not affect uranium extraction. It was found that an acid consumption of 50 kg/t and a temperature of 50°C gave an optimised operating point at Eh >650 mV, with uranium extraction at 95.63 % and molybdenum extraction at 90.22 %.

The presence of high molybdenum in the pregnant leach solution (PLS) necessitates effective removal of molybdenum from the PLS, which was accomplished using an ion exchange process. Purolite S9701 resin was selected for the process ion exchange circuit. Molybdenum was efficiently loaded from PLS in adsorption tests using S9701 resin at 50°C. Molybdenum uptake improved compare to the tests conducted at ambient temperature with previous PLS solution. Maximal molybdenum loading achieved during tests was 20 g/L. Breakthrough tests were conducted on a PLS generated at condition representing future operation. The test showed good results with low molybdenum (<2 mg/L) in ion-exchange (IX) barren. For the IX elution circuit, alkaline elution followed by acidic elution at 50°C showed better molybdenum stripping efficiency and no need for resin regeneration after the complete elution cycle.

The bulk molybdenum eluate was subjected to precipitation for molybdenum recovery using published requirements for the “Rapid Acidification” process, producing a molybdenum sulfide product (MoS_3). It was found that the product precipitated readily and produced a MoS_3 solid with an expected >98 % ppt efficiency.

Uranium recovery via solvent extraction from the clarified PLS was evaluated and found to be the most appropriate approach to uranium extraction from the pregnant leach solution and collection prior to precipitation of yellowcake (U_3O_8). Good separation of molybdenum allows the production of a final yellowcake product that meets the requirements for saleable yellowcake as defined by the convertors. Optimised SX operational conditions were thus defined. Recovery for the extraction circuit was modelled for >99 % uranium extraction. Three stages are required in the extraction circuit. Approximately three counter-current stages would be required for stripping of uranium off the organic phase. A loaded strip liquor containing 14 g/L uranium could be produced.

Using this flowsheet, the calculated overall metallurgical uranium recovery is reported as 94.8 % for the open pit ore and 91.5 % for the underground ore, with molybdenum recovery at 88.9 % for the open pit and 79.9 % for the underground ore. The drop in recovery for the underground ore is attributed to the losses over flotation.

1.13 Mineral Resource Estimates

The deposits that comprise the Madaouela Uranium Project are Miriam, Marilyn and Marianne (M&M), Maryvonne (MYVE), MSNE, MSCE, and MSEE (Figure ES 3). The mineral resource models prepared by SRK consider drill holes completed and sampled by GoviEx during the period from 2008 to 2021. To support the Feasibility Study in 2021/2022, SRK have prepared updated geological models and Mineral Resource Estimates (MRE) for the Miriam, M&M, MSEE, and MSCE deposits. The estimates for MYVE and MSNE deposits were not updated as these were not informed by any new information since they were prepared in 2016.

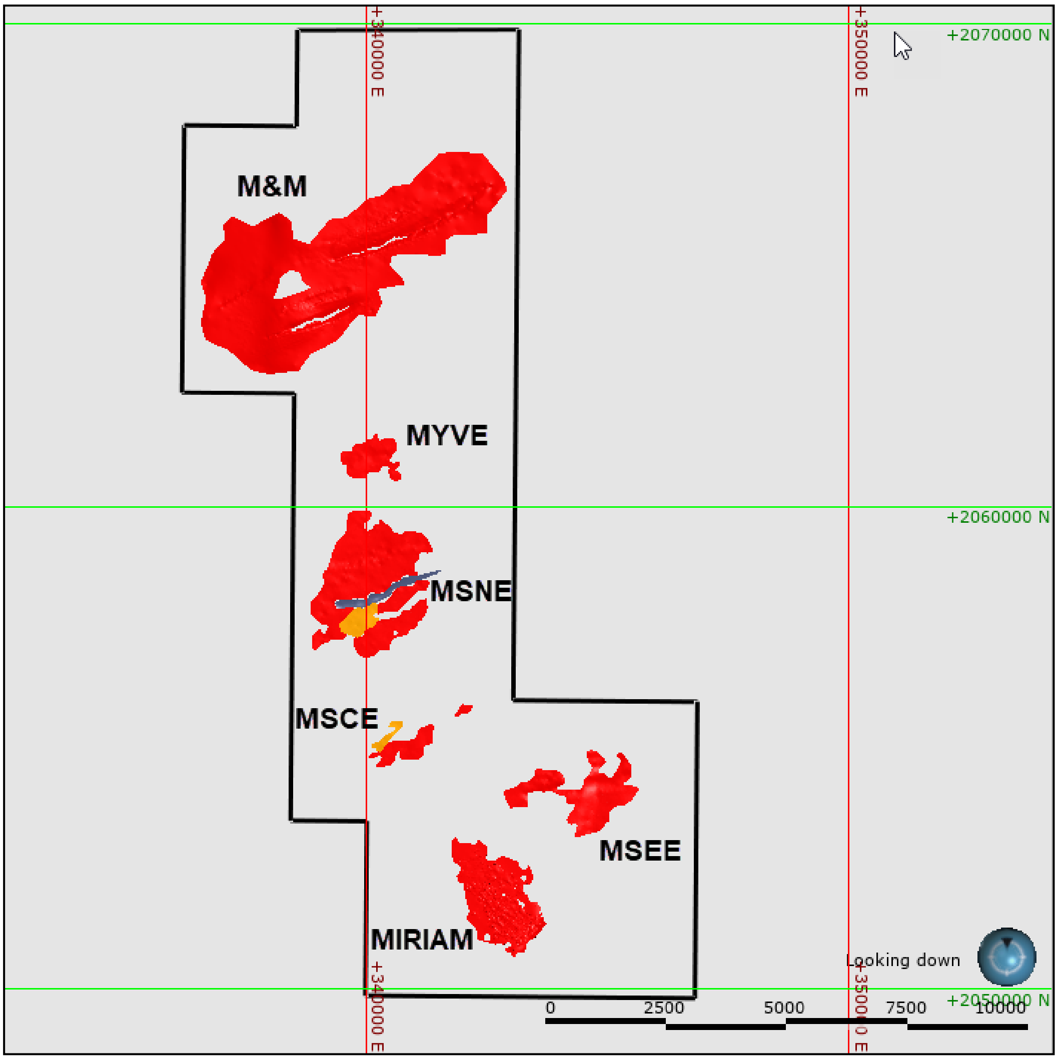

Figure ES 3: Plan view of the Madaouela Uranium Project deposits and the MAD I license boundary.

This MRE was completed and reported in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Reserves (CIM Definition Standards, May 19, 2014) and National Instrument 43-101 (NI 43-101). SRK have considered the CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines (November 29, 2019) and CIM Best Practices in Uranium Estimation Guidelines (November 23, 2003) for all aspects of the MRE presented here.

The MRE methodology for each deposit involved the following steps:

1. database compilation and verification;
2. stratigraphic modelling;
3. exploratory data analysis and construction of mineralisation models;
4. statistical review and selection of domains suitable for estimation of uranium and molybdenum (at Miriam and M&M only) and bulk density;
5. geostatistical analysis and grade continuity modelling (variography);
6. block modelling and grade interpolation;
7. validation of estimates and mineral resource classification;
8. assessment of reasonable prospects for eventual economic extraction (RPEEE) through either underground or open pit optimization, and selection of appropriate cut-off grades; and
9. preparation of the mineral resource statement.

For the Miriam deposit, a ‘3-dimensional’ approach was taken to the estimation, where multiple composites are created through the various horizons of mineralisation. The estimation requires the kriging of grade directly and does not incorporate accumulation in the methodology.

For the M&M, MYVE, MSNE, MSCE, and MSEE deposits, which are characterised by generally thin and tabular (although locally deformed) mineralisation an ‘unfolded’ accumulation method has been employed. Using this method, the estimation is effectively approached in ‘2-dimensions’) where single composites are created and un-folded for each intersection through the mineralisation and the final grade estimate is the quotient of the kriged accumulated grade (grade * thickness) and kriged thickness. The un-folded estimates are then ‘re-folded’ back into true 3-dimensional space.

A summary of the Mineral Resources for all deposits comprising the Madaouela Project are presented in Table ES 3 for eU and Table ES 4 for molybdenum.

Table ES 3: Summary of the Madaouela Uranium Mineral Resources, effective date July 01, 2022

Classification	Tonnes (Mt)	Grade		Metal	
		eU (kg/t)	eU_3O_8 (kg/t)	eU_3O_8 (t)	eU_3O_8 (Mlb)
Marianne/Marilyn					
Measured	3.00	1.50	1.77	5,257	11.6
Indicated	14.00	1.19	1.41	19,726	43.5
Inferred	3.10	0.96	1.14	3,477	7.7
Miriam					
Measured	10.70	0.67	0.79	8,384	18.5
Indicated	0.50	0.46	0.54	281	0.6
MSNE					
Indicated	5.05	1.37	1.61	8,111	17.9
Inferred	0.10	1.14	1.34	131	0.3
Maryvonne					
Indicated	1.23	1.52	1.79	2,195	4.8
Inferred	0.42	1.41	1.66	703	1.6
MSCE					
Inferred	1.16	1.15	1.35	1,571	3.5
MSEE					
Inferred	1.95	1.31	1.54	3,003	6.6
TOTAL MEASURED	13.70	0.85	1.00	13,641	30.1
TOTAL INDICATED	20.78	1.24	1.46	30,313	66.8
TOTAL INFERRED	6.73	1.12	1.33	8,885	19.6

Table ES 4: Summary of the Madaouela Molybdenum Mineral Resources, effective date July 01, 2022

Classification	Tonnes (Mt)	Grade	Metal
		Mo (ppm)	Mo (Tonnes)
Marianne/Marilyn			
Indicated	1.90	486	914
Inferred	4.90	388	1,897
Miriam			
Measured	10.70	101	1,076
Indicated	0.50	38	20
TOTAL MEASURED	10.70	101	1,076
TOTAL INDICATED	2.40	393	934
TOTAL INFERRED	4.90	388	1,897

1.14 Mineral Reserve Estimates

The Qualified Persons accepting the professional responsibility for the respective open pit and underground Mineral Reserve estimates section are Ms. Colleen MacDougall, PEng (PEO#100530936) and Mr. Jurgen Fuykschot, MAusIMM (CP) (#306269). The Mineral Reserve estimate is presented in Table ES 5 for the open pit and Table ES 6 for the underground. Project base case economic analysis shows that the Madaouela life of mine (LoM) plan, used to estimate the Mineral Reserves, provides a positive present value of the net cash flow, confirming that the Mineral Reserves are economically viable, and that economic extraction can be justified. The author is not aware of any additional mining, metallurgical, infrastructure, permitting, or other factors not presented in this report that could materially affect the Mineral Reserve estimate.

Table ES 5: Mineral Reserve Estimate for the Miriam Open Pit Deposit, Madaouela Project, Niger, July 01, 2022

Classification	Quantity (kt)	U Grade (kg/t)	Mo Grade (ppm)	U Contained (t)	Mo Contained (t)
Open Pit Miriam					
Proven	5,344	0.88	124.3	4,696	664
Probable	55	0.40	0.0	22	0
Sub-Total	**5,399**	**0.87**	**123.1**	**4,718**	**664**

Notes:

1. All figures are rounded to reflect the relative accuracy of the estimate and have been used to derive sub-totals, totals and weighted averages. Such estimates inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, SRK does not consider them to be material.
2. The Concession is wholly owned by and exploration is operated by GoviEx.
3. The standard adopted in respect of the reporting of Mineral Reserves for the Project, following the completion of required technical studies, is in accordance with the NI 43-101 guidelines and the 2014 CIM Definition Standards, and have an Effective Date of July 01, 2022.
4. The Open Pit Mineral Reserves are reported with engineered pit designs using a cut-off grade of 0.28 kg/t U, which is based on a selling price of US$55/lb U_3O_8, operating costs of US$33.48/t feed, recovery of 94.5 %, royalty of 9 %, and transportation costs of 0.97/lb U_3O_8.
5. The Open Pit Mineral Reserves are derived from a regularized block model of 7.5 m x 7.5 m x 0.75 m and include an additional 2 % dilution and no mining loss.

Table ES 6: Mineral Reserve Estimate for the Underground Deposits, Madaouela Project, Niger, July 01, 2022

Classification	Quantity (kt)	U Grade (kg/t)	Mo Grade (ppm)	U Contained (t)	Mo Contained (t)
Underground M&M					
Proven	3,149	1.06		3,353	
Probable	10,602	0.81	79	8,629	834
Sub-Total	**13,750**	**0.87**	**61**	**11,981**	**834**
Underground MSNE + Maryvonne					
Proven					
Probable	6,652	0.79		5,273	
Sub-Total	**6,652**	**0.79**		**5,273**	
Combined Underground Totals					
Proven	3,149	1.06		3,353	
Probable	17,254	0.81	48	13,902	834
Total	**20,403**	**0.85**	**41**	**17,255**	**834**

Notes:

1. All figures are rounded to reflect the relative accuracy of the estimate and have been used to derive sub-totals, totals and weighted averages. Such estimates inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, SRK does not consider them to be material.
2. The Concession is wholly owned by and exploration is operated by GoviEx.
3. The standard adopted in respect of the reporting of Mineral Reserves for the Project, following the completion of required technical studies, is in accordance with the NI 43-101 guidelines and the 2014 CIM Definition Standards, and have an Effective Date of July 01, 2022.
4. The Underground Mineral Reserves are reported using a variable cut-off grade ranging between 0.5 and 0.6 kg U/t to account for the effect of ore sorting to reduce the dilution associated with varying seam thicknesses in different underground panels. This is based on a selling price of US$55/lb$U_3O_8$, operating costs of US$29.28/t feed, recovery of 94.5 %, and transportation costs of 0.97/lb U_3O_8.

1.15 Mining Methods

1.15.1 Open Pit Mining

Mining

The Miriam open pit operation will be a conventional drill, blast, truck and shovel operation. Ore loading will be undertaken on 6 m benches, mining to the orebody contacts, down to 0.75 m flitches where required. Two 12 m^3 excavators will be used to load 91 tonne haul trucks in the pit with a 6.4 m^3 front-end loader on the stockpiles and for backup in the pit.

A pit optimization was undertaken based on a USD 55/lb U_3O_8 price. The pit design was divided into six stages resulting in 5.4 Mt of run-of-mine (ROM) at 0.87 kg/t uranium and 123 ppm molybdenum with 50 Mt of waste, for a strip ratio of 9.3. The inventory is based on a cut-off grade of 0.28 kg/t uranium and includes 2 % dilution and 0 % mining loss.

The open pit production schedule is based on a ROM production rate of 1 Mtpa for five years and follows a 9-month pre-production period. High grade (HG) material, with a cut-off of 0.35 kg/t eU, is fed to the crusher, while all Low Grade (LG) material is stockpiled to be fed to the process at the end of the mine life.

Open Pit Water Management

Miriam dewatering will be achieved via sumps in the pit, with a pump to transfer water to the pit crest. Dewatering flow rates for Miriam have been determined from the numerical groundwater model and site wide water balance which considers groundwater inflows and direct precipitation whereby P10, P50 and P90 percentile dewatering rates have been derived.

The installed duty pumping capacity at Miriam is estimated to be 65 m^3/hr. Dewatering water pumped from the Miriam pit will be sent to a dewatering pond nearby to the process plant for subsequent use by the plant.

1.15.2 Underground Mining

Mining

The M&M and MSNE-Maryvonne deposits are planned to be mined as two independent underground room and pillar operations. M&M is to be mined first following completion of the Miriam open pit operation, with MSNE-Maryvonne following on after M&M. The mining methods are similar to the adjacent Orano S.A.'s. COMINACK mine (closed in 2021).

At both underground operations the mine development and ore production operations are planned to be by conventional drill and blast. Ore panels are to be mined as room and pillar, with ventilation provided by multiple raise bored holes positioned in each panel. Mined ore will be fed onto a conveyor system via feeder breakers. Run of mine ore will be sorted at the portal by X-ray fluorescence (XRF) and post sorted ore will be trucked to the process plant at a rate of 1.0 Mtpa.

M&M development will take 18 months until first ore, with an estimated production duration of 11 years. MSNE-Maryvonne decline and development will start in Year 10, with a development period of 28 months and an estimated production duration of 5 years.

Updates to the underground mining study subsequent to the PFS include:

- M&M mine design updated with adjustments to the main access tunnels and panel orientations in the SW of the deposit,
- Increased granularity in M&M's mine schedule following a new approach to define the mining blocks above cut-off grade.
- Review and update of the mine ventilation approach for both M&M and MSNE-Maryvonne mine.
- Reserve update following mine design adjustments and resource classification update.

Besides the improvements in the underground mine plan, there have also been schedule and overall underground mining assumption improvements. While there have been considerable updates to the underground design in the last 18 months, additional geotech and further ore sorter test work is still required for the underground and overall the underground design remains at a pre-feasibility level.

Underground Dewatering

Dewatering flow rates for M&M and MSNE have been determined from the numerical groundwater model and site-wide water balance which considers groundwater inflows whereby P10, P50 and P90 percentile dewatering rates have been derived. The installed duty pumping capacity is 300 and 350m^3/hr for M&M and MSNE respectively, with standby pumping capacities of 400 and 550 m^3/hr.

Dewatering from M&M and MSNE is predicted to produce significant volumes of excess water that will exceed the mine's water demand. For the purposes of design and costing it is assumed excess water from M&M will be discharged via a seepage recharge trench and excess water from MSNE will be discharged into the vacant M&M workings. The trench is designed for the P90 excess inflow from M&M; approximately 350 m^3/hr. Further assessment is required for the FS including a trade-off against other methods, such as reinjection wells, along with supporting field investigations and modelling.

Treatment of excess water will be required. For the purposes of design and costing the study allows for a treatment system comprising settlement ponds near the portal of each deposit. From this, water will be pumped to a shared water treatment facility which will comprise oil water separators and rotating biological contactors (RBCs) for nitrate removal. Further work will be required during the Feasibility Study design to evaluate in detail additional treatment requirements, including volumetric capacity of the plant.

1.16 Recovery Methods

1.16.1 Project Process Plant

A traditional flowsheet has been chosen for the treatment of ore from the open pit (Miriam), which is relatively low in gangue acid consumers, with the exception of a novel dry milling process and the addition of a Ion Exchange (IX) process for the recovery of molybdenum. The flowsheet comprises crushing, milling, two stage tank leaching, molybdenum recovery by ion exchange (IX) and uranium recovery by solvent extraction (SX) followed by precipitation of ammonium diuranate (ADU). A flotation section can be added in later years, to reject carbonates and consequently decrease acid consumption, when underground ore is treated.

Ore is initially fed through a single stage open circuit primary crusher, where a product size of 100 mm (P_{80}) is achieved. The ore is then fed from the mill feed stockpile at an average rate of 3,223 tpd to milling. The ore is fed via apron feeders to discharge conveyers and transported to the milling circuit. The crushed ore is fed to a VeRo liberator® milling circuit operated with a closed-circuit screen to produce a grind size of 300 µm (P_{80}) which proceeds to the leaching circuit after slurrying using process water. The VeRo circuit consists of 2 x 100 tph units, operated in parallel. Each VeRo mill will produce open circuit fines fed forward to leach, with oversized material recirculating back to the VeRo mill via wet vibrating screening. Both VeRo units will feed oversize material to a single vibrating screen.

The two-stage leaching circuit consists of primary and intermediate thickeners in combination with a primary and secondary agitated tank leach system. Tanks are agitated to allow the ore to react with concentrated sulfuric acid allowing dissolution of the contained uranium, while the redox potential is controlled by the addition of hydrogen peroxide. The leach tanks in both stages are sparged with steam to maintain 50°C in the leach circuit. The leach residue is then filtered on horizontal belt filters, with filtered solids residue discarded to the dry stacked tailing's storage facility.

The pregnant leach solution (PLS) containing uranium, molybdenum as well as other metal contaminants undergoes clarification before being fed to a continuous ion exchange plant (CIX) where molybdenum is selectively adsorbed onto the resin. Uranium remains in solution and is fed to a conventional uranium SX plant (Alamine 336) for uranium recovery. Molybdenum is eluted from the resin using a sodium hydroxide solution, from which a molybdenum sulfide product is precipitated via the rapid acidification process.

For purposes of determining reagent consumption related to molybdenum grades varied molybdenum feed grades were used, progressing as the pit (Miriam) ore is mined and the underground (M&M) ore is fed to the process. Molybdenum grades of the pit (Miriam) range from 55 ppm – 200 ppm molybdenum. Underground (M&M) grades are also expected to vary during the life of mine from 55 ppm – 550 ppm molybdenum.

In the SX circuit, uranium is extracted from the IX barren solution into the organic phase through a series of mixer settlers. The loaded organic is scrubbed to remove impurities and then stripped with ammonium sulfate to produce a uranium-rich liquor (OK Liquor) for the ADU precipitation stage and recirculated back to extraction. ADU precipitation is conducted in a series of agitated tanks with the addition of ammonia and air. The ADU precipitate is thickened, washed and filtered followed by drying and drum packaging of the ADU yellow-cake product (U_3O_8).

The SX raffinate is recirculated back as process water to recover acid to the circuit. The metal-ion tenor of the recirculating process water load in the circuit is controlled by bleeding a stream from the overflow to the neutralisation circuit. This prevents the metal-ion concentration in the recirculating water load from reaching critical levels. This bleed is largely used for dust suppression on the mine roads with excess deposited to the dry stack tailings facility.

1.17 Project Infrastructure

General Infrastructure

This section presents the surface infrastructure assets proposed at four separate operational areas:

- Miriam open pit operation (Miriam);
- Explosives Storage Facility (ESF);
- Bulk power supply;
- Marianne-Marilyn underground operation (M&M);
- MSNE-Maryvonne underground operation (MSNE); and
- Transport and Logistics;

The main project infrastructure will be located adjacent to the Miriam open pit, processing plant, and tailings storage facilities (TSF). The overall layout of the Madaouela Miriam open pit area is shown below on Figure ES 4.

Potential logistics scenarios to transport the anticipated quantities of reagents and consumables required supporting the proposed Madaouela mine and process plant have been assessed. This includes existing regional infrastructure to establish multi-modal solutions to transport reagents and consumables to Arlit, approximately 12 km north-west of the proposed development.

The assessment indicates that road transportation from Cotonou in Benin represents the most cost-effective option to transport process reagents/consumables to Arlit.

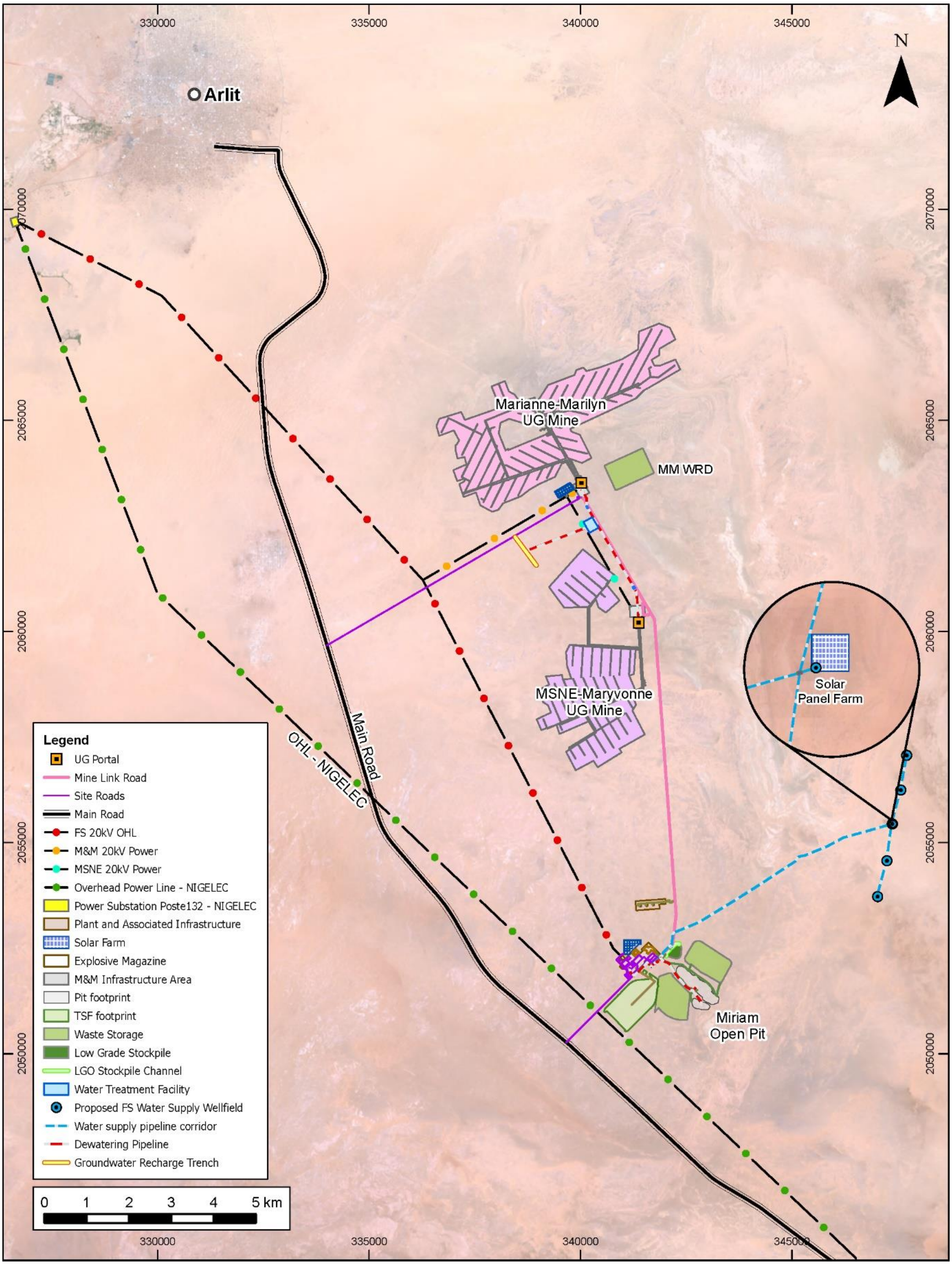

Figure ES 4: Madaouela Project Infrastructure Full Extent

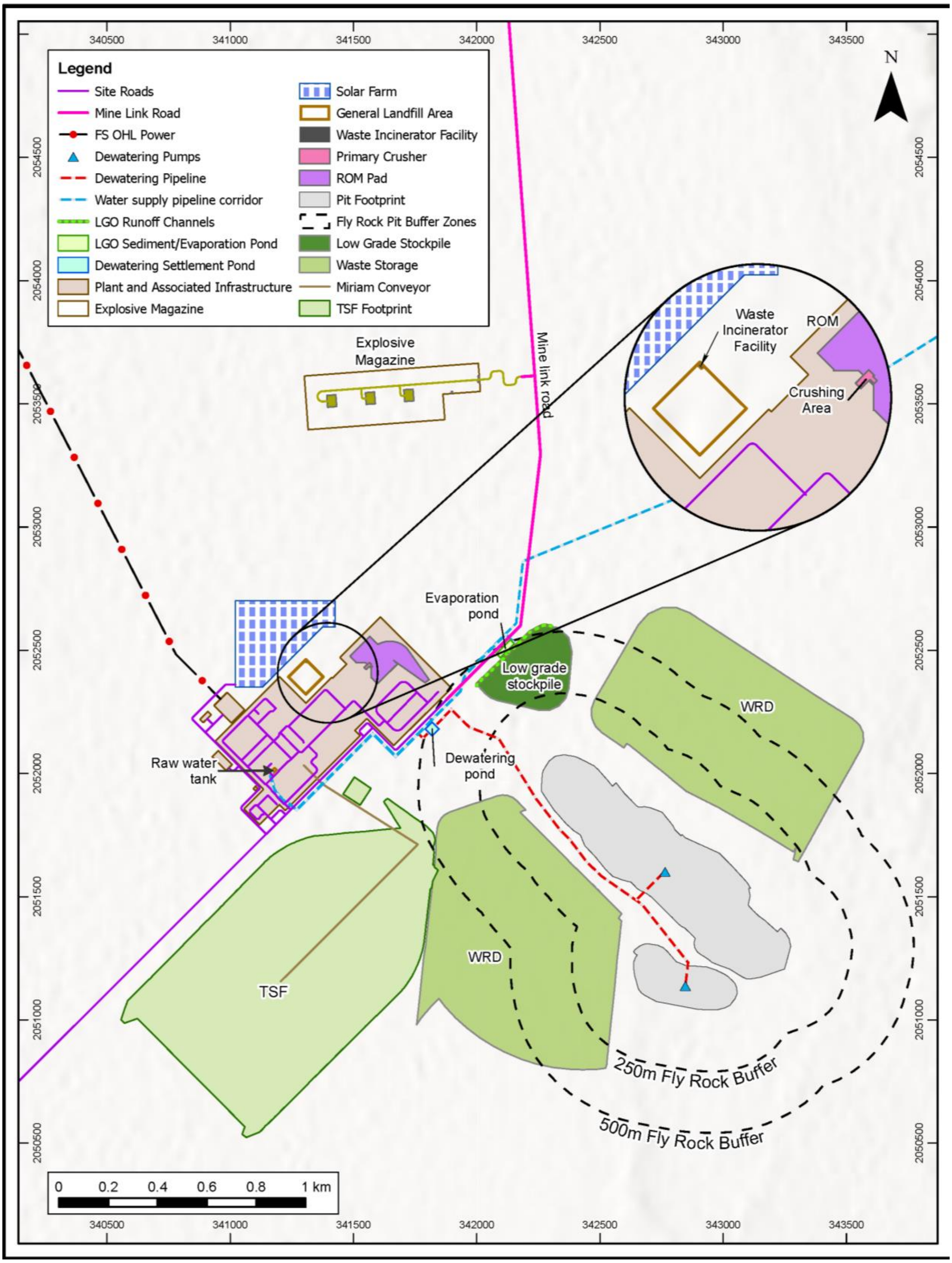

Figure ES 5: Madaouela Project Miriam Infrastructure

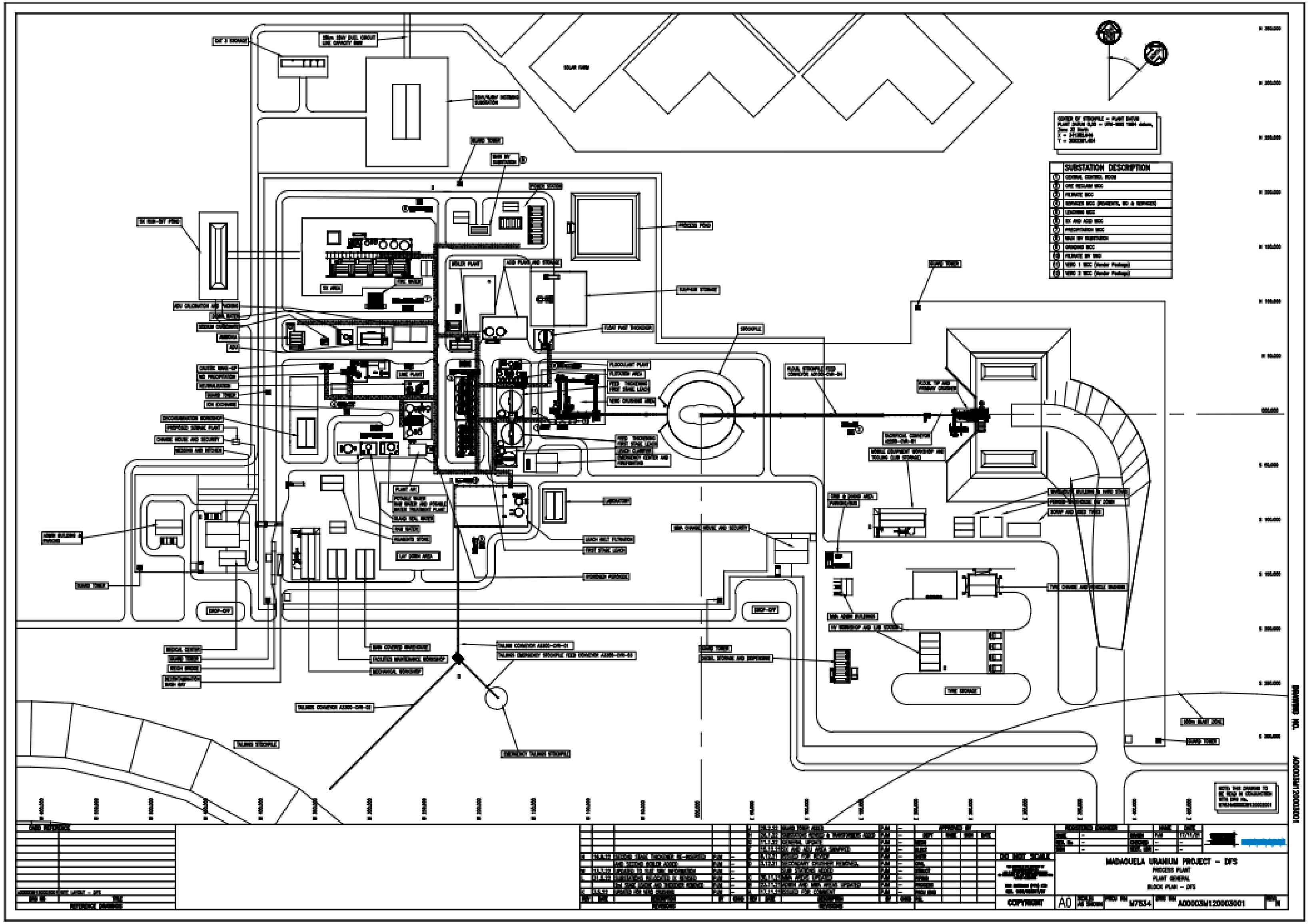

Figure ES 6: Madaouela Project Infrastructure Block Plan

Water Supply Wellfield

The Project's make-up water demand will be met by a wellfield, comprising five production wells, located approximately 7.5 km north-east of the process plant. A range of power options were investigated as part of the Feasibility Study and, considering favourable climatic conditions, a solar powered solution was selected. Water will be pumped via a pipeline to the process plant.

Abstraction rates for the wellfield have been determined from the site-wide water balance which calculates the mine's make-up water demand. The wellfield has been designed based on a conservative water demand, namely the P10 scenario, which peaks at a maximum of 3,500 m^3/day. This assumes underground dewatering water is not utilised by the plant, which would significantly reduce wellfield abstraction rates in the medium to long term. A numerical groundwater model has been used to assess the long-term sustainability of the wellfield.

1.18 Market Studies and Contracts

This section aims to provide an overview of the fundamental principles of the uranium market and how the derived U_3O_8 is sold into the market; transported; and transformed for use in nuclear reactors. As such the following elements will be described in order to:

- Understand the position and role of uranium within the nuclear fuel cycle.
- Analyse U_3O_8 demand with particular reference to the U_3O_8 requirements of the world's reactors.
- Explain the transformation of U_3O_8 into UF_6 and the role of the Conversion Facilities who provide such a service.
- Summarise the requirements for transportation of U_3O_8 from GoviEx's Madaouela Uranium Project to the Conversion Facilities.
- Examine the contractual relationship between GoviEx as the Uranium Producer and the Conversion Facilities.

Since 2011 the key impact on primary uranium demand was excess inventories throughout the supply pipeline. Increasing nuclear energy production and primary uranium supply constraints have resulted in declining inventories. The uranium miners have reduced their inventories to just-in-time levels through supply reductions, sell down of surplus inventories, on-market purchases and in the case of Kazatomprom, sale of its surplus inventory to the financial fund Yellow Cake.

Utility inventories have been declining as long-term contracts have unwound, and utilities have undertaken active inventory control. This has been compounded by uncertainty associated with geo-political factors, especially effecting the US, including the Iran Sanctions, Russia Suspension Agreement and Section 232/Nuclear Fuel Working Group. During 2020 and into the start of 2021 the utilities have been affected by Covid, which while it reduced nuclear energy generation by approximately 4 % in 2020, resulted in a decline of between 20-30 % of annual purchases.

In late 2021, the activity of Sprott Physical Uranium Trust (SPUT), and in 2022, the disturbances in the Russian Sphere of Influence (RSOI) have dramatically focussed the industry's attention on security of fuel supply issues and have increased the uncertainty faced by buyers and sellers alike.

Inventories on conversion and enrichment material have also been declining, as highlighted by the rising price and increasing concerns on conversion and enrichment capacity in the medium to long term.

The increasing supply constraint and declining inventories has already been noted by the improving uranium price. Based on history alone, uranium prices can make swings when future production levels are uncertain due to the long lead times required to bring new projects online. Since the actions taken by Cameco and Kazatomprom to constrain supply, and the recent market impacts of SPUT and conflicts in the RSOI, the uranium price has responded positively.

1.19 Environmental Studies, Permitting and Social or Community Impact

In accordance with the requirements of Niger legislation for Environmental Impact Assessments (EIAs), GoviEx contracted Legeni to undertake various baseline studies (including a socio-economic assessment, air quality monitoring, reconnaissance surveys of fauna and flora, soils and geomorphology and archaeology and cultural heritage) for the Project. SRK reviewed the specialist baseline studies as well as completing hydrology and hydrogeological studies on the Project concession. SRK then led and completed an impact assessment process (ESIA) and Legeni conducted stakeholder engagement in accordance with Niger in-country regulatory requirements and international good practice. The final ESIA report and supporting baseline information was submitted to the Ministry on March 10, 2015. On July 28, 2015 the ESIA was approved by the Minister in charge of the environment.

In 2022, as part of the Feasibility Study, Labogec updated aspects of the environmental and social baseline data. This was based on a request by SRK to review and update specific elements of the original study given the amount of time that has lapsed since the original baseline was conducted. The update was also done in light of the evolution of the project design since the compilation of the ESIA report. This is discussed further in Section 20.4.8.

The update targeted aspects of the baseline that may have altered over the course of the last 8 - 10 years. The update focused on the physical environment, social-economic characteristics, natural resources and land use, avifauna, traffic and water supply. GoviEx plans to conduct additional air quality, dust and water sampling before construction work starts. This will ensure a current baseline is recorded immediately prior to the start of the project construction. This will provide the basis for future monitoring and evaluation of any changes as a result of the project development. The project’s environmental and social setting is presented in Section 5.

The overall conclusion of the ESIA is the majority of potential negative impacts identified can be reduced to acceptable levels with effective management measures, which GoviEx is committed to implementing. There are a number of management controls requiring interaction with either government officials or potentially affected communities. GoviEx will actively engage with these key stakeholders to present the proposed management controls and seek to find consensus on the way forward. GoviEx is also committed to continuing to undertake ongoing stakeholder engagement with the wider communities and other stakeholders potentially affected, positively and negatively, by the Project.

Stakeholder engagement is required in accordance with Niger legislation and international good practice. To date several interactions have been undertaken with local stakeholders as part of the data collection for the social baseline studies. These meetings took place in the Communes of Arlit, Gougaram and Dannet and included discussions with groups of men, women and youths and background information on the Project was presented. In addition, meetings were held with traditional authorities, community leaders, technical experts and other key informants.

A number of issues and concerns were raised during these meetings such as the existing negative legacy of mining activities in the area; the potential loss of local livelihoods due to competition for land and water resources, which will be exacerbated by population influx; possible pollution to the environment; potential infrastructure improvement and job creation; and the necessity for proper stakeholder consultation. There is currently an ongoing GoviEx CSR program focused on education, food and water.

Several impacts have already been managed through inherent measures incorporated into project design. There is further opportunity to avoid or reduce the severity of some impacts by continuing to consider environmental and social elements as final designs are confirmed. The robustness of the supporting management programmes, along with implementation, assurance and continual improvement functions of the planned Environmental and Social Management System, are fundamental to enabling the successful implementation of management measures by the GoviEx, its contractors and sub-contractors. Prior to the start of construction, a number of specific management plans will be developed with associated monitoring programmes. Monitoring results will be regularly reviewed to confirm the nature and scale of any predicted impacts. The plans will include trigger action levels where mitigation measures may need to be reviewed and revised.

1.19.1 Socioeconomic Impacts

GoviEx will bring significant direct and indirect investment to the Nigerien economy with a planned initial capital expenditure of USD 343 million, and total project capital expenditure of USD 619 million.

The Project will provide economic benefits based on a total life of project revenue of approximately USD 3,300 million with an anticipated total of around USD 233 million in life of project royalty payments. Over the 20 year planned mine life, based on a received uranium price of USD 65/lb U_3O_8, this equates to a LoM royalty rate of 7 %.

The predicted tax incomes are based on the 2006 Mining Code and are projected to amount to USD 252 million, tax on profits, over the life of the mine, as well as employment taxes that would be derived from an anticipated labour cost of over USD 180 million (approximately 10 % of total operating costs).

Direct and indirect employment opportunities will vary across the life of the mine in terms of numbers and skills required. GoviEx has a policy to employ 100 % Nigeriens where practicable and is committed to sourcing labour as close to the Project as possible. It is estimated that around 800 skilled and semi-skilled jobs will be created during the life of operations with substantially more temporary positions during construction. The project includes a training allowance of 5 % base salary for annual training. Substantial financial provisions are made for training throughout the mine life.

Playing a proactive role in this through training suppliers to enhance the quality of their service and products could also result in skill development that is transferable to other industries. If this were linked into existing technical and vocational education and training (TVET) initiatives, it would begin the process of ensuring a positive legacy and sustainable benefits. This could also impact positively on a large proportion of the disengaged young people in urban and rural communities of the Department through increasing their access to direct and indirect employment opportunities.

1.19.2 Post ESIA changes

The project design changes are largely beneficial from an environmental perspective. The relocation of project infrastructure results in the main noise, dust and air emission sources being located further from the towns of Arlit and Akokan. The impact to air, noise and soil remain similar and the change in location does not impact the nature or scale of the impacts, particularly given lack of local community receptors. Air quality parameters will be reviewed against the final process flow sheet and the air quality monitoring programme adapted as required. Handling and storage of ammonia will require specific operating procedures.

The optimisation of the uranium and molybdenum recovery processes has led to reductions in water and power requirements for the project. This has reduced the potential impacts on groundwater aquifers and reduced the carbon footprint for the project. The incorporation of solar and battery storage as a key feature of the overall power design has further improved the quantity of carbon associated with each tonne of uranium produced.

The proposed mitigation measures remain appropriate and applicable, and their effectiveness will continue to be measured through the implementation of the social and environmental management plan.

1.20 Capital and Operating Costs

The tables below summarise the capital and operating costs for the Madaouela Uranium Project. The detailed development of these individual costs is provided in the relevant sections.

1.20.1 Capital Expenditure

Total capital expenditure for the life of the operation is presented in Table ES 7. Capital costs include a 10 % contingency.

Table ES 7: Capital expenditure

Parameter	Units	Total amount
Initial Capital		
Open Pit Mining	(USDm)	46.1
Processing	(USDm)	242.4
Tailings	(USDm)	14.8
Infrastructure	(USDm)	28.6
Water	(USDm)	6.0
Owners Costs	(USDm)	4.8
Total	**(USDm)**	**342.7**
Sustaining Capital		
Open Pit Mining	(USDm)	2.7
Underground Mining	(USDm)	218.6
Tailings	(USDm)	7.8
Power	(USDm)	2.5
Infrastructure	(USDm)	34.2
Water	(USDm)	7.6
Processing	(USDm)	3,1
Total	**(USDm)**	**276.6**
Total Capital Expenditure	**(USDm)**	**619.3**

1.20.2 Operating Costs

Life of mine operating costs are presented in Table ES 8.

Table ES 8: LoM operating costs

	USD /t Process	USD /lb U_3O_8	LoM USDm
Open Pit Mining	*20.8*	*9.1*	102.6
Underground Mining	*44.0*	*16.0*	633.7
Total Mining*	38.1	14.5	736.3
Processing	35.8	13.6	691.5
SG&A	9.3	3.5	179.0
Sub Total Operating Costs	83.1	31.7	1,607.0
Mine Closure	0.4	0.2	8.5
Total Operating Costs	**83.5**	**31.8**	**1,615.4**

Molybdenum mineralisation occurs in both the open pit and the underground mines and the process plant has been designed and costed for the recovery of molybdenum for the life of the mine. Molybdenum reserves are defined for the Miriam open pit and the initial mining period in M&M but molybdenum resources have not been classified for the majority of M&M and not at all for MSNE. The financial model incurs the costs associated with molybdenum recovery throughout the life of mine immaterial of the molybdenum grade from ore resources which provides a conservative cashflow approach. A sensitivity approach including molybdenum grades in the underground mining operations not included in the measured and indicated resource categories is presented in Section 21.

1.21 Economic Analysis

1.21.1 Uranium and Molybdenum Production

Molybdenum production (MoS_3) is an independent by-product of the processing plant based on metallurgical testwork results that demonstrates recovery to produce a clean U_3O_8 product. Therefore, associated operating and capital costs to recover MoS_3 are included in the model in all cases no matter the molybdenum resource status.

The project contains molybdenum mineralisation in both the Miriam open pit and underground mines at the following average levels:

Table ES 9: Average Molybdenum Content (ppm) for Indicated, Inferred and Unclassified Resource

	Indicated	Inferred	Unclassified
Miriam	130	-	-
MM	474	335	388
MSNE	-	-	568

As a result of the confirmation of appreciable molybdenum in metallurgical tests conducted, it is considered relevant to present the potential positive impact that recovery of MoS_3 product from processing uranium ore life of mine would have on project economics.

Inputs

The assumptions applied and the inputs to the financial model include:

- The ore tonnages and uranium grades in the LoM plan, constitute the Mineral Reserves, prepared in line with the CIM definition standards.
- A plant capacity of 1 Mtpa.
- On average a 76.7 % mass yield is achieved via the ore sorter stage, this includes a portion of screened fine material that does not pass through the ore sorter.
- Overall uranium recovery of 94.8 % for open pit plant feed, 91.5 % for underground plant feed.
- The molybdenum feed sources are split between indicated (73 ppm), indicated and inferred (127 ppm) and indicated, inferred and unclassified (360 ppm). Recovery of molybdenum metal is 88.9 % for the open pit and 79.9 % for the underground. The base case considers only indicated molybdenum however the results for all cases are calculated.
- Plant operating costs include an allowance for molybdenum recovery based a 50 ppm molybdenum grade even if no molybdenum resource is present.
- A LoM of 19.5 years based on plant production, excluding construction.
- An assumed U_3O_8 price of USD 65 /lb and a molybdenum price of USD 5.9 /lb MoS_3. This is based on the Q3 2022 long term price sourced by the Company.
- Operating and capital costs are defined in Section 21. These include a 10 % contingency on all upfront capital costs.
- A 30 % income tax rate after a three-year tax holiday.
- Royalty rate based on the 2022 Niger Mining Code which stipulates a flat rate of 7 %.
- A base case 8 % discount rate.
- No provision for salvage value at closure has been assumed.

LoM ore tonnages and uranium grades for the three different deposits are presented in Table ES 10.

Table ES 10: Technical Mining Inputs

Parameter	Units	
Ore production period	(years)	19,7
Plant operating period	(years)	**19,5**
Miriam	(years)	Year 0 to 5
Marianne-Marilyn	(years)	Year 5 to 16
MSNE-Maryvonne	(years)	Year 15 to 19,5
RoM Ore to Plant	(kt)	**19,341**
Miriam	(kt)	4,940
Marianne-Marilyn	(kt)	9,945
MSNE-Maryvonne	(kt)	4,457
RoM U Grade	(kg/t eU)	**1.08**
Miriam	(kg/t eU)	0.87
Marianne-Marilyn	(kg/t eU)	1.16
MSNE-Maryvonne	(kg/t eU)	1.14
U Content	(kt)	**21.18**
Miriam	(kt)	4.58
Marianne-Marilyn	(kt)	11.53
MSNE-Maryvonne	(kt)	5.08

Results

The economic analysis of the production case including the Mineral Reserve and recovery of a molybdenum by-product is presented in Table ES 11. Revenue generated by MoS_3 sales refers only to the indicated case with the inferred and classified cases shown separately.

Table ES 11: Uranium and Molybdenum Mineral Reserve Economic Summary

Parameter	Units	
Mining		
RoM Ore	(kt)	19,341
U Grade	(kg/t eU)	1.10
U Content	(Kt eU)	21.33
Processing		
Average U Recovery	(%)	92.20%
U Recovered	(M lb)	43.06
Revenue		
U_3O_8 Sales	(Mlb U_3O_8)	50.78
U_3O_8 Price	(USD/lb U_3O_8)	65.00
U_3O_8 Revenue	(USDm)	3,301
MoS_3 Sales	(USDm)	30.64
Operating Expenditure		
Direct Operating Costs	(USDm)	1,615
Royalty (U + Mo)	(USDm)	233
Total Operating Costs	(USDm)	1,848
Unit Operating Costs		
Subtotal Operating Costs	(USD/t ore)	83.51
	(USD/lb U)	37.51
	(USD/lb U_3O_8)	31.81
Royalty	(USD/t ore)	12.06
Total Operating Costs	(USD/t ore)	95.57
	(USD/lb U)	42.93
	(USD/lb U_3O_8)	36.40
Operating Profit – EBITDA	(USDm)	1,483
Corporate Profit Tax	(USDm)	252
Net Free Cash	(USDm)	611
NPV @ 8.00%	(USDm)	120
IRR	(%)	12.71%
Breakeven Price (NPV=0 @ 8%)	(USD/lb U_3O_8)	57.09

Sensitivity

Table ES 12 and Table ES 13 presents NPV and IRR sensitivity results for changes in uranium prices and molybdenum prices, at the base U_3O_8 price of USD 65 /lb and 8 % discount rate.

Table ES 12: NPV and IRR Sensitivity to uranium Price

Price (USD/lb U_3O_8)	NPV (USDm)	IRR (%)
70	199	15,5%
65	**120**	**12,7%**
60	41	9,7%

A sensitivity to the molybdenum price is presented in Table ES 13 at the base U_3O_8 price of USD 65 /lb and 8 % discount rate.

Table ES 13: NPV and IRR Sensitivity to MoS_3 Price[1]

Price (USD/lb MoS_3)	NPV (USDm)	IRR (%)
6.49	121	12.8%
5.90	**120**	**12.7%**
5.36	119	12.7%
[1] based on a USD 65 /lb U_3O_8 price		

1.21.2 Molybdenum Upside Cases

The inputs are the same as those previously presented in the “Uranium and Molybdenum Mineral Reserves”, however include upside from the inferred and unclassified molybdenum grades.

Figure ES 7 below shows the difference in mass of molybdenum recovered per year for each of the three modelled cases.

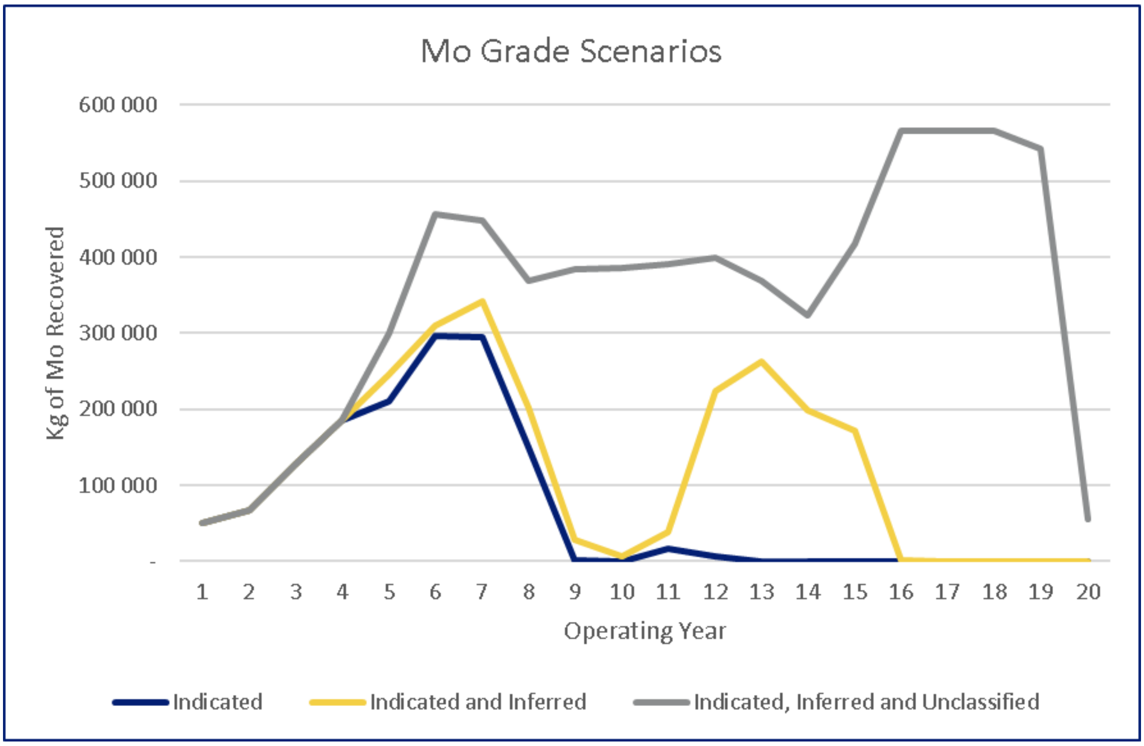

Figure ES 7: Recovery of Molybdenum for Three Cases

1.21.3 Results

The economic analysis for the indicated; indicated and inferred; indicated, inferred and unclassified molybdenum cases for the LoM are shown in Table ES 14.

Table ES 14: Molybdenum Cases: Economic Summary

Parameter	Units	Indicated Mo Only (as above)	Indicated and Inferred Mo	Indicated, Inferred and Unclassified Mo
Revenue				
U_3O_8 Sales	(M lb eU_3O_8)	50.78	50.78	50.78
U_3O_8 Price	(USD/lb U_3O_8)	65.00	65.00	65.00
U_3O_8 Revenue	(USDm)	3,301	3,301	3,301
Molybdenum Sales	(USDm)	31	53	146
Operating Expenditure				
Direct Operating Costs	(USDm)	1,615	1,618	1,635
Royalty (U + Mo)	(USDm)	233	235	241
Total Operating Costs	(USDm)	1,848	1,852	1,877
Unit Operating Costs				
Operating Costs (Excl. Royalty)	(USD/t ore)	83.51	83.63	84.55
	(USD/lb eU)	37.51	37.56	37.98
	(USD/lb eU_3O_8)	31.81	31.85	32.21
Royalty	(USD/t ore)	12.06	12.14	12.48
Total Operating Costs	(USD/t ore)	95.57	95.77	97.03
	(USD/lb eU)	42.93	43.02	43.58
	(USD/lb eU_3O_8)	36.40	36.48	36.96
Operating Profit – EBITDA	(USDm)	1,483	1,501	1.570
Corporate Profit Tax	(USDm)	252	258	278
Net Free Cash (EBITDA - Tax - CAPEX)	(USDm)	611	624	673
NPV @ 8%	(USDm)	120	125	140
IRR	(%)	12.71%	12.85%	13.27%
Breakeven Price (NPV=0 @ 8%)	(USD/lb U_3O_8)	57.38	57.09	56.12

Sensitivity

Table ES 15 and 8 presents NPV sensitivity results for changes in uranium and molybdenum price based on the range of long-term forecasts sourced by the Company.

Table ES 15: NPV Sensitivity to Uranium Price (at 8 % discount rate)

Price (USD/lb U_3O_8)	Indicated Mo Only - NPV at 8% (USDm)	Indicated and Inferred Mo - NPV at 8% (USDm)	Indicated, Inferred and Unclassified Mo-NPV at 8% (USDm)
70	199	126	219
65	**120**	**125**	**140**
60	41	123	61

Table ES 16: NPV Sensitivity to Molybdenum Price (at 8 % discount rate)[2]

Price (USD/lb MoS_3)	Indicated Mo Only - NPV at 8% (USDm)	Indicated and Inferred Mo - NPV at 8% (USDm)	Indicated, Inferred and Unclassified Mo-NPV at 8% (USDm)
6.49	121	126	144
5.90	**120**	**125**	**140**
5.36	119	23	136
[2] based on a USD 65 /lb U_3O_8 price			

1.21.4 Conclusion

Cresco has undertaken an economic assessment to verify and demonstrate the economic viability of the Mineral Reserves. Mineral Reserves declared at a price of USD 65/lb U_3O_8 and USD 5.90 /lb MoS_3 (indicated molybdenum only) return a positive NPV of USD 120 million at a discount rate of 8 %, with an IRR of 12.71 %.

As a result of recoverable molybdenum being present in assay and metallurgical testwork, two additional cases are considered which are the indicated and inferred molybdenum with a positive NPV of USD 125 million at a discount rate of 8 %, with an IRR of 12.85 %, and an indicated, inferred, and unclassified molybdenum case with a positive NPV of USD 140 million at a discount rate of 8 %, with an IRR of 13.27 %.

1.22 Adjacent Properties

There are currently two historical producing mines in the Arlit region that are on property positions immediately adjacent to the Madaouela Uranium Project:

1.22.1 SOMAÏR

Société des mines de l'Aïr (SOMAÏR) has operated several uranium deposits near the town of Arlit since 1971. The company is operated by Orano, which owns 63.4 % of the share capital; the remaining 36.6 % is held by SOPAMIN, the Nigerien national mining company. SOMAÏR historically produced approximately 2,000 to 3,000 metric tons of uranium per year.

1.22.2 COMINAK

COMINAK (Compagnie Minière d'Akouta) is operated by Orano (34 %). COMINAK historically produced approximately 1,000 to 2,000 metric tons of uranium per year. The COMINAK mine was closed on March 31, 2021 and is currently under site remediation.

1.22.3 Imouraren

Located 80 kilometres south of Arlit, the Imouraren deposit was discovered in 1966 and constitutes one of the largest deposits in the world today. Orano received the mining permit for the deposit in early January 2009. The Imouraren SA mining company was established, with Orano Mining (95.3 % AREVA and 4.7 % KIUI) holding a 66.65 % interest, 10 % by Niger and 23.35 % SOPAMIN. The site, equipment and facilities are currently under care and maintenance.

1.23 Other Relevant Data And Information

1.23.1 Geotechnical Studies

Geotechnical Infrastructure

SRK has undertaken an FS-level ground investigation for the waste dumps, tailings storage facility, Miriam overhead line, mine link road, portals, borrow pit areas and the process plant area within the Madaouela project. The key aims of the investigation were to:

- Characterise the geotechnical properties of the near surface soils.
- Understand the potential geohazards and foundation conditions of the infrastructure and waste areas.
- Characterise the distribution of clay and sandy soils.
- Identify areas for borrow pit material.

The GI was completed between August 13, 2021 and September 10, 2021 by an experienced SRK associate engineer and comprised of 14 rotary bored boreholes and 47 trial pits. A total of 6 boreholes were completed around the perimeter of the TSF. The remaining 8 boreholes were completed across the plant site. All 47 trial pits were excavated using a mechanical excavator to a target depth of 3 m. They were completed in the TSF, waste rock dumps, plant, overhead cable alignment, haul road alignment and borrow pit areas. No water was noted in any of the exploratory hole records provided.

Selected samples from the trial pits and boreholes were transported to Rocklab, Pretoria, South Africa for geotechnical laboratory testing, with some tests conducted by SGS Laboratory.

The investigation focussed on two main areas with distinct ground conditions, the main mine infrastructure area and the borrow pit area.

In general, the ground conditions encountered across the project site were Aeolian blow sands underlain by weathered Guezouman (sedimentary rock) grading into competent Guezouman. Localized zones of fine grained borrow pit are also present throughout the site.

Geotechnical Open Pit

Open Pit Slope Analyses

SRK has undertaken an FS-level geotechnical study of the Miriam open pit within the Madaouela project. Within it, SRK has updated the geotechnical logging database, totalling 2,120 m of core, of which 1,461 m have been surveyed with downhole televiewers. In addition, 108 laboratory tests were carried out on rock samples, of which 65 were UCS tests and 33 triaxial tests. This enabled defining the intact rock and rock mass strength parameters for subsequent stability analyses.

Slope geometry has been designed with 6.6 m berm width and 12 m bench height, with a 75° bench face angle and 51° inter-ramp angle (in the Weathered Tchinezogue unit) and an 85° bench face angle and 57° inter-ramp angle (in other units).

The overall design assuming one 20 m geotechnical berm or ramp, this design will yield an overall slope angle of ~53°.

1.23.2 Water Studies

Hydrogeological Characterisation and Modelling

The ore horizons at Madaouela are located at the base of the Guezouman Formation, which is an aquifer and must be dewatered to facilitate extraction of the ore. Over-exploitation of groundwater is a major issue in the area and the impacts of dewatering must be thoroughly evaluated and mitigated. The Project must also operate within the Mining Code and is therefore committed not to waste water. Careful planning of the dewatering programme is therefore essential to avoid wastage of groundwater.

There is no legislative requirement to pay for abstracted groundwater. It is also understood that the exploration and mining licences come with a right to abstract groundwater within that licence area. The right to abstract groundwater is however dependent on that abstraction having no adverse impact on existing groundwater users within or adjacent to that licence area.

Groundwater flow is primarily controlled by both lithology and structure, as is typical for sedimentary groundwater systems. The majority of groundwater flow occurs within the sedimentary sandstones. The major faults, including the Arlit and Madaouela Faults, result in discontinuity within the high permeability sandstone beds and form low permeability barriers within the regional groundwater system.

Groundwater levels in the Marilyn area are heavily influenced by both historic and current groundwater abstractions. The Marilyn deposit was dewatered for a period of approximately 12 months during the 1960’s and the Guezouman is still used to provide a water supply for the army camp. This had resulted in a cone of depression that is concentrated along the UA channel in the Marilyn deposit. The phreatic surface sits at approximately 390 mRL along the centre of the UA channel, and rises to between 405 mRL and 410 mRL to the north and south. The eastern extreme of the Marilyn deposit is in close proximity to the dry limit of the Guezouman; the deepest section of the Marianne deposit is approximately 80 m below water level.

The phreatic surface ranges from approximately 405 to 410 mRL across the MSNE deposit, approximately 80 to 90 m above the elevation of the workings. Groundwater flow direction is from the southeast to the northwest in the MSNE and is influenced by the abstractions at Marilyn and the regional impact of dewatering at the SOMAÏR and COMINAK mines to the northwest.

The majority of the abstraction is from the Tarat aquifer. Drawdown within the Tarat has also extended to the south and east of Arlit, extending into the Madaouela I concession area. Drawdown in the Tarat is estimated at 40 m immediately to the west of Miriam (compared to over 100 m in the vicinity of the COMINAK mine). The extent of drawdown further south is yet to be confirmed. The impact on water levels east of the Madaouela Fault is minor although some leakage across the fault is occurring in the Miriam area due to drawdown within the Guezouman.

Groundwater modelling was completed as part of the Integrated Development Plan (IDP) in 2013. A 3D numerical model was constructed to estimate dewatering rates, cone of depression and wellfield sustainability. The model constructed as part of the IDP study was constructed in MODFLOW 2005. This model was updated for the FS modelling using the MODFLOW Python package, FloPy. FloPy includes pre-processing and post-processing functionality as well as the capacity to run MODFLOW simulations. The increased functionality allowed for the construction of stochastic simulations with customised sequential alterations to the numerical groundwater model, and the subsequent post-processing of a large amount of data.

Water Balance

SRK has developed a water balance model to predict site-wide water inflows and outflows and assess water management requirements for the project throughout the life of mine. The water balance model combines all inflows and outflows across all project facilities, including the open pit, the underground mines, the plant area, as well as the water treatment plant and discharge areas.

SRK developed a water balance study to evaluate the seasonal and annual variability of water flows (excess/deficit) through the water management system using GoldSim™ software version 14.

A wellfield located to the north-east area of the main mine site area is considered as the main source of water for process make-up water, road dust suppression and fresh/potable demand.

Make-up demand for the first 2 - 3 years is approximately 105 m^3/hr which then reduces through to 2030 where the additional influx from Miriam pit dewatering is provided to the plant. Water demand peaks between c.2030 - 2031 at approximately 140 m^3/hr whereas Miriam dewatering ceases and M&M dewatering ramps up. From c.2032 the demand stabilises at around 105 m^3/hr.

Excess water is predicted to start manifesting between 2029 (P90) and 2034 (P10) at the onset of dewatering from M&M. For the P90 scenario, excess water volumes rise gradually to approximately 350 m^3/hr to 2040 and peak in 2041 at over 600 m^3/hr when both M&M and MSNE are dewatering.

1.23.3 Tailings Storage Facility

The Madaouela tailings storage facility has been designed by SRK (UK) as a filtered tailings stack. This method of tailings storage was selected to maximize the return of water to the process plant and minimize the potential for release of tailings or seepage to the environment. This strategy also offers the potential for progressive reclamation, which will greatly reduce potential for dust generated from the tailings surface.

Tailings produced from processing the ore are thickened to remove excess water before entering the filter circuit. Once tailings have been thickened, they are deposited on a vacuum belt. The vacuum belt removes additional water from the tailings to form a filter cake that falls onto an overland conveyor. Tailings are transported by conveyor to the Dewatered Stack Facility (DSF), where they are deposited off a spreader-stacker. The disposal methodology is very similar to the method used at other nearby uranium mine sites (Somaïr and Cominak).

Key features of the DSF design are listed below:

- The DSF has been designed to store 19.5 Million tonnes (Mt), or 12.5 Million cubic metres (Mm^3) of tailings over 20 years at an average production rate of 1 Million tonnes per annum (Mtpa). It will be progressively constructed, operated and closed in a series of five stages.
- The DSF site has been selected based on proximity to the processing plant and orientated to take advantage of the natural topography to promote seepage toward the southwest of the facility where an evaporation pond will be constructed.

- The DSF will have a composite basal lining system to contain tailings and water. The composite basal lining system comprises a 500 mm thick compacted clay soil geological barrier overlain by a 1.5 mm thick, single textured white High-Density Polyethylene (HDPE) geomembrane. The composite basal lining system is overlain by herringbone-pattern drains to provide underdrainage of the tailings waste mass.
- Use of waste rock and soil from the open pit to construct the DSF base platform and perimeter berms allows for optimisation of tailings footprint creating an efficient ratio of lined basal area to stored tailings tonnes.
- Temporary berms will be created across the width of the DSF base to create an evaporation pond for each development stage, using suitable waste rock material.
- Dust suppression is required to prevent tailings material from being blown to surrounding areas. A series of sprinklers will be placed on the tailings surface to help maintain a wetted surface during deposition. The tailings surface will be progressively covered throughout the project in accordance with best practice for tailings management. A simple temporary cover system, consisting of 0.3 m suitable waste rock material, will be placed behind the working face to minimize the amount of tailings exposed to the atmosphere.
- The conceptual closure plan proposes that the DSF is permanently closed as the DSF progresses. The cover system will consist of two layers; 1) 500 mm of suitable clay soil material to prevent oxygen ingress, radon emissions and to act as a general barrier to radiation; and, 2) 1 m of suitable waste rock material, to prevent wind and water erosion of the underlying clay soil.

The design of the DSF is supported by; tailings laboratory test work; slope stability analysis; and water balance / unsaturated flow modelling to justify the size/extent/volume of the evaporation ponds. The design includes sufficient and appropriate containment contingency to account for variation in tailings and water parameters.

The DSF cost estimation is based upon the quantities and material specifications arising from the design, and unit rates obtained from supplier quotes, calculated from first principles and/or experience from similar equivalent operations.

1.24 Interpretation and Conclusions

SRK's interpretations of the geology, mineral resources, and pre-feasibility level studies of mining, infrastructure and processing options for the Madaouela Uranium Project are as follows.

SRK and SGS-Bateman have completed technical studies to a feasibility level of confidence for the Miriam open pit project and additional work and mine modelling has been carried out on the two underground mines. The Project development plan envisions an average 2.60 Mlb per year eU_3O_8 yellowcake production rate over a nineteen and half year mine life, with uranium recovery of 94.8 % and 91.5 % respectively from the open pit and underground mines based on mineral reserves. Initial capital costs are estimated at USD 343 M, LoM capital costs at USD 619 M, and cash operating costs of USD 83.5/t ROM excluding royalties and by-product credits. A long-term uranium price of USD 65 /lb U_3O_8 has been applied. During the uranium metallurgical recovery process, MoS_3 will be recovered at an average rate estimated at 577 t MoS_3 per annum. A production case has been presented in the FS, which includes the equivalent credits received for MoS_3, at a sales price of USD 5.9/lb, to offset processing costs. Molybdenum reserves are not reported for the full underground mines due to a lack of data for the full underground mine. The production case economics at a long-term uranium price of USD

65/lb U_3O_8 indicate an after-tax NPV of USD 140 M (at 8 % discount rate) with an IRR of 13.3 % and a total life of mine net free cash of USD 673 M. Cresco has assessed the economic viability of the uranium Mineral Reserves, which return a positive NPV of USD 120 million at a discount rate of 8 %, with an IRR of 12.7 % at a price of USD 65/lb U_3O_8.

The Madaouela Uranium project is sufficiently attractive from a technical and economic perspective that it justifies continued pursuit by GoviEx toward project development.

1.25 Recommendations

This study presents summary information that supports the advance the Madaouela project to construction and development. The recommended development path is to advance key activities that will reduce project execution time. SRK believe identified project risks are manageable, and there are clear opportunities that can further improve the economic value.

The project exhibits positive economics with the assumed uranium price, currency exchange rates, and consumables pricing. Value engineering should be advanced in anticipation of full project finance to de-risk the construction schedule and minimise costs. From the identified project risks and opportunities, the following were noted as critical actions that have the potential to strengthen the project and further reduce risk and should be pursued as part of the project development plan.

- Use of a Power Purchase Agreement (PPA) for the supply of renewable energy for the project. The FS assumes a USD 14.3 million capital investment at the start of the project to provide a solar hybrid power plant to ensure power stability
- Inferred Resources – Continue with exploration drilling programmes designed to find additional Inferred Resources, and improve confidence in convert existing Inferred Resources, to convert into higher confidence Measured & Indicated Resources.
- Used Equipment – Assess options to source quality used equipment that meets the required specifications. Conduct trade-off studies to ensure used pieces of equipment are cost effective to the project.
- Basic & Detailed Engineering – Initiate basic and detailed engineering work to finalise engineering designs and prepare work packages for procurement.

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A FEASIBILITY STUDY FOR THE MADAOUELA URANIUM PROJECT, NIGER

2 INTRODUCTION

SRK Consulting (UK) Limited (SRK) has been commissioned by GoviEx Uranium Inc. (GoviEx) to prepare a Feasibility Study in accordance with Canadian National Instrument 43-101 *Standards of Disclosure for Mineral Projects*, for the Madaouela Uranium Project (the Project) in the Republic of Niger, Africa (the FS). SRK previously completed a pre-feasibility study on the Project in 2015 entitled “An Updated Integrated Development Plan for the Madaouela Project, Niger” having an effective date of August 11, 2015 and revision date of August 20, 2015 (the 2015 Study) and an updated Pre-Feasibility Study with an effective date of April 5, 2021. This study incorporates results from a drilling campaign carried out in 2021, additional hydrogeological testing, process plant test work, and further social baseline data collection. The Project is located near Arlit, in north central Niger, in one of the most significant areas of producing sandstone-hosted uranium deposits in the world. The Project is controlled 100 % by the Nigerien mining company, Compagnie Miniere Madaouela SA (COMIMA), which is 80 % owned by GoviEx, a public company listed in Canada, and 20 % by the Republic of Niger.

The Feasibility Study covers five deposits that have been developed to a high level of confidence (Marianne, Marilyn, Miriam, MSNE and Maryvonne). The study is based on detailed geological studies, metallurgical testing and processing options, mine design, economic analysis, infrastructure, rock mechanics, tailings, hydrogeological and environmental assessments. The work program has been completed by SRK in collaboration with SGS Bateman and Cresco.

Mining schedules have been developed including open pit mining at the Miriam deposit, and underground room and pillar mining with decline access from M&M, MSNE and Maryvonne deposits.

Ore processing for the open pit is based on the following circuit: crushing; milling; two-stage tank leaching; molybdenum recovery by IX; and uranium recovery by SX. The processing of the underground ore is the same as the open pit circuit but also includes a radiometric ore sorter (to remove waste dilution) and a flotation circuit (to remove acid consuming gangue).

The Life of Mine Plan (LoMP) for the Project envisages a processing rate of 1 Mtpa, producing an average 2.60 Mlb of eU_3O_8 (yellowcake) per annum over a nineteen and a half year mine life. Uranium recovery rates are modelled at 94.8 % for the open pit and 91.5 % for the underground operations based on the Mineral Reserves. A long-term uranium price of USD 65 /lb U_3O_8 has been applied. Initial capital costs are estimated at USD 343 M, LoM capital costs at USD 619 M, and cash operating costs of USD 83.5 /t ROM excluding royalties and by-product credits.

During the uranium metallurgical recovery process, MoS_3 is recovered at an average rate of 577 t MoS_3 per annum. A production case has been presented in the FS, which includes the revenue received for MoS_3, at a sales price of USD 5.9 /lb, to offset processing costs. Molybdenum has been included in the Miriam open pit Mineral Resource model but only a small portion of the M&M underground mine based on the 2021 drilling campaign.

Cresco has undertaken an economic assessment to verify and demonstrate the economic viability of the uranium Mineral Reserves. Mineral Reserves declared at a price of USD 65 /lb U_3O_8 return a positive NPV of USD 120 million at a discount rate of 8 %, with an IRR of 12.7 %. The main difference is that in the reserve case molybdenum production averages approximately 121 t of MoS_3 per annum.

As a result of recoverable molybdenum being present in assay and metallurgical test work, two additional cases are considered which are the indicated and inferred molybdenum with a positive NPV of USD 125 million at a discount rate of 8 %, with an IRR of 12.85 %, and an indicated, inferred, and unclassified molybdenum case with a positive NPV of USD 140 million at a discount rate of 8 %, with an IRR of 13.27 %.

The prospects for reasonable economic extraction of the Mineral Resources and the economic assessment of the Mineral Reserves are necessarily based on technical and economic factors and assumptions. These are forward looking and many are beyond the control of the Company. They may materially change in the future and impact the Mineral Resources, Mineral Reserves and the economic assessments. The achievability of the projections in the Life of Mine Plan, including production and sales volumes, sales revenue, operating and capital expenditure, cannot be assured and are neither warranted nor guaranteed by SRK. Future cashflows and profits derived from such forecasts are inherently uncertain and actual results may be significantly more or less favourable.

This Feasibility Study is based on a number of historical studies and incorporates results from a further drilling campaign carried out in 2021. In addition, during the course of 2021 and H1 2022 further hydrogeological testing, process plant test work, and social baseline data collection was carried out. The results of this work are reflected in the FS design and costs. Mineral Resources and Mineral Reserves for the Project have been declared by SRK, dated July 01, 2022. They have been reported following the CIM Definition Standards.

The purpose of this FS Report is to provide a review of the historical and current exploration activities conducted at the Project, an update to the resource estimate based on the latest drilling results, and a discussion of the elements of the detailed design for mining and processing, including a financial assessment of the Project's potential economic viability.

3 RELIANCE ON OTHER EXPERTS

The Qualified Persons (QPs) for this Technical Report, Robert Bowell, Guy Dishaw, Jurgen Fuykschot and Colleen MacDougall, have examined the historical and current data for the Project provided by GoviEx with respect to Mineral Resources, metallurgical test work, and other project information, and have relied upon that basic data to support the statements and opinions presented in this Technical Report. Several other technical specialists, including GoviEx staff members, are also contributors of information in sections of this report. These contributions have been supervised and reviewed by the QPs and the QPs have taken reasonable measures to confirm the information provided by others.

In the opinion of the authors, the Project data is present in sufficient detail to provide an accurate representation of the Project. Table 3-1 summarises the QP and technical specialists involved in the Project and Section 3.1 provides an overview of qualifications for each of these specialists.

Table 3-1: Summary of roles and responsibilities

Name	Qualification	Designation	Role
Rob Bowell	PhD Eur Geol. C.Chem. C.Geol	Corporate Consultant	Project Director, Processing review and overall QP
Guy Dishaw	P.Geo	Principal Consultant	Mineral resource estimation and QP
Jurgen Fuykschot	MSc MBA MAusIMM (CP)	Principal Consultant	Underground mining and QP
Colleen MacDougall	BEng, MAusIMM(CP)	Principal Consultant	Open pit mining and QP
Chris Ashworth	BSc, CFA	Senior Associate, Cresco	Financial model
Derrin Auerswald	BSc, PG Dip Member of South African Institute for Chemical Engineers	Engineering Manager, SGS Bateman	Metallurgical testwork and recovery options
Chris Bray	BEng, MAusIMM(CP)	Principal Consultant	Open pit and underground mining review
Max Brown	CEng MIMMM MSc	Principal Consultant	Geotechnical Study
Nuno Castanho	MEng, MSc	Consultant	Underground mining
Colin Chapman	CEng, MSc, MIMMM	Principal Consultant	Bulk power
Richard Martindale	CEng BSc MSc MCSM MIMMM FGS	Principal Consultant	Tailings storage facility
John Merry	BSc., MPhil, MIMMM.	Principal Consultant	Project Manager and Environmental and Social
Daniel Millar	Pr.Eng.	Principal Process Engineer, SGS Bateman	Metallurgical testwork and recovery options
Inge Moors	(MSc, MiMMM)	Principal Consultant	Financial model review
Michael Palmer	MSc, CGeol FGS	Senior Consultant	Water management

Name	Qualification	Designation	Role
Alva Short	Pr. Eng	Project Manager, SGS Bateman	Project Manager, Process plant, infrastructure and logistics
Desana Štambuk	MSc, MEng	Senior Civil Engineer - Hydrotechnical	Climate study and climate change
Carl Williams	BEng, MSc, CEng, MCIWEM	Principal Consultant	Closure planning and costing

QP qualifications are detailed below.

It is the opinion of the QPs that there are no material gaps in the information for the Project at the current level of study. Following on from the Pre-Feasibility Study, in addition to the uranium resource model, a resource model has been developed for the molybdenum contained within the Miriam open pit and portions of the Marianne-Marilyn underground deposit. Sufficient information was available to prepare this Technical Report, and any statements in this Technical Report related to deficiency of information are directed at information, which in the opinion of the authors, should be sought as the Project progresses.

This Technical Report includes technical information, which requires subsequent calculations to derive subtotals, totals, and weighted averages. Such calculations inherently involve a degree of rounding and consequently can introduce a margin of error. Where these rounding errors occur, SRK does not consider them material.

The results of this Technical Report are not dependent upon any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings between GoviEx, SRK, and the authors. SRK will be paid a fee for its work in accordance with normal professional consulting practice.

3.1 Qualifications of Consultants

3.1.1 Qualified Persons

Robert J. Bowell, BSc PhD C.Chem. C.Geol FGS, E.Geol.FIMMM

Robert Bowell is a Principal Geochemist with SRK, with 34 years' experience in applied geochemistry, data analysis and qualification, exploration, exploration management, and mining project evaluation. He has had 18 years direct experience with uranium exploration, geochemical analysis, environmental geochemistry, geometallurgy, mineralogy, process chemistry, metallurgy and evaluation of uranium deposits for project development. He is a registered professional geologist with the Geological Society of London and with the European Geological Association. He is a QP for this Technical Report and is in particularly responsible for Sections 1 to 6, 13, and 0 to 26. Robert Bowell is also overall QP for the overall Technical Report.

Guy Dishaw CP (P.Geo.)

Guy Dishaw is a Principal Consultant (Mining Geology) with over 20 years of international experience in mining operations, mineral exploration, and Mineral Resource evaluation. He specializes in providing operational assistance to mining geology teams, 3D geological modelling, geostatistical analysis and Mineral Resource estimation and reporting in accordance with International Reporting Codes. He has experience in a variety of commodity and deposit types, but specializes in base metal, precious metal, and uranium projects. Guy is a QP for this report and is responsible for Sections 7 to 12 and 14 of this Technical Report.

Jurgen Fuykschot (MSc MBA MAusIMM)

Jurgen Fuykschot (MSc MBA, MAusIMM CP) is a Principal Consultant (Mining) who has 10 years of operational experience gained at underground gold and nickel operations, followed by 15 years as a consultant with SRK. Jurgen is an experienced user of mining software for the creation of underground mine designs, scheduled, and 3D visualisations. His operational experience ranges from mine development, ventilation, drill and blast and ground support design and scheduling to mine management which allows him to take into account the interrelatedness of the various technical disciplines for setting up and improving mines as well as underground storage facilities. Jurgen is a QP for this report and is responsible for the discussion on underground mining presented in Section 16.3 to 16.22 of this Technical Report.

Colleen MacDougall (P.Eng)

Colleen MacDougall is a Principal Consultant with SRK Canada with 15 years of experience. She focuses on open pit feasibility studies and specialises in strategic planning, mine design, life of mine planning, equipment trade-off studies and cost estimation. Colleen is also involved in due diligence reviews for asset evaluations, external investments, and acquisitions. She is an experienced user of Deswik, Vulcan, NPV Scheduler and Whittle. Her operational experience includes technical services and production roles in open pit iron ore. She also has considerable experience in precious metals, iron ore, base metals, phosphate, ilmenite, and rare earth elements. Colleen is a QP for this report and is responsible for the discussion on open pit mining presented in Section 16.1 of this Technical Report.

3.1.2 Other Technical Specialists

Chris Ashworth (CFA)

Christopher Ashworth is a senior financial modeller with Cresco Project Finance and has 4 years of experience in building and updating financial models. Projects that he has worked on span multiple sectors including mining, energy, infrastructure and healthcare. Chris has a bachelor's degree in Mathematics from the University of Cape Town and is a CFA Charter holder. He is responsible for Section 22 of the Technical Report.

Derrin Auerswald (BSc, PG Dip Member of South African Institute for Chemical Engineers)

Derrin Auerswald is a Process Engineering Manager with SGS Bateman, with over thirty years experience in the metallurgical industry, including process engineering and management roles in both operations and project environments. Derrin's experience covers hydrometallurgical, pyro metallurgical and electrometallurgical processes. He has been involved in process design, study work, technology development and plant design for a number of uranium, gold, base metal and rare earth projects. He holds a Chemical Engineering degree from the University of the Witwatersrand and has contributed to the metallurgical testing program and processing presented in Section 13 and 17 of this Technical Report.

Chris Bray (BEng, MAusIMM(CP))

Chris Bray is a Principal Consultant (Mining) with 24 years' international mining experience who manages and contributes to a wide range of multidisciplinary technical studies for international reporting. He has a strong background in underground and open pit mining which can assist in finding a path and communicating practical solutions for challenges faced by mining projects and operations. Chris' technical expertise includes: open pit and underground mine optimisation, mining method selection, mine design, scheduling, ventilation, water management, equipment selection (including battery-electric), cost estimation, materials handling, contracting, financial modelling, benchmarking, due diligence and valuation. He has worked on base-metal, precious-metal, potash, lithium, iron ore, manganese, bauxite, coal, uranium, and industrial mineral projects throughout Australia, Central Asia, Russia, India, Europe, Africa and Central/South America. Chris has reviewed the mining study in Section 16.

Max Brown (CEng MSc, BSc, FGS, MCSM)

Max Brown is a Principal Consultant (Geotechnical Engineering) with over 20 years' international experience in the extractive industries specialising in rock mechanics within both open pit and underground mining.

He is an experienced geotechnical engineer, skilled in the development and interpretation of geotechnical datasets (drillhole, geophysics and mapping) and subsequent definition of rock mass characterisation for use in excavation design. Max is conversant with 3D modelling and specialist limit equilibrium and finite element software.

He has managed several large-scale open pit and underground geotechnical programmes ranging from scoping through feasibility level as well as active operations. Max has worked on base, precious-metal, coal, uranium, diamond and industrial mineral projects throughout Europe, Africa, Asia and the Americas. Max oversaw contributions to the geotechnical study in Section 24.1 to 24.3.

Nuno Castanho (MEng, MSc)

Nuno Castanho (MEng, MSc) is a Consultant Mining Engineer with 15 years working experience in underground mining, mineral exploration and quarrying. His current work is focussed on underground mining engineering, mine design, scheduling, optimisation, strategic planning, mining method selection, equipment selection, materials handling and cost estimation.

Nuno's professional career has included underground mine planning (including design and scheduling), quarry planning and project management including operational work at the Neves Corvo copper mine and several gold and tungsten exploration projects in Portugal and Spain. He has experience with the following mine planning software: Deswik, Vulcan, Studio 5D Planner, EPS, Surpac and GEMS. Nuno has authored the underground mining section in Section 16.3 to 16.22.

Colin Chapman (CEng, MIMMM)

Colin Chapman is a Chartered Engineer and Principal Consultant (Mining Infrastructure and Logistics) who joined SRK in 2012. Colin has over 17 years of experience in mining, civil engineering and construction industries. He specialises in the development of mine infrastructure and utilities supply, transport logistics (road, rail, port, marine), and civil geotechnical engineering. Colin has worked in multiple commodities types and on numerous projects throughout the UK, Europe, Asia, Africa and the Americas. He contributed to Section 18 of the Technical Report.

Richard Martindale (CEng; BSc; MSc; MCSM; MIMMM; FGS)

Richard Martindale is a Principal Consultant (Geotechnical and Tailings Engineering) with over 17 years' experience in consulting within the Mining, Civil Engineering and Waste Management Sectors.

Richard is a Chartered Engineer with significant practical experience in design, analysis, evaluation and construction of geotechnical structures including; slopes; retention dams; foundations; and, lining systems.

Richard specialises in; assessment and design of rock and soil slopes; numerical modelling; design and management of ground investigations; design and management of ground performance monitoring schemes; technical due diligence; and, audits of slopes and waste storage facilities for project evaluation, technical performance and regulatory compliance. He is also experienced in providing Expert Witness services to insurers and lawyers in relation to his areas of specialisation.

Richard has worked on base, precious-metal, coal and industrial mineral projects throughout the UK, Europe, Africa, South America and North America. Richard has oversaw the tailings storage facility study in Section 24.7.

John Merry (MPhil, MIMMM)

John Merry is a Principal Consultant with over 25 years of experience in social and environmental management in the mining sector. John has spent most of his career working with a number of the major mining companies, developing social and environmental management programmes for operating mines and advanced exploration projects. John has also managed the impact assessment and permitting processes for two large scale projects through the detailed feasibility stage. More recently John has managed the delivery of an EIA for a gold project in Europe working closely with the client legal team and planning advisors to meet EU requirements. He has also worked on the scoping and implementation of a mine closure in southern Africa, working with an engineering team responsible for removal of infrastructure and overseeing the stabilisation and rehabilitation plans. He is responsible for section 20 of the Technical Report.

Daniel Millar (Pr.Eng.)

Daniel Millar is a Principal Process Engineering with SGS Bateman, with over 11 years experience in the metallurgical industry, including process engineering roles in both operations and project environments. Daniel's experience covers mineral processing, hydrometallurgical processes and electrometallurgical processes. He has been involved in process design, study work, technology development and plant design for a number of uranium, gold, base metal and rare earth projects. He is a registered professional engineer (Pr.Eng.) with the Engineering Council of South Africa. He holds a BSc. Chemical Engineering degree from the University of the Witwatersrand and has contributed to the Metallurgical test work program presented in Section 13 and Mineral Processing Design presented in Section 17 of this Technical Report.

Inge Moors (MSc, MiMMM)

Inge Moors is Principal Consultant (Mineral Economics) has over 12 years of experience in financial modelling, with an MSc in mining engineering. Her work focuses on the development of financial models (notably technical economic models) for projects in various stages of technical studies, from PEA/scoping study, pre-feasibility and feasibility, and models for operating and expanding assets. The models are a key element required to demonstrate projects' economic viability when reporting Ore Reserves. Inge is also involved in multi-disciplinary due diligence reviews and reporting, in support of acquisitions and debt and equity finance. Her clients include large international conglomerate mining companies, alongside medium and small companies. Commodity experience includes precious, base and rare-earth metals, and industrial and bulk minerals. She has worked on projects located throughout Africa, the CIS, Europe and South and Central America. Inge has reviewed the financial model developed by Cresco (Section 22).

Michael Palmer (MSc, CGeol FGS)

Michael Palmer is a Senior Hydrogeologist with SRK (UK). He has an MSc in Hydrogeology and is accredited as a Chartered Geologist with the Geological Society of London. He has eight years' experience in the mining industry and has worked on projects across the world, including Australia, the UK, Western Europe, the Middle East, Africa and Asia. He has been involved in numerous technical and environmental projects. Key projects include; the Curraghinalt project (Northern Ireland), the Yaramoko project (Burkina Faso) and the Mako project (Senegal). His experience includes setting up field investigation programmes, developing groundwater models, assessment of environmental impacts from mining and development of solutions for mine water management. Mike has contributed to all of the hydrological and hydrogeological aspects within Sections 16, 18 and 24.

Alva Shortt (Pr. Eng)

Alva Shortt is a project manager and registered professional engineer with over 25 years mechanical engineering and project execution experience. He possesses project execution experience in the execution of metal and minerals processing projects in diamonds, mineral sands, iron ore, platinum, uranium and rare earths as a lead mechanical engineer, engineering manager and project manager, responsible for the schedule, budget and quality of the engineering work and management of the total project. He is a registered professional engineer (Pr.Eng.) with the Engineering Council of South Africa. He holds a MEng. Mechanical Engineering degree from the University of the Witwatersrand. He oversaw contributions to the

Mineral Processing Design, Project Infrastructure plus Transport and Logistics (Sections 13 and 18).

Desana Štambuk, MSc, MEng

Desana Štambuk is a senior civil engineer with SRK UK with over10 years of experience in water resources engineering in international engineering consultancies. She is experienced in design, design management and hydraulic modelling whilst working on medium to large scale infrastructure projects from master planning level to all aspects of the design cycle from strategic, concept development, option analysis, feasibility and detailed design.

After almost six years in the UK and Middle East working on projects in the United Arab Emirates and Qatar as a stormwater and infrastructure lead and design manager in CH2M, Jacobs and GHD, she joined the SRK water team to support hydrological studies, storm water management and civil design. She worked in water balance schemes in GoldSim for both open pit and underground mining projects.

She has been involved in numerous hydrologic studies in various climate environments and conducted climate change assessments according to Couple Model Intercomparison Project Phase 6, a project that is part of the World Climate Research Program. Desana has authored the climate study and contributed to wellfield design (Section 5.2 and 18.8).

Carl Williams (MSc, BEng, CEng, MCIWEM, C.WEM)

Carl Williams is a Chartered Principal Environmental Engineer with over 20 years' experience. Carl has a background in environmental management (including working in Ghana as Environmental Manager for AngloGold Ashanti (AGA) and Europe within the mining industry), mining, process engineering and in environmental engineering (successfully managing several large mine closure and large scale water treatment projects). He specialises in the application of environmental and process engineering to a wide range of mining and engineering problems. His main field of expertise is in mine closure and SRCE cost estimation, characterisation of mine wastes for assessment of Acid Rock Drainage and Metal Leaching (ARDML); field and laboratory based analytical geochemistry, mineral processing and the active treatment of mine waste and water (including waste cyanide solutions, acid rock drainage and saline water). He is also a certified Cyanide Code Technical Expert Auditor (mining). Carl has authored the Conceptual Closure Plan which is summarised in Section 20 of this Technical Report.

3.1.3 Site Visits

SRK has completed several site visits during the Project's execution and had staff on site continuously from September 2012 to March 2013 for the purpose of geotechnical and hydrogeological supervision. Specific field tasks undertaken include:

- Site visit March 2009.
- Site visit September 2009.
- Collection of bulk metallurgical sample, March 2011.
- Project orientation study, April 2012.
- Collection of mineralogical samples, June to July 2012.
- Collection of quarterly water quality samples from July 2012 to June 2013.

- Supervision of geotechnical and hydrogeological drilling, July 2012, September 2012 to March 2013.
- Social and environmental assessment, April 2012 and May 2013.
- Project orientation study, April 2012.
- Water quality assessments, November, 2012.
- Site visit to collect data for the ESIA, April, July and October 2014.
- ESIA Regulatory Workshop, May 2015.
- Site visit for inspection of 2021 drill programme, core and sample preparation and review of ESIA data validity, September 2021.

4 PROJECT DESCRIPTION AND LOCATION

The Project extends over an area of approximately 234.86 km^2 of granted tenements and 1,788.86 km^2 of area under application for a potential area of 2,023.72 km^2 of exploration and mining tenements.

The Project is located in the Agadez region (Arlit Department), in the Northern central part of Niger (Western Africa), southeast from the town of Arlit and west of the Aïr Mountain. The town of Arlit was founded in the 1960's, as a mining town, when the first uranium deposits were discovered by exploration department of the Commissariat à l'Energie Atomique (CEA). Arlit is located approximately 800 km north-east by air from the capital city Niamey (Figure 4-2). There is no commercial flight direct from Niamey to Arlit, but there is a direct flight from Niamey to Agadez (Agadez to Arlit is approximately 250 km by road), the driving distance from Niamey to Arlit is 1,200 km.

4.1 Niger Primary Mining Legislation

The Constitution of the Republic of Niger (Section 4.1.5) states the natural resources and the subsoil are the property of the Nigerien people. The law determines the conditions of their prospecting, their exploitation and their administration which must be done with transparency and must protect the environment, the cultural heritage and the preservation of the interests of present and future generations (Article 149).

Niger's mining sector is governed by the Mining Code composed of Ordinance No. 93-16 of March 02, 1993 supplemented by Ordinance No. 99-48 of November 05, 1999 and amended by Law No. 2006-26 of August 09, 2006. The Mining Code is implemented by the associated Decree No. 2006-265/PRN/MM/E of August 18, 2006. The new 2022 Mining Code has recently been adopted (June 29, 2022) by the parliament and was promulgated on July 05, 2022 by the President. Stability clauses in the Madaouela Mining Convention means there should be no direct legal implications of the new law for the project. However, GoviEx will need to be cognisant of the changing expectations associated with this new code. At present, the project follows all the requirements of the 2006 Code.

4.1.1 Mine Titles

Mineral rights in Niger are issued in the form of mine titles. The Mining Code (2006) provides for five standard mine titles, awarded by the Ministry of Mines on a first come first served basis. Niger's Constitution (Section 4.1.5) obliges the State to publish mining (and petroleum) contracts. These are disclosed via the country's mining cadastre and on Niger's Extractive Industries Transparency Initiative website (ITIE Niger) (Section 4.1.3).

The five standard titles include prospecting permit, exploration license, small and large-scale exploitation permits and artisanal exploitation license. Of relevance to the Madaouela Project:

- Exploration licenses are issued with a three-year validity and are renewable twice for a period of three years each, provided the title holders have met their obligations.
- Large-scale exploitation (mining) permits are valid for 10 years. They may subsequently be renewed every five years until the resource has been depleted. Renewal application files and a draft agreement must be forwarded to the Minister of Mines at least one year before the expiry date of the mining permit.

Application for an exploitation permit must include a feasibility study, an environmental impact study, an environmental protection programme, a site rehabilitation plan and an environmental compliance certificate (Table 4-3).

Exploration and exploitation permits are accompanied with a mining convention (Section 4.1.2) negotiated and signed between the proponent and the Ministry of Mines, after approval by the Council of Ministers decree. This convention specifies the contractual nature of the relations between the State and the proponent. The convention is signed for a term of not more than 20 years, it covers the exploration period and the first period of validity of the exploitation permit, after which it is renegotiated upon each renewal of the latter.

On the issuance of an exploitation permit, the State is entitled to 10 % of the equity of a mining company as 'free shares' and is then entitled to purchase additional shares for consideration, either in cash or kind, up to a maximum of 40 % of the equity of the company. This is defined in the mining convention.

The Madaouela Uranium Project

The Project consists of the following Mine Titles as listed below and shown in Table 4-1. The Geographic boundaries of titles are provided in Table 4-2 and shown in Figure 4-3):

- Large scale exploitation (mining) permit for Madaouela I (Mad I Permit). In January 2016 the Mad I Mining Permit was granted to GoviEx Niger Holdings Ltd. (Decree No. 2016-056/PRN/MM/DI) for 10 years following submission of an ESIA (Section 4.6).
- Exploration licence for Eralral. Originally granted in January 2016 (Order No. 2016-057/PRN/MM/DI), this was renewed in 2019 and now covers an area of 111.96 km^2.
- Five exploration permits - Madaouela II, III, IV, Anou Melle and Aokare - which are under application with the State. Madaouela II, III, IV, Anou Melle were originally granted in 2007 (Orders No. 57, 59, 60 and 61/MNE/DM) and expired on January 28, 2019. The company lodged new applications on January 29, 2019. An application for the Aokare exploration licence was submitted in March 2022. Aokare is part of the surrendered area that originally fell within the Mad I permit.

Table 4-1: Niger tenement schedule

Title Name	Date		Area (km^2)	Min. Commitments ($ USD)			Total ($ USD)	Status
	Granted	Expiry		Year 1	Year 2	Year 3		
Mad I Exploitation	January 26, 2016	January 25, 2026	122.9	NA**	NA	NA		Granted/ Changed
Eralral	January 25, 2016	February 17, 2023	111.96	4,329,621	3,756,544	3,499,466	11,585,631	Granted
AOKARE			119.4					Under application
Mad II	Jun 04, 2007	January 28, 2019	458.4					Under Application
Mad III	Jun 04, 2007	January 28, 2019	477.7					Under Application
Mad IV	Jun 04, 2007	January 28, 2019	449.6					Under Application
Anou Melle	Jun 04, 2007	January 28, 2019	396.6					Under Application
Agaliouk	October 18, 2018	October 17, 2021	243.3	1,613,036	1,892,363	403,968	3,909,367	Expired and not being renewed

The original mineral exploration rights of the property, covered by the Madaouela I, II, III, IV, Anou Melle exploration licenses, were secured by GoviEx Niger Holdings Ltd. (GNH Ltd. or GNH) after the signing, in May 2007, of five Mining Conventions between the Republic of Niger (the State) and GNH Ltd.

A Mining Permit application was filed with the Minister of Mining on June 30, 2015, for the Madaouela I Permit (Mad I Permit) and on January 26, 2016, the Mad I Permit was granted to GNH Ltd (Decree No 2016-056/PRN/MM/DI).

The Mining Code, revised in 2006, raised the potential State participation in mining company capital from 30 to 40 %, with 10 % free carry. On June 13, 2018, the State made an election to hold its statutory 10 % free-carried interest in a Nigerien operating company, that would be formed to become the operating entity for the project and to hold the Mad I Permit.

Under the Mining Code (2006) any application for a title involves the payment of an annual area royalty, which varies with the phase (prospection, exploration or exploitation) and the period of validity. In early 2019, the State requested the payment of annual area taxes of CFA 1,216,000,000 from 2016 to 2018 for the Mad I Permit.

In July 2019, the Company signed definitive agreements with the State whereby the State agreed to convert the final € 7,000,000 acquisition payable pursuant to the Madaouela I Mining Convention Side-Agreement (MIMC-SA) (Section 4.1.2), as well as the three years (2016-2018) of contested area taxes into an additional 10 % working interest in the new Nigerien operating company that would hold the Mad I Permit.

The definitive agreements with the State allowed the Project to progress, based on the Mad I Permit. To give effect to the various agreements, the Nigerien operating company, Compagnie Minière Madaouela SA (COMIMA), was incorporated in Niger. COMIMA is owned 80 % by GNH Ltd and 20 % by the Government of the Republic of Niger (Figure 4-1). The State also agreed to defer annual area tax payments related to the Madaouela Project for three years starting 2019. The definitive agreements are included in the 2019 EITI report published online (Section 4.1.3).

As part of the definitive agreements, GoviEx is also required to:

- Finance the relocation of the Madaouela military base.
- Contribute to the financing of the construction of a mining cadastre building for a total amount of USD 514,000.
- Provide financial support for a solar electrification programme, agricultural and pastoral programme and the sinking of pastoral wells and boreholes in the impacted area. The latter is covered by GoviEx's ongoing CSR programmes. Some elements associated with this commitment including the integrated health centre, maternity facility and Gougaram's Primary school have been already covered by solar electrification under GoviEx financing.

The status of implementation of these requirements, as of November 2019, is provided in the 2019 EITI Report. From the project perspective, relocation of the Madaouela military base is currently planned for 2032 which is when the M&M underground mine will begin to impact the surface area near the base. A provisional cost has been included in the project financial model for this relocation process. The personnel based at the camp are understood to be looking to move into Arlit town before this date and may take advantage of existing infrastructure in the town.

In September 2019, the State approved the revision to the shape of the Mad I Permit to include additional mineral resources associated with the Miriam deposit occurring within the Agaliouk exploration license. In October 2021 the Agaliouk exploration permit expired and was not renewed by GNH. In February 2022 the Mad I Permit area was reduced (Decree No 2022-180/PRN/MM) at the request of GNH. The remaining area has been converted to the Aokare exploration licence and GNH submitted an application for that permit in March 2022.

The Mad I Mining Permit has not yet been linked to COMIMA. The Permit will expire in 2026 and the Mining Convention expires in 2027. The intention is for the Mad I Mining Permit to be regularised and associated with COMIMA as soon as practical. A request for this process to be completed was submitted to the Ministry of mines on July 28, 2022. A new Mining Convention will then be signed between COMIMA and the State at the time of renewal in 2027.

4.1.2 Mining Conventions

The purpose of the Convention is to set out the legal, financial, fiscal, social and environmental conditions under which a company will carry out exploration work within the area defined in the mine title. The Convention also guarantees holders that these requirements shall remain unchanged for the duration of the agreement.

GNH Ltd signed five mining conventions (MIMC 2007) with the State that covered the Mad I, II, III, IV and Anou Melle exploration licences area. The Madaouela I Mining Convention (MIMC) together with its Side-Agreement (MIMC-SA) were given legal status on May 26, 2007 after the promulgation by the State, of the corresponding Decree, referenced as Decree no. 2007-186/PRN/MME and dated May 25, 2007, in the State's Official Gazette No.7 special edition dated June 08, 2007. GNH also signed a mining convention for Eralral in March 2017. These conventions have a validity of 20 years depending on exploration or exploitation permit validities.

The conventions give all necessary descriptions regarding the geographic identification and location of the property itself and describe the respective rights and obligations of each of the parties. The conditions described in the Mining Conventions are consistent with the Mining Code (1993), as amended by Law No. 2006-26. The conditions aim to incentivise investment on the one hand while satisfying the West African Economic and Monetary Union (WAEMU) (Section 4.1.4), requirements on the other.

For both the Madaouela I and Eralral conventions the following guarantees and obligations are stipulated.

State of Niger guarantees

- General conditions (legal, administrative, economic, financial, fiscal, etc.) as committed to by the State and stipulated in the conventions remain in force for the duration of the convention (Article 21).
- Stability of administrative conditions thereby making the exploration business more predictable, lower risk and allows the operator to concentrate on its core exploration business.

Land and mine guarantees

In Article 25 the State guarantees the company the occupation and use of any land required for the exploration work and mining of the deposit(s) covered by any mine title for exploration and/or mining within the framework of the convention both inside and outside the perimeter and under the conditions prescribed by the Mining Regulations. Surface rights are covered further in Section 4.2.

GNH Ltd obligations

The MIMC stipulates reporting requirements on the exploration technical results and expenditures to be submitted to the Ministry of Mines. It also stipulates the annual surface lease fee (for exploration licenses) and area tax (for mining permits).

GNH Ltd's mining conventions also have environmental and social obligations which include:

- Contribute to the development of local communities by contributing to the financing of community infrastructure (Article 18). While the Madaouela I Convention does not stipulate an amount, the Eralral Convention stipulates an annual contribution of USD 100,000 for the development of local communities.
- Use local services, raw materials, and Nigerien manufactured products as much as possible (Article 18).
- Prioritise the employment of Nigerien personnel, ensure worker accommodation is of a suitable standard with respect to hygiene and sanitation, and respect labour laws in accordance with the regulations currently in force (Article 19).

- Carry out an environmental impact statement prior to the exploitation of any new deposit and take the necessary measures to protect the environment, natural flora and fauna and known natural resources and preserve the health and safety of neighbouring populations linked to mining operations. This includes monitoring of the water, soil and air quality in the impacted area (Article 27).
- Manage industrial waste generated by the project to avoid their dispersion in the environment and rehabilitate sites if possible during the course of operations and at the end of mining activities.
- Provide for a period of surveillance for five years after the end of mining operations.
- Declare the discovery of any archaeological value to the State (Article 28).

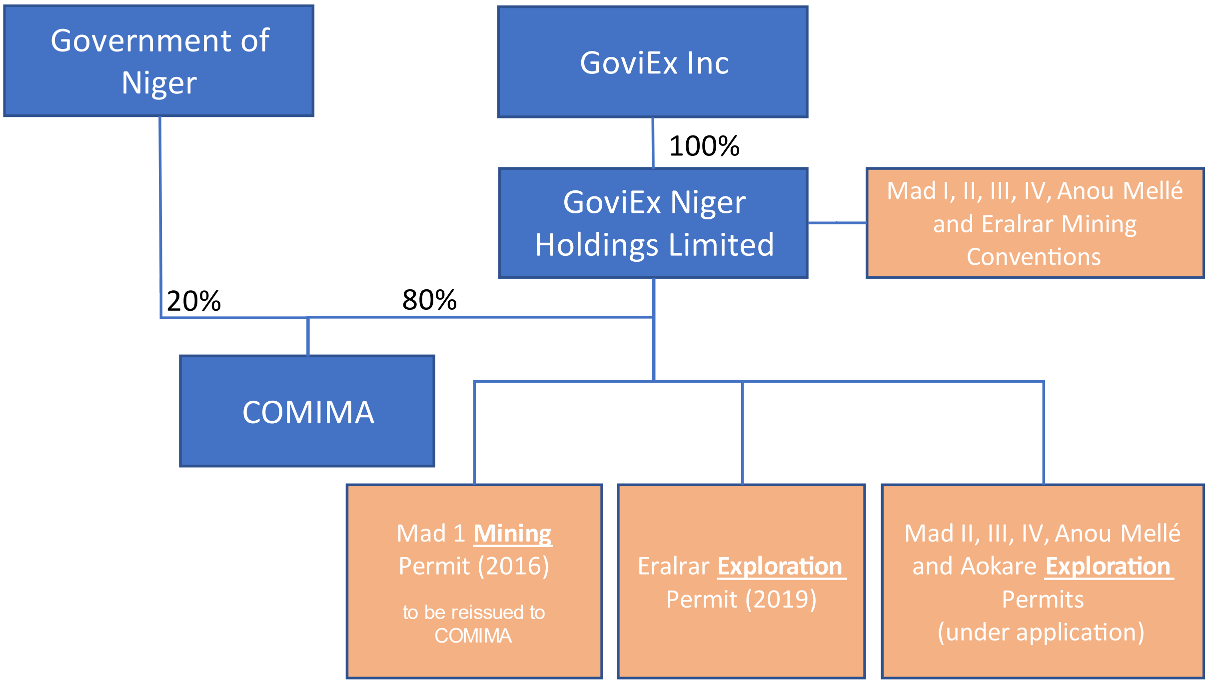


Figure 4-1: Tenement Holding

Table 4-2: Geographic boundaries of GoviEx land holdings

Mine Title	Corner	East Longitude	North Latitude
Madaouela I	A	7° 28' 8.4"	18° 42' 50.4"
	B	7° 30' 45"	18° 42' 52"
	C	7° 30' 45"	18°35'20"
	D	7° 32' 55"	18°35'20"
	E	7°32'55"	18°32'00"
	F	7° 29' 2.4"	18° 32' 00"
	G	7° 29' 2.4"	18° 33' 57.6"
	H	7° 28' 8.4"	18° 33' 57.6"
	I	7° 28' 8.4"	18° 38' 45.6"
	J	7° 26' 49.2"	18° 38' 45.6"
	K	7° 26' 49.2"	18° 41' 45.6"
	L	7° 28' 8.4"	18° 41' 45.6"
Madaouela II	A	7°35'00"	18°45'00"
	B	7°48'00"	18°45'00"
	C	7°48'00"	18°32'30"
	D	7°35'00"	18°32'30"
Madaouela III	A	7°37'15"	18°32'30"
	B	7°48'00"	18°32'30"
	C	7°48'00"	18°20'00"
	D	7°37'15"	18°20'00"
Madaouela IV	A	7°25'00"	18°32'00"
	B	7° 33' 37''	18° 32' 00"
	C	7° 33' 37''	18° 20' 00''
	D	7°25'00"	18°20'00"
Eralral	A	7° 30' 45''	18° 32' 00''
	B	7° 33' 37''	18°32'00"
	C	7° 33' 37''	18° 20' 00''
	D	7° 30' 45''	18° 20' 00''
Anou Melle	A	7°07'50"	18°28'00"
	B	7°18'20"	18°28'00"
	C	7°18'20"	18°25'40"
	D	7°25'00"	18°25'40"
	E	7°25'00"	18°20'00"
	F	7°07'50"	18°20'00"
AOKARE	A	7°25'00"	18°45'00"
	B	7°27'22"	18°45'00"
	C	7°27'22"	18°42'52"
	D	7° 28' 8.4"	18° 42' 50.4"
	E	7° 28' 8.4"	18° 41' 45.6"
	F	7° 26' 49.2"	18° 41' 45.6"
	G	7° 26' 49.2"	18° 38' 45.6"
	H	7° 28' 8.4"	18° 38' 45.6"
	I	7° 28' 8.4"	18° 33' 57.6"
	J	7° 29' 2.4"	18° 33' 57.6"
	K	7° 29' 2.4"	18° 32' 00"
	L	7°25'00"	18°32'00"

4.1.3 Extractive Industries Transparency Initiative (EITI)

The Extractive Industries Transparency Initiative (EITI) is a global standard for the good governance of oil, gas and mineral resources and disclosure on this in a publicly accessible, comprehensive and comprehensible manner. Niger first became an EITI candidate country in 2007. The country was suspended from the EITI and its full withdrawal followed in October 2017.

The main areas of disagreement which led to Niger's suspension and withdrawal had been civil society engagement, governance of EITI process, transparency in license allocations and quality of EITI reporting. According to the World Bank, further institutional reform was needed is to recover earlier gains (inside or outside the EITI process) and to resolve key issues such as the environmental impact of mining and local communities' appropriate share of mining revenues collected by the Government.

In January 2019, Niger announced that it intended to resume its place within the EITI and in the same year published its National Implementation Mechanism report[1]. The aim of this report was to strengthen understanding of the level of contribution of the extractive sector to the economic and social development of Niger with a view to improving transparency. This report discloses details on the Madaouela Project including potential tax revenue and employment benefits which will require updating for the next iteration of the report. The report also discloses GNH Ltd's definitive agreements with the State to settle its outstanding debts (Section 4.1.1).

Niger was once again accepted as an EITI member in 2020. The next validation against the 2019 EITI Standard will start on October 01, 2022.

4.1.4 Regional Law Influencing Mining

Niger is a member of WAEMU and ECOWAS. The following legal texts are relevant to the project

West African Economic and Monetary Union (WAEMU)

The WAEMU's 2003 Regulation concerning the adoption of the Community Mining Code of WAEMU (Regulation 18/2003/CM/WAEMU) standardised the mining legislation in member states. The regulation is directly enforceable, it does not need to be transposed into the legislation of the member states to be applicable and is binding in its entirety. This WAEMU Mining Code aims to both create conditions favourable for mining investment and promote sustainable mining. It establishes a need for permits for exploration and exploitation, the requirement to undertake an environmental assessment to inform the decision on an exploitation permit, the need to create a local mining company to mine, and caps the free-carried interest of the State at 10 %. The code also covers diversification of mining outputs and local beneficiation of minerals; co-existence of industrial mines and artisanal mining; improvement of infrastructure; and enhancement of the economic and social benefits of mining.

[1] https://eiti.org/sites/default/files/attachments/rapport-itie-niger-2019-version-finale-301121.pdf

Economic Community of West African States (ECOWAS)

ECOWAS introduced a Mining Directive in 2009 that has been transposed into the legislation of its 12 member states, transposition was required by July 2014. The ECOWAS Community Court of Justice ensures its application. The directive harmonises policy and guiding principles in the mining sector and aims to create a mining environment favourable to sustainable macroeconomic development. Key themes in the directive are: minerals as State resources; protection of the environment; protection of national interest; improving access to information and fostering subscription to the Extractive Industry Transparency Initiative (EITI); respect for and promotion of recognized human rights and protection of the local community rights; dispute resolution; and institutional and implementation arrangements.

4.1.5 Environmental and Social Obligations of Mineral Rights Holders

Constitution of the Republic of Niger

In Niger, the Constitution (November 25, 2010 with Amendments through 2017) provides the structure of the state and protects the fundamental rights of citizens, including against adverse environmental and human rights impacts of extractives. According to the Constitution, Niger will develop its energy potential in a way that allows it to achieve national development. As such, the companies operating in Niger are required to employ, as a priority, Nigerien personnel and to allow their accession to all employments, in relation to their capacities according to the laws in force (Article 147).

Mining Code

The 2006 Mining Code for Niger includes environmental and social provisions relating to:

- The protection of the environment. The development of any new deposits shall be subject to an environmental impact study (Article 27).
- The sustainable development of national resources and environmental protection. Companies must conduct their operations using technologies accepted by the mining industry and take the steps necessary to prevent environmental pollution, for the treatment of waste and to preserve forest and water resources (Article 99).
- Protected or prohibited areas. Mine title holders shall ensure their activities and facilities do not adversely affect the natural and cultural heritage of the Republic of Niger (Section 4.6), unless duly authorised by the State (Article 63). No prospecting, exploration or mining activities may be within a radius of 100 meters:
  - around properties enclosed by walls or similar structures, villages, clusters of houses, wells, religious buildings, burial sites and sites considered as sacred, without the approval of their owners; and
  - On both sides of communication routes, water pipes and more generally around all public utility works and engineering works, without any prior authorisation.
- Local procurement, employment and training (Articles 102,103 & 104). Preference must be given to local companies for subcontracting and local purchases of goods and services. Preference must be given to Nigerien workers for positions they are qualified for. Holders of mine titles and their subcontractors shall develop a training program and promote as much as possible skill transfer in favour of Nigerien contractors and workers.

- Health and safety (Article 121). Activities must be undertaken so as to guarantee the security and health of employees and third parties. Minimum health and safety rules shall be provided for in rules and regulations. Any accident which occurs in a mine, a quarry or accessories must be reported to the Director of Mines and his/her local representative.

These environmental and social provisions of mineral rights holders are largely consistent with the obligations stipulated in GNH's mining conventions (Section 4.1.2). It is worth noting that Niger's Mining Code has recently been reviewed to better align with regional mining codes (ECOWAS and WAEMU (Section 4.1.4) which prevail over the domestic law of their member states and is directly enforceable. The new code has been approved by parliament and is awaiting final ratification. Changes are already coming through as indicated by the National Mining Policy (Section 4.1.6).

4.1.6 National Mining Policy

In July 2020 the Council of Ministers adopted in the National Mining Policy of Niger, 2020-2035. This policy was developed, in part, in light of the poor performance of the mining sector and to take into account the Economic and Social Development Plan (PDES) 2017-2021. This 5-year plan is designed for the implementation of the Niger 2035 Sustainable Development and Inclusive Growth Strategy (SDIGS) adopted by the Government of Niger on May 09, 2017.

The overall goal of the National Mining Policy is to contribute to sustainable development and inclusive economic growth in Niger by 2035 through the implementation of a strategy and an initial ten-year action plan from 2020 to 2029. According to the Mining Policy 2020-2035 its vision aligns with the African Mining Vision and it complies with the mining policies of WAEMU and ECOWAS (Section 4.1.4). The guiding principles of the national mining policy include the following:

- Ownership of the mineral resources located in the soil and subsoil of Niger by its people.
- Respect for the environment, for gender, human rights and respect for the rights of communities living near mining activities.
- The social responsibility of mining companies.
- Equity in the sharing of revenues generated by the sector.
- The duty of care.

According to Article 95 of Ordinance No. 2017-03 of June 30, 2017 amending Ordinance No. 93-16 of March 02, 1993, there is a requirement for the State to pay 15 % of income from mining activities to the budgets of local authorities bordering mining activities. This payment, as well as the social investments made by mining companies within the framework of social responsibility, is to support sustainable development of the municipalities hosting the mining operations.

The National Mining Policy acknowledges however the weak implementation of this and the poor socio-economic development of host municipalities in terms of access to basic social services (education, health, drinking water, electricity), limited opportunities for local community employment in skilled jobs and low levels of involvement of women in mining activities. The policy therefore recognises the need for the State to formalise the contribution of mining companies to development through a legal provision such as establishing a Community Development Fund. The policy recommends mining companies contribute up to at least 0.5 %

of their turnover of their three-year budgets, excluding taxes (0.2 % for those with exploration licenses.) This fund, supplemented by the 15 % of mining revenues retroceded by the State, would be dedicated exclusively to the host municipalities.

The policy also highlights the lack of a funding and management mechanism for the rehabilitation and closure of mine sites and post-mining management. The changes being introduced through the National Mining Policy, the associated strategy and action plan and the updated Mining Code will likely become obligations in future GNH Ltd's mining conventions. These will include more specific and prescriptive requirements for social contributions, local content and closure.

4.2 Surface Rights and Legal Access

4.2.1 The Mining Code

The Mining Code stipulates prospecting or mining permits shall be authorised, by a joint decree of the Minister of Mines and the Minister of State Property, to occupy lands necessary for mining activities and related industries. Article 61 of Decree No. 2006-265/PRN/MME requires applications for occupying lands needed for such activities, inside and outside the perimeter of the mine title, to include consent from the head of the relevant administrative unit. The head of the administrative unit will lead a consultation process and where applicants and land right owners fail to reach an agreement, the Minister of Mines and the Minister of State Property shall initiate a land expropriation process for public purposes. This may be by either by following customary land expropriation procedures or, for other lands, by following procedures of expropriation for public purposes.

According to Article 116, compensation and fees resulting from the occupation of lands shall be borne by title holders concerned. Where land occupancy deprives landowners their rights over lands for more than one year or where occupied lands can no longer be used for agricultural purposes after mine operations, landowners or customary land right holders may require title holders to purchase these lands. Pieces of land that are largely damaged or degraded shall be totally purchased if landowners or customary land right holders so demand.

Lands to be purchased under such conditions shall always be estimated at twice their value before occupancy.

4.2.2 Land tenure and customary law in Niger

Two types of rural land tenure are recognised in rural Niger: individualised ownership rights and a variety of land-use rights. Individual landowners have the right to use the land as they wish, exclude others from the land and lease or sell the land. The variety of land-use rights include family land and village common land, known as chieftaincy lands (terre de chefferie) and based on customary tenure law of first occupancy. Newcomers are traditionally accorded use rights only. Furthermore:

- In some cases, families hold individualised parcels over which they have complete control, but traditional leaders and the principles of customary law discourage them from selling.
- Chieftaincy land uses can include cultivated, pasture, fallow and land devoted to village activities. Chieftaincy lands are held and managed by the village chief (Section 5.4) on behalf of a group.

Current legislation decrees that common land is accessible to everyone, although customary right to priority of use vary according to the distance between this land and private water points on home grazing territories (see below).

4.2.3 Rural Code (1993)

In 1993, Niger adopted a legal and institutional system, the Rural Code. The Code's main objective is to better organise and manage rural land. It recognises all Nigeriens an equal right in terms of access to natural resources and establishes various standards in order to safeguard and support pastoralism in Niger. For example, in the pastoral zone in the North, herders are entitled to collective use rights that allow them to move their livestock in search of water and pastureland[2].

The Rural Code narrows the state's ability to expropriate land for public use and requires the state to pay just compensation for land expropriated. As part of land reform legislation, the Code also attempts to reduce the power of traditional chiefs, individualise chieftaincy land, decentralise land administration and allow for registration of customary land rights. However, the Code has been criticised for causing confusion over what rights can be registered. Furthermore, it has been said the lack of capacity to manage land registration has caused an increase in land disputes and has increased the risk of ultimately losing land rights for those with less power to assert claims, such as women and pastoralists[3].

4.2.4 Pastoral Code (2010)

In May 2010, a sector-specific law on pastoralism was passed adding up to the group of texts that constitutes the Rural Code. The Pastoral Code's aim was to fill the gaps, define, and specify the rules and principles concerning pastoralism and what the 1993 Rural Code had previously established.

It sets out pastoralists' rights and creates a legal framework for interaction between people whose livelihood is based on animal husbandry and other groups such as agriculturalists or mining companies (Snorek, 2021). Most importantly, the Pastoral Code includes an explicit recognition of pastoral mobility as a fundamental right, and that this right is recognised and guaranteed by the State and local authorities (Article 3). Therefore, the State cannot grant private concessions in the pastoral zone when it might impede the mobility of pastoralists[4]. Also, no concession can be granted in the public interest on a home grazing territory located within the pastoral zone, without fair compensation determined after assessing the concession's impact on the pastoral system.

A further important element in the Pastoral Code is the recognition of priority use rights in their pastoral homelands/ home grazing territory (*terroirs d'attache*)[5]. The concept of home grazing territory thus allows nomadic or transhumant herders to be attached to a land commission, and to voice their concerns to the Rural Code's institutions, but also, more generally, to fully participate into the pastoral zone's governance. For instance, no hydraulic works (Section 4.6) can be engaged without the agreement of the community attached to the territory involved.

[2] https://www.agter.org/bdf/_docs/niger_-_paper_4_-_pastoralism.pdf
[3] https://landwise-production.s3.amazonaws.com/2022/03/USAID_Land-Tenure-Niger-Profile-2010-1.pdf
[4] https://www.agter.org/bdf/_docs/niger_-_paper_4_-_pastoralism.pdf
[5] Decree No. 97-007/PRN/MAG/LE of January 10, 1997 defines the status of pastoralist home grazing territories.

Historically, during the issuing of permits for exploration and exploitation of uranium and other mines, the legal recognition of pastoral rights and their needs for seasonal use of salty pastures in the same territories were not adequately considered. Pastoralists in the Project area have a common right to rangelands and priority rights over both land and water in their home areas (terroir d'attache) on the basis of customary use. This is explained in more detail in Section 20.4.3.

4.2.5 Land use and natural resource management

Niger has been working towards addressing issues of pastoral land law and preventing and managing conflict around natural resource governance (see project setting in Section 5). It has also been working towards producing a rural land policy and to create a national multi-actor watchdog on rural land issues, a process which started in March 2019 launched by the Permanent Secretariat for the Rural Code.

4.3 Location of Mineralisation

The mineralised deposits on the Madaouela I licence are shown on Figure 4-3 as of July 2022. The deposits on the Madaouela I licence targeted for developing uranium resources and their estimation, and for inclusion in the study are: Miriam, Marilyn and Marianne (M&M) and MSNE. The Mad South Central East (MSCE) and Mad South Extreme East (MSEE) deposits, have Inferred mineral resources. These are excluded from the economic assessment subject to further work.

4.4 Encumbrances

As stated in Section 4.1 an exploitation license by the State allows it to hold 10 % in the share capital of the operating company during exploitation. The holding is "free of charge and may not be diluted". The State is entitled to contribute in cash or assets to the share capital of the company in consideration for an additional 30 %, either directly, or through a public (State-owned) entity. The definite agreements between GoviEx and the State have formalised the State participation at 20 % for the project. In addition, there is a 5.5 % to 12 % sliding scale royalty payable to the State based on the commercial value of exported minerals (note the new Mining Code has a flat rate of 7 %). These are the only financial encumbrances (or royalties) on the property.

There have historically been some physical restrictions associated with operations on the Madaouela I exploration licence area:

4.4.1 Security

Road access from Agadez to Arlit was previously under military control, with convoys (including export shipments of uranium) being accompanied by military escort. Local Tuareg groups historically opposed to the State have reached peace agreements with the central government (Section 5.3); however, there is still the potential for theft of trucks and other equipment. As a result, GoviEx has arranged for security personnel to accompany GoviEx teams during field operations. This collaboration between the Company and the State security units is anticipated to continue into project construction and operations. The project cost structure includes provision for suitable security and military escorts for the movement of the final product to market.

GoviEx, and most other exploration and mining companies operating in the State, reported interruptions to operations for a 27 month period during 2007 to 2009, over which time the State declared a "mise en garde" (state of alert) in the Arlit-Agadez region due to local separatist activity. The “mise en garde” was lifted in November 2009, and GoviEx reported no security incidents against the Company or its personnel since this period.

4.4.2 Madaouela Military Camp and Access to Exploration Land

According to guarantees stated in the MIMC, the State is committed to facilitating access to every part of the Project area. A military camp is present in the Project area for which GoviEx has negotiated separate permission to operate within the camp boundaries. Historically, the presence of the camp has helped secure the work around it.

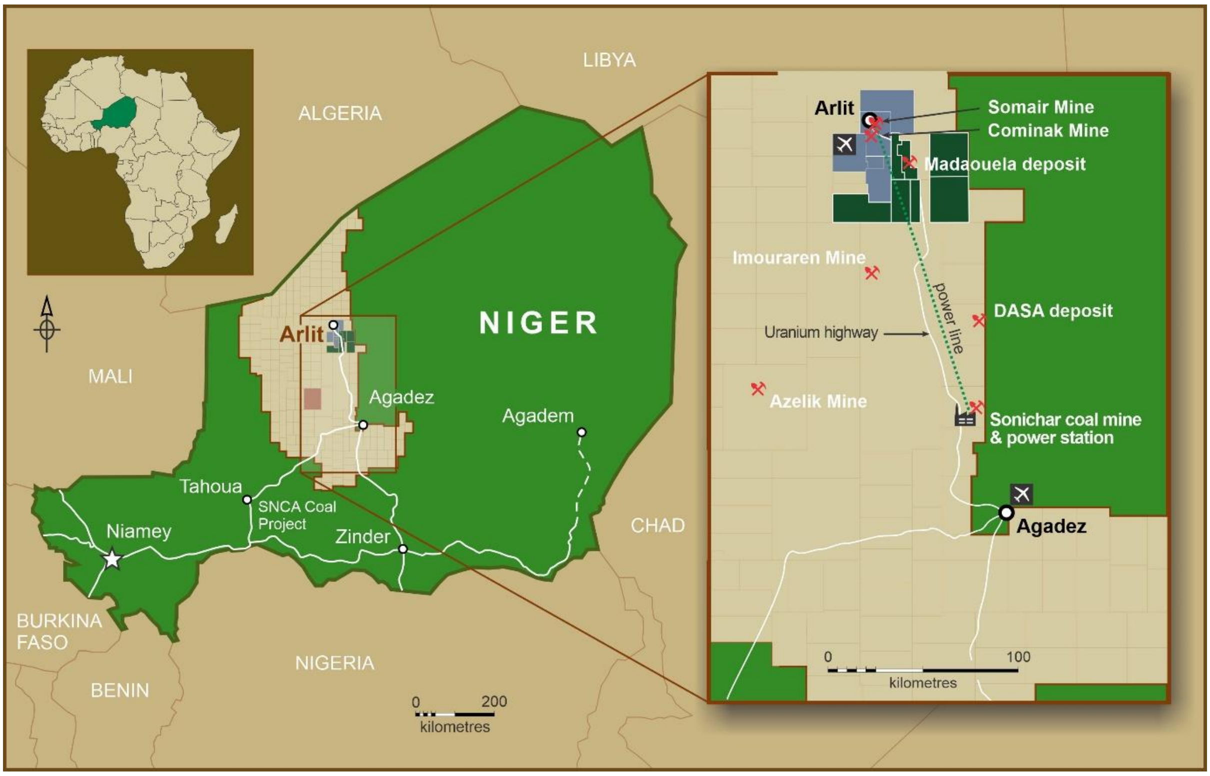
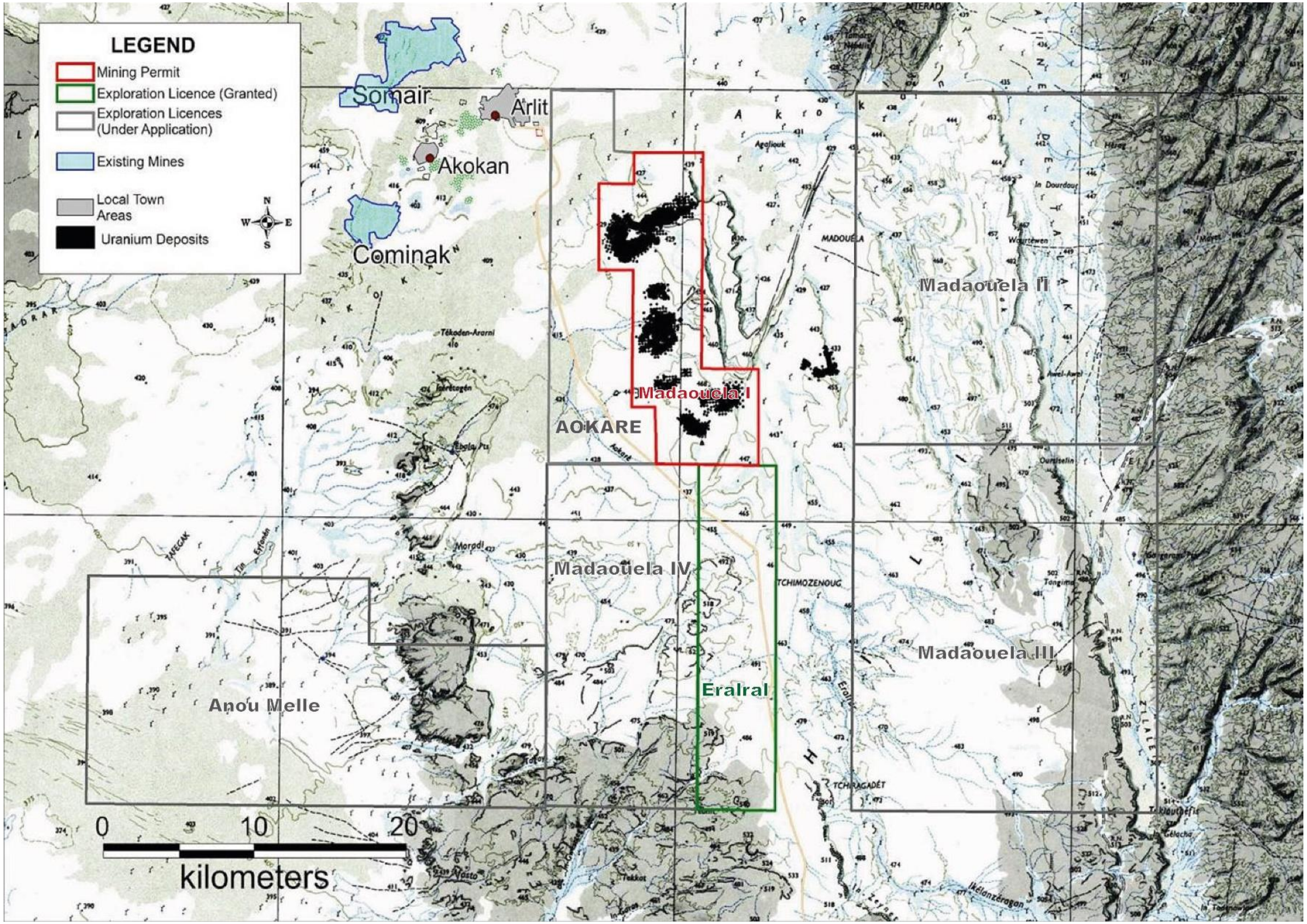


Figure 4-2: Niger Location Map – Madaouela Uranium Project

As noted in Section 4.1.1, GoviEx has committed to assisting with the financing of the relation of the military camp as required when this facility is impacted by the M&M underground mine.



Source: GoviEx

Figure 4-3: GoviEx Land Holdings – Madaouela Uranium Project

4.5 Environmental Liabilities

4.5.1 CEA Old Exploration Camp

The French Commissariat à l'Energie Atomique (CEA) started exploring in the 1960's and identified two main mineralised targets, which they named Marilyn and Marianne. They constructed a campsite to accommodate the CEA exploration team. Traditional buildings, mostly small structures made of "banko", a mixture of clay and thatch, still remain in place and are currently used by the Niger military. As noted above GoviEx is committed to financing the relocation of the camp. This is currently anticipated for 2032.

4.5.2 CEA Old Drillholes

CEA drilled a large number of drillholes, generally marked on the ground surface by markers. Most of the old CEA drillholes, where they can be found, have been reopened, reamed and relogged as part of the GoviEx exploration work.

4.5.3 CEA Old Mining Workings

CEA implemented some test mining work to further explore the Marilyn prospect. They sunk a shaft (67 m deep) and excavated a network of galleries (330 m) to sample the mineralisation and better understand the mineralisation at different locations. CEA stockpiled two ore grade categories and waste rock. The stockpiles remain enclosed within the old CEA camp perimeter. The quantity of mineralised material was estimated be more than 2,000 t in total (some has been collected previously by Overseas Uranium Resources Development Corporation (OURD) of Japan to realise their feasibility study). Waste rock quantities have not been evaluated.

SRK visited the stockpiles of mineralisation. One pile was hand sampled by GoviEx on one end for metallurgical samples, and it was noted that essentially no oxidation of mineralisation is present, due in part to the very limited annual rainfall in the region. GoviEx has taken further samples from the stockpiles over the course of the PFS and FS studies. These piles of uranium mineralised material will eventually need to be removed and / or processed, but they pose little environmental concern at present, as there is no residence or dwelling within 150 m.

4.5.4 Underground Water Quality

Underground water is still being pumped from two water holes and the old shaft and is used by the military camp. However, the underground water quality at the camp does not meet generally accepted drinking water quality standards, due to bacterial and chemical contamination during several years when the shaft was collecting used water from the camp.

4.5.5 Domestic Garbage Dumps

The Madaouela I exploration licence area, being in close proximity to the town of Arlit, has been littered with small piles of domestic garbage originating from former drilling activities, from town dwellers, and/or from the military camp. An inventory of such dumps has been mapped to establish a baseline for environmental monitoring purposes.

4.5.6 Cuttings from Drillholes

The drilling operation produces cuttings and mud that are collected in small pits on surface and examined by geologists to document the geology and the geophysical logs. When drilling through mineralised sections, the drilling operation produces uranium-bearing materials. Although their radioactivity is rather modest, such materials are thereafter disposed of and buried in small pits at each drillhole location in a manner to reach radioactivity readings equivalent to the general background radioactivity level on surface.

4.6 Required Permits and Status

The institutional framework related to the legislation on environmental issues and prevention of risks in mine operations involves three Ministerial departments. These are: (a) The Ministry of Environment; (b) The Ministry of Labour and Employment; (c) The Ministry of Public Health.

The primary approvals required by GoviEx to develop the Project are regulated by the legislation relevant to mining (Section 4.1), environmental and social management (Section 4.1.5), and water and radioactive material usages which are presented here and shown in Table 4-3.

Environmental management is governed, in part, by the following:

- Law 98-56 of December 29, 1998 on the Environmental Code establishing the general legal framework for and the fundamental principles of environmental management in Niger.
- Law 2018-28 of May 14, 2018 determining the fundamental principles of environmental assessment in Niger and Decree No. °2019- 027/ PRN/MESU/DD of January 11, 2019, on the terms of application of the said Law.

Table 4-3: List of primary approvals relevant to a Nigerien uranium mining project

Approval	Legislation	Authority	Covering	Requirement	Status
Environmental compliance certificate	• Environmental management Code (Law No. 98-56 of December 29, 1998) • ESIA Ordinance (No. 97-001 of January 10, 1997)	Minister of Environment (Ministre de l'Environnement, de la Salubrité urbaine et du Développement durable –ME)	Adverse effects to biophysical and social environments	An ESIA report, prepared in accordance with the Ordinance, must be submitted and approved before construction	The ESIA report was submitted to the BEEEI on the March 10, 2015. On July 28, 2015 the ESIA was approved by the Minister of Environment.
Exploitation permit	Mining Code (Ordinance No. 93-16 of March 02, 1993)	Minister of Mines (Ministre des Mines et du Développement industriel – MM)	Right to mine authorised substances	Before construction, submit and have approved: • A feasibility study; • An operation development plan; • An ESIA including an environmental protection program and a rehabilitation plan; • An environmental compliance certificate	On January 26, 2016, the Madaouela I Mining Permit (Mad I Permit) was granted to GNH (Decree No 2016-056/PRN/MM/DI).
Water usage approvals	Water Code (Ordinance No. 2010-09 of April 01, 2010)	Minister of Hydrology (Ministre de l'Hydraulique et de l'Assainissement – MH)	• Abstraction of surface and ground water • Modification to water levels or water flow patterns • Water discharge or storage • Installations likely to harm public health and safety or to decrease water resources	Obtained following exploitation permit granted and before water usage infrastructure construction	GoviEx to update the existing authorisations which were specific to the exploration stage. This needs to include quantities of water required. GoviEx to then notify MH and Governor of Agadez and Prefet of Arlit on project commencement.

Approval	Legislation	Authority	Covering	Requirement	Status
Radioactive materials usage authorisation	Law no. 2018-21 on the safety, security and peaceful use of atomic energy.	Regulatory and Nuclear Safety Authority (ARSN)	Production, usage, transportation and waste management of radioactive materials	Before operation, submission and approval of: • a safety assessment covering the nature, magnitude and likelihood of exposure to radiation and possible contamination into the environment; • an ESIA report including baseline survey data; • evidence of measures in place necessary for the protection of worker and public health; • evidence of a qualified team in radiation protection and dosimetry, ventilation and occupational medicine. • an emergency response plan	To be obtained prior to the start of construction
Waste	Arrêté 003/MME/DM Jan 08, 2001- Ministry of Mines relating to the protection of the environment from radioactive waste - Article 41.	Ministry of Mines, Ministry of Health, Nuclear Safety Regulatory Authority (ARSN)	Waste management arising from the mining and processing operations	A radioactive solid waste management plan must be developed by the employer in the early stages of project planning.	Details to be developed prior to the start of construction. It is not clear if a specific permit is required. Waste management is described in this Feasibility Study

Approval	Legislation	Authority	Covering	Requirement	Status
Cultural heritage	Article 41 of the Constitution of the 7th Republic (November 25, 2010) and Article 41 of the Law No. 97-002 on the protection, conservation and enhancement of cultural and natural heritage (June 30, 1997) as brought into in force by Decree No. 97-407/PRN/MCC/MESRT/IA (November 10,1997).	Heritage sites in Niger are protected by the Constitution and are the property of the State.	Prior to commencing any detailed heritage resources research or site excavations.	A research authorisation will be required from the Minister of Research (Ministre de l'Enseignement Supérieur, de la Recherche et de l'Innovation).	147 heritage sites were visually identified within the Project area. GoviEx is in the process of developing a Cultural Heritage Management Plan that will be developed in conjunction with local communities and land owners and agreed with the local administration.
Occupation of Land for Infrastructure	Article 61 of Decree No. 2006-265/PRN/MME requires applications for occupying lands needed inside and outside the perimeter of the mine title, to include consent from the head of the relevant administrative unit.	Ministry of Mines, Minister of Urbanism, Housing, and Land Registry	Authorisation to use and occupy land for the project	An application to be made to the Prefet of Arlit. Following their assessment, the Prefet applies to the Min of Mines and Min of Town Planning and Urbanism who jointly issue a land occupation authorisation.	

4.6.1 Environmental and Social Impact Assessment (ESIA)

The primary environmental approval required by GoviEx to develop the Project is an environmental compliance certificate. This certificate is obtained following an environmental impact study or environmental and social impact study (ESIA) process undertaken in accordance with Niger regulatory requirements. The Minister in charge of environment (ME) is the responsible authority in Niger for implementing the Environmental Management Code (Law No. 98-56 of December 29, 1998). According to Art. 31 to 36, the Code stipulates the requirement for an authorisation to be granted by the ME prior to construction of a project likely to impact the environment.

The decision of the ME is based on the assessment of an ESIA report supported by the ESIA Ordinance (No. 97-001 of January 10, 1997) and implemented by the associated decrees (ESIA Decree No. 2000-397/PRN/ME/LCD of October 20, 2000 and the Bureau d'évaluation environnementale et des études d'impact or "BEEEI" (Decree No. 2010-540/PCSRD/MEE/LCD of July 08, 2010). The BEEEI has subsequently been changed to the "Bureau National d'Evaluation Environnementale "BNE" (law N°2018-28 of May 14, 2018). The ESIA report submitted to the MM for the exploitation permit application needs to include an environmental protection programme and a conceptual mine closure strategy (schéma de réhabitlitation des sites in French) together with the environmental compliance certificate issued by the Ministry of Environment.

An ESIA was conducted for the Project in 2014 based on the project description at the time. On March 10, 2015, the ESIA was filed with the ME. The ESIA was prepared by SRK with assistance from Legeni S.A. on the field work and stakeholder engagement. The ESIA included an environmental and social management framework plan and closure plan. The ESIA was approved by the Minister in charge of the environment on July 31, 2015 and an environmental compliance certificate was granted.

Subsequent to the environmental study carried out for the Madaouela Project, the legal framework governing the execution of an environmental assessment was updated by Law 2018-28. The project does however already have a valid environmental certificate and is not required to address these updates retrospectively.

Baseline data for this ESIA study was largely collected during 2014 (some quantitative data was collected in 2012) and previous project development studies have relied largely on the continued use of this data. In 2022 Labogec, updated some of the environmental and social baseline data as part of this FS to better understand the baseline conditions and determine if there might be any significant changes in impacts identified based on the updated project description. Baseline data pertinent to this study is presented in Section 5 and Section 20.

An Environmental and Social Design Criteria and Guidance (ESDCG) was prepared by SRK in early 2022 to facilitate integration of environmental and social factors into the design process alongside engineering and financial considerations early in the FS process with the aim of:

- Reinforcing the need for compliance with Nigerien environmental laws and regulations and internationally accepted standards and guidelines; and
- Preventing or at least minimising potential negative environmental and social impacts during the construction and operational phases by modifying project design and identifying

appropriate operational management controls in accordance with the management hierarchy.

4.6.2 Water Code

Water usage in Niger is regulated by the Water Code (Ordinance No. 2010-09 of April 01, 2010). The Minister in charge of hydrology (Ministère de l'Hydraulique et de l'Assainissement – MH) is the authority responsible for implementing the Water Code in Niger. The Code defines the legal regime for the protection of surface and groundwater.

The Code has provisions for protection of water resources from any form of pollution, reduction, water wastage and use. Any facility for abstraction of surface or ground water, for water discharge or storage, modifying water levels or flow patterns or installations likely to harm public health and safety or to decrease water resources requires approval from the MH before construction. The law in Niger sets liquid effluents standards (Order No. 140/MSP/LCE/DGSP/DS/DH of September 27, 2004).

Water points are the cornerstone of the system of natural resource use in pastoral and agropastoral areas. In the pastoral zone water is a key element for survival and development and is essential for the growth of natural pastureland and to maintain livestock. Access to water plays a key role in securing herders' livelihoods as it determines their ability to access grazing. The texts regulating the water sector in Niger are designed to avoid hampering pastoralists' mobility (AREN, 2007)[6]. The Code permits open access to public water points and access to waters in public domains cannot be forbidden to pastoralists. The public water points are often managed by local Management Committees and as such the water points in most rural areas are regarded as common property resources. In principle, even private waters (ponds located on private lands, private wells) must be accessible to herds, provided the load capacity of the infrastructures allows for this.

The project will be applying for a water abstraction and water use permit; the current authorisation from the MH is for a limited number of water holes. A detailed hydrogeology study and water balance have been developed to support the application.

4.6.3 Radiation Legislation

Nuclear safety and security, and protection against the dangers of ionizing radiation are regulated by the Nuclear Regulation and Safety Authority (Autorité de Régulation et de Sûreté Nucléaire – "ARSN") established through Law No. 2016-45 of December 06, 2016 and as amended and supplemented by Laws No. 2018-21 of April 2018 and No. 2020-048 of October 14, 2020. The ARSN replaced the National Centre for Radiation and Protection (CNRP).

The Law No°2018-21 of April 27, 2018 covering nuclear safety and security and protection against the dangers of ionizing radiation, updates and replaces all previous provisions, in particular those in law no. 2006-17.

6 https://sawap.files.wordpress.com/2015/02/assessment-of-the-impacts-of-pastoral-policies-in-niger-e28093-niger-experience-in-terms-of-national-legislation-enforcement-for-pastoralists-mobility-and-cattle-circulation-rights.pdf

In relation to the Madaouela project, Law No. 2018-21 specifically includes provisions relating to the exploration, extraction and processing of uranium ore and the transport of any associated radioactive products within Niger. The law sets out in broad terms the regulatory framework for the development and operation of such facilities and the requirements for certificates of conformity in relation to radiation protection (including that relating to workers and the natural environment) Chapter 5, Items 64; 65 and 66. The law also describes offences and financial and penal sanctions associated with breaches of the law.

The law specifically states that the production, usage, transportation and waste management of radioactive materials or ionizing radiation sources cannot take place without prior authorisations issued by ARSN. An applicant for an authorisation must provide proof of technical and financial capabilities to execute a project and to ensure the safety and security of the associated activities.

Authorisation holders and employers must also take appropriate measures to ensure security and safe management of radioactive sources in accordance with the International Atomic Energy Agency (IAEA) Code of Conduct on the Safety and Security of Radioactive Sources and its guidance on Import and Export. There should be an emergency response plan in place to deal with any radiation related emergencies. This plan has to be approved by ARSN. Authorisations are non-transferrable.

Article 23 of Law 2018-21 requires adequate financial arrangements for the management of radioactive waste, the decommissioning of associated facilities and the rehabilitation and monitoring of its location.

Arrêté 003/MME/DM January 08, 2001 from the Ministry of Mines, ARSN (Law 2018-21) and IAEA guidance on the mining of uranium requires the development of a management plan for radioactive solid waste before the construction phase of any uranium mining operation. This management plan should detail the provisions adopted to limit, during the exploitation phase and post-closure, the radiological impact on any surrounding population.

According to the Mining Code, holders of prospecting and mining permits or quarry opening and development licenses are required to submit, to the mining administration, an annual report on general safety issues. Holders of radioactive substance mining permits must also submit semi-annual and annual reports on protection against radiation.

Additionally, uranium exploitation permit holders have to provide the MM with a biannual and annual report on radiation protection.

4.6.4 Cultural heritage legislation

Heritage sites in Niger are protected by Article 41 of the Constitution of the 7th Republic (November 25, 2010) and are the property of the State, in accordance with Article 41 of the Law No. 97-002 on the protection, conservation and enhancement of cultural and natural heritage (June 30, 1997) as brought into force by Decree No. 97-407/PRN/MCC/MESRT/IA (November 10, 1997). Recent Islamic tombs are protected by Sharia Law (Islamic ethical code).

According to Order No. 0113/MESS/RS/SG/DRS of June 24, 2010, a research authorisation will be required from the Ministry of Higher Education, Research and Innovation. (Ministère de l'Enseignement Supérieur, de la Recherche et de l'Innovation) prior to commencing any detailed heritage resources research or site excavations. Research applications have to be submitted to the Direction of Scientific Research as required by Article 4 of this Order.

The heritage surveys undertaken as part of the baseline study (Section 5.7) identified 147 funeral sites (including fifteen settlement and funeral mixed sites) within the Project area. Although none of these sites have been identified as recent Islamic tombs, careful considerations will be needed if further sites are discovered and relocation or excavation required. A 'chance find' procedure will be developed to address this.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Access to Property

The Madaouela Uranium Project is situated southeast of the mining town of Arlit, as shown in Figure 5-1. The proposed Miriam open pit is approximately 25 km south-east of Arlit with the M&M and MSNE underground mines 14 km north of Miriam. There is a national road from Niamey to Arlit via Agadez. The Miriam infrastructure will be located approximately 1 km from the national road. Currently access to the site is via dirt track and requires the use of 4x4 vehicles.

An airstrip belonging to SOMAÏR Mine, a subsidiary of Orano, was constructed at the start of their mining operation. Subject to the owner's agreement and the payment of a landing fee the airstrip can be used by charter companies. No commercial flights are available to Arlit. A commercial airstrip exists in Agadez. The drive to Arlit from Agadez is approximately 250 km.

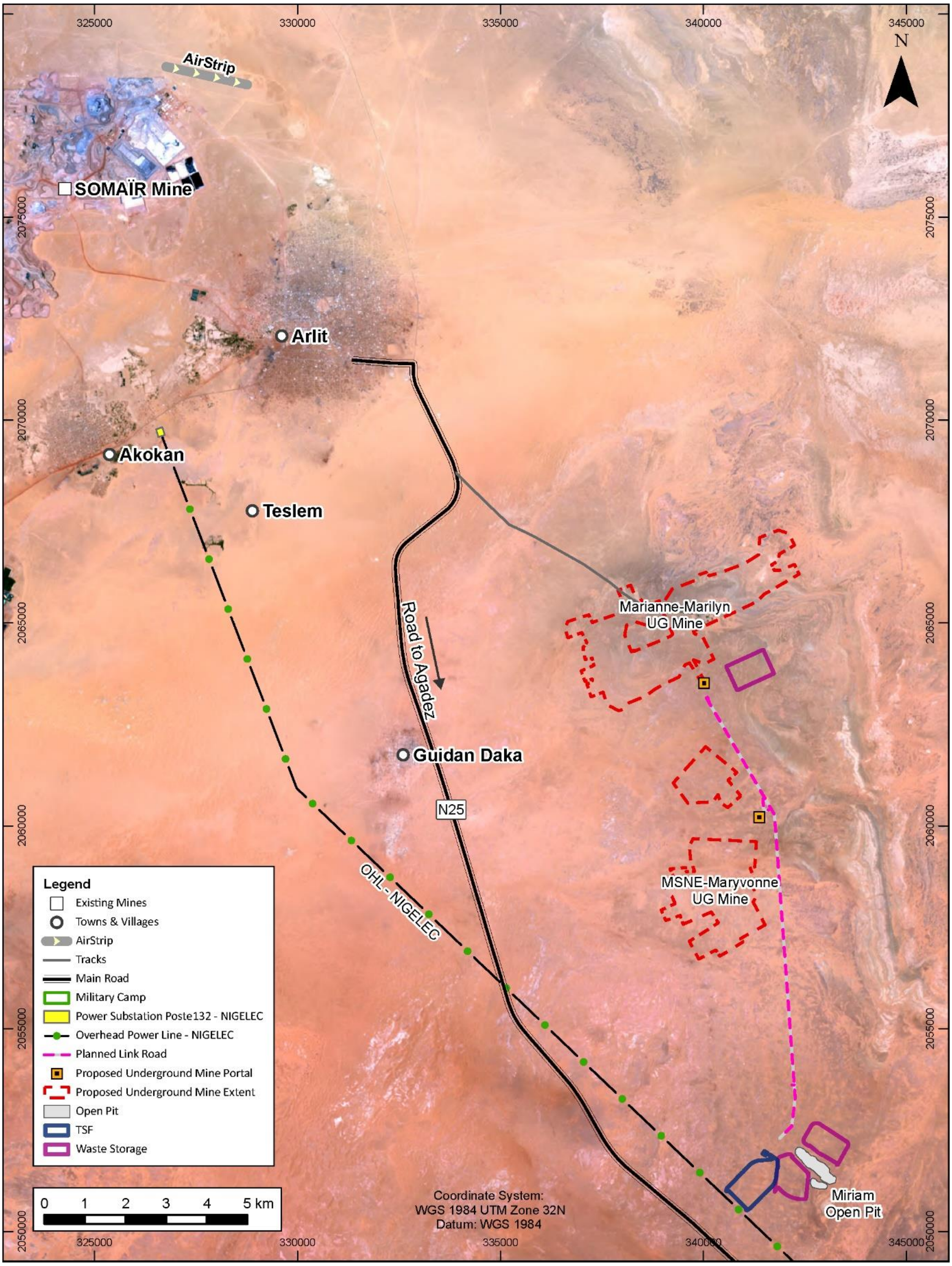


Figure 5-1: Project Site General Location

5.2 Climate and Climate Change

5.2.1 Introduction

According to Köppen-Geiger's climate classification, the Madaouela Project site is located in a hot desert climate setting (BWh). This climate type is characterised as being very dry, with less than 250 mm of rainfall a year. Hot desert climate typically features two distinct seasons; summer, when the temperature ranges between 35 °C to 40 °C, and winter, when the temperature is 20 to 30 °C.

A climate characterisation of the Project site is summarised here with full details provided in SRK (2022a).

A climate change assessment has also been completed (SRK, 2022b) based on the information available from the Intergovernmental Panel on Climate Change (IPCC) from the Sixth assessment report [AR6] and using General Circulation Models (GCMs) to assess future changes on two of the four "Tier 1" greenhouse gas emission scenarios known as Shared Socioeconomic Pathways (SSPs).

5.2.2 Meteorological Data

Local meteorological records

Local meteorological records were reutilised from the Integrated Development Project (IDP) plan for the Madaouela project carried out in 2013 (SRK 2013a). Measurements were utilised from the SOMAÏR mine site (SOMAÏR Station), located approximately 30 km northwest of the Project site. The dataset comprises temperature, precipitation, relative humidity, wind speed, and solar radiation records spanning from March 2005 to July 2012; see Table 5-1 below.

Table 5-1: Details of the SOMAÏR meteorological station

Station Name	Measurement Interval	Period of available data
SOMAÏR	1 minute	15/03/2005 to 24/03/2005
	15 minutes	25/03/2005 to 03/07/2012

Figure 5-2 shows the location of the SOMAÏR station relative to the Project site (Mine site in the legend).

Figure 5-3 presents the available information from the three meteorological stations, the x-axis grid lines representing the information available per year, and the y-axis representing the different data sources. The resultant blocks are colour-coded to represent the amount of information available in terms of number of days with records. Dark blue represents a complete year of information, while white identifies a year without records.

NOAA Databases

Regional records obtained from the publicly available National Oceanic and Atmospheric Administration databases (NOAA, 2022) include quality controlled daily, monthly, seasonal and yearly measurements of air temperature, total precipitation and wind speed/direction.

NOAA stations located at In Guezzam and Agadez are the only stations located within 250 km of the Project site. In Guezzam station is approximately 217 km northwest of the site and Agadez is situated approximately 180 km southeast (Figure 5-2). The NOAA station details are provided in Table 5-2.

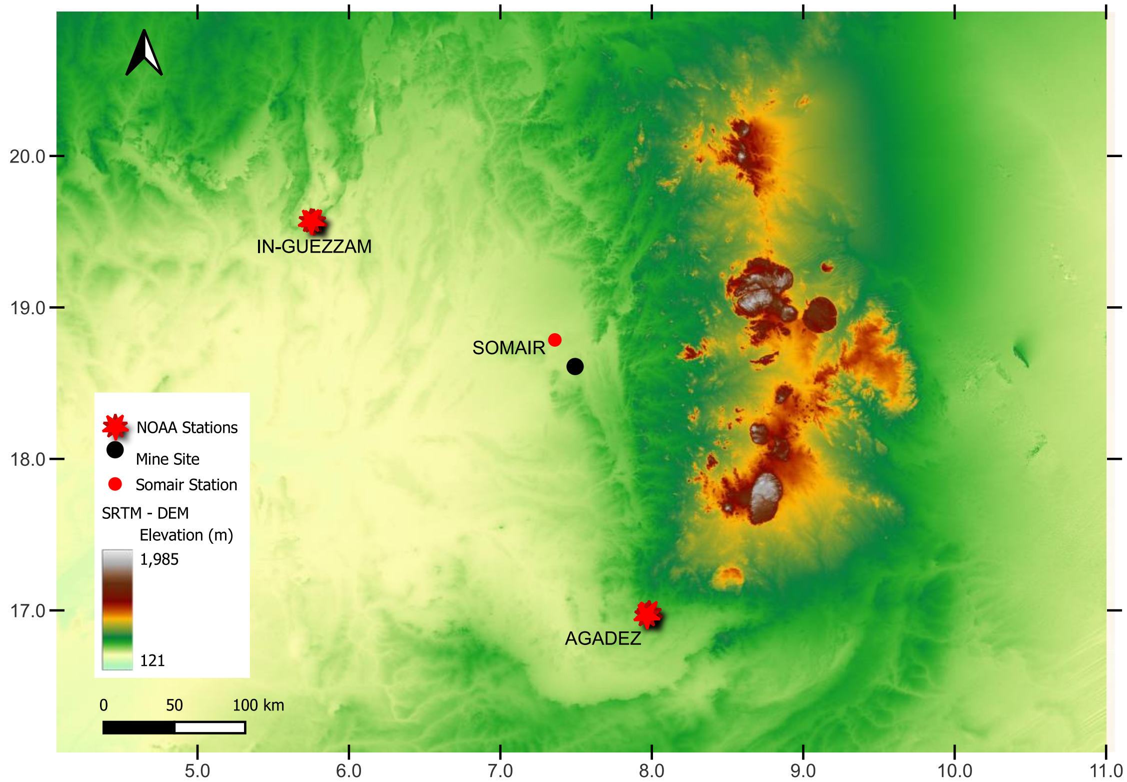


Figure 5-2: Location of the Regional Meteorological Stations

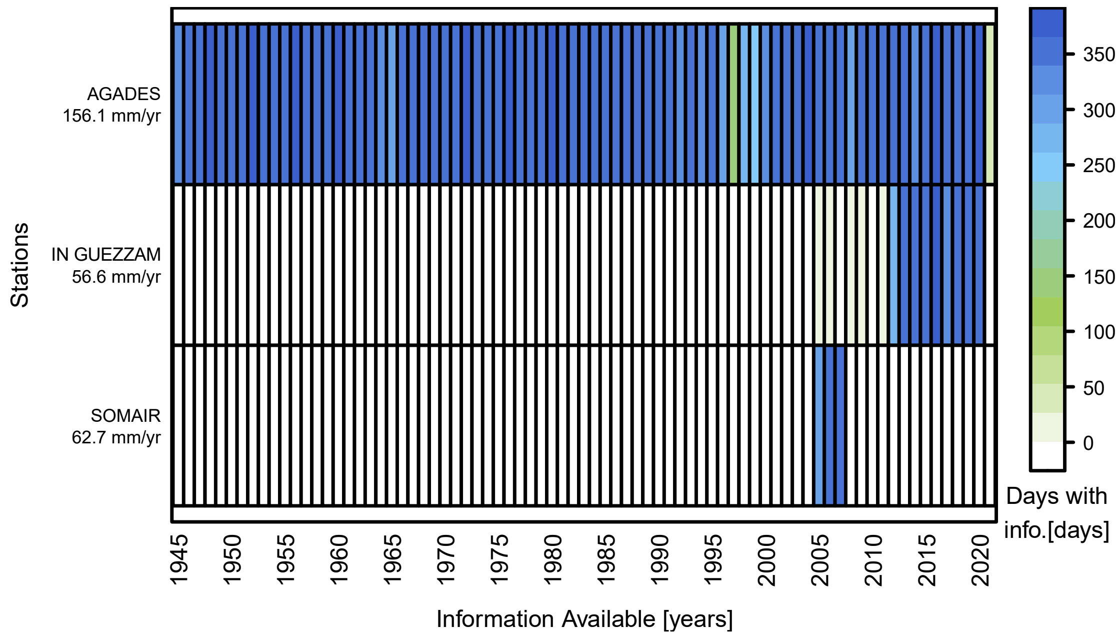


Figure 5-3: Data Availability for the Three Regional Meteorological Stations

Table 5-2: Summary details of NOAA Stations within 250 km of the mine site

Station Name	Latitude	Longitude	Elevation	Period of available data
Agadez	17.967°	7.967°	505 m	1957 – 2021
In Guezzam	19.570°	5.750°	400 m	2005 – 2020

Climatic Gridded Models

Climatic gridded models are used to develop a comprehensive record of changes to weather and climate over time. Nine global reanalysis models were reviewed to support the climate analysis for the Project as summarised in Table 5-3 below.

Table 5-3: Climatic gridded models used for the Project

Source	Grid size	Spatial	Grid time	Period of Record	Parameters
TRMM	0.25 x 0.25	60° Lat (N/S)	3 hours	1997 - 2015	Precipitation
GPM	0.10 x 0.10	Planet	30 min	2000 - present	Precipitation
CHIRPS	0.05 x 0.05	50° Lat (N/S)	daily	1981 - present	Precipitation
MERRA2	0.50 x 0.50	Planet	hourly	1983 - present	Precipitation Air Temperature
ERA5-Land	0.1 x 0.1	Planet	hourly	1950- present	Precipitation Air Temperature
ERA5	0.25 x 0.25	Planet	hourly	1950 - present	Precipitation Air Temperature
PERSIANN	0.25 x 0.25	60° Lat (N/S)	daily	2000 - present	Precipitation
PERSIANN-CDR	0.25 x 0.25	60° Lat (N/S)	hourly	2000 - present	Precipitation
PERSIANN-CCS	0.04 x 0.04	60° Lat (N/S)	hourly	2003 - present	Precipitation

Further details of data used in the climate review are presented in SRK (2022a).

Climate Analysis Methodology

To understand historical climate trends, a trend analysis was implemented for precipitation and temperature. This analysis was performed using five different regression and trend statistical methods.

Frequency analysis was undertaken to relate the magnitude of extreme events to their frequency of occurrence. The frequency analysis was performed using Normal, Log-Normal, GEV, Gumbel, Pearson III, and Log-Pearson III probabilistic distributions and the distribution parameters were selected with the L-moments methodology. The selection of the best-fit distribution was then based on four criteria and implemented in the statistical software R.

Given the proximity to the project site, the SOMAÏR station was judged to have similar climatic conditions to the Project site and was therefore used as the site precipitation dataset for comparison with other data sources. The monthly precipitation values for each source (regional meteorological NOAA stations, satellite-related data sources and reanalysis models) were compared to determine the best relationship to the site data. Correlation analysis was then carried out by comparing the annual precipitation values of the local meteorological datasets with geographic parameters including elevation, latitude and longitude and distance from the Project site.

The site air temperature records (maximum, mean and minimum) were compared to other data sources (i.e. regional NOAA and satellite-related data sources and reanalysis models) to determine the best relationship to the site. Initial comparison results indicated that SOMAÏR and ERA5 Land records were well correlated. For further analysis, the hourly records from the SOMAÏR station and ERA5 Land data set were used.

For evaporation estimates benchmarking was carried out using the Global Potential Evapotranspiration (Global-PET) dataset as a reference PET. The Global-PET was modelled using the data available for the WorldClim Global Climate Data. To apply the methods used, climate data, including wind speed, relative humidity, and solar radiation obtained from data sources considered representative of the site were used. Due to scarce data for some variables, measurements taken in the period 2005 to 2008 were used for the evaluation.

The recorded wind speeds at SOMAÏR Station were considered most representative of the site given the high variability among the other data sources analysed. In order to develop a wind rose, the local revised time series for wind speed and wind direction was analysed on an hourly and daily monthly basis.

5.2.3 Precipitation

A boxplot distribution of the monthly site analogue rainfall is presented in Figure 5-4. The central bar within each box represents the median where the box itself represents the central half of the data range, while the 'whiskers' indicate variability outside the upper and lower quartiles, except outliers which are plotted individually.

The analysis confirms a wet season period (June – October) and a dry season period (November – May). Table 5-4 summarises the monthly averaged precipitation records. The average annual precipitation is 69 mm**.**

Table 5-4: Monthly Average Rainfall (mm) for Site Analogue (2005 - 2007)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0	0	1	0	2	4	11	37	11	2	0	0	69

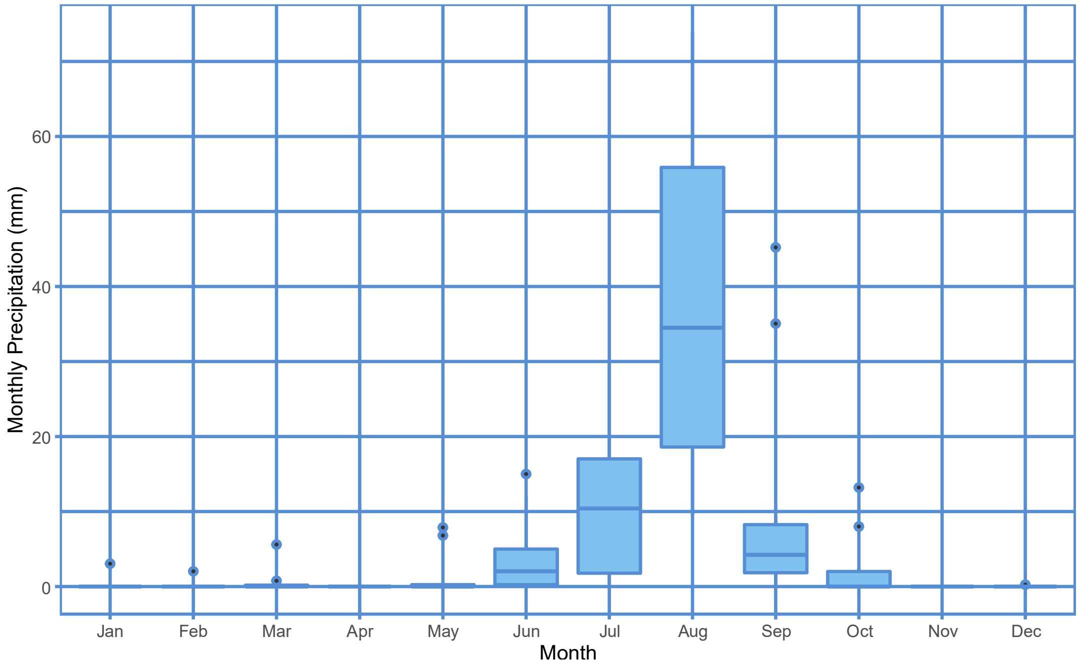


Figure 5-4: Monthly Precipitation for the Project Site

Table 5-5 and Table 5-6 summarise the intensity–duration-frequency (IDF) and depth- duration-frequency (DDF) values respectively, adjusted to the site based on the precipitation records for the site analogue.

Table 5-5: IDF adjusted for the site based on daily site information [mm/hour]

Probability	Return Period (years)	24-hr	48-hr	72-hr
0.5	2	0.88	0.46	0.33
0.8	5	1.50	0.79	0.60
0.9	10	2.00	1.02	0.76
0.95	20	2.58	1.27	0.94
0.98	50	3.38	1.58	1.18
0.99	100	4.04	1.85	1.38

Table 5-6: DDF adjusted for the site based on daily site information [mm]

Probability	Return Period (years)	24-hr	48-hr	72-hr
0.5	2	21	22	24
0.8	5	36	38	43
0.9	10	48	49	55
0.95	20	62	61	68
0.98	50	81	76	85
0.99	100	97	89	99

5.2.4 Air Temperature

Figure 5-5 presents the monthly boxplot for the maximum, mean, and minimum monthly temperature at the site for the period 1900 to 2021. On this basis the annual average air temperature is found to be 29.6°C, with average maxima and minima of 36.1°C and 21.6°C respectively. Air temperature shows little seasonal variability when compared to precipitation records.

The historical trend for mean annual air temperature shows a positive gradient of 0.36°C per decade (Figure 5-6). This increase is reflective of the temperature records between 1990 to 2021, for which there is a statistically significant trend. This is in line with the climate change projection for the area which indicates an increase of 1.4 °C by the mid-century corresponding to 0.5 °C per decade.

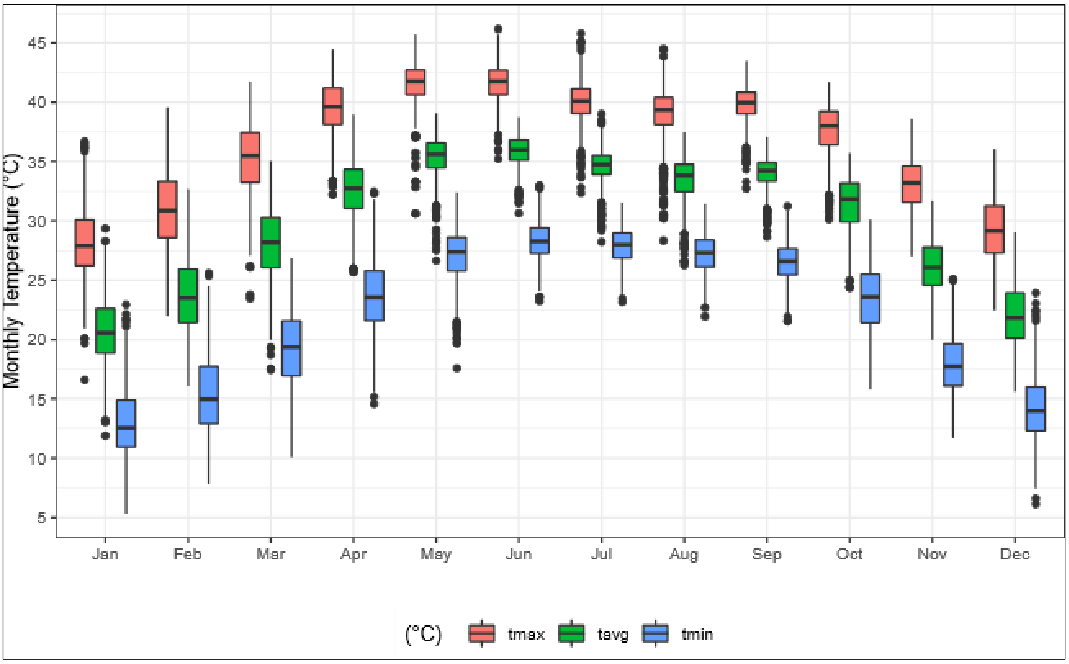


Figure 5-5: Monthly Air Temperature 1990 – 2021

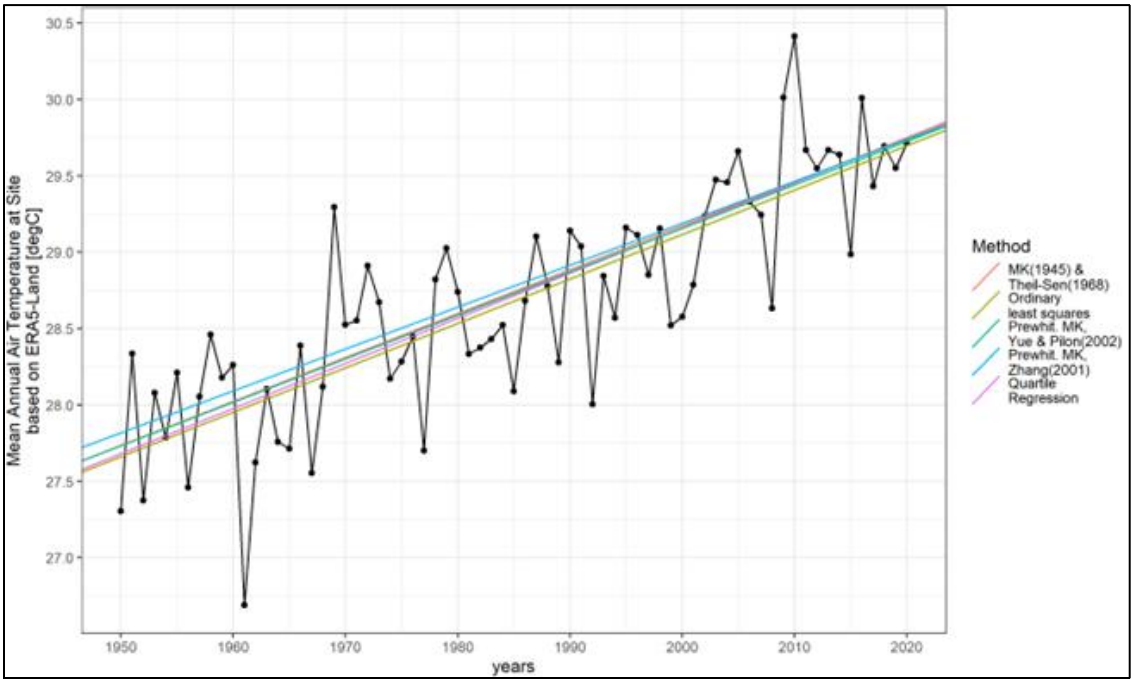


Figure 5-6: Historical Trend of Mean Annual Temperature

Table 5-7: Monthly average air temperature (1990 – 2021)

Air Temp. (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum	28.2	31	35.1	39.5	41.6	41.7	40.1	39.1	39.9	37.7	33.1	29.3	36.3
Average	20.9	23.7	27.9	32.6	35.4	35.9	34.6	33.5	34	31.4	26.1	22.1	29.8
Minimum	13	15.4	19.2	23.6	27.1	28.3	27.9	27.2	26.5	23.4	17.9	14.2	22

5.2.5 Evaporation

A range of potential evaporation values that can be expected on site were estimated using a variety of different methods. Figure 5-7 compares the monthly average potential evaporation between several methodologies for 2005 – 2008. All methods show the same trend, with the highest evaporation occurring from May to July and decreasing to a minimum during the dry months. The Penman-Monteith FA056 reference crop evaporation (2016 mm) and the Morton CREWE shallow lake evaporation (2178 mm) presented results in a similar range to the yearly estimates of the Global-PET (2126 mm).

The annual potential evaporation is significantly greater than the annual average precipitation (69 mm), indicating low runoff at the site area and very short and limited water accumulation. The potential evaporation values presented here provide a range that can be expected on site. Site values should be confirmed in the future using local instrumentations such as a pan-A evaporimeter.

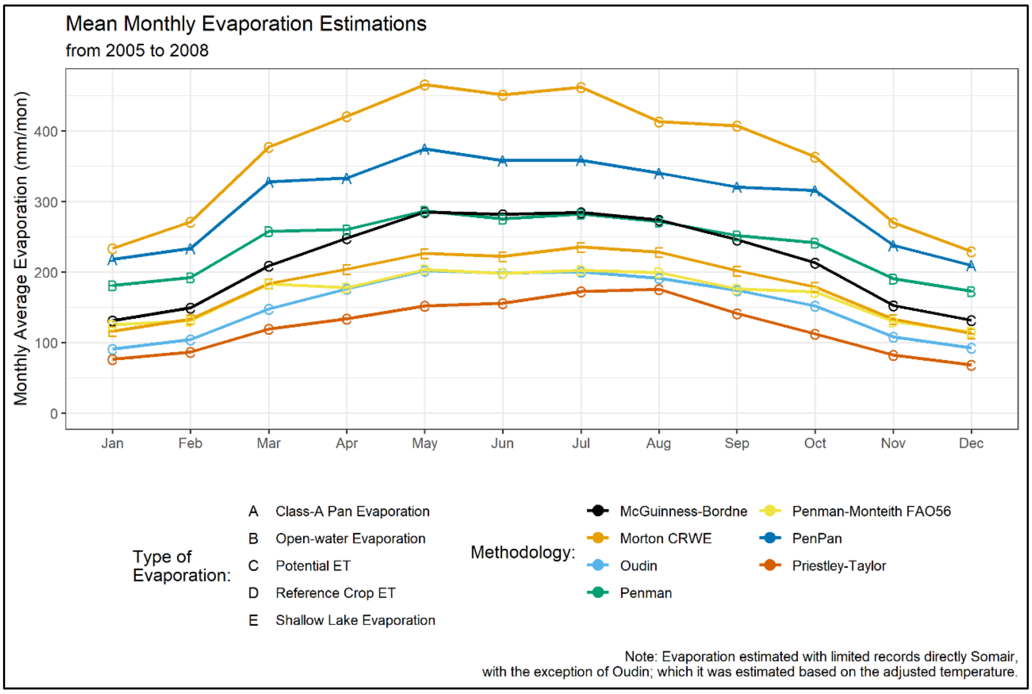


Figure 5-7: Monthly Average Evaporation

5.2.6 Wind Speed

Statistical analysis was conducted on the SOMAÏR wind speed records to evaluate seasonal variation and to evaluate median, maximum, minimum and extreme values. These values are presented in the Figure 5-8. Table 5-8 shows the median values for each month, with the annual mean wind speed of 3.4 m/s. This corresponds to daily mean values recorded on-site during 2005-2012.

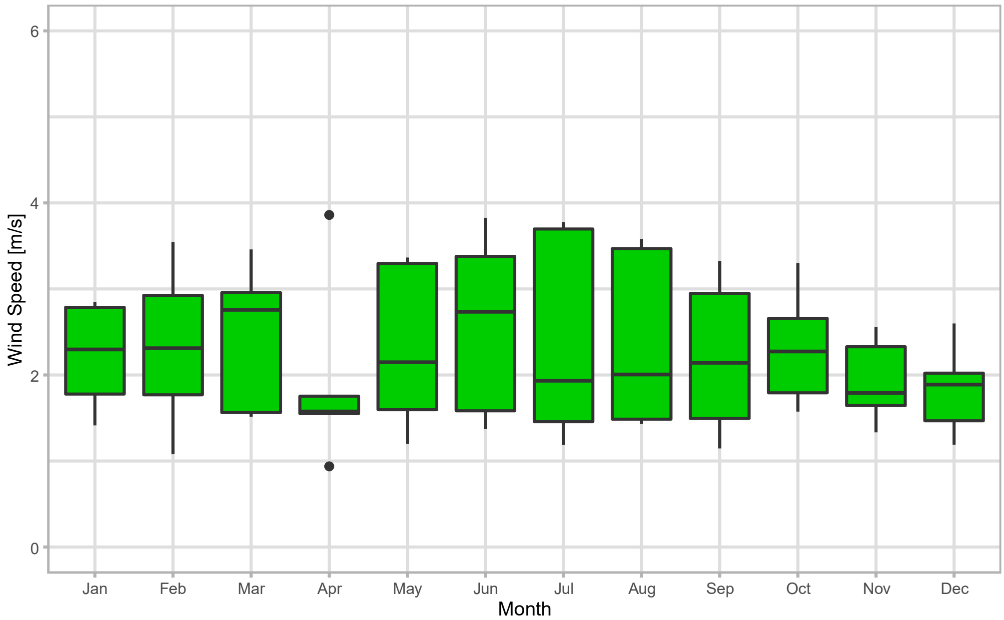


Figure 5-8: Monthly Wind Speed (2005 - 2012)

Table 5-8: Site representative average monthly mean wind speed (2005 - 2012)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Wind Speed (m/s)	2.2	2.3	2.5	1.9	2.3	2.6	2.4	2.4	2.2	2.3	1.9	1.8	2.2

Hourly, daily and monthly wind roses were constructed. On an hourly basis, the most frequent wind direction is north-northeast (NNE), east-southeast (ESE) and south (S), each amounting to approximately 12 % of the time across the project area. The maximum wind speed recorded was 15.7 m/s, while the hourly mean was 2.3 m/s, with 3.2 % of the time being calm conditions (no wind). The daily scale shows similar wind direction trends, with the daily average maximum recorded as 7.4 m/s, daily mean 2.2 m/s, and 0 % of days recording no wind.

5.2.7 Climate Summary

A summary of climate parameters for the Project site is presented below in Table 5-9. These values are considered site representative and were used to inform the relevant elements of the FS design.

Table 5-9: Estimated monthly average climate parameters for the Project site

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Maximum Temperature [°C]	28.2	31.0	35.1	39.5	41.6	41.7	40.1	39.1	39.9	37.7	33.1	29.3	36.3
Mean Temperature [°C]	20.9	23.7	27.9	32.6	35.4	35.9	34.6	33.5	34	31.4	26.1	22.1	29.8
Minimum Temperature [°C]	13.0	15.4	19.2	23.6	27.1	28.3	27.9	27.2	26.5	23.4	17.9	14.2	22
Total Precipitation [mm]	0	0	1	0	2	4	11	37	11	2	0	0	69
Potential evaporation, Oudin [mm]	91	105	148	176	202	199	200	191	174	152	108	92	1,840
Penman-Monteith FAO56 [mm]	125	131	183	178	204	198	202	199	177	172	130	115	2,016
Wind Speed [m/s]	2.2	2.3	2.5	1.9	2.3	2.6	2.4	2.4	2.2	2.3	1.9	1.8	2.2

5.2.8 Climate Change

Methodology

The climate change assessment was based on General Circulation Models (GCMs), a class of computer-driven models for weather forecasting, understanding climate and projecting climate change, also commonly called Global Climate Models. The NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP) data set comprises downscaled climate scenarios for the globe derived from 35 GCMs. Future changes are assessed on two of the four “Tier 1” greenhouse gas emissions scenarios known as Shared Socioeconomic Pathways (SSPs). Whilst observed historical data could be used to investigate trends, GCMs are most often used to generate data to investigate the impacts of climate change into the future on a global or continental scale.

Climate change modelling for the project was conducted through a compilation of available GCMs and by completing an analysis on multiple climatic models with a purpose-built script developed by SRK using R Software. The results of the analysis provide an estimate of the expected change of different climatic parameters for a specific location, defined by longitude and latitude, with respect to baseline conditions (1985 - 2014).

Precipitation

A statistical review was conducted to analyse short-term (2020 to 2049) and long term (2070 to 2099) climate change predictions at the project site. Table 5-10 summarises the mean annual precipitation anomaly for the periods of the current and immediate conditions for which the mine will operate, the middle period of the 21st century, and finally, projections made with respect to the end of the 21st century.

In general, the majority of GCMs are aligned regarding MAP projections which suggest a high inter-annual variation. Statistical analysis of the 2030s time period, that is, the short-term change in mean annual precipitation (MAP), suggests an annual change estimated to be between 30.2 % and 31 % for SSP2-4.5 and SSP5-8.5, respectively. An expected increase in mean annual precipitation of between 28.7 % (SSP2-4.5) and 27.4 % (SSP5-8.5) is predicted in long-term projections.

Based on this analysis, it is expected that MAP will increase as a median close to 29 % with respect to baseline conditions (1985 to 2014) by the year 2100. However, the inter-annual variation must be considered as some months may increase or decrease within the annual trend.

Table 5-10: Mean annual precipitation anomaly as a percentage (%) with upper and lower quartiles below in brackets for two SSP-RCP scenarios

Scenario	2030s	2050s	2080s
	2020 - 2049	2040 - 2069	2070 - 2099
SSP2-4.5	30.2	25	28.7
	(9.8, 47.3)	(13.3, 50.8)	(−2.8, 52.7)
SSP5-8.5	31	33.9	27.4
	(14.6, 57.9)	(12, 63.5)	(15.7, 42.7)

Figure 5-9 displays a heat map of the projected mean temperature anomaly based on the SSP2-4.5 scenario and SSP5-8.5 for each decade until the end of the 21st century. This figure represents the yearly variation of the total precipitation by considering historical and projected precipitation anomalies. Using the heat map as a starting point for further analysis, one can deduce how the climate parameters change in terms of duration (e.g., increased number of wet days, or length of a dry spell), their magnitude or intensity, their frequency and timing (i.e. what time of the year).

Projected increases in precipitation for the months July to September are shown in the heatmap. In the context of the SSP5-8.5, precipitation increases in excess of 90 % are projected.

The area has a hot desert climate, with the majority of precipitation falling in months April-October. High relative change in August and September translates as an approximate increase of 10 mm per month or more.

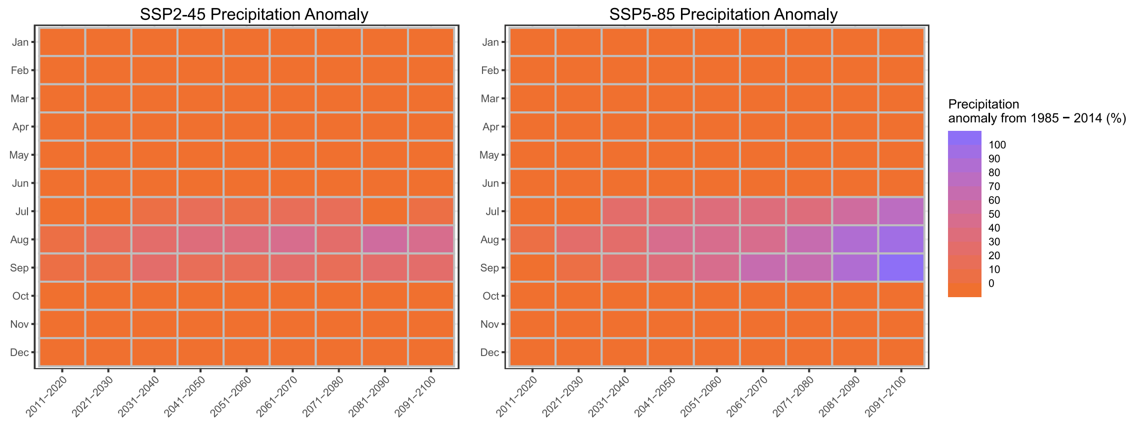


Figure 5-9: Projected Monthly Precipitation Anomaly Heatmap for SSP2-4.5 and SSP5-8.5 Scenarios

Temperature

Figure 5-10 illustrates the predicted temperature adjustments under the SSP2-4.5 and SSP5-8.5 scenarios for the Project site. An upward shift of 0.3 °C was applied to adjust the GCM projections to be in line with site records. The projections in Figure 5-10 indicate that the mean annual temperature (MAAT) is expected to increase by 1.6 % at the end of the 21st century under the SSP5-8.5 scenario. Conversely, if CO_2 emissions are kept at an intermediate level (SSP2-4.5), then the temperature is expected to be 0.9 %.

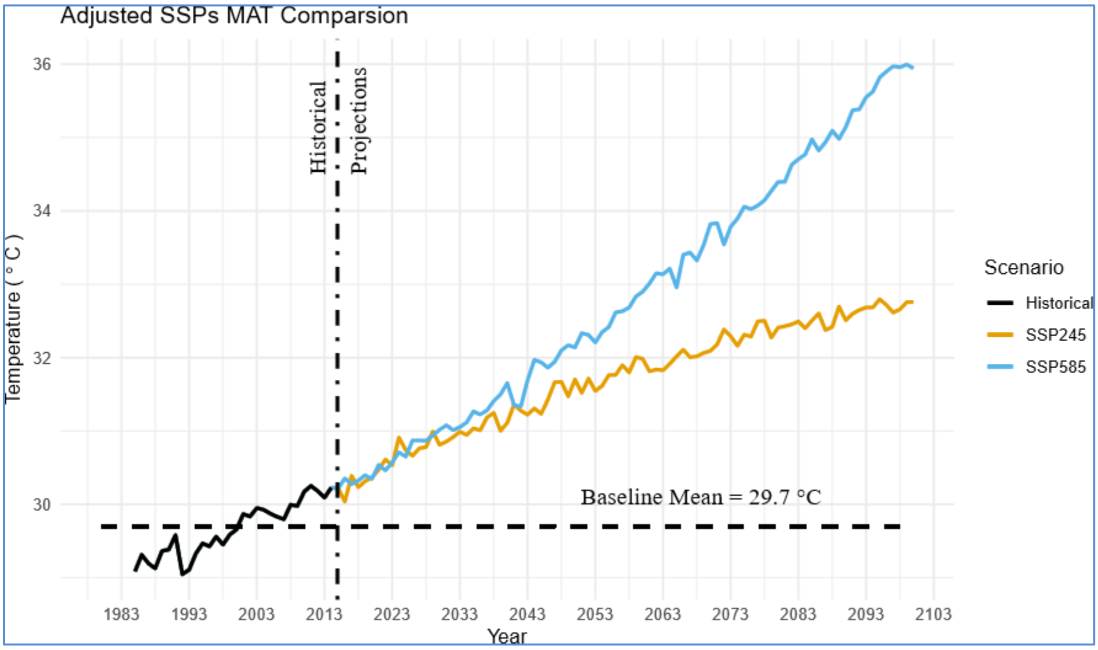


Figure 5-10: Adjusted Mean Annual Temperature (MAAT) Projections for the Project Site

The magnitude of the MAAT anomalies for 2030s, 2050s and 2080s are presented in Table 5-11. GCMs are aligned with a predicted increase in MAAT by the end of the century, with median values ranging from +2.8 °C to +4.9 °C over baseline conditions in the 2080s for the SSP2-4.5 and SSP5-8.5, respectively. Relative temperature increase presented as [%], uses Kelvin scale and absolute zero (or -273,15 °C) as a reference.

In the short-term (2030s), an increase in MAAT is expected to be +1.4°C and +1.5°C for SSP2-4.5 and SSP5-8.5, respectively.

The MAAT parameter is indirectly associated with changes in actual evaporation that can affect water balance calculations, soil moisture conditions and water vapour in air.

Table 5-11: MAAT anomaly expressed in both (%) and (°C) with the upper and lower quartiles in brackets

Scenario	2030s		2050s		2080s	
	2020-2049		2040-2069		2070-2099	
	(%)	(°C)	(%)	(°C)	(%)	(°C)
SSP2-4.5	0.5	1.4	0.7	2	0.9	2.8
	(0.4, 0.5)	(1.1, 1.6)	(0.6, 0.7)	(1.7, 2.2)	(0.7,1.0)	(2.2, 3.2)
SSP5-8.5	0.5	1.5	0.9	2.7	1.6	4.9
	(0.4, 0.6)	(1.3, 1.8)	(0.8, 1.0)	(2.3, 3.1)	(1.4, 1.9)	(4.1, 5.8)

Figure 5-11 displays a heat map of the projected MAAT anomaly based on the SSP2-4.5 and SSP5-8.5 scenarios. This figure represents the monthly variation of temperature for each decade until the end of the 21st century showing months from April to November warming up the most.

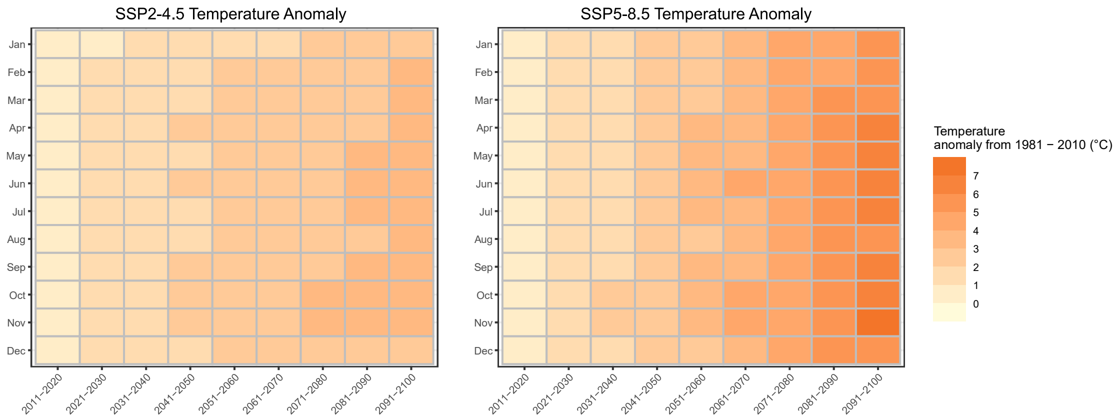


Figure 5-11: Projected monthly MAAT anomalies (left: SSP2-4.5, right: SSP5-8.5)

Climate Change Summary

A summary of climate trends for some typical meteorological parameters are presented in Table 5-12 for the two assessment periods under the two assessment scenarios, SSP2-4.5 and SSP5-8.5.

Table 5-12: Summary of Climate Change Factors

Climate Factor	Effects on the project	Assessment period	Baseline and forecast based on Shared Socioeconomic Pathways (SSPs)	Predictions in parameter changes with respect to baseline period (1985-2014) and implications on design
Mean Annual Precipitation	○ Water balance ○ Runoff ○ Water availability ○ More water to store, treat, discharge ○ Dam safety	2021 - 2041 and 2081 - 2100	BASELINE 1985 - 20 SSP2-4.5 2030s +30.2 % 2020 - 20 SSP5-8.5 2030s +31.0 % SSP2-4.5 2080s +28.7 % 2070- 20 SSP5-8.5 2080s +27.4 %	• Short term forecast suggests increase of up to 31% in precipitation (GCM medians). • Increase in total precipitation with respect to baseline is expected to be maximum ~29 % (GCM medians) for long term prediction.
Mean Annual Air Temperature MAAT *(change %)*	○ Evaporation ○ Water balance	2021 - 2041 and 2081 - 2100	BASELINE 1985 - 20 SSP2-4.5 2030s +0.5 % 2020 - 20 SSP5-8.5 2030s +0.5 % SSP2-4.5 2080s +0.9 % 2070 - 20 SSP5-8.5 2080s +1.6 %	• Short term forecast suggests an increase of up to 0.5% over baseline conditions (GCM medians). • Long term increase in mean annual air temperature up to 1.6% over baseline conditions (GCM medians) which is recommended for closure design considerations.
Mean Annual Air Temperature (MAAT) *(change °C)*	○ Evaporation ○ Water balance ○ Change in hydrological cycle	2021 - 2041 and 2081 - 2100	BASELINE 1985 - 20 SSP2-4.5 2030s +1.4 °C 2020 - 20 SSP5-8.5 2030s +1.5°C SSP2-4.5 2080s +2.8 °C 2070 - 20 SSP5-8.5 2080s +4.9 °C	• Short term forecast suggests increase in MAAT of up to +1.5°C over baseline conditions (GCM medians). • Long term increase in MAAT up to +4.9°C over baseline conditions (GCM medians).

5.3 Economic and Political Climate

Niger's economy is dominated by activities in the rural sector. Agriculture accounted for 28.5 % of GDP in 2018 and is the main source of income for over 80 % of the population. Reflecting this, more than 20 % of Niger's export earnings are generated by livestock, produced upon rangelands and through transhumant pastoralism. However, frequent climatic shocks impact agricultural productivity and cause food insecurity. The extractives industry is another important sector but its contribution to GDP has been relatively low, estimated at 4.4 % as of 2018. The main minerals produced include uranium, of which Niger is the world's 7th largest producer as of 2020, oil and gold. Seventy percent of extractives revenue come from oil whereas uranium accounts for 28.5 %.

Niger's recent GDP growth performance has been relatively robust (5.2 % on average from 2000 to 2020) and the WAEMU and ECOWAS sub-regional markets are important outlets for Niger. However, Niger's overall economic growth has been weak and according to the 2020 Human Development Index, Niger ranked 189 out of 189 countries and territories and more than 10 million people (41.8 % of the population) were living in extreme poverty in 2021[7]. The state of emergency and restrictive security measures in the border regions of Niger have also stifled economic activity.

The spread of violence and instability continues to be an issue. Niger is ranked as 'high' on the TDI (Conflict-Affected and High-Risk area) CAHRA index[8]. The northern Agadez region, is popular with armed groups, bandits and smugglers and a route for the trafficking of humans, weapons and drugs. The town of Arlit is a hub and transit town for migrants (including asylum seekers and refugees) heading further north towards Algeria and Libya. Although most West African countries have adopted the UN protocol against the smuggling of migrants and anti-trafficking laws and received financial support from the EU to tackle the issues, migrants are able to move across the West African region because of the free movement policy of ECOWAS among member states.

Niger has made progress in improving its business climate; however, much remains to be done to strengthen this performance. Constraints noted for the extractives industry include cumbersome regulation, the complexity of getting licenses, limited capacity to enforce regulations and monitor activities of mining companies, a significant level of corruption and low human capital (PDES, 2017).

5.4 Administrative Setting

Niger is divided into seven regions including Agadez (where the Project is located) and one capital district, Niamey. Each region is subdivided into departments, communes, cantons and groupements. Niger has both state and traditional political regimes. Mohamed Bazoum, the candidate of the party in power, was elected president in elections held in December 2020 and February 2021, marking the first democratic transfer of power in the country's history.

[7] https://www.worldbank.org/en/country/niger/overview
[8] https://tools.tdi-sustainability.com/cahra_map

A policy aimed at decentralisation was passed in 2004, giving greater autonomy to local level authorities to enforce national level policies (including the Rural Code and the Pastoral Code, see Section 4.2) within their local context. The local governance structure includes a chief administrator (governor) in each region who is appointed by the government and functions primarily as the local agent of the central authorities. Communes have elected councils and mayors (PNDIR, 2005).

Cantons (groupings of sedentary villages) and Groupements (a unit of tribal government whose population is dispersed and constantly on the move) have customary leadership represented by customary chiefs (see also Section 4.2). Groups from all ethnic backgrounds that are considered sedentary are administered by Canton Chiefs (Chefs de Canton) who are responsible for the management of defined territories, control tenure rights and may also allocate cultivable land. Nomadic groups including the Fulani, Tuareg (Section 5.7) and others that have maintained all or part of their capacity to move around are usually administered by of pastoral groups chiefs (Chefs de Groupement), whose powers are limited to the people in their charge. They exercise no formal rights over land and must interact effectively with other governance actors to enforce pastoral rights, although they can authorise or refuse permission to sink wells, in the interest of any of their constituents (Hammel, 2005)[9].

Historically the Tuaregs have claimed to have been marginalised, lacked participation in decision making regarding extractive industry projects and lacked political representation in Niamey (Section 5.7). Decentralisation has given Tuaregs access to positions in local administrations and the Tuareg communities now enjoy some autonomy in Niger. Decentralisation has also contributed to a gradual shift of jurisdiction over land holdings from customary chiefs to democratically elected leaders, which have included land formalisation processes. This has also created more complicated overlapping layers of governance.

5.5 Physical Setting

The Project is located in the Sahara Desert climate zone and the average annual precipitation ranges between 100–200 mm in the north. Given the Sahara Desert climate is extremely arid, precipitation is less than evaporation and therefore there is minimal water available for storage, runoff or recharge. There is a clearly defined dry season between October and May with little or no rainfall. The wet season occurs between June and September, with the peak rainfall month being August. Storm duration and intensity comprises short, intense peaks of heavy rain lasting 15 minutes with less intensive rainfall either side of the main downpour event lasting in total between 2 and 3 hours. Average annual temperature ranges between approximately 15°C and 35°C, with a mean of 28°C. There are three seasons: a relatively cold season, October to February, a hot season, March to June, and a humid season, June to September. In the hot season temperatures can exceed 40°C and in the cold season nights are generally cool with temperatures below 20°C.

[9] Hammel. *Securing land for herders in Niger,* 2005
https://pubs.iied.org/sites/default/files/pdfs/migrate/9025IIED.pdf

A preliminary climate change prediction forecast was prepared by SRK and provided to project engineers to ensure climate change resilience was embedded in the design of project infrastructure. The results indicate precipitation is expected to increase only for the months of July to September. Mean annual precipitation is expected to increase by 31 %, with wet months projected to receive almost twice as much rainfall. Mean annual temperatures are expected to increase by 0.5 % (a 1.5°C increase).

Topographic relief in the Project area is minimal, ranging between 350 and 560 m above sea level (masl). Areas of drilling are at approximately 420 m elevations and over much of the areas drilled, relief is less than 40 m from low ridges of sandstone outcrops to flat sand covered plains. The higher elevations are associated with the foothills of the Aïr Mountains, 15 to 20 km to the east of the Project area. The nearest area of topographic of significance is Mount Bagzane (elevation 2,022 m), located in the Aïr Mountains. The Aïr plateau forms an island of Sahel climate which supports a wide variety of life, many pastoral and farming communities, and dramatic geological and archaeological sites.

The Project properties are located in the Tim Mersoi Basin. Apart from the Niger River flowing through the southwestern tip of the country, and adjacent to the capital city of Niamey, there are no other free flowing perennial water bodies in Niger. The Project is situated in a region where surface water is scarce and the drainage network consists of ephemeral rivers also referred to as wadis. They are characterised by short duration flow events in response to heavy rainfall and remain dry for most of the year. Surface water usage is limited to supporting the sparse vegetation and opportunistic livestock watering in short lived pools.

In the vicinity of Arlit, carboniferous sandstone formations host underground water tables that have been exploited since the start of the uranium mining operations in the 1960’s. The human concentration that has accumulated over the years in the Arlit area has contributed to reducing the underground water resources; however, water reserves in the region are considered to be large. The uranium ore bodies in the region are hosted within sandstone aquifers. The Madaouela and COMINAK ore deposits are hosted by the geological formations supporting the Guezouman aquifer and the SOMAÏR ore deposit is hosted by the Tarat aquifer formation. The Tarat aquifer supports the water supplies to the towns of Arlit and Akokan and has been impacted by dewatering in the past to facilitate mining of SOMAÏR. The communities to the east of the Project area have their own water supply boreholes, which access older pre-carboniferous aquifers. A number of pastoral wells are also present to the east of the Project area; these include pastoral wells provided by GoviEx.

The groundwater monitoring data shows groundwaters range from fresh to brackish to saline. There was found to be minimal seasonal variation in groundwater quality across the six rounds of sampling (July 2012 to October 2014), this reflects the low levels of rainfall in the region resulting in virtually no infiltration to groundwater. In general, the water quality was poorer in the vicinity of the ore bodies and could not be used for drinking water purposes without treatment. Trace metal concentrations were generally low, although elevated molybdenum concentrations were recorded in many of the samples collected, particularly those from wells in the vicinity of the army camp. Slightly elevated uranium concentrations were also recorded in boreholes in the vicinity of the army camp. These elevated uranium concentrations are thought to be occurring as these wells intercept the ore bodies of Marianne and Marilyn. A further round of sampling was carried out in 2021 to validate the baseline data collected in 2012-14.

Levels of dust showed a strong seasonal trend, increasing as expected during the dry season. Naturally occurring levels of fine dust in the air are above international guidelines and levels of dust fallout are also high. Levels of nitrogen dioxide and sulfur dioxide (gases typically associated with industrial activity) were found to be low.

5.5.1 Radiation Levels

The Project area is located in a region of elevated background radiation due to the natural presence of high concentrations of uranium in the earth. The baseline study looked at the communities to the east of the Project area, the Project area and Arlit/Akokan to provide a holistic view of the current radiation doses received by community members.

A baseline estimation of the total radiation dose received by a person present in and around the Project area was calculated using a range of scenarios that produced a low, medium and high value for the dose received. The estimated radiation dose was calculated from several sources, including: external cosmic radiation; external radiation received from the ground; inhaled dust and radioactive gases; ingestion of radionuclides on foodstuffs; and drinking of water containing radionuclides. The low scenario predicted a total dose that was just below the world average, however the average and high calculated doses for the area were both above the world average total dose. The highest calculated does are to the east of the Project Area. It is worth noting that the calculated total doses were still lower than some other regions globally that have naturally elevated radionuclides in their soils.

5.6 Biological Setting

Approximately 40 % of the Project area is covered by South Saharan Steppe and Woodlands ecoregion in the northwest and with 60 % covered by the Sahelian Acacia Savanna ecoregion in the southeast. The highest floral diversity in Niger occurs in the Aïr mountains. The Southern Steppe and Woodlands ecoregion used to attract large herds of arid-adapted migratory herbivores after the rains but the area has been overgrazed by herds of domestic livestock and habitat degradation is widespread. This ecoregion serves as a transition from the Sahara to the Sahel.

As part of the project baseline data collection a total of 20 plant species were identified on the Project area during the rainy season. Fifteen of these were herbaceous species and five were woody. A number of plant species were identified as having direct use value to local communities. These included medicinal plants, food plants and plants used for firewood. Medicinal plant use and grazing are considered two of the critical ecosystem services provided by the Project area. Pastoral land, grazing areas (see below), trees for firewood and charcoal production are regarded as common property resources (Section 4.2) as they are available to all members of the community.

The only endemic faunal species occurring in the two ecoregions on the Project area are small, arid adapted rodents. Only one species of vertebrate is strictly endemic to the South Saharan Steppe, the gerbil Gerbillus dongolanus. The Project area is located within the Aïr and Ténéré UNESCO- MAB Biosphere Reserve[10]. The Reserve covers 24 million ha in the north of Niger, in the Agadez region of the arid Saharan region. The Project area is located approximately

[10] www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=gen&code=NER+0

150 km southwest of the Addax Sanctuary that forms part of the larger Aïr and Ténéré National Nature Reserve, a UNESCO World Heritage Site located 90 km southwest of the Project area.

The soils in the desert tend to be poorly developed and undergo limited physical or chemical reactions. The evolution of soil is principally controlled by the actions of wind erosion with a systematic stripping of topsoil resulting in poor nutrient and organic matter content. This results in a hummocky terrain of sandy plateaus, plains, valleys and steep rolling hills. Metal concentrations were generally below South African Soil Screening Values (SSV) guidelines, with the exception of arsenic, copper and lead. Elevated lead and copper samples were found throughout the study area, with the highest values seen in Arlit, Takred Eghas and Gougaram (>40 mg/kg). Arsenic was elevated to the east of the Project area and in Arlit with values up to 13 mg/kg.

Land capability is low across most of Niger. The Talak plain is vegetated briefly following any rainfall events and the semi-nomadic population move around the Talak plain with their livestock for grazing, but also to harvest pasture for the hot dry season. Nomadic pastoralists from other regions can also be present in the wider area in search of pasture. The rest of the area has little to no vegetation.

5.7 Social Setting

Niger's indigenous population include the Tuareg[11] and the Fulani[12]. Most of the indigenous people are livestock herders and therefore lead nomadic lifestyles. Niger voted for the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) in 2007. However, the government has not signed ILO Convention 169 nor has it recognised indigenous peoples in the country's Constitution.

The Tuareg make up 8.3 % of the population and sustain their livelihood as camel and goat herders in the North and West of the country (Cultural Survival, 2015). Between 1990 and 1995 the Tuareg in Niger sought autonomy from the government. This uprising ended in a peace deal which promised the Tuareg's a larger share of the region's mineral wealth. The peace process has placed more of an emphasis on their socio-economic reintegration, poverty reduction and inclusion.

The nearest communities to the Project are located in the towns of Arlit, Akokan, and Teslem, in the commune of Arlit, 13 km North West of the Marianne deposit. Arlit Commune has a multi-ethnic population estimated at 200,000 inhabitants, mainly associated with Orano's uranium mining operations. The population is young, 50 % are between 0 and 14 years of age; unemployment is high.

[11] The Tuareg are a group of Berber clans of obscure origin (https://www.economist.com/the-economist-explains/2017/02/21/who-are-the-tuareg)

[12] https://www.iwgia.org/en/niger.html

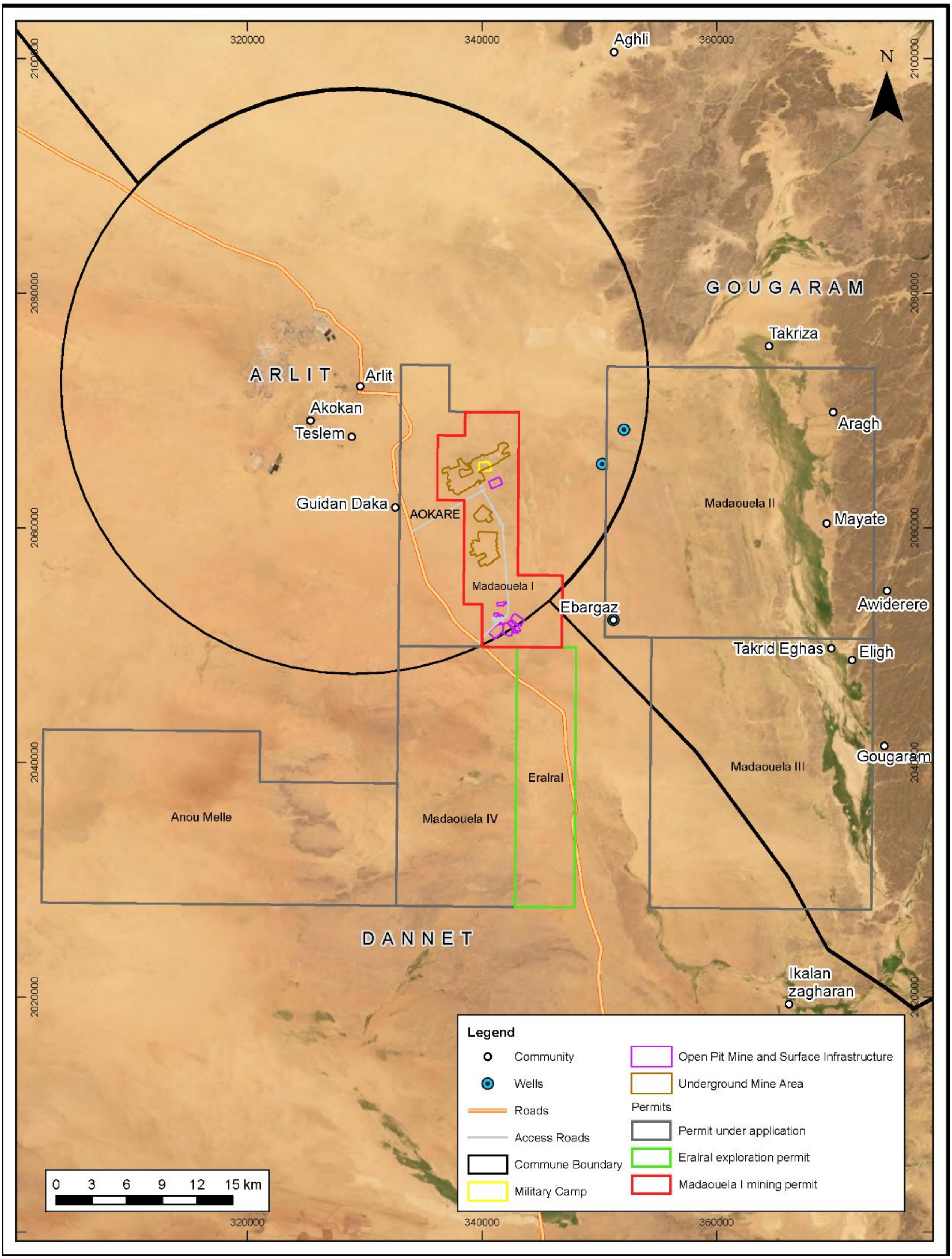


Figure 5-12: Location of Communities near the Project Area

The villages in the communes of Gougaram and Dannet, 50 km east of the project area, have a current estimated population of 18,500 and 20,570, respectively. This is a significant increase from 2014 figures of 6,500 and 10,000 respectively. Over 75 % of the population of Dannet is under 35, unemployment is high and many attempt to cross the border to Algeria or Libya for better economic opportunities. The rural communes are predominantly occupied by Tuareg tribes and the occasional Fulani tribe and are accessed via a number of informal tracks, some of which cross the Project area.

A new community was established in March 2017 called ‘Guidan Daka’, located 12 km South from Arlit town (Figure 5-12). This community has been established by the Arlit regional office of Mines and is a gold processing site. With an estimated population of 10,000 relatively young people (5 % are women providing auxiliary services), this community has grown significantly over the years and largely comprises of artisanal gold miners who bring ore from gold sites in the North and near the border with Algeria and go on to trade the gold produced. The community is multi-ethnic and comprised of individuals from different nationalities organised under a head who ensures collaboration with the defence and security forces.

The main economic activities of Niger are subsistence agriculture and livestock. Horticulture is the dominant livelihood activity cited in urban communities close to the project, although the livelihoods in Arlit and Akokan are geared towards work in mining and related sectors (traders and artisans). In the rural areas more traditional livelihoods are valued with the dominant economic activity by semi-nomadic tribes being livestock keeping.

Traditionally, the Tuareg move around the region following established routes to different pasture and grazing areas for their livestock (a mixture of camels, goats and sheep) at different times of the year. Access to the pastoral land and ranges is critical. Around the Project area, two areas are of particular importance both ecologically and traditionally - the Talak Plain during the wet season (locally referred to as Ghafet) and the Project area during the cold dry season (Tegrist). In particular, certain plants that grow there are said to contain salts that improve the well-being of livestock during the cold dry season. Otherwise, most land within the project area is considered unsuitable for agriculture by local communities due to the combined effect of poor soil, human pressure, overgrazing and droughts.

Climate change means that rainfall in Niger’s semi-arid Sahel region is becoming increasingly unpredictable, with changes in timings, frequency and the amount of rainfall. Temperatures are rising gradually. These changes are further complicating the situation in this region where under-development, endemic poverty, instability, inter-community conflicts and persistent food insecurity further compound the country’s vulnerability to these climate threats. Climate change is making it increasingly difficult for pastoralists to find permanent pastures, grazing land and water points, resulting in loss in livestock and increased food insecurity for Tuaregs. This is reflected in the communities located around the project area. The 2022 baseline update indicates that many pastoralists have also taken up market gardening as a secondary economic activity to support livestock keeping due to climate uncertainties. However, the crops are vulnerable to pest attacks.

The majority of houses in Arlit, Akokan and Teslem are made from mud or clay brick, locally referred to as ‘banco’. There are a few luxury homes found in the area built by SOMAÏR and COMINAK and mine employees tend to live in estates, with a clubhouse and restaurants. The towns are well established, regionally important centres with some houses having electricity and potable water, with standpipes in other areas, and no electricity or access to piped water in the poorer areas. Gas is the dominant cooking fuel in the more affluent areas, being replaced with charcoal and then wood as the areas get poorer. Urban domestic waste management is inadequate. Also in the poorer areas of the towns, dwellings are made from sticks and straw and scrap materials ranging from sheet metal to cardboard.

In rural areas the Tuareg nomads live in covered tents, while the Fulani live in small collapsible huts made of woven mats. There is no mains electricity in most rural areas, although the commune of Dannet has benefited from a rural electrification programme. Some people use solar panels and generators to meet their energy needs. Water is collected from wells and/or boreholes fitted with pumps for domestic and livestock use.

The new community, Guidan Daka was created to avoid the Arlit population and to prevent underground water contamination of the Tarat aquifer through their use of acid and others chemical products to wash the rocks. Housing is informal sheds and the community lacks basic social services. Drinking water is transported in from Arlit.

The Arlit Commune has 57 primary schools and 20 secondary schools (10 state and 10 private). In the rural communes of Gougaram and Dannet there are no secondary schools. 90 % of the population of Dannet is illiterate.

The area has numerous archaeological and pre-historic sites with rock engravings indicative of ancient human settlement. 147 heritage sites were visually identified within the Project area. The sites have been classified into three main groups, namely: funeral (tombs), settlement (remains of habitations such as ruins and various fragments of tools and pottery) and natural (fossils and ostrich eggs) sites. Of the sites identified only two funeral sites are within the proposed infrastructure footprint, and date from 4000 BP. Further sites may be impacted by surface infrastructure associated with the planned underground developments of M&M and MSNE. There may be additional sites buried in the sand which would only be identified when earth works commence.

5.8 Surface Rights and Access to Power, Water and Mining Personnel

The proximity of the town of Arlit and Akokan are an asset for the Madaouela Uranium Project. The towns have electricity and potable water. The municipality of Arlit has 27 health facilities including one district hospital and two private hospitals (operated by SOMAÏR and COMINAK). There are filling stations, bus transportation and repair shops that provide support services to sustain the community associated with mine development. Some of these services are currently under pressure due to population growth.

Arlit is connected to southern Niger via the so-called “uranium road” through Agadez and Tahoua to Niamey, the Niger capital in the south. This road is paved almost the entire way, but poor road maintenance has resulted in deterioration. Most of the goods and services that are necessary for people to live in Arlit and for the uranium industry arrive on this main access road. The northern link to Algeria, a poorly maintained dirt road, is not practicable for major transportation of equipment and supplies but is still used by most local transporters for petrol and food. Most of the local roads are degraded and in a poor state making road travel slow and difficult.

A power line connects the town to the Sonichar coal-fired power station located north of Agadez. Extensions are reportedly planned to the power station to accommodate the needs of Imouraren and possibly other new mining developments. An intensive drilling program has reportedly demonstrated additional mineable coal resources in the vicinity of the power station. However, any future mines development would have to seek guarantees from Sonichar to provide sufficient supply.

Land access for the exploration programmes completed to date has typically been negotiated without problem. Land use related to any future exploration or/and mine development scheme is allowed under the mining convention provisions, including rights to use any portion of the tenement land and/or any of neighbouring lands, so long as there is consent from the head of the relevant administrative unit. In the case of this project, GoviEx will require approval from the Prefet of Arlit (see also Section 4.2 and Table 4-1). The introduction of a rural land policy and the creation of a national multi-actor watchdog on rural land issues and stronger legal recognition of pastoral rights through the Pastoral Code (Section 4.2) may encourage pastoral groups to try and negotiate compensation for any potential loss of access to land and natural resources. This is further described in Section 20.4.3.

GoviEx completed construction of an exploration camp consisting of several small buildings to facilitate drilling activities in the southern part of the Project area. Manpower requirements will be sourced as skilled, semi-skilled and unskilled labour from the Arlit area which benefits from a workforce that has been trained for mining related skills. The neighbouring COMINAK mine which closed in 2021 has the potential to provide a pool of labour for GoviEx.

6 HISTORY

6.1 Past Exploration and Development

6.1.1 CEA (1963 to 1965)

In the mid 1960’s, the French Alternative Energies and Atomic Energy Commission (CEA) conducted drilling operations using drilling grids of 800 m over large areas and down to 100 m, two contiguous mineralised zones termed Marianne and Marilyn. The discovery of the Marilyn deposit led to further drilling at 50 m and less spacing in the area where a mining test was subsequently carried out with a view to sampling uranium mineralisation and investigating the global rock quality underground.

CEA sunk a 67 m deep shaft at Marilyn and drove 330 m of drifts within the mineralised formation. The simultaneous discovery of the SOMAÏR uranium deposits, north-west of Madaouela, resulted in the decision to stop all works at the Madaouela site. The aim of the Marilyn mining test was threefold:

- To bulk sample the mineralisation and carry out tests for processing and recovery, and to study the mineralogical characters of the mineralisation and get a global understanding of the mineralised zone geology;
- To establish and calibrate procedures for grade estimation and grade control (grade/radioactivity correlations, U/Ra equilibrium, etc.); and
- To evaluate mining schemes for future mining possibilities.

Results of Madaouela CEA mining test are summarised in a report published in 1967. This is not repeated here as it does not specifically relate to this technical report.

6.1.2 PNC (1980 to 2000)

PNC, the Japanese Pacific Reactor and Nuclear Fuel Development Corporation, took over the CEA tenement in 1980 in association with ONAREM, a Niger State-Owned Organization. In 1981, PNC resumed uranium prospection across the Sekiret exploration tenement and in 1988 across the Tessili tenement. Both tenements were then defined with a much larger surface area than the current Madaouela I tenement.

PNC conducted additional uranium exploration work up to 1992 and produced a report on the feasibility of the Madaouela deposit in 1993, which was later updated (1999) by the Japan Nuclear Cycle Development Institute, the new company name for PNC. Very few drillholes (less than 20) were drilled by PNC in the area of what is now Madaouela I; all were located either on the south or the east, none on Marianne or Marilyn. The feasibility study was based on CEA drillholes and ore sourced from the CEA stockpiles. The 1993 feasibility study looked at open pit and underground mining schemes for the Marianne and Marilyn deposits, based on mineral resources of 6,199.7 t U, and their economic assessments. Its main conclusions were as follows:

- Open-pit mining would not be economic, even when considering a uranium price of USD 60 /lb U_3O_8; and
- Underground mining would not be cost-effective if the uranium price was below USD 40 /lb U_30_8.

In 1999, the economic assumptions and data for the 1993 feasibility study were updated and a new run concluded that:

- Underground mining could be cost-effective, provided the uranium price stabilizes at around USD 27-28 /lb U_30_8 level.

However, the open-pit mining scheme remained uneconomical under the same assumptions as those of the 1993 study.

A Chinese company (CNUC) took over Madaouela and held the land from 2003 to 2006. They drilled a limited number of holes and departed, apparently because they could not access the CEA original data. Little exploration work seems to have been carried out until GoviEx Niger Holdings Ltd. (GNH Ltd.) took over the property in 2007. Note that GoviEx was in the same situation as far as access to old data and decided to select and reopen many former holes necessary to sustain its drilling program.

6.2 Historic Mineral Resource and Reserve Estimates

The 1993 PNC feasibility study quotes in pages 9-10 of the report the uranium resources as 3,263,000 t at 0.19 % uranium or 6,199.7 t uranium. In 1999, the updated PNC study reported the mineable mineral resources shown in Table 6-1, after simulating the underground operation on Marianne and Marilyn, using a cut-off grade of 0.1 %.

Table 6-1: Historical mineable mineral resources

Deposit	Mineable (t)	Grade (% U)	Contained U (t)
Marilyn	1,642,660	0.17	2,777
Marianne	1,016,059	0.16	1,569
Total	2,658,719	0.17	4,346

Source: PNC

At 0.15 % cut-off grade, the overall mineable reserves were computed at 1,887 t U, equally distributed between Marianne and Marilyn.

These historical reserves are being presented as part of the historical record only and demonstrate significant historical effort to evaluate the uranium mineralisation at the Madaouela Uranium Project. These historical reserves have not been evaluated by a Qualified Person for compliance with CIM resource/reserve classification, and therefore should not be relied upon. In addition, GoviEx is not presenting these historical numbers as current resources or reserves for the Madaouela I tenement. GoviEx has completed additional drilling of the mineralisation at Marianne and Marilyn, and other areas on the Property, as presented in the current CIM compliant resources in Section 14.9 of this study.

6.3 Historic Production

Historic production of uranium at the Madaouela Uranium Project is limited to the few thousand tonnes of material extracted from the CEA underground trial mine. Commercial mine production has never occurred. Historic production from the two mining operations, COMINAK and SOMAÏR, in the Arlit District are estimated to be over 250 Mlb U_3O_8.

7 GEOLOGICAL SETTING AND MINERALISATION

7.1 Regional Geology

The following description of the geology of the area was compiled from descriptions by Bigotte and Obelliane (1968), Valsardieu (1971), Black et al., (1967), Elhamet (1983), Forbes, (1989), Gerbeaud (2006) and the written notices accompanying the BRGM geological maps for the Tegama quadrangle.

The Madaouela Uranium Project properties are located in the Tim Mersoi Basin, a sub-basin of the Phanerozoic Iullemeden Basin developed on the Proterozoic West-African shield basement. This basin covers most of the western part of the Republic of Niger with extensions in Algeria, Mali, Benin and Nigeria. It opens and deepens toward the south and west. In early Paleozoic, an open gulf developed to the south of the Central Saharan Massif and fed continental sediments to the developing basin. During the Mesozoic and Tertiary, the area was mainly continental, periodically invaded by marine transgressions diminishing in thickness to the south and passing laterally into continental series. Uplift movements beginning in the Middle Eocene gave the basin its present aspect. It was subsequently filled with continental fluvial and lacustrine sediments.

In the Madaouela Uranium Project area, the total thickness of the sediments could reach up to 1,500 m. Five main periods could be distinguished:

1. The Proterozoic basement of the Air Mountains.
2. The large deltas with reduced sedimentation associated with low temperate climate during the Lower Carboniferous.
3. The Gondwana deserts associated with the warmer climate during the Upper Carboniferous and Permian.
4. The large fluvial system and volcanism during the Jurassic.
5. The clay lake and fluvial system during the Cretaceous.

A generalised stratigraphic column of the Madaouela Project area is presented in Figure 7-1 and the regional geological map presented in Figure 7-2.

7.1.1 Proterozoic Basement of Air

The basement of the Air Mountains is composed of Upper Proterozoic highly metamorphosed rocks, crosscut by numerous granite and alkaline intrusions. Seven lithologies have been recognised, including biotite gneiss, leptynites, diopside-hornblende leptynitic gneiss and micaceous shale, with some quartzite, amphibolite and limestone. To the west, they are thrust on to epimetamorphic rocks, probably middle Proterozoic in age.

Several generations of granite have been recognised, such as early leucocrate granites, resulting from melting of the sediment, syntectonic calkalcaline granites, and late tardi-tectonic alkaline granites. A second generation of alkaline granites crosscut all the formation. The basement is strongly folded and crosscut by numerous N-S, N20 and N140 faults.

During the Mesozoic, large annular massifs were emplaced and constitute the northern extension of the Younger granites in Nigeria. Tertiary trachytes and some basalts have been also described.

7.1.2 Paleozoic Formations

The Paleozoic sediments are outcropping between Arlit and the Algerian boundary. Pre-Carboniferous sedimentation consists of Cambro-Ordovician sandstones and graptolite shales. Several Devonian sandstone units are deposited from lower to Upper Devonian (Idikel, Touaret, and Akara). During the Lower Dinantien, the Farazekat sandstone marked a glacial sedimentation, followed by varved argillites.

The Carboniferous formations are of major interest because they host the major reduced uranium deposit in the Arlit area. The stratigraphic sequence begins by the grey-black Talak Visean argillites. It consists of black shale with brachiopods, productoids and spiriferoids. The upper unit is a phosphatic siltstone, coarsening upward, which represents the continental shelf deposition.

The Akokan unit (UA) is a transitional term between the marine clay of Talak and the fluvio deltaic sedimentation of the Guezouman and Tarat. It consists of several lenticular fine grained silty clay units, which could not be mapped individually. The units seem to have deposited conformably on the Talak argillites. Locally sediments of the Akokan unit have been accumulated and preserved of erosion within monoclinal structures. These structures could correspond to extensional half-grabens.

The Guezouman formation includes a lower and an upper member. The lower member deposited on a paleo surface dominated by N70E ridges, and the flow direction is generally in that direction. It is composed of fine- to coarse-grained cross-bedded sandstone units with minor conglomerates (Teleflak) at the base. These contain quartz, phosphatic siltstone gravels, more or less deformed silty shale debris, metaquartzite, granite and rhyolite pebbles. This conglomerate corresponds to channel lag deposition and contains reworked debris of extensive silcrete formed during the emersion of the Talak-UA ensemble. The upper member, flowing southwest to south, consists of fine to medium grained sandstone, with minor siltstone and thin argillaceous intercalations. The Tchinezogue Namurian argillite and silty to fine sandstone follow and are capped by the Unite Terminale, which may consist of argillaceous siltstone and local fine-grained sandstone. Several subunits are distinguished in the Tchinezogue, based on their colour and their silt or clay dominant composition (gris bleu, blanchatre, bleu-vert).

The late Carboniferous megasequence, the Tarat Formation, is of Westphalian age; it consists mainly of sandstones interbedded with organic- and pyrite- rich mudstones. It represents the filling of large fluviatile channels. The lateral variations are large, ranging from coarse sandstone, without internal preserved structures to fine sandstones and siltstones. The Tarat sedimentation ends with reduced argillaceous siltstone (Tarat argileux), with micro-ripple laminations

The Madaouela formation consists of coarse arkose and arkosic sandstone unit intercalated with laminated silty clays. The formation has not been recognised west of the Madaouela flexure, it reappears west of the Arlit in Azzaoua Permo-Triassic Formations

During the Permian time, another sandstone unit, the Izegouande is deposited. It is more arkosic, with carbonate cement, showing evidence for an oxidised environment. The sandy argillite of Tejia caps the series. Continental sedimentation continues during the Triassic, including the Tamamait sandstones, the Moradi red argillites and the sandstone of the Aokare unit.

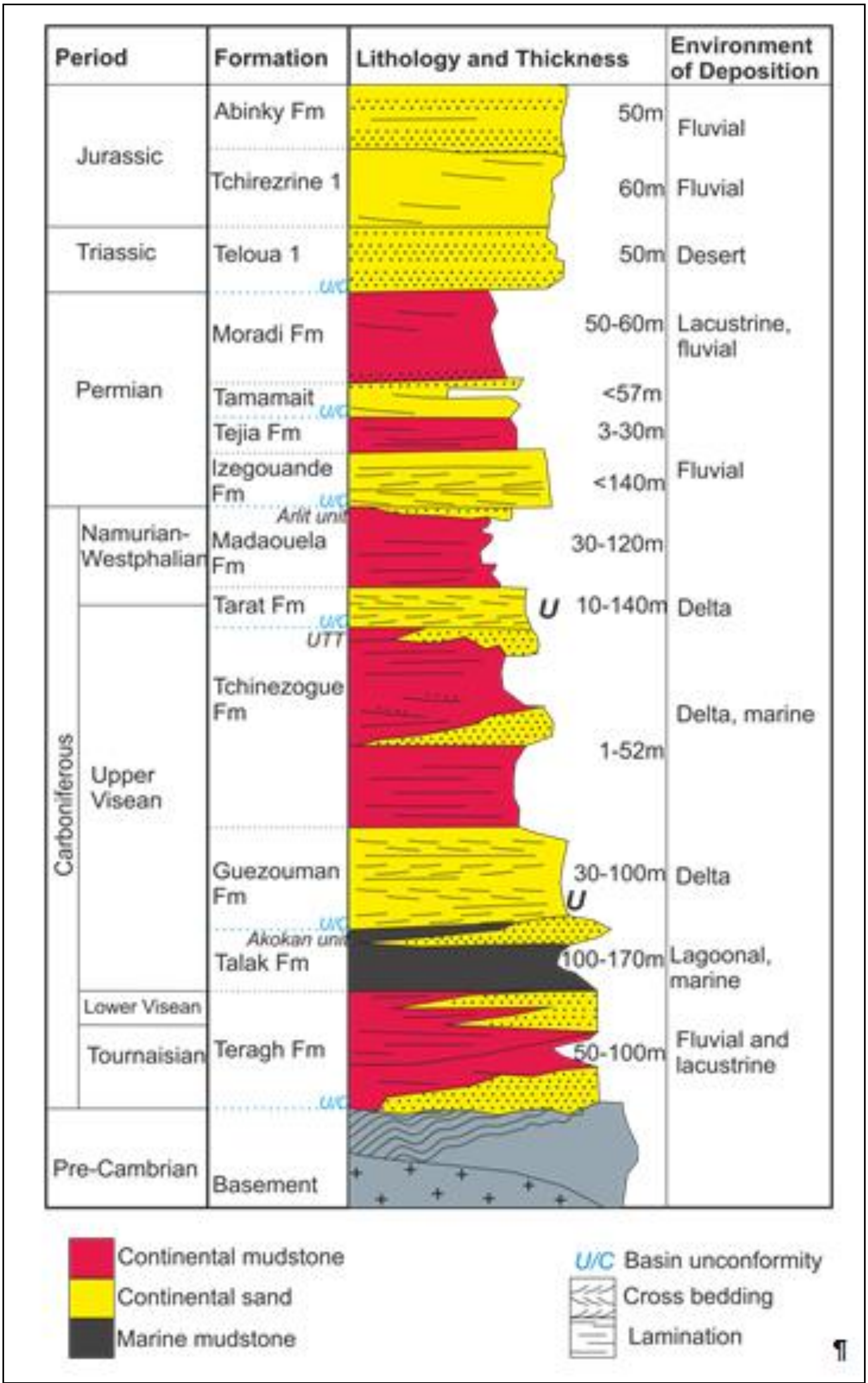
7.1.3 Jurassic Formations

The Jurassic formations are largely distributed and cover most of the district. They have been collectively named the Agadez sandstone, but comprise several units (Teloua, Tchirezrine) where some analcimolite of volcanic origin have been described (Abinky). The upper Tchirezrine is composed of feldspathic sandstone with oblique stratifications. This unit hosts the large Imouraren uranium deposit located south of the Madaouela Uranium Project.

7.1.4 Cretaceous to Present

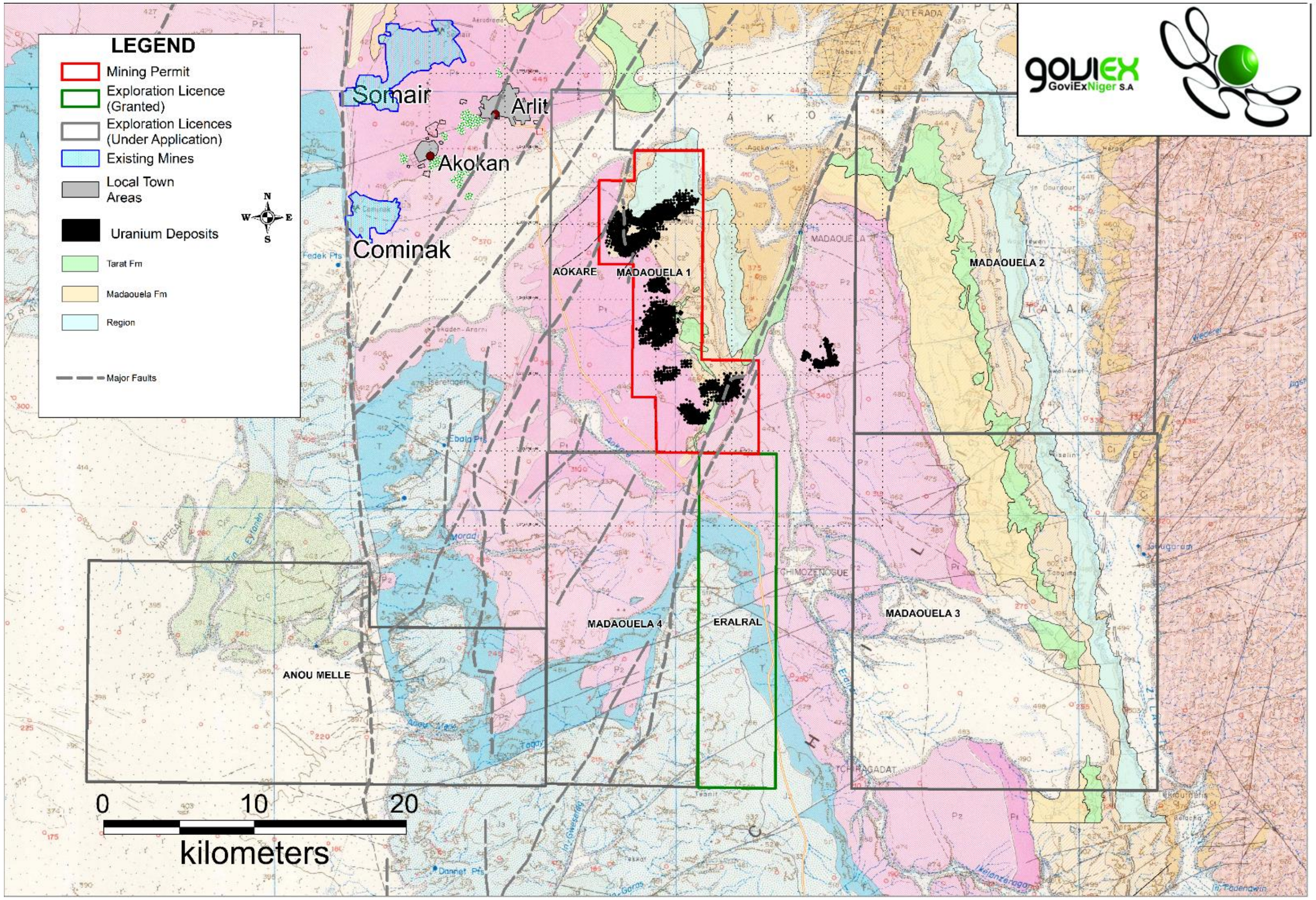
During the Cretaceous, argillites and sandstones were deposited, especially near paleo-reliefs. The main unit is the Irhazer argillites and silts, with marl, limestone, silexite and fine sandstones, and is followed by the Tegama sandstones and argillites characterised by dinosaur-rich beds.

The continental sedimentation is still active along the palaeochannels where sedimentary detritus cones result from the erosion of the Aïr Massif.



Source: Stratigraphy of the Madaouela District based on GoviEx information, drillhole geological logs and published materials (Bigotte and Obelliane 1968; Coquel et al. 1995; Tabore et al. 2011)

Figure 7-1: Madaouela Project Stratigraphic Column



Source: GoviEx

Figure 7-2: Project Geological Map

Mad I is to be mined by COMIMA which is owned 80 % by GoviEx Niger Holdings Ltd and 20 % by the Government of the Republic of Niger. GoviEx Niger Holdings Ltd has 100 % ownership of Eralral, and filed applications on January 29, 2019 for MAD 2,3,4 and Anou Melle which are pending, and "Aokare" on March 01, 2022.

7.2 Regional Geological Structures

The structure of the Tim Mersoi basin is marked by the westward dip of the units. The deformation of the sedimentary body resulted from basement fault activities located between the Air Massif and the Azaoua lineament. Several large faults systems cut the sediments and have played a major role during the sedimentation since the Upper Paleozoic.

Gerbeaud (2006) have proposed a structural evolution including an E-W Jurassic extension, and a NW-SE Cretaceous compression. The main structure is the NW to N20 Arlit fault-flexure, on the In Azaoua continental lineament. It has not been active during the sedimentation of the Guezouman, but active during the Tarat sedimentation, and has been reactivated several times. It shows a complex organisation, with mainly sinistral, reverse and normal faults and folds, dome structures. All the major uranium deposits are located immediately to the east of the fault.

The Madaouela fault, NE-SW (N30) shows similar characters; with a large uplift of the northwestern compartment (Qrt-de-brie). It is also probably inherited from a basement fault.

The ENE-WSW (N70) faults display a regular set with mainly dextral offset; faults show pop-up structures related to trans-pressional relay and trans-tensional graben, both of them could be mineralised (Azelik, Dalj).

A set of NW-SE (N150) sinistrial faults is less apparent but could have played a role during the sedimentation.

7.3 Localised Geology of the Madaouela Uranium Project Deposits

7.3.1 Miriam

Mineralisation at Miriam is shallower, lower grade and thicker than the mineralisation at Marianne-Marilyn. The mineralisation is generally near surface (upper 110 m) and is planned to be mined by open pit.

Geology

Geology within the Miriam deposit consists of three main sub-horizontal sedimentary units. From shallowest to deepest, the main units are Tchinezogue, Guezouman and Talak and can be described as follows:

- Tchinezogue is a fluvio-deltaic sedimentary unit with thin and sub-horizontal bedding. In the upper 30-40 m, this unit is weathered and oxidised, as a result of exposure caused by retreat of the groundwater table (Figure 7-3).
- The Guezouman formation (Figure 7-4) is a coarse-grained sandstone, mainly composed of quartz with K-feldspar, plagioclase, and clay minerals. It is relatively massive with low fracture frequency. It is equigranular and has a low density due to the relatively large percentage of pores between grains. Some fine-grained sub-formations exist within the Guezouman Sandstone.
- The Talak is a grey-black fine-grained shale/argillite unit (Figure 7-5) and forms the base of the stratigraphic sequence at Miriam. The majority of mineralisation sits within the Guezouman Sandstone immediately above the Talak argillite.

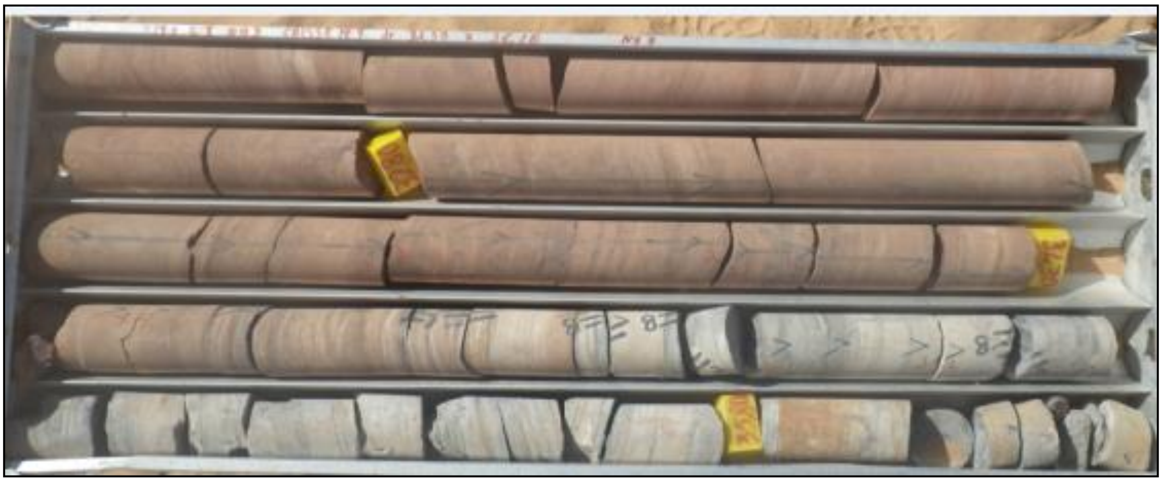


Figure 7-3: Oxidation and weakening of the Tchinezogue unit due to exposure above the water table. Below the water table (approximately 35 m depth) the rock is generally unweathered.

Figure 7-4: Guezouman sandstone showing a zone of relatively closely spaced bedding planes

Figure 7-5: Example of the Talak argillite at Miriam (this will form the floor of the pit)

Structural Setting

Miriam is located within the southern extent of the Madaouela license area. Structurally the deposit is located directly to the west of the regional NNE-SSW striking Madaouela fault, which accommodates approximately 300 m of vertical down-to-the-east displacement. The precise nature of the structural geology of the deposit is not particularly well understood as surface exposure in the area of the Miriam planned open pit is very poor.

Major Structures

Faults

Unlike the other deposits considered herein, Miriam is not associated with any notable domes or monoclinal structures. Only two faults have been explicitly modelled in the area of the Miriam deposit. These structures have been interpreted primarily on the basis of linear traces on the Quickbird image. During the course of the 2022 MRE update for Miriam, it has been observed that high-grades and thicknesses of eU are coincident with subtle disruptions in the contact between the Guezouman and Talak which trend in a northwesterly direction, and are thought to be sub-vertical features as the thicknesses of mineralisation are greatest immediately above these features.

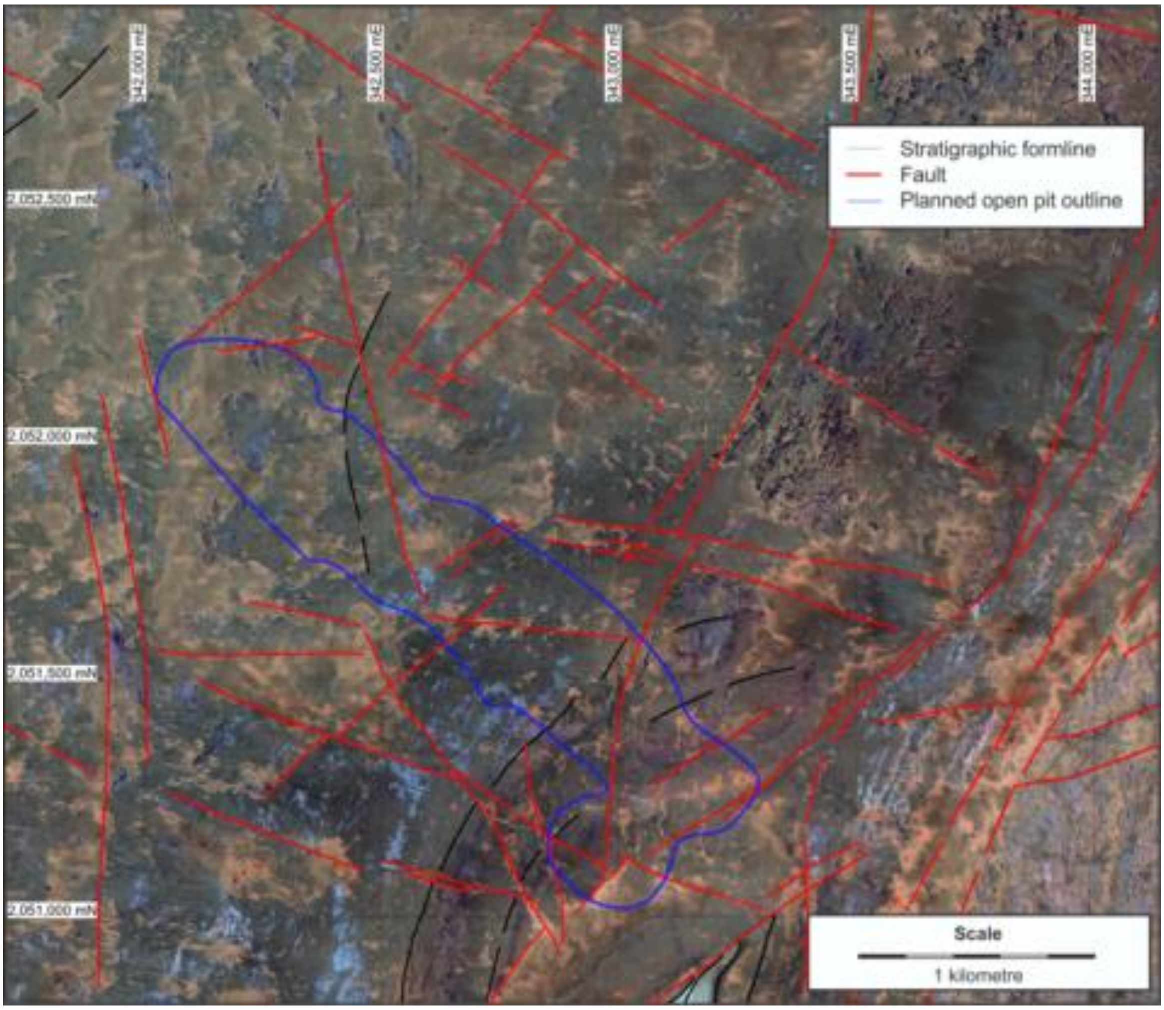


Figure 7-6: Plan view of stratigraphic formlines and structures interpreted at Miriam relative to the Quickbird imagery

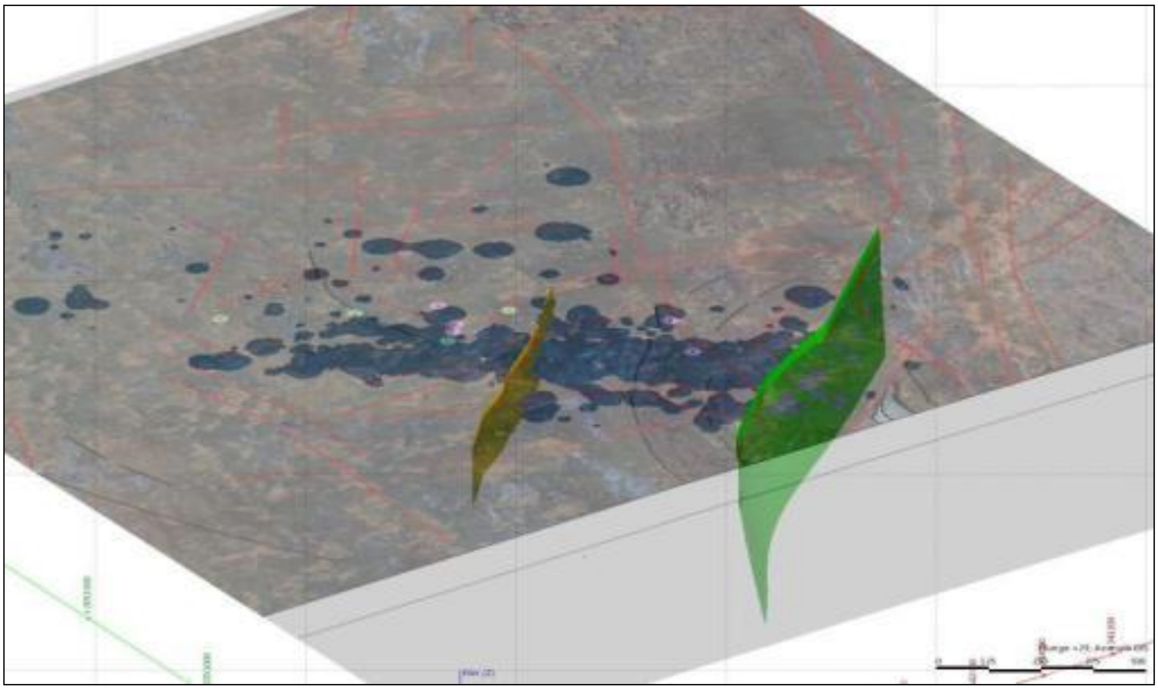


Figure 7-7: Miriam faults shown relative to topography with Quickbird drape and Leapfrog 0.4 kg/t eU grade shell. (green fault - MI-NE-Ft-1; yellow fault - MI-NE-Ft-2)

Stratigraphic Dip

Stratigraphic dip based on drillhole interval elevations are low, predominantly 0-4 ° over the deposit area. Towards the south of the deposit, there is a minor decrease in the average dip and dip variability.

7.3.2 Marianne-Marilyn (M&M)

The Marianne-Marilyn deposit is the northern most deposit in the Project area.

Geology

Four main sub-horizontal geological formations exist in the Marianne-Marilyn Project area. From surface, these are Tchinezogue, Guezouman, UA and Talak sedimentary units and are described as follows from youngest to oldest:

- Tchinezogue is a fluvio-deltaic sedimentary unit with thin sub-horizontal bedding. A degree of heterogeneity exists, and areas near the surface are weakened due to weathering effects.
- Guezouman is a massive, relatively competent fine to coarse grained sandstone unit with a relatively low density. The base of this unit, situated at depths ranging from 50 to 160 m from surface, hosts the uranium mineralisation.
- UA exists in channels between the Guezouman and Talak and is characterised as thinly bedded mudstones and siltstones.
- Talak unit is fine grained claystone and mudstone is considered the basal unit within the Project area.

An isometric view of the Project area and an N-S cross section through the lithology is shown in Figure 7-8.

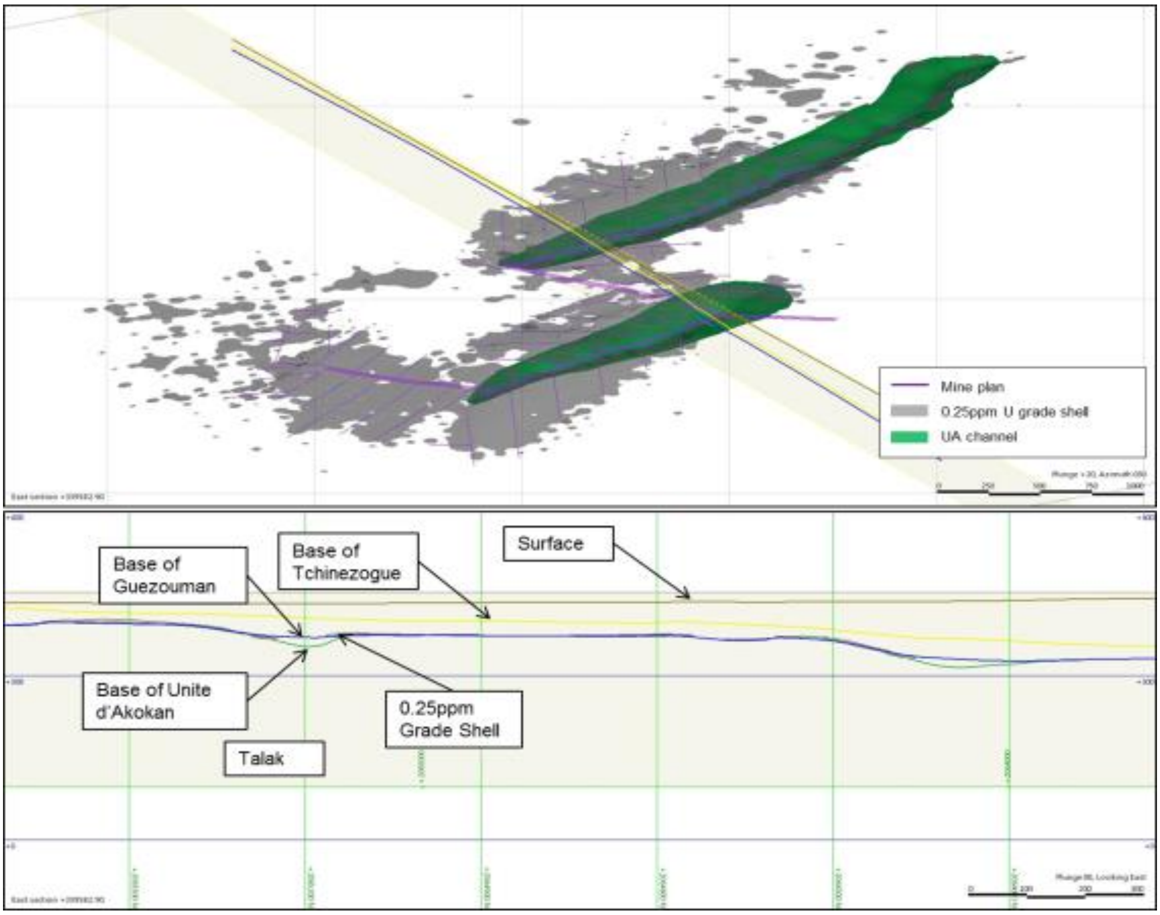


Figure 7-8: Isometric view and Cross section view of Marianne-Marilyn geology

Structural Geology (Marianne-Marilyn)

Structural Setting

The uranium mineralisation is elongate along a WSW-ENE trending structural axis that comprise of a series of domes, faults and monoclines (Figure 7-8).

The major structures affecting the deposit and their potential implications for the geotechnical evaluation are outlined below.

Major Structures

Monoclines

The Marianne-Marilyn deposits are affected by two well-defined monoclinal structures that control the location of the UA sediments (Figure 7-9); Yahaya & Lang, 2000). Based on subtle gradient changes in the base of the Guezouman/Top Talak horizon a further, smaller, monoclinal-type structure has been interpreted to the north of the large southwestern Akokan-bearing structure.

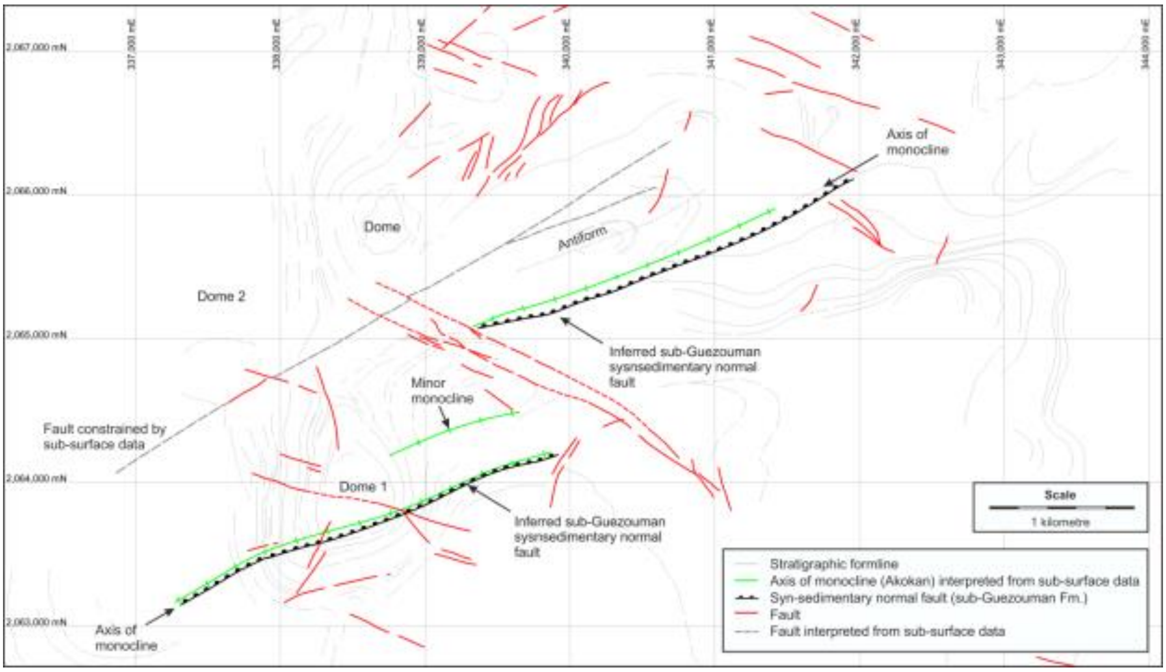


Figure 7-9: Plan view of stratigraphic formlines and structures interpreted at Marianne-Marilyn.

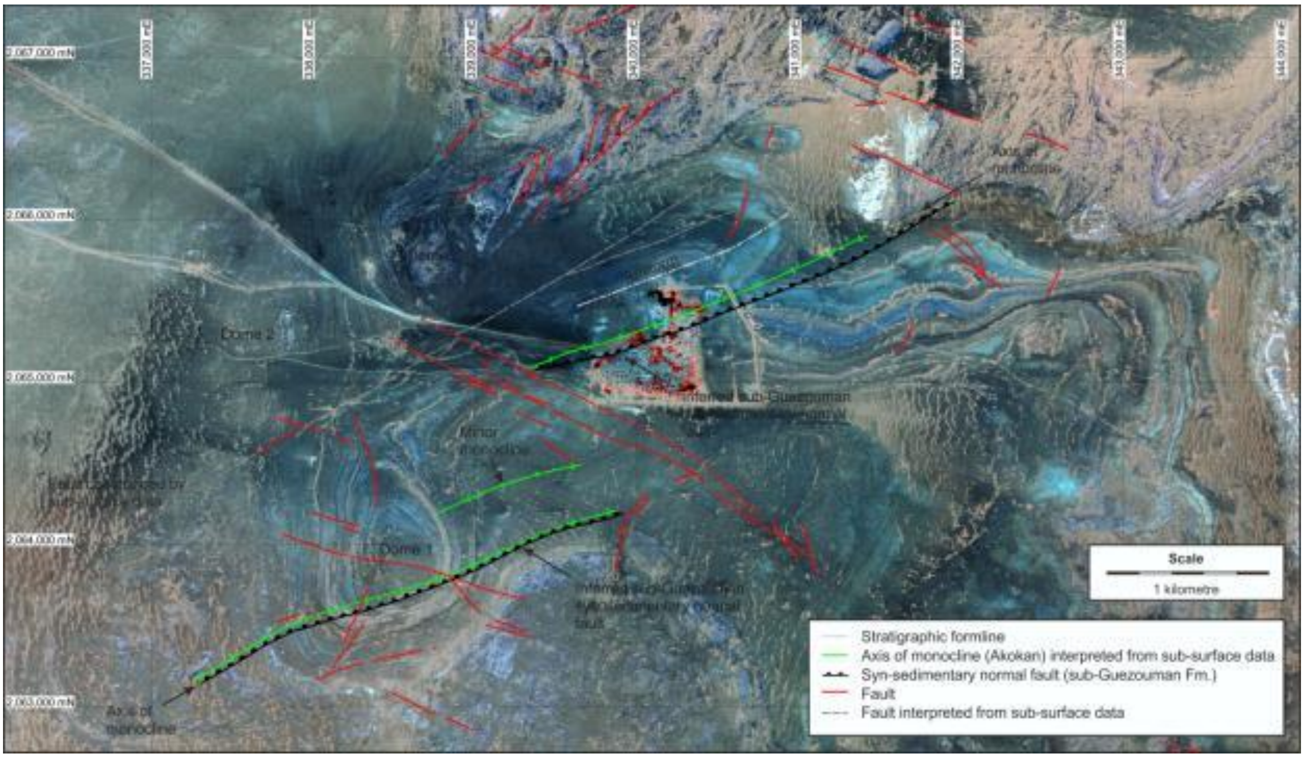


Figure 7-10: Plan view of stratigraphic formlines and structures interpreted at Marianne-Marilyn relative to the Quickbird imagery

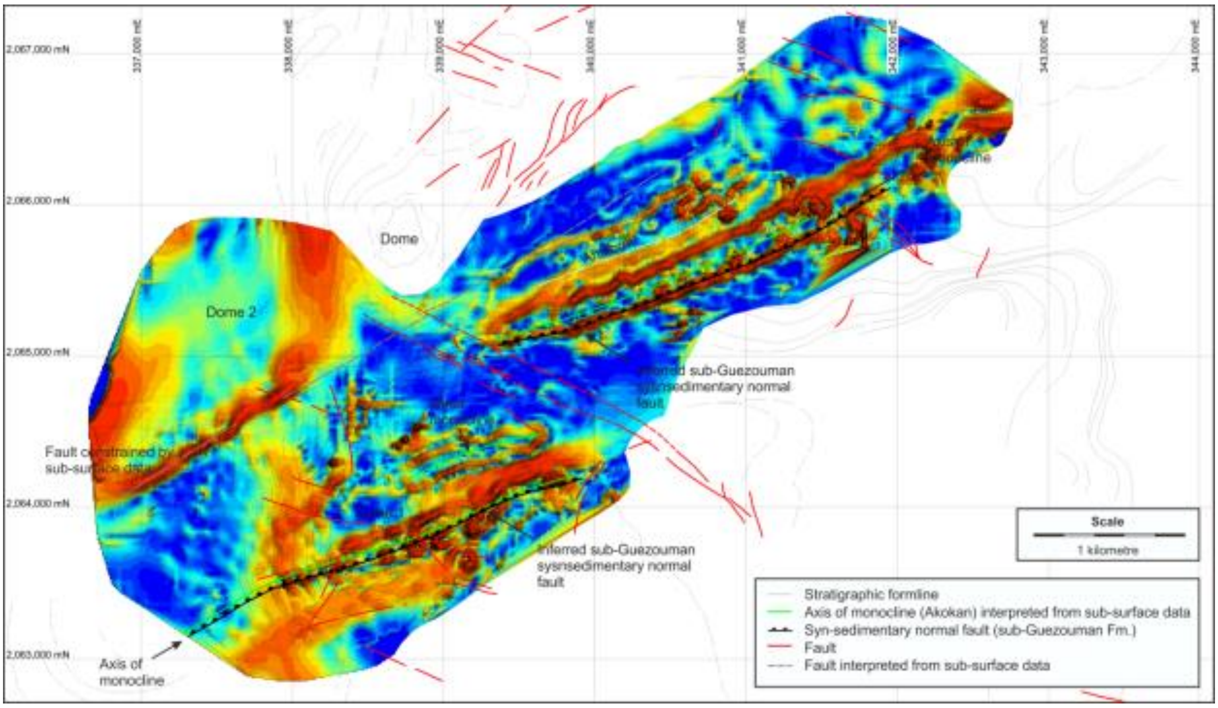


Figure 7-11: Plan view of stratigraphic formlines and structures interpreted at Marianne-Marilyn relative to a dip map of the top Talak/base Guezouman

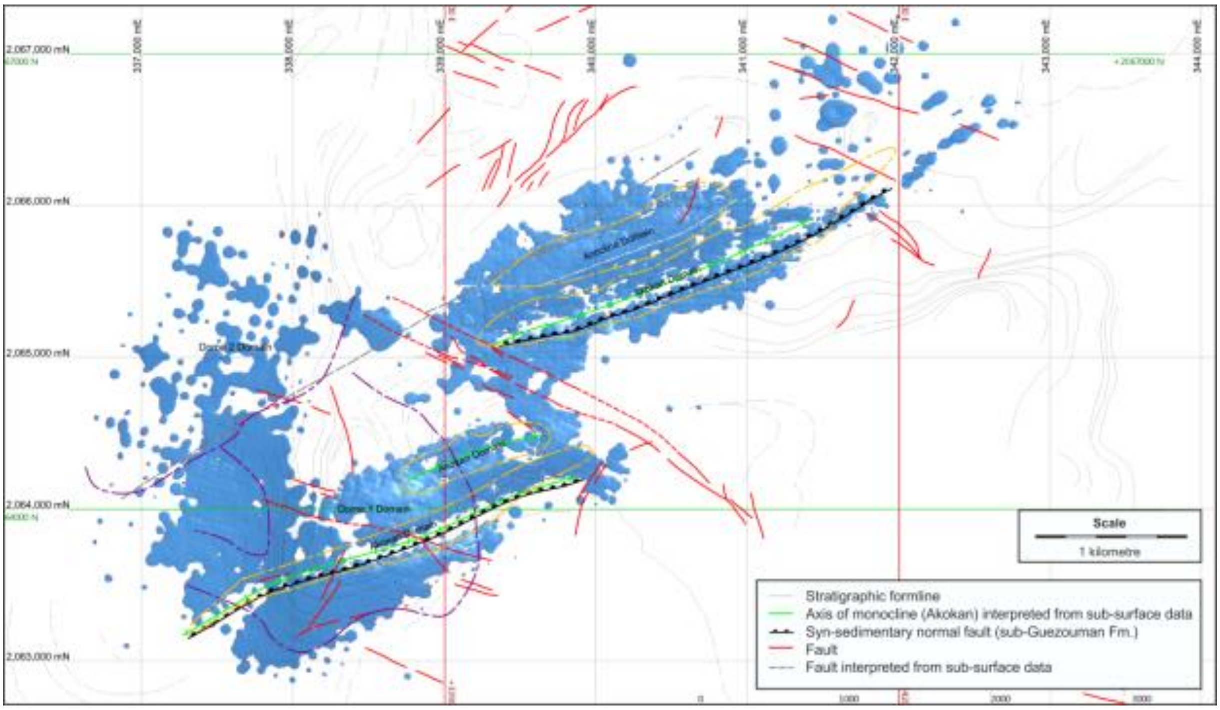


Figure 7-12: Plan view of structural domains relative to the Leapfrog 0.25 kg/t eU grade shell for Marianne-Marilyn.

Domes

The west of the Marianne-Marilyn deposit is dominated by a dome, where the stratigraphy defines a radially gently-dipping zone of uplift (Figure 7-10 and Figure 7-10). Stratigraphic dips are accentuated on the flanks of this structure but near-horizontal at the apex. In general, the stratigraphic dips on the flanks are approximately 5° or less.

The origin of the domes is not fully understood but is likely to be related to contraction over basement-controlled structures, related to broadly N-S or NW-SE oriented shortening during the Upper Cretaceous and Tertiary (Gerbeaud, 2006).

Faults

In total eight faults have been interpreted to be through-going structures. The majority of these traces are associated with small displacements of the stratigraphy at surface. In addition to these interpreted through-going fault structures are suspected zones of syn-sedimentary faulting, which control the positions of the Akokan channels.

Broadly radial to the dome are a set of minor brittle faults that radiate out from the centre of the dome. Where stratigraphy permits the displacement to be constrained, these faults accommodate 1-2 m of vertical displacement and/or 5-15 m of strike-slip displacement. They are therefore considered to be minor faults.

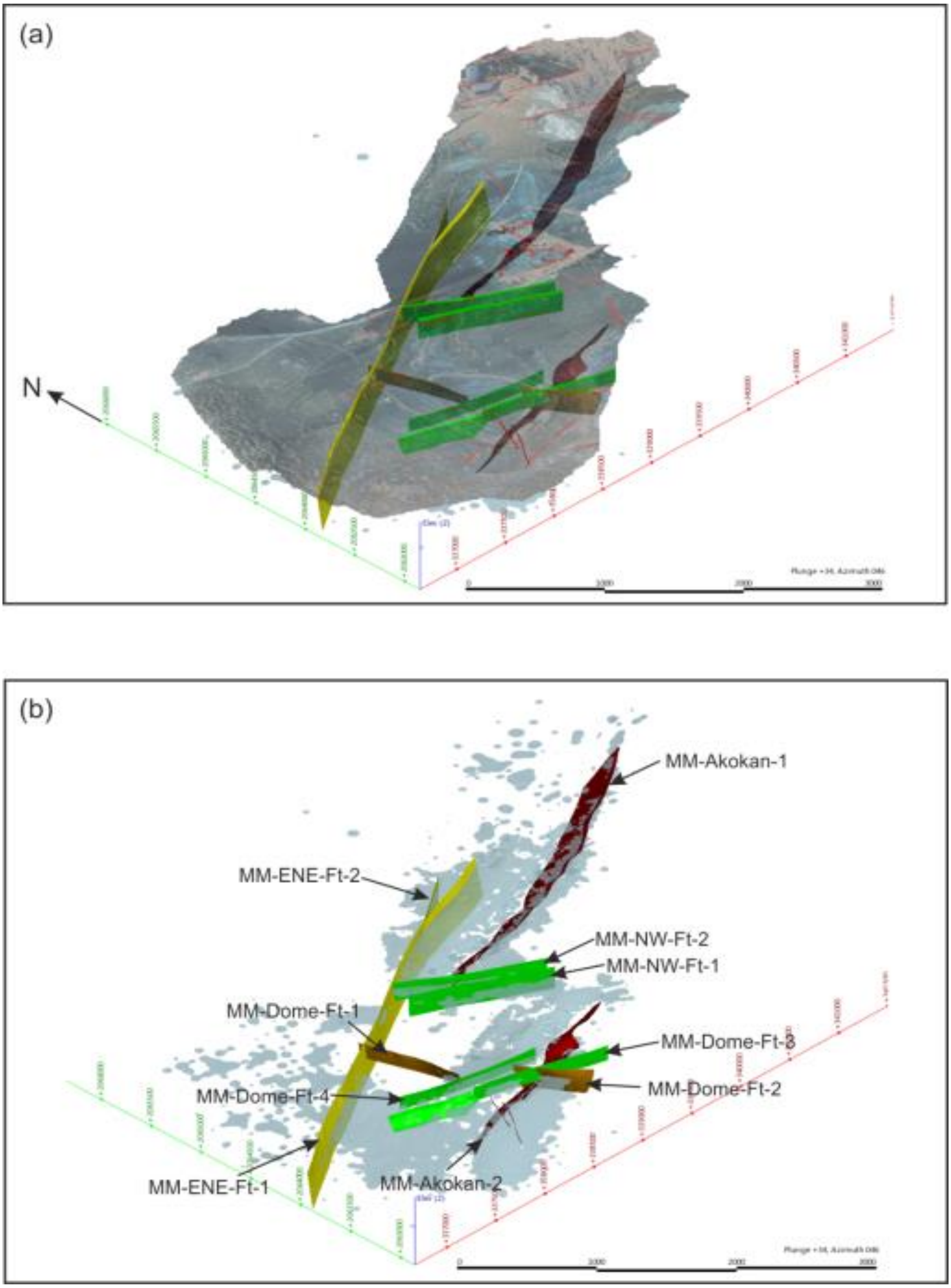


Figure 7-13: 3D view of interpreted faults at Marianne-Marilyn: (a) relative to topography with interpreted Quickbird image drape; (b) relative to Leapfrog 0.4 kg/t eU grade shell.

Stratigraphic Dip

Stratigraphic dips are known from both average dip of horizons between drillholes and direct determinations of bedding dip from acoustic televiewer data and oriented drill core. Generally bed dips are low, <5 °, outside of the monocline and dome structures. Importantly from an underground mining perspective, bed dips from drillholes generally show good agreement with the 3D horizons modelled from horizon intercepts. This supports the interpretation that the horizons are generally flat and not affected by short-wavelength dip changes that may have affected the elevation of the mineralised horizon. It is anticipated that few problems will be encountered staying on the mineralisation during mining associated with dip variations.

Drill on Marilyn in mid-ground, Army Camp in background.

Source: SRK

Figure 7-14: Photo looking southeast from Guezouman outcrops

Sandstone (background) and Unite d' Akokan (foreground)

Source: SRK

Figure 7-15: Typical outcrop of Guezouman

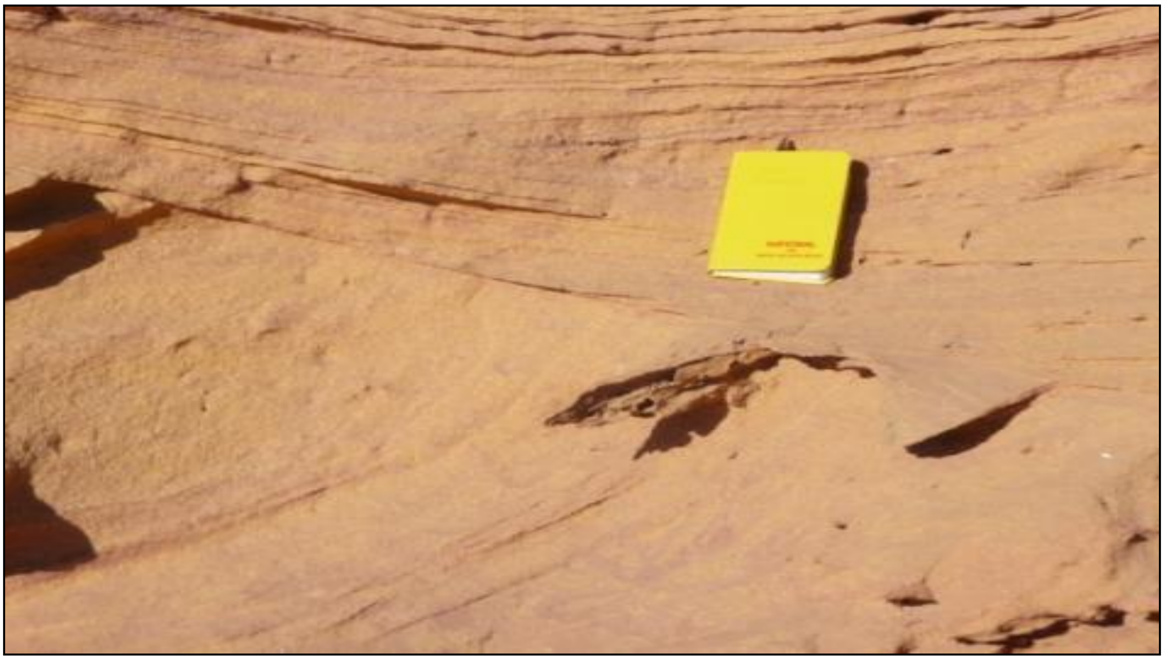


Figure 7-16: Cross bedding in Guezouman Sandstone

7.3.3 MSNE

The MSNE deposit mineralisation depth ranges from 100 m to 160 m across the deposit.

Geology

Exploration and geotechnical drilling suggests that the geology at MSNE comprises Guezouman sandstone overlying UA channels overlying Talak mudstone formation. The Guezouman dips sub-horizontally across the whole deposit and forms the hanging wall and host rock. The UA formation exists in the southern area of the deposit and forms the footwall. To the north, where UA is absent, the Talak unit is the footwall. Figure 7-17 shows isometric view of MSNE Project area and an N-S cross section through MSNE Project area with the geology wireframes provided by GoviEx.

Characteristics of each formation are considered to be similar to those described in Section 7.3.2.

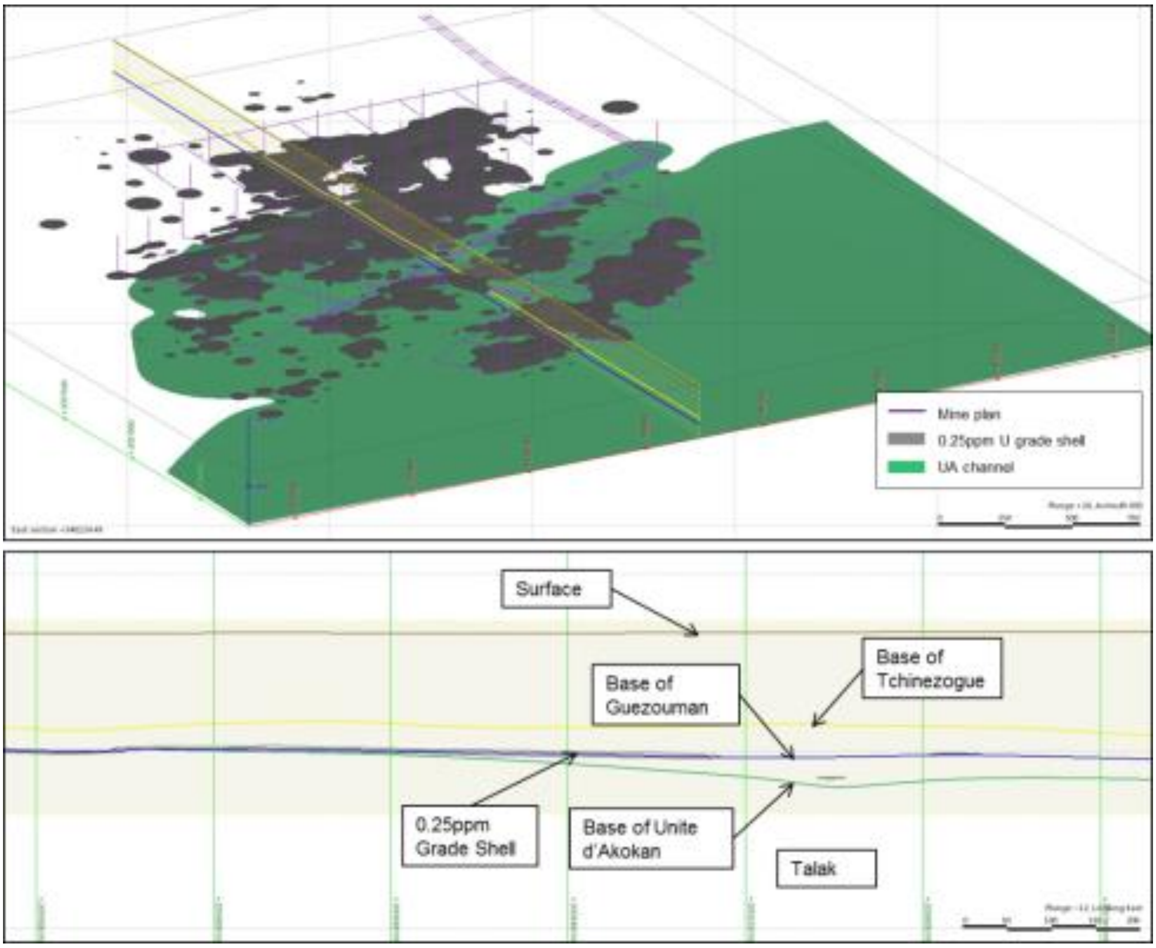


Figure 7-17: Isometric view and Cross section view of MSNE geology

Structural Geology

Structural Setting

The structural setting of the MSNE deposit is only partially understood because of the very poor exposure across the deposit area.

Major Structures

Monoclines

A single WSW-ENE trending monocline is interpreted from the depressed floor of the Talak Formation (Figure 7-18 and Figure 7-19) and the presence of an Akokan *barre* (Yahaya and Lang, 2000).

Faults

In total six faults have been modelled to be through-going structures at MSNE. All of the structures interpreted at MSNE have some surface manifestation.

MSNE-NE-Ft-1 appears to belong to a relatively significant NE-SW fault trend. This fault trace appears to bound the deposit area to the west and accommodates a significant west-side-down dip-slip displacement that juxtaposes Tchinezogue Formation on the west against Tarat Formation on the east. Fault displacement is interpreted to be transferred to an adjacent segment to its south over a broad zone of fault overlap, which may constitute a relay zone.

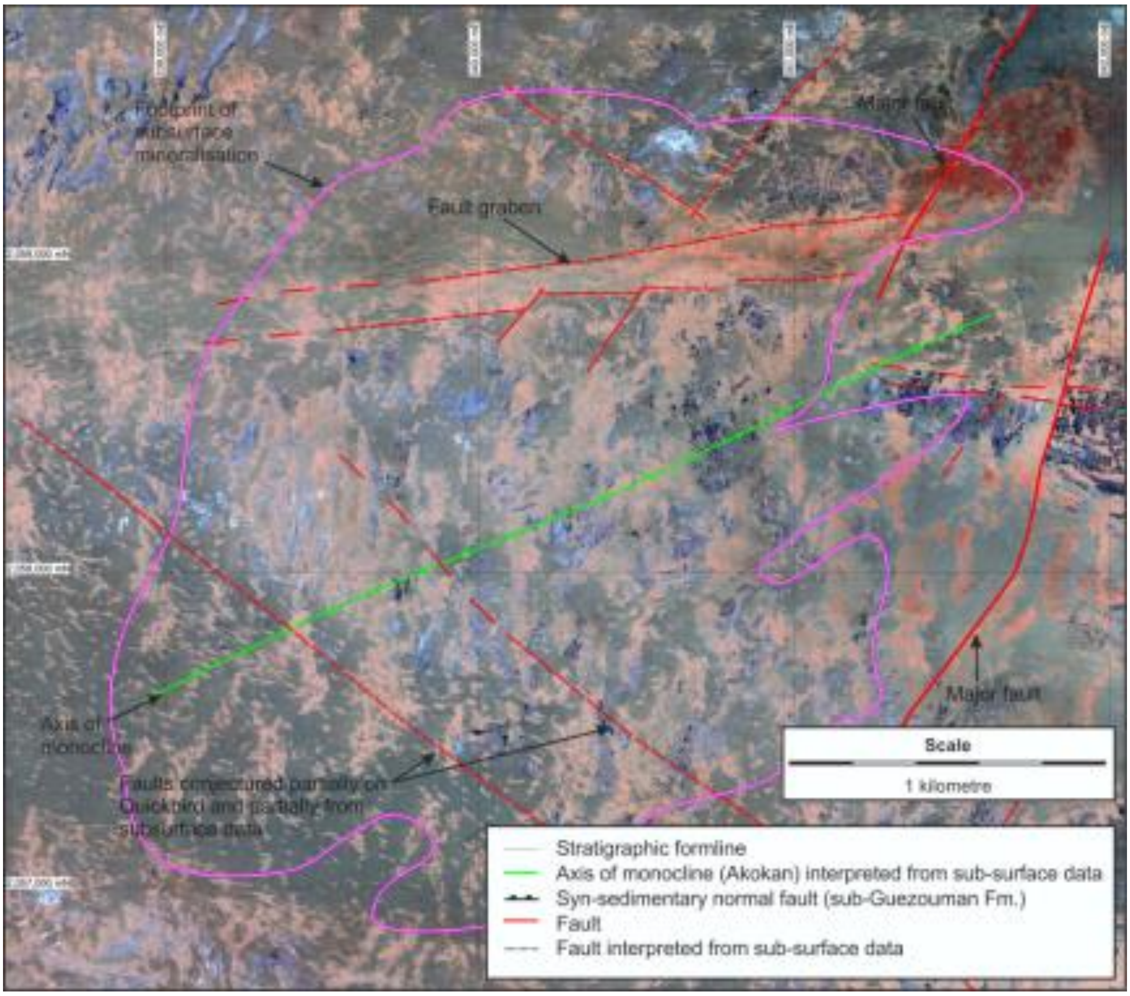


Figure 7-18: Plan view of stratigraphic formlines and structures interpreted at MSNE relative to the Quickbird imagery

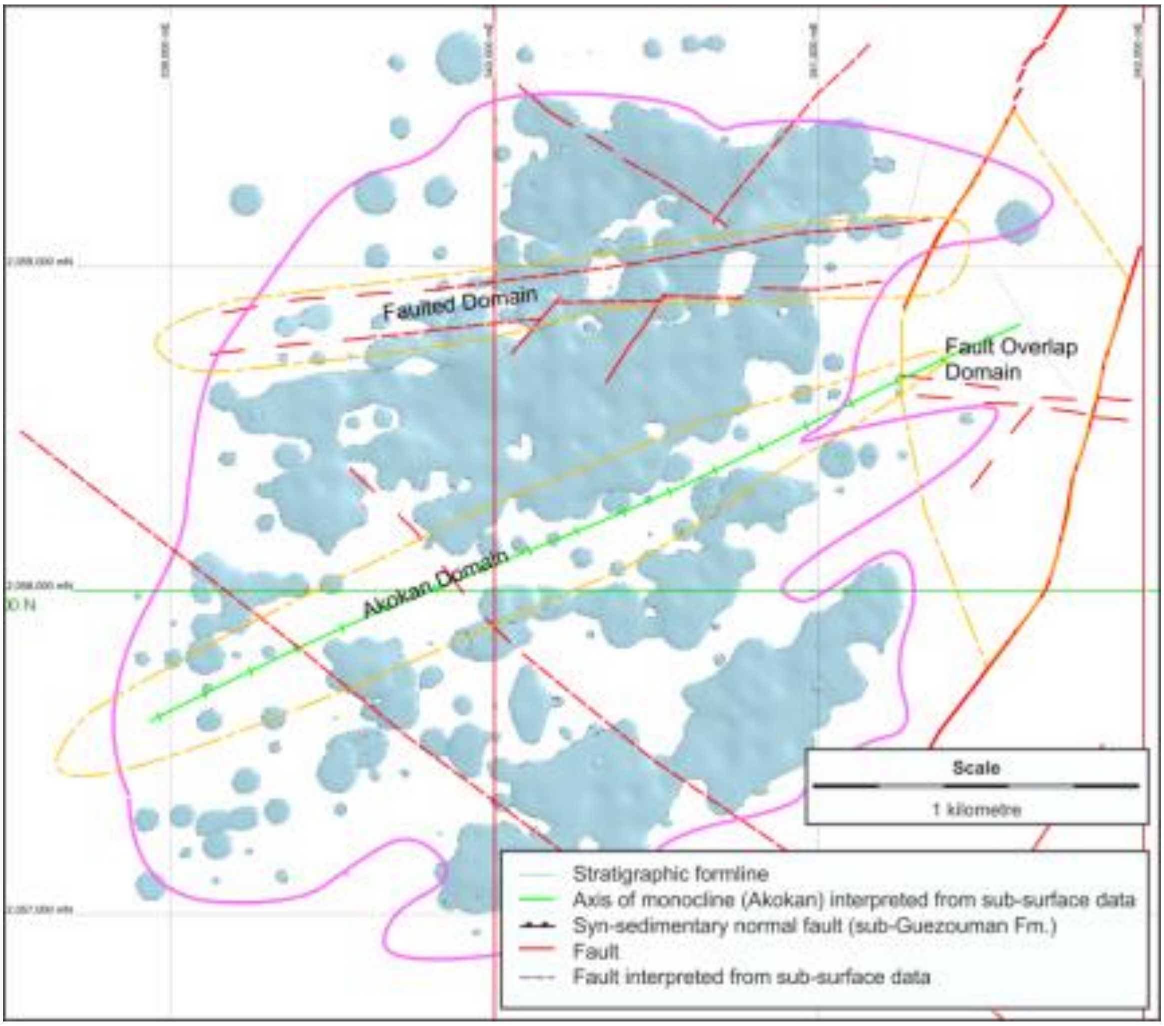


Figure 7-19: Plan view of structural domains relative to the Leapfrog 0.25 kg/t eU grade shell for MSNE.

Stratigraphic Dip

The stratigraphic dips in the MSNE deposit area are relatively subdued away from significant structures. Dips calculated on the basis of horizon intercepts are commonly 0-3 ° and rarely exceed 5 °. Dip increases up to approximately 10 ° locally around fault MSNE-NW-FT-1. Undulations in the footwall away from the monocline and other structures are not anticipated.

7.3.4 Maryvonne (MYVE)

The Maryvonne Deposit occurs between Marianne-Marilyn deposit and MSNE. The geological setting is similar to MSNE and M&M deposits.

Geology

Geology across Maryvonne is interpreted to be similar to the northern part of MSNE. The hangingwall is expected to consist of Guezouman Sandstone and the footwall will be within Talak shales. UA formation was identified in a small portion of boreholes trending NE-SW. This may represent a small UA channel with a vertical thickness of 10-30 m. Stratigraphy is generally sub-horizontal (dip less than 6 °) across the deposit.

Structural Geology

At surface, Maryvonne is located in a relatively sandy area with interrupted exposure of the Izegouande Formation, similar to MSNE.

Structurally the deposit is located 6 km west of the regional NNE-SSW striking Madaouela Fault. Unlike Marianne-Marilyn, to the north, domes do not affect the Maryvonne deposit area. However, the precise nature of the structural geology of the deposit is not particularly well understood due to poor surface exposure and widely spaced exploration drillholes.

The principal structures that have been outlined at Maryvonne are based solely on the topography of stratigraphic horizons in 3D. Towards the south of the deposit, a broad linear depression in the top Talak horizon with several drilled intervals of Akokan Unit is interpreted to represent an ENE-trending monocline, similar to those at Marianne-Marilyn.

Two loosely constrained structures have been interpreted which comprise an oppose-dipping set of moderately SSE and NNW dipping faults. The nature of these faults are unknown, but are conjectured to have similar characteristics to the Akokan faults at Marianne-Marilyn.

A second pair of faults has been interpreted in the central part of Maryvonne, based similarly on a broad linear zone of depression, but without any intervals of the Akokan Unit. These structures are very tentative and may only accommodate 5-10 m of displacement. They are therefore likely to be relatively minor faults in nature, but with similar characteristics to the Akokan-bounding faults at Marianne-Marilyn.

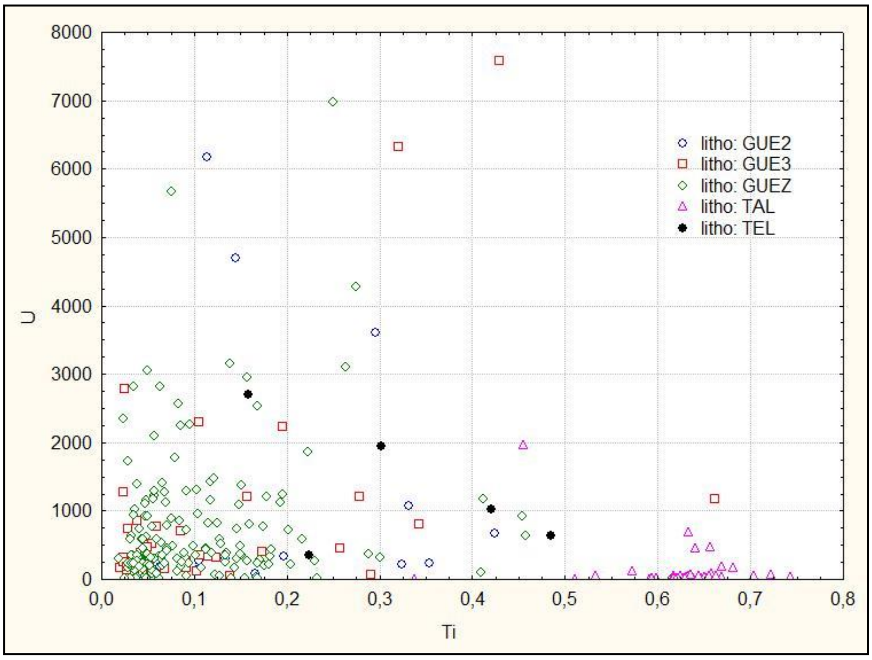
7.4 Mineralisation

7.4.1 Geochemistry and Mineralogy of the Madaouela Uranium Project

The Madaouela deposits exhibit classic characteristics of uranium sandstone deposits common the world over (Cuney, 2009).

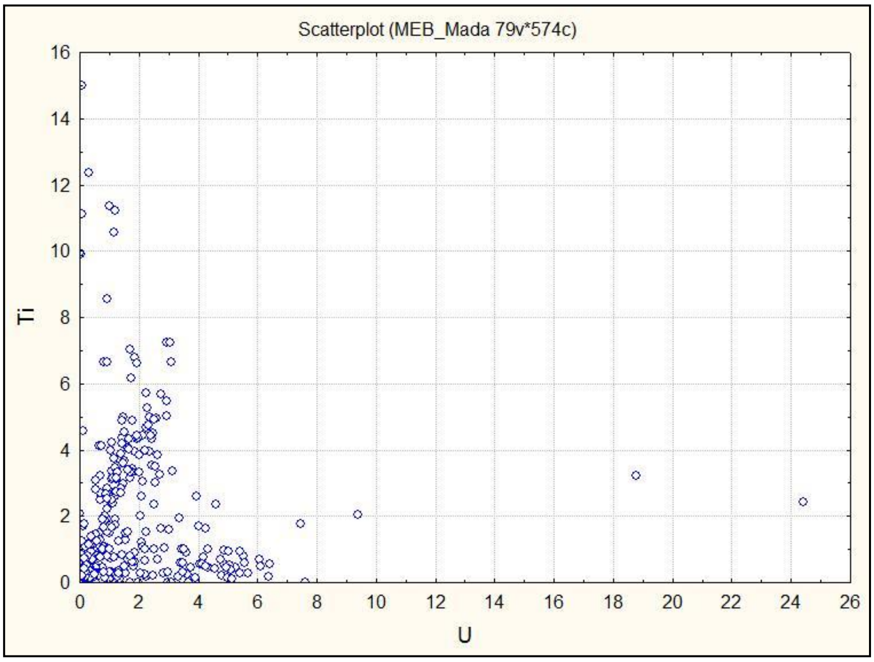
The mineralogy of uranium in the deposit is dominated by pitchblende and coffinite. The overall paragenesis could be divided in three stages: (1) early sulfides; (2) uranium on organic matter such as wood fragments; (3) carbonates and barite. The uranium minerals largely occur on the surface of minerals, or as infillings between the grains.

Figure 7-20 shows the X-Y plot of uranium and titanium for several lithologies, and Figure 7-21 shows the U-Ti relationship in SEM scans. This relationship has been described in other deposits, with uranium “adsorbed” on corrugations at the surface of Ti oxides.



Source; GoviEx

Figure 7-20: X-Y plot of uranium versus titanium



Note: Analysis of grains from the Madaouela deposit by SEM: uranium and Ti show two types of relations; high uranium phase have low Ti content, and high Ti shows low U.

Source: GoviEx

Figure 7-21: U-Ti relations in SEM scans

In the nearby Akouta uranium mine, the paragenesis is composed of three associations: (1) Pre-ore minerals: wood fragments replaced by pyrite, quartz overgrowths, barite; (2) Ore-stage minerals: Uraninite, coffinite, with calcite and sphalerite, radiogenic galena, jordisite, marcasite; and (3) Post-ore minerals, with kaolinite as feldspar replacements. The Madaouela deposit seems to follow the same pattern.

It is important to note that pyrite may have developed on large areas, but is now preserved only in the halo of the regional redox front.

7.4.2 Modelled Mineralisation

The overall trend of mineralisation on the Mad I tenement extends about 17 km from the M&M to the Miriam deposit (Figure 7-23). The deposits are believed to be located along a paleo-groundwater redox boundary within the Guezouman sandstone (the interpreted trace is shown in red in Figure 7-22).

The Marianne-Marilyn (M&M) deposit is a nearly flat tabular body of mineralisation that spans approximately 7 km (N70E direction) by 3 km across in plan, and the deposit thickness varies from 0.2 to over 2 m (average thickness of about 1 m).The mineralisation occurs at depths from about 30 m on the eastern end of Marilyn, to approximately 60 m in depth in the middle of the Marianne-Marilyn deposit, up to 120 m in depths on the west extensions of Marianne; below the relatively flat topographic surface.

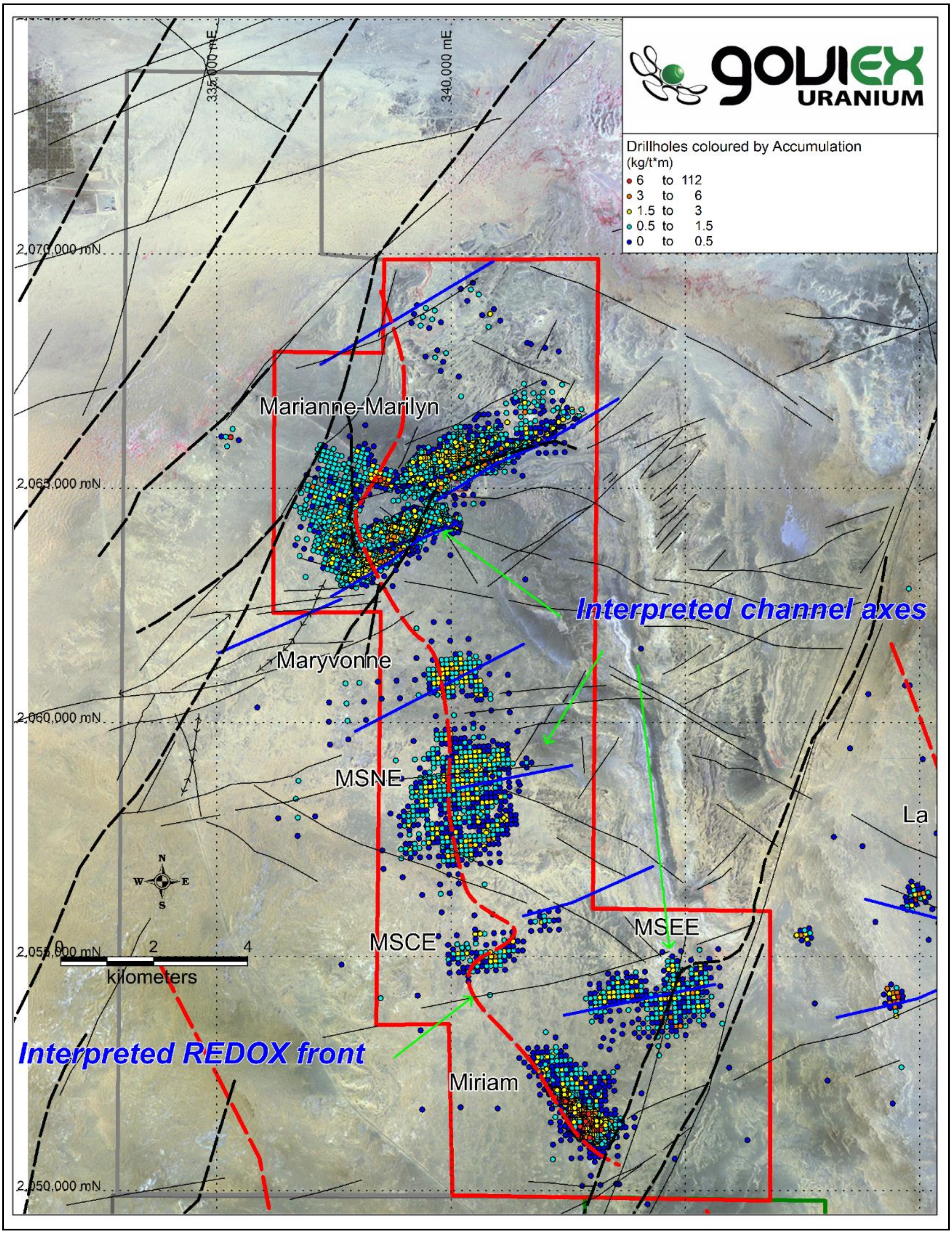
The MYVE deposit is a nearly flat tabular body of mineralisation that spans approximately 1 km (N70E direction) by 0.6 km across in plan, and the deposit thickness varies from 0.2 to 1.8 m (average thickness of about 1 m). The mineralisation occurs at depths from about 105 m in the east to 120 m in the west.

The MSNE deposit spans approximately 2.8 km (N60E direction) by 2.4 km across in plan, and the deposit thickness varies from 0.2 to 2.4 m (average thickness of about 1 m). The mineralisation occurs at depths from about 140 m in the north to 130 m in the south. There is discontinuous uranium mineralisation within the N60E trending UA channel which also varies in orientation depending on position within the channel. Thin uranium mineralisation is also present at the base of the Tarat, in the south of the deposit.

The MSCE deposit is relatively flat and spans approximately 2.0 km (N70E direction) by 0.4 km across in plan, and the deposit thickness varies from 0.4 to 3.4 m (average thickness of about 1.4 m). The mineralisation occurs at depths from about 110 m in the east to 160 m in the west. Thin uranium mineralisation is also present at the base of the Tarat, in the south of the deposit.

The MSEE deposit is affected both by an east-west channel as well as the Madaouela fault in the south-east. Significant mineralisation is irregularly distributed, but the deposit area roughly spans approximately 2.2 km (E direction) by 1.7 km across in plan, and the deposit thickness varies from 0.2 to 2.4 m (average thickness of about 1.0 m). The mineralisation occurs at depths from about 95 m in the north to 140 m in the south, on the downthrown side of the Madaouela fault.

The Miriam deposit mineralisation is a combination of the Guezouman-Talak contact mineralisation present at the other deposits, but also thicker, stacked horizons focussed about a north-westerly trend. The deposit is also affected by the Madaouela fault in the south-east, similar to MSEE. The deposit area spans approximately 2.5 km (N40W direction) by 1.5 km across in plan, and the deposit thickness varies from 0.2 to over 30 m thick localized along the north-westerly structures. The mineralisation occurs at depths from about 65 m in the south-east to 120 m in the north-west.



Source: GoviEx

Figure 7-22: Relationship of MSSE to Marianne-Marilyn and redox front, Mad I

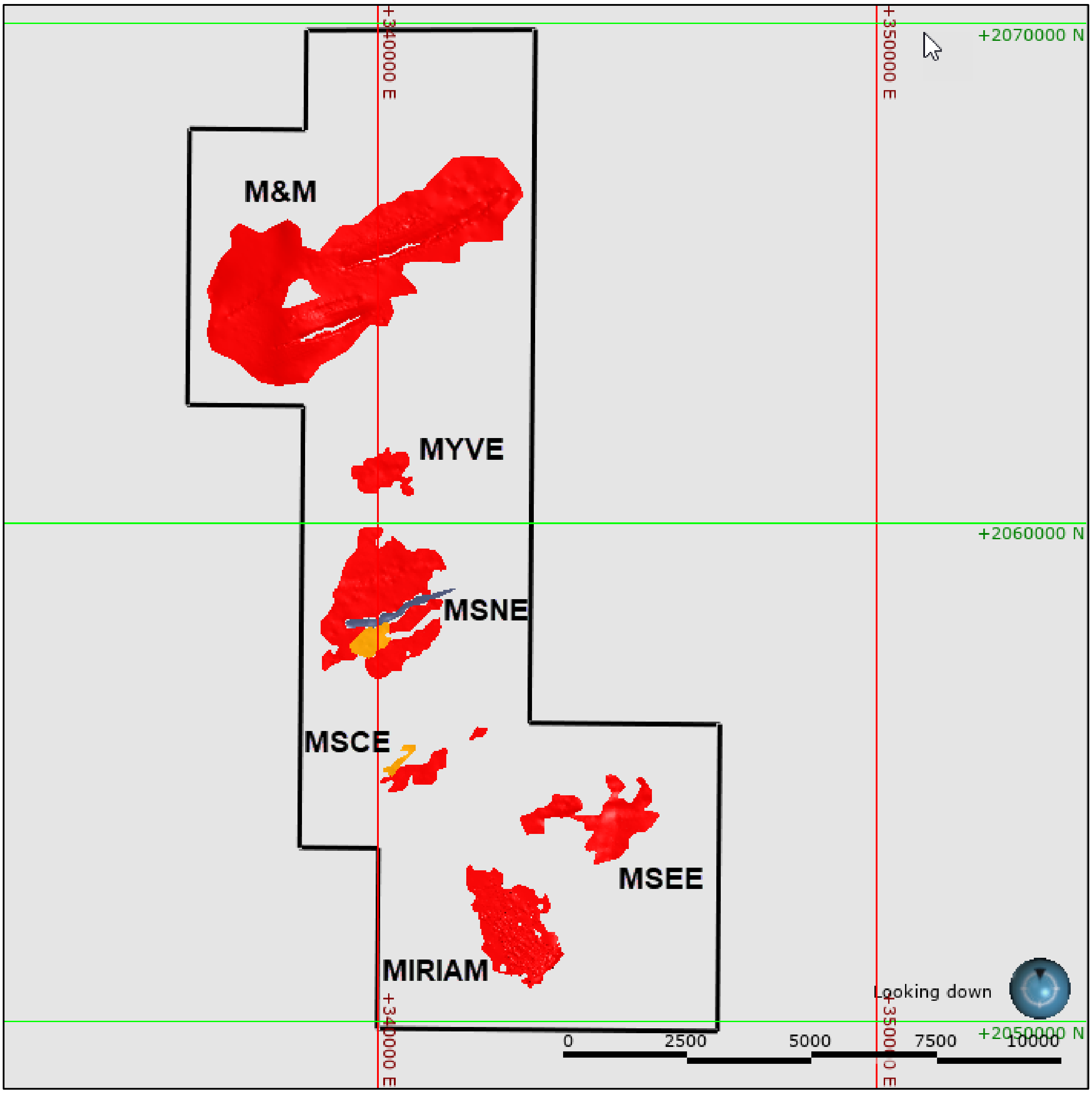


Figure 7-23: Plan View of the uranium mineralisation models for the Madaouela Project.

Surrounding Rock Types

The lithological unit below the Guezouman-hosted uranium mineralisation is the Talak argillite/siltstone. The lithology immediately above the mineralised horizon is un-mineralised Guezouman sandstone. The argillite and silt of the Tchinezogue constitute a reduced capping which had probably played an important role in preserving the uranium mineralisation in the Guezouman

Geological Controls on Mineralisation

The Guezouman sandstone at the Guezouman-Talak contact in the primary locus of mineralisation, as controlled by the reducing environment and lesser permeability of the Talak argillites below mineralisation, and the regional paleo-groundwater redox boundary in the Guezouman sandstone, down gradient from outcrops. Other relevant geological controls are the N70E structural, which represent older faults, and edges of paleo-channels. Low-amplitude domal features in the sedimentary units are related to the structural environment and are therefore relevant exploration guides.

Type, Character and Distribution of Mineralisation

The uranium mineralisation is all reduced uranium minerals (uranium (IV) minerals), uraninite and coffinite. The uranium minerals occur as disseminations in the matrix of the sandstone, with nearly all the mineralisation occurring in one tabular horizon. At the favor of vertical “redox front”, uranium mineralisation in the Guezouman may occur at several levels, as it is the case in the Miriam deposit. The Akouta “front” was the best example of this type of concentration. In the Miriam case a close relationship with structural features is very likely. Mineralisation can sometimes be present at the contact of the Guezouman and the UA formation, in the Talak, and in the UA where the UA is preserved against a N70E fault; however, that mineralisation is also relatively insignificant to the main basal Guezouman sandstone tabular lens of mineralisation.

8 DEPOSIT TYPES

Sandstone-hosted uranium deposits are defined as epigenetic concentrations of uranium minerals occurring as impregnations and replacements primarily in fluvial, lacustrine, and deltaic sandstone formations. They occur in permeable medium- to coarse grained sandstone, usually deposited in continental fluvial or marginal marine sedimentary environments. Impermeable shale or mudstone are inter-bedded in the sedimentary sequence, and often occur above and below the mineralisation.

The source of uranium is usually igneous or volcanic rocks (alkaline tuffs, granitic intrusion) either in close proximity to or inter-bedded with the sandstone units. The uranium mineralisation typically precipitates from oxidizing fluids, under reducing conditions caused by a variety of reducing agents including: carbonaceous material (detrital plant debris and amorphous humate), sulfides accompanying organic matter decay, hydrocarbon, and inter-bedded mafic volcanic rock with abundant ferro-magnesian minerals (Figure 8-3). The reducing agent for Madaouela is most likely in-situ organic material (lignite), primarily within the Talak, or hydrocarbons transported along major faults.

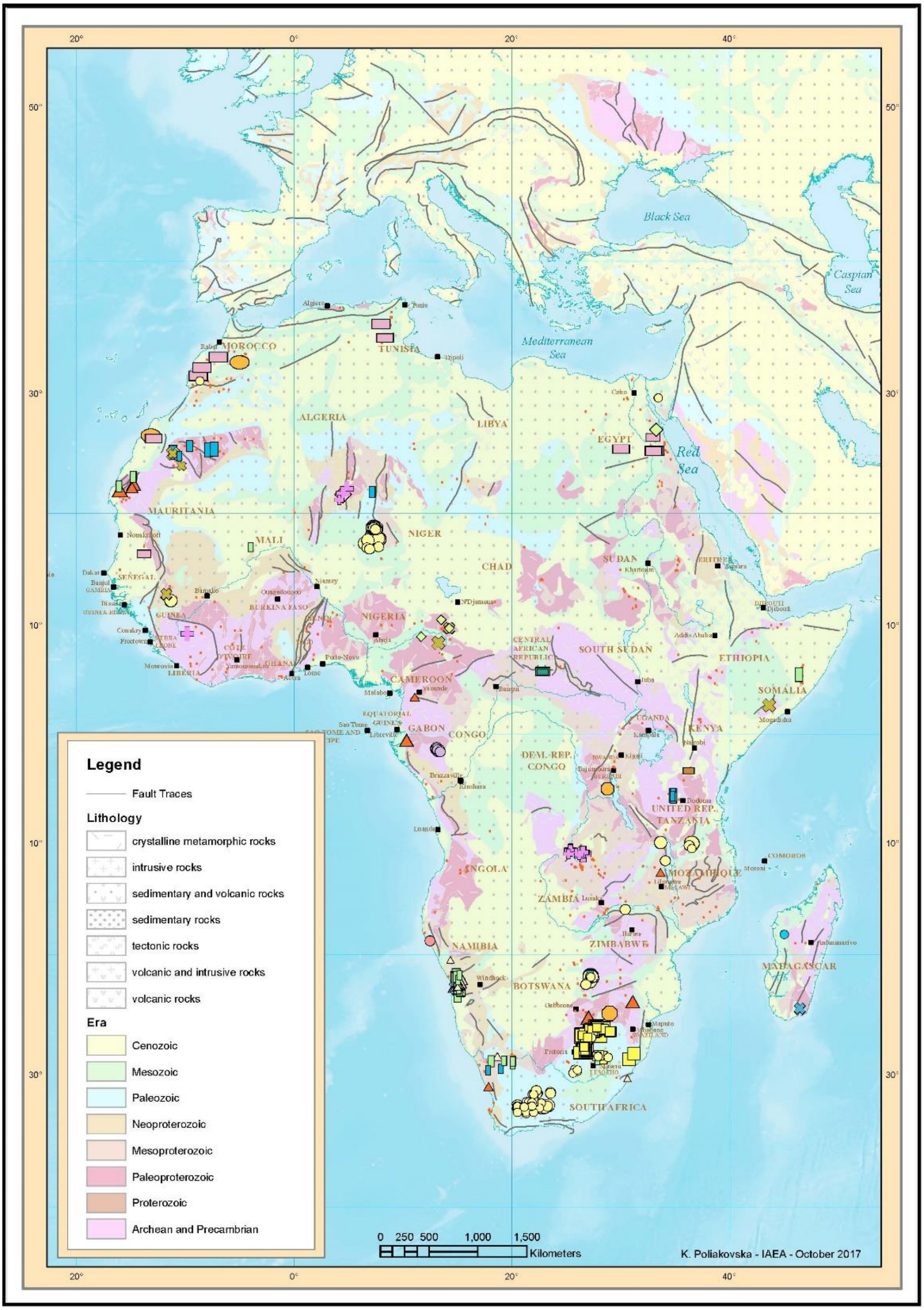
The main primary uranium minerals are uraninite and coffinite with minor secondary uranium minerals being noted in exposed (weathered) mineralisation.

Sandstone deposits are an important source of uranium representing approximately 28 % of the world's known uranium resources and accounting for a significant percentage of the African uranium deposits in 2020 (Figure 8-1 and Figure 8-2). This style of uranium deposit typically yields small to medium size deposits (10,000 to approximately 50,000 t of U_3O_8) characterised by low to medium grade (0.05 to 0.5 % U_3O_8). The deposits typically occur in clusters within a broad redox front.

Major sandstone-hosted uranium deposit provinces worldwide include the Powder River Basin in Wyoming, the Colorado Plateau and the Gulf Coast Plain in south Texas in the United States, the Tim Mersoi Basin of Niger, the Franceville Basin of Gabon, Cretaceous basins in Kazakhstan and Uzbekistan, the Frome Embayment of South Australia, and the Karoo Basin of RSA, and Tanzania. The sedimentary basins occur mainly in rock from Carboniferous to Tertiary age, since the development of the continental vegetation, and therefore the formation and preservation of fossil carbonaceous material that establish a reducing environment in continental sandstone.

Four main types of sandstone deposits have been recognised world-wide: (1) Basal-type deposits in paleo-valleys incised in basement rock; (2) tabular deposits; (3) roll front deposits and (4) structural deposits, within sandstone adjacent to a permeable fault zone.

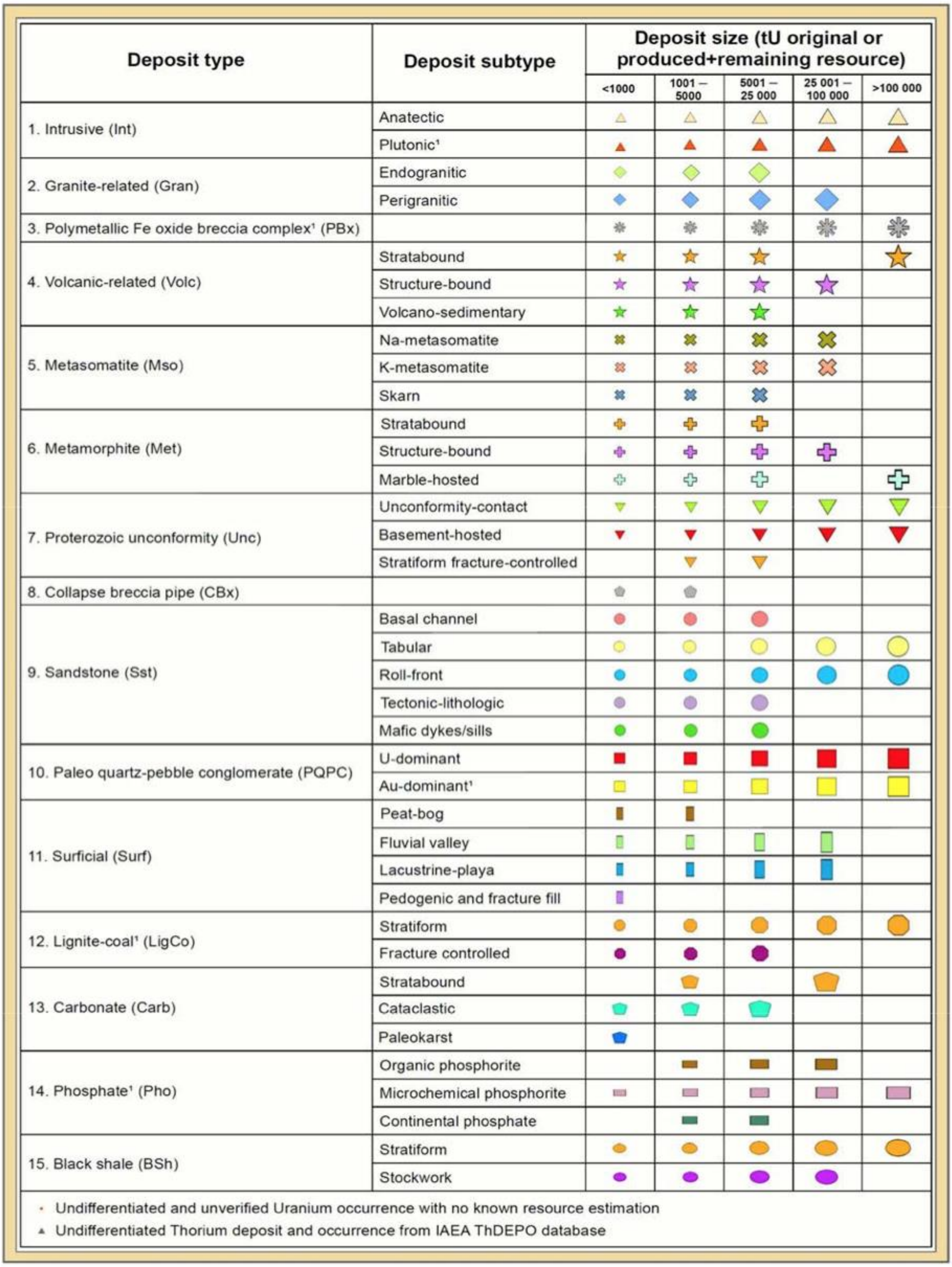
In Niger, including the Madaouela Uranium Project, the uranium deposits belong to the tabular and roll front deposit types. The deposits are epigenetic (Pagel et al, 2005).



Source: International Atomic Energy Agency (2020), World Uranium Geology, Exploration, Resources and Production, IAEA, Vienna.

Figure 8-1: Regional geological setting of Africa showing the distribution of selected uranium deposits and occurrences.

For general uranium deposit legend see Figure 8-2



Deposit type	Deposit subtype	Deposit size (tU original or produced+remaining resource)				
		<1000	1001 – 5000	5001 – 25 000	25 001 – 100 000	>100 000
1. Intrusive (Int)	Anatectic					
	Plutonic[1]					
2. Granite-related (Gran)	Endogranitic					
	Perigranitic					
3. Polymetallic Fe oxide breccia complex[1] (PBx)						
4. Volcanic-related (Volc)	Stratabound					
	Structure-bound					
	Volcano-sedimentary					
5. Metasomatite (Mso)	Na-metasomatite					
	K-metasomatite					
	Skarn					
6. Metamorphite (Met)	Stratabound					
	Structure-bound					
	Marble-hosted					
7. Proterozoic unconformity (Unc)	Unconformity-contact					
	Basement-hosted					
	Stratiform fracture-controlled					
8. Collapse breccia pipe (CBx)						
9. Sandstone (Sst)	Basal channel					
	Tabular					
	Roll-front					
	Tectonic-lithologic					
	Mafic dykes/sills					
10. Paleo quartz-pebble conglomerate (PQPC)	U-dominant					
	Au-dominant[1]					
11. Surficial (Surf)	Peat-bog					
	Fluvial valley					
	Lacustrine-playa					
	Pedogenic and fracture fill					
12. Lignite-coal[1] (LigCo)	Stratiform					
	Fracture controlled					
13. Carbonate (Carb)	Stratabound					
	Cataclastic					
	Paleokarst					
14. Phosphate[1] (Pho)	Organic phosphorite					
	Microchemical phosphorite					
	Continental phosphate					
15. Black shale (BSh)	Stratiform					
	Stockwork					

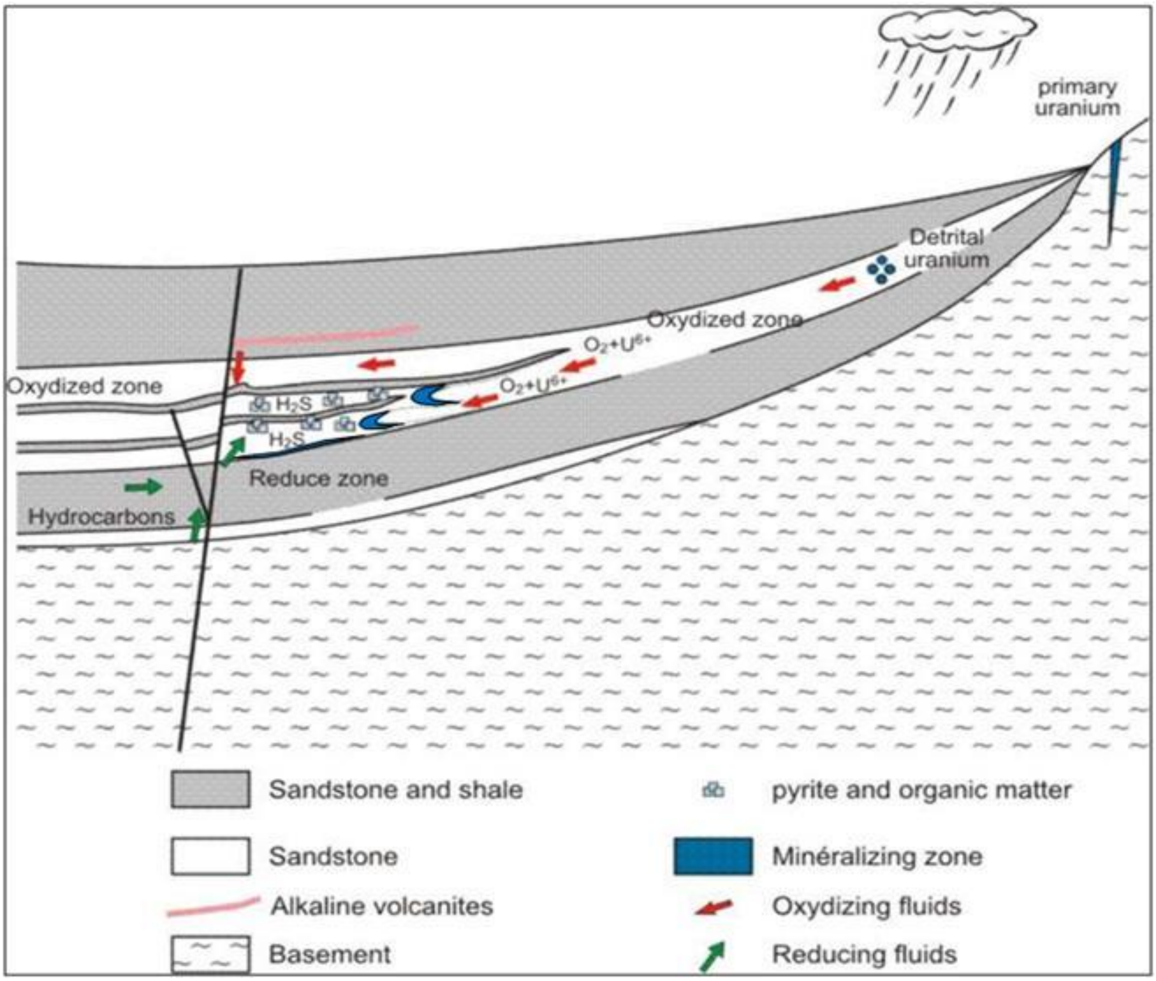
• Undifferentiated and unverified Uranium occurrence with no known resource estimation

▲ Undifferentiated Thorium deposit and occurrence from IAEA ThDEPO database

Source: International Atomic Energy Agency (2020), World Uranium Geology, Exploration, Resources and Production, IAEA, Vienna.

Figure 8-2: Deposit type and subtype and deposit size legend for Figure 8-1 and all regional geological setting maps for country sections in the following sections

Approximately 35 km northwest of the M&M deposit is the Akouta uranium deposit, operated by COMINAK (a subsidiary of Orano) from 1978 to 2021. Five mineralizing phases have been distinguished by Forbes (1989) in the Akouta deposit: (1) an early replacement of wood fragments by pyrite and formation of quartz overgrowths on detrital quartz grains; (2) a sulfate phase with formation of barite; (3) the U-Mo-V deposition phase; (4) the alteration of feldspars and formation of kaolinite on the west side; and, (5) the formation of iron oxides and manganese-rich cements. The uranium mineralisation in the Carboniferous and Tarat deposits consists of pitchblende (enriched in ZrO_2) and coffinite, associated with V-bearing chlorite, corrensite, jordisite, montroseite, pyrite, molybdenite, marcasite, sphalerite and dolomite. It is likely that the mineralisation at the Madaouela Project shares some, or all of the characteristics described by Forbes.



Source: GoviEx; modified by SRK

Figure 8-3: Schematic cross-section of a fluvial basin and conceptual formation of uranium deposits

9 EXPLORATION

9.1 Introduction

The main exploration tool used by GoviEx on the Madaouela Uranium Project has been by drilling on a defined grid pattern and interpreting the presence of redox fronts or anomalous uranium intercepts to justify further drilling. This is described in Section 10 Drilling. Other exploration work completed on the Project includes; field mapping at MAD I in 2009-10. Strip mapping along drill lines was completed at MAD I, MAD II and MAD III in 2011; MAD IV in 2012; and Anou Melle in 2014. Remote sensing by MIR Teledetection was completed over the whole project in 2009 and has greatly assisted in understanding the structural complexity of the area.

9.1.1 2009

MIR Teledetection were contracted to carry out remote sensing analysis of the Madaouela licences. This included obtaining quality satellite imagery SRTM for topography, Landsat and Aster imagery for spectral analysis and photo interpretations.

9.2 Principle Component and Spectral Analysis

MIR Teledetection used the Aster and the Landsat data to carry out the spectral analysis.

- ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) provides high-resolution images of the planet Earth in 14 different bands of the electromagnetic spectrum, ranging from visible to thermal infrared light.
- Landsat a joint initiative between the U.S. Geological Survey (USGS) and NASA represents the world's longest continuously acquired collection of space-based moderate-resolution land remote sensing data. Landsat collects data over 7 channels in the visible, near infrared, and shortwave infrared wavelength regions as well as a panchromatic band.

The various channels were enhanced to increase the contrasts, followed by the application of filters to accentuate the peaks and spectral decorrelation was applied to each input channels. A number of composite maps were generated using the combination of visible, near-infrared and mid-infrared. The focus was on Landsat channels 4,3 and 2, which visually highlights the contrasts in minerals contents. Figure 9-1 below shows the contrasts between the various lithological packages.

By analysing the spectral component of each pixel it is possible to identify mineral signature information for a given terrain. MIR identified 11 classes of information, which they linked with ground information. Hence a thematic map could be created which matches with the regional geological map (Figure 9-2).

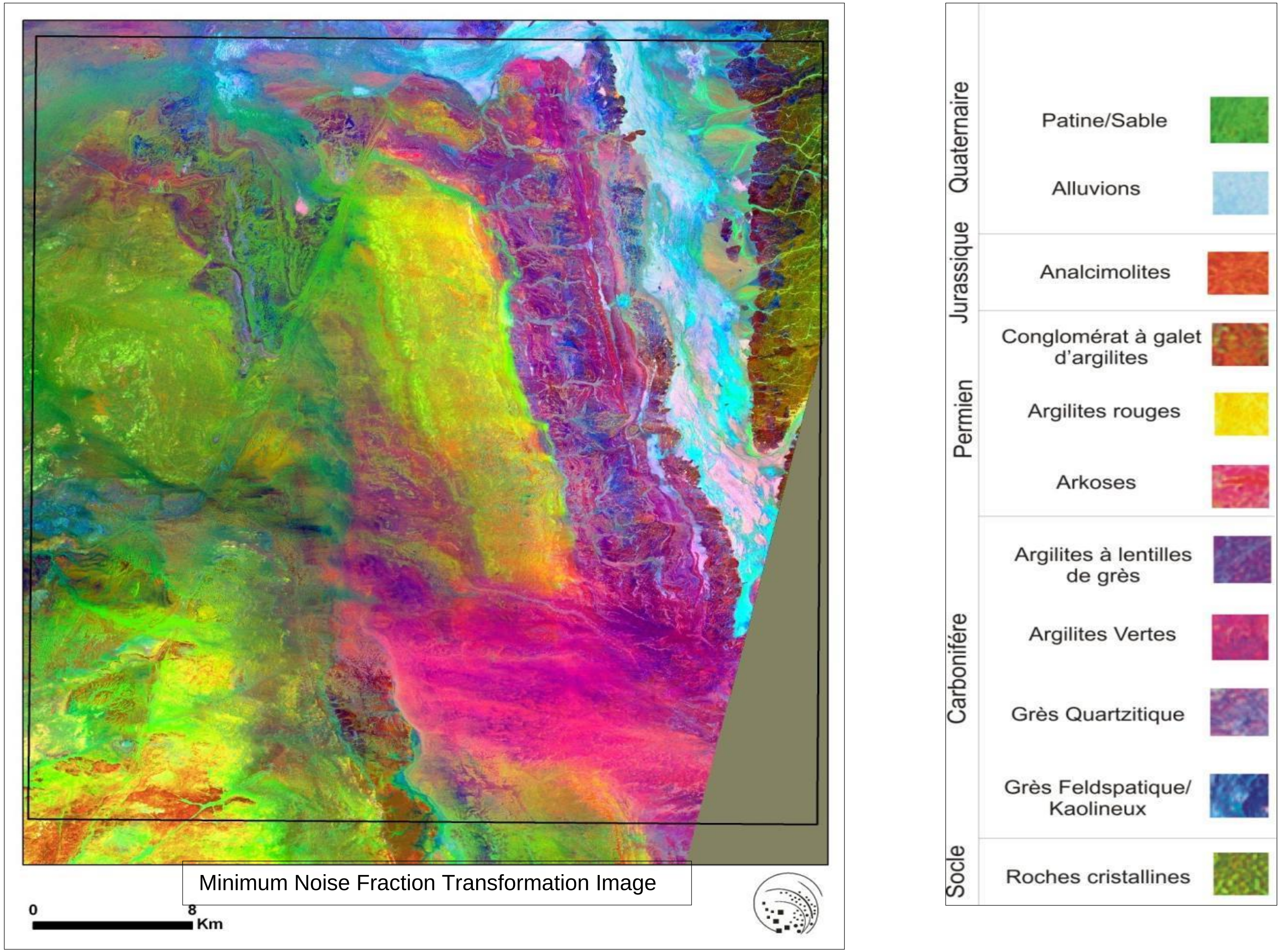


Figure 9-1: ASTER RGB (Red-Green-Blue) representation of principle components of channels 4,3 and 2 respectively. This choice of channels highlights the lithological packages and matches with the regional geological map

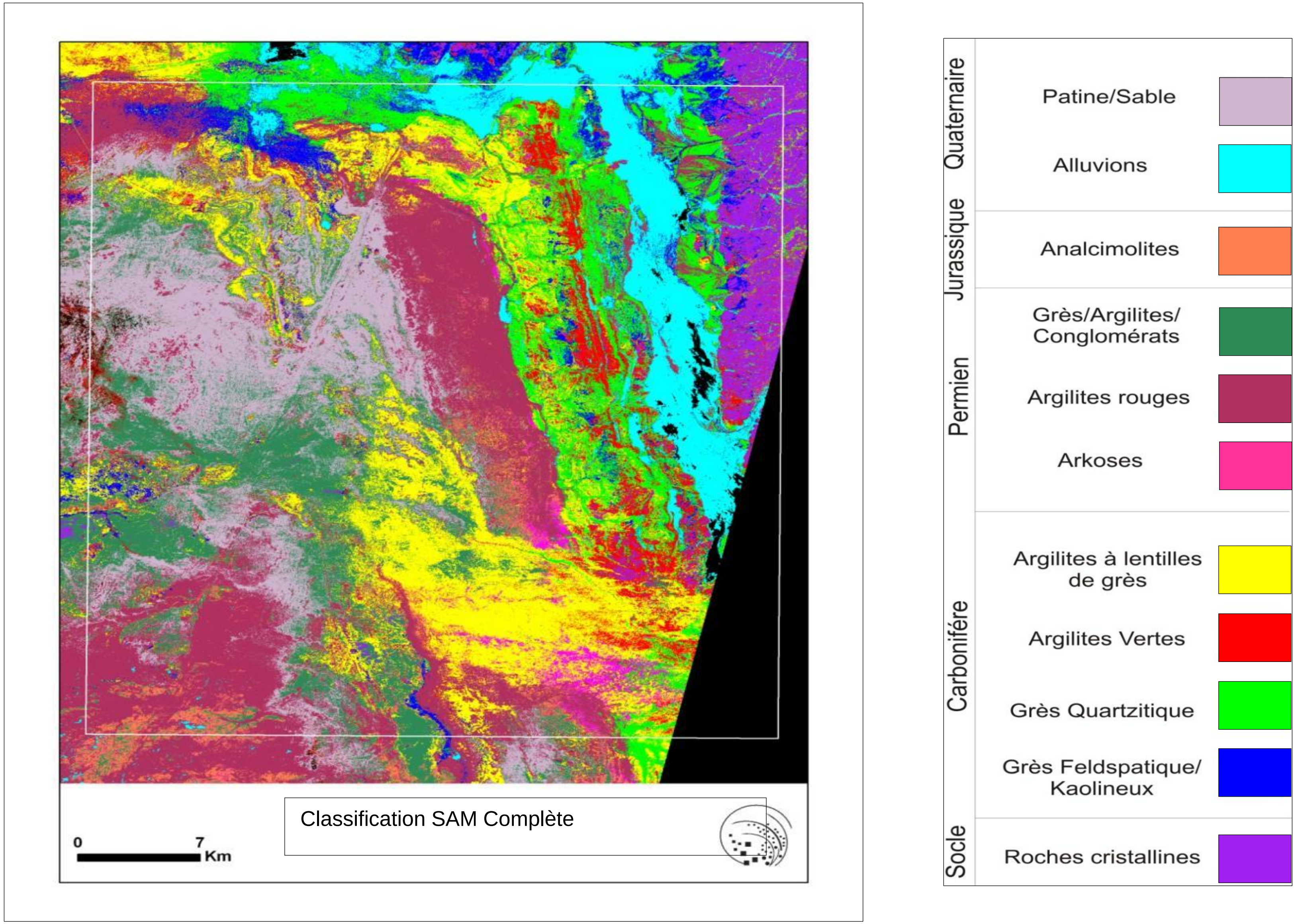


Figure 9-2: Classification of pixels based on 11 mineral signatures determined by analysing the Aster data set. It provides a better distinction between the various rock units, and also surface alteration of the rocks

9.3 Structural Analysis

Structural analysis was carried out by analysing the ASTER as well as the SRTM data.

- The **Shuttle Radar Topography Mission** (**SRTM**) is an international research effort that obtained digital elevation models on a near-global scale to generate the most complete high-resolution digital topographic database of Earth prior to the release of the ASTER GDEM in 2009.

The lineaments such as faults and fractures were identified, as well as bedding structures (Figure 9-3). The movement along the faults was also identified based on the interpreted rock relation, Figure 9-4A, and the identification of dome structures, which are believed to play an important role in the mineralisation of uranium, with a suggested relationship of faults and domes - Figure 9-4B.

9.4 Hydrography

Automated identification of hydrographical features (drainage) was carried out using the SRTM data, based on the theory that current drainage patterns may reflect historical patterns, Figure 9-4C.

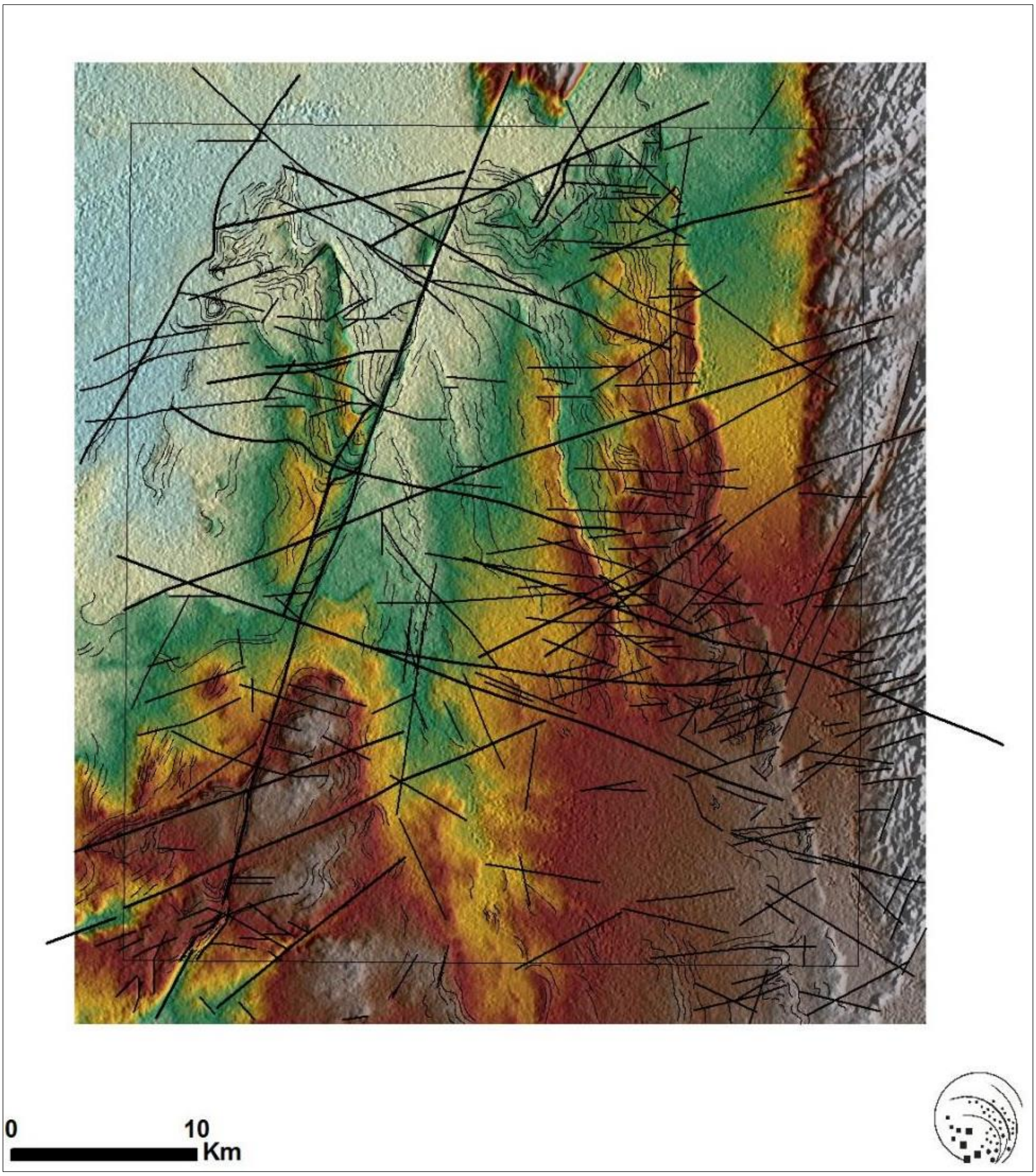


Figure 9-3: Structural analysis over SRTM elevation image, was used to interpret major faults and fractures as well as bedding patterns.

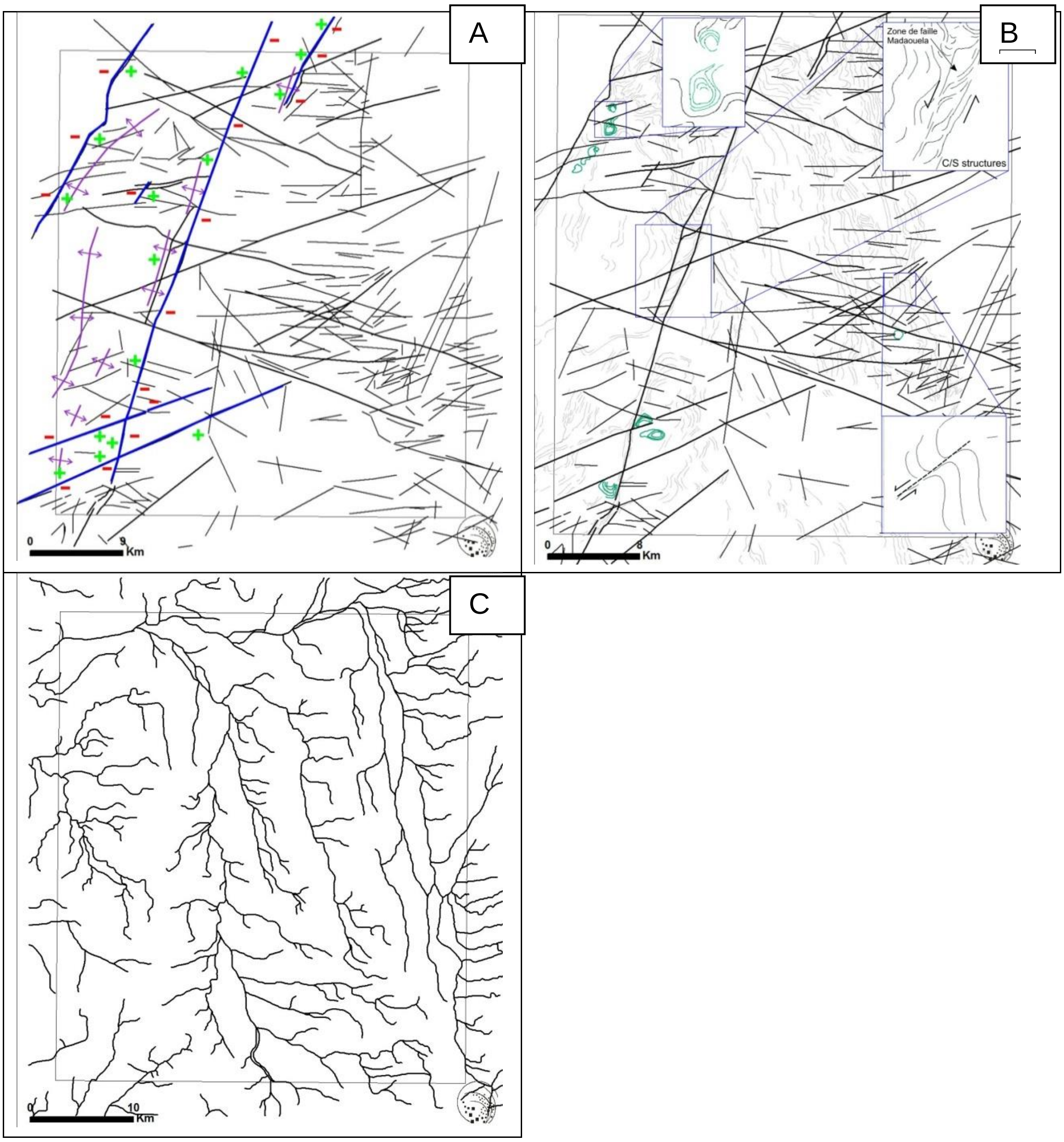


Figure 9-4: Interpretations of domes and also fault movements were interpreted from the structural interpretation. Hydrographical interpretation was also included from SRTM dataset.

9.4.1 2009 to 2010

Mapping by GoviEx was carried out on the Marianne and Marilyn deposits. The mapping used preliminary photo interpretation, followed by field validation as access was restricted due to security concerns associated with the military camp at the time.

From field observations a number of proposals were made for the mineralisation event and confirmed the structural complexity proposed by MIR Teledetection.

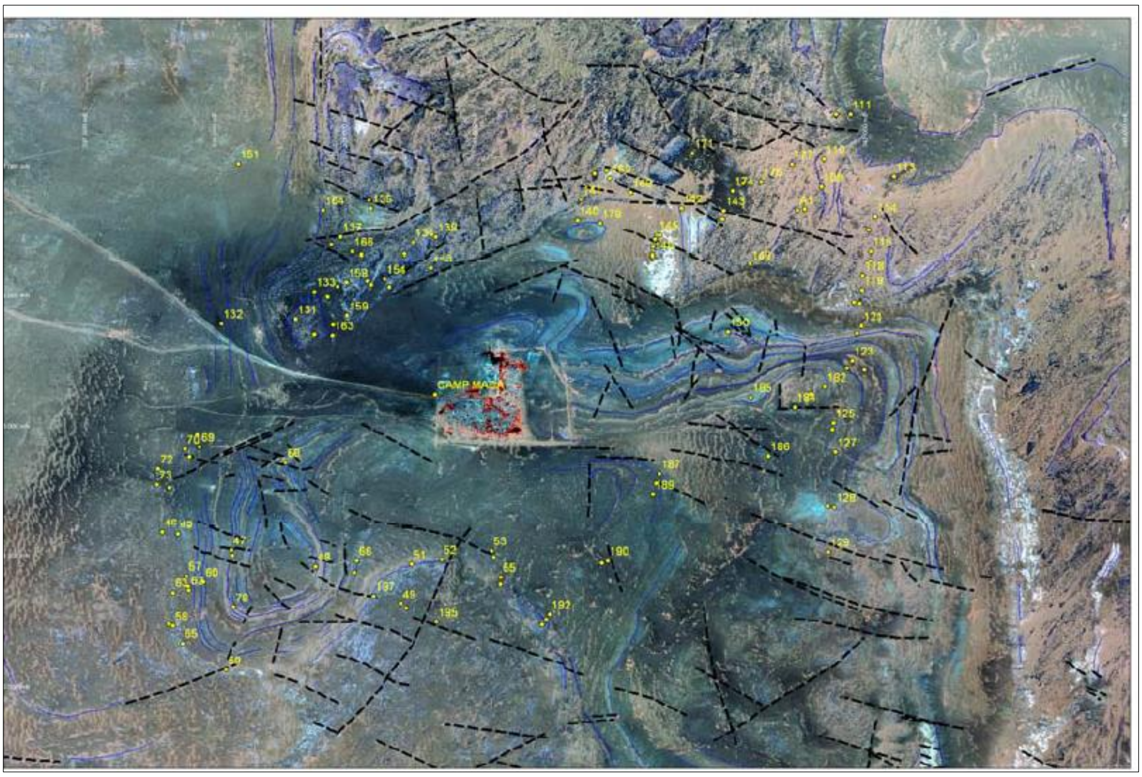


Figure 9-5: Quickbird image of the zone of study, with points of observation in yellow.

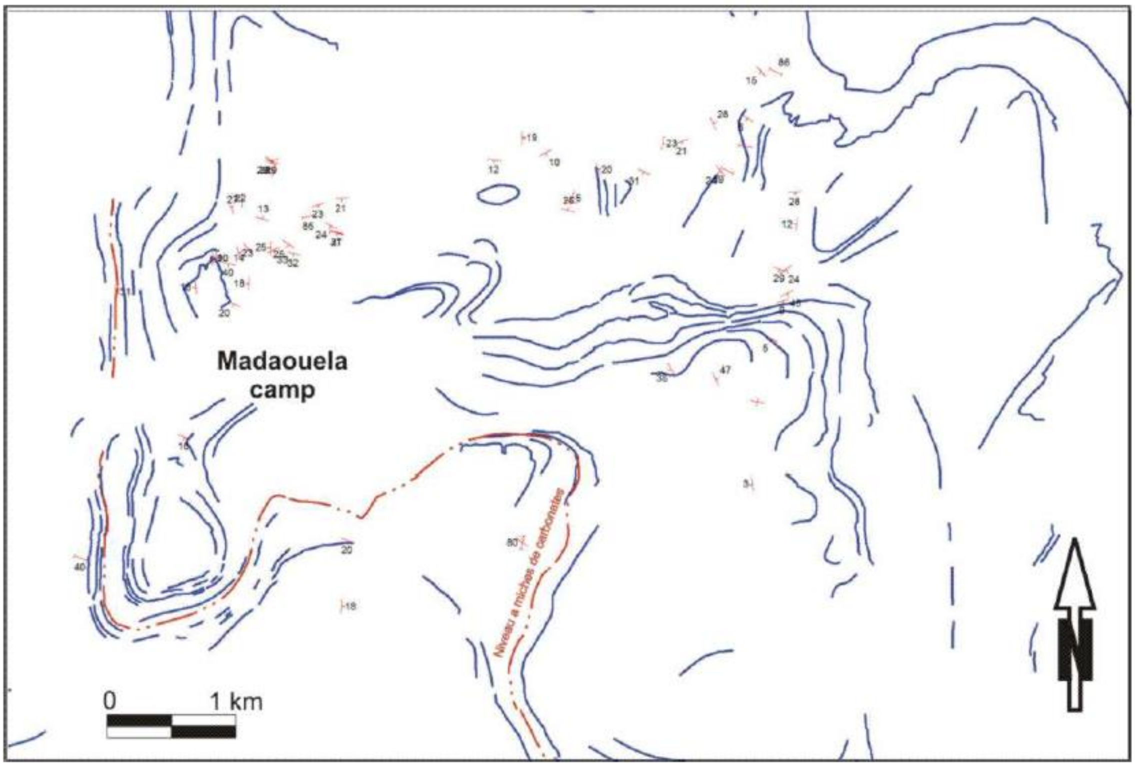


Figure 9-6: Stratification interpreted from Quickbird image and dip and strike from measurement in the field.

The presence of pyrite, organic matter, generally reduced sandstones within deeper "graben like structure bounded to one side by N80 fault created the ideal environment for uranium deposition. The observation of features such as evidence of fluid flows along fractures (Figure 9-7), and presence of pyrite and organic matter in outcrop led to those conclusions.

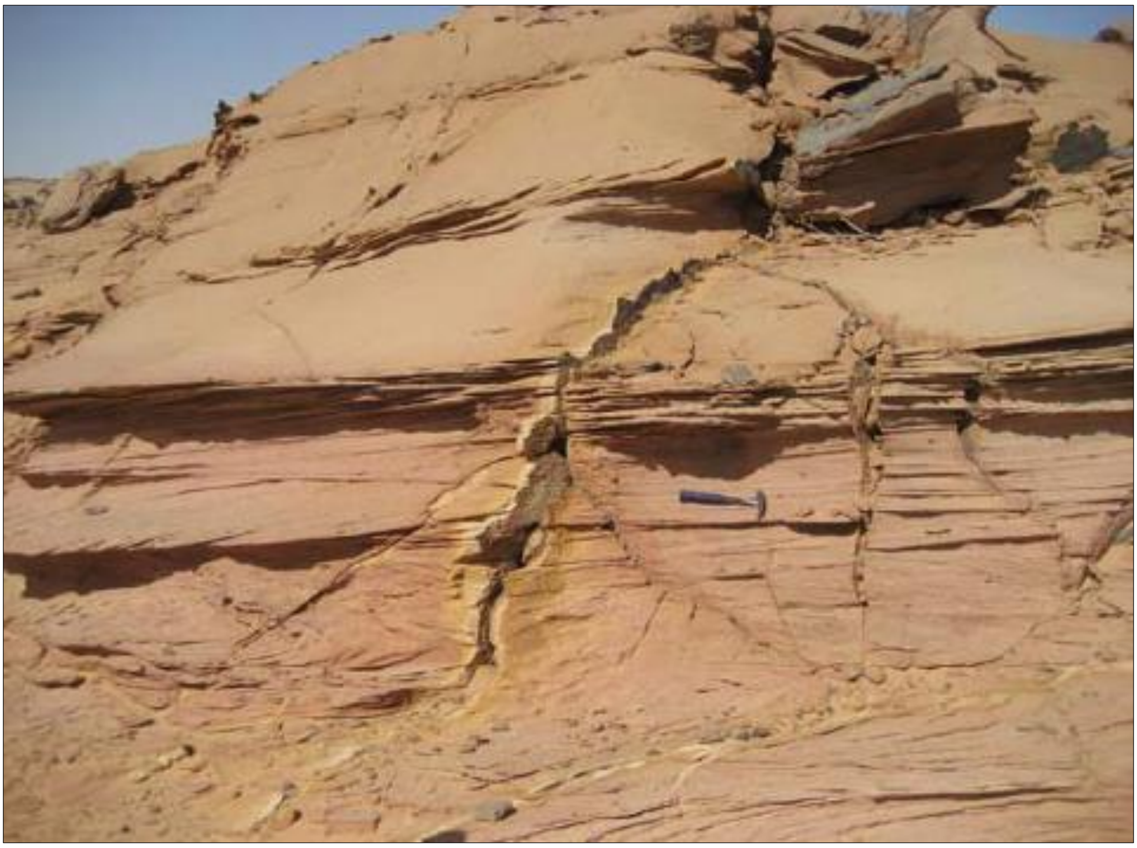


Figure 9-7: Large N80 joint showing evidence of strong hydrothermal alteration

9.4.2 2011-2012

Strip mapping along regular spaced lines was completed by GoviEx over MAD I, MAD II, MAD III and MAD IV. The main purpose of the exercise was to validate the regional geological map data, followed by measuring the direction of paleo-flow to determine channel development and help in defining drill sites. The reading of radioactivity using a SPP2 spectrometer help identified potential target horizons. The geologist's primary task was the recording the lithology, stratigraphy, bedding orientation, presence of faults and fractures. Further to this once drilling was completed, it helped in the interpretation of drill sections.

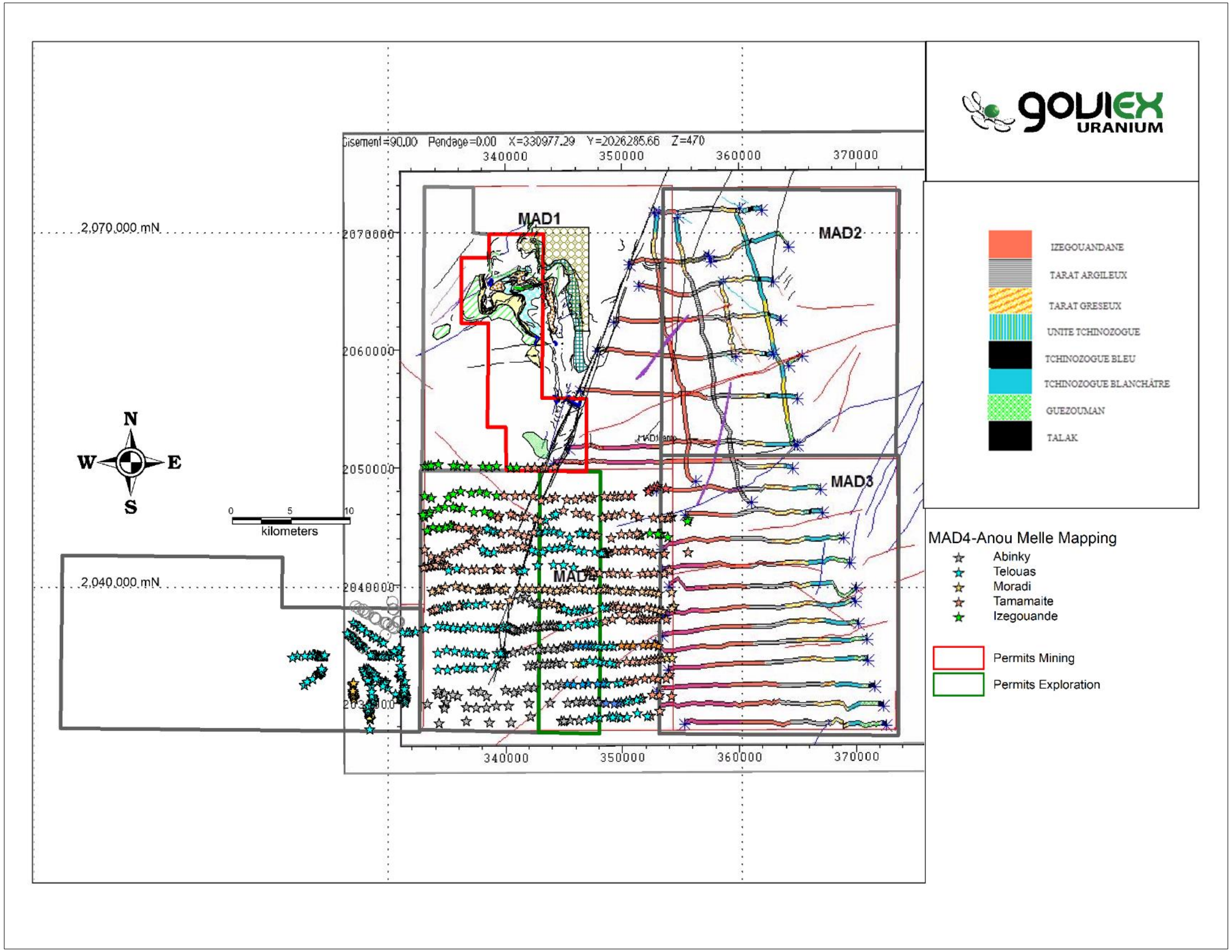


Figure 9-8: Strip Mapping over Madaouela Uranium Project

9.4.3 2014

In 2014, GoviEx completed field verifications on the Anou Melle licence. The main aim of the mapping programme was to confirm; the presence of faults interpreted by MIR Teledetection in 2009; previous work by CEA in the 60's; to confirm the stratigraphy and to verify a number of surface radiometric anomalies. This area is along strike from the Orano deposits (Akouta and Arlit to the north and Imouraren in the South). There was some initial drilling done in the area by the CEA, and also by GoviEx in 2010 that showed some anomalies in the target formations.

There were 10 sections identified which maximized the ground covered, focusing on the eastern part of the licence where there was a maximum of complexity, surface radiometrics and also downhole intercepts. (Figure 9-9).

There were an abundance of fractures on all 10 sections, most showing evidence of fluid flow, such as bleaching, siliceous or iron fill, and brecciation (Figure 9-10), as the area lies next to a major continental fracture like the Arlit Fault. The main directions identified were:

- NS parallel to the Arlit fault
- N70- such as the Capucines and Tagait Faults
- N40 parallel to the Izeretagen and Madaouela Faults
- N120 to 140, which is not as well recognised in the literature but may be significant.

The bedding was generally flat lying to very shallowly dipping to the west, except near some of the faults where steepening of the dips was evident.

The surface radiometric anomalies occur near faults and at the top of the Moradi and base of the Teloua formation within paleo channels of conglomerates and sandstone.

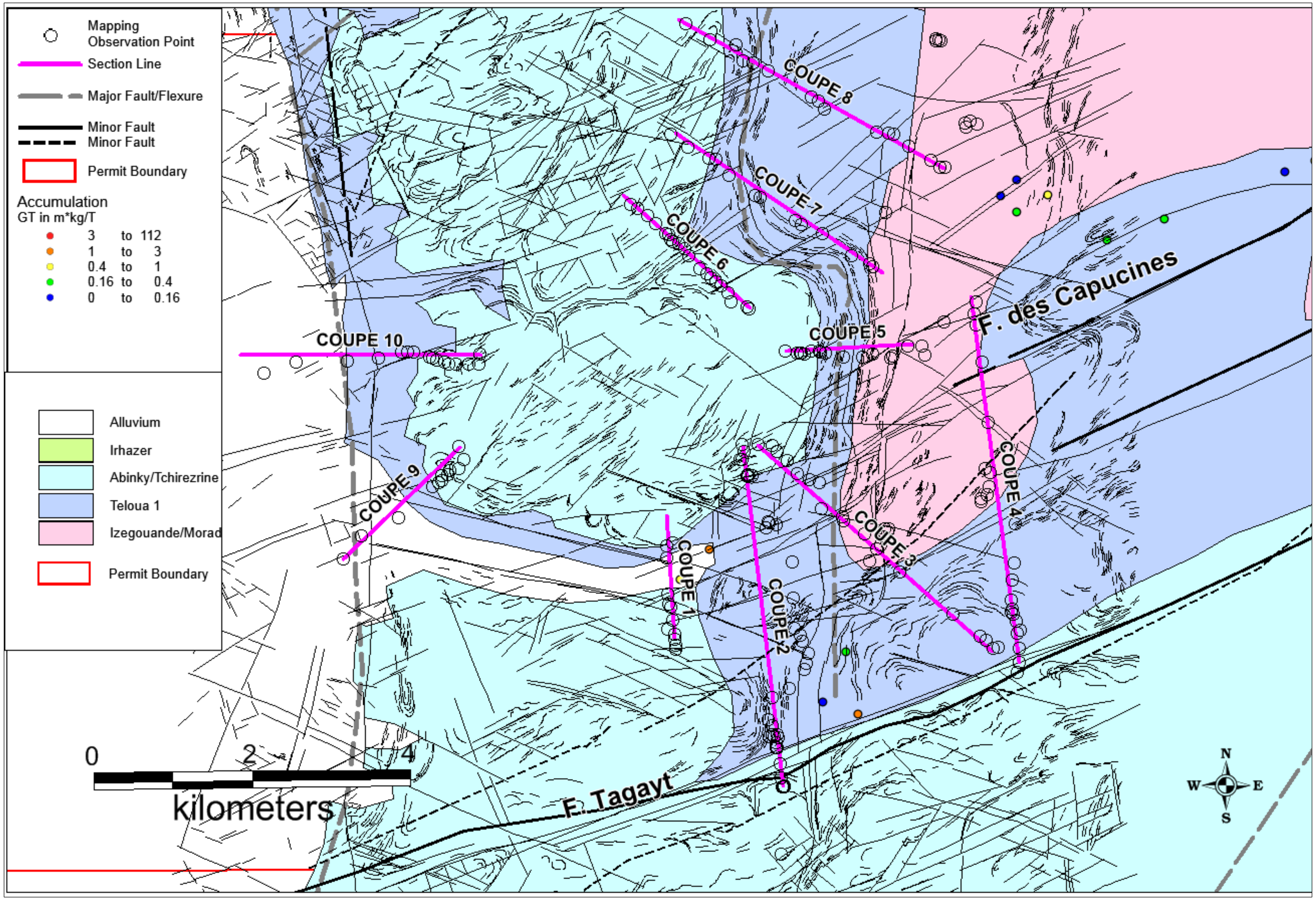


Figure 9-9: Location map of the various sections mapped (pink lines), over the local geology map.

Figure 9-10: At point C01-P6, brecciated and silicified rock, strikes N100 and dips steeply to the SSW.

The Trois Grace is a series of three distinct rocky mounds that line up along the central NS fault (The Trois Grace Fault along the middle of Coupe 3). It is heavily silicified, evidence of past fluid flows, but also potential to create physical barriers to fluid flow if the fault zone was sealed prior to major uranium remobilisation event. The uranium would pond along these structures, hence making them a prime target. (Figure 9-11).

Figure 9-11: Three remnant outcrops of silicified material align NS along one of the interpreted faults. This is the feature known as Les Trois Graces (photo taken from the Northern side)

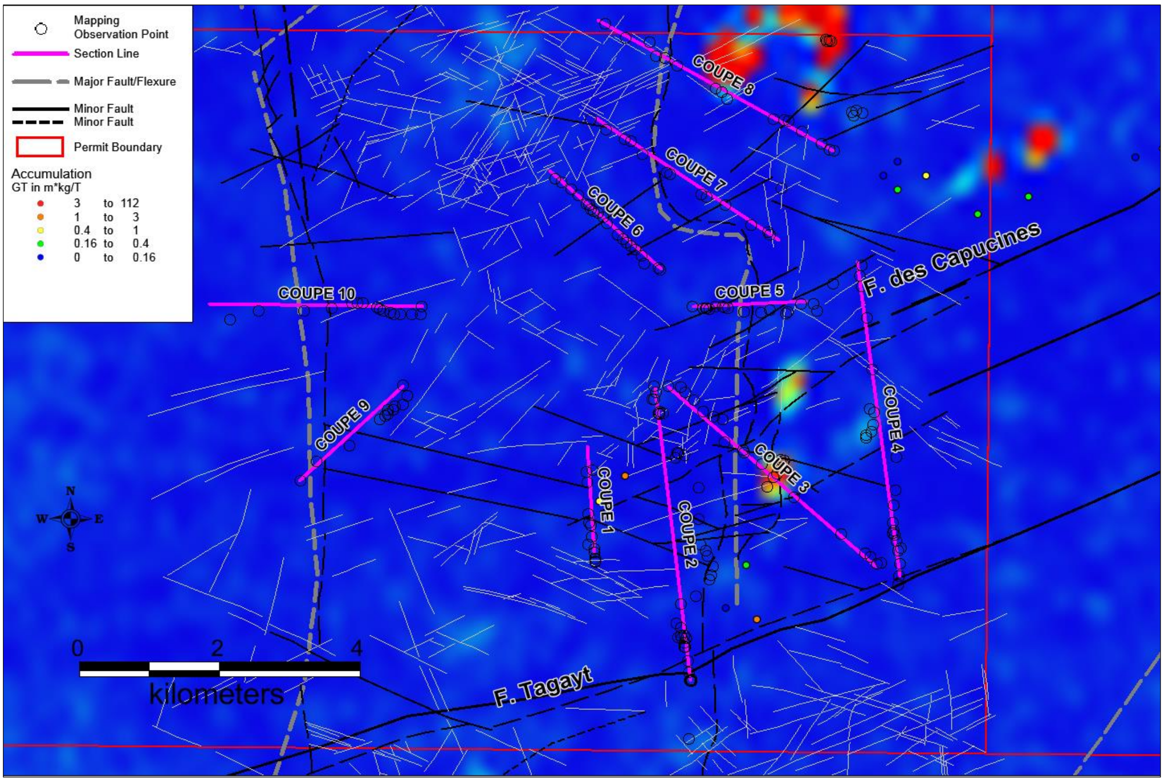


Figure 9-12: Mapping sections and locations over the U2/Th radiometric image, which shows the radiometric anomalies lying along faults.

9.4.4 2016

A radon survey was carried out over the Madaouela I mining permit in 2016. The survey covered two areas, 1st initially around the Miriam deposit, to see if the signature of Miriam could be used to find other anomalous areas nearby. A second area was west of the Marianne deposit, to look for radon extensions beyond the drilled areas.

Figure 9-15 and Figure 9-16 show the two anomalous radon flux zones. The grids were done using an inverse distance squared method and a full histogram stretch using the Mapinfo Discover software.

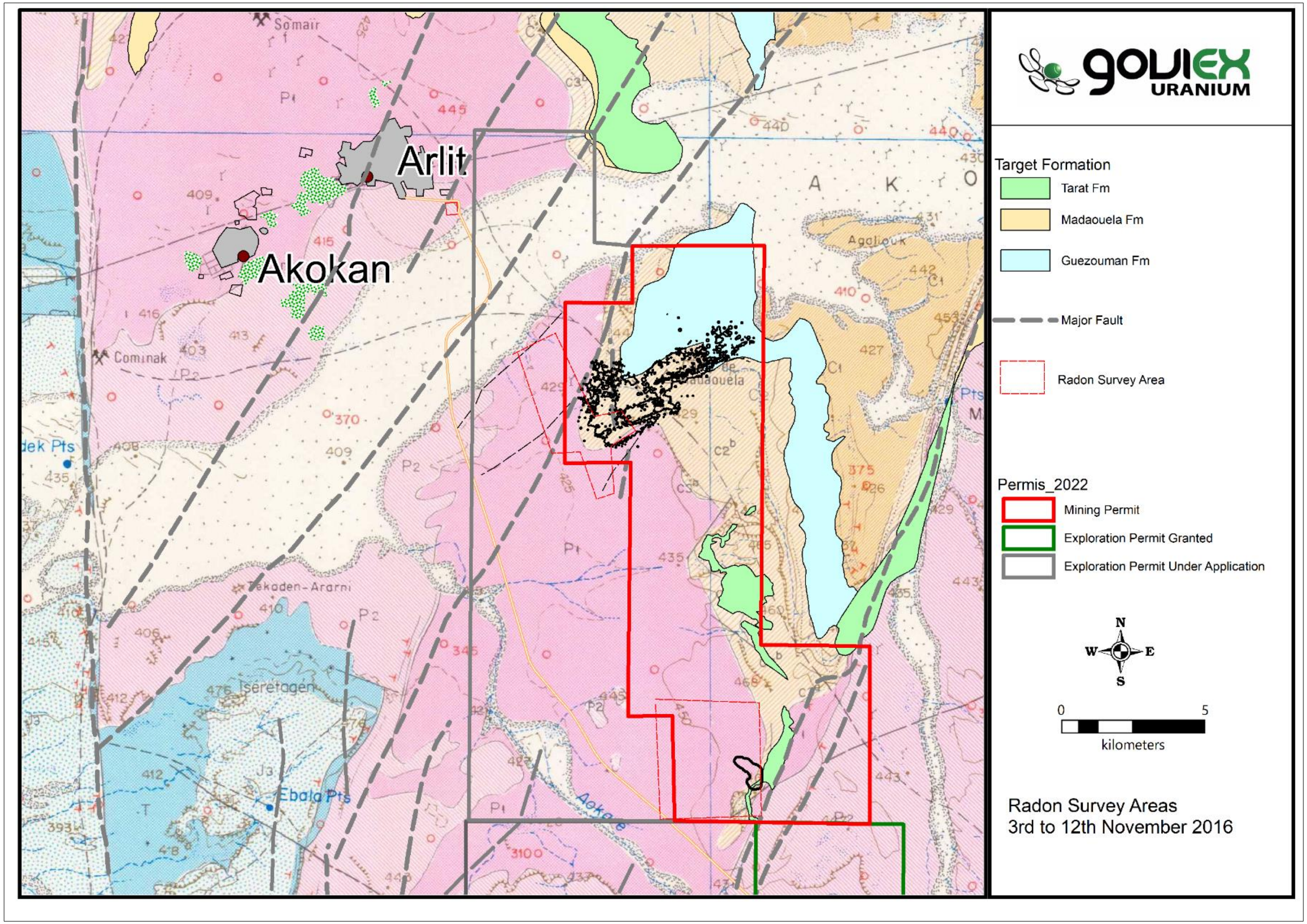


Figure 9-13: Location of survey areas near the Miriam and Marianne deposits

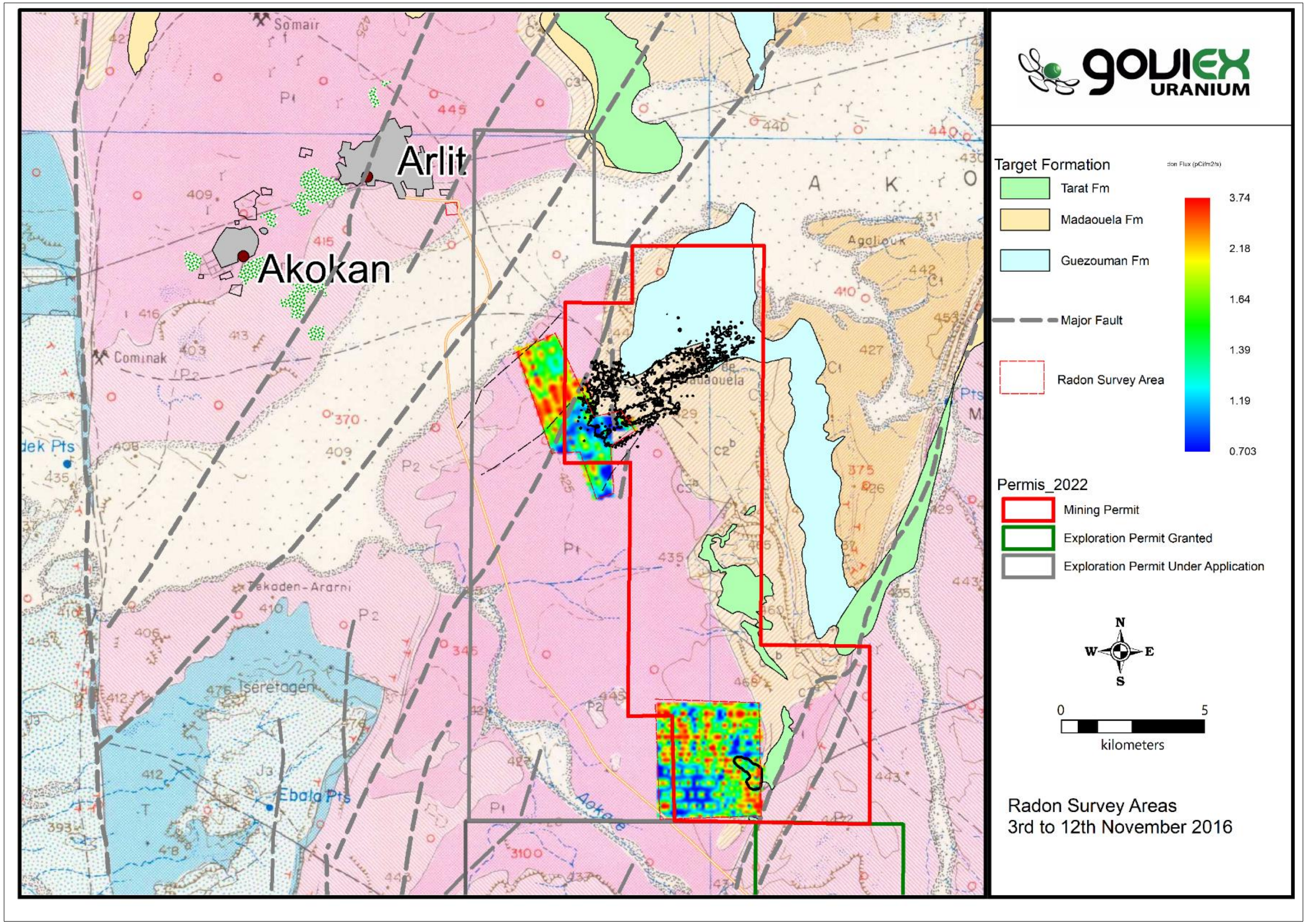


Figure 9-14: Gridded radon flux results from both areas.

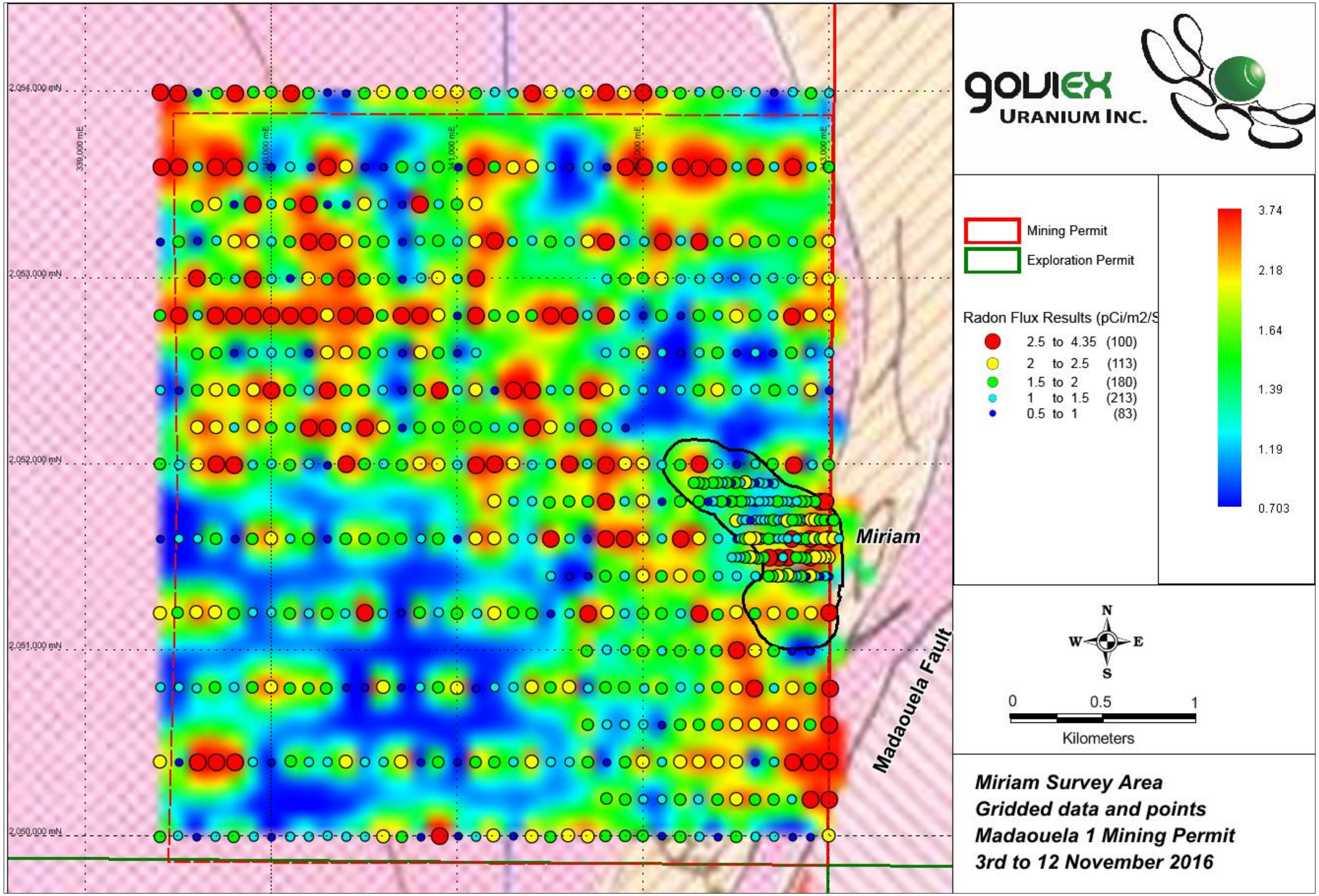


Figure 9-15: Miriam survey area with gridded radon flux results and points coloured by radon flux.

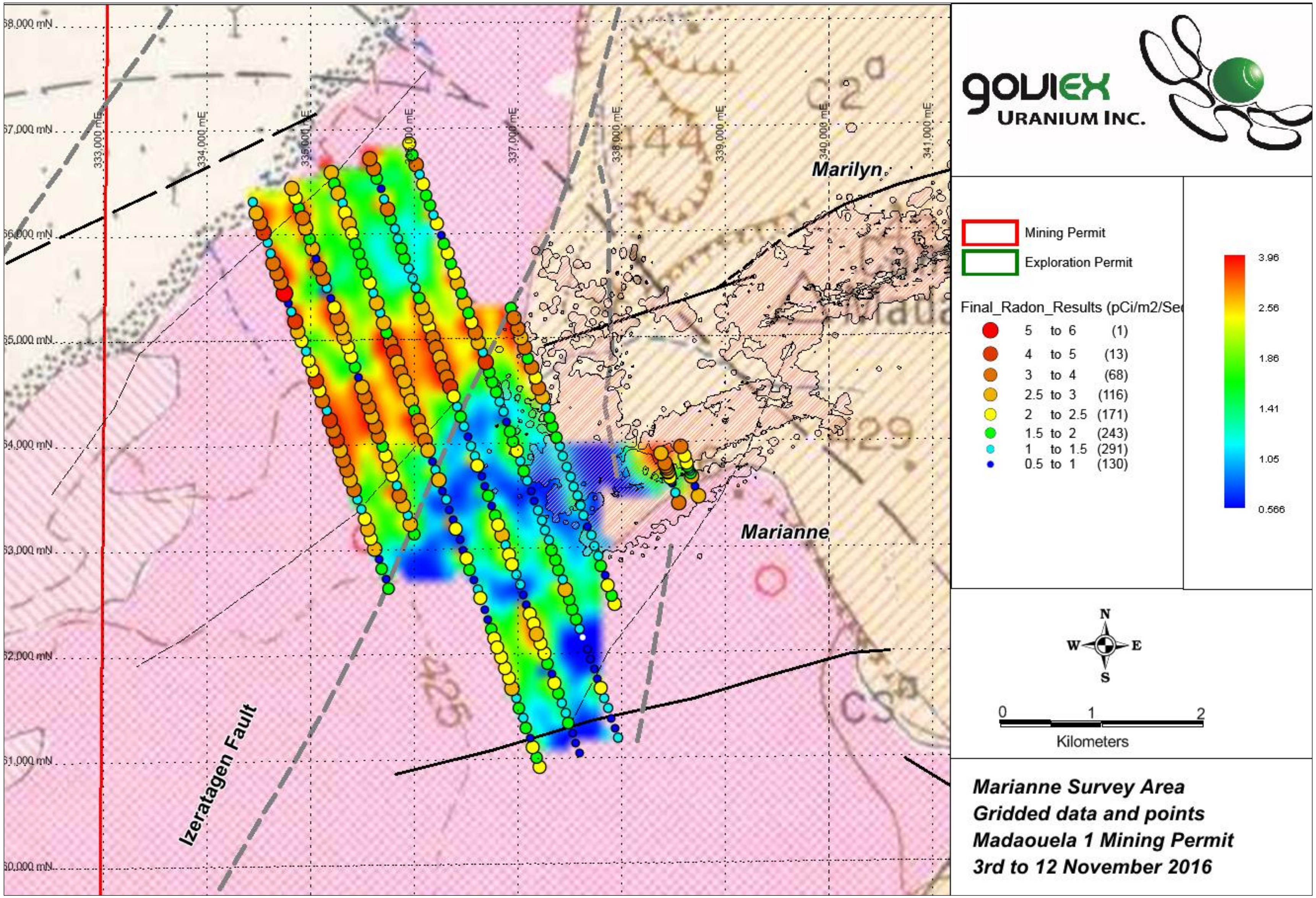


Figure 9-16: Marianne survey area with gridded radon flux results and points coloured by radon flux.

The radon flux results showed that there are areas of interest that should be tested by drilling near the Miriam and Marianne deposits. It also indicates that it could be useful as a first pass exploration technique allowing us to cover large areas relatively quickly and cheaply.

9.5 Drilling Miriam

In 2017**,** 32 drill holes for a total of 3,525 m, carried out by Nigerien company ESAFOR.

Drilling targeted a large radon anomaly located to the SW of the Miriam deposit for the purpose of increasing mineral resources. The drilling results however returned negative results. It appears the radon anomaly was actually offset from the Miriam deposit.

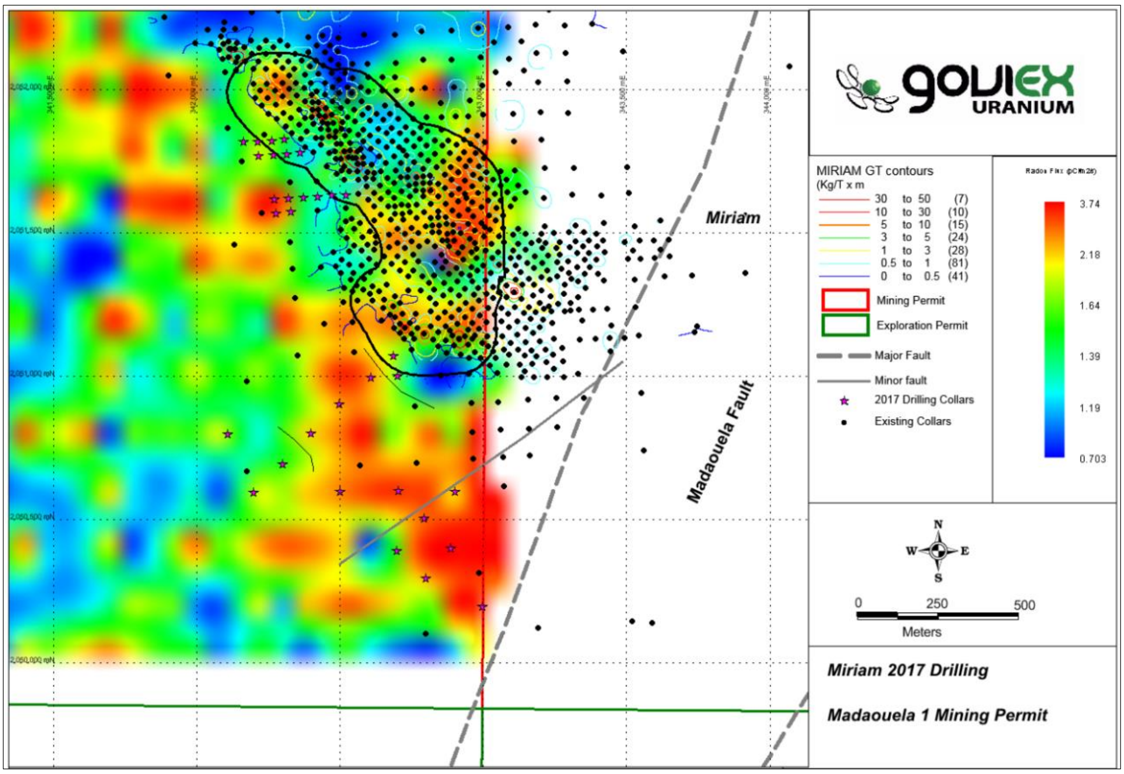


Figure 9-17: Final drilling locations.

9.6 Conclusions (SRK)

Extensive surface and sub-surface exploration has been conducted by GoviEx at Madaouela using industry best practice for the style and extent of mineralisation which occurs here. The detailed and regular spaced drilling has allowed the deposits to be outlined with a high degree of confidence, and coupled with the field mapping, structural, hydrographic and remote sensing analysis, has enabled the identification of additional potential.

10 DRILLING

10.1 Introduction

Between 1963 and 1965, the CEA drilled the area extensively, leading to the discovery of the Madaouela deposits (Marilyn and Marianne). CEA conducted drilling operations using drilling grids of 800 m over large areas and then locally reduced down to spacings of 100 m where required. The discovery of the Marilyn deposit was then drilled locally at 50 m and at closer drill spacing in the areas where a mining test was implemented with a view to sampling uranium mineralisation and investigating the rock quality underground.

From 2008 GoviEx started drilling and proceeded to drill Marianne and Marilyn to initially estimate an Inferred resource, which led to further drilling which has finally led to the current Measured, Indicated and Inferred resources over a number of deposits.

Drilling was the main tool of exploration used by the CEA in the 1960's and GoviEx followed the same procedures by initially drilling on a large 800 to 1600 m grid to obtain initial stratigraphic, redox and radiometric information. The use of historical results based on research of historical drilling data, from the Government archives mainly, proved to be partially successful even though only partial data could be found and some of the data content could not be verified. Historical results were extensively used to identify mineralised intersections, stratigraphic surfaces, and provided for orientation of the various drilling programs.

This led to re-drilling of old CEA holes either by reopening or fresh re-drilling and logging to confirm the results of the CEA, and furthermore the new results were considered the only reliable data collection that would be compliant with the new drilling data.

10.2 Organisation

The drilling campaigns have been monitored and supervised by GoviEx personnel. Geophysical logging has been conducted routinely with SEMM equipment operated by GoviEx personnel initially under the supervision of a geophysicist from SEMM. The SEMM geophysicist was in the first year responsible of the data acquisition and storage and conducted all QA/QC protocols, along with training of GoviEx staff. Geological survey, database entry and controls were implemented by GoviEx personnel. The raw data are stored in WellCad format. The working sequence (log circuit) is:

- Field Grid Implementation (pegging at various grid intervals dependent on purpose);
- Mud Pit on to be drilled sites;
- 30 minutes mud circulation upon completion of hole;
- Geophysical logging;
- Data control (WellCad, along Drillhole)
- Data transfer (WellCad to Utimine, and Coralis Data Base); 3D controls operated in UTIMINE prior to entry of new data in the GoviEx Coralis Database. This database has been tailored to GoviEx's needs by CORALIS and is compatible with any commercial database;
- Geological survey of rock chips (1 m spacing of samples, lithology, stratigraphy, colour of grain coatings and matrix composition, definition of standard redox state);

- Reporting drill data into Well Cad, Utimine, Coralis database;
- Daily afternoon meeting;
- QA/QC control;
- Finalizing of logs, Log transformation and grade transfers;
- Updating accumulation tables; and
- Sectional controls in UTIMINE.

The GoviEx exploration programs consisted of the following:

- A drilling contract was secured with the local drilling contractor ESAFOR or FORACO. ESAFOR is based in Arlit and has been drilling in the area for over 20 years on all the main Orano deposits. They are highly specialized in drilling the local rock formations and have an excellent record. FORACO is an international drilling company specialising in diamond drilling, with an office in Niamey.
- GoviEx recruited a qualified staff of geologists and prospectors having between four and ten years' experience in the geology and the exploration methods applied by Orano, or its subsidiaries (SOMAÏR and COMINAK). Some of the hired geologists had also worked with open pit and underground grade control. This unique panel of personnel with local experience helped enter directly into an intensive drilling phase and to apply the tried-and-tested procedures and methods developed at the mines in the district. To prevent confusion and a steep learning curve, GoviEx has used similar software and geological criteria use in the district.
- GoviEx organised three down-hole gamma logging units and personnel to run them. SEMM Logging of France (with an office in Niamey) was contracted to supply and organise the installation of the logging vehicles and to supervise GoviEx logging technicians. The GoviEx logging technicians were recruited locally, each with over three years' experience, acquired from other uranium projects in Niger. In addition, GoviEx purchased and mounted a logging unit (Mount Sopris) with a DHT 27 gamma probe, used as an international reference for in situ gamma measurements. This system was instrumental in determination of correlations between historical counts per second (CPS) gamma measurements and the CPS recorded by the routine SEMM equipment. The DHT 27 unit is also used as a permanent QA/QC control of radiometric probe data for over 25 % of the holes drilled.
- GoviEx purchased a complete set of digital global positioning (DGPS) surveying equipment (Rascal), and trained staff to use the equipment, in order to obtain rapid and accurate coordinates of drillholes.
- GoviEx opened an office and base location in Arlit, then Akokan, which is fully equipped with accommodation and office equipment to manage the exploration program. The facilities today include a walled storage facility with a water well in Arlit and offices in a secure compound in Akokan equipped with two main workstations, a portable computer for each geologist, a central printing and scanning unit, a large format plotter, and some temporary housing, offices, and food service facilities. All project working documents are prepared and printed at the Akokan office or in the Ebarghas' exploration camp.

Drilling was routinely performed using the rotary mud drilling technique, followed by geophysical logging (deviation, resistivity and radioactivity measured with scintillometer and Geiger Muller).

10.3 Work Programs

All exploration programs were executed and supervised by GoviEx staff, using local or external contractors including:

- ESAFOR, LEGENI and FORACO – Drilling;
- SEMM – Logging;
- ALS-Chemex – Assays of core for uranium and trace elements;
- MIR Technologies;
- ULC, with M Patrick Brunel, geophysicist, to validate the process of correlating SEMM gamma probes and the DHT27 probe; and
- Dr Amit Tripathi, independent consultant, for the training and QA/QC of Rascal DGPS surveying system.

10.4 Exploration and Development Drilling

10.4.1 MAD I (Including Agaliouk)

Historically the Marilyn and Marianne deposits were drilled by CEA teams (1963-1965) using an average 100 m square grid. This spacing was considered in 1965 sufficient to define reasonably assured resources. A number of zones of interest were identified using a much larger grid (from 800 m to 400 m), with the exception of a small area in the southern part of Mad I. PNC drilling from 1980 to 1992, largely as in-fill definition drilling for the PNC feasibility level study of Marianne-Marilyn.

The GoviEx exploration program commenced in August 2008, following property acquisition in 2007. Between 2008 and 2010 almost all of the drilling undertaken was focused on the Mad I property, and was a combination of exploration and in-fill resource definition drilling. The main reasons for the focus on the Mad I property were;

- known resources at Marianne and Marilyn;
- in August 2008 GoviEx entered into a USD 28 M funding agreement with Cameco, which was conditional on a commitment to invest the majority of the funds in Mad I, and;
- during 2008 - 2009 security issues required GoviEx to operate close to the military camp on Mad I.

GoviEx's drilling program on the Madaouela Uranium Project has been a combination of exploration and development and has been driven by a number of factors including commercial and security.

Table 10-1 summarises GoviEx's exploration drilling program for the period August 2008 to October 2021.

Table 10-1: Summary of GoviEx drilling program for the period August 2008 to October 2021

	Drill	2008		2009		2010		2011		2012		2013		2017		2021		TOTAL	
Deposits	**Type**	**Number**	**Total (m)**	**Number**	**Total (m)**	**Number**	**Total (m)**	**Number**	**Total (m)**	**Number**	**Total (m)**	**Number**	**Total (m)**	**Number**	**Total (m)**	**Number**	**Total (m)**	**Number**	**Total (m)**
MARTINE	Water well									0	0	0	0						
	RDH			0	0	27	1,351	0	0	0	0	0	0					27	1,351
	mixed RDH-DDH			0	0	0	0	0	0	0	0	0	0					0	0
	Reopening historical DH					4	201	0	0	0	0	0	0					4	201
MARIANNE	Water well	1	84							0	0	1	266					2	350
	RDH	560	57,162	351	29,740	97	11,627	24	2,824	1	266	499	44,129			3	215	1,535	145,963
	mixed RDH-DDH	42	316	24	150	0	0	0	0	112	12,270	13	569			26	1943	217	15,248
	Reopening historical DH	59	5,086	42	3,192	5	592	0	0	19	1,704	0	0					125	10,574
MARILYN	Water well									0	0	0	0					0	0
	RDH			643	37,323	61	3,140	59	2,179	141	9,238	114	6,517					1,018	58,396
	mixed RDH-DDH			5	30	0	0	48	981	7	470	0	0					60	1,480
	Reopening historical DH			134	9,612	18	875	0	0	0	0	0	0					152	10,487
MAD SOUTH	Water well			0	0	1	152			2	288	0	0					3	440
	RDH			165	23,141	577	77,458	49	6,556	898	109,632	202	19,308	32	3,574	5	152	1,896	236,247
	mixed RDH-DDH			0	0	0	0	20	208	49	3,374	38	2,698			141	13,596	248	19,876
	Reopening historical DH			24	2,648	40	5,157	40	4,488	45	5,049	0	0					149	17,341
MAD I EXPLO	Water well			0	0	1	409			1	192	1	137					3	738
	RDH			0	0	8	3,140	176	48,077	95	22,551	0	0					279	73,768
	mixed RDH-DDH			0	0	0	0	0	0	3	796	0	0					3	796
	Reopening historical DH			0	0	2	767	0	0	0	0	0	0					2	767
MAD I CUMUL	Water well	1	84	0	0	2	561			4	745	2	403			0	0	8	1,528
	RDH	560	57,162	1,159	90,204	770	96,717	308	59,637	1246	153,690	815	57,186	32	3,574	8	367	4,755	515,725
	mixed RDH-DDH	42	316	29	179	0	0	68	1,189	78	6,344	51	3,424			167	15,539	528	37,400
	Reopening historical DH	59	5,086	200	15,452	69	7,592	40	4,488	45	5,049	0	0			0	0	432	39,370

Note: Mad I Cumul includes Madaouela I and Agaliouk

The majority of the drilling carried out by GoviEx was completed on the Madaouela I license (which was then split into the Madaouela I and Agaliouk licenses). The drilling activities started in August 2008, after permission was granted to conduct drilling west of the Madaouela Army Base, and initially focussed on development drilling of Marianne on a 50 m grid with a total of 62,648 m drilled in 2008.

Drilling east of the army camp was authorized in April 2009, enabling drilling to commence the 50 m grid on Marilyn. Development drilling on Marianne and Marilyn has continued until March 2013 as the size of the deposit has increased and further in-fill definition drilling has been required. The development drilling completed on Marianne and Marilyn since September 2012 has now been included in the resource update.

In order to increase the global potential and define inferred resource in areas historically drilled on a large grid (800 m to locally 400 m), from 2009 drilling targets were identified in the area south of the Marianne deposit. The drilling targets were identified by similarity with the geological controls defined for the Marianne-Marilyn mineralisation as previously discussed.

Known historical drill intercepts that were in the suspected redox boundary trend line were drilled on a 200 m grid basis.

One area was discovered in the north east of the Madaouela South area (MSNE) and two smaller zones further south (MSCE, which was in fact the “historical” main CEA target). Drilling since February 2010 in the southern part of the area has confirmed the newly discovered Miriam deposit, together with the discovery of a new area termed the MSEE (Mad South Extreme East) deposit, of similar thickness and grade to the MSNE deposit. In 2012 the Maryvonne deposit was discovered.

Between 2008 and the end of 2013 a total of 2,550 holes were drilled totalling 20,415m on the Marianne and Marilyn deposits. Over the same period a total of 518,170 m were drilled on the Mad I and Agaliouk licenses with 4,890 holes. Included in this drilling was the discovery of the La Banane deposit (on the Agaliouk license), which is the first deposit to be discovered in the Madaouela sandstones.

Table 10-2: Summary of core drilling and sampling

Secteurs	Number Holes	Total Metres
Marianne	191	13,304
Marilyn	60	1,480
MAD South	248	19876
MAD I Explo	3	796
Totals	**361**	**11,452**

Diamond core drilling was carried out initially on Marianne to obtain a correlation between assays and radiometric data, this was subsequently followed by drilling over the other known deposits for stratigraphic correlation, but also as further validation of the correlation factor used from the initial Marianne core. Cores were sampled and prepared on the basis of industry standards, and assayed by ALS-Chemex in Johannesburg, South Africa.

In 2017, 32 mud rotary drill holes for 3,574 m were drilled on the south western edge of the Miriam deposit to test the results of a radon survey carried out the previous year. This proved to be unsuccessful.

In 2021, GoviEx carried out a diamond drilling program over the Miriam and Marianne deposits, in order to obtain samples for chemical assay to enable the modelling of molybdenum resources as well as confirming eU grades derived from downhole radiometric surveys.

In addition to the diamond drilling program, 6 holes were completed for geotechnical purposes within the proposed Miriam open pit area, 14 short diamond holes were also completed for the civil engineering of the process plant area, and a further 5 mud rotary holes were drilled over the planned process plant area for sterilisation purposes. No significant mineralisation was found in the sterilisation holes.

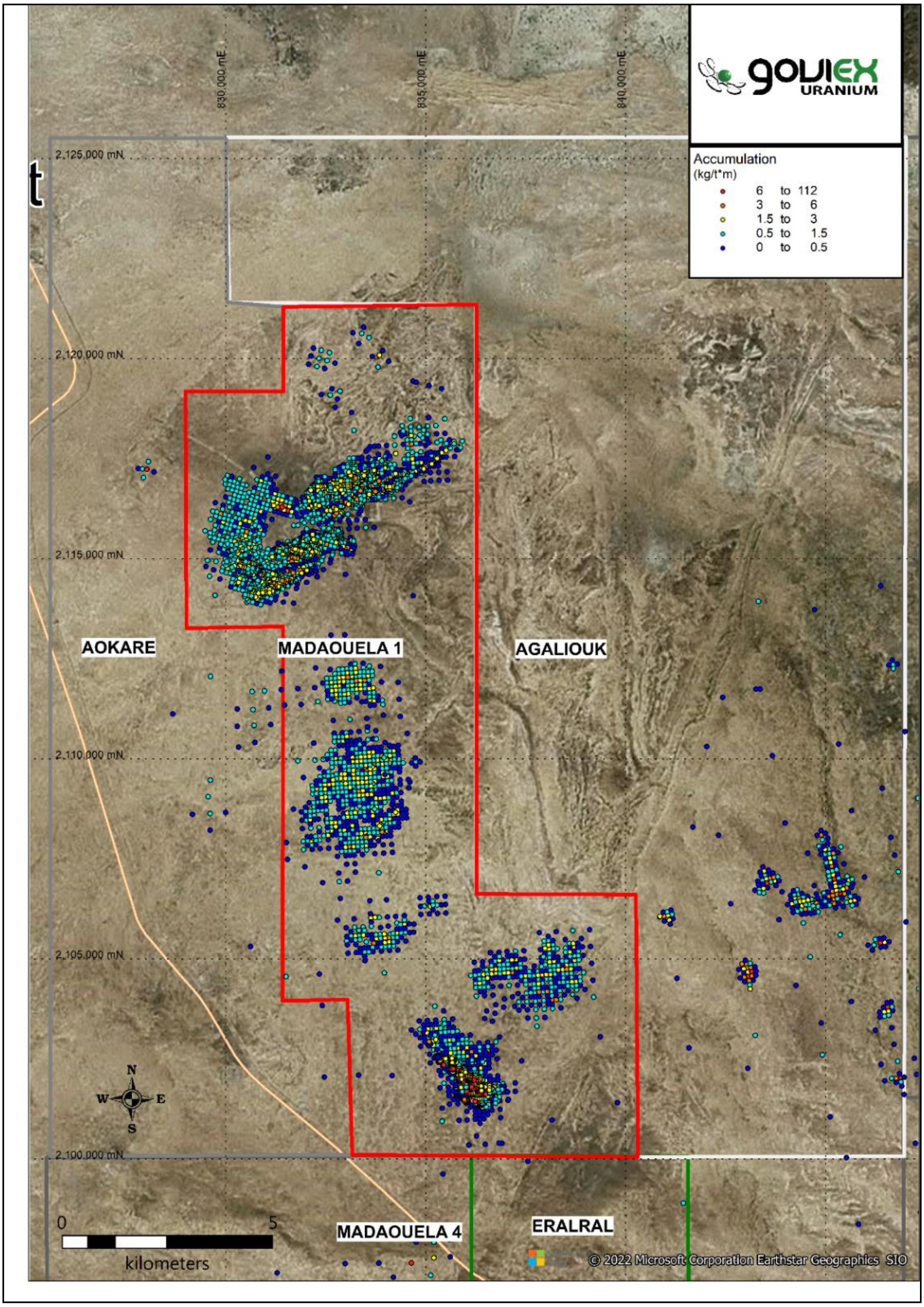


Figure 10-1: Drill hole positions and GT on Mad I and Agaliouk licences

Mad I is to be mined by COMIMA which is owned 80 % by GoviEx Niger Holdings Ltd. and 20 % by the Government of the Republic of Niger. GoviEx has 100 % ownership of Mad I, and Eralral, and filed applications on January 29, 2019 for MAD 2, 3, 4 and Anou Melle which are pending. Aokare licence was applied for on March 01, 2022. The Agaliouk licence was relinquished in October 2021.

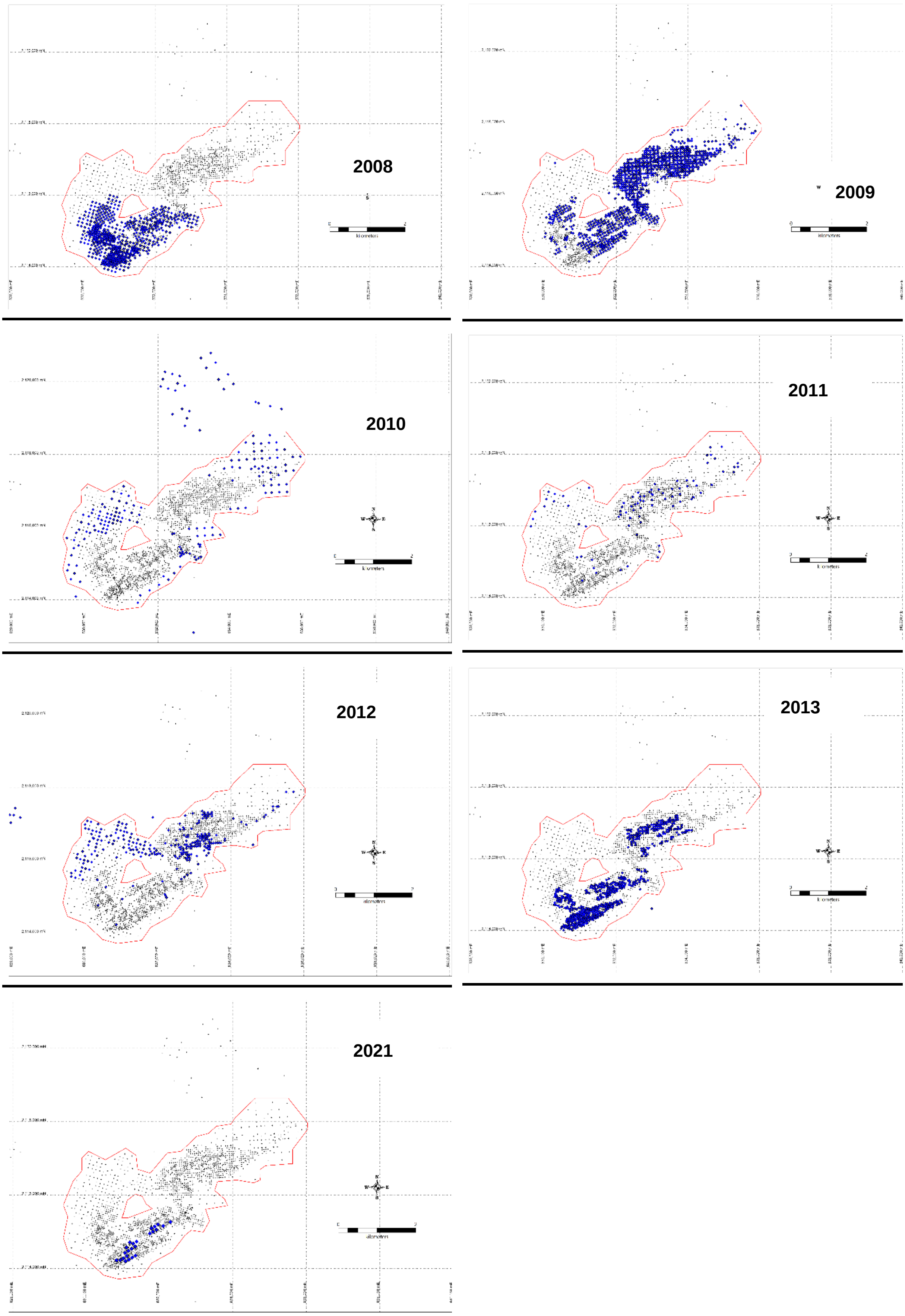
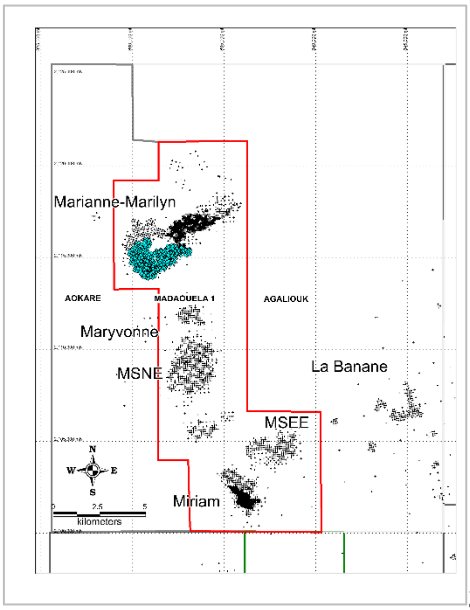
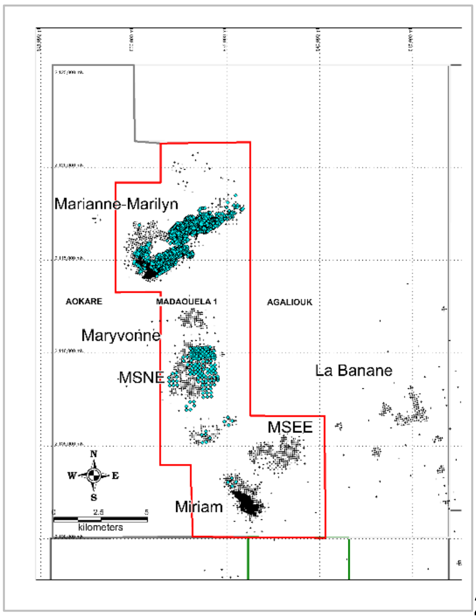


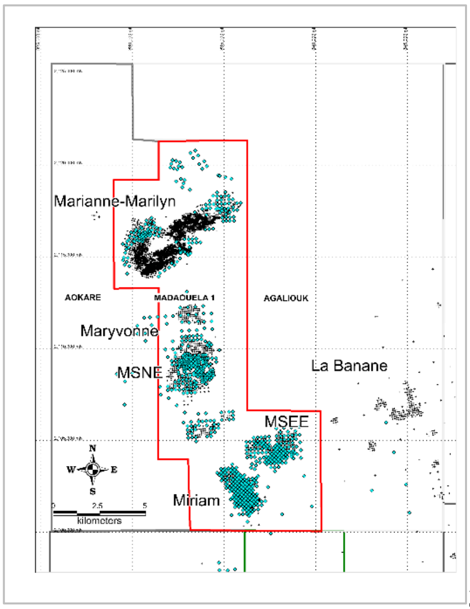
Figure 10-2: Drilling Progress at Marianne and Marilyn over time



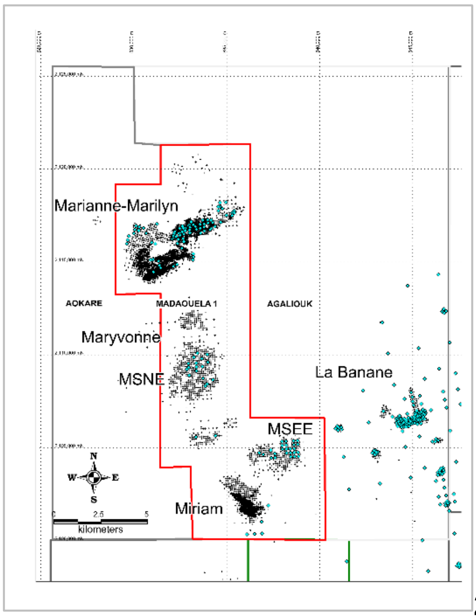
2008



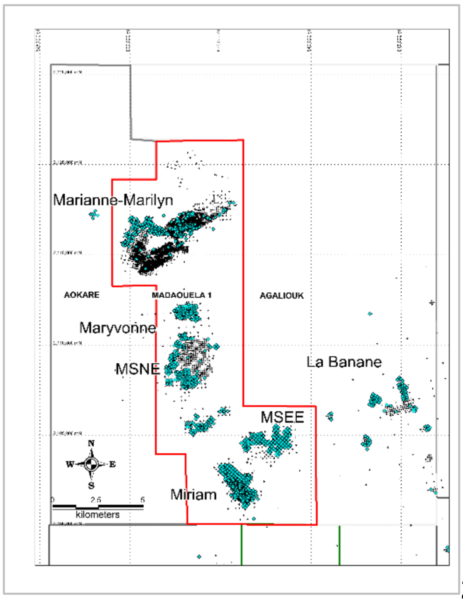
2009



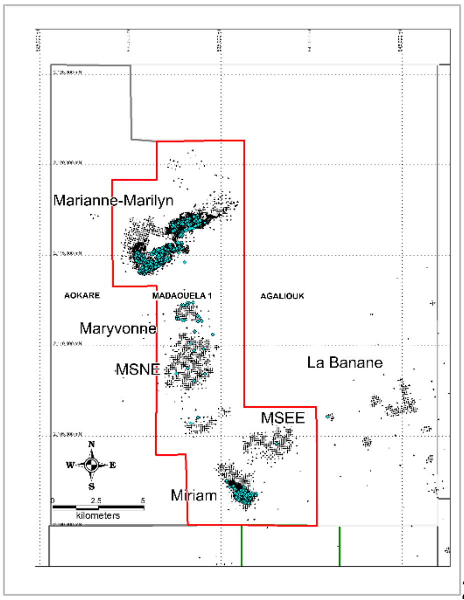
2010



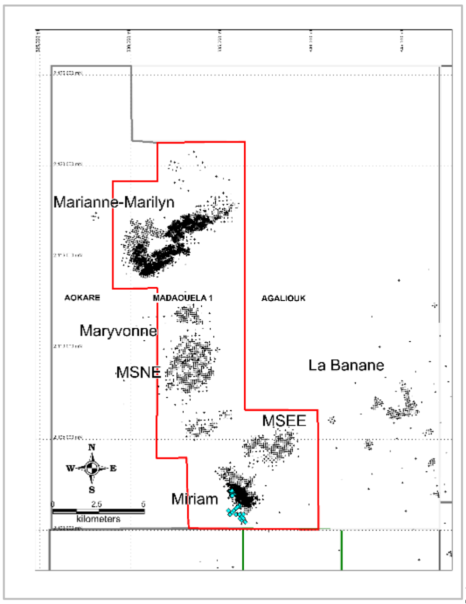
2011



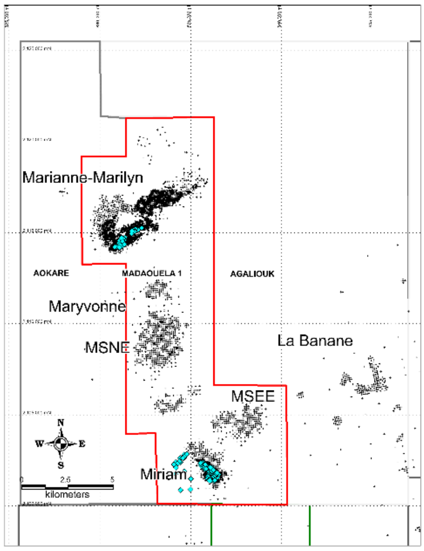
2012



2013



2017



2021

Figure 10-3: Drilling Progress at MAD I (incl. Agaliouk) over time (2008 – 2021)

Madaouela II, MAD III, IV, Eralral and Anou Melle

Exploration on these properties started in April 2010 and continued until 2013 except at Anou Melle where it ended in July 2010. The distance to the drilling camp and the poor state of available drilling rigs at the time, resulted in an earlier stop to this program.

The subsequent exploration activity then was concentrated east of the Madaouela fault on Mad II, Mad III, Mad IV and Eralral from August 2010 to January 2013, following the purchase of three new rotary drills by GoviEx. The exploration was conducted at 3,200 m grid on EW profiles, and following redox interpretation profiles at a 1,600 m grid were drilled on the northern part of Mad IV and Mad III.

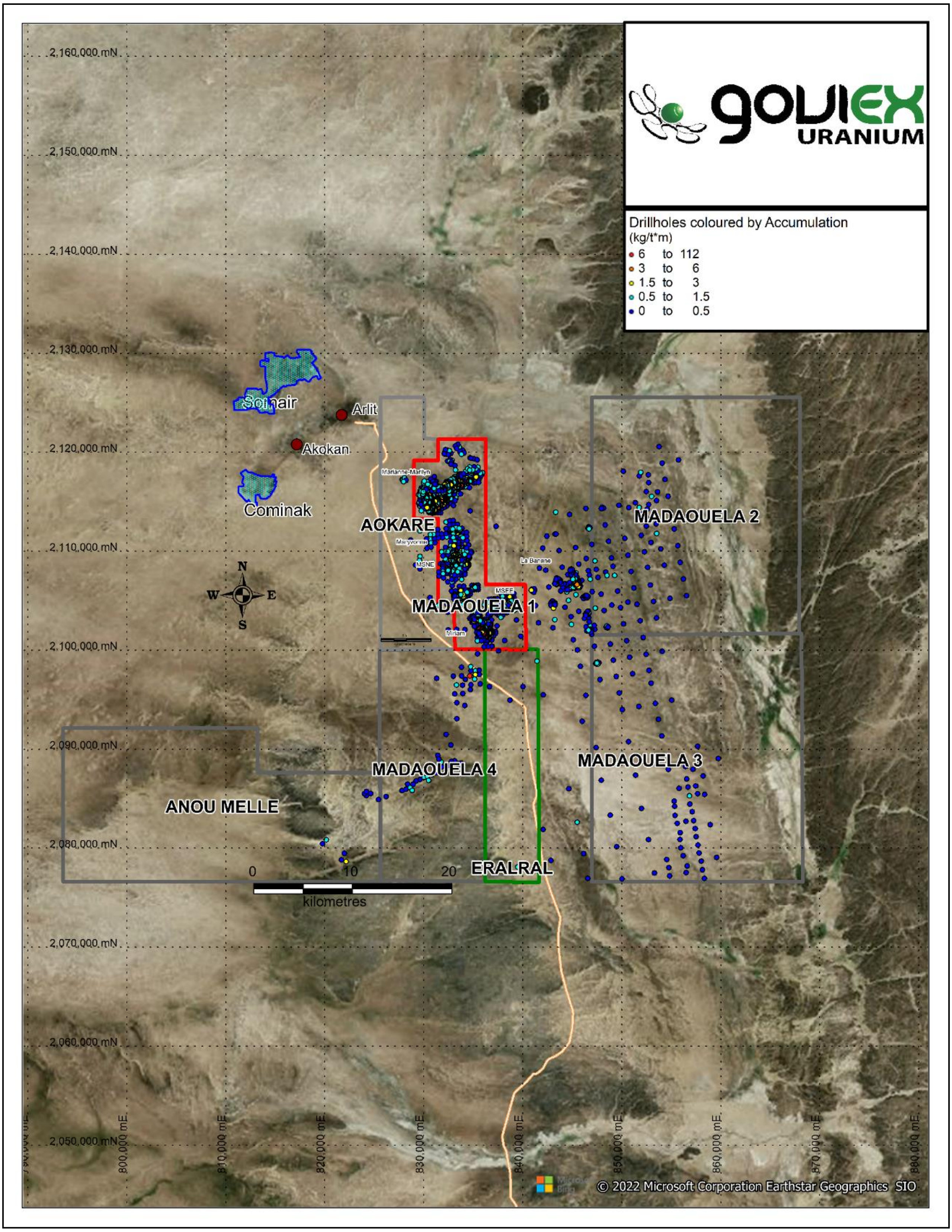


Figure 10-4: Position of GoviEx drill holes

MAD II

As of 2010 onwards activities started on MAD II, including surface mapping along sections (Figure 10-5), debouchage/reopening of old CEA holes to check their readings and grid drilling at 1.6 to 3.2 km spaced lines. The results were encouraging with intercepts within the Madaouela, Tarat, Tchinezogue and the Guezouman Formations, see Table 10-4, Table 10-5 and Figure 10-6.

Table 10-3: Summary drilling activities- Debouchage means re-opening of old CEA holes, and re-logging with resistivity and gamma tools.

	Year	Number holes	Depth (m)
Debouchage	2010	2	746.52
	2011	10	1,687.21
Drilling	2010	3	570.85
	2011	48	9,624.99
	2012	0	0
	2013	7	11,75.24

Table 10-4: GoviEx drill intercepts at 400 ppm cut off within the Guezouman

Hole_ID	From (m)	To (m)	Th (m)	GTh	G (kg/t)	Formation
MAD20004	145.8	146.4	0.6	0.44	0.74	GUEZ
MAD20005	167.8	168.2	0.4	0.19	0.49	GUEZ
MAD20009	94.2	94.6	0.4	0.17	0.43	GUEZ
MAD20011	214.8	215.2	0.4	0.24	0.6	GUEZ
MAD20013	136.6	137.2	0.6	0.53	0.89	GUEZ
MAD20020	255.2	255.6	0.4	0.28	0.69	GUEZ
MAD20029	265	265.4	0.4	0.33	0.82	GUEZ
MAD20035	171	171.6	0.6	0.37	0.62	GUEZ
MAD20044	280	280.8	0.8	0.48	0.6	GUEZ
MAD20046	242.2	243	0.8	0.42	0.52	GUEZ
TALA197	143.8	144.6	0.8	0.78	0.97	GUEZ
TALA228	123.6	124	0.4	0.23	0.57	GUEZ
TALA229	122.4	122.8	0.4	0.29	0.73	GUEZ
TALA231	152.2	152.6	0.4	0.22	0.54	GUEZ
TALA234	155.2	155.8	0.6	0.54	0.89	GUEZ
TALA248	166	166.8	0.8	0.96	1.2	GUEZ

Table 10-5: GoviEx Drill Intercepts within other formations, including the Tarat, Madaouela and Tchinezogue (UTT)

Hole_ID	From (m)	To (m)	Th (m)	GTh	G (kg/t)	Formation
MAD20004	17.4	18.4	1	0.58	0.58	TARA
MAD20005	20.2	20.6	0.4	0.26	0.66	TARA
MAD20020	120.6	121.2	0.6	0.33	0.55	TCHI
MAD20036	119.2	120.2	1	1.04	1.04	TCHI
MAD20043	124	124.4	0.4	0.23	0.58	TCHI
MAD20047	96.2	96.8	0.6	0.32	0.53	MADA
MAD20047	130	131.4	1.4	0.81	0.58	TARA
MAD20048	95.2	96.4	1.2	0.77	0.64	MADA
MAD20048	122.6	123	0.4	0.24	0.59	MADA
MAD20049	93	93.4	0.4	0.2	0.49	MADA
MAD20050	118	119.2	1.2	0.96	0.8	MADA
TALA206	51	51.6	0.6	0.41	0.68	UTT
TALA231	27	27.4	0.4	0.21	0.53	TARA
TALA234	26.8	27.2	0.4	0.23	0.56	TARA

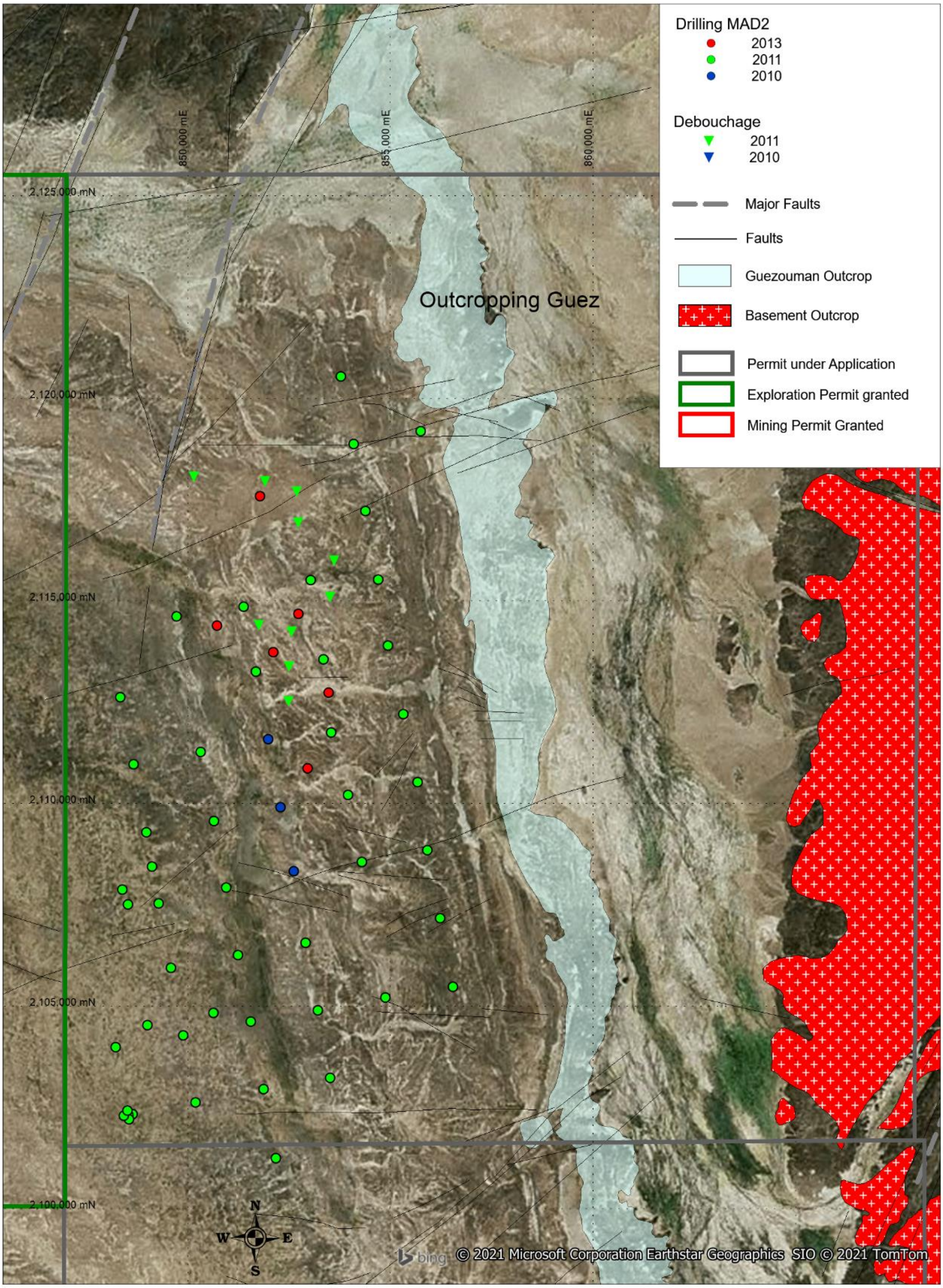


Figure 10-5: MAD II GoviEx drill hole locations showing holes that were re-opened and newly drilled holes, coloured by date drilled.

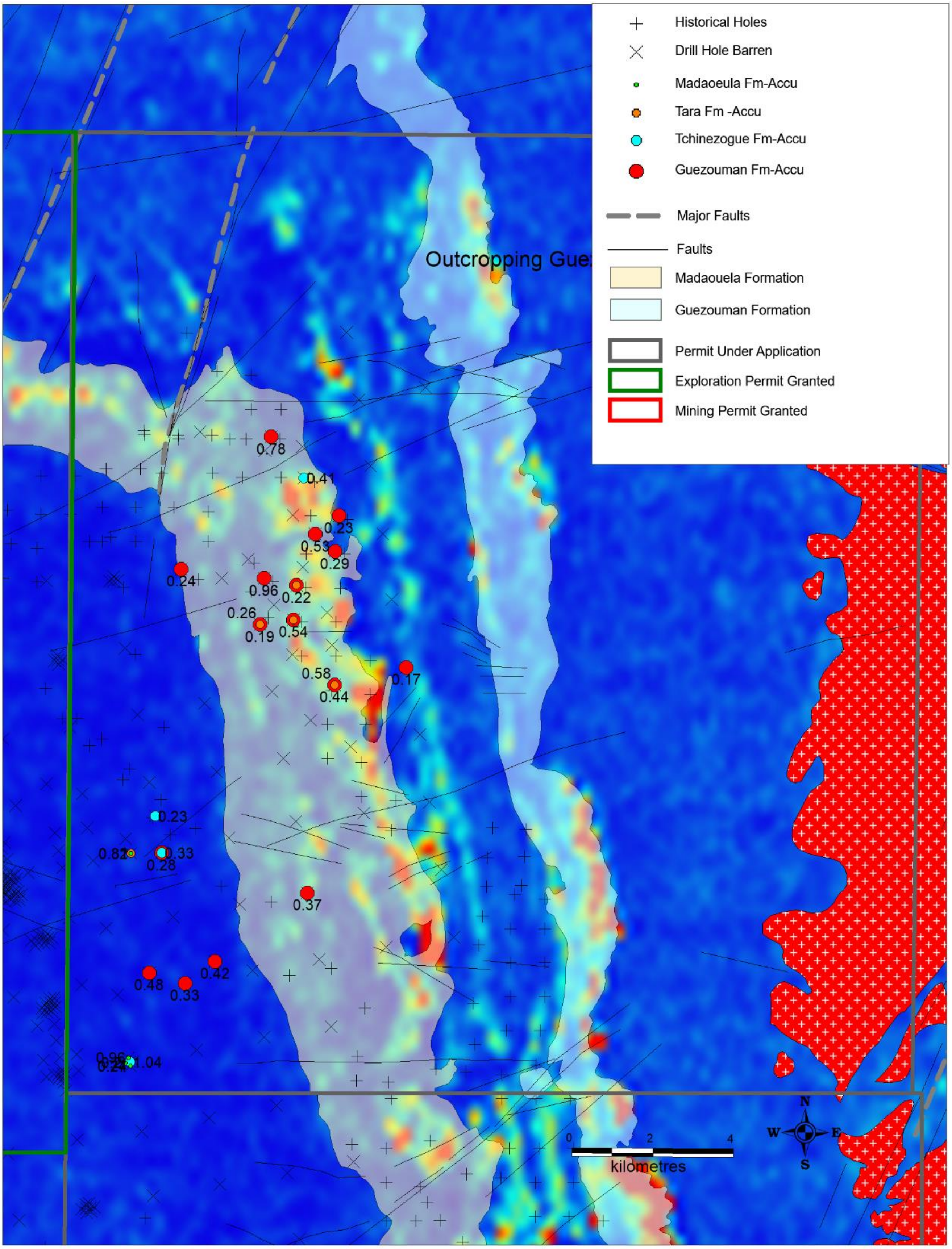


Figure 10-6: MAD II Significant intercepts by formation.

MAD III

From 2011 onwards activities started on MAD III, including surface mapping along sections, grid drilling at 800 m to 1,600 m spaced lines (Figure 10-7). The results were encouraging with intercepts within the Madaouela, Tarat, Tchinezogue and the Guezouman. See Table 10-7.

Table 10-6: Summary drilling activities.

Year	Number holes	Total metres
2011	64	16,292
2013	1	424

Table 10-7: GoviEx drill intercepts at 400 ppm cut off

Hole_ID	Project	From (m)	To (m)	Th (m)	Gth	G (kg/t)	Formation
SMAD300021	MAD_3	288	288.4	0.4	0.18	0.46	GUEZ
SMAD300041	MAD_3	302	302.4	0.4	0.28	0.7	GUEZ
SMAD300421	MAD_3	285.4	286	0.6	0.44	0.73	GUEZ
SMAD300541	MAD_3	102	102.6	0.6	0.43	0.72	TARA
SMAD300541	MAD_3	198	198.4	0.4	0.36	0.9	GUEZ
SMAD300541	MAD_3	199.2	199.8	0.6	0.36	0.59	GUEZ
SMAD400031	MAD_3	160.6	161.6	1	0.91	0.91	TARA
SMAD400151	MAD_3	156.6	157	0.4	0.31	0.78	MADA
SMAD400161	MAD_3	163.2	163.6	0.4	0.36	0.9	MADA
SMAD400171	MAD_3	152.8	153.8	1	3.21	3.21	MADA
SMAD400281	MAD_3	151.2	151.8	0.6	0.92	1.54	MADA

Note: MAD IV prefixed holes were misnamed and is reported under MAD4 drilling

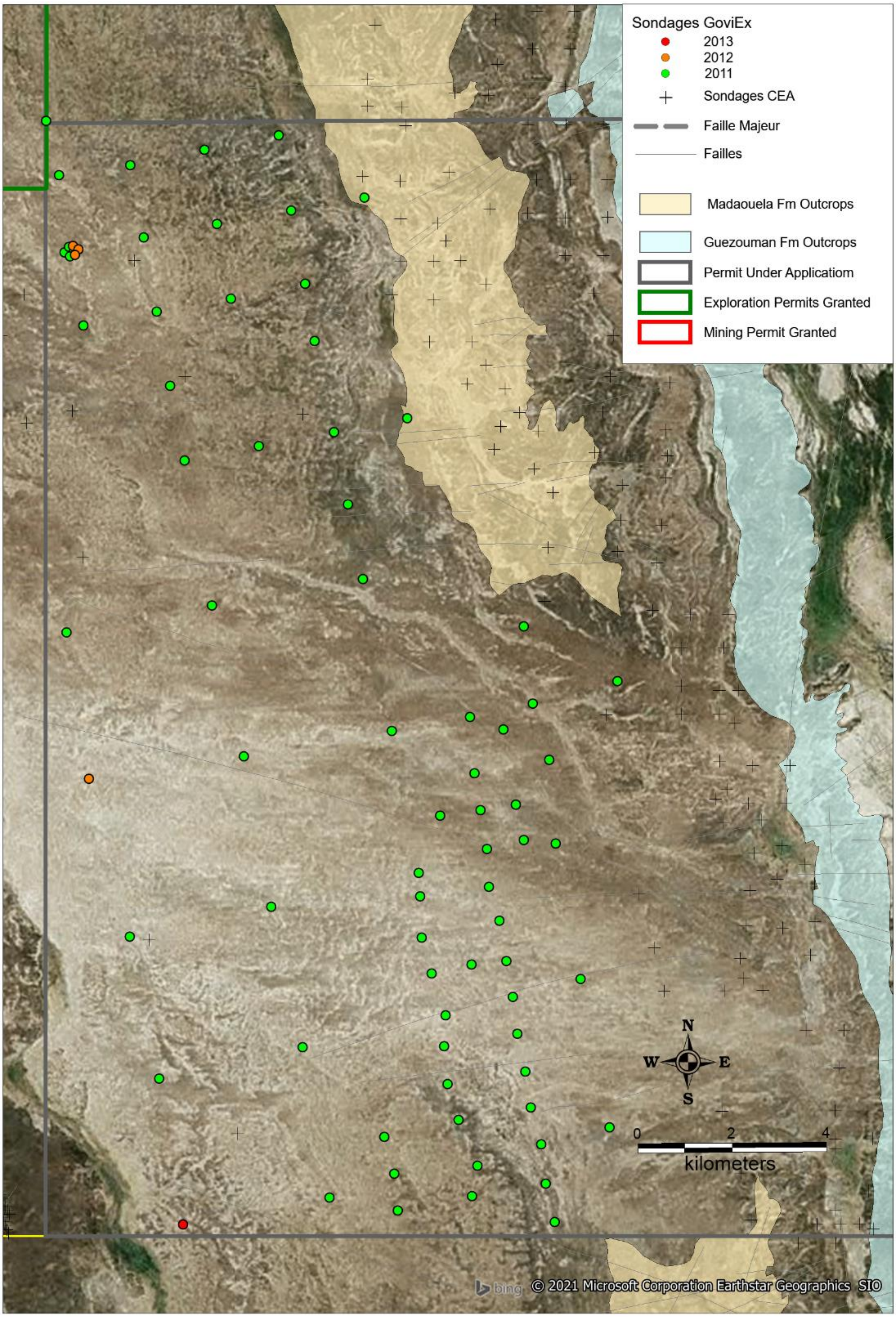


Figure 10-7: GoviEx drill hole locations, coloured by date drilled.

MAD IV (Including Eralral Application Area)

The drilling carried out over the MAD IV licence area (including Eralral) spans the period 2010 to 2013. The 2010 drilling was focussed around known anomalies from CEA or PNC drilling results, from there follow up drilling in 2012 and 2013 around the same areas as well as a focussed drilling over an area of radiometric anomaly in 2013 (Figure 10-8). In 2011, most of the drilling consited of large spaced grid drilling for mainly stratigraphic and exploration purposes.

Table 10-8: Summary drilling activities

Year	Number holes	Total metres
2011	20	7,959
2012	19	6,096
2013	37	11,217

Table 10-9: GoviEx accumulated drill intercepts at 400 ppm cut off

Hole_ID	From (m)	To (m)	Thickness (m)	GT	G (kg/T)
SMAD400051	189.2	190	0.8	0.72	0.9
SMAD400061	365	365.4	0.4	0.16	0.41
SMAD400081	408.8	409.2	0.4	0.25	0.62
SMAD400111	474.4	475.6	1.2	0.56	0.46
SMAD400211	446.4	470	1.2	1.24	1.04
SMAD400231	213.4	273.6	1.6	1.34	0.83
SMAD400321	224.8	225.2	0.4	0.21	0.53
SMAD400341	115.8	117.4	1.6	6.21	3.88
SMAD400411	116.8	117.4	0.6	0.65	1.08
SMAD400431	150	150.4	0.4	0.18	0.45
SMAD400481	287	288	1	0.95	0.95
SMAD400491	259.2	277	1.4	0.93	0.67
SMAD400501	276.2	276.8	0.6	0.86	1.43
SMAD400511	240.8	241.2	0.4	0.17	0.42
SMAD400521	4.2	4.8	0.6	0.44	0.73
SMAD400531	254.4	255.4	1	0.86	0.86
SMAD400541	370.6	371	0.4	0.26	0.66
SMAD400551	6.2	7.4	1.2	0.93	0.77
SMAD400571	282.4	282.8	0.4	0.21	0.52
SMAD400591	417.2	417.8	0.6	0.32	0.53
SMAD400601	10.2	12.2	1.4	0.76	0.54
SMAD400611	245.8	288	0.8	0.4	0.5
SMAD400621	283.4	284.2	0.8	1.11	1.39
SMAD400641	248	248.6	0.6	0.35	0.58
SMAD400651	268.2	268.6	0.4	0.25	0.63
SMAD400731	255.4	256	0.6	0.4	0.67
SMAD400751	305.6	306.4	0.8	0.53	0.67
SMAD400761	292.2	293.2	1	0.66	0.66
SMSNE44581	73.8	74.4	0.6	0.83	1.39
SMSNE45211	92	92.8	0.8	0.79	0.98
SMSNE45241	97.8	139.6	2.4	1.77	0.74

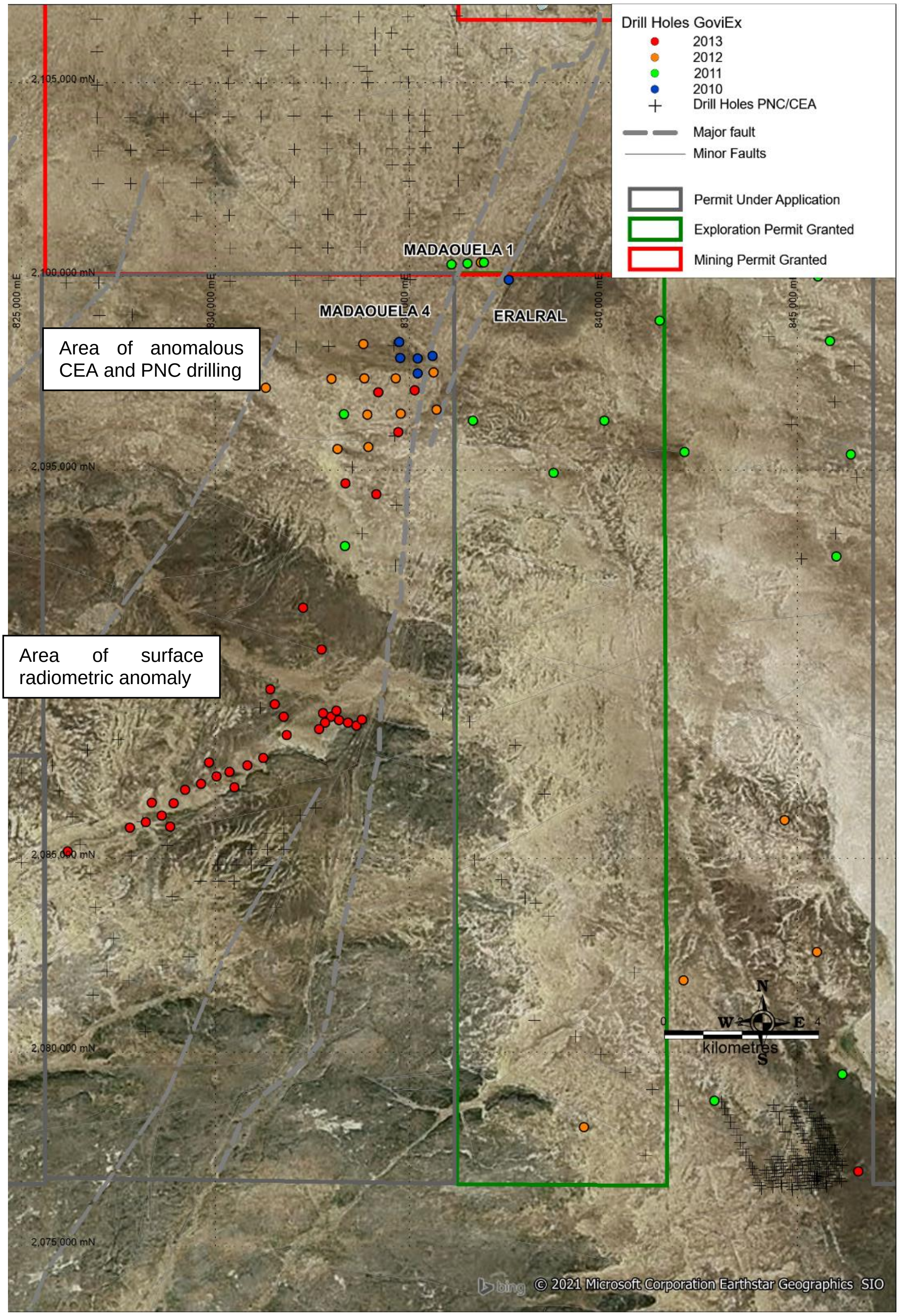


Figure 10-8: MAD IV including Eralral drilling collar position, coloured by date

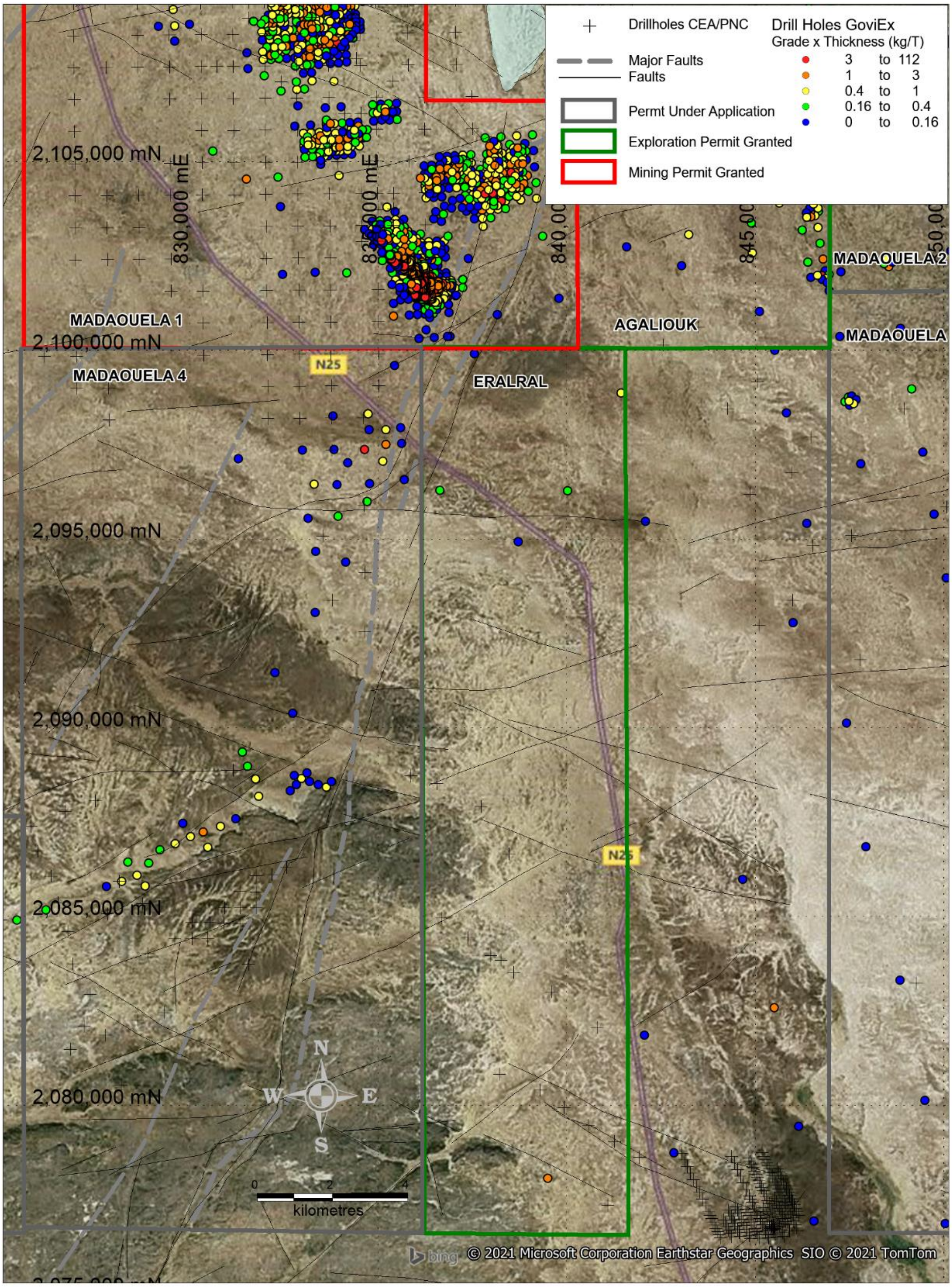


Figure 10-9: MAD IV including Eralral drilling collar position, coloured by grade accumulations

Anou Melle

In 2010, GoviEx carried a preliminary drill program over the Anou Melle licence. As previously reported for logistical and security reasons and the poor quality of the drill rigs, the program was abandoned and no further follow up were carried out due in changes in priority. Mapping in 2014 reveals the prospectivity of the area.

Table 10-10: GoviEx drill intercepts at Anou Melle, using a 400 ppm uranium cut off

Hole_ID	From (m)	To (m)	T (m)	GT	G (kg/T)	Formation
SMAD40056	281.6	282.2	0.6	0.24	0.4	Tarat
SANOU5001	329.2	329.6	0.4	0.24	0.61	Tchinezogue
SANOU5003	40.6	41.2	0.6	0.26	0.44	Moradi
SANOU5003	328.6	329	0.4	0.23	0.57	Guezouman
SANOU5005	404.6	405.2	0.6	0.49	0.82	Guezouman
SANOU5007	351.2	351.6	0.4	0.33	0.83	Guezouman
SANOU5008	20	20.8	0.8	0.49	0.62	Teloua
SANOU5008	307.8	308.2	0.4	0.28	0.7	Tchinezogue
SANOU5008	346.6	347	0.4	0.19	0.47	Guezouman
SANOU5008	348.6	349.2	0.6	0.5	0.84	Guezouman
SANOU5008	350.6	351.4	0.8	0.85	1.06	Guezouman
SANOU5009	299.4	301.4	2	1.11	0.56	Tarat
SANOU5009	400	400.4	0.4	0.26	0.65	Guezouman

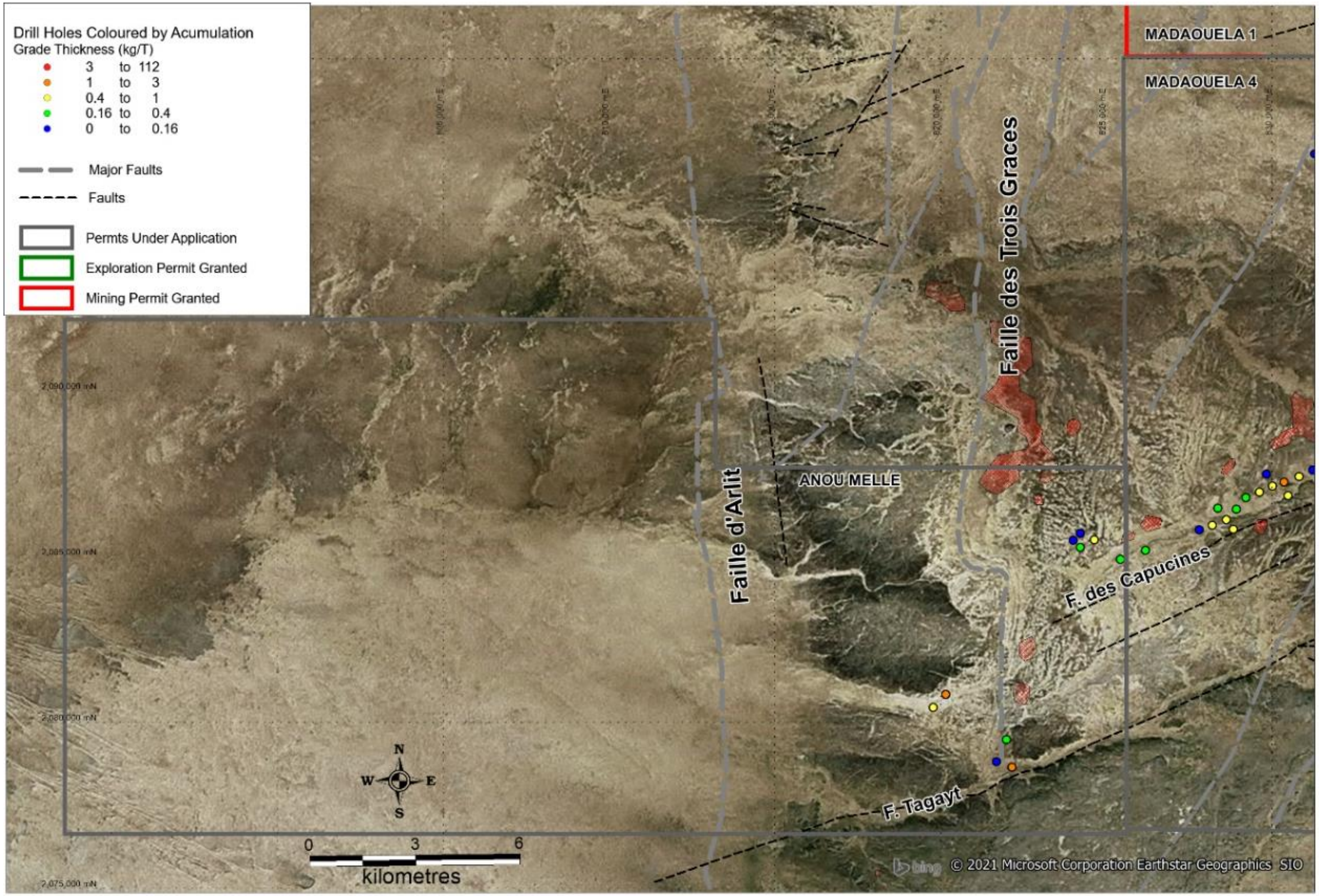


Figure 10-10: Anou Melle drilling location, coloured by grade accumulation (GT). All holes were drilled in 2010

10.5 Surveys and Investigations

10.5.1 Surveying

Surveying is done with precision, care and crosschecking in the field, using the DGPS equipment (Table 10-11); thus providing collar locations to centimetre accuracy. Surveying uses a network of permanent survey monuments for base stations and is tied to real-world coordinates using WGS 84 as a format.

10.5.2 Survey Methodology

Allen Osborne Associates Rascal DGPS equipment was purchased and a crew trained on its utilization both in static and dynamic modes.

In the absence of a reliable certified geodesic benchmark (reference point), the establishment of a reference point with a VLBS (Very Long Base Line) was implemented in August 2008, by measuring from the roof of an office in Arlit. A second base point was then established on Marianne and used for surveying the drillholes in the field from August until January 2009. The measurements were conducted in the static mode, which required a post-treatment.

While pursuing the survey in a static mode, the elevation (Z) of the surveyed points, although very precise in relative terms, was at a variance with the IGNN (Institut Geographique National du Niger) grid by about 25 m. This discrepancy remained because the elevation was measured in reference to the mean sea level instead of the ellipsoid height as used by the IGNN.

In February 2009, the survey team obtained the coordinates of one geodesic point that was apparently used by COGEMA (ORANO) since 1968/1969. Those coordinates were later confirmed by IGNN. This point was located in the field and served to calibrate the survey grid. From this reference benchmark, a reference elevation was adopted and previous data corrected accordingly.

Thus, a new VLBS station was established on the roof of the current office in Akokan. At this location, a GPS base was established on February 12, 2009, and a continuous 28 hour GPS observation was made. Subsequent calibration of this observation was made using nine IGS stations located in Spain, Malta, Italy, Greece, Uganda, Cote d'Ivoire and Canary Islands. The GPS processing files were downloaded from these stations and used as reference to reprocess the 28 hour Akokan office base station data. The calibrated position of the reference station in UTM zone 32 WGS 84 is:

E 325,109.941m	N 2,069,339.230m	Elevation 442.756m above mean ellipsoid

All DGPS points have then been reprocessed with the new reference coordinates. Out of 800 surveyed points, 98 % had very high degree of confidence in relative positional fixes. 2 % of the points that did not meet the same confidence have since been resurveyed in the field and corrected in the database.

Three new base stations in the field have been established and calibrated using the new coordinates of the Akokan office base station.

Since February 2009, the survey team has been trained on the use of Graf Nav Kinematic software for the Rascal controller. Radio modems are used to transmit the error matrix from the DGPS reference station to the Rover, which provides a highly precise positional fix in real time. This method removes the need for post processing of the DGPS data. Table 10-11 lists the current GoviEx reference survey points.

Table 10-11: DGPS, listing of current GoviEx reference survey points

Reference (Topo 23 07 09)			
Survey Points	**E**	**N**	**H**
Office base AKOKAN	325,109.925	2,069,339.225	418.813
Former offices in ARLIT (Mahmud's villa)	331,312.427	2,071,357.210	430.487
BASE CHANT IER 2	339,139.389	2,063,580.003	440.605
BASE CHANT IER 3	339,187.784	2,063,634.480	440.745
BASE CHANT IER 4	338,800.109	2,065,718.820	435.290
IGN(D)(Akokan)	328,750.028	2,071,149.985	420.546
BASE 5	340,491.971	2,059,202.602	440.885
BASE 6	341,953.446	2,065,716.220	440.305

The DGPS team is under the supervision of the chief geologist and comprises of one geologist and one qualified prospector (working alternatively) accompanied with two field assistants (4 persons in total). Surveys of drill collars are transferred to the database daily; therefore, geologists are provided coordinates of drillhole positions for interpreting and validating exploration results in real time. In the event that geological interpretations reveal that some holes are not correctly reported, the collars are resurveyed, and the resurveying includes often neighbouring points for homogeneity controls.

In 2021, an external surveyor ''CETO Consulting'' was employed to carry out the survey of the drill collars of the completed drill holes. He used a Leica GS15 base and rover, in RTK over UHF radio.

10.5.3 Drilling

Drilling is primarily done with mud-rotary drill rigs that drill approximately 120.65 mm diameter holes (Figure 10-12). Historical drillholes have been located where possible in the field, and reamed with this larger diameter drill bit, and re-logged. GoviEx is therefore relying on GoviEx data from historical drillholes, not historical data. The few historical holes that could not be found to re-enter (re-drill) were offset and a new hole was drilled. Upon completion of drilling to 8 to 9 m below the mineralised horizon, the hole is cleaned and circulated with drilling mud for 30 minutes, to allow for fluid-filled holes for electrical logs as well as gamma logs and avoid radon contamination.

All mineralised holes (intercepts over 100 c/s (scintillometer (PM) and Geiger probe (GM)) are relogged with the Mount Sopris GoviEx logging unit equipped with DHT27 reference probe, and by ULC using Geovista probes (UMC logging include caliper, deviation and resistivity as well as PM and GM)

Core drilling is done selectively, with:

- Rotary drilling up to a defined depth

- Core drilling with specific core drilling rig to collect core from the mineralised horizons. Core samples were assayed to determine the Uranium and Molybdenum content at Miriam and Marianne deposits. The uranium data was also used to define the ‘counts/second’ eU correlation line. The 42 core hole intersections in the Marianne deposit for approximately 320 individual core samples were used initially. More samples were collected on Marilyn, MSNE and Miriam, but the correlation line of Marianne was kept for all deposits, as it proved to be acceptable. It is a conservative option, as it may be locally minoring grades from several %, but it is preferred at this stage to use one single correlation line.

10.5.4 Logging

Logging is done using; three SEMM designed logging units, with probes modified for GoviEx. Internal QA/QC of intersections greater than 100 raw c/s (GM probe) is conducted using one Mount Sopris logging unit (GHN owned) equipped with DHT27 reference probe. For each drillhole logging unit, two probes have been utilized;

- a resistivity and natural gamma (scintillation (PM)) probe,
- and a probe containing natural gamma (by Geiger tube GM) and by scintillation counter (PM)) and deviation (magnetic/inclinometer) instrumentation. GM logs are used to define in-situ uranium grades for the drillhole database.

10.6 Interpretation and Conclusions (SRK)

SRK’s interpretation of the GoviEx exploration program is that of a well-planned and executed exploration and resource definition-drilling program. Contractors and GoviEx personnel are knowledgeable in drilling and logging equipment and procedures. GoviEx has installed procedures for data checks and verifications to ensure data accuracy and consistency. The GoviEx exploration team were in place are a competent crew of geologists that work very well together and have been sufficiently trained and instilled with the need for data verification that allows for minimal errors in the drillhole database. SRK found that the procedures in place for exploration drilling, data gathering, and data verifications are at a high level, and meet or exceed industry norms for uranium exploration methods.

The exploration programs are appropriate for the style of uranium mineralisation. SRK found no deficiencies in the exploration methods. The field procedures are appropriate and adequate for developing a drillhole database sufficient for resource estimation.

Significant up-side exploration potential exists on GoviEx concessions at the Madaouela Uranium Project.

SRK concludes the drilling methods used by GoviEx are industry standard methods and are appropriate for the style of uranium mineralisation at the Madaouela Uranium Project. SRK found no deficiencies in the exploration methods. The field procedures are appropriate and adequate for developing a drillhole database sufficient for resource estimation.

Following SRK recommendations, GoviEx has conducted a large amount of core drilling, originally with ESAFOR, and ultimately with Geodrill and FORACO, within the frame of the contract signed to execute the geotechnical core drilling.

Source: GoviEx

Figure 10-11: Digital GPS surveying in the field; reference and rover

Source; SRK

Figure 10-12: Drill rig at Madaouela south

11 SAMPLE PREPARATION, ANALYSIS AND SECURITY

11.1 Sampling Method and Approach

The industry standard methods of determining in-situ uranium grades are by assay methods on core and by equivalent uranium grade determination from down-hole radiometric survey logging equipment. The radiometric logging probe uses either a scintillometer or a Geiger-Muller tube to record gamma radiation as counts per second (CPS). The probe is calibrated against a known source and correlated with core assays to derive conversions of CPS to eU grades.

GoviEx has used the Geiger-Muller gamma probe data as the primary sampling tool in determining uranium mineralisation thickness and grade. Radiometric probing (gamma logs) and the conversion to eU data have been industry-standard practices used for in-situ uranium determinations since the 1960's.

11.1.1 Sampling Methods

Rotary Cuttings

Rotary drill cuttings are collected on 1 m intervals and laid out at the drill site, for geological logging only; cuttings are not retained for future use. Rotary mud drilling provides samples that by the nature of the drilling medium are not sufficient for accurate chemical analysis of in-situ uranium grades. GoviEx has not analysed rotary drill cuttings.

Nevertheless, rotary drill cuttings are an important geological sample as they are compared with geophysical logs (electrical logs and gamma by scintillation) to determine lithological contacts, redox state, dominant granulometry which are important to stratigraphic correlation and therefore mineralisation correlations hole-to-hole.

Core Sampling

In 2021, HQ (63 mm) diameter drill core was collected for chemical analyses purposes (primarily for molybdenum and uranium data) at Miriam and M&M deposits. Core sample intervals were selected based on the gamma readings, where intervals above 300 cps were sampled at 50 cm and anything below at 1 m length. The entire Guezouman interval was sampled at Miriam. At M&M, the mineralised interval with an additional overlying low-grade to barren interval of 5m were selected. A selection of drill holes were sampled for metallurgical purposes, where half cores were selected, leaving only a quarter core in the core box.

Prior to 2021, GoviEx sampling procedures for metallurgical and geochemical assays used HQ core (63 mm) , assaying ¼ core on 30 cm samples mostly within the mineralised intervals, and a overlying of 5m of barren material, retaining ½ core samples for metallurgy and/or a thick (5 to 10 mm) slice of core (length-wise along the core axis) is glued to a wood strip to preserve a sample of for lithology/mineralogy/alteration reference.

Bulk density measurements taken from drill cores in 2021, have been used to verify the historic determination of 2.3 t/m^3 for the Guezouman sandstone. At Miriam, 183 measurements taken had very low variability and resulted in a mean bulk density of 2.3 t/m^3. The distribution of measurements supports the use of the mean value for the density of mineralisation in the Guezouman sandstone. At Marianne/Marilyn, 21 measurements and 52 measurements taken in the mineralized and low-grade hangingwall volumes of the Guezouman had very low variability and resulted in a mean bulk density of 2.3 t/m^3 and 2.1 t/m^3 respectively. The distribution of measurements supports the use of the mean values for the density of mineralisation and low-grade hangingwall volumes of the Guezouman sandstone.

Radiometric Sampling

The standard method used by GoviEx is downhole radiometric surveying, by gamma probe as further described below (Figure 11-1). GoviEx uses two types of probes to log each drillhole:

1. A 42 mm diameter probe, called BDGG. It records two natural gamma readings using.
    a. One photomultiplier tube (PMT), equipped with a 2.5 cm NaI crystal.
    b. One scaling unit attached to two Geiger Muller tubes: ZP 1200 (gamma CPS used in grade estimation).
    c. Borehole deviation recording (tilt and azimuth) using a three-axis magnetometer and inclinometer.

2. The second probe called GUIP (38 mm diameter) records natural gamma (PMT with 2.5 cm NaI crystal), resistivity and conductivity.

Only the BDGG gamma probe records are used for estimation purposes and for converting radioactivity into the equivalent uranium grade (eU or teneur).

Gamma logging speeds are set at 1 m per minute in mineralisation, and 5 m per minute in non-mineralised rock. The resistivity (GUIP) probe is logged at 5 m per minute. Typical logging procedures are to monitor the probe data while the probe is lowered to maximum drillhole depth, to identify the mineralisation, then set the logging speed to 1 m/min and log the mineralisation as the probe is winched out of the hole; changing to the faster logging speed above mineralisation.

CPS data are gathered as composited 10 cm data, for conversion to eU data in Utimine software. Each gamma probe is calibrated at an onsite calibration pad, using a caesium source for 20 minutes. This calibration is to verify each probes functionality and lack of drift. Probes are compared to a reference probe ensuring that all probes are calibrated correctly.

11.1.2 Factors Impacting Accuracy of Results

The most important factors affecting the accuracy of gamma probe derived eU grade data are the calibration and correlation of the gamma probes. The probes have been calibrated and a K factor determined at external logging facilities (Canada and France). The QA/QC procedures are summarised in Section 12 (Data Verification).

SRK considers the sampling method and approach to be appropriate for the mineralisation, and adequate for generating a reliable database to be used in resource estimation. The methods are standard industry practice for sampling uranium deposits.

Source; SRK

Figure 11-1: Down-hole gamma logging at Madaouela

11.2 Sample Preparation and Assaying Methods

11.2.1 Chemical Analyses

Up to the end of 2021, a total of 528 cored drill holes were completed over the various deposits and prospects.

Prior to 2021, core samples from 65 drillholes in Marianne-Marilyn were collected and 400 samples analysed as whole core at ALS. Chemical analyses of core for uranium (U) are used to compare against radiometrically determined uranium (expressed as gamma log CPS data) for the purpose of establishing a correlation curve to apply to determine the equivalent uranium grades (eU) that forms the basis for the drillhole database. Other assays were used to verify that the factor used derived from Marianne data could be used at the other deposits. It was concluded that the Marianne factor was conservative and could be appropriately used.

Table 11-1: Totals of core samples actually sent for assays.

Secteur	Holes	No Samples	Length
MARIANNE	91	586	277.7
MARYLIN	53	394	116.5
MIRIAM	180	6,366	3,757.50
MSCE	2	27	5.4
MSSE	5	81	28.5
MSNE	17	116	34.5
Totals	**348**	**7,570**	**4,220**

GoviEx uses ALS Laboratory Services in Johannesburg, South Africa, for analytical work on core samples. Prior to 2021, sample preparation included crushing and pulverizing to 75 µm the entire 30 cm length sample interval, without keeping representative samples on site. This was done for the purpose of analysing the entire volume of core, as GoviEx's intent was to include all mineralisation to provide the most representative sample possible. Subsequent to initial core drilling and sampling for determination of the radiometric/grade correlation, some core holes, or representative sections are being retained on site. In 2021, the core were crushed on site and a representative 150 g sample sent to ALS, where they were further crushed to 75 µm if necessary prior to analysis.

Analyses for uranium and other elements were done by ALS Laboratory by standard 4-acid digestion on pulps samples, and ICP-MS analytical methods. ISO registration and accreditation provides independent verification that analytical labs have a Quality Management System in place. Most ALS laboratories are registered or are pending registration to ISO 9001:2000, and a number of analytical facilities have received ISO 17025 accreditations for specific laboratory procedures.

Uranium assay results were composited to establish the correlation line with radiometric data. Uranium assays are not used in resource estimation.

11.2.2 Radiometric Determinations

The basic analysis that supports the uranium grade reported in the Madaouela database of uranium grades and thickness of drill intercepts is the down-hole gamma log created by the down-hole radiometric probe. That data is gathered as digital data and composited to 10 cm data as the radiometric probe is extracted from a drillhole.

The down-hole radiometric probe measures total gamma radiation from all natural sources, including potassium (K) and thorium (Th) in addition to uranium-bearing minerals. In most uranium deposits, K and Th provide a minimal component to the total radioactivity, measured by the instrument as CPS. At the Madaouela Uranium Project, the uranium content is high enough that the component of natural radiation that is contributed by K from feldspars in sandstone, and minor Th minerals is expected to be negligible. The conversion of CPS to equivalent uranium concentrations is therefore considered a reasonable representation of the in-situ uranium grade. Thus, determined equivalent uranium analyses are typically expressed as kg/t eU (e for equivalent) and should not be confused with uranium or U_3O_8 determination by standard XRF or ICP analytical procedures. The conversion process can involve one or more data corrections; therefore, the process used for Madaouela is described here.

The gamma probes are 42 mm in diameter and about 1.5 m in length. The probe has a standard sodium iodide (NaI) crystal that is common to both hand-held and down-hole gamma scintillation counters. GoviEx constructed probes include the scintillation counter and the Geiger-Muller tube, both of which function similarly to count natural radiometric emanation from uranium and its daughter products (the uranium decay series). GoviEx is using the Geiger tube readings for uranium grade determinations and the scintillation counter for depth correlations and for lithology picks. The logging system consists of the winch mechanism (which controls the movement of the probe in and out of the hole) and the digital data collection device (which interfaces with a portable computer and collects the radiometric data as CPS at defined intervals in the hole). Radiometric readings are collected digitally into WellCad software for correlation with geology and resistivity. Subsequently, data is transferred to Utimine software for conversion to eU grade data (G), along with thickness (T), and accumulation (GT; Grade-thickness product).

Raw data can be viewed and plotted graphically from WellCad software, to provide a graphic down-hole plot of CPS. The CPS radiometric data may need corrections prior to conversion to eU or eU_3O_8 data. Those corrections include accounting for water in the hole (water factor) which depresses the gamma response, hole diameter variations, the instrumentation lag time in counting (dead time factor), and corrections for reduced signatures when the readings are taken inside casing (casing factor). The water factor and casing factor account for the reduction in CPS that the probe reads while in water or inside casing, as the probes are typically calibrated for use in air-filled drillholes without casing. Water factor and dead time factor corrections are made to the data at Madaouela; there are no instances of mineralisation inside casing at Madaouela.

Conversion of CPS to eU or eU_3O_8 is done by determining the relationship of core to radiometric data for a set of core-hole sample intercepts and developing a correlation curve.

The procedure used by GoviEx at Madaouela is to convert CPS per anomalous interval by means of a correlation curve developed by comparing core intervals with gamma-log intervals for the 46 core hole intervals drilled at Marianne. The process involves re-positioning the core pieces for the whole-core interval of mineralisation and determining the contacts and peak radiometric reading with a hand-held scintillometer on the core. This is then matched with the radiometric curve developed from a down-hole plot of CPS. The core is cut and analysed for uranium content for the same interval as the radiometric indicate. A best fit line defines the relationship of GT as follows:

$$GT_{core} = U_{core} \times T_{core} = (\text{Factor} \times CPS \times T_{probe}) = GT_{probe}$$

The same can be done on composited grade (uranium%) versus (CPS) at a given composite interval for each; the relationships have been found to be similar to that for GT. The factor is then used to convert CPS to eU grade.

GoviEx has found that the coefficient of correlation between GT_{core} and GT_{probe} is 0.968, with a 2-sigma precision on the mean of 8.1 %; a relatively close clustering of data along a linear relationship.

In uranium exploration, the usual technique consists in:

- Measuring the radioactivity in the drillholes using dedicated probes; and
- Transforming the radioactivity into uranium grade (equivalent uranium grade (eU or eU_3O_8).

In mineral deposit of recent age or close to surface alteration, where the uranium is not in equilibrium with its daughter products, the measurement of the gamma radioactivity to determine the uranium grade is imprecise and inaccurate. In such cases, the use of radioactivity estimations is completely incorrect.

In deposits such as Marianne-Marilyn at Madaouela, and all known mineralisation in the carboniferous in Niger, the disequilibrium problem has never been encountered. These uranium deposits are characterised by a secular equilibrium of uranium with its daughter products (uranium/radium). In specific locations within a deposit, the ratio U/equivalent. Radioactivity can vary (from 0.8 to 1.2), but the weighted mean value remains close to 1. This fact is well established through all analyses carried out on cores and mine face samples, as well as through the numerous reconciliations of mining and development or grade control estimation in the district.

On the Madaouela Uranium Project, this particular aspect was carefully examined historically by CEA; unfortunately, none of the relevant historical technical data was available to GoviEx. GoviEx did require ALS to carryout gamma spectrometry on 100 core sample pulps already assayed for G/Ra correlation. These measures were outsourced by ALS laboratory in RSA to Becquerel Laboratories Inc., Mississauga, Canada.

The following isotopes were to be measured (measurement method in bracket, results in Bq/g): [Bi214, Pb-210, Pb-212, Ra-226, Ra-228, Th-228, Th-230, Th-234, U[235](GAMMA), [U-238, Th-232](NAA). Note that results relate only to the samples analysed and only to the items tested. Ra-228 was estimated from Ac-228 and Th-228 from Pb-212.

The lab delivered only the value of disequilibrium with the ratio U-238/Ra-226. GoviEx did perform grade re-composition with the help of specialists from CEA lab. Results are summarised in Table 11-2.

Table 11-2: Disequilibrium and reconstructed uranium grades from isotopic spectrometry (Becquerel data, ALS chem, GoviEx recalc)13

										U235	U238	Ra226
		Hypothèse = valeurs en Bq/g de roche						Période (secondes)		2.22E+16	1.41E+17	5.05E+10
								Masse molaire (g/mol)		235.044	238.051	226.026
								Avogadro (atomes/mol)		6.02E+23	6.02E+23	6.02E+23
								Activité massique (Bq/g)		7.996E+04	1.244E+04	3.658E+10
ME-MS61	SPECTROMETRIE (GAMMA, NAA) données en Bq/g par le labo											
V	SAMPLE	res en spectro gamma pour Ra et U235, en NAA pour U238)							Calculs des teneurs massiques (en g / g de roche)			
ppm	DESCRIPTION	U-238/Ra-226	Ra226	U235	U238	235/u238(%)		U‰ (recalculé d'apres les mesures spectro ou pluto NAA)	U235	U238	Ra226	Teneur massique en U ‰ total
217	E004/2200	**1.06**	16.96	0.8	17	5	1.3	1.298211538	1.001E-05	1.367E-03	4.637E-10	1.377
240	E003/2200	**1.09**	11.99	0.5	12	4	0.9	0.916384615	6.253E-06	9.649E-04	3.278E-10	0.971
381	E002/2200	**1.36**	45	2.3	61	4	4.7	4.658288462	2.876E-05	4.905E-03	1.230E-09	4.934
227	E0010/2202	**1.13**	16.95	0.7	17	4	1.3	1.298211538	8.754E-06	1.367E-03	4.634E-10	1.376
277	E008/2202	**1.18**	103.84	4.4	104	4	7.9	7.942	5.503E-05	8.363E-03	2.839E-09	8.418
431	E0017/2203	**1.22**	71.98	3	72	4	5.5	5.498307692	3.752E-05	5.790E-03	1.968E-09	5.827
208	E0015/2203	**1**	15	0.6	15	4	1.1	1.145480769	7.504E-06	1.206E-03	4.101E-10	1.214
338	E0289/2204	**1.05**	44.1	1.9	44	4	3.4	3.360076923	2.376E-05	3.538E-03	1.206E-09	3.562
177	E0037/2207	**1.04**	26	1.2	26	5	2.0	1.9855	1.501E-05	2.091E-03	7.108E-10	2.106
186	E0036/2207	**1**	13	0.6	13	5	1.0	0.99275	7.504E-06	1.045E-03	3.554E-10	1.053
323	E0045/2208	**0.76**	15.96	0.7	16	4	1.2	1.221846154	8.754E-06	1.287E-03	4.363E-10	1.295
113	E0044/2208	**1.15**	29.9	1.2	30	4	2.3	2.290961538	1.501E-05	2.412E-03	8.175E-10	2.427
127	E0055/2209	**1.54**	20.02	0.7	20	4	1.5	1.527307692	8.754E-06	1.608E-03	5.473E-10	1.617
102	E0062/2211	**1.13**	25.99	1.2	26	5	2.0	1.9855	1.501E-05	2.091E-03	7.106E-10	2.106
64	E0098/2212	**0.93**	26.97	1.1	27	4	2.1	2.061865385	1.376E-05	2.171E-03	7.374E-10	2.185
189	E0097/2212	**1.14**	72.96	3.4	73	5	5.6	5.574673077	4.252E-05	5.870E-03	1.995E-09	5.913
71	E0087/2213	**1**	15	0.6	15	4	1.1	1.145480769	7.504E-06	1.206E-03	4.101E-10	1.214
260	E0086/2213	**1**	16	0.8	16	5	1.2	1.221846154	1.001E-05	1.287E-03	4.374E-10	1.297
286	E0085/2213	**1**	22	0.9	22	4	1.7	1.680038462	1.126E-05	1.769E-03	6.015E-10	1.780
101	E0103/2214	**0.93**	25.11	1.1	25	4	1.9	1.909134615	1.376E-05	2.010E-03	6.865E-10	2.024
166	E0102/2214	**1.18**	47.2	1.8	47	4	3.6	3.589173077	2.251E-05	3.779E-03	1.290E-09	3.802
228	E0120/2215	**1**	14	0.6	14	4	1.1	1.069115385	7.504E-06	1.126E-03	3.828E-10	1.133
226	E0122/2217	**0.88**	51.04	2.2	51	4	3.9	3.894634615	2.751E-05	4.101E-03	1.395E-09	4.129
247	E0127/2218	**0.87**	13.05	0.6	13	5	1.0	0.99275	7.504E-06	1.045E-03	3.568E-10	1.053
283	E0126/2218	**0.88**	21.12	1	21	5	1.6	1.603673077	1.251E-05	1.689E-03	5.774E-10	1.701
49	E0133/2219	**0.93**	13.95	0.5	14	4	1.1	1.069115385	6.253E-06	1.126E-03	3.814E-10	1.132
130	E0132/2219	**1.13**	33.9	1.4	34	4	2.6	2.596423077	1.751E-05	2.734E-03	9.268E-10	2.752
275	E0131/2219	**0.87**	13.05	0.5	13	4	1.0	0.99275	6.253E-06	1.045E-03	3.568E-10	1.052
153	E0137/2220	**0.93**	26.04	1.1	26	4	2.0	1.9855	1.376E-05	2.091E-03	7.119E-10	2.104
465	E0136/2220	**1.08**	82.08	3	82	4	6.3	6.261961538	3.752E-05	6.594E-03	2.244E-09	6.631
197	E0154/2222	**1**	38	1.5	38	4	2.9	2.901884615	1.876E-05	3.056E-03	1.039E-09	3.074
230	E0153/2222	**1.06**	36.04	1.4	36	4	2.7	2.749153846	1.751E-05	2.895E-03	9.853E-10	2.912
63	E0160/2223	**0.85**	22.95	1	23	4	1.8	1.756403846	1.251E-05	1.849E-03	6.275E-10	1.862
309	E0161/2223	**0.93**	25.11	1	25	4	1.9	1.909134615	1.251E-05	2.010E-03	6.865E-10	2.023
242	E0165/2224	**1.21**	16.94	0.6	17	4	1.3	1.298211538	7.504E-06	1.367E-03	4.631E-10	1.375
299	E0164/2224	**0.96**	66.24	2.6	66	4	5.0	5.040115385	3.252E-05	5.307E-03	1.811E-09	5.340
311	E0170/2225	**1.05**	46.2	2	46	4	3.5	3.512807692	2.501E-05	3.699E-03	1.263E-09	3.724
118	E0178/2226	**0.94**	31.96	1.3	32	4	2.4	2.443692308	1.626E-05	2.573E-03	8.738E-10	2.589
285	E0177/2226	**1.1**	147.4	4.9	147	3	11.2	11.22571154	6.128E-05	1.182E-02	4.030E-09	11.882
330	E0176/2226	**0.85**	28.05	1.2	28	4	2.1	2.138230769	1.501E-05	2.252E-03	7.669E-10	2.267
43	E0187/2227	**1.07**	16.05	0.6	16	4	1.2	1.221846154	7.504E-06	1.287E-03	4.388E-10	1.294
105	E0186/2227	**0.88**	43.12	1.7	43	4	3.3	3.283711538	2.126E-05	3.458E-03	1.179E-09	3.479
97	E0193/2228	**1.1**	22	0.9	22	4	1.7	1.680038462	1.126E-05	1.769E-03	6.015E-10	1.780
168	E0192/2228	**1.09**	25.07	1.2	25	5	1.9	1.909134615	1.501E-05	2.010E-03	6.854E-10	2.025
311	E0191/2228	**1**	34	1.6	34	5	2.6	2.596423077	2.001E-05	2.734E-03	9.296E-10	2.754
286	E0199/2229	**1.13**	16.95	0.8	17	5	1.3	1.298211538	1.001E-05	1.367E-03	4.634E-10	1.377
335	E0204/2230	**1.19**	74.97	3.1	75	4	5.7	5.727403846	3.877E-05	6.031E-03	2.050E-09	6.070
417	E0203/2230	**0.22**	2.42	0.08	2.4	3	0.2	0.183276923	1.001E-06	1.930E-04	6.616E-11	0.194
323	E0208/2231	**1.09**	23.98	1.2	24	5	1.8	1.832769231	1.501E-05	1.930E-03	6.556E-10	1.945
141	E0215/2232	**1.08**	12.96	0.5	13	4	1.0	0.99275	6.253E-06	1.045E-03	3.543E-10	1.052
285	E0214/2232	**1.14**	15.96	0.7	16	4	1.2	1.221846154	8.754E-06	1.287E-03	4.363E-10	1.295
45	E0222/2233	**1.12**	29.12	1.3	29	4	2.2	2.214596154	1.626E-05	2.332E-03	7.961E-10	2.348
201	E0221/2233	**1.06**	36.04	1.5	36	4	2.7	2.749153846	1.876E-05	2.895E-03	9.853E-10	2.914
14	E0231/2234	**1.07**	14.98	0.7	15	5	1.1	1.145480769	8.754E-06	1.206E-03	4.096E-10	1.215
229	E0228/2234	**1.24**	26.04	1.2	26	5	2.0	1.9855	1.501E-05	2.091E-03	7.119E-10	2.106
37	E0237/2235	**1.27**	13.97	0.7	14	5	1.1	1.069115385	8.754E-06	1.126E-03	3.819E-10	1.135
260	E0236/2235	**0.96**	24	1.1	24	5	1.8	1.832769231	1.376E-05	1.930E-03	6.562E-10	1.944
365	E0241/2236	**1.03**	30.9	1.4	31	5	2.4	2.367326923	1.751E-05	2.493E-03	8.448E-10	2.510
209	E0249/2237	**1.05**	23.1	1.2	23	5	1.8	1.756403846	1.501E-05	1.849E-03	6.316E-10	1.864
89	E0256/2238	**0.94**	15.04	0.7	15	5	1.1	1.145480769	8.754E-06	1.206E-03	4.112E-10	1.215
136	E0255/2238	**1.41**	38.07	1.6	38	4	2.9	2.901884615	2.001E-05	3.056E-03	1.041E-09	3.076
32	E0263/2239	**1.08**	7.668	0.31	7.7	4	0.6	0.588013462	3.877E-06	6.192E-04	2.096E-10	0.623
60	E0262/2239	**1.13**	18.08	0.84	18	5	1.4	1.374576923	1.051E-05	1.447E-03	4.943E-10	1.458
113	E0260/2239	**1.12**	28	1.2	28	4	2.1	2.138230769	1.501E-05	2.252E-03	7.655E-10	2.267
75	E0266/2241	**1.06**	34.98	1.5	35	4	2.7	2.672788462	1.876E-05	2.814E-03	9.564E-10	2.833
77	E0265/2241	**1.08**	28.08	1.3	28	5	2.1	2.138230769	1.626E-05	2.252E-03	7.677E-10	2.268
320	E0269/2242	**0.97**	33.95	1.3	34	4	2.6	2.596423077	1.626E-05	2.734E-03	9.282E-10	2.750
35	E0278/2243	**1.05**	39.9	1.5	40	4	3.1	3.054615385	1.876E-05	3.216E-03	1.091E-09	3.235
94	E0275/2243	**0.88**	14.96	0.5	15	3	1.1	1.145480769	6.253E-06	1.206E-03	4.090E-10	1.212
371	E0274/2243	**1.15**	63.25	2	63	3	4.8	4.811019231	2.501E-05	5.066E-03	1.729E-09	5.091
165	E0281/2244	**1.15**	14.95	0.6	15	4	1.1	1.145480769	7.504E-06	1.206E-03	4.087E-10	1.214
52.1	E0282/2245	**0.95**	18.05	0.9	18	5	1.4	1.374576923	1.126E-05	1.447E-03	4.935E-10	1.459
34.9	E0285/2247	**0.91**	20.93	0.9	21	4	1.6	1.603673077	1.126E-05	1.689E-03	5.722E-10	1.700

13 Note V grade indicated as an indication of visual redox context

SRK notes that the mineralisation at Madaouela is reduced, has not been exposed to secondary oxidation/mobilisation by groundwater, and is therefore not likely to have any disequilibrium issues on a global deposit basis. Rare presence of yellow products in drilling chips was observed northwest of Marilyn (Martine sector) associated with very shallow mineralisation (mineralisation that has been oxidised to uranium (VI) minerals). No mineralisation of this area is included in the resource.

GoviEx estimations are based on Grade/Radioactivity conversion built from dedicated core sampling carried out initially on Marianne. The relationship has been controlled now for Marilyn, the group MSNE, MSCE and recently Miriam. As mentioned above the Marianne relationship appeared relatively conservative and has consequently been kept for all deposits.

11.3 Quality Controls and Quality Assurance (QA/QC)

The purpose of quality assurance/quality control (QA/QC) is to assess whether the data have been collected using appropriate methodologies and procedures, adequate control checks are in place to validate the accuracy and precision of data collected and to ensure no material bias has been introduced during the data collection process.

The company implemented a QA/QC system as part of the exploration drilling campaign, comprising the submission of duplicates and insertion of certified reference materials (CRMs) and blanks into the sample streams. SRK was provided with the QA/QC sample data for analysis; the results are summarised in the following sections.

11.4 Radon Survey

All mineralised holes are relogged within 3 days after completion for Radon control. This procedure, derived from CEA Instructions Techniques is very important, especially:

- in drilling phases of high drilling rate;
- in the case of well mineralised holes.

11.5 Chemical Assays pre 2021

GoviEx inserted a small number of blanks at random interval within their sampling programme and relied solely on the internal lab QA/QC of ALS for the quality of their data. Since chemical assay results were not used directly as part of the resource model, GoviEx did not feel the need to implement a detailed QA/QC programme of the assay results with standard, blanks and duplicates. The quality of the radiometric data was backed up by other means as described elsewhere in this section.

11.6 Chemical Assays 2021

The QA/QC program for the 2021 drilling program focussed on uranium and molybdenum data, although GoviEx did not source a molybdenum CRM for the program. The QA/QC procedures were reviewed by Mr Guy Dishaw while on site in September 2021 as the sampling for M&M was ongoing at the time.

11.6.1 Blanks

Typical QA/QC programmes include the submission of blank sample material in order to confirm no sample contamination is occurring. A total of 148 blanks samples were analysed for uranium and molybdenum. Blank samples were inserted into the sample stream at a rate of 1 in 12.5 samples (8 %) and the scatter plots are provided in Figure 11-2 and Figure 11-3. The results for the blank samples show that there is quite significant scatter in the blank data, more so for molybdenum than uranium. For molybdenum, the blank data seems to systematically decrease by about 16 ppm. The uranium data shows fewer elevated values, though still shows a subtle value decrease and some contamination intervals.

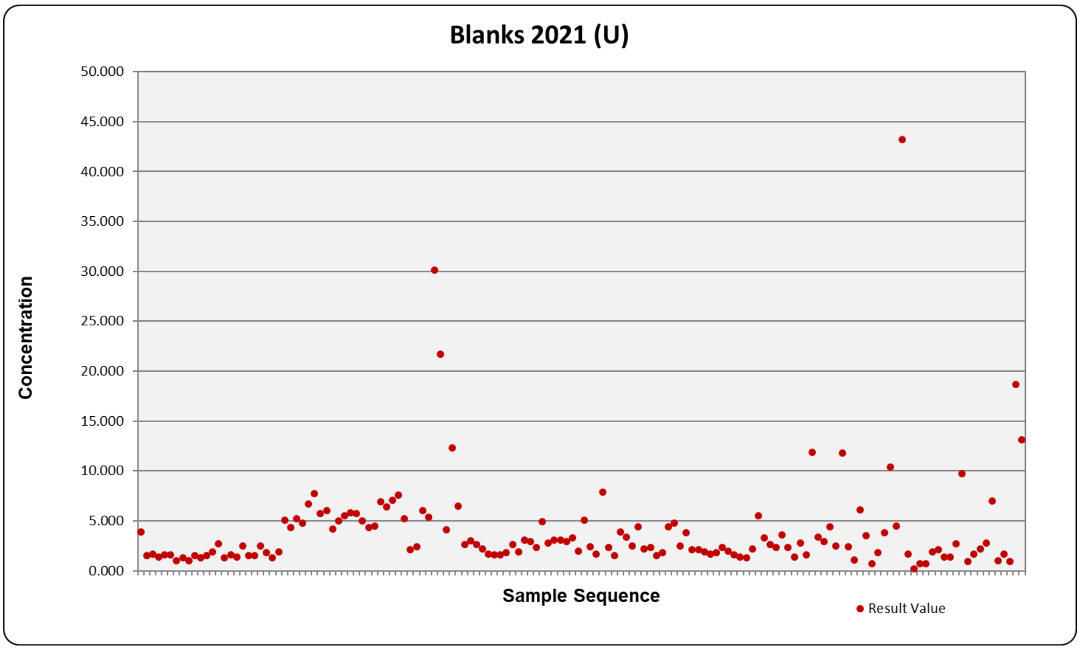


Figure 11-2: Blanks performance for U

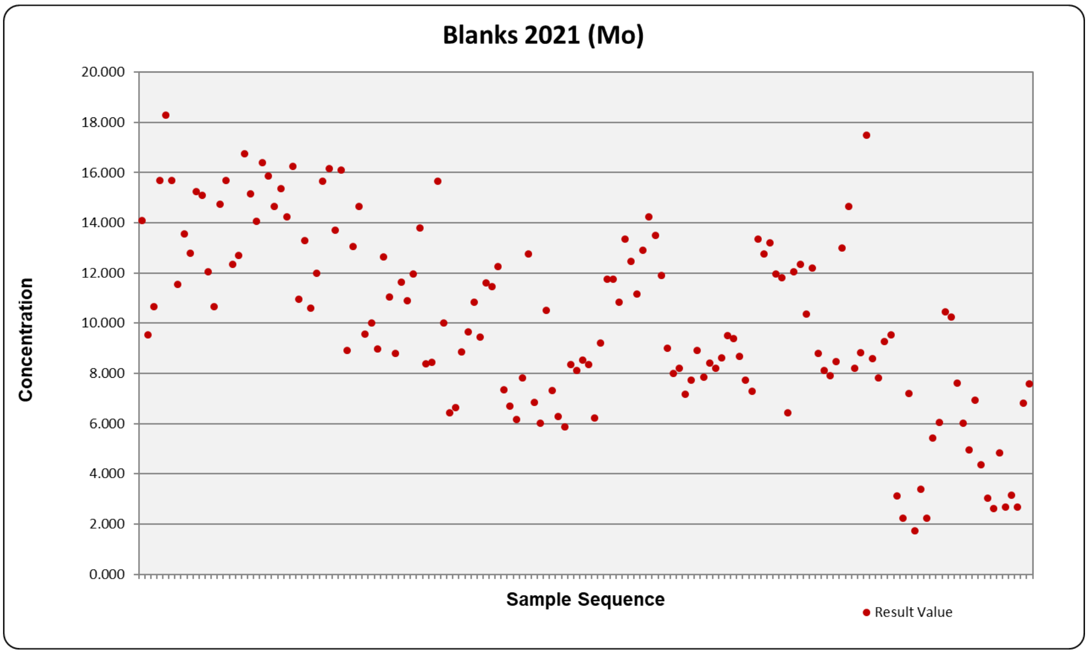


Figure 11-3: Blanks performance for Mo

11.6.2 Certified Reference Materials

CRM comprise samples that are used to measure the accuracy of analytical processes and are composed of material that has been thoroughly analysed by several laboratories to accurately determine its grade within known error limits. 'Blind' CRM are inserted by the Company into the sample stream, and the expected value is concealed from the laboratory. By comparing the results of a laboratory's analysis of a CRM to its certified value, the accuracy of the result is monitored.

A summary of the CRM used for the Madaouela exploration drilling campaigns is shown in Table 11-3. All named CRM were supplied by AMIS. 148 CRM samples were inserted into the sample stream for uranium and molybdenum at a rate of 1 in 12.5 samples (8 %). Note that the CRM values for molybdenum here are not appropriate for the levels of molybdenum anticipated in the mineralisation at the Madaouela project and are secondary elements within the uranium CRM. SRK have included them here in the review as they are the only CRM available to verify the molybdenum assay data.

Table 11-3: CRM used for exploration drilling campaigns

CRM	Element	Certified Mean	Standard Deviation	No. Samples
CRM 460	U	1,603	64	47
CRM 466	U	3,424	130	38
CRM 553	U	629	54.5	30
CRM 685	U	3,490	107	33
CRM 460	Mo	2.49	0.33	28
CRM 466	Mo	3.35	0.25	34
CRM 553	Mo	3	0.25	44
CRM 685	Mo	3	0.15	42

When assessing CRM results, sample assays are compared to certified mean of the sample. A scatter of results is expected falling close to the certified mean; results within 1 standard deviation (SD) of the certified mean indicate very good accuracy; results within 2 SD are normal; results exceeding 3 SD are considered a failure.

Over 90 % of the CRM results are within 2 standard deviations of the certified mean and therefore show a good level of accuracy, with no material trends or biases identified except for the CRM 460 molybdenum results (Figure 11-8). These are consistently elevated above the certified mean with approximately 39 % of the samples above 2 standard deviations. There are also numerous examples of suspected mislabelling of samples for all CRM's. Plots of sample values compared to certified means are shown for all named CRM's in Figure 11-4 to Figure 11-11.

SRK recommends that in the future appropriate CRM for molybdenum are introduced into the sampling program, and that all labelling procedures are reviewed to reduce the number of errors being included in the results.

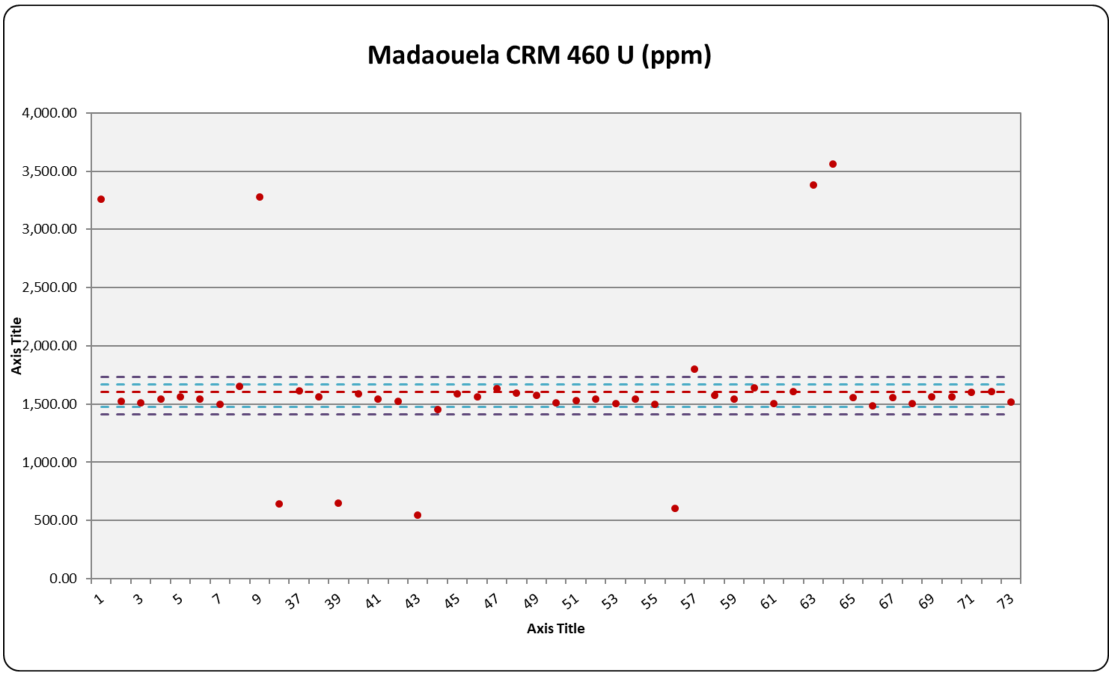


Figure 11-4: CRM performance for CRM 460 (U)

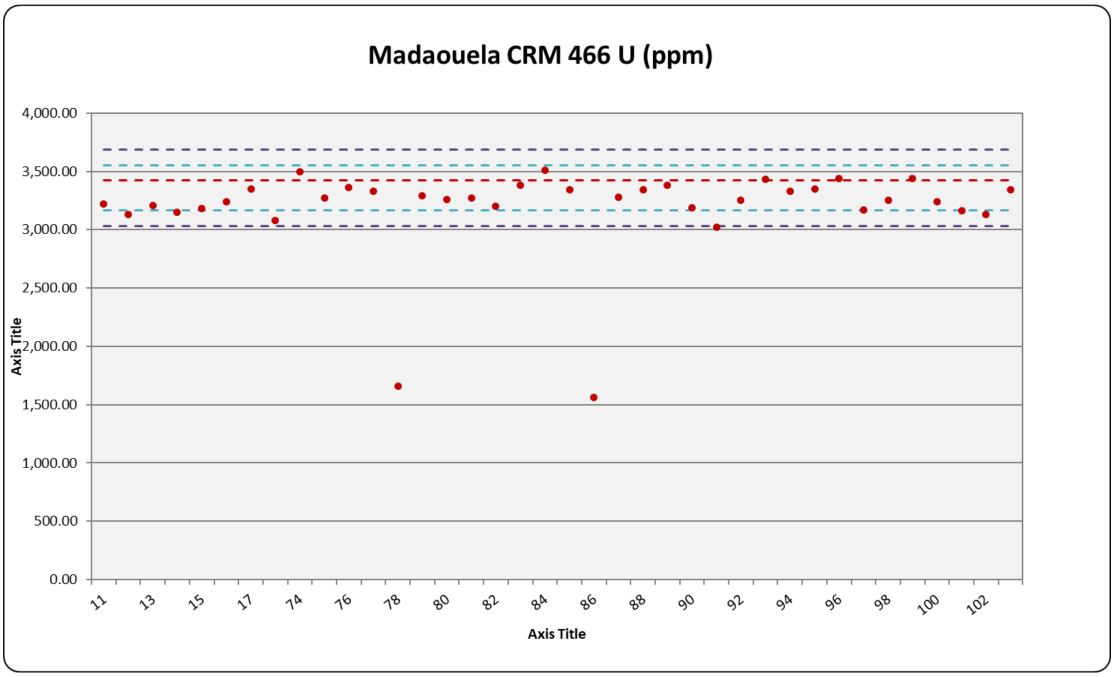


Figure 11-5: CRM performance for CRM 466 (U)

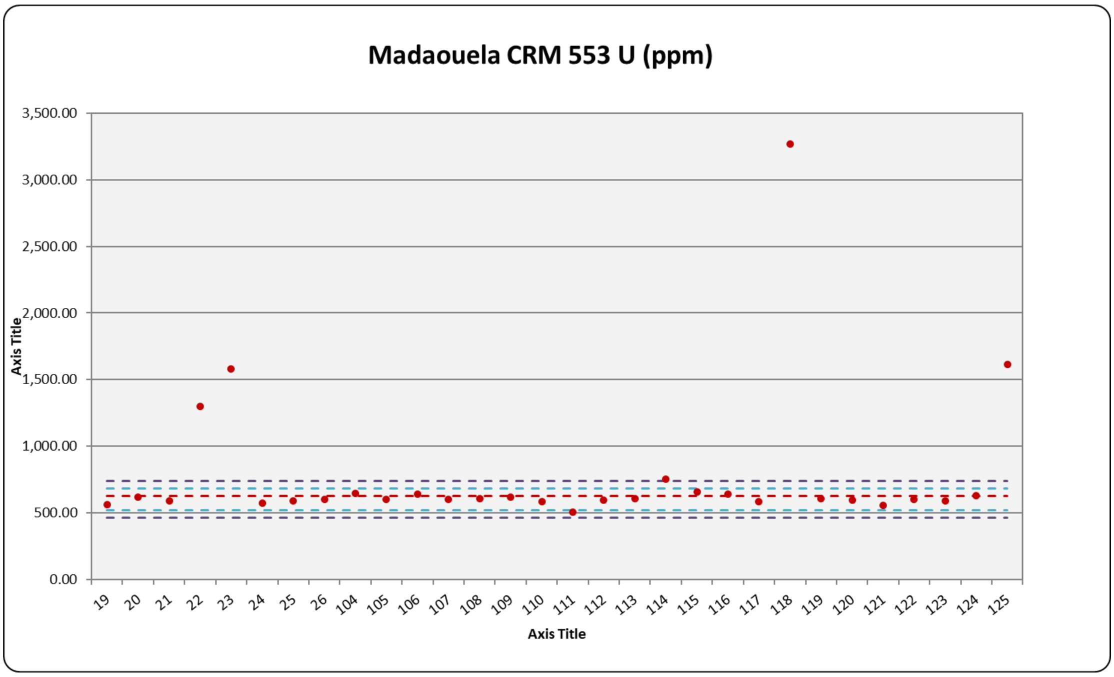


Figure 11-6: CRM performance for CRM 553 (U)

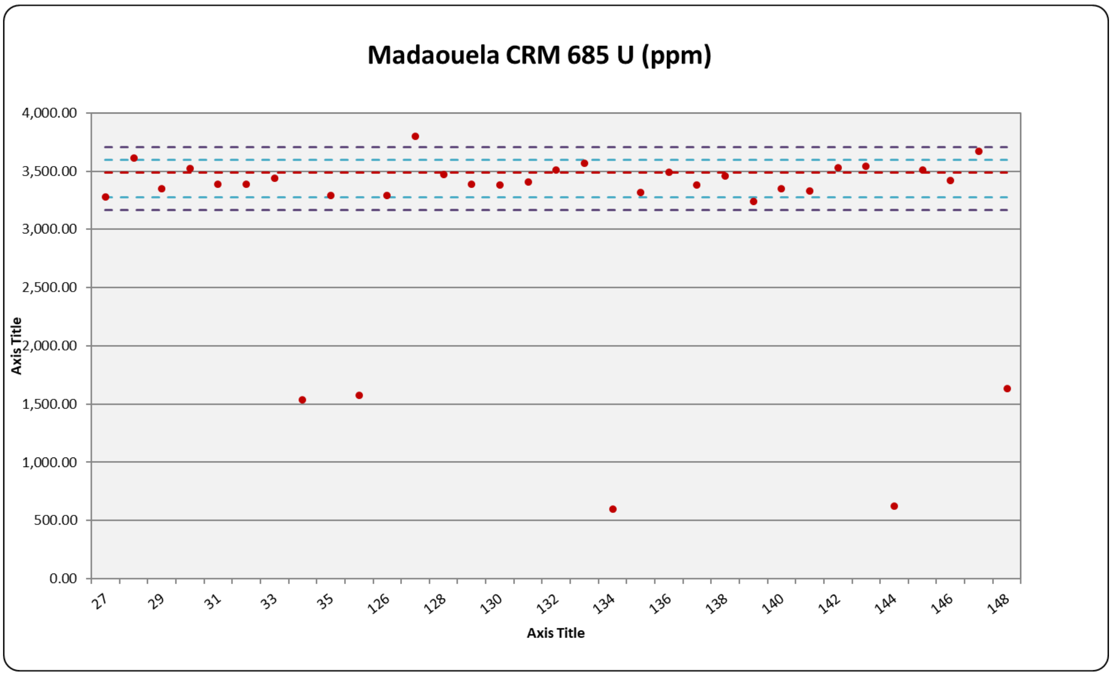


Figure 11-7: CRM performance for CRM 685 (U)

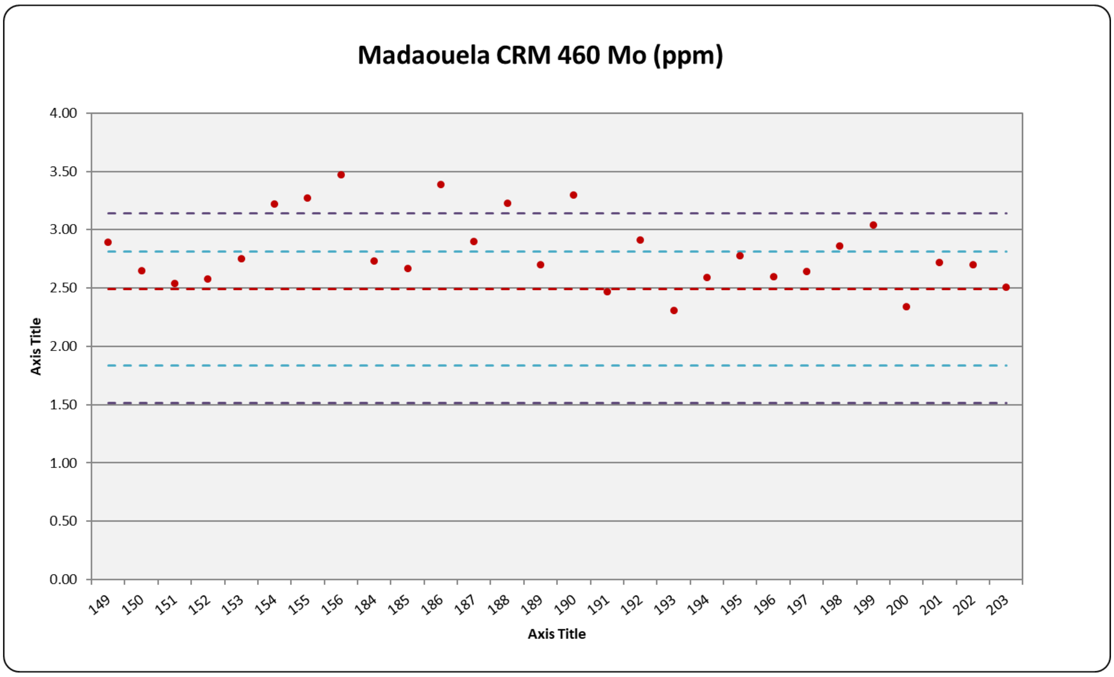


Figure 11-8: CRM performance for CRM 460 (Mo)

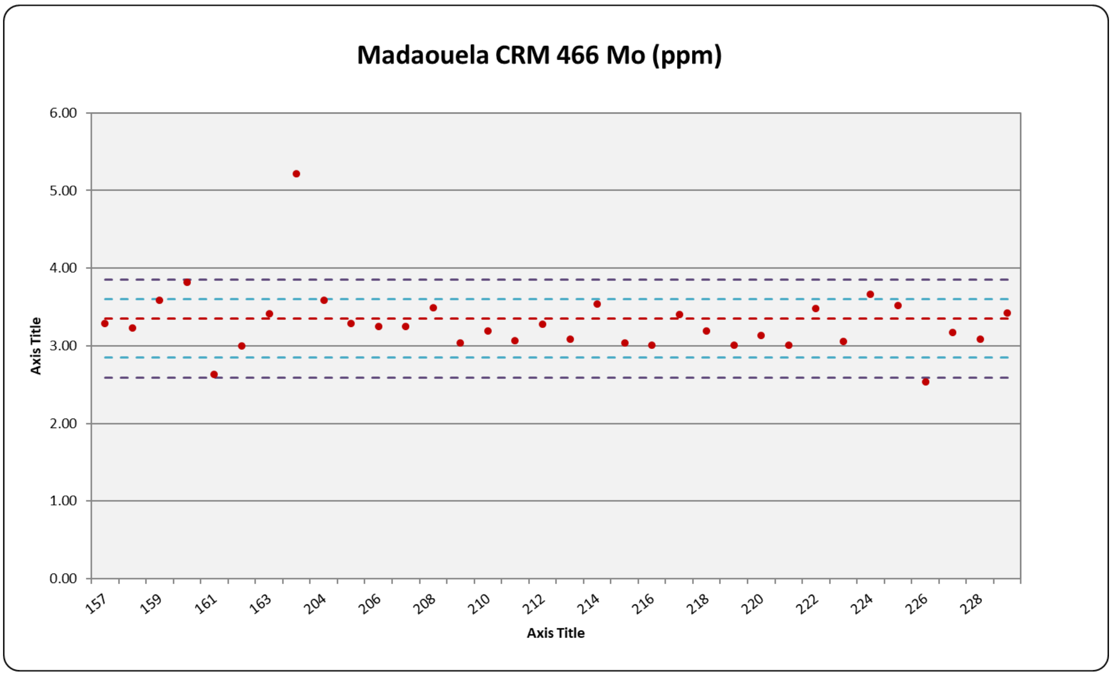


Figure 11-9: CRM performance for CRM 466 (Mo)

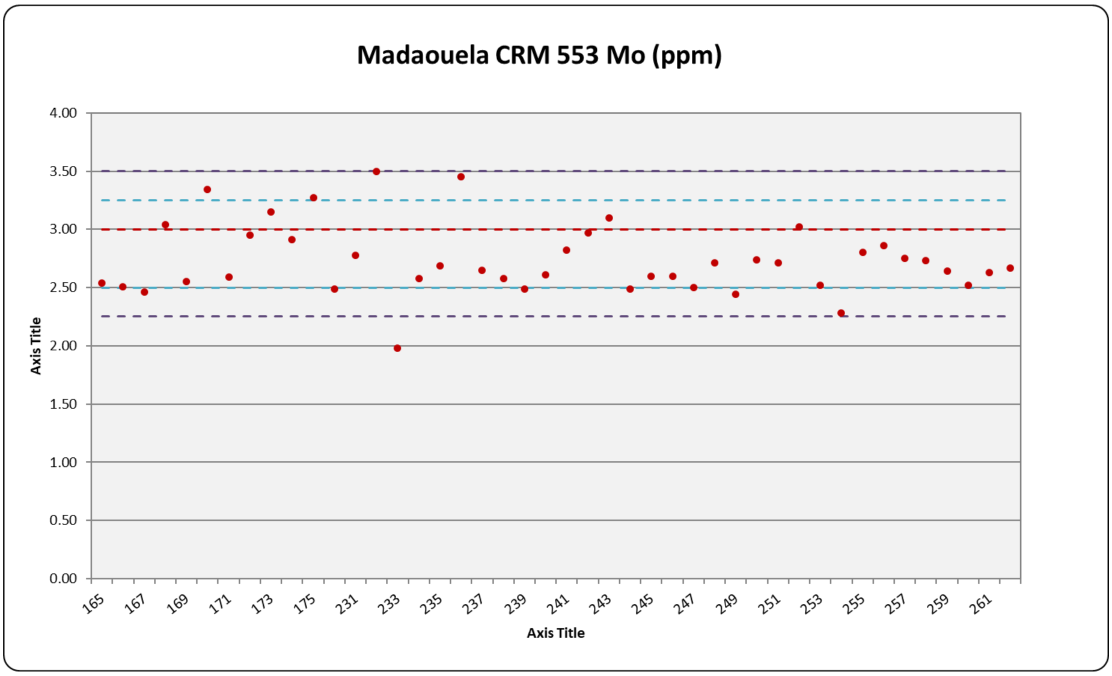


Figure 11-10: CRM performance for CRM 553 (Mo)

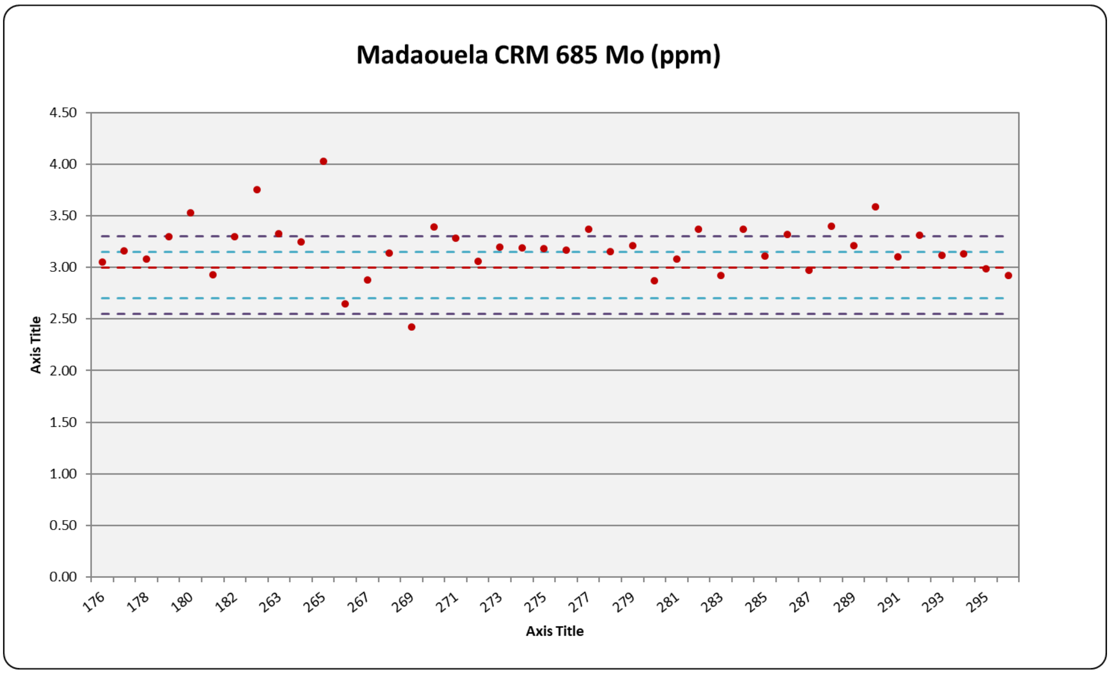


Figure 11-11: CRM performance for CRM 685 (Mo)

11.6.3 Duplicates

The precision of sampling and analytical results can be measured by re-analysing a portion of the same sample using the same methodology. The variance between the results is a measure of their precision.

Precision is affected by mineralogical factors such as grain size and distribution and inconsistencies in the sample preparation and analysis processes. There are different types of duplicate sample which can be used to determine the precision for the sampling process, sample preparation and analyses.

A total of 148 duplicates were analysed for uranium and molybdenum. Duplicate samples were inserted into the sample stream at a rate of 1 in 12.5 samples (8 %) and the scatter plot is provided in Figure 11-12 and Figure 11-13. The results for the duplicates show a strong correlation between original and duplicate assay values and no biases have been identified in the scatter plot.

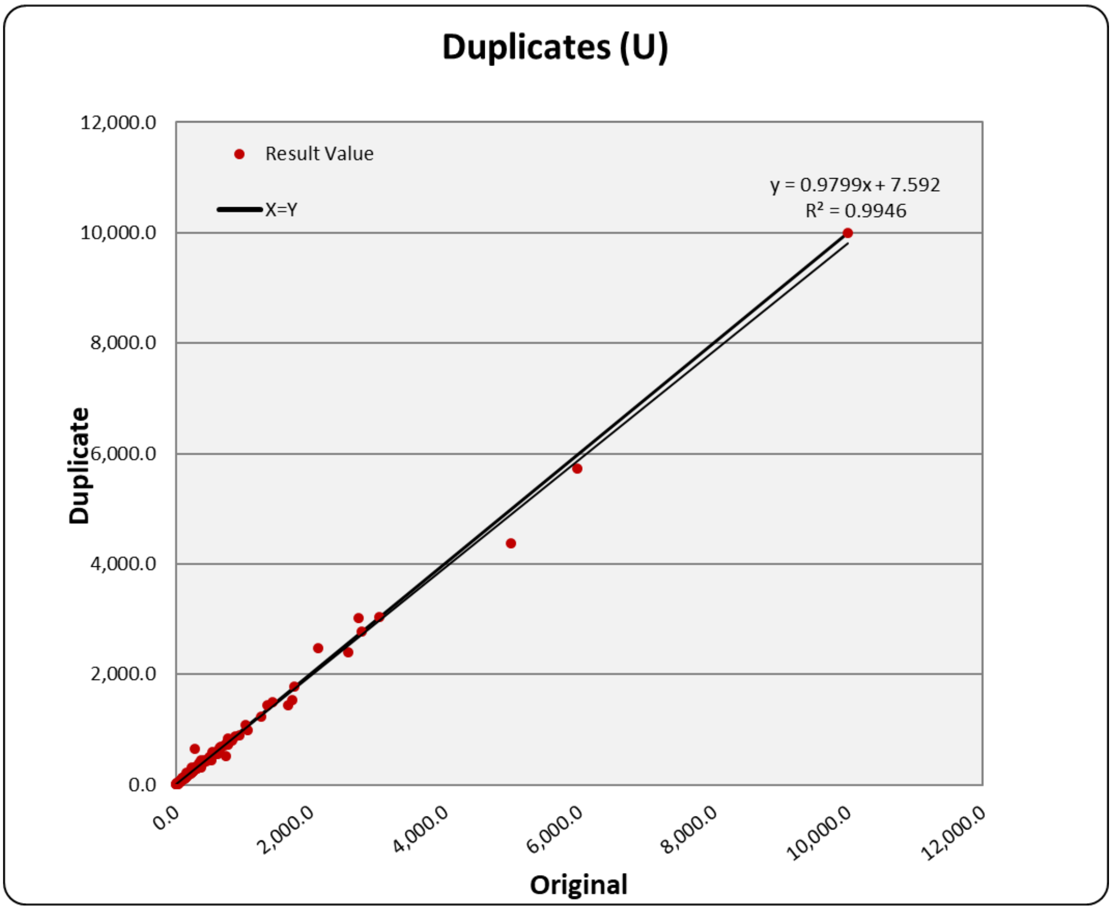


Figure 11-12: Duplicate performance for U

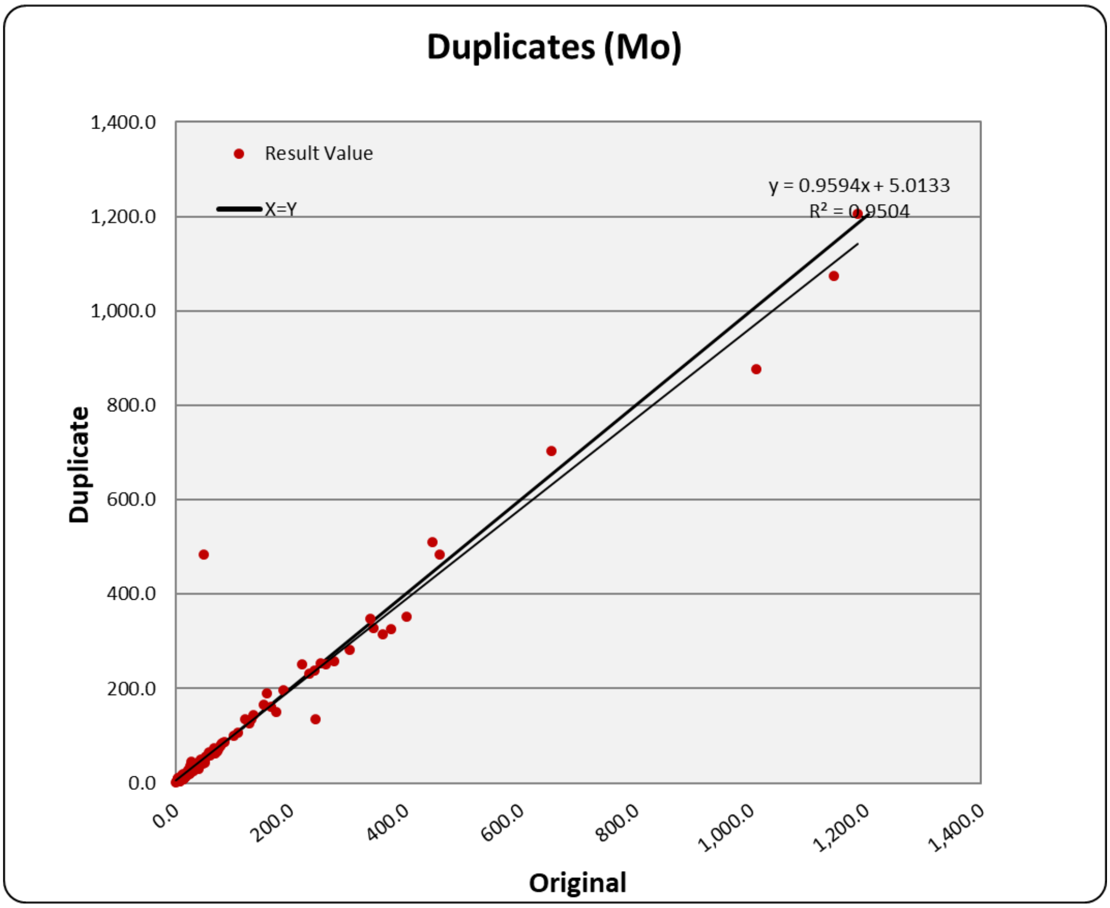


Figure 11-13: Duplicate performance for Mo

11.7 Radiometric Determinations

GoviEx has implemented a significant program of data checks and calibrations to ensure accuracy and comparative determination of eU from the various probes in use at Madaouela.

The quality assurance and quality control on the logging equipment and on the recorded logs is continuous and involves two sets of control:

1. Equipment control: the counting rate of probes is regularly checked for evidence any bias or counting loss. The controls are of two types.
    a. Static mode: control checks daily against calibrated sources. Once daily a probe is checked at a dedicated calibration pad on-site, where a cesium source is places along-side the probe for a 20-minute period to verify stability and daily repeatability of the gamma readings.
    b. Dynamic mode: All probes are regularly checked by comparison with the log from a Mount Sopris gamma probe (DTH 27 reference probe); which has been done for approximately 25 % of the drillhole data to-date. GoviEx schedules a minimum of one in every 20 holes for re-logging with the reference probe.
2. Record control: The controls consist of:
    a. Re-logging holes with a reference probe and/or with another SEMM logging unit (identical to item "1.b" above). Data logs are compared for accuracy of depth, grade, thickness, and GT of mineralisation.

b. Re-logging holes after three days (Radon half-life period). This is done to determine if radon is an issue in the radiometric determinations, which has been determined thus far to be on minimal consequence.

All data is reviewed and plotted by GoviEx to determine if any radiometric probe is out of calibration or faulty. Any holes in question are re-logged. Any probes in question result in the hole being re-logged by another probe for all holes logged that day. Figure 11-14 is a sample plot of the calibration check for one gamma probe demonstrating minimal (± 2 %) daily variance in CPS counting.

A Tubular SEMM reference source is used for probe calibration checks on a daily basis. The source was built with stabilized crushed ore from a French mining site. The ore grade is not precisely given, but the activity of the source is moderate to high. The counting rates of this source for the various probes in use at Madaouela are shown in Table 11-4 and an example of BDGG 8101 in Figure 11-14.

Table 11-4: Reference standard counting rate on SEMM source

Probe	SEMM Source 15O ms Sampling	
	Average Geiger	Average Scintillometer
BDGG 8101	32.42	4,132.44
BDGG 8102	30.40	4,001.72
BDGG 8103	31.63	4,120.11
BDGG 828	32.35	4,039.54
BDGG 829	32.05	4,012.32
BDGG 830	31.99	4,179.17
GUIP 8111	na	3,951.89
GUIP 8112	na	3,798.34
GUIP 8113	na	3,847.11
GUIP 8114	na	3,971.14
GUIP 842	na	3,804.79

Additional static radioactive control sources were purchased from CERCA LEA, France. The type and certificate references of each source are summarised in Table 11-5.

Table 11-5: Caesium reference sources

Elem	Reference	N° id	Ext dia.	Sealed Sources Classification	Activity kBq	Ext. Relative Uncertainty (%k=2)
^{137}Cs	CS137EGSB15	50547	38 mm	C22212	38	5
^{137}Cs	CS137EGSB15	50548	38 mm	C22212	38.4	5
^{137}Cs	CS137EGSB15	50549	38 mm	C22212	36.6	5
^{137}Cs	CS137EGSB15	50549	38 mm	C22212	39	5
^{137}Cs	CS137EGSB20	50551	38 mm	C22212	401	5
^{137}Cs	CS137EGSB20	50552	38 mm	C22212	397	5
^{137}Cs	CS137EGSB20	50553	38 mm	C22212	400	5
^{137}Cs	CS137EGSB20	50554	38 mm	C22212	400	5

Source: Areva - CERCA LEA, 2008

The radioactive caesium sources are fitted into a special housing and the probe is laid against it for measurement at a dedicated calibrations pad. All radioactive sources are stored at the Project logging/calibration site inside a locked and secure facility.

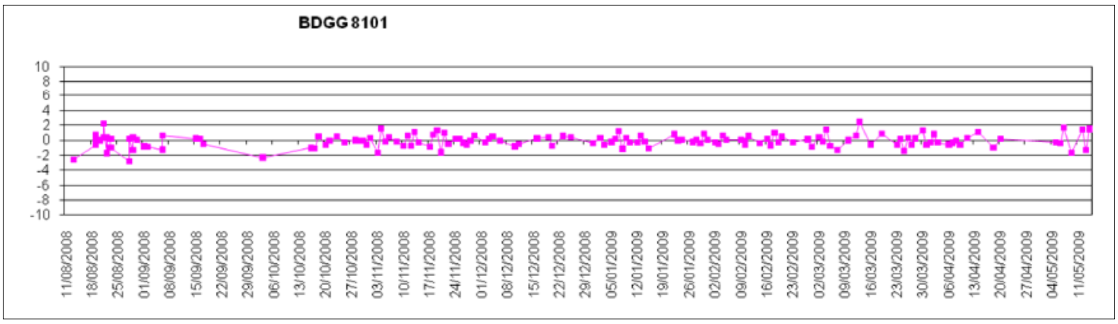


Figure 11-14: Example daily plot of % variance in CPS for probe BDGG 8101

11.8 Independent Verification

In order to have an independent validation of GoviEx geophysical logging results, ULC, an independent geophysical logging company was appointed to initially log about 60 drill holes and to repeat the log measurements and compare the results with those used for the resource estimate. This initial work was completed between October and December 2009, using their equipment (Geovista) and personnel. This verification work showed the reliability of GoviEx logging teams and units and confirmed the repeatability of the logs. ULC continued to supply logging services up to the closure of work sites in 2013. A total of 343 holes were logged, with excellent comparisons with GoviEx results.

Table 11-6: Summary of ULC logging

Number	Sector	Year
13	MAD1	2011-2012
2	MAD4	2011-2012
171	MSNE	2011-2012-2013
45	MARI	2008-2009-2011-2012-2013
57	MARL	2009-2011-2012-2013
55	BSRK	2012-2013

11.9 Interpretation (SRK)

SRK concludes that GoviEx's sample preparation, methods of analysis, and sample and data gathering are being implemented with a high degree of care in data collection, data transfer, data conversion, and gamma probe QA/QC. QA/QC data from the chemical analyses for uranium in the 2021 program demonstrate that the uranium information has been collected with no bias and no evidence of contamination. Where the occasional result differs by more than two standard deviations, these can be explained as sample swaps as they plot where other CRM are expected. Although a suitable molybdenum CRM was not implemented in the 2021 program, the results obtained from the CRM used do indicate that the analyses are reasonable and that there is no reason to suspect any bias being introduced. In the opinion of SRK, the methods are acceptable by industry-standard procedures and are applicable to the uranium deposits at the Madaouela Uranium Project. With regard to the eU results obtained from downhole radiometric probing, SRK have also completed an independent verification of these results as part of this study and is summarised in Section 12.

12 DATA VERIFICATION

Data verification supporting the MRE for the Madaouela Project has been completed by both GoviEx and SRK Consulting.

The Qualified Person for the reporting of Mineral Resources, Mr Guy Dishaw, visited the project site from September 16 to 18, 2021 to review the exploration and sampling procedures, examine drill core and surface outcrops, and discuss the interpretation and models with project staff.

12.1 SRK Data Verification March 02, 2016

SRK completed data verification in support of the previous MRE with effective date March 02, 2016. The verifications were completed by Daniel Guibal of SRK Australia and involved the following:

Database verification

1. Spot checks of a number of drillhole gamma logs for grade determination, thickness, and depth of mineralisation;
2. Verification of drillhole locations as plots;

Visual data verification;

1. Verification of anomalous radioactivity in drill cuttings corresponding to mineralised intervals, and mineralised stockpiles from former CEA underground;
2. Visual confirmation of lithological designations;
3. Visual confirmation of surface geology and controls to mineralisation; and
4. Visual verification of historical and current drillhole collar locations and documentation; confirmed as identified on maps.

Drilling (Rotary Mud) verification

SRK reviewed the field procedures which are essentially all drilling related, and include the following:

1. Drillhole gamma-logging and resistivity-logging procedures including local gamma probe calibration measurements;
2. Geological logging of cuttings;
3. Core logging and hand-held radiometric procedures;
4. DGPS drillhole collar surveys; and
5. Hole plugging, capping and documentation.

SRK concludes that the field procedures are appropriate and adequate for developing a drillhole database sufficient for resource estimation. Furthermore, the process includes many data checks and verifications to assure the data is accurate. Multiple QA/QC procedures are in place to validate the data as it is acquired. The geological staff are sufficiently trained and instilled with the need for data verification, and multiple geologists examine the data inputs into the database. Therefore, the procedures in place allow for proper data verification with minimal database errors.

Of particular note are the following QA/QC procedures noted by SRK that contribute to the overall integrity of the database:

1. Individual gamma probes are calibrated against the DHT 27 reference probe to insure all probes are reading the same.
2. Drillholes with greater than 1.5 GT are re-logged after three days to check for radon build-up (which has been determined to be negligible).
3. Approximately ¼ of the mineralised holes are re-logged with the DHT 27 reference probe as a check.
4. Two probes are run for each hole, one with gamma by Geiger tubes, and one with gamma by scintillation counter, which provides a check.
5. Scintillation logs are used for depth correlation and for lithology picks as a check against geological picks from cuttings.
6. Each probe in calibration checked against a standard (Caesium source) for 20 minutes at an above ground calibration station each day to verify accuracy.
7. Geology of the drill chips, collected on 1.0 m intervals, is logged with the assistance of the resistivity logs as a check.
8. No historical drillhole intercept data is used – all historical holes use have been re-drilled and re-logged; therefore, all the data in the database is GoviEx collected gamma log data and internally consistent.
9. Geology logs in the field are entered into Excel spread sheets and the Geologist imports the data into WellCad with the geophysical logs on a daily basis and can make visual QA/QC checks at that time for any errors.
10. The conversion of log data by the geologist is then checked by another geologist for errors and for correlations with adjacent drillholes in cross-section in WellCad prior to conversion from CPS to eU % which is done in Utimine software.
11. A final check of the drillhole data is done by Chief geologist as new drillholes are entered into the database.
12. Drill core correlations with gamma logs are carefully done at the core logging site in the field. Core is photographed and radiometrically scanned with a hand-held counter to verify and compare mineralised core intervals with the gamma logs, prior to cutting and quartering for assay on 30 cm intervals.

SRK did not determine any variance from the GoviEx determinations of mineralisation, or geology. Therefore, SRK did not verify the grade and thickness determinations in all drill holes in the database.

SRK did not independently collect samples for assay determinations of uranium content, as radiometric confirmation minimized the need to verify presence of uranium mineralisation by chemical assays.

12.2 SRK Data Verification July 01, 2022

SRK completed data verification in support of the MRE presented here with effective date July 01, 2022. The verifications were completed by Guy Dishaw, SRK UK, and involved both activities at the project site as well as desk based, but specifically include the following verifications:

- Data location;
- Geological setting and controls on mineralisation; and
- eU values derived from downhole radiometric surveys.

12.2.1 Data Location

SRK used a handheld GPS (Garmin InReach Explorer) to walk over the Madaouela Project area and confirm the location of the 2021 drilling positions (Figure 12-1). The GPS used by SRK is accurate to within 5 or 10 m under normal working conditions (much less than the accuracy of the DGPS surveys of the collars completed by GoviEx) and is considered sufficient to confirm the drilling locations at Miriam and M&M.

SRK found excellent agreement between locations of holes as well as the bearing along which the drilling lines are oriented (Figure 12-2 and Figure 12-3).

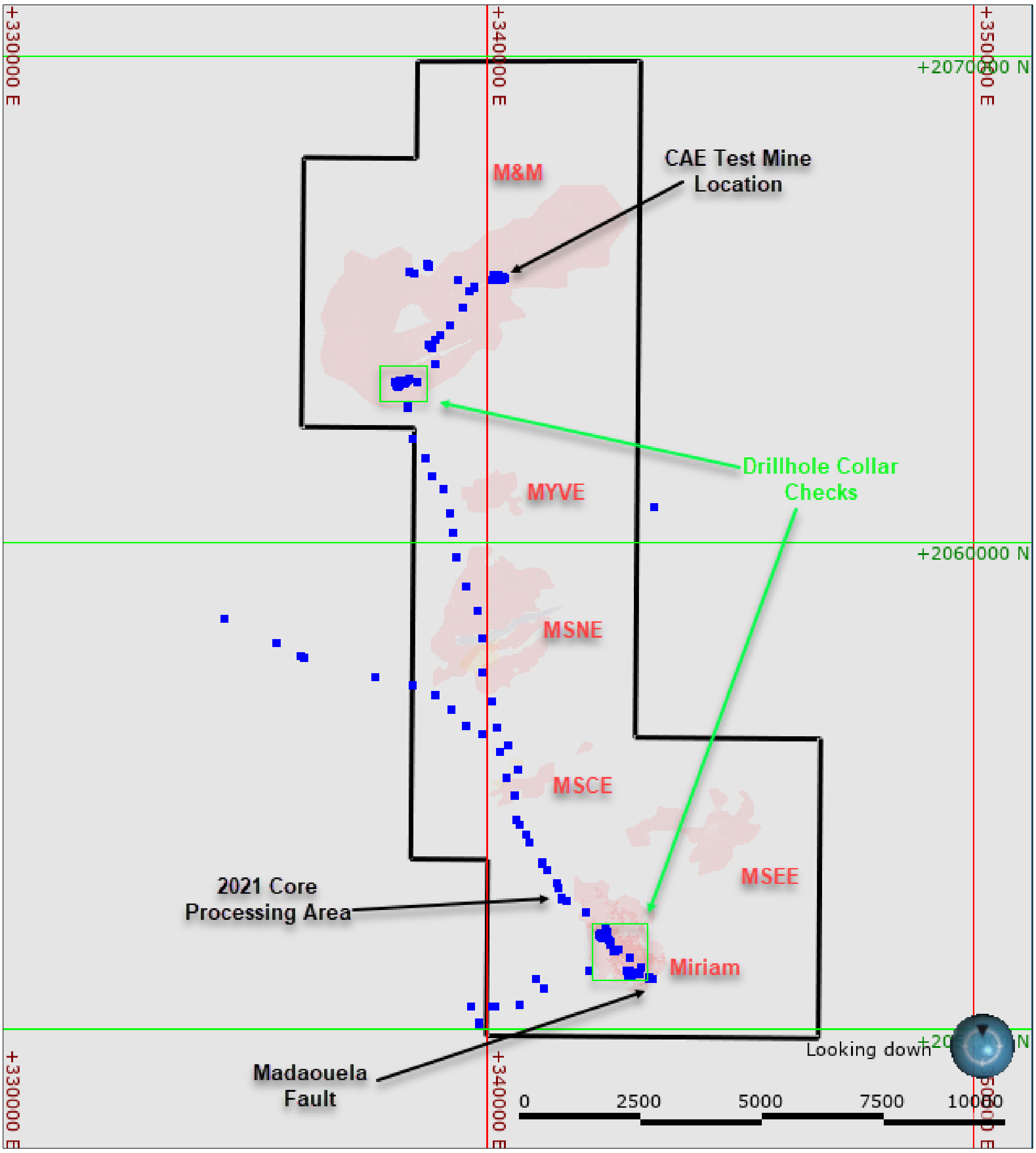


Figure 12-1: Plan view of the Madaouela I License and deposits with SRK 2021 verification route locations in blue. Note green boxes inset indicating locations of specific collar checks for Miriam and M&M drillholes.

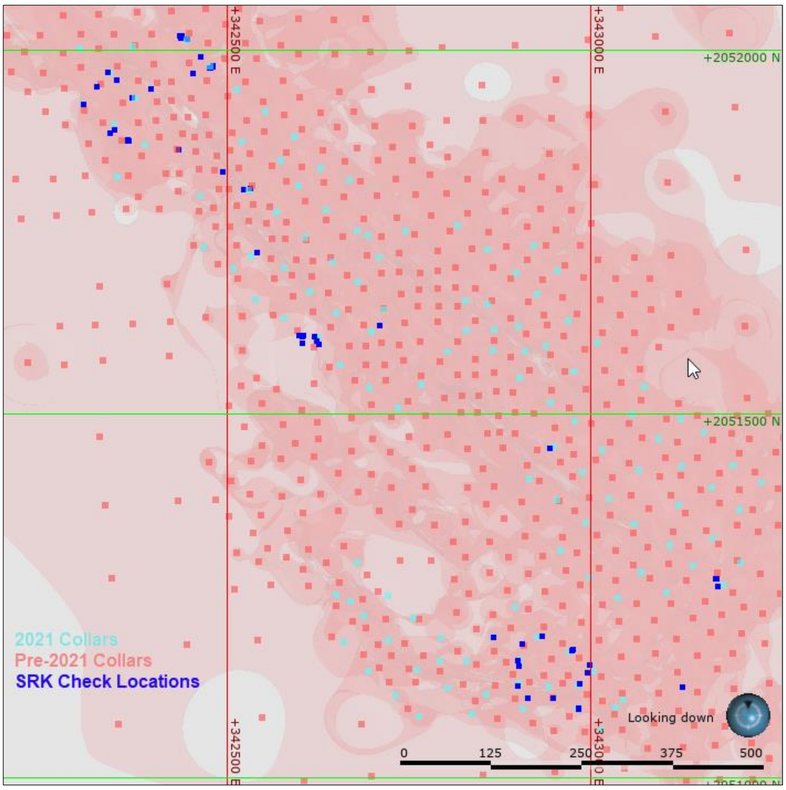


Figure 12-2: Plan view of Miriam collars and SRK verification route

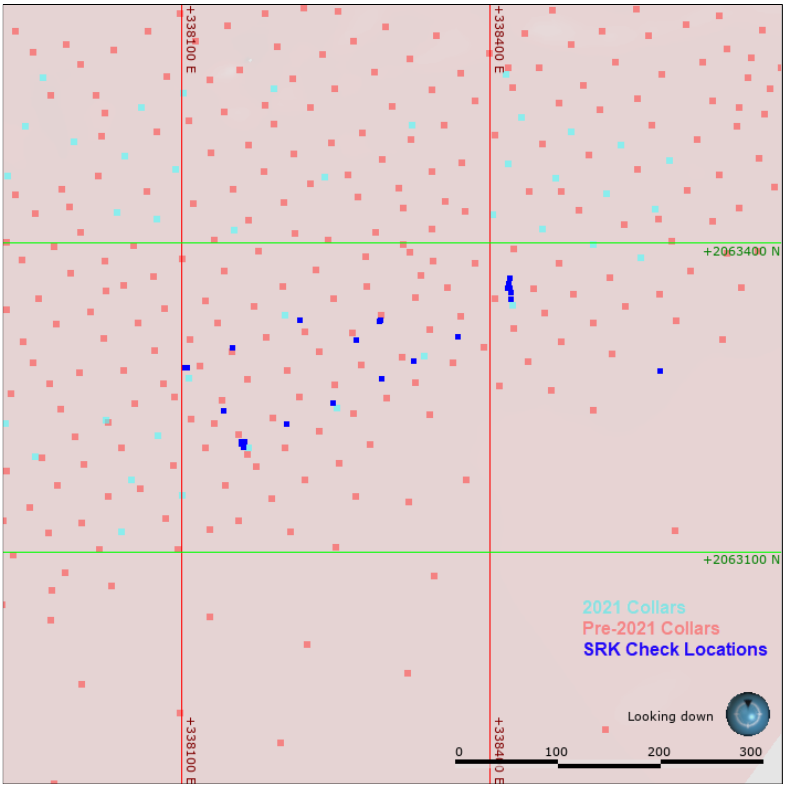


Figure 12-3: Plan view of M&M collars and SRK verification route

12.2.2 Verification of Controls on Mineralisation

SRK reviewed select core intervals from Miriam and M&M 2021 drilling programs at the project site. The Guezouman sandstone is coarse grained and generally equigranular, except immediately above the Talak contact, where the Guezouman can be conglomerate (Figure 12-5). The sandstone exhibits many sedimentary textures, including syn-sedimentary faulting, cross-bedding, and flame structures, all of which observed indicate a younging direction up (Figure 12-4). The bedding is generally flat, with high angle to the core axis. Although the uranium mineralisation is very fine grained, analysis with a scintillometer highlights the intensity of the mineralisation, which consistently intensifies immediately above the Talak contact.

Based on observations of these select intersections at site, SRK is confident in the interpretation of the geological setting and controls on mineralisation at the Madaouela project.

Figure 12-4: Guezouman sandstone in half-core exhibiting sedimentary textures including syn-sedimentary faults (left), cross-bedding (right), and younging indication towards top of image.

Figure 12-5: Guezouman contact with Talak shale. Base of Guezouman is relatively coarse grained, approaching conglomerate, and accompanied by intensification of mineralisation (strong scintillometer response).

12.2.3 Verification of eU by uranium

As part of the drilling programs at Miriam and M&M, the Guezouman unit was cored in select holes to allow for chemical assay of uranium and molybdenum. These chemical analyses, available in 290 holes largely drilled in the 2021 program (Figure 12-6 and Figure 12-7), allow for direct comparison of eU (down hole radiometric survey derived grade) versus uranium (chemical assayed).

SRK have composited the eU grades (teneur) to the sample length returned from chemical assaying and based the following comparisons and statistics on these composites (Table 12-1). For all composites, the correlation between eU and uranium is very good, R=0.86, and the QQ plot demonstrates excellent agreement in the distributions from 0.2 kg/t to about 5 kg/t, which represents the majority of samples of interest in the model (Figure 12-8). SRK notes that the chemical assays have an upper detection limit of 10 kg/t which are clear on the scatter plot.

Miriam makes up the majority of composites available for the comparison, and the correlation between eU and uranium is excellent, R=0.89 (Figure 12-9). SRK notes that the chemical assays have an upper detection limit of 10 kg/t which are clear on the scatter plot.

For M&M, there are significantly less composites available for comparison, but the correlation between eU and uranium is good, R=0.75. The QQ plot indicates relative positive bias for eU at grades below 1 kg/t, but positive bias for uranium above 1 kg/t (Figure 12-10). Still, the mean grade of each is the same, at 0.74 kg/t (Table 12-1).

Based on the comparison of available uranium and eU data available, SRK is confident that the eU derived from downhole radiometric surveys by GoviEx is an accurate measure of the uranium grade and can be relied on for the estimation of Mineral Resources.

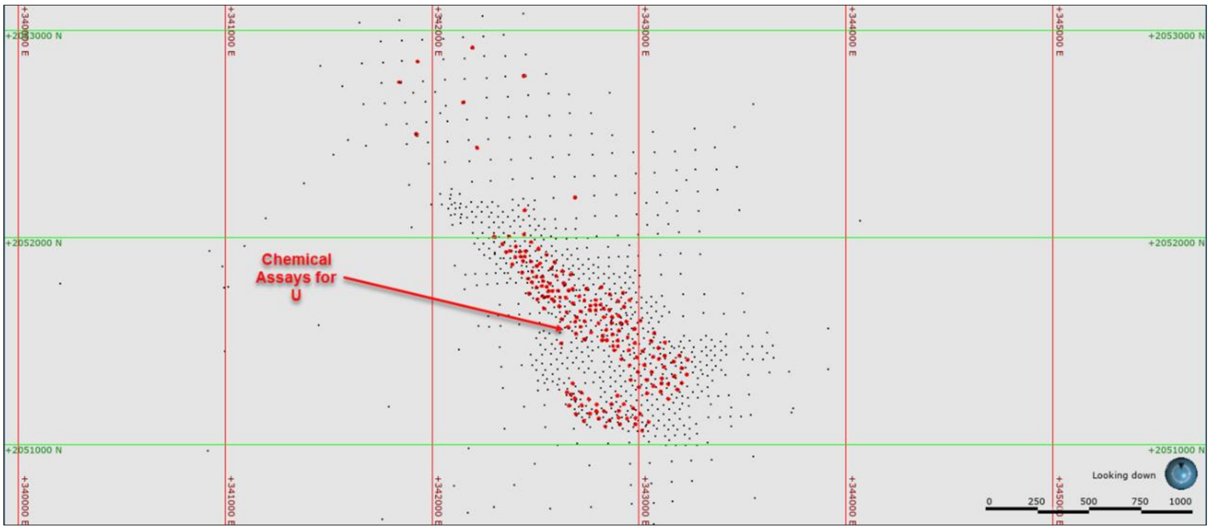


Figure 12-6: Plan view of Miriam drill hole locations (black) and highlighted locations where coincident uranium chemical assay and eU radiometric assay available.

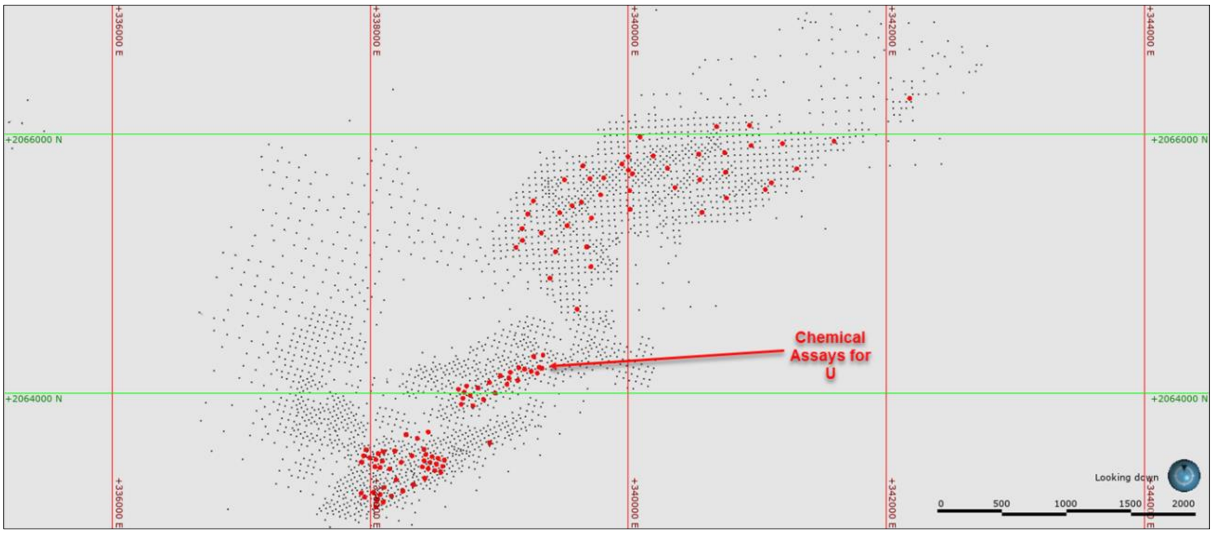


Figure 12-7: Plan view of M&M drill hole locations (black) and highlighted locations where coincident uranium chemical assay and eU radiometric assay available.

Table 12-1: Composite statistics for available chemical uranium assays and eU assays

Deposit	Samples	Chemical Assay U				Radiometric Survey eU			
		Min	Max	Mean	CV	Min	Max	Mean	CV
All	4,335	0.00	10.00	0.53	1.88	0.00	15.18	0.54	1.87
M&M	789	0.00	10.00	0.74	1.62	0.00	5.07	0.74	1.20
Miriam	3,546	0.00	10.00	0.48	1.94	0.00	15.18	0.49	2.07

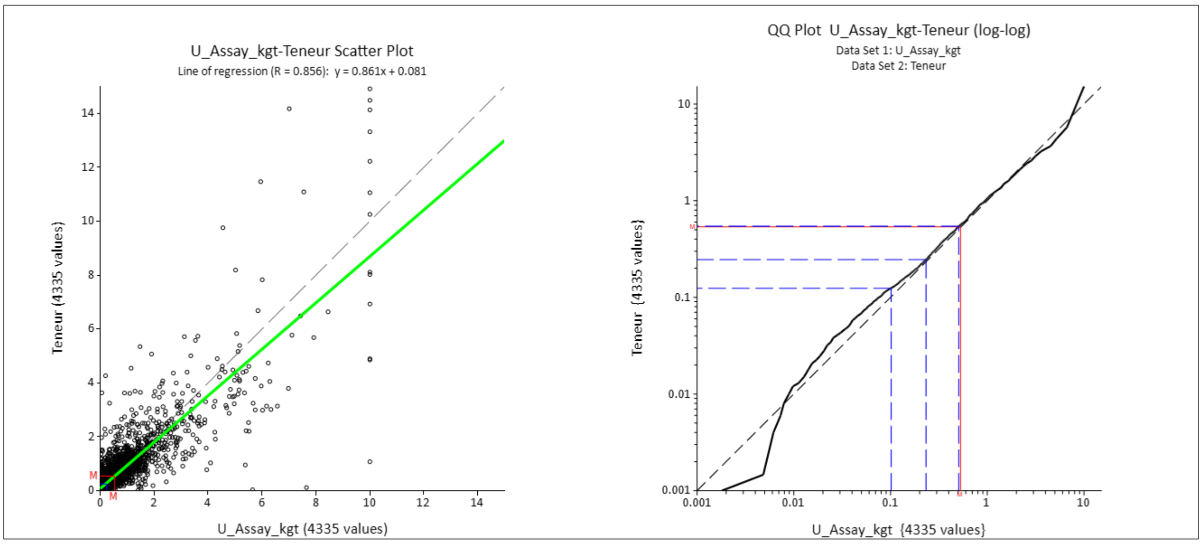


Figure 12-8: Scatter plot and QQ (Log) plot of eU (teneur) versus uranium (chemical assay) for all composites.

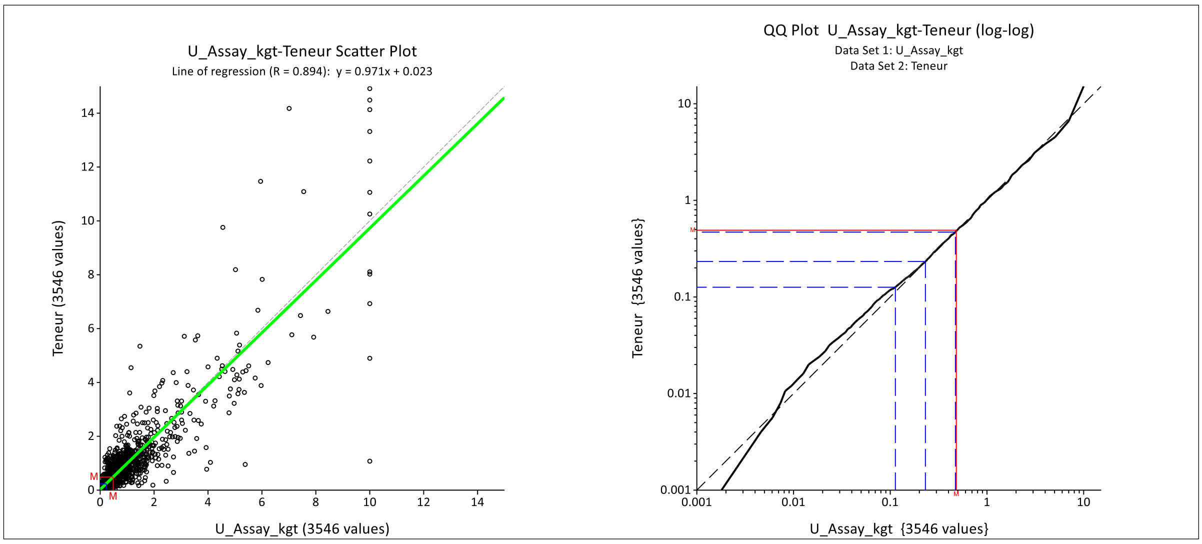


Figure 12-9: Scatter plot and QQ (Log) plot of eU (teneur) versus uranium (chemical assay) for Miriam composites.

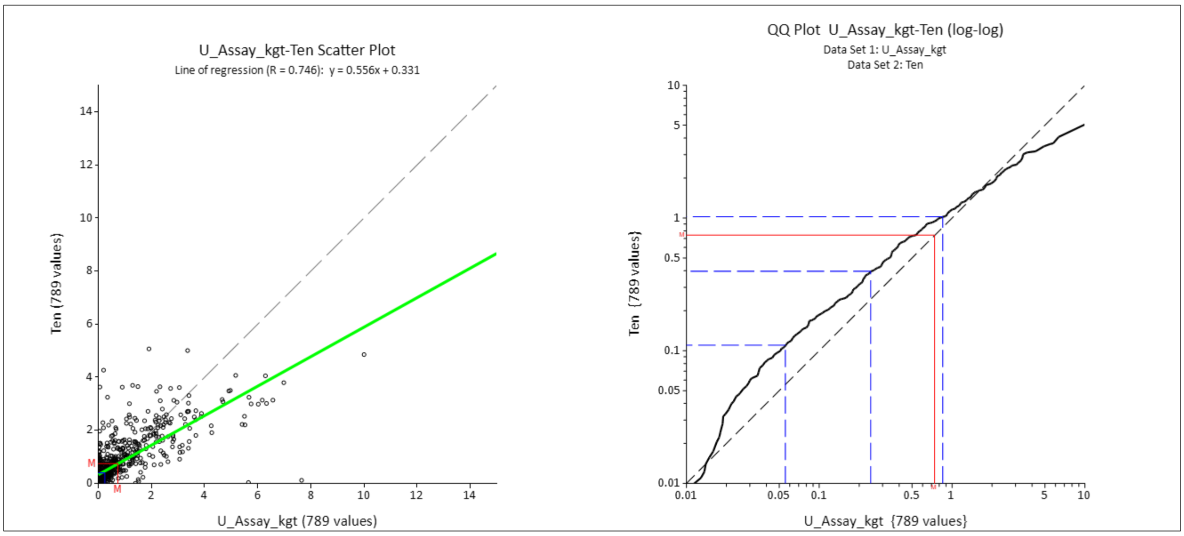


Figure 12-10: Scatter plot and QQ (Log) plot of eU (teneur) versus uranium (chemical assay) for M&M composites.

12.3 GoviEx Data Verification

12.3.1 Database Structure

The drilling database is hosted in CORALIS database structure was designed by Coralis to GoviEx specifications.

The working databases continue to be active in their hosting software, they are:

WellCad software is comprised of WellCad and Excel files. WellCad data is transferred into Utimine during drilling.

Utimine is software that was developed for GoviEx to perform geological interpretations and correlations. Utimine calculates all mineralisation data (accumulations) and is user-friendly software to interpret logs, sections, and maps. The software offers several functions that are needed in uranium exploration and development. Management control of daily progression of drilling is performed through Utimine with sectional interpretations. Utimine contains the databases and all geostatistical modeling tools necessary to estimate resources.

Mapping data are in Utimine and in MapInfo. MapInfo hosts all map data from external sources as well as updates of practical maps to follow everyday development and drilling program.

Export/Import from/into Utimine can take place in pre-formatted text files include the following: Excel (csv, pin), Surpac, Gemcom, Vulcan, GoCad, Isatis.

SRK noted in 2016 that the entire database has multi-person checks during the WellCad and the Utimine data process stages. Multiple geologists will have input to the logging, data entry and resulting sectional interpretations.

While each geologist is responsible for his own daily geological logs, the drillholes will need to correlate lithologically into the database of existing drillholes. Geologists import their geological logs into excel and WellCad on a daily basis, and the data gets validated by the geologist in charge of stratigraphic data. Drillhole data is transferred from WellCad to Utimine by geologists dedicated to data entry, and the inputs are verified by a second geologist. The data is verified in cross-section to validate the lithology picks. The Chief geologist also examines the data inputs for visual errors.

The Project Geologist and Chief Geologist also verify geological determinations as a final check daily.

12.3.2 Collar Coordinates

The survey database integrity and homogeneity is verified through the following procedure:

- Drill collar elevations are plotted on a topographic map interpreted from all data. All data points that appear as surface spikes are re-surveyed. Re-surveying is carried out on each abnormal point and all neighbouring points.
- Trace of the surface is also visualized in sections, and any particular surface feature that seems abnormal is re-checked in the field.
- A certain amount of historical holes on Mad I are still plotted after approximate reconversion of their coordinates, which are derived from map documents. None of those holes have been used to inform the MRE unless they have been re-drilled and surveyed.

12.3.3 Drillhole Deviation

Drillholes are all vertical by design. The angle deviation that may occur during drilling is measured with initial drillhole logging. Verification of the deviation measuring equipment reliability was conducted as follows:

- In a limited number of drillholes, cross checks were carried out with the deviation device attached to the DHT27 reference probe.
- If suspicious probe deviation records are indicated, the equipment is checked on surface by pulling the probe on the ground along a marked line to verify the measurement are correct.
- Every 20 to 50 holes, randomly selected holes are tested again for deflection using one of the other probes.

12.3.4 Geological Logs

Geological logs are subjected to a series of verifications:

Depth Errors

Logging depth is corrected for resistivity and scintillometer records by the probe manufacturer. Strict zero collar point in resistivity and gamma logging results in marginal differences between the geological depth and the gamma depth. For estimation purposes, the depth as measured by the gamma probe is used as the depth in the database.

Some visible errors occur in total depth lithology picks, as geologists often note the depth rounded to the number of chip sample intervals below the RT geological marker. A final correction is done to the correct depth from gamma probe data.

Coding Errors

The applied field procedures are as follows:

- Compare geological with geophysical logs ensuring depth reporting of lithology is logical;
- Rechecking in office of field data and control of main stratigraphic breaks. Any subsisting doubts are verified in the field the following day with the chief geologist;
- Re-control of depths by entering data into Excel and WellCad; and
- Converted WellCad logs with deviated trace are plotted in cross sections and lateral homogeneity is verified with neighbouring holes.

Additional validation occurs when interpreting sections and maps. Prior to a revision of the coding, in most cases the geologist revisits the chips on the drill site, as due to the dry climatic conditions, chips are preserved sometimes for years at the drill site. The coding revision is then defined with respect to neighbouring drillhole data.

12.3.5 Gamma Logs

Gamma log verifications are discussed in Section 11.2.2 (Radiometric Determinations); a discussion of QA/QC procedures for gamma logging. Those QA/QC procedures include:

- Duplicate determinations (re-logging with the same probe, if necessary);
- Replicate determinations (re-logging with a second probe or the reference probe); and
- Third Party determinations, equivalent to third party lab analyses (re-logging of a percentage of the drillholes by and independent contractor).

All Data verification and QA/QC procedures have been compiled into a document by GoviEx staff.

12.4 Conclusions (SRK)

In the opinion of SRK, GoviEx has in place sufficient QA/QC and database verification procedures to render the drillhole database consistent, verifiable, and appropriate for use in resource estimation. SRK has independently verified key aspects of the data collection procedures used for the Madaouela project and are confident that the database on which the MRE is based is informed by data of suitable quality. Most importantly, the chemical assays of uranium have demonstrated that the derivation of eU from downhole radiometric surveys (probing) has been completed to an appropriate standard by GoviEx and that the data can be relied upon for Mineral Resource estimation of uranium.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 Introduction – History and Summary

A comprehensive body of metallurgical development work has been conducted, from 2008 to 2022, on the Madaouela ores which is most recently described in the Updated Integrated Development Plan (IDP) published in August 2015 and the Pre-Feasibility Study published in April 2021.

The historical metallurgical testwork was conducted by SGS Lakefield in Canada and Mintek in South Africa, and comprised the following:

- mineralogical investigations
- geometallurgy
- comminution testwork
- Flotation testwork
- pre-concentration by radiometric sorting and flotation
- bottle roll and column leaching (involving acid and alkaline leaching)
- acid pugging
- two stage acid leaching
- ion exchange and solvent extraction
- Molybdenum Precipitation work
- uranium recovery assessment by precipitation and assaying of yellowcake product
- Tailings Thickening and Filtration Test Work

As part of the 2015 update, GoviEx investigated the use of proven SX reagent (Cyanex 600) with Cytec, for an improved recovery of molybdenum and uranium from the pregnant leach solution. Ablation was also investigated as part of the comminution options to reduce material requiring acid leaching, upgrading uranium and reducing carbonate content and Australian Nuclear Science and Technology Organisation (ANSTO) and Synexus assessed the potential to recover the various acids used in several parts of the circuit.

Since the testwork done to 2015 is comprehensively described in the Updated Integrated Development Plan (IDP) published in August 2015, and test work completed for the Pre-Feasibility Study (PFS) is detailed in the PFS report, only the parts that are relevant to the current flowsheet are summarised in this document, while subsequent testwork completed for the Feasibility Study is described in more detail.

13.2 Geometallurgy Summary

Geometallurgical work done in the previous phase has defined uranium mineralisation present as coffinite (60 %) and uraninite (40 %) with negligible other phases such as autunite and becquerelite at Miriam and rarely silica-mix-TiO_2 minerals. Uranium minerals occur with interstitial clays and carbonate in the cement of the Guezouman sandstones. Grain size is bi-modal with coarse and fine grained uranium minerals. Uranium minerals are dominantly present as fine grained, typically less than 30 µm size phases with occasional grains up to 100 µm in size. The most abundant uranium-bearing minerals in the sample are “pitchblende/silica-mix-TiO_2”, “Mo-coffinite-mix-TiO_2” and coffinite. Uranite and autunite are less abundant. The “pitchblende/silica-mix-TiO_2” and “coffinite-mix-TiO_2” phase contribute 65 % of the total uranium. The uranium-bearing minerals in the high-grade ore mostly report to the 10 - 25 µm size fraction.

Molybdenum occurs in the ores largely as a trace element in coffinite and pyrite with only minor molybdenite identified. In samples from the ore stockpile from M&M, powellite ($CaMoO_4$) was also identified.

Calcite comprises up to 1 % of the ore zone as interstitial cement intermittently associated with uranium minerals. Dolomite-siderite clasts in the ore feed, up to 4 % of total by weight, are the main potential source of gangue acid consumption. They are mainly associated with the underground ore at M&M.

13.3 Sample Descriptions/Ore Description

All metallurgical test work completed at Mintek for the Feasibility Study has been conducted on drill core samples from the Miriam deposit. Comminution work used both Miriam (~1,000 kg) and M&M stockpile (~110 kg) samples.

Miriam Low grade sample

The approximately 1,000 kg Miriam (low grade) sample was crushed to -1.7 mm, blended and split into 10 kg portions for characterisation and metallurgical test work. A representative sub-sample were removed from the crushed material for head sample characterisation. A milling curve was constructed to determine the suitable milling time to reach the target grind. 5 kg and 120 kg of the crushed sample was milled to 80 % -300µm for leach optimisation test work and bulk leach.

Miriam High grade sample

The Miriam (high grade) sample was crushed to -1.7 mm, blended and split into 10 kg portions for characterisation and metallurgical test work. A representative sub-sample were removed from the crushed material for head sample characterisation and grind size optimisation. 3x1 kg samples were milled to 80 % -150, 212 and 300 µm for grind size optimisation test work. The rest of the sample was milled to 80 % - 300 µm, which was selected based on test results, and used for metallurgical test work.

13.4 Comminution

13.4.1 Drop Weight Test

A standard drop weight test comprises the breaking of rock particles in the five narrow size ranges at three different energy inputs, making fifteen energy-size combinations. The broken product from each set of particles is sized on a root-two sieve series. This information, together with energy applied, is analysed to provide the model parameters, which reflect the impact resistance of the ore under test.

The A and b parameters are used in mill modelling to predict the required throughput, power draw, product size distribution, and ultimately, mill performance. The smaller the value of A*b, the greater the resistance to impact breakage. The parameter ta is a valuable indicator of the resistance to abrasion of the ore; the lower the value of ta, the higher the abrasion resistance. The specific energy value for the “standard” circuit is termed the “SCSE” (SAG Circuit Specific Energy).

The Miriam and the M&M stockpile samples are classified as very soft based on the classification using the A*b values.

Table 13-1: Drop Weight test results

Sample ID	A	b	A*b	ta	SCSE*
Miriam Sample 1	64.6	1.9	122.7	0.45	6.63
Miriam Sample 2	55.6	2.06	114.5	0.38	6.77

13.4.2 Abrasion Test

This test is conducted on a 3 kg sub-sample taken from the above 100 kg drop weight test sample. For assessing the resistance of the ore to abrasion, the abrasion test requires tumbling of the 3 kg sample in a mill of standard geometry for a fixed time. The product is sized so that the abrasion parameter can be calculated.

The parameter ta is a useful indicator of the resistance to abrasion of the ore – the lower the value of ta, the higher the resistance to abrasion, with ta values ranging between 0.38 and 0.45.

13.4.3 SAG Milling Comminution (SMC) Test

A total of six tests were done, one on a stockpile sample and five on the Miriam sample. Samples for testing will be selected in consultation with the client. JKMRC (Julius Kruttschnitt Mineral Research Centre) took the approach of decoupling material and machine in the simulation of comminution. Their approach was one of controlled breakage of single particles, which led to the development of the JK Drop Weight Test (DWT), which measures the impact breakage parameters of the ore. The ore specific parameters are used in JKSimMet to analyse or predict SAG mill performance. The Sag Mill Comminution (SMC) test was therefore developed as a lower cost precision technique to determine the impact breakage characteristics of drill core samples. It can be considered an alternative to the JK Drop Weight Test for cases where limited sample is available. It is well suited for the small samples typically derived from drill cores. The SMC test generates a “Drop Weight Index” (DWi), which is a measure of the rock strength when broken under impact. The DWi is directly related to the JK impact breakage parameters A and b, used in the JK SAG mill models to predict throughput, power draw and product size distribution.

M_i = Work index related to the breakage property of an ore (kWh/tonne). For grinding from the product of the final stage of crushing to a P_{80} of 750 microns (coarse particles) the index is labelled M_{ia} and for size reduction from 750 microns to the final product P_{80} normally reached by conventional ball mills (fine particles) it is labelled M_{ib}. For conventional crushing M_{ic} is used and for HPGRs M_{ih} is used.

Table 13-2: SMC test results

ID	DWi	M_{ia}	M_{ih}	M_{ic}	A	b	A*b	sg	ta	SCSE*
	kWh/m³	*kWh/t*	*kWh/t*	*kWh/t*						*kWh/t*
Miriam Sample 1	3.27	12.7	8.2	4.2	56.1	1.27	71.25	2.33	0.79	7.8
Miriam Sample 2	3.48	13.4	8.7	4.5	52.7	1.27	66.93	2.33	0.74	7.97
Miriam Sample 3	3.24	13	8.3	4.3	54.4	1.28	69.63	2.26	0.8	7.98
Miriam Sample 4	3.26	12.7	8.1	4.2	48.3	1.48	71.48	2.33	0.79	7.8
Miriam Sample 5	4.08	15.4	10.3	5.3	49.9	1.13	56.39	2.29	0.64	8.54
MM Stockpile	1.25	5.8	3.1	1.6	62.9	2.98	187.44	2.35	2.07	5.93

Notes:
sg = specific gravity

13.4.4 Bond Ball Work Index (BBWI)

This test was conducted on one Miriam sample.

This test provides valuable information for the design of grinding circuits and, in particular, to estimate the energy requirements for closed circuit ball milling.

The Bond ball work index (BBWI) test was conducted on the Miriam sample at 150 µm limiting screen. The BBWI tests results showed that the sample was classified as being hard with the work index of 11.4 kWh/t.

13.4.5 Bond Crushability (Impact) Work Index (CWI)

This test was conducted on five Miriam samples. This test provides valuable information, such as the energy requirements to accomplish a given crushing operation. This information is required by crusher manufacturers for crusher design and selection.

The summarised CWI test results are reported in Table 13-3. Typical hardness classification based on crushability work index indicate that most of the specimens tested can be categorised as being very soft to soft.

Table 13-3: Bond crushability work index results

Sample ID	S.G (t/m³)	Minimum (kWh/t)	Maximum (kWh/t)	Average (kWh/t)	75th Percentile
Sample 1	2.33	5.5	15.7	**9.9**	10.5
Sample 2	2.30	6.6	19.4	**9.7**	10.6
Sample 3	2.30	6.6	12.7	**9.2**	9.8
Sample 4	2.32	6.0	11.3	**8.7**	9.7
Sample 5	2.29	6.6	16.0	**10.0**	10.6

Notes:

S.G = specific gravity

13.5 VeRo Liberator®

The VeRo Liberator® is a novel vertical shaft impact crusher, a new and emerging comminution technology. The technology utilises two counter-rotating sets of tools arranged on vertical shafts to achieve comminution by high-speed impact, operates dry and claims to offer significant energy savings over conventional wet milling technologies. The VeRo Liberator® offers a compelling advantage over SAG milling for the Madaouela uranium project when comparing the estimated capital and operating costs offered by the two milling technologies. A significant cost saving provided motivation to investigate the application of the technology.

After initial tests using small samples of Madaouela waste rock showed promising results, a larger test using a sandstone proxy was completed, as transporting uranium ore into Germany would not be possible.

Thus, test work was conducted in Horneburg, Germany facilitated by fre-e-tec and observed by SGS Bateman. The purpose of the work was to confirm the successful application of the VeRo Liberator® in the Madaouela flowsheet, achieving the required grind (P_{80} = 300 µm) at the required throughput.

The main objectives of the test work program where as follows:

- Measure specific energy consumption (kWh/t)
- Measure recycling rate requirement for circuit
- Demonstrate, that the unit can perform as expected in the circuit such as to replace the conventional SAG mill circuit.
- Measure wear rates of the tools

The material used for the tests was a locally (Horneburg, Germany) sourced hard sandstone ore, similar in hardness to the Madaouela ore such as to provide analogous comparisons to expected performance of the VeRo Liberator® units. The locally sourced sandstone ore did show an increased hardness to the Madaouela Miriam ore (BBWi = 11.4 kWh/t) with a Bond Ball Work Index of 12.8 kWh/t. This suggests that the sample will thus give us conservative results due to its increased hardness relative to the expected Madaouela ore hardness.

The VeRo Liberator® units showed good performance on the sandstone ore with the specific energy requirement at 4.5 kWh/t and an expected 20 % recirculating load during operation.

It was also noted that the VeRo Liberator® units can likely crush the Madaouela ore in a single pass, reducing the feed solid load to each unit even further during operation. Dust and noise emissions were no issue during the tests.

13.6 Leaching

A number of leaching methods have previously been investigated prior to the Feasibility Study which include:

- Heap leaching
- Acid pugging
- Alkaline tank leaching
- Acid tank leaching

A detailed description of the large body of testwork comprising these investigations is included in the IDP report (SRK, 2015a). Of these methods, two-stage tank leaching provided the best result.

In the Feasibility Study phase the leach conditions were optimised and the performance of a 2-stage leach circuit was further examined.

13.6.1 Leach Optimisation Tests

Variable parameters include operating pH, Eh, feed grind size, temperature and percentage solids were examined to define optimum leach condition, maximizing extraction while minimizing reagent consumption.

Grind size and acid optimisation

Three bottle roll tests were conducted to optimise grind size at fixed addition of 50 kg/t H_2SO_4. Another three tests were done at 80 % -300 µm but with different acid addition. pH was monitored during the test and adjusted to the value of 1.5.

It was observed that the majority of the acid added was consumed during the first hour of the leach. Tests conducted on the sample milled to 80 % -150 µm required the addition of extra acid (above 50 kg/t added at the start) to maintain pH 1.5.

Results indicated that uranium behavior was similar for all tests except at the finest grind size (80 % -150 µm) which resulted in a relatively high final pH. uranium extraction efficiency obtained on the high-grade sample was in line with results reported in 2011.

The trend observed was higher molybdenum extraction at higher residual acid.

Results indicated that uranium and molybdenum extraction was similar for different grind sizes tested. However, the amount of soluble iron increased significantly with the finer milling of the ore. Thus, 39 % iron was extracted from the ore at 80 % -300 µm and 51 % at 80 % -150 µm. An increase in acid addition also had a positive effect on iron dissolution.

As expected, acid consumption changed in reverse order with the ore particles size. Less H_2SO_4 was consumed by the ore at 80 % -300 µm than at 80 % -150 µm. Higher acid addition resulted in a higher amount of acid consumed, presumably due to the reaction with gangue minerals.

The optimal conditions selected for further tests was, thus, milling to 80 % -300 µm and acid addition of 50 kg/t.

Two stage leach optimisations

Leach optimization work was completed via two test work campaigns. The initial test work campaign performed cyclic leaching to simulate plant performance, with the second campaign focusing on stage 2 optimization.

First leach optimization campaign

Four cycles of 2 stage leach were conducted on the high-grade material to evaluate uranium and molybdenum extractions and impurities build-up. The test was conducted as per the procedure described below:

Stage 1:

The milled sample was slurried to a pre-determined solids percentage. The slurry was leached in an agitated reactor according to specific leach conditions. The slurry was stirred with an overhead stirrer for the duration of the leach. H_2SO_4 and H_2O_2 was added to adjust the pH and Eh to the targeted values. Operating parameters such as pH, Eh and, temperature readings were recorded on an hourly basis.

Stage 2:

A similar process as described for stage 1 leach was be applied for stage 2, except that the filter cake from leach stage 1 will be used as feed material.

Uranium extraction was similar at different ore grind size and solids percentage in the slurry. Kinetic samples were analysed, indicating that uranium extraction was quick, achieving maximal concentration of uranium in the PLS after 2-8 hours.

Results indicated that the performance of leach cycles 2 to 4 was similar. The majority of uranium was leached in the first stage. However, increased uranium concentration was observed during the second stage indicating dissolution of additional uranium from the ore.

Molybdenum and iron were mainly leached during stage 2 where acid concentration was higher. Soluble molybdenum in the PLS transferred from stage 2 to stage 1 of the next cycle was re-precipitated when pH increased.

Solution analysis was used to calculate extraction for metals of interest.

Second leach optimization campaign

The second leach optimization campaign was introduced to focus on the second stage optimization. Acid addition was varied at changing temperatures to evaluate the optimum leach conditions for the 2-stage leach in terms of temperature and acid addition along with maintained Eh.

Bulk leach (stage 1):

15 kg of milled sample will be leached at 30 % solids pH 1.4-1.5, Eh >650 Mv (controlled by H_2O_2 addition). Intermediate samples (solutions) were taken hourly for XRF analysis. After 6 hours leach time the slurry was filtered, washed and solids were dried prior to stage 2. Feed, residue, and filtrate were analysed for uranium, molybdenum and base metals.

Leaches (stage 2):

For stage 2 a matrix of test conditions was explored, this was done to identify the optimised leach operating conditions in terms of acid addition and temperature:

- 20 g/L acid, ambient T
- 50 g/L acid, ambient T
- 100 g/L acid, ambient T
- 20 g/L acid, 50°C
- 50 g/L acid, 50°C
- 100 g/L acid, 50°C
- 20 g/L acid, 90°C
- 50 g/L acid, 90°C
- 100 g/L acid, 90°C
- Optimal conditions
- Optimal condition – filtrate from stage 1

In order to simulate stage 2 more precisely, mixing of dry residue and filtrate from 1st stage was done (1 kg solids and 1 L filtrate). Acid was added as required and Eh >650 mV was maintained via H_2O_2 addition.

Each test was run for 6 h with kinetic samples taken hourly for scan. Final filtrates and residues were submitted for detailed analysis.

Results showed a strong relationship between uranium and molybdenum recovery with acid addition and temperature. A steady tread between acid addition and uranium and molybdenum extraction was observed. A similar trend was observed with Uranium and molybdenum extraction and temperature. This is provided the system is maintained at the required Eh. Eh was maintained >650 mV to provide an adequately oxidative environment.

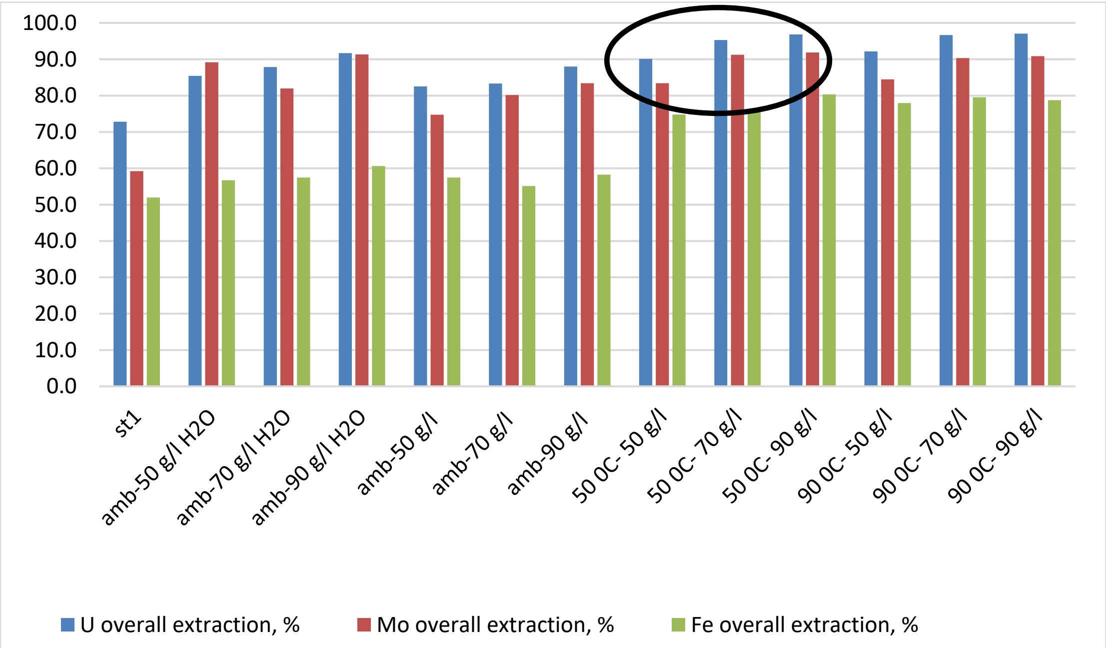


Figure 13-1: Uranium and molybdenum Extraction 2-Stage Leach

A clear tend can be observed between leach uranium and molybdenum extraction performance and acid consumption rates. This was trended to determine the optimum operating point for the 2-stage leach.

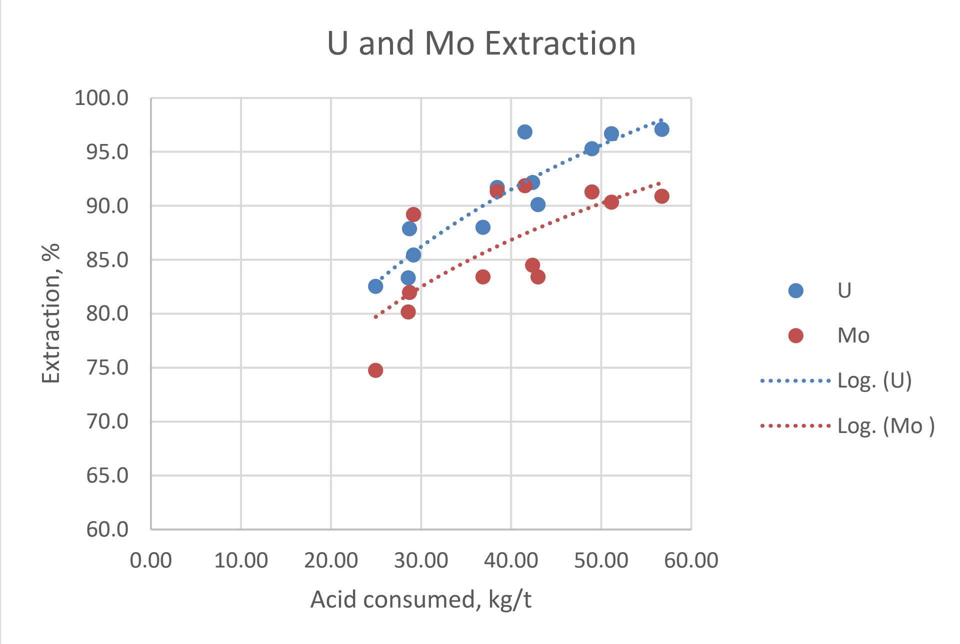


Figure 13-2: Uranium and molybdenum Extraction Relative to Acid Consumption

From the above we can define the optimum leach conditions in terms of acid addition, temperature and Eh. It was found that an acid consumption of 50 kg/t and a temperature of 50°C gave an optimised operating point at Eh >650 mV, with uranium extraction at 95.63 % and molybdenum extraction at 90.22 %.

13.6.2 Bulk Leach

The optimal conditions identified from the leach test work were used for this test. A maximum leach time of 24 hours with 100 kg feed material was allowed for the bulk leach. The bulk pregnant leach solution (PLS) will be used as feed liquor for subsequent ion-exchange (IX) and solvent extraction (SX) test work. Settling tests will be conducted on slurry samples removed after each leach step.

13.7 Recovery – IX, SX and Precipitation

After leaching a bulk sample under optimised conditions, uranium recovery via solvent extraction from the clarified pregnant leach solution (PLS) was investigated. Optimised SX operational conditions were defined. IX test work was performed aimed at recovering molybdenum.

13.7.1 SX and Product Precipitation Testing

Extraction Equilibrium Isotherm

The barren liquor from the IX bulk loadings step was used as feed liquor for the SX test work. Alamine 336 will be prepared in a diluent, Shellsol D70 with isodecanol as a modifier.

An extraction equilibrium isotherm was generated by contacting the aqueous phase with the organic phase (4 % (v/v) Alamine 336 plus 2.5 % (v/v) Isodecanol in Shellsol D70) at various O/A phase ratios at 40°C. Mixing of the phases was accomplished using a magnetic stirrer and stirring bar (45 mm long) rotated at 500 - 750 rpm to make sure that homogeneous dispersion of the two phases occurred for 15 minutes. Samples of both the aqueous phases and the organic phases were filtered and submitted for analyses.

An extraction isotherm was completed by contacting the organic (O) and aqueous (A) feed in different phase ratios. A mass balance for each of the extraction points for the major metals was completed. McCabe-Thiele constructions were constructed on the extraction isotherm, and the stage requirements and appropriate O/A phase ratio was estimated for efficient uranium recovery. Recovery for the extraction circuit was modelled for >99 % uranium extraction. Three stages are required in the extraction circuit.

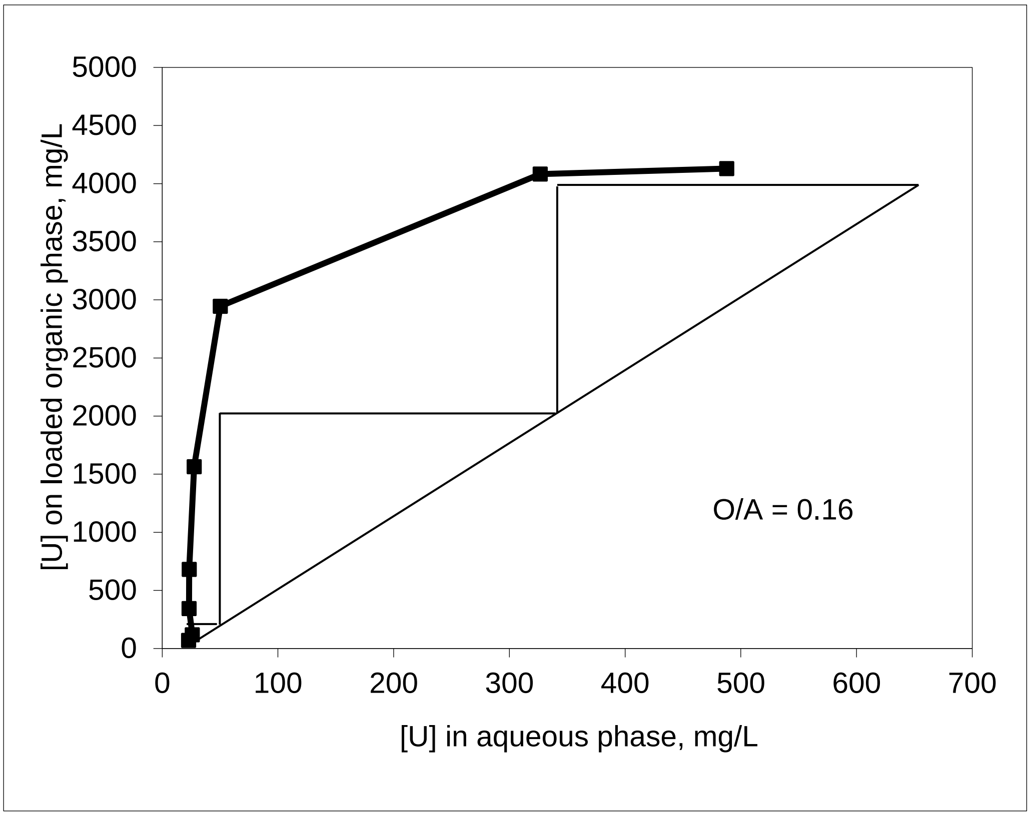


Figure 13-3: SX Extraction Isotherm

Scrubbing

The loaded organic phase was scrubbed using the standard scrub solutions which are used in industry for uranium purification using Alamine 336. Scrubbing was done at 40 °C and at an O/A phase ratio of 10:1. The scrubbing of the loaded organic phase employed three scrub solutions, namely pH adjusted water (at a pH value of 1.8), 10 g/L sulfuric acid and 40 g/L sodium hydroxide solution. Mixing of the phases was accomplished using a magnetic stirrer and stirring bar (45 mm long) rotated at 500 - 750 rpm to ensure a homogeneous dispersion of the two phases.

Stripping Equilibrium Isotherm

The stripping equilibrium isotherm was generated by contacting the aqueous phase with the scrubbed organic phase at various O/A phase ratios at 40 °C. Mixing of the phases was accomplished using a magnetic stirrer and stirring bar (45 mm long) rotated at 500-750 rpm to make sure that homogeneous dispersion of the two phases occurred. The pH values (measured by means of a calibrated combined glass-reference electrode) of the aqueous phase were adjusted by the addition of a 120 g/L NH_4OH. 200 g/L sulfuric acid solution and 70 g/L ammonium hydroxide solution were used to control pH between 5 and 3.8.

The McCabe-Thiele construction for uranium stripping using 120 g/L ammonium sulfate as a strip liquor and the scrubbed organic phase is shown below.

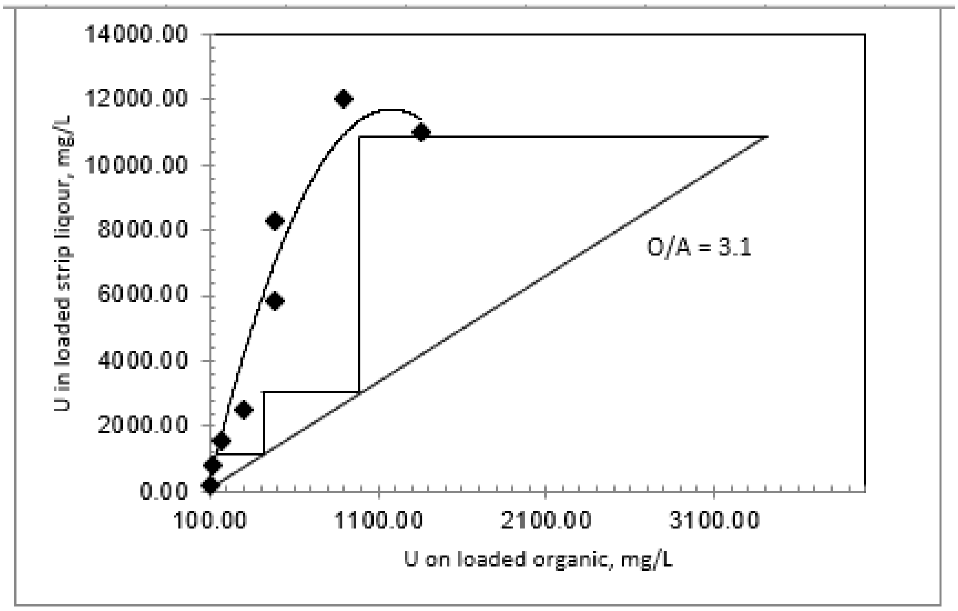


Figure 13-4: SX Stripping Isotherm (Corrected)

Gradual pH adjustment is required for uranium stripping as too hastily increasing the pH would result in uranium yellow cake formation which is undesirable for the operation of mixer-settler cells. All O/A phase ratios that were tested resulted in clear phases. The McCabe-Thiele construction indicated that at an O/A phase ratio of 3:1, approximately three counter-current stages would be required for stripping of uranium off the organic phase. A loaded strip liquor containing 11 g/L could be achieved.

ADU Precipitation and Yellow Cake Calcination

A single uranium precipitation test was conducted from a bulk strip liquor using sodium hydroxide. The mixture was reacted for 6 hours with solution samples taken at 1, 3 and 6 hours. The final solution was fully analysed by ICP and the recovered precipitate analysed for uranium by XRF and an ICP scan was performed to quantify deportment of impurities.

Based on the feed and barren uranium concentrations the precipitation efficiency was 99.5 %. It is possible that with longer duration even more complete uranium precipitation would have occurred, further test work has indicated that 99.8 % is achievable.

Post precipitation the ADU precipitant was calcined at 750°C to produce typical yellow cake product. The product was produced as a powder with the following assay results from NECSA:

Table 13-4: U_3O_8 solids assay (NECSA)

Product Specification - NECSA			
·	Component		NECSA
·	Uranium (U)	m/m (dry weight)	84.10%
·	Arsenic (As)	m/m (dry weight)	0.0007%
·	Barium (Ba)	m/m (dry weight)	0.0008%
·	Boron (B)	m/m (dry weight)	0.001%
·	Cadmium (Cd)	m/m (dry weight)	0.0003%
·	Calcium (Ca)	m/m (dry weight)	0.029%
·	Chromium (Cr)	m/m (dry weight)	0.001%
·	Iron (Fe)	m/m (dry weight)	0.075%
·	Lead (Pb)	m/m (dry weight)	0.009%
·	Magnesium (Mg)	m/m (dry weight)	0.0014%
·	Mercury (Hg)	m/m (dry weight)	0.0001%
·	Molybdenum (Mo)	m/m (dry weight)	0.009%
·	Potassium (K)	m/m (dry weight)	0.007%
·	Selenium (Se)	m/m (dry weight)	0.00002%
·	Silica (SiO_2)	m/m (dry weight)	0.130%
·	Silver (Ag)	m/m (dry weight)	0.00003%
·	Sodium (Na)	m/m (dry weight)	0.006%
·	Thorium (Th)	m/m (dry weight)	0.003%
·	Titanium (Ti)	m/m (dry weight)	0.007%
·	234U	µg/gU	50 µg/gU
·	Vanadium (V_2O_5)	m/m (dry weight)	0.0007%
·	Zirconium (Zr)	m/m (dry weight)	0.0036%

13.7.2 Molybdenum Ion Exchange and Precipitation

It is proposed to use ion exchange (IX) to remove molybdenum from the PLS. A major advantage of this is that it allows a conventional uranium SX using Alamine 336, as described above, and an ammonia precipitation circuit. Research work conducted by Mintek indicates that molybdenum removal can be achieved using a commercially available IX resin incorporating an oxime type functional group. A similar process has been described by Beutier and Le Quesne.

pH vs. Extraction and Resin Selection

Two resins were tested for molybdenum recovery from PLS 1 generated in leach.

The loading was done at pH 1.2 and 1.5. Results of the tests (metals extraction from solution and resins loading) are shown in Figure 13-5. Results indicated that both resins adsorbed molybdenum efficiently and selectively. From two products tested, S 9701 showed better performance as it had higher molybdenum loading and lower Fe and uranium co-loading at solution-to-resin ratio tested. It was found that pH value of the feed solution did not have noticeable effect on the resin's performance.

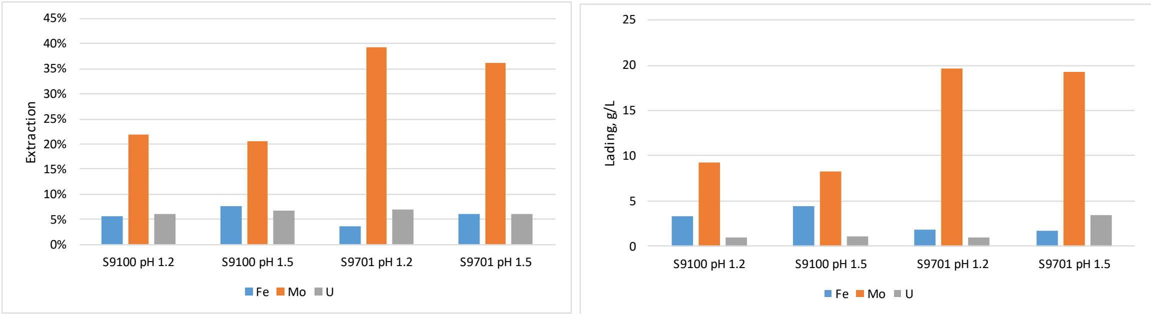


Figure 13-5: Resin Extraction and Loading

Based on results, pH 1.5 was selected for further test work as it is expected terminal pH of the PLS and no pH adjustment would be required after leach and prior molybdenum IX.

Equilibrium Adsorption Isotherms at Ambient and 50°C

The initial tests were conducted for two resins contacting with the solution generated in leach at a pH adjusted to the value of 1.5 (with NaOH) at ambient conditions. The then selected resin was tested at 50°C.

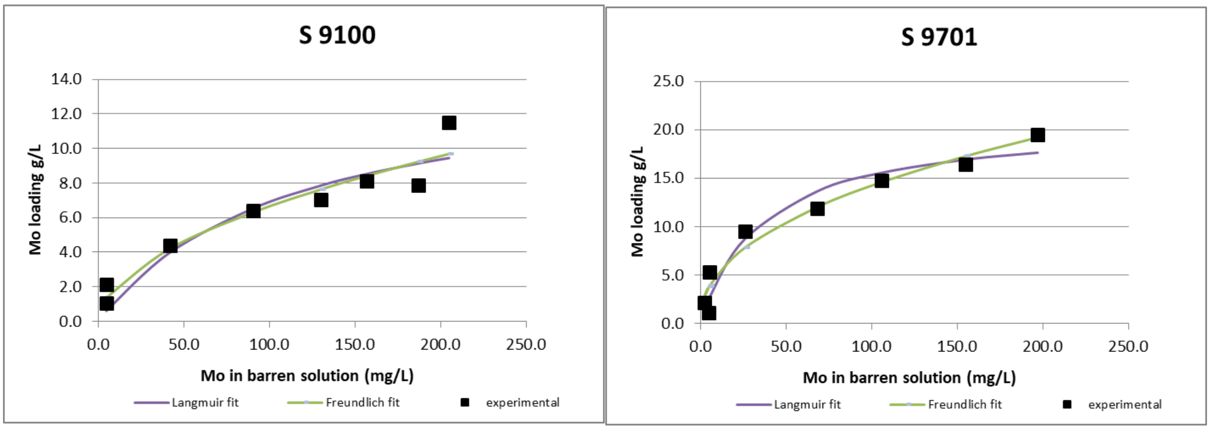


Figure 13-6: Molybdenum Equilibrium Adsorption Isotherms (Ambient)

- Both products extracted molybdenum well;
- Lowest molybdenum detected in barrens was around 5 mg/L;
- Maximal molybdenum loading achieved during tests was 20 g/L for S9701 resin and 11 g/L for S9100 resin.

The resins co-loaded iron and uranium. Both products were more selective for molybdenum than other elements. However, S 9701 had significantly lower co-loading of uranium and iron.

Thus, S 9701 resin was selected for the process IX circuit.

Tests were then conducted to optimize molybdenum adsorption. Molybdenum was efficiently loaded from PLS in adsorption tests using S 9701 resin at 50°C. Molybdenum uptake improved compared to the tests conducted at ambient temperature with previous PLS solution. Maximal molybdenum loading achieved during tests was 20 g/L.

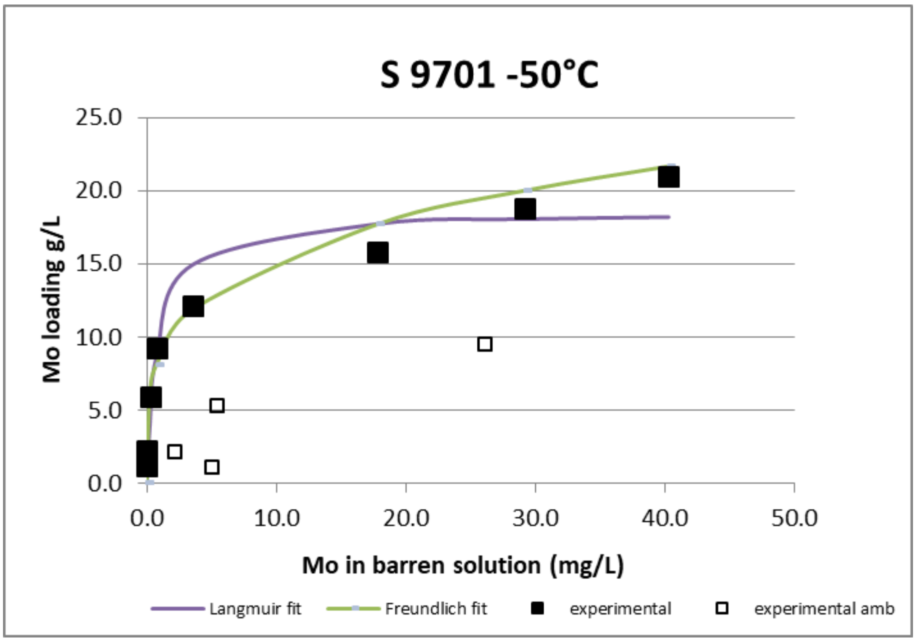


Figure 13-7: Molybdenum Equilibrium Adsorption Isotherms (50°C)

It was thus reported that elevated temperature (50 – 60 °C) improved molybdenum adsorption.

Molybdenum Breakthrough

Breakthrough tests were conducted on a PLS generated at condition representing future operation. pH of the solution was adjusted to the value of 1.5 using NaOH. Barren was collected in 4-2 BVs portions. The test showed good results with low molybdenum (<5 mg/L) in IX barren. It was reported that elevated temperature (50 – 60 °C) improved molybdenum adsorption.

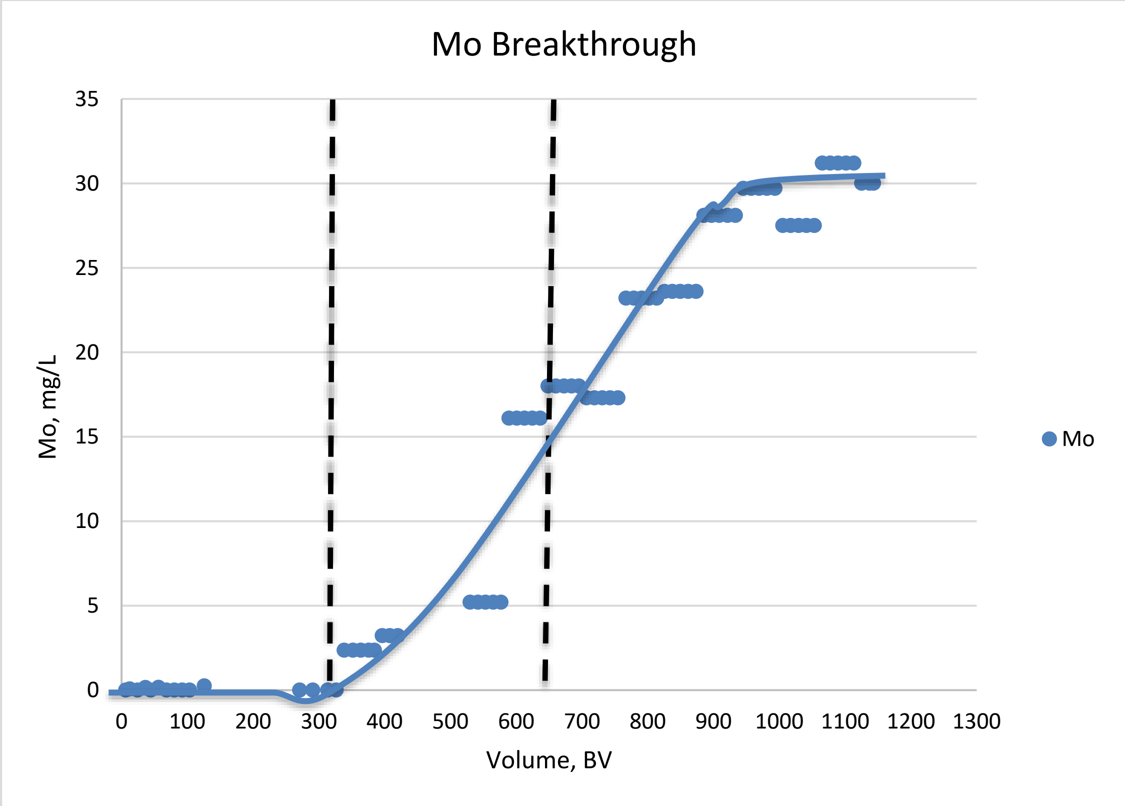


Figure 13-8: Molybdenum Breakthrough test

It would be expected that MoO_2+, $HMo_2O_6^{+}$, H_2MoO4, $HMo_8O_{26}^{3-}$, $H_3Mo_7O_{24}^{3-}$, $H_2Mo_7O_{24}^{4-}$ and Mo_8O_{264} present in the PLS. High concentration of S (sulfate) in the PLS can also play a role in molybdenum adsorption by the resin.

Elution Optimisation

The aim of the tests was to find optimal conditions for selective removal of molybdenum and U/Fe from the loaded resin.

Two elution cycles were tested:

- Impurities (Fe, U) stripping
- molybdenum elution

Fe and uranium were stripped with H_2SO_4 solution. The eluent strength played a key role in the elution step. 1 M H_2SO4 showed better performance as higher elution efficiencies were achieved with a smaller volume of eluent and eluates produced had higher Fe and uranium concentrations. Resin samples were analysed, and results showed that Fe and uranium could be removed quantitatively from the loaded resin.

It was observed that in the case when alkaline elution was done first, the peak Fe and uranium elution concentrations were obtained at 6 BV of the eluent passed through the column. A portion of acid (3 BVs) used for uranium and Fe stripping was likely neutralised first. This is due to the formation of hydroxides inside of resin beads and/or adsorption of OH- during elution with NaOH. The OH- reacts with H_2SO_4 consuming acid.

molybdenum elution was conducted using alkali, NaOH and NH_3. 1 M NaOH performed better that 0.5 M NaOH or 1M NH_3. In the case when molybdenum elution was done first, prior to the impurities removal, molybdenum elution profile was sharp. If acid elution is done first followed by alkaline elution, the molybdenum elution profile had a long tail. This is due to polymerisation or precipitation of Molybdenum inside of resin beads at acidic conditions and re-speciation when alkali is added. It was also noted that, small amounts of Molybdenum were eluted from the loaded resin during acid elution (when acid was applied first) and higher acid concentrations resulted in higher Molybdenum concentrations in the corresponded eluates. It must be noted that, no complete Molybdenum stripping was achieved. However, elevated temperature and soaking in NaOH eluent assisted Molybdenum removal.

Results indicated that the sequence of elution steps (alkaline and acidic) did not play a significant role in impurities removal. Advantage of alkaline elution followed by acidic elution are:

- Smaller volume of eluate (5BVs) at higher Molybdenum concentration;
- No need for the resin regeneration into SO_4^{2-} form after complete elution.

It was noticed that elevated temperature (50 °C) had a positive effect on uranium and Fe stripping. Elevated temperature (50 °C) also benefited Molybdenum removal from the loaded resin.

The following sequence was thus suggested: alkaline elution followed by acidic elution at 50°C. This approach allows better Molybdenum stripping efficiency and no need for the resin regeneration after the complete elution cycle.

Molybdenum Precipitation

The bulk molybdenum eluate was subjected to precipitation for Molybdenum recovery. Three tests were conducted to evaluate optimal conditions for Molybdenum precipitation. The reagents and conditions to be used were defined by typical requirements for the “Rapid Acidification” process for Molybdenum recovery as a Molybdenum Sulfide product (MoSx). In the “Rapid Acidification” process initially Molybdenum Eluate is treated such that the pH is lowered to between 5 and 6 by controlled addition of concentrated sulfuric acid. The solution is then pumped to the precipitation tank, which has a steam jacket to maintain the temperature at 80 °C, where molybdenum sulfide is precipitated by the addition of a sodium sulfate solution. Once the precipitation reaction is complete, the solution is pumped to the rapid acidification tank, where the pH is dropped to 2.5 before being pumped to the molybdenum product thickener.

The barren solution post precipitation and MoSx solid product were analysed to determine precipitation efficiency. It was found that the product precipitated readily and produced a MoSx solid with an expected >98 % ppt efficiency. The solid was found to be difficult to filter however and resulted in long filtration times, which poses a risk for re-dissolution of Molybdenum to solution. The precipitate performed well under pressure filtration, reducing the filtration time required.

There is a potential to further re-process the molybdenum sulfide product to a Molybdenum Oxide product through high temperature roasting at 773 K. This was explored in test work on the MoS_x product and produced an almost pure oxide product as MoO_3.

Table 13-5: MoO_3 solids assays, %

Al	Ca	Co	Cr	Cu	Fe	Mg	Mn	Ni	Pb	Si	Ti	V	Zn	Mo	S	U-XRF
0.6	0.083	<0.05	0.18	<0.05	1.005	<0.05	<0.05	0.0905	<0.05	<0.05	<0.05	0.06	<0.05	62.5	0.02	0.56

13.8 Miscellaneous Testing Summary

13.8.1 Thickening and Filtration Testwork

Vietti Slurrytec conducted laboratory scale thickening and filtration test work on one Uranium Tailings slurry material prepared by Mintek. The purpose of test work was to characterize the thickening and filtration behaviour of the material and to generate design data for process engineering plant design.

The Uranium Tailings post leach slurry is characterized by low pH 1.6 and a high conductivity of 14 mS/cm. It is naturally in the coagulated (settling) state and therefore receptive to flocculation. The non-ionic flocculant N-100 supplied by Kemira was selected as the optimum flocculant type based on overall performance in terms of settling rate and supernatant clarity, for a thickening application.

The optimum flocculation conditions are as follows based on the results of both static settling tests and bench-top dynamic thickening tests:

- Flocculant type = Kemira N100
- Flocculant dosing concentration = 0.025 %m
- Flocculant dose rate = 35 to 40 g/t

Bench-top dynamic thickening tests showed that underflow solids concentrations in the region of 34 %m to 38 %m can be achieved over a flux rate range of 0.2 to 0.4 t/m^2/h, under High-Rate thickening conditions (no pickets on rake). Excellent overflow clarity was achieved across all flux rates tested. Mud bed consolidation tests over a 24-hour period showed that more than 90 % of the consolidation took place within the first 3 hours, achieving a solids concentration of 64 %m after 3 hours of bench-top High-Rate thickening.

The cake moisture content that could be achieved with vacuum filtration, was 21 %m moisture at a cake form time of 60 seconds and a drying time of 180 seconds, with a cake thickness of 15 mm. This corresponded to a laboratory filter flux rate of 202 kg/m^2/h. Good filtrate clarity of 43 NTU was achieved with a S30 cloth type. Indicative pressure filtration tests showed potential to further reduce cake moisture content.

13.9 Summary of Approach and Recoveries

A pragmatic approach to flowsheet selection for treating the Madaouela ore will be to utilize a simple and proven flowsheet including whole ore, two-stage acid leaching to treat the ore arising from the open-pit Miriam operation, which has relatively low gangue-acid consumers (GAC), and then add reverse flotation preceded by de-sliming, in later years, when the underground ore with higher acid consumption is treated.

Ion Exchange (IX) will be utilized to remove molybdenum from the PLS, which will allow uranium to be recovered using the proven SX process using a tertiary amine extractant. Using this approach will de-risk the primary uranium production process, with the only circuits that are not proven on an industrial scale being the VeRo Liberator® and the molybdenum CIX.

13.9.1 Conceptual Circuit

The process will consist of the following circuits, during the early years when low GAC ore from Miriam is treated:

- Crushing and VeRo Liberator® milling
- Two stage tank acid leaching of the whole ore to produce a PLS containing uranium, molybdenum, iron and other impurities.
- Belt filtration for leach residue dewatering followed by tailings disposal by dry stacking
- Recovery of molybdenum by IX using an oxime resin
- Elution of Molybdenum using sodium hydroxide followed by precipitation of MoSx
- Recovery of uranium from the IX barren, SX using Alamine 336
- Precipitation of uranium as ADU using ammonia
- ADU calcination to produce U_3O_8

Reverse flotation can be developed further and added in later years to achieve rejection of acid consuming minerals when moving to the underground ore.

This circuit has been modelled using Metsim. Key parameters predicted by the model when treating ore from Miriam are shown in Table 13-6 below.

Table 13-6: Key process parameters

	Units	Base Case 1MTPA WOL
Feed		
Ore Feed to process plant	t/year	1,000,000
Available hours	h/year	7,446
Plant throughput	t/h	134.3
U grade	g/t	850
Mo grade	g/t	200
Ca grade	%	0.94
Mg grade	%	0.17
Recoveries		
Overall U	%	94.8
Overall Mo	%	88.9
Other		
Predicted leach acid consumption	kg/t	50

14 MINERAL RESOURCE ESTIMATE

14.1 Introduction

The deposits that comprise the Madaouela Uranium Project are Miriam, Marilyn and Marianne (M&M), Maryvonne (MYVE), MSNE, MSCE, and MSEE (Figure 14-1). The mineral resource models prepared by SRK consider drill holes completed and sampled by GoviEx during the period from 2008 to 2021. To support the Feasibility Study in 2021/2022, SRK have prepared updated geological models and Mineral Resource Estimates (MRE) for the Miriam, M&M, MSEE, and MSCE deposits. The estimates for MYVE and MSNE deposits were not updated as these were not informed by any new information since they were prepared in 2016.

The MRE for Miriam, M&M, MSEE, and MSCE presented here have been completed by Guy Dishaw, P.Geo. of SRK Consulting UK Ltd while the MRE for MYVE and MSNE were completed by Daniel Guibal, FAusIMM (CP) of SRK Consulting (Australasia) Pty Ltd. Although no new information was available for the MYVE and MSNE deposits for the 2021/2022 study, Mr Dishaw has reviewed these models in the context of the project characteristics and considers these suitable for the reporting of Mineral Resources.

This section describes the resource estimation methodology and summarises the key assumptions considered by SRK. In the opinion of SRK, the MRE reported herein is a sound representation of the Uranium, and Molybdenum in the case of Miriam and M&M, mineral resources found on the Madaouela Uranium Project at the current level of sampling.

This MRE was completed and reported in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Reserves (CIM Definition Standards, May 19, 2014) and National Instrument 43-101 (NI 43-101). SRK have considered the CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines (November 29, 2019) and CIM Best Practices in Uranium Estimation Guidelines (November 23, 2003) for all aspects of the MRE presented here. The CIM Definition Standards have been aligned with the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) reporting template. Accordingly, SRK considers the CIM Definition Standards to be an international reporting standard which is recognised and adopted world-wide for market-related reporting and financial investment.

The Uranium resources are defined using the convention of “eU” in kg/t for grade. The eU distinguishes concentration as being uranium concentration largely defined from gamma spectrometry with only a small fraction of core being chemically assayed for uranium. This does not compromise the integrity of the result but only seeks to demonstrate the source of the information. This value can be related to eU_3O_8 concentration by a factor of 1.17924. Uranium concentrations determined by chemical assay are shown simply as uranium or U_3O_8. eU_30_8 is used for the reporting of contained metal in the Mineral Resource statements.

The database used to estimate the Madaouela Uranium Project MRE was reviewed by SRK. SRK is of the opinion that the current drilling information is sufficiently reliable to interpret with confidence the boundaries for sandstone-hosted uranium mineralisation and that the assay data are sufficiently reliable to support mineral resource estimation.

Leapfrog Geo and Leapfrog EDGE was used to review, verify, and design the resource estimation domains, prepare assay data for geostatistical analysis, construct the block model, estimate metal grades, and tabulate mineral resources. In addition, Supervisor and Vulcan software were used to supplement the work in Leapfrog.

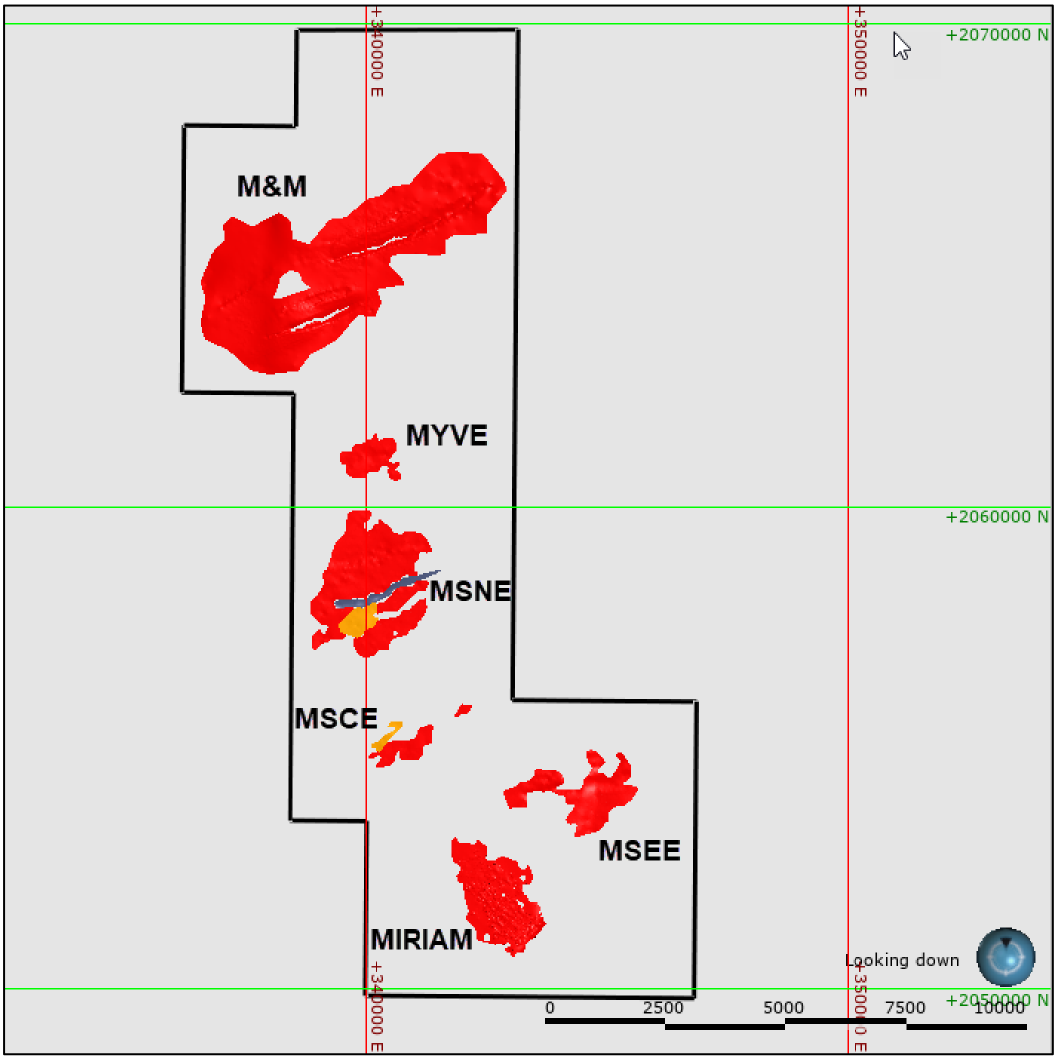


Figure 14-1: Plan view of the Madaouela Uranium Project deposits and the MAD I license boundary.

14.2 Mineral Resource Estimation Procedures

The MRE methodology for each deposit involved the following steps:

- database compilation and verification;
- stratigraphic modelling;
- exploratory data analysis and construction of mineralisation models;
- statistical review and selection of domains suitable for estimation of uranium and Molybdenum (at Miriam and M&M only) and bulk density;
- geostatistical analysis and grade continuity modelling (variography);
- block modelling and grade interpolation;

- validation of estimates and mineral resource classification;
- assessment of reasonable prospects for eventual economic extraction (RPEEE) through either underground or open pit optimization, and selection of appropriate cut-off grades; and
- preparation of the mineral resource statement.

The Madaouela Uranium Project is characterised by sandstone-hosted uranium deposits where the majority of significant uranium (U) mineralisation occurs as a thin tabular zone at, or near, the contact (or redox front) between the Guezouman sandstone and Talak argillite. Molybdenum (Mo) is also known to be distributed similarly as U, although the precise location is interpreted to be offset from uranium supposedly due to different redox conditions required for each element. Mineralisation is found at other horizons in the local stratigraphy, but rarely forms significant deposits, except for the Miriam deposit. At Miriam, a pronounced structural control also affects the distribution of mineralisation, and here significant mineralisation occurs at multiple horizons through the Guezouman, but is focussed on sub-vertical structures. The difference in controls on mineralisation at Miriam necessitates a different approach to the estimate than the other deposits.

For the Miriam deposit, a '3-dimensional' approach was taken to the estimation, where multiple composites are created through the various horizons of mineralisation. The estimation requires the kriging of grade directly and does not incorporate accumulation in the methodology.

For the M&M, MYVE, MSNE, MSCE, and MSEE deposits, which are characterised by generally thin and tabular (although locally deformed) mineralisation an 'unfolded' accumulation method has been employed. Using this method, the estimation is effectively approached in '2-dimensions') where single composites are created and un-folded for each intersection through the mineralisation and the final grade estimate is the quotient of the kriged accumulated grade (grade * thickness) and kriged thickness. The un-folded estimates are then 're-folded' back into true 3-dimensional space.

14.3 Miriam

14.3.1 Supporting Data

The Miriam deposit has been defined by a generally regular grid of vertical drill holes that vary in density from 20 x 20 m up to 100 x 100 m, but the majority of the deposit is defined by at least 40 x 40 m spacings (Figure 14-2). A total of 1,048 drill holes, with total length of 117,790 m, support this Mineral Resource estimate. The key mineralised horizon at Miriam is the Guezouman Sandstone, which is locally flat lying, dipping gently to the North. The uranium and molybdenum mineralisation is typically oriented parallel to this unit, although locally very high grades are focussed in a sub-vertical orientation. The vertical drilling grid is appropriate to adequately define the flat-lying, Guezouman parallel, mineralisation but is not optimal to define the sub-vertical mineralisation. In the deposit areas characterized by sub-vertical mineralisation, the drilling grid density is increased which SRK believe mitigates the sub-optimal orientation and provides adequate information to define these sub-vertical volumes.

All drill holes have been radiometrically probed, and after processing, provide eU (referred to as ‘teneur’ at the project) data for the full length of holes. Uranium and molybdenum assays have been obtained from diamond drill holes and are not available for the entire deposit area, although are preferentially concentrated in the area of the deposit reported in the mineral resource statement (Figure 14-2).

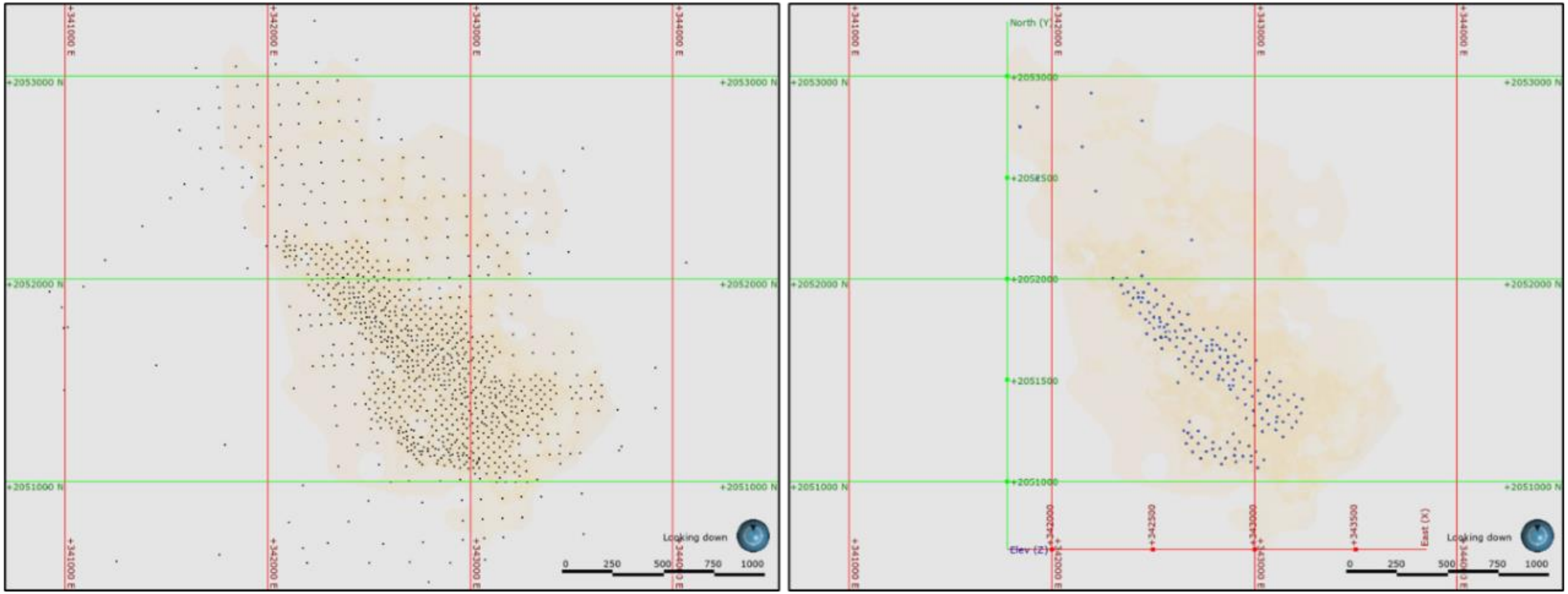


Figure 14-2: Miriam eU data (left) and Molybdenum data (right) locations.

Table 14-1: Summary of drilling at Miriam

Sampling Type	Number of holes	Total Meters
Radiometric Assay (eU)	872	99,076
Radiometric (eU) and Chemical Assay (U and Mo)	176	18,714
Total	**1,048**	**117,790**

14.3.2 Geological Modelling

The stratigraphy at Miriam has been logged in drill holes and is consistent across the project area. SRK have built a stratigraphic model based on the drill hole logging. Uranium mineralisation is primarily constrained within the Guezouman sandstone, but weak mineralisation is also present in the Tchinezogue sandstone, higher in the stratigraphy. The Talak unit, at the base of the Guezouman is an important feature of the deposit as it is the reductant source responsible for localizing the uranium and molybdenum mineralisation.

Although the stratigraphy is generally consistent in the project area, there is localised deformation believed to be influenced by the presence of fault structures. When viewing the modelled Talak surface, there is north-westerly/south-easterly disruptions in the consistency of the surface which can be highlighted by viewing the model coloured by dip of the wireframe (Figure 14-4). Also obvious is the north-easterly trending Madaouela fault that affects the southeast of the deposit.

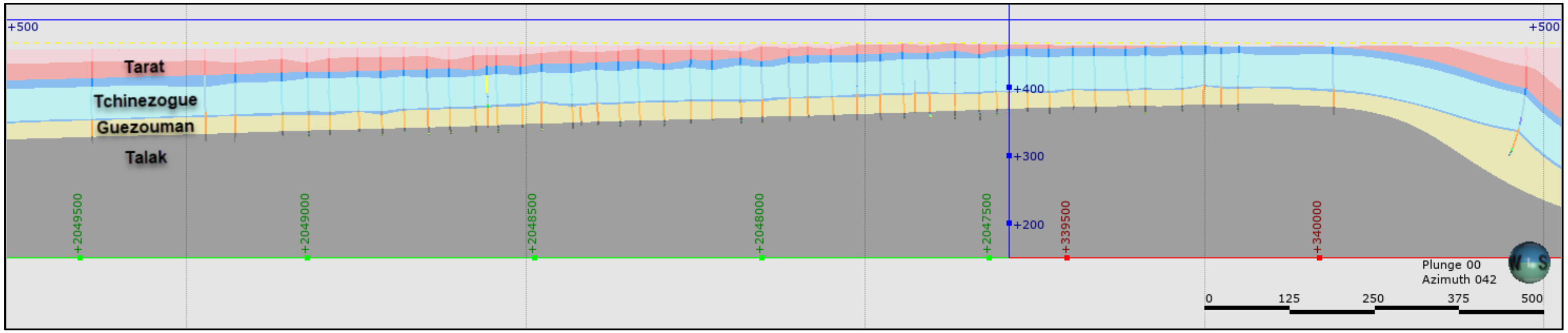


Figure 14-3: Long section looking northeast at the Miriam Lithological model with supporting drillholes. Note the consistency of the stratigraphy and deformation in the south (right of image) where the units are affected by the regional Madaouela fault.

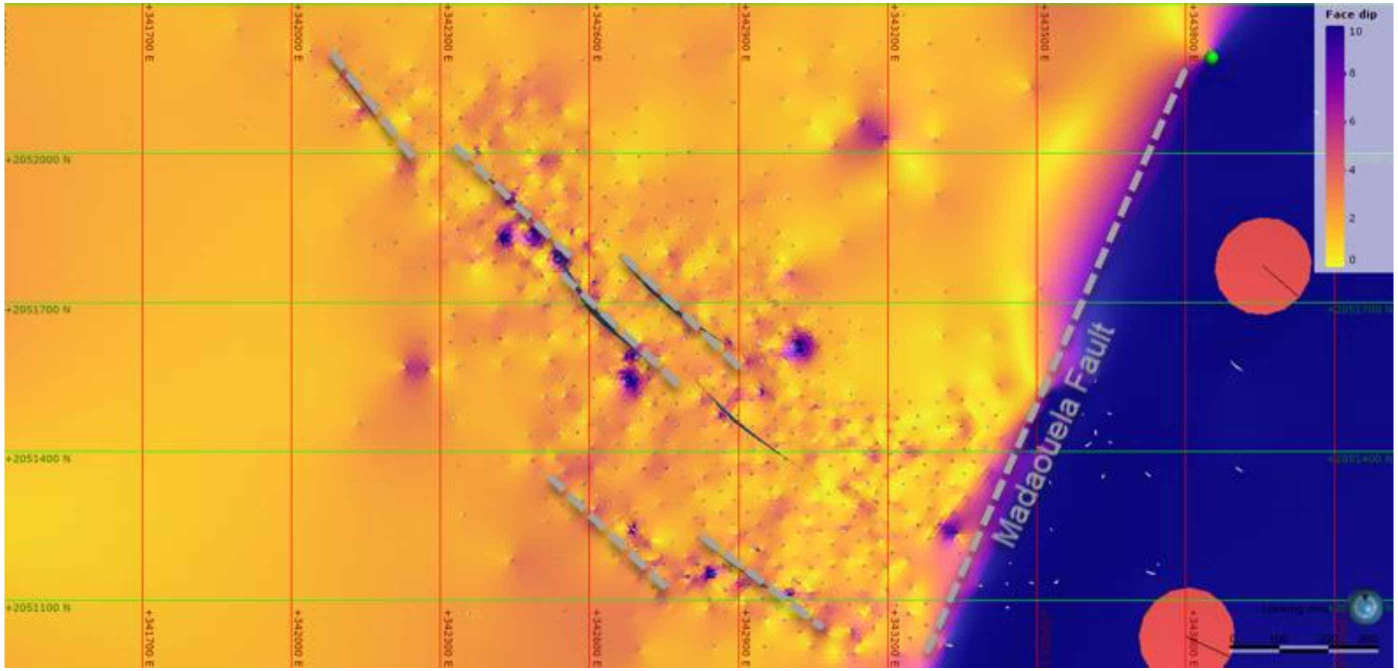


Figure 14-4: Talak surface is coloured by dip of the wireframe, darker areas indicating higher relief.

14.3.3 Mineralisation Model

eU Models

The distribution of uranium mineralisation at Miriam is controlled by two key features:

- Reducing formation (Talak) at the base of the Guezouman sandstone; and
- Sub-vertical structures trending SE-NW

In addition to these, there is weak uranium mineralisation within the Tchinezogue sandstone, correlated with the presence of the SE-NW structures.

This distribution of uranium mineralisation can be shown with eU grade contours. Isotropic grade contours at the base of the Guezouman sandstone and top of Guezouman sandstone, highlight both key mineralisation controls (Figure 14-5). What these demonstrate is a flat and laterally continuous mineralising control at the base of the Guezouman, coincident with the Talak contact (lithological and redox control) and discrete, laterally restricted control, coincident with the NW-SE striking structures (structural and redox control), which also align with the disruption in the Talak contact. There is no clear, or visible, boundary that defines the uranium mineralisation so the distribution of eU grades in the Guezouman Sandstone was investigated and a modelling cut-off of 0.2 kg/t eU was chosen to represent mineralised material (Figure 14-6). Relatively high eU grades are also coincident with the NW-SE trending structures. SRK modelled a sub-domain generally above 1 kg/t eU within the 0.2 kg/t shell which represents these sub-vertical features (Figure 14-6). SRK notes that previously at Miriam a 0.4 kg/t eU shell was modelled and is believed to be an important historical cut-off used by GoviEx geologists. SRK also modelled a 0.4 kg/t eU shell which has been incorporated into the mineralisation model.

The mineralisation model for uranium is presented in Figure 14-7.

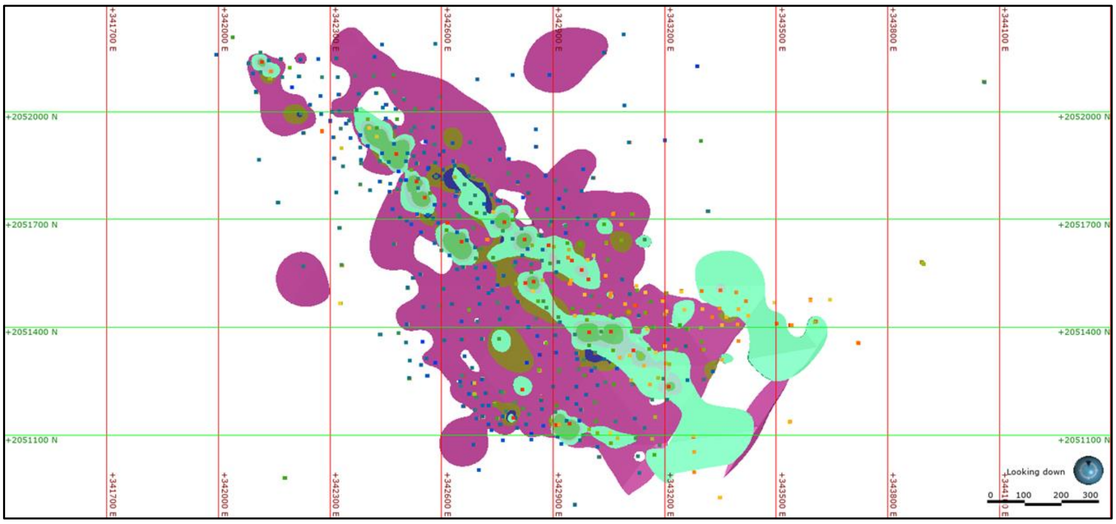


Figure 14-5: Isotropic uranium grade contours at 0.2 kg/t eU at the base of the Guezouman (purple) and top of Guezouman (green)

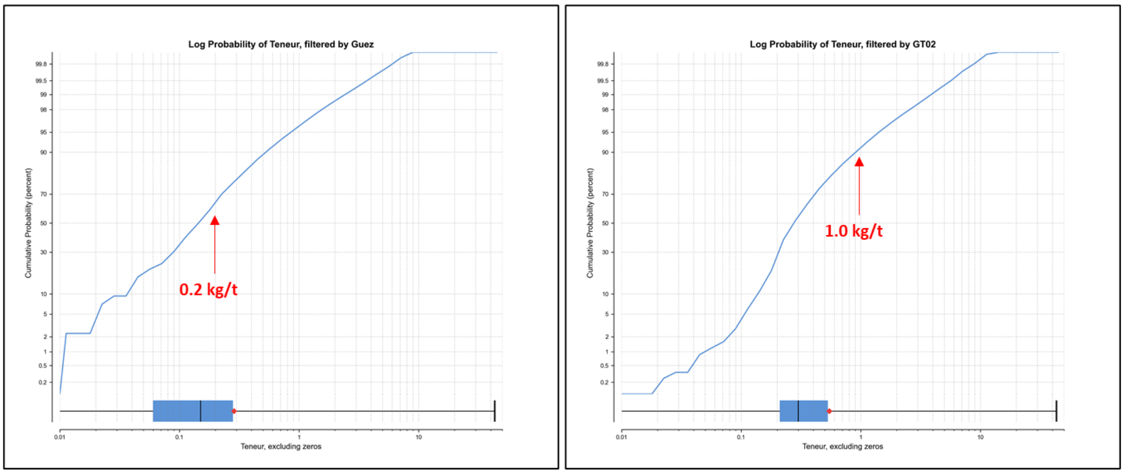


Figure 14-6: Log-probability plots of eU in the Guezouman Sandstone (left) and within the 0.2 kg/t shell (right).

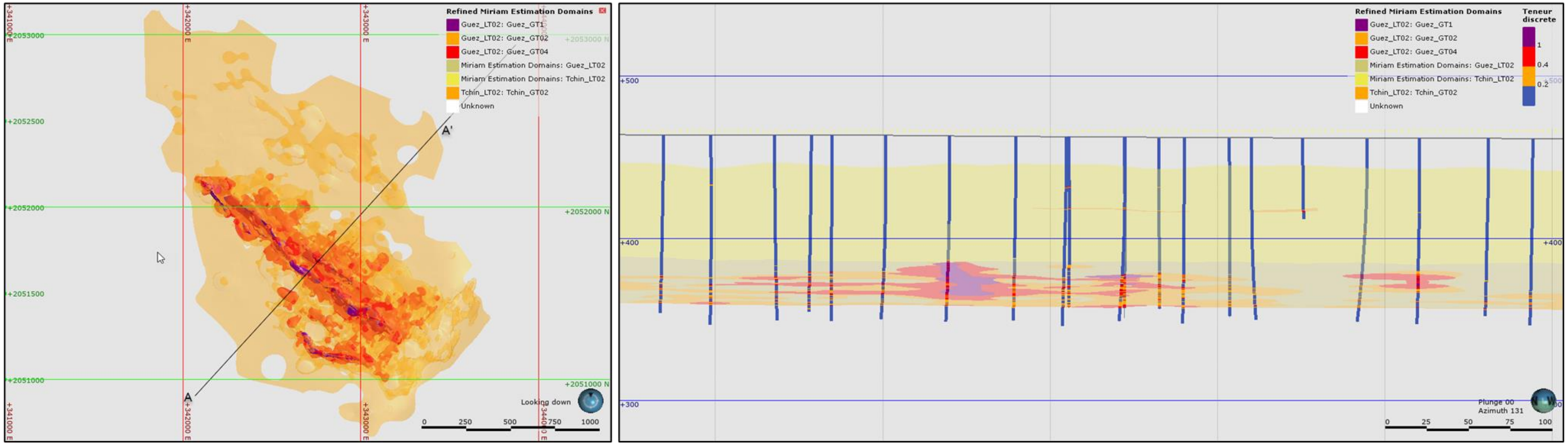


Figure 14-7: Miriam Uranium Mineralisation Models

Molybdenum Models

The distribution of molybdenum mineralisation appears to be correlated to the uranium mineralisation, although appears to be slightly offset which could indicate a different redox condition required for the mineralisation. Importantly, the highest grades of Molybdenum are coincident with the location of the NW-SE trending structures that are characterized by relatively thick and high-grade eU intersections.

There is not a clear logged feature indicative of Molybdenum mineralisation so SRK investigated the Molybdenum grades and determined that 100 ppm Molybdenum is a suitable modelling cut-off representative of mineralisation focussed along the NW-SE trending structures (Figure 14-8).

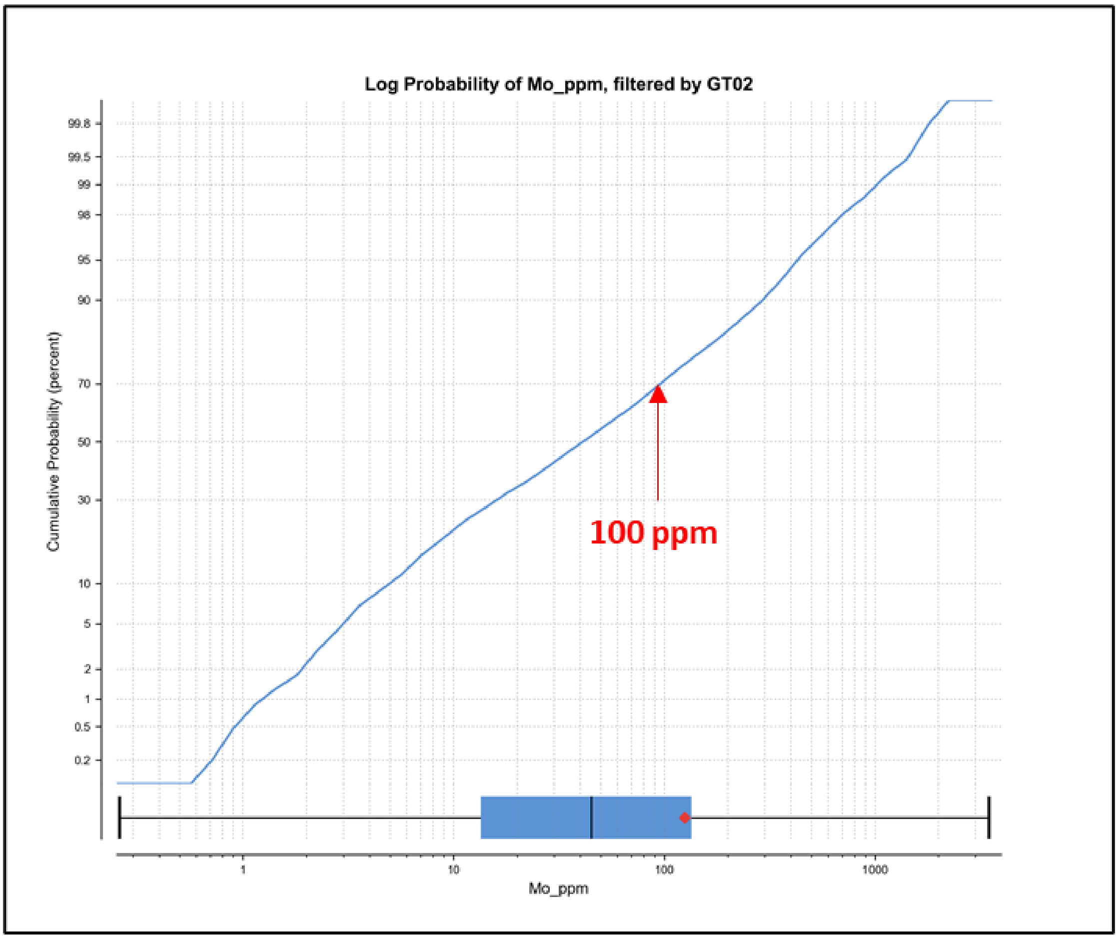


Figure 14-8: Log-Probability Plot of Molybdenum in the 0.2 kg/t eU Shell.

The mineralisation model for molybdenum is presented in Figure 14-9.

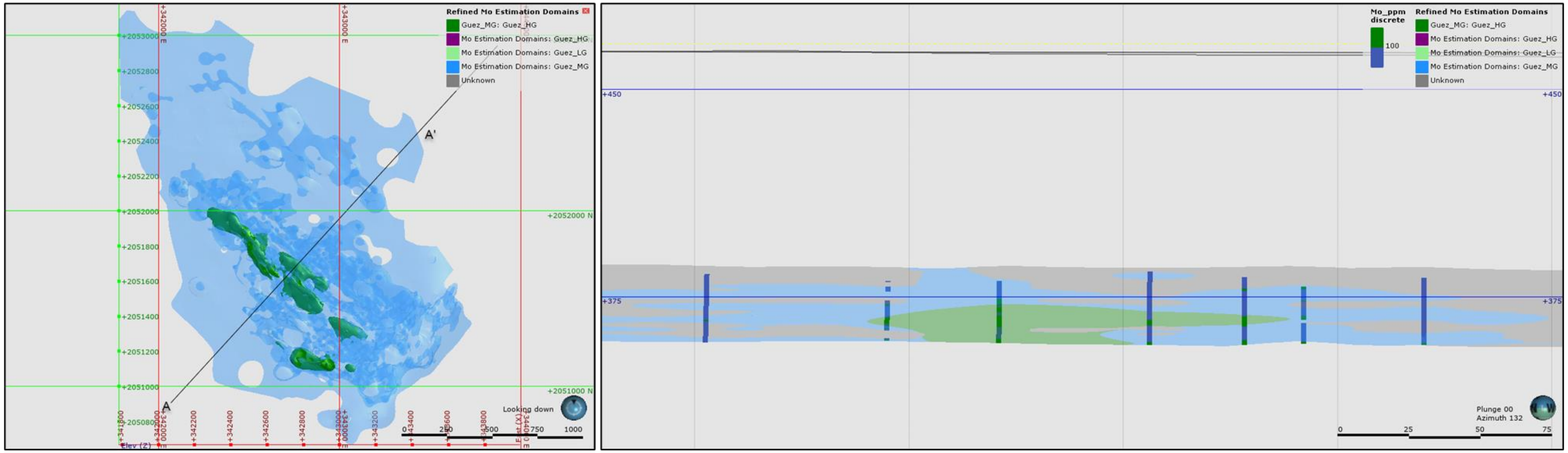


Figure 14-9: Miriam Molybdenum Mineralisation Models

14.3.4 Estimation Domains

Both lithologically and structurally controlled mineralisation appears to be influenced or offset by structures (EW and NW) and the Madaouela Fault. SRK have considered these structures when investigating grade continuity and have developed structural sub-domains to separate the mineralisation models into blocks of similar orientation (Figure 14-10).

The estimation domains for Miriam comprise uranium and molybdenum mineralisation and structural sub-domain models (Table 14-2).

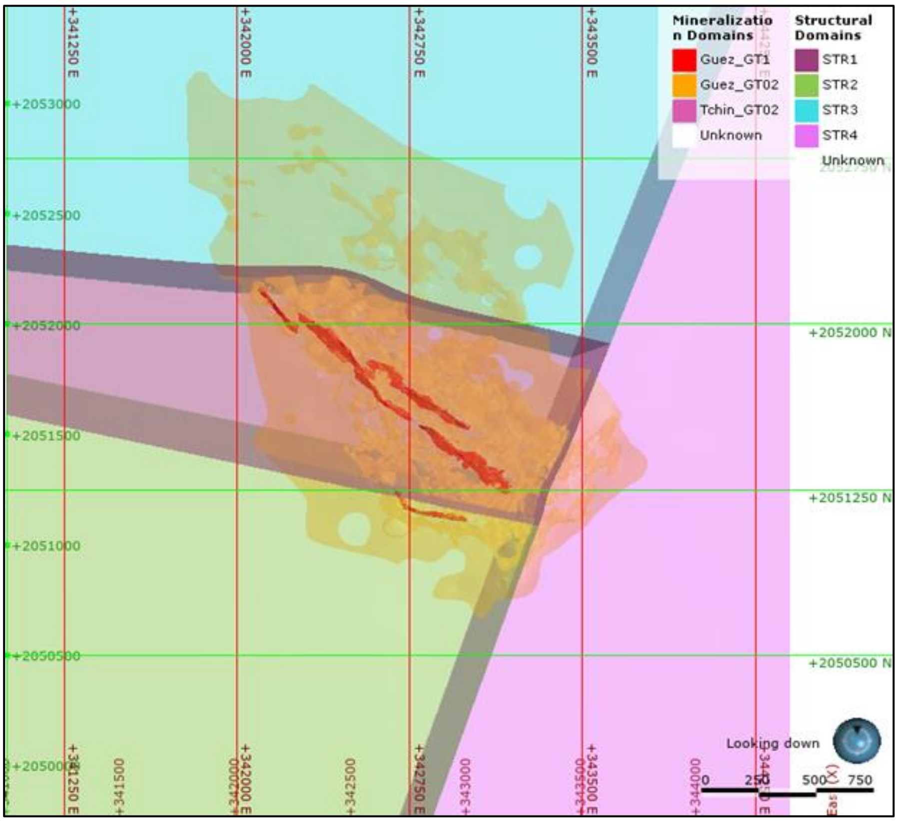


Figure 14-10: Structural sub-domains for the uranium mineralisation.

Table 14-2: Final Estimation Domains for Miriam

Domain	Domain Code	Structural Sub-Domain
U	Guez_GT04	STR1, STR2, STR3, STR4
	Guez_GT1	
	Guez_GT02	
	Guez_LT02	NA
	Tchin_GT02	NA
	Tchin_LT02	
Mo	Guez_HG	NA
	Guez_MG	NA

14.3.5 Data Conditioning and Statistical Analysis

Prior to undertaking any grade interpolation, SRK performed a statistical study on composited eU and Molybdenum assay data within the modelled mineralisation wireframes to assess their suitability for grade estimation and to confirm that appropriate estimation domains had been modelled.

Compositing

The typical sample length for the eU analyses is 0.2 m (Figure 14-11) and statistics for the samples flagged by domain are given in Table 14-3. Based on the sample length and geometry of the mineralisation, SRK have chosen to composite the samples to 0.4m, with any residual samples of 0.2 m or less being distributed equally across the domain.

The typical sample length for the Molybdenum samples is 1 m with over 70 % of the samples being 1 m or less (Figure 14-11) and for the samples flagged by domain are given in Table 14-3. Based on the sample length and geometry of the mineralisation, SRK have chosen to composite the samples to 1.0 m, with any samples of 0.5 m or less being added to the previous interval in the domain.

Table 14-3: Raw statistics for uranium and Molybdenum domains at Miriam

Domain	Domain Code	Count	Min	Max	Mean	Standard deviation	Co-Variance	Variance
U	Guez_GT04	15,990	0.00	11.86	0.62	0.53	0.85	0.28
	Guez_GT1	4,765	0.00	43.26	2.19	2.81	1.29	7.9
	Guez_GT02	35,243	0.00	6.07	0.28	0.2	0.7	0.04
	Guez_LT02	87091	0.00	2.69	0.08	0.08	1.06	0.01
	Tchin_GT02	445	0.07	7.75	0.58	0.84	1.45	0.71
	Tchin_LT02	300,795	0.00	17.89	0.02	0.08	3.3	0.01
Mo	Guez_HG	2,008	0.26	3,480	277.36	314.66	1.13	99,011.23
	Guez_MG	3,651	0.43	2,110	54.66	109.8	2.01	12,055.26

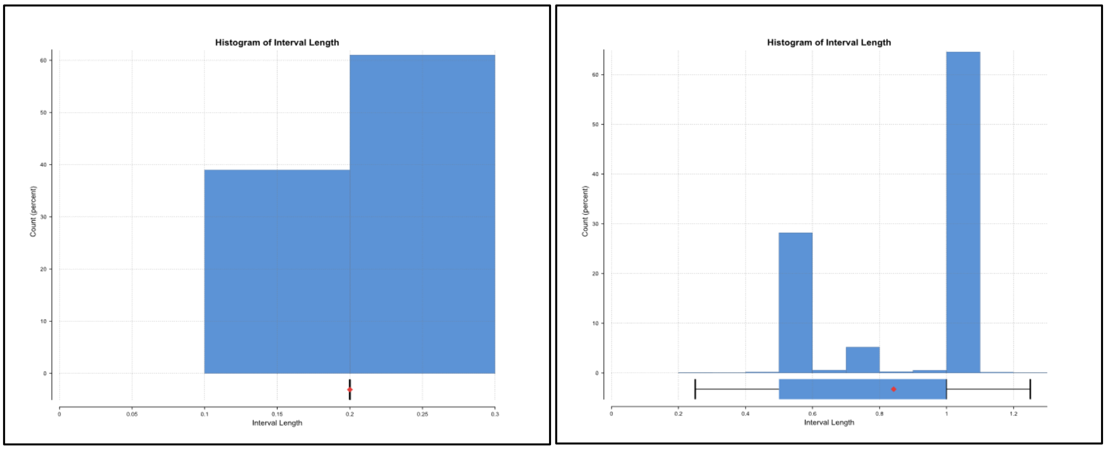


Figure 14-11: Histograms of interval length for the uranium (left) and the Molybdenum (right) domains in Miriam

Treatment of high-grade outliers

Capping, or 'top-cuts', are applied to high grades in order to reduce the influence they may have on the estimate and prevent smearing high grades into adjacent blocks. High grades can be treated by applying a cap to the assay values in the database based on an assessment of the histograms and log probability plots, but they can also be treated by applying a distance restriction on the grades in order to limit the influence of the very high grades at the kriging stage.

Based on an analysis of the eU and Molybdenum grade distribution statistics, SRK decided on a variable approach towards treatment of high-grade outliers depending on each domain (Figure 14-12 to Figure 14-14). For some domains the histograms were approaching log normal with right skew and some significant, but few high grades, which led to the choice of distance restrictions being applied in some cases rather than top-cuts (Table 14-4). The final statistics for the domains can be found in Table 14-5.

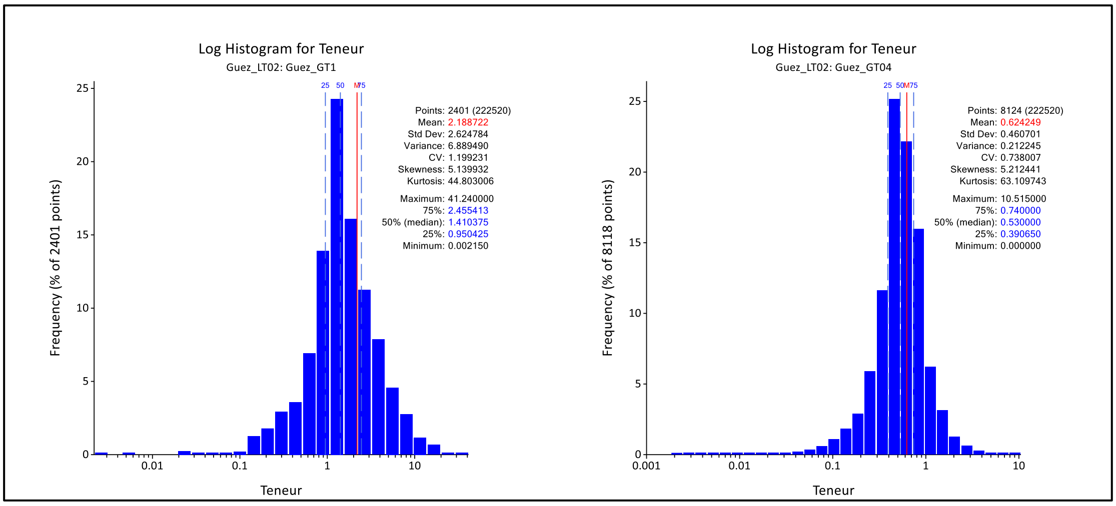


Figure 14-12: Log-histograms of eU for the Guez_GT1 and Guez_GT04 domains.

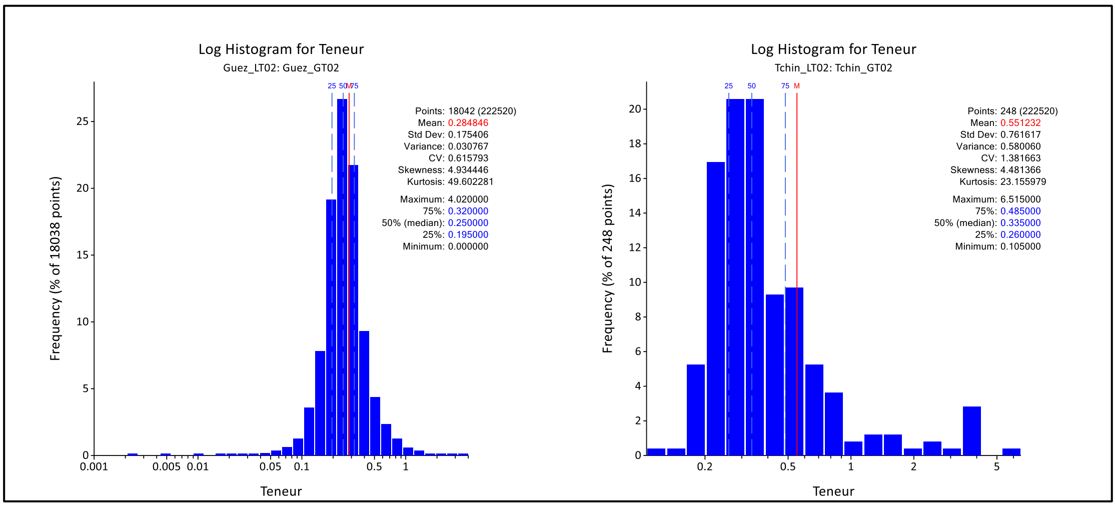


Figure 14-13: Log-histograms of eU for the Guez_GT02 and Tchin_GT02 domains.

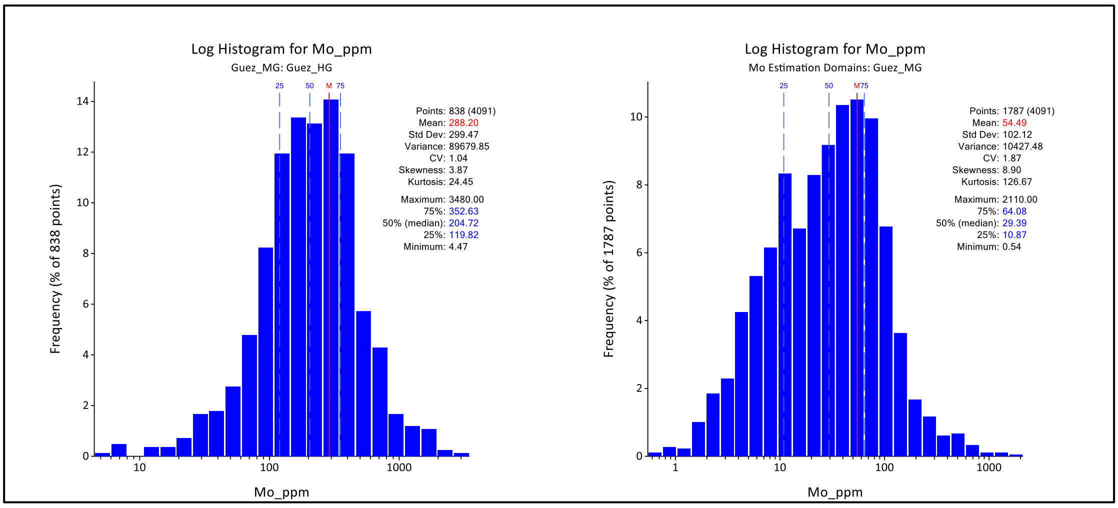


Figure 14-14: Log-histograms of Molybdenum for the Guez_HG and Guez_MG domains.

Table 14-4: Treatment of high-grade outliers for uranium and Molybdenum domains at Miriam

Domain	Domain Code	Treatment of high-grade outliers		
		Cap	HG Restriction value	HG Restriction Max distance
U	Guez_GT04	N/A		
	Guez_GT1	N/A		
	Guez_GT02	N/A	2.8	75
	Guez_LT02	25	0.2	50
	Tchin_GT02	25	4	50
	Tchin_LT02	1	NA	NA
Mo	Guez_HG	3,000	NA	NA
	Guez_MG	1,500	200	50

Table 14-5: Composite and capped statistics for uranium and Molybdenum domains at Miriam

Domain	Domain Code	Count	Min	Max	Mean	Standard deviation	COV	Variance
U	Guez_GT04	8,124	0.00	10.52	0.62	0.46	0.74	0.21
	Guez_GT1	2,401	0.002	41.24	2.19	2.62	1.2	6.89
	Guez_GT02	18,042	0.00	4.02	0.28	0.18	0.62	0.03
	Guez_LT02	43,645	0.00	2.13	0.08	0.08	0.95	0.01
	Tchin_GT02	248	0.11	6.52	0.55	0.76	1.38	0.58
	Tchin_LT02	150,060	0.00	13.81	0.02	0.07	3.06	0.01
Mo	Guez_HG	838	4.47	3,480	288.2	299.47	1.04	89,679.85
	Guez_MG	1,787	0.54	2,110	54.49	102.12	1.87	10,427.48

Density

183 density measurements are available for the Miriam deposit (Figure 14-15). The concentration and distribution of the density data is such that SRK determined estimation of density to not be viable. The variance of the density results is very low and therefore a mean of 2.3 t/m^3 has been applied to each of the blocks (Figure 14-16).

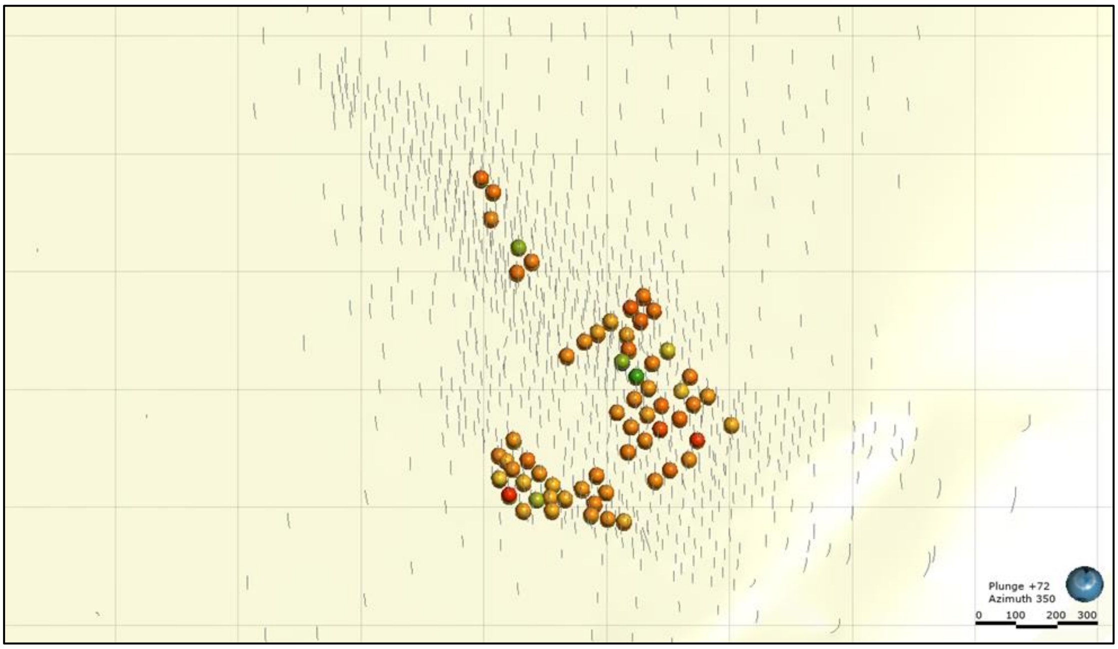


Figure 14-15: Distribution of density samples at Miriam

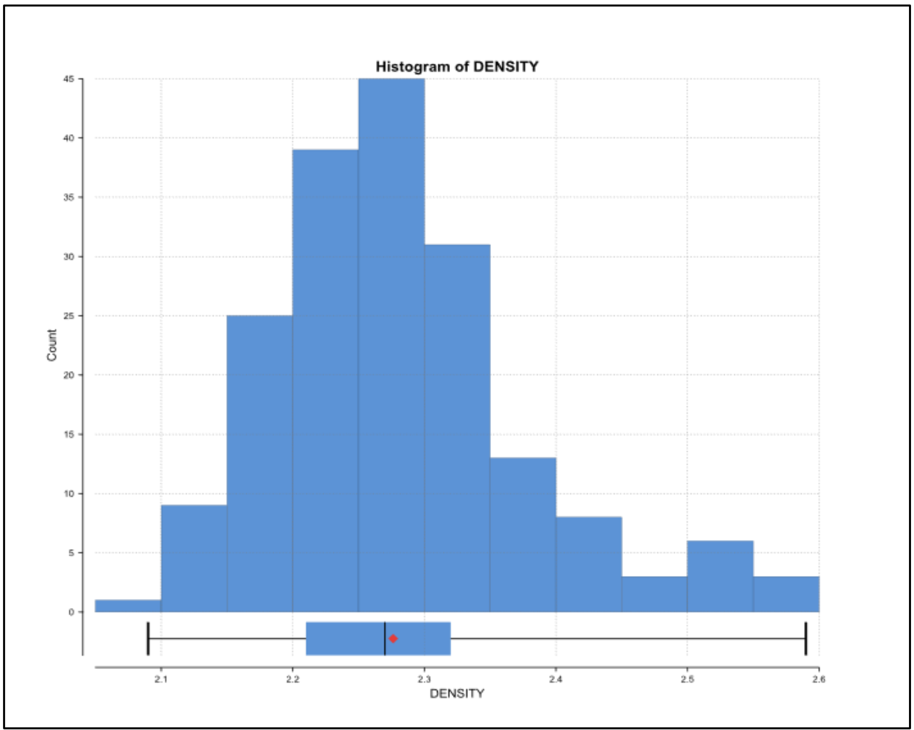


Figure 14-16: Histogram of Density Samples at Miriam

14.3.6 Geostatistical Analysis

Contact Analysis

SRK investigated the contact conditions of uranium and molybdenum grades within the modelled mineralisation domains by plotting average composite grades at various distances from the modelled contacts. For U, although the Guez_GT04 domain is not based on any noticeable feature, the contact analyses from this domain into the Guez_GT1 and Guez_GT02 domains is quite sharp (example in Figure 14-17). For Mo, the same is true from the Guez_HG to the Guez_MG domains, although the Guez_HG domain was based on statistical analysis (Figure 14-18).

Based on the observations in the contact analyses plots, and visual examinations of the drill hole intercepts, SRK chose to employ limited soft-boundary condition for eU in the uranium domains, where 1 composite (0.4 m) from the adjacent domain was considered in the estimates while hard boundary conditions were employed for Molybdenum in the Molybdenum domains.

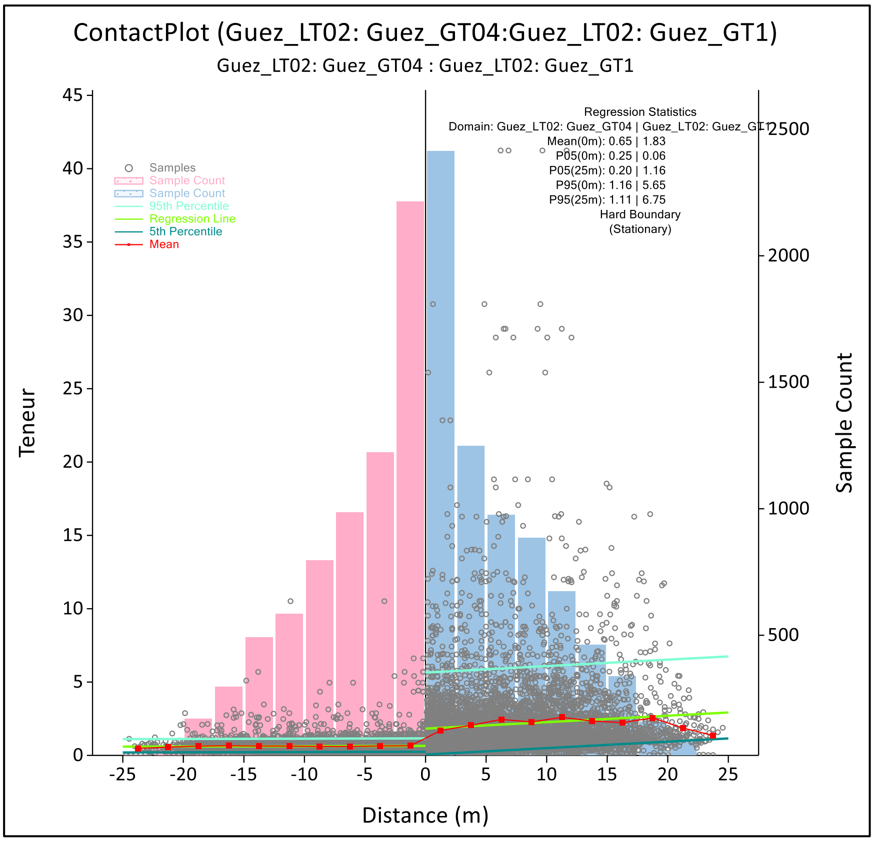


Figure 14-17: Contact plot of eU from Guez_GT04 domain (left) to Guez_GT1 (right).

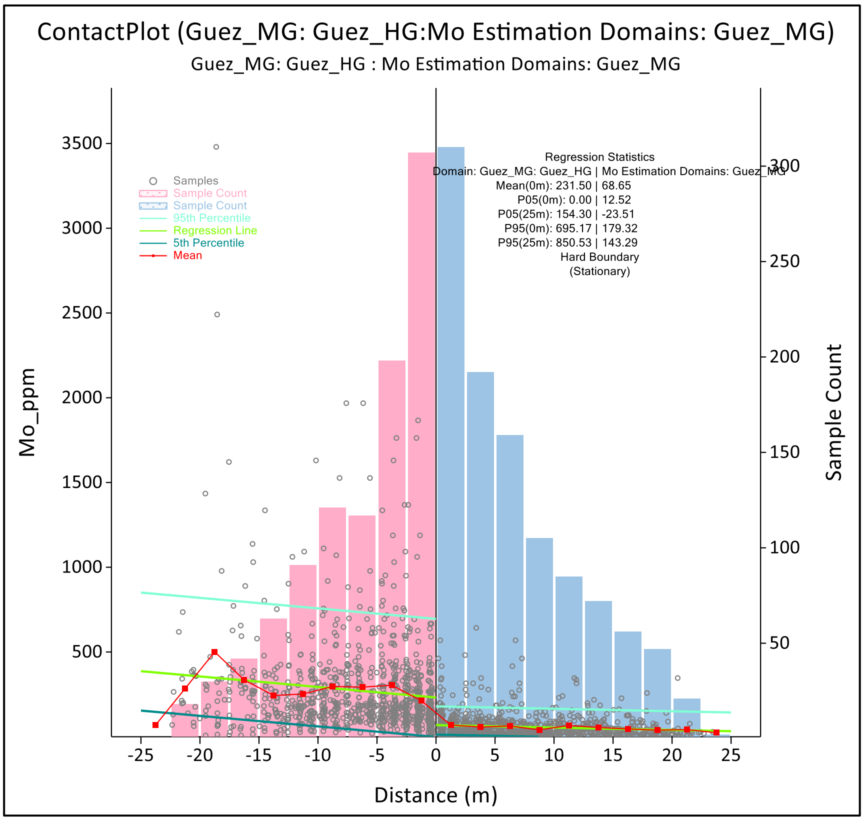


Figure 14-18: Contact plot of Molybdenum from Guez_HG domain (left) to Guez_MG (right).

Grade Continuity

For eU in the Guez GT02, GT1 and GT04 domains, SRK investigated the grade continuity for each of the four structural zones described in Section 14.3.4. Variography has been completed in normal score transformed data, as the retained high grades in certain domains has resulted in a right skew to the distributions (Figure 14-20, Figure 14-21, and Table 14-6).

SRK noted a very consistent direction of major continuity at an approximately 135^{o} bearing (for all domains) which is strongly anisotropic, with approximate ratio of 5 to 1 (major to minor) (Figure 14-19). Consistent ranges were observed in well informed structural domains, with the major direction consistently at around 90 m. The variograms for the Guez GT02, GT1 and GT04 domains are presented in Figure 14-20 and Figure 14-21 and the variogram parameters are detailed in Table 14-6.

For the Molybdenum domains, SRK investigated the grade continuity for both the Guez_HG and Guez_MG domains (Figure 14-22). Variography has been completed in normal score transformed data, as the retained high grades in certain domains has resulted in a right skew to the distributions. The variograms for the Guez MG and HG domains can be seen in Figure 14-23 and the variogram parameters are detailed in Table 14-6.

Table 14-6: Variogram model parameters for eU and Molybdenum within the mineralisation domains

Variogram Name	Direction				Structure 1					Structure 2				
	Dip	Dip Azimuth	Pitch	Nugget	Sill	Structure	Major	Semi-major	Minor	Sill	Structure	Major	Semi-major	Minor
eU STR1, Guez_GT02	1.8	302.0	101.2	0.20	0.51	Spherical	30	7	2	0.29	Spherical	90	40	15
eU STR2, Guez_GT02	1.8	270.8	101.2	0.20	0.51	Spherical	30	7	2	0.29	Spherical	90	40	15
eU STR3, Guez_GT02	1.2	297.4	103.0	0.20	0.51	Spherical	30	36	2	0.29	Spherical	90	40	15
eU STR4, Guez_GT02	17.8	129.9	96.8	0.20	0.51	Spherical	30	7	1	0.29	Spherical	90	40	9
eU STR1, Guez_GT1	72.4	217.1	174.9	0.15	0.45	Spherical	51	5	10	0.40	Spherical	90	30	25
eU STR2, Guez_GT1	59.5	9.6	173.0	0.05	0.55	Spherical	51	5	10	0.40	Spherical	90	30	25
eU STR1, Guez_GT04	2.2	308.0	0.0	0.15	0.45	Spherical	13	24	2	0.40	Spherical	45	75	15
eU Guez_GT04	2.2	281.8	0.0	0.15	0.45	Spherical	16	36	5	0.40	Spherical	45	75	13
eU Guez_LT02	1.8	302.0	101.2	0.10	0.35	Spherical	30	15	2	0.55	Spherical	100	75	19
eU Tchin_LT02	1.8	302.0	39.0	0.25	0.20	Spherical	40	15	1	0.55	Spherical	120	60	4
eU Tchin_GT02	1.8	302.0	39.0	0.25	0.20	Spherical	40	15	1	0.55	Spherical	120	60	4
Mo Guez_HG	1.7	315.0	170.4	0.18	0.82	Exponential	30	70	10	-	-	-	-	-
Mo Guez_MG	1.7	315.0	1.1	0.18	0.82	Exponential	95	120	15	-	-	-	-	-
Mo Waste	1.7	315.0	1.1	0.07	0.92	Exponential	150	160	20	-	-	-	-	-

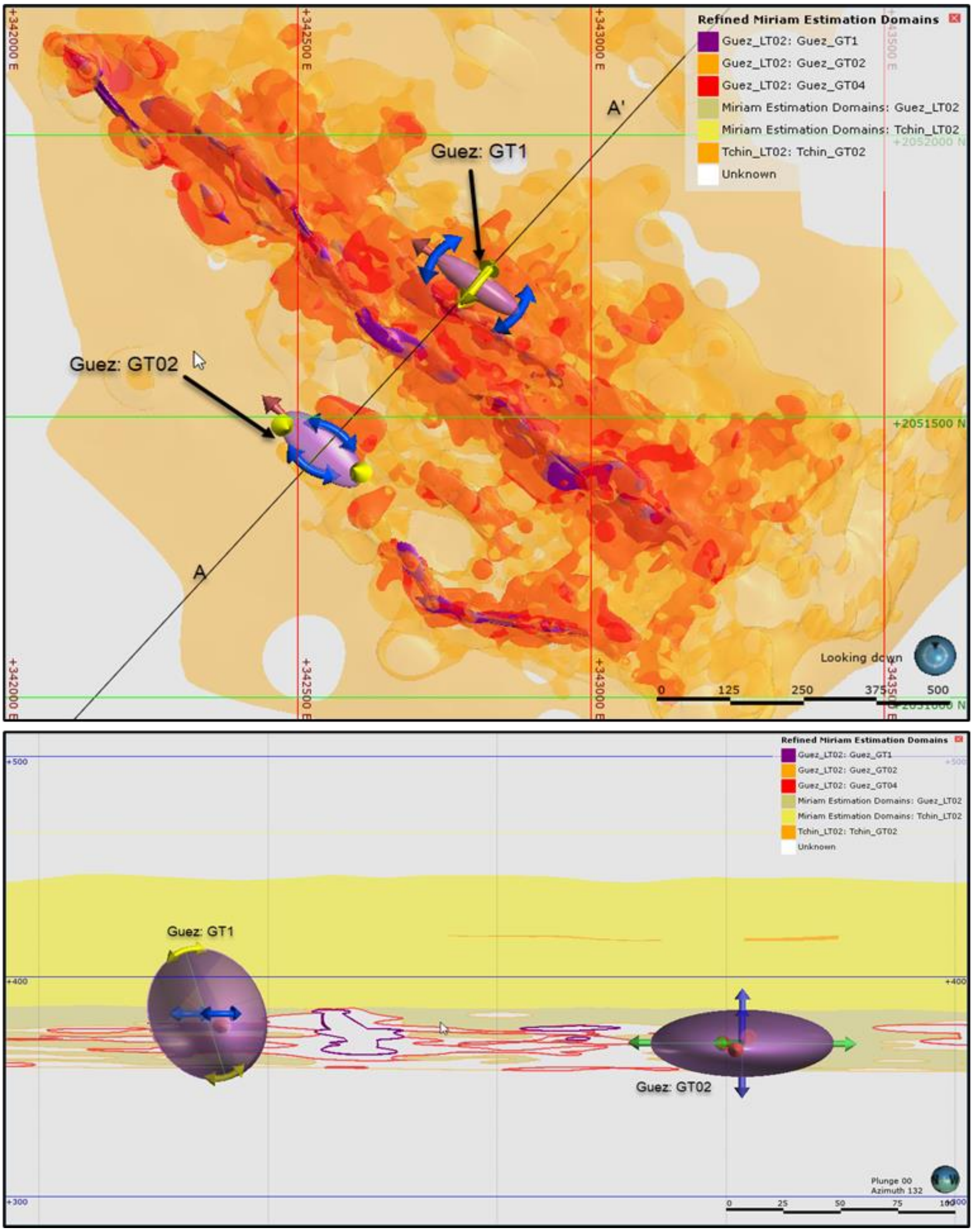


Figure 14-19: Modelled variograms for eU displayed as ellipses for the Guez_GT1 and Guez_GT02 uranium domains.

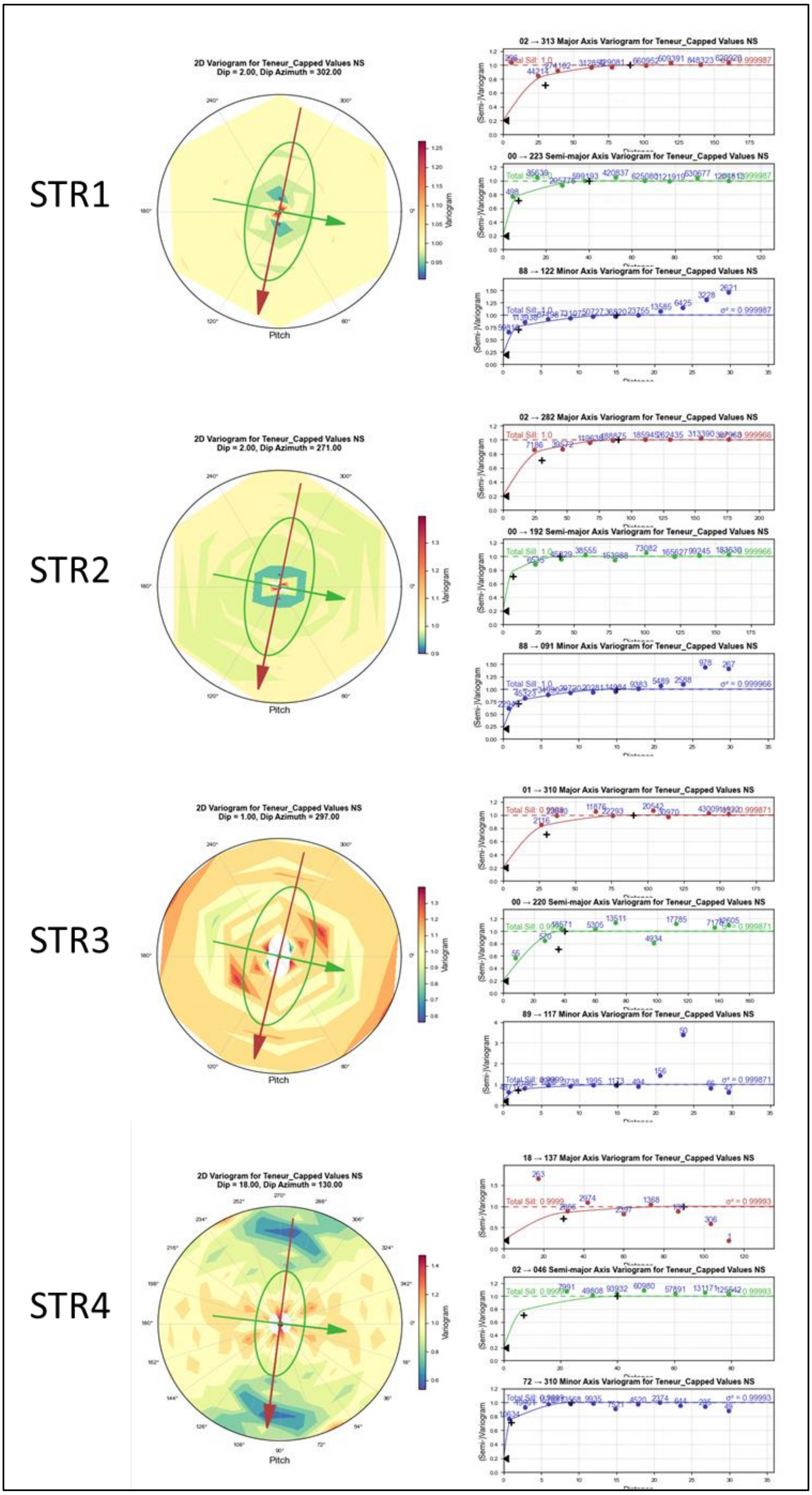


Figure 14-20: Modelled semi variograms for Guez_GT02 uranium mineralisation domain

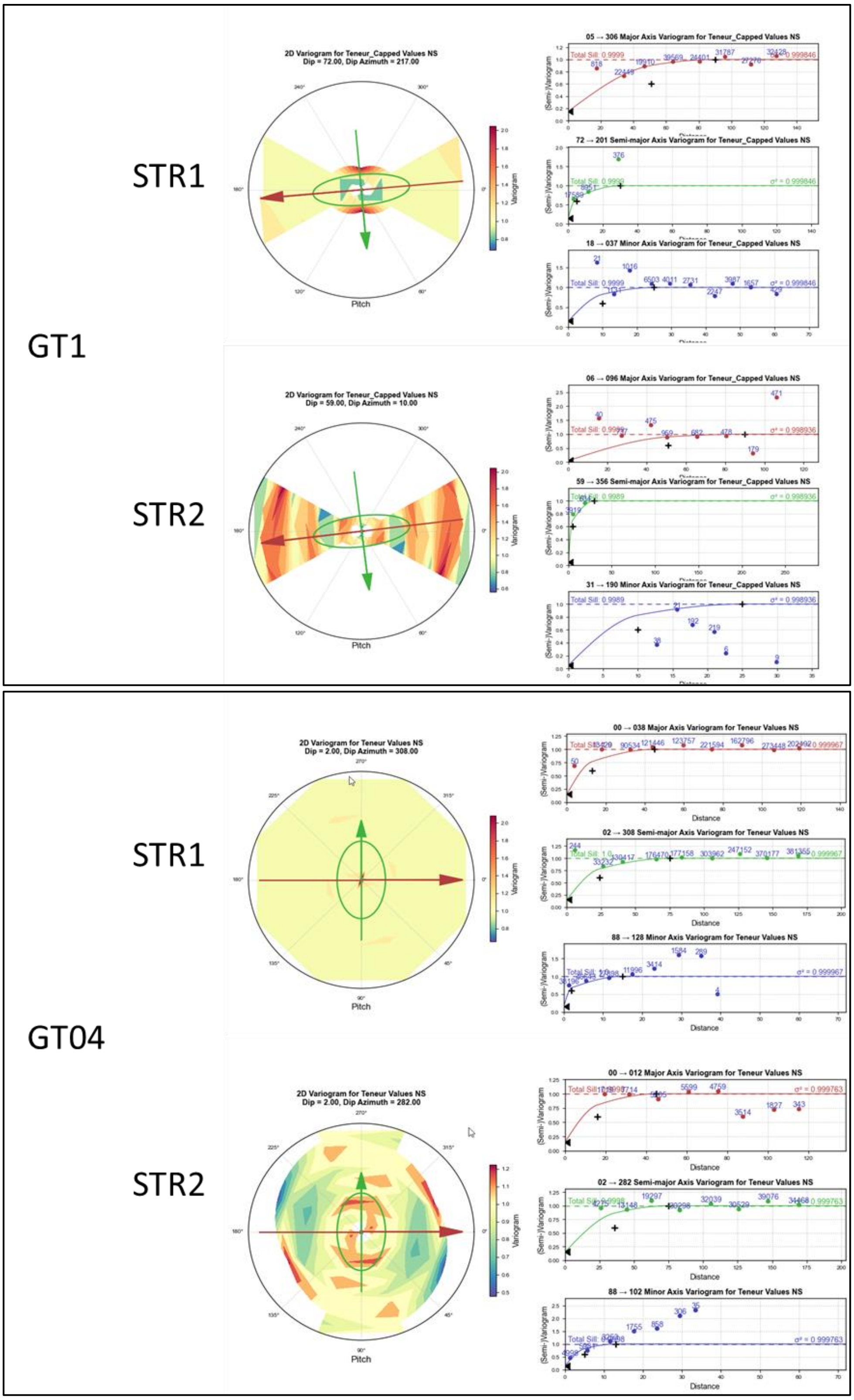


Figure 14-21: Modelled semi variograms for Guez_GT1 and GT04 uranium mineralisation domains

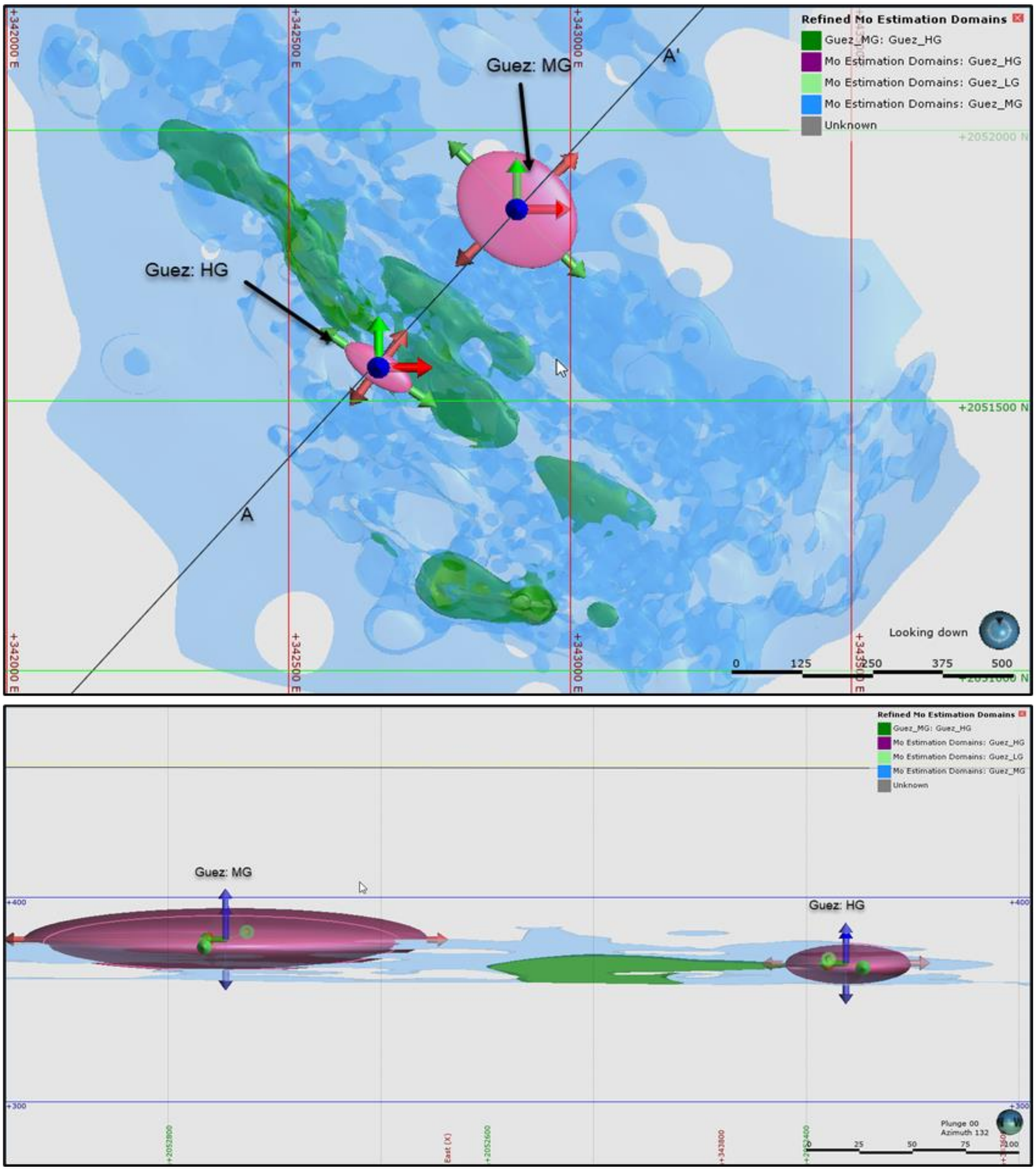


Figure 14-22: Modelled variograms for Molybdenum displayed as ellipses for the MG and HG Guez Molybdenum domains

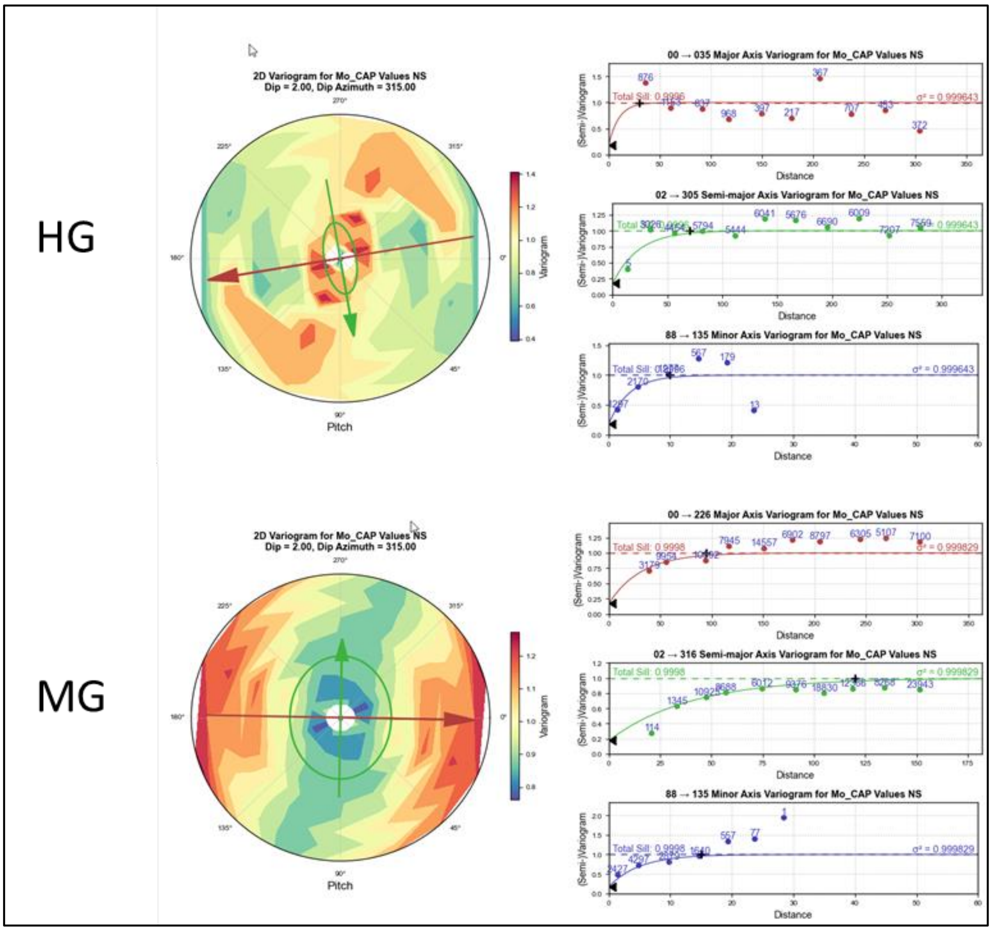


Figure 14-23: Experimental semi variograms for Guez MG and HG molybdenum mineralisation domains

Kriging Neighbourhood Analysis (KNA)

Kriging variance and slope of regression are both measures of the performance of the kriging that are written to each block. These parameters are often used to evaluate different model runs in tests that aim to optimise the kriging search parameters, called Kriging Neighbourhood Analysis (KNA). SRK investigated the optimal block size using KNA methods and identified that 15 x 15 x 0.75 m showed a reasonable slope of regression and kriging variance results. As the drilling grid is between 25 m and 40 m for the majority of main deposit, 15 x 15 m block spacing are approximate to 1/2 to 1/3 of the drill spacing.

Change of Support (COS) Study

There is a relationship between the size or “support” of the composite data or block grades and the distribution of their values. The larger the support of the data, the less variable is their distribution. Block estimated grades should not only be unbiased but should ideally exhibit variability comparable to the expected grade variability of the selective mining unit (SMU) used during mining. The SMU grade variability during mining can be assessed by an application of an indirect log-normal change of support correction (ILC) to the composite assays. The ILC adjustment results in the assay distribution mimicking the true block grades. In other words, under ideal circumstances with no dilution taking place during mining, the adjusted grade distribution should be similar to the distribution of mined block grades.

The COS study was completed within the Guez_GT1 and combined Guez_GT04 and Guez_GT02 domains for eU. The composite file was declustered using a cell declustering method and the COS study was run using backtransformed normal-score variogram models for the domains. A block size of 15 x 15 x 0.75 m was used as this block size is well suited for the typical drill hole spacing and geometry of mineralisation (See above KNA description). From these parameters, the support model was calculated and represented by a grade tonnage curve (Figure 14-24).

Estimation sensitivity tests were completed where the sample selection parameters were varied through different combinations of:

- Search Volume;
- Minimum number of samples; and
- Maximum number of samples.

The estimation results were plotted against the Support Model and the parameters producing the best match, particularly at relevant cut-offs, was chosen as the optimal parameters to produce grade estimates that suitably represent expected grade variability at the block size (Figure 14-24). These parameters were implemented in the block estimates presented in the following section.

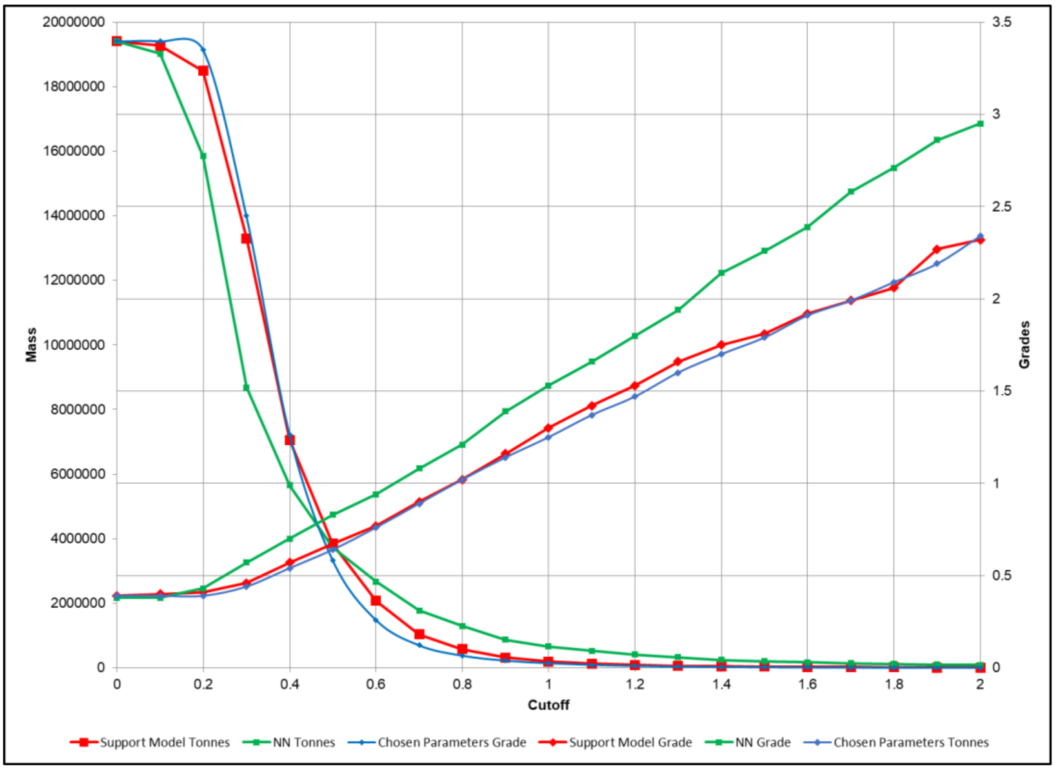


Figure 14-24: Grade tonnage curve of Sample level support, COS model (Support Model), and the model with the chosen sample selection parameters,

14.3.7 Grade Interpolation

Resource estimation was completed within an area encompassing the modelled Miriam mineralisation with block model geometry and extents as presented in (Table 14-7). The block model is rotated to an azimuth of 315 to optimize the alignment of blocks with the mineralisation.

The grade interpolation methodology is based on the following:

- Composited data were capped for very few true outliers, and distance restrictions on high-grade populations were applied as described in Section 14.3.5.
- During estimation, domain boundaries for the selection of composites were treated as either hard or tightly restricted soft-boundaries.
- Search Volumes were aligned according to the modelled variograms (by structural sub-domain), with dimension of 90 x 40 x 20 m for the first pass, and doubled for the second pass.
- Minimum and maximum sample selection parameters were set at 7 and 12 respectively in the first pass, and 3 and 12 for the second pass. A max of 4 samples per drill hole were allowed for both passes;
- Block discretization of 5 x 5 x 2.
- eU and molybdenum were estimated by Ordinary Kriging.
- Density of 2.3 t/m^3 was assigned to all blocks.

Table 14-7: Block model parameters for Miriam

Parameter	X	Y	Z
Origin (block centroid)	343,050	2,050,000	500
Block Size	15	15	0.75
Number of Blocks	127	194	334
Sub-block Count	8	8	4
Sub-block Minimum Size	1.875	1.875	0.1875

14.3.8 Block Model Validation

SRK validated the block model estimates through visual and statistical checks of block grades compared with composited drillhole data in 3D and cross-section and by comparing mean block model grades with mean composite data. The validation is designed to confirm that the block model is representative of the underlying sample data at both local and global scales and to check that the estimate is not biased.

SRK believes that the block model reflects the current understanding of the distribution of mineralisation and is an acceptable basis for a Mineral Resource statement.

Visual Validation

SRK visually compared block grades to composite sample grades in 3D and along sections to assess the correlation of the interpolated block model to the composite data on a local scale. SRK found that local block estimates were similar to nearby composite samples and that the block model reflected the patterns in grade variability with depth observed in the drillhole composites without over-smoothing in the vertical direction and without excessive lateral smearing of high grades. Example validation cross sections are shown in Figure 14-25.

The OK block estimate shows a degree of vertical smoothing compared to sample grades, as expected, while still maintaining the overall variability in the vertical grade profile. Blocks reflect the local grades near to drillholes, but relative highs or lows are not smeared out laterally. The results of the visual validation show that the block model is an acceptable representation of drillhole composites on a local scale. SRK confirms that the block model reflects the current understanding of the deposit.

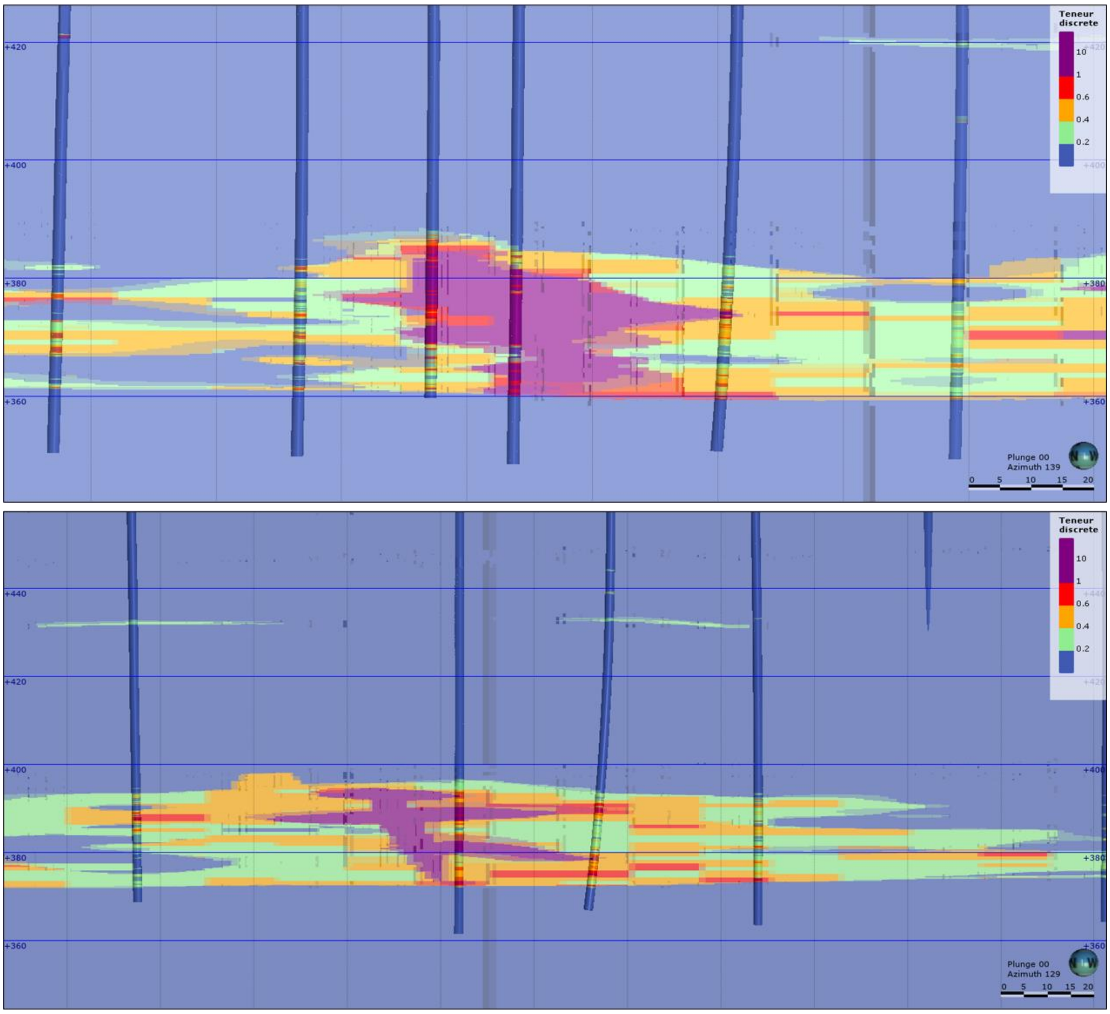


Figure 14-25: Select cross-sections showing composite samples and OK block model grades for eU

Statistical Validation

The mean estimated block grades are compared to the mean of the composite samples for each domain in Table 14-8 and Table 14-9 to assess the global fit of the block model to the composite data. For eU, the mineralized domains have been grouped as restricted soft boundaries have been employed in the estimate. The OK block estimate shows some degree of smoothing compared to sample grades, as would be expected, and the domain variance is significantly lower for the block model compared with the samples.

The results show a satisfactory correlation between block model and sample at a global scale. SRK is confident that the model reflects the current understanding of the deposit.

Table 14-8: Validation of block model versus sample eU grades

Domain	Mean (ppm)	% difference (block model compared to samples)	Standard deviation	Coefficient of variation	Variance
Block model					
Guez_GT1, Guez_GT04, Guez_GT02	0.46		0.48	1.04	0.23
Tchin_GT02	0.39		0.12	0.3	0.01
Declustered Composites					
Guez_GT1, Guez_GT04, Guez_GT02	0.47	2.1	0.76	1.62	0.57
Tchin_GT02	0.43	9.3	0.23	0.54	0.05

Table 14-9: Validation of block model versus sample Molybdenum grades

Domain	Mean (ppm)	% difference (block model compared to samples)	Standard deviation	Coefficient of variation	Variance
Block model					
Guez_HG	282.53		153.93	0.54	23,693.32
Guez_LG	56.73		54.01	0.95	2,917.3
Composites					
Guez_HG	288.2	-2.0	299.47	1.04	89,679.85
Guez_LG	54.49	3.9	102.12	1.87	10,427.48

Swath Plots

As part of the validation process swath plots were generated in the X (easting), Y (northing), and Z (vertical) coordinate directions. Average grades for input samples and estimated blocks are calculated along a series of vertical and horizontal slices (swaths) and plotted on graphs. In effect, a moving average is calculated for blocks and samples along three coordinate axes; this enables the fit of the block model to the underlying data to be assessed at an intermediate scale and the block model can be checked for spatial biases in estimated grade.

Figure 14-26 and Figure 14-27 show the swath plots for the combined Guez_GT02 domain in STR1 zone and the Guez_GT1 domain in STR1 zone respectively. The graphs show the average block model grade (coloured line), the average sample grade (black line), and the number of samples (grey bars) per swath.

In general, the plots show a good correlation between the OK block model and sample grades. There is no indication that any bias has been introduced, and the OK block models display an adequate degree of smoothing with respect to the samples.

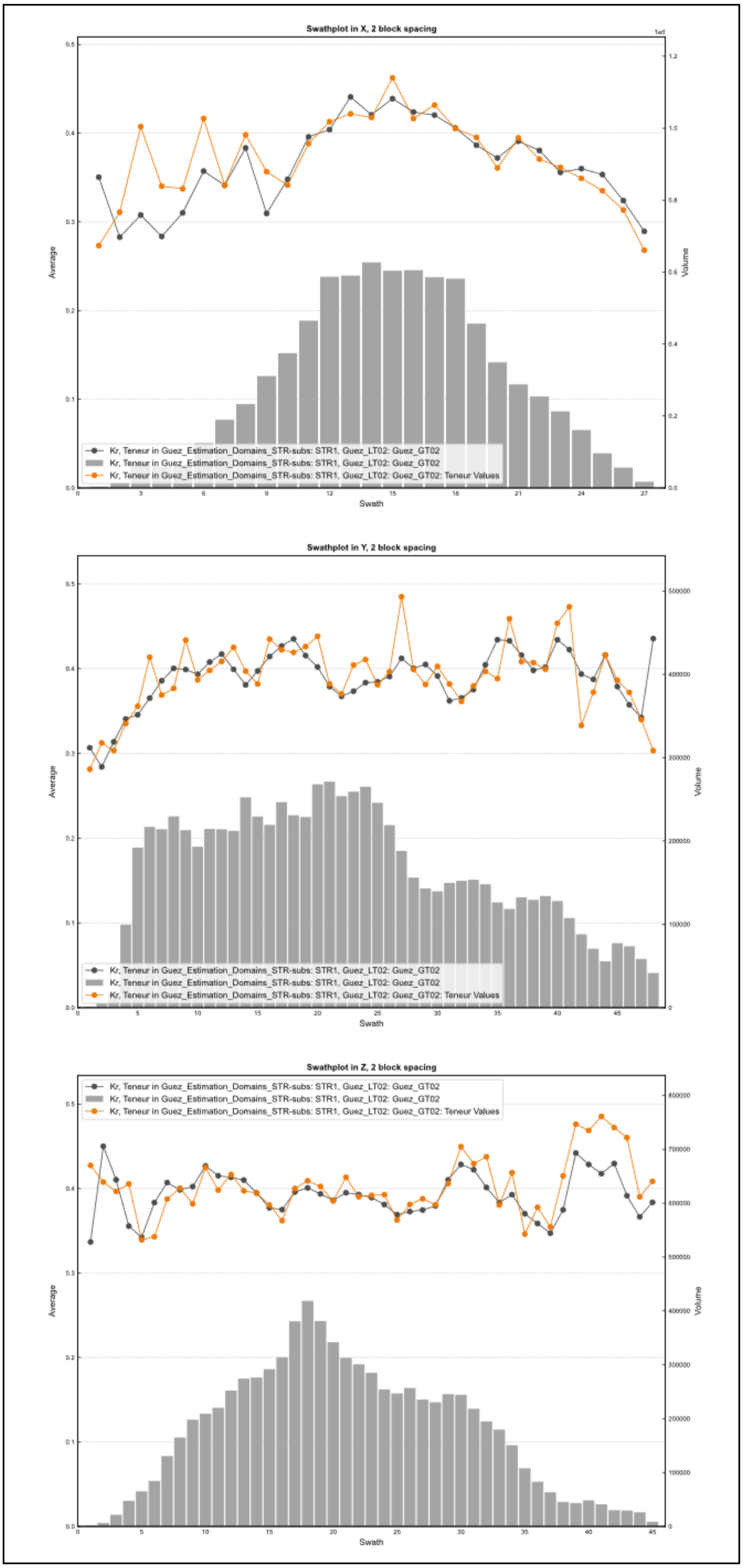


Figure 14-26: Swath plots for Guez_GT02 domain in STR1 zone

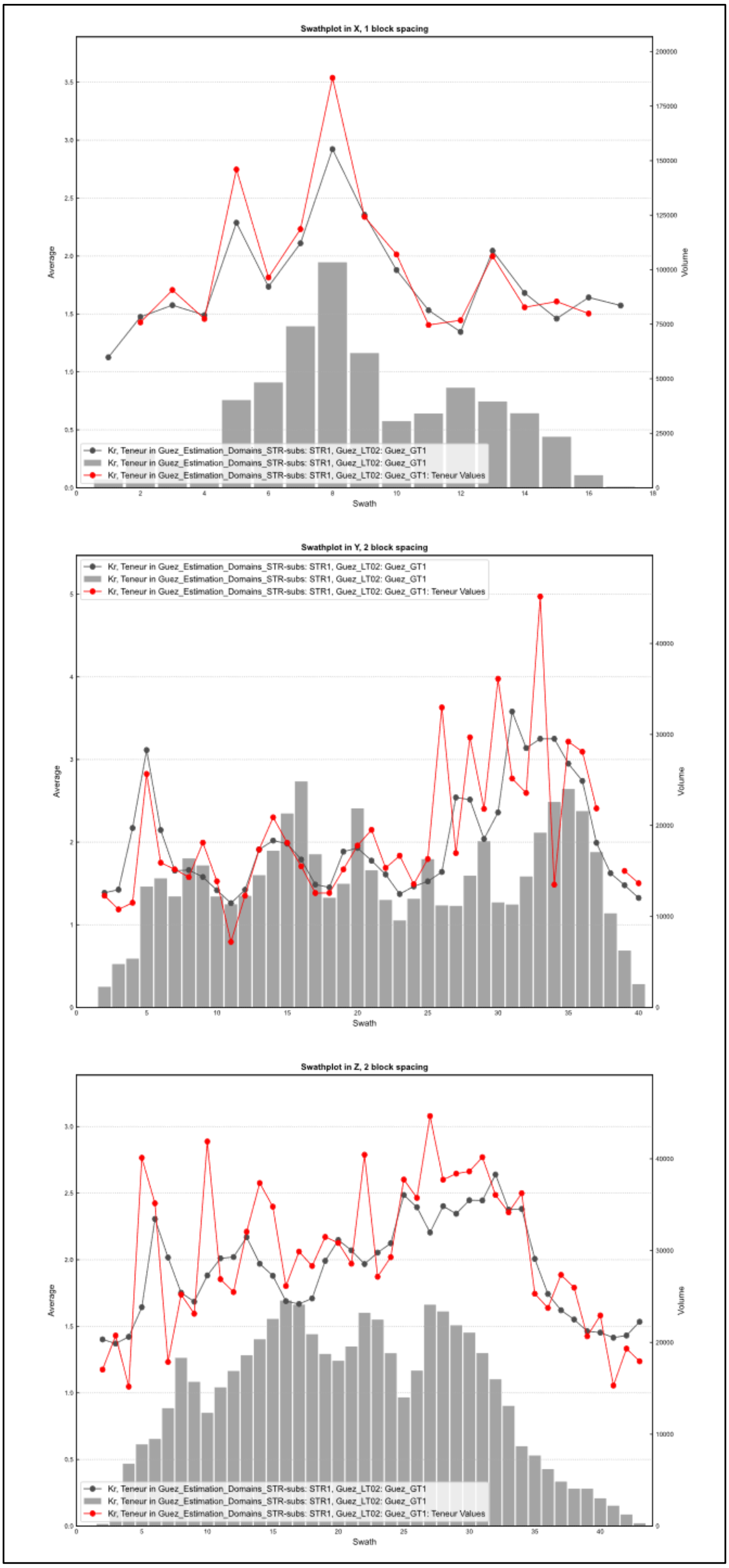


Figure 14-27: Swath plots for Guez_GT1 domain in STR1 zone

14.3.9 Mineral Resource Classification

The Mineral Resources have been classified according to the definitions and guidelines of the CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Standard).

After the drilling campaigns, a significant amount of the deposit is explored at or near a 25 m x 25 m grid. In Niger, based on a long exploration and mining history, such a drilling density is associated to a good knowledge of the geology and a good understanding of the continuity of the mineralisation. SRK believes that this holds true for the model and estimates at Miriam and have therefore used the following criteria for the Miriam estimates:

- Measured = 30 m or better drill spacing
- Indicated = 60 m or better drill spacing
- Inferred = all remaining modelled mineralisation, extrapolated to max of 150 on basal contact of Guezouman.

SRK used this data density criteria assessment, along with consideration of data quality, geological continuity and complexity, and estimation quality to define wireframes to outline contiguous zones of blocks with similar levels of confidence. In this process, some isolated blocks that satisfy the criteria are excluded from the final assignment, while some blocks are included (Figure 14-28). To ensure the final volumes have captured blocks with high estimation quality, SRK have verified the slope of regression (SoR) of the Measured and Indicated blocks (Figure 14-29).

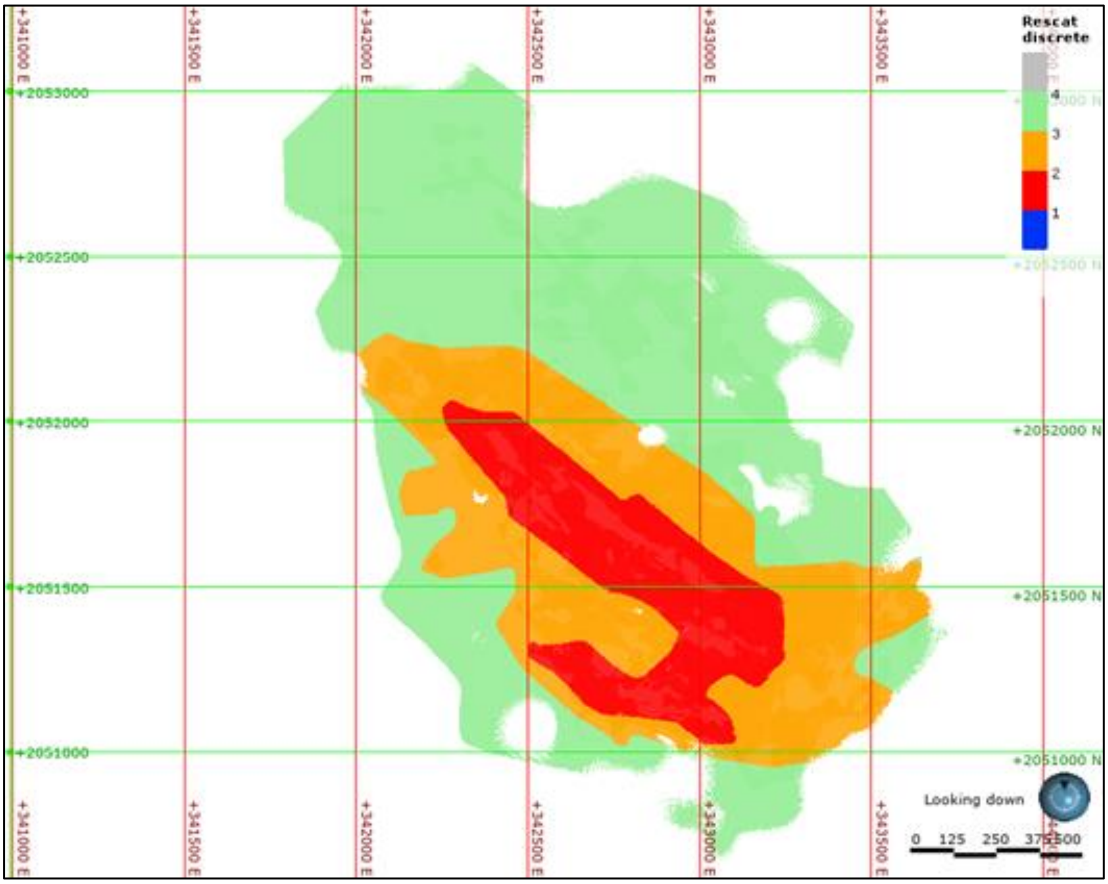


Figure 14-28: Miriam deposit coloured by classification; Measured (Red), Indicated (Orange) and Inferred (Green)

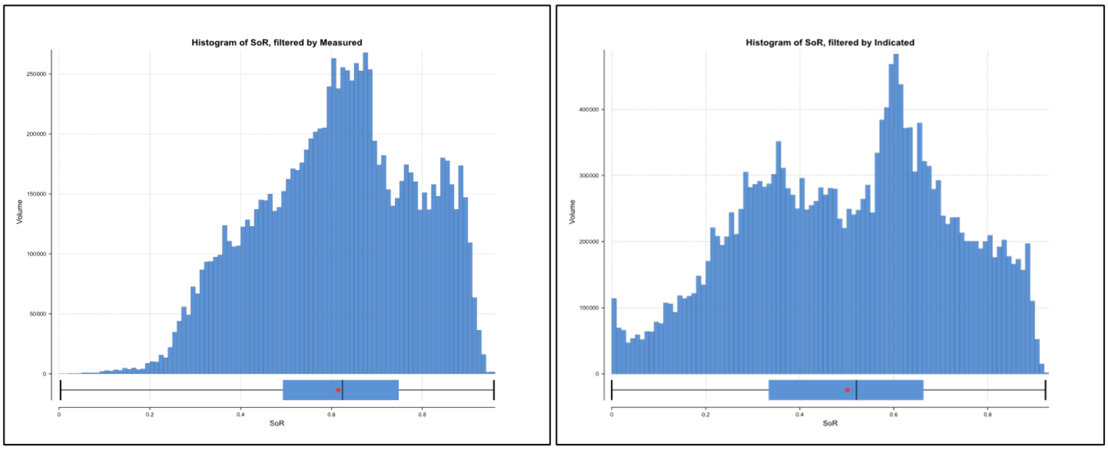


Figure 14-29: Histogram SoR filtered by Measured (left) and Indicated (right)

14.3.10 Reasonable Prospects for Eventual Economic Extraction

SRK has reported the Mineral Resource as that portion of the block model which has been included in an optimised open-pit shell, considering the appropriate mining, processing and general and administrative cost, geotechnical parameters and processing recoveries, as discussed with the Company and determined in the TEM (Table 14-10). SRK considers that the material reported as a Mineral Resource fulfils the requirement by the CIM Guidelines of having "…reasonable prospects for eventual economic extraction" (RPEEE), through open pit mining, which is supported by a Feasibility Study for the project. The optimised open pit volume is presented relative to the classified block model in Figure 14-30.

Table 14-10: Summary of key assumptions for conceptual pit optimisation and cut-off grade calculation

Parameters	Units	Number		Comment
Production				
Production Rate - Ore	(Mtpa)	1		Production Rate
Geotechnical				
Weathered	(Deg)	51		
Fresh	(Deg)	54		
Mining Factors				
Dilution	(%)	2		Use 7.5 x 7.5 x 0.75m model + dilution factor
Recovery	(%)	100		Use 7.5 x 7.5 x 0.75m model + no additional loss
Processing				
<u>Processing Recoveries to Concentrate</u>				
Recovery U	(%)	94.5		
Operating Costs				
<u>Mining Costs</u>				
Base Mining Cost	US$/t mined	3.05		Average 3.15
Incremental Depth Mining Cost	US$/t/m	0.008		
Base Mining Cost Reference Level	(Z Elevation)	465		
Bench Height	(m RL)	20		
<u>Processing Costs</u>				
Processing Cost	US$/t ore	25.40		From TEM
<u>Transport Costs</u>				
Concentrate Transportation Costs	US$/lb U_3O_8	0.97		
<u>Infrastructure and Site Management</u>				
Infrastructure	US$/t ore	3.97		From TEM
Tailings	US$/t ore	1.21		From TEM
Water Management	US$/t ore	0.58		From TEM
Environment & Social	US$/t ore	0.1		From TEM
Rehandle	US$/t ore	0.03		From TEM
G&A	US$/t ore	2.19		From TEM
Royalty				
U	(%)	9		Sliding scale from 5.5% to 12%, majority of material at 9% in TEM
Metal Prices				
U	US$/lb U_3O_8	70		
U	US$/kg U_3O_8	154		From TEM
U	US$/kg U	182		
Other				
Discount Rate	(%)	10		
Cut-Off Grade				
Marginal Costs	US$/t ore	33.48		
U Calculated Diluted	kg/t U	0.22		SRK Calculation
U Calculated In-Situ	kg/t U	0.22		

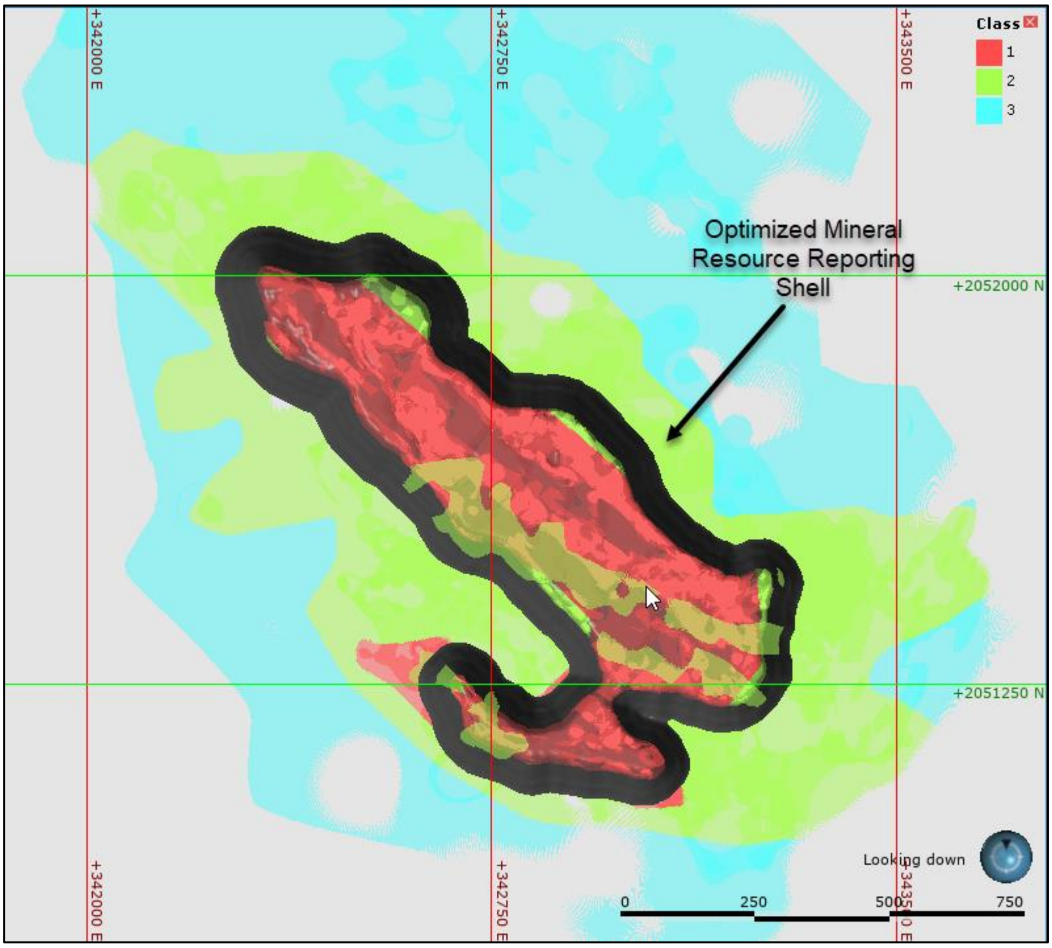


Figure 14-30: Mineral Resources coloured by classification showing outline of Optimised Mineral Resource Reporting Shell

14.3.11 Mineral Resource Statement

The CIM Definition Standards defines a Mineral Resource as:

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."

The "reasonable prospects for eventual economic extraction" requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade taking into account extraction scenarios and processing recoveries.

The Mineral Resource Statement for the Miriam Deposit is presented in Table 14-11.

Table 14-11: Mineral Resource Statement for the Miriam Deposit effective July 01, 2022

Classification Category	Tonnage (Mt)	Grade			Metal		
		eU (kg/t)	eU_3O_8 (kg/t)	Mo (ppm)	eU_3O_8 (Tonnes)	eU_3O_8 (M lbs)	Mo (Tonnes)
Measured	10.7	0.67	0.79	101	8,384	18.5	1,076
Indicated	0.5	0.46	0.54	38	281	0.6	20
Measured & Indicated	11.2	0.66	0.77	98	8,664	19.1	1,096
Inferred	—	—	—	—	—	—	—

In reporting the Mineral Resource statement, SRK notes the following:

- *Mineral Resources have an effective date of July 01, 2022*
- *Mineral Resources are classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 29, 2019).*
- *Mineral Resources are reported here are Inclusive of Mineral Reserves and are reported as undiluted, with no mining recovery applied in the Statement.*
- *Technical and economic assumptions were agreed between SRK and GoviEx for mining factors (mining and processing costs) and processing factors (metal recovery, processing costs), which were used for optimisation, and which were developed to a Feasibility Study level of detail and accuracy.*
- *SRK considers there to be reasonable prospects for economic extraction by constraining the resources within an optimised pit shell shape constructed assuming a Uranium price of US$70/lb U_3O_8.*
- *Mineral Resources are reported within volumes defined by the Optimised pit shell above a eU cut-off of 0.22 kg/t.*
- *Tonnages are reported in metric units, grades in kilograms-per-tonne (kg/t) and parts-per-million (ppm), and the contained metal in Tonnes and Million pounds (M lbs). Tonnages, grades, and contained metal totals are rounded appropriately.*

14.3.12 Sensitivity Analysis

The mineral resources of the Miriam deposit are sensitive to the selection of the reporting cut-off eU kg/t value. To illustrate this sensitivity, the block model quantities and grade estimates within the conceptual pit used to constrain the mineral resources are presented in Table 14-12 at different eU kg/t cut-off values. The reader is cautioned that the figures presented in these tables should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of the eU kg/t cut-off value. Figure 14-31 presents the sensitivity as a grade tonnage curve.

Table 14-12: Block model quantities and grade estimates within the optimised pit shell at Various eU kg/t cut-off values for Miriam

eU Cut-off (kg/t)	Tonnage (Mt)	Grade
		eU (kg/t)
0	11.4	0.65
0.1	11.4	0.65
0.22	11.2	0.66
0.3	9.2	0.74
0.4	6.4	0.92
0.5	4.6	1.10
0.6	3.4	1.29
0.7	2.6	1.47
0.8	2.1	1.66
0.9	1.8	1.82
1	1.5	1.98
1.1	1.3	2.14
1.2	1.1	2.32
1.3	0.9	2.49

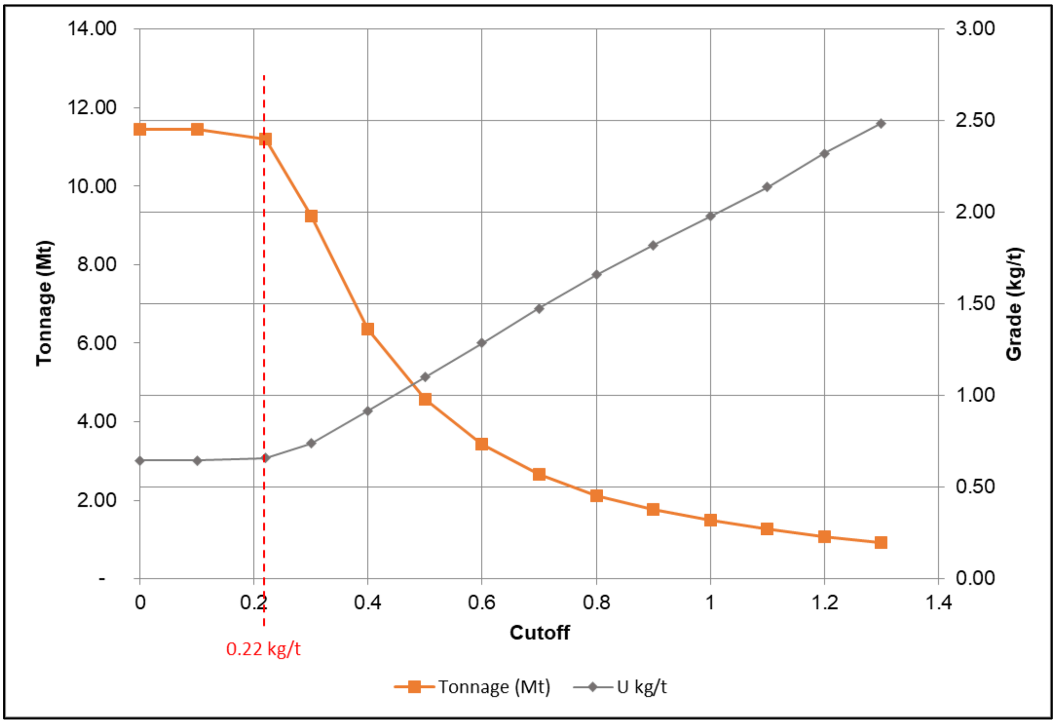


Figure 14-31: Grade tonnage curve for the Miriam deposit

14.3.13 Comparison with Previous Estimate

The Mineral Resource presented here includes a number of factors that have led to changes compared to the previous Mineral Resource, effective date March 02, 2016. At Miriam, a considerable number of drill holes were added, which led to remodelling of the mineralized zones. In addition to the remodelling, an open pit mining optimization was used to restrict the reportable Mineral Resources considering RPEEE, something that was not considered for the March 02, 2016 Mineral Resource. These factors combined have led to the following key changes:

- Increase in Measured eU_3O_8 Tonnes and Metal due to increased data available;
- Decrease in grade across all categories due to additional data and modelling approach; and
- Decrease in Indicated and Inferred eU_3O_8 Tonnes and Metal due to RPEEE considerations.

There were no previous estimates of Molybdenum at the Miriam deposit.

Table 14-13: Miriam Comparison with previous estimate (2016 vs 2021)

Category	2016			2021			Difference (%)		
	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes	eU_3O_8	eU_3O_8 Metal
Measured	9.62	1.08	22.92	10.67	0.79	18.48	+11%	-27%	-19%
Indicated	2.68	0.79	4.66	0.52	0.54	0.62	-81%	-31%	-87%
M&I	12.30	1.02	27.58	11.19	0.77	19.10	-9%	-24%	-31%
Inferred	0.58	1.33	1.70	-	-	-			
All	12.88	1.03	29.28	11.19	0.77	19.10	-13%	-25%	-35%

14.4 M&M

14.4.1 Supporting Data

The M&M deposit has been defined by a generally regular grid of vertical drill holes that vary in density from 30 x 30 m up to 100 x 100 m, but the majority of the deposit is defined by at least 50 x 50 m spacings (Figure 14-32). A total of 2,852 drill holes, with total length of 225,473m, support this Mineral Resource estimate. The key uranium and molybdenum mineralised horizon at M&M is the Guezouman Sandstone, which is locally deformed by a northeast trending channel and offset by northwest trending faults. There is uranium mineralisation within the channels as well, although this is relatively discontinuous. The vertical drilling grid is appropriate to adequately define the flat-lying, Guezouman parallel and channel mineralisation (Figure 14-33).

All drill holes have been radiometrically probed, and after processing, provide eU (referred to as 'teneur' at the project) data for the full length of holes. Uranium and molybdenum assays have been obtained from diamond drill holes and are not available for the entire deposit area and provide adequate coverage only in certain areas so is limited in reporting in the mineral resource statement (Figure 14-34).

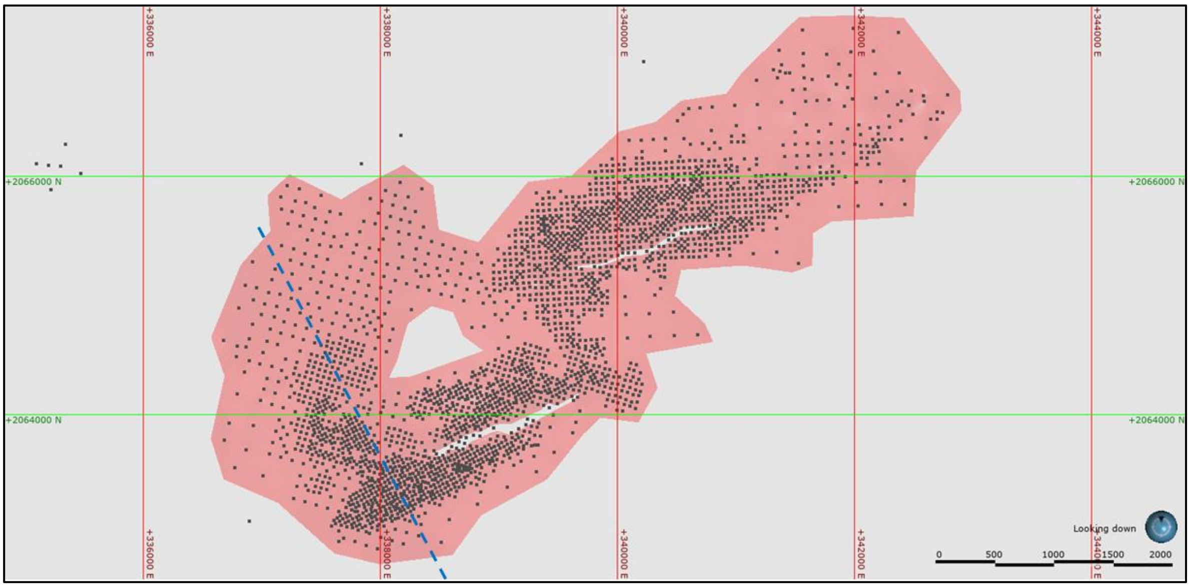


Figure 14-32: M&M drill collar locations with respect to the modelled mineralisation

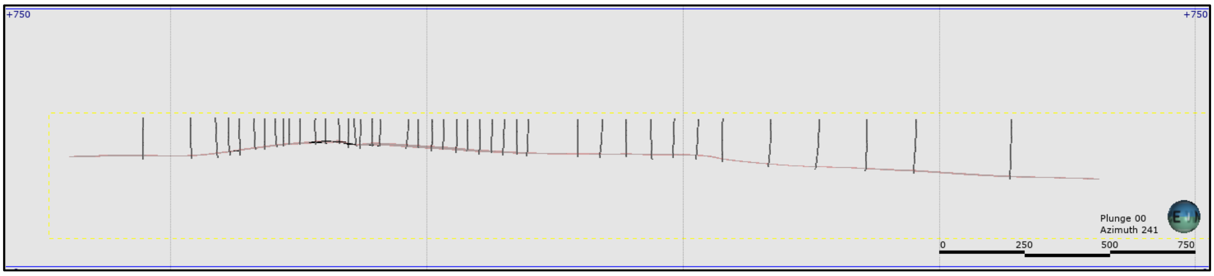


Figure 14-33: Cross section (section line highlighted in Figure 14-32) of the vertical drill holes with respect to modelled mineralisation (vertical exaggeration x3).

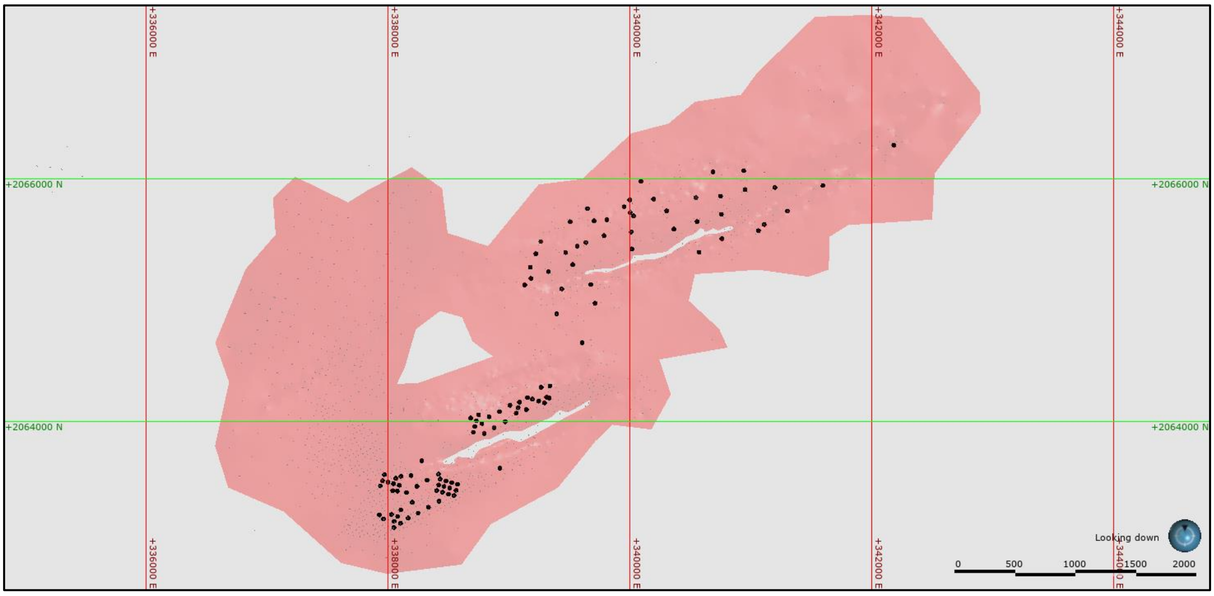


Figure 14-34: M&M diamond drill collar locations where chemical assays have been taken.

Table 14-14: Summary of drilling at M&M

Sampling Type	Number of holes	Total Meters
Radiometric Assay (eU)	2,738	217,802
Radiometric (eU) and Chemical Assay (U and Mo)	114	7,671
Total	**2,852**	**225,473**

14.4.2 Geological Modelling

The stratigraphy at M&M has been logged in drill holes and is consistent across the project area, although is locally affected by channels deflecting the units. SRK have built a stratigraphic model based on the drill hole logging (Figure 14-35).

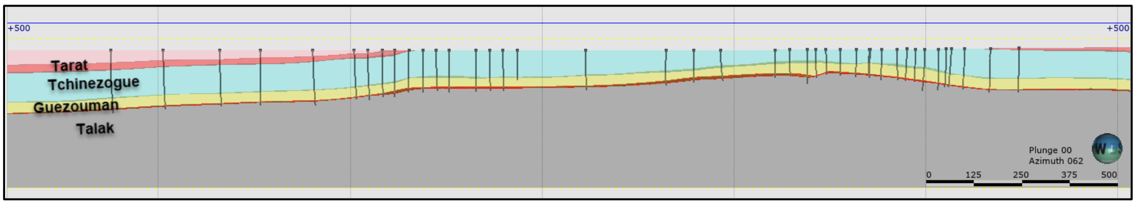


Figure 14-35: Cross section of the modelled stratigraphy at M&M (Cross section location shown in Figure 14-32).

14.4.3 Mineralisation Model

eU Models

The distribution of uranium and molybdenum mineralisation at M&M is controlled by the reducing formation (Talak) at the base of the Guezouman sandstone. There is no clear, or visible boundary that defines the upper contact of uranium mineralisation so the distribution of eU grades in the Guezouman Sandstone was investigated and a modelling cut-off of 0.4 kg/t eU was chosen to represent mineralised material, called the Guez_Min_GT04 domain (Figure 14-36). The modelled mineralisation results in a thin layer immediately above the Talak contact. SRK also modelled a layer above the GT04 domain where the thickness was less than the minimum mining width of 1.8 m, called the Guez_Min_HW_LT04 domain. There is a 60-degree bearing control, which aligns with the channels. The fault offset between Marianne and Marilyn does not seem to offset Talak contact, at least at the resolution of the currently available drilling.

Uranium mineralisation has also been modelled within the channels (Channel1_Min_GT04 and Channel2_Min_GT04), using the same cut-off of 0.4 kg/t eU, but is relatively discontinuous.

The final mineralisation domains, and their respective numeric codes for reference, are presented in Table 14-15.

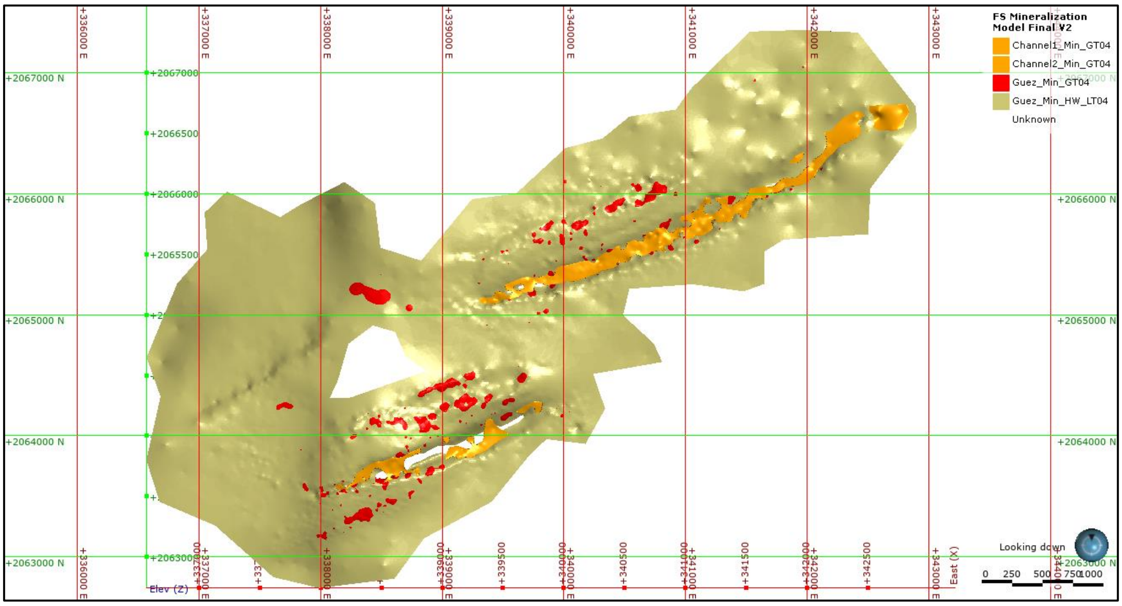


Figure 14-36: Plan view of the M&M modelled uranium mineralisation.

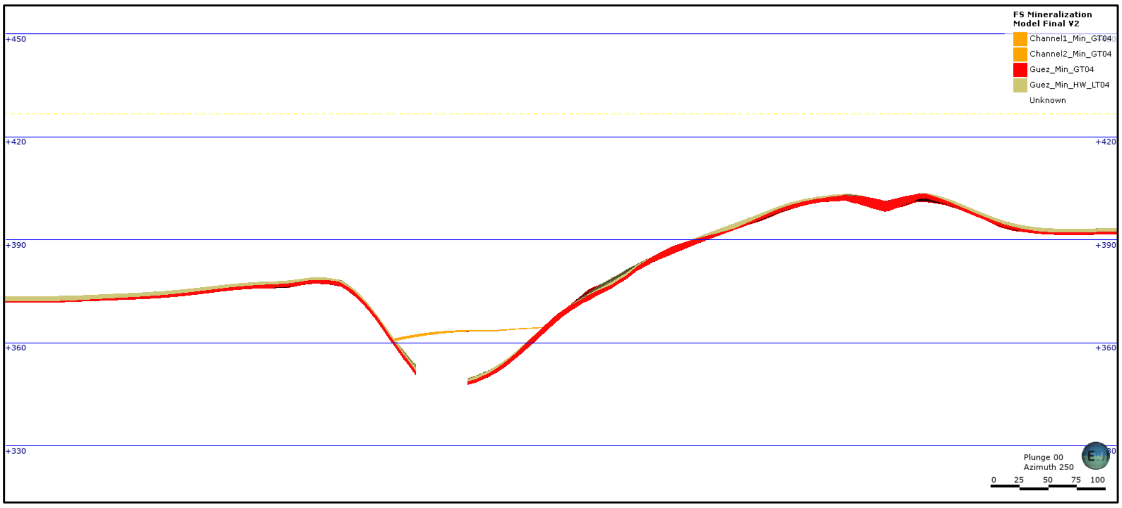


Figure 14-37: Typical cross section (exaggerated x5 vertical) of the modelled mineralisation.

Table 14-15: Domain descriptions for M&M

DOMAIN CODE	Description
100	Guez_Min_HW_LT04, <0.4 kg/t U
101	Guez_Min_GT04, >0.4kg/t U
201	Channel1_Min_GT04, >0.4 kg/t U
202	Channel2_Min_GT04, >0.4 kg/t U

Molybdenum Models

Although Molybdenum has been assayed in a number of holes, it has been selectively sampled in the uranium mineralized (GT04) zone of the Guezouman unit and there is insufficient information to determine if specific Molybdenum domains are required for estimation. SRK have chosen to estimate Molybdenum within the eU Guez_Min_GT04 domain only and believe the statistics support this decision at the current level of sampling.

14.4.4 Data Conditioning and Statistical Analysis

Prior to undertaking any grade interpolation, SRK performed a statistical study on composited eU and Molybdenum assay data within the modelled mineralisation wireframes to assess their suitability for grade estimation and to confirm that appropriate estimation domains had been modelled.

Compositing

Since the mineralisation forms a single thin and continuous layer, samples were composited to the thickness of the modelled mineralisation, resulting in 1 composite per drill hole for both eU and Mo, for each of the modelled domain, with the following fields (see 2-dimensional approach described in Section 14.2):

- Grade – eU kg/t and Molybdenum ppm
- Thickness (Th) – m
- Accumulation (GTh) – Grade x Thickness

The grade distribution of GTh and Th for eU are presented in Figure 14-38 and Figure 14-39 respectively, and summarised statistics in Table 14-16.

The grade distribution of GTh and Th for Molybdenum are presented in Figure 14-62 and Figure 14-63 respectively, and summarised statistics in Table 14-27. SRK investigated the correlation of molybdenum with uranium and found they are generally poorly correlated. At low uranium grades, below 200 pm, there is evidence of a positive correlation but above 200 ppm there is none.

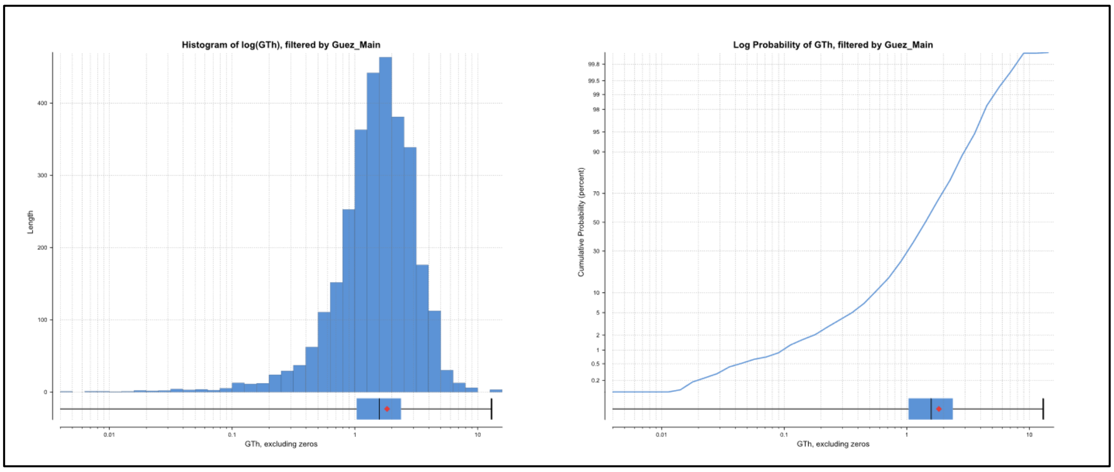


Figure 14-38: Log-histogram and log-probability plot of composited GTh (eU) in the 101 Domain.

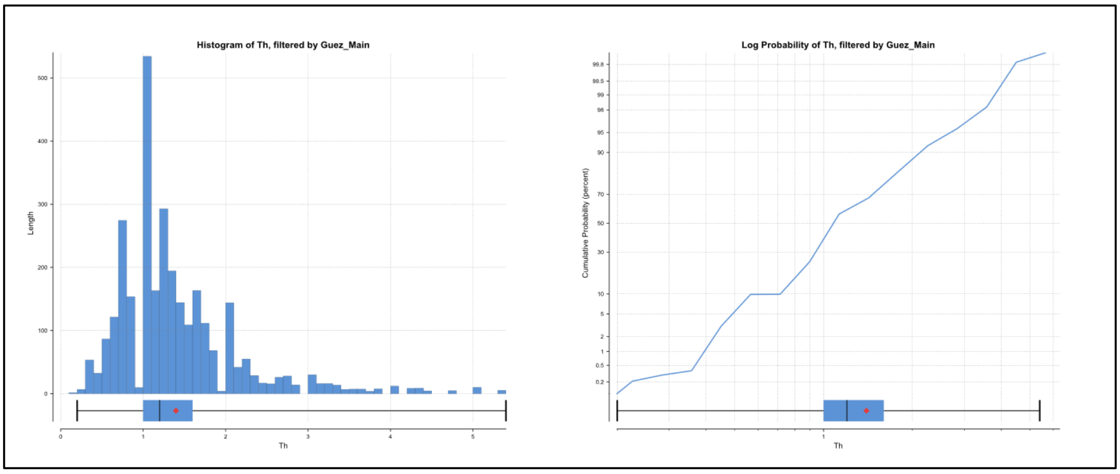


Figure 14-39: Log-histogram and log-probability plot of composited Th (eU) in the 101 Domain.

Table 14-16: Composite statistics for M&M Uranium domains

Statistic	Guez_Min_GT04	Channel GT04	Guez_HW_LT04
GTh			
	101	**201&202**	**100**
Count	2,785	186	2,495
Length	3,057.07	115.76	2,122.61
Mean	1.83	0.82	0.14
CV	0.66	1.20	0.58
Minimum	0.00	0.01	0.00
Maximum	12.99	4.48	1.20
Th			
	101	**201&202**	**100**
Count	2,785	186	2,495
Length	3,057.07	115.76	2,122.61
Mean	1.40	1.01	1.04
CV	0.54	0.86	0.38
Minimum	0.20	0.20	0.00
Maximum	5.40	4.40	3.12

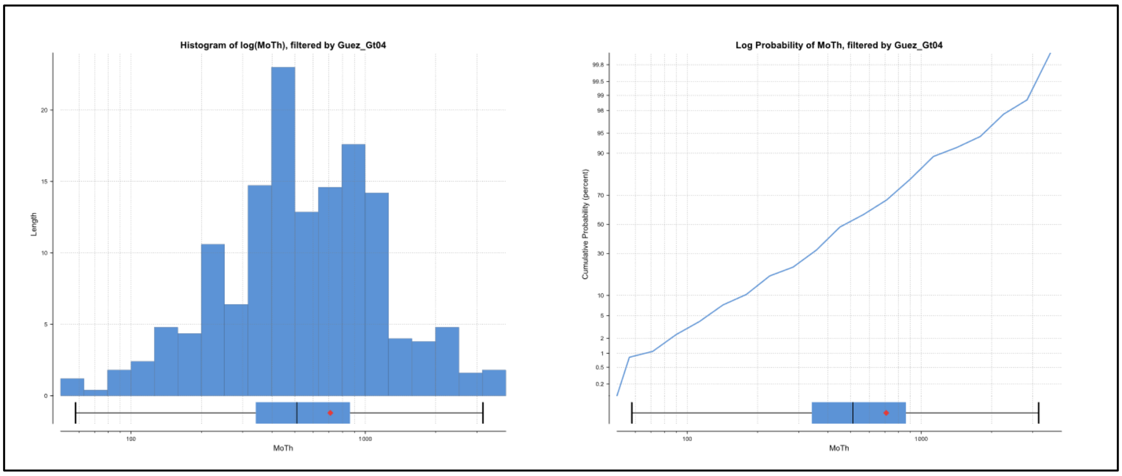


Figure 14-40: Log histogram and Log Probability plots for GTh (Mo) in the Guez_Min_GT04 domain.

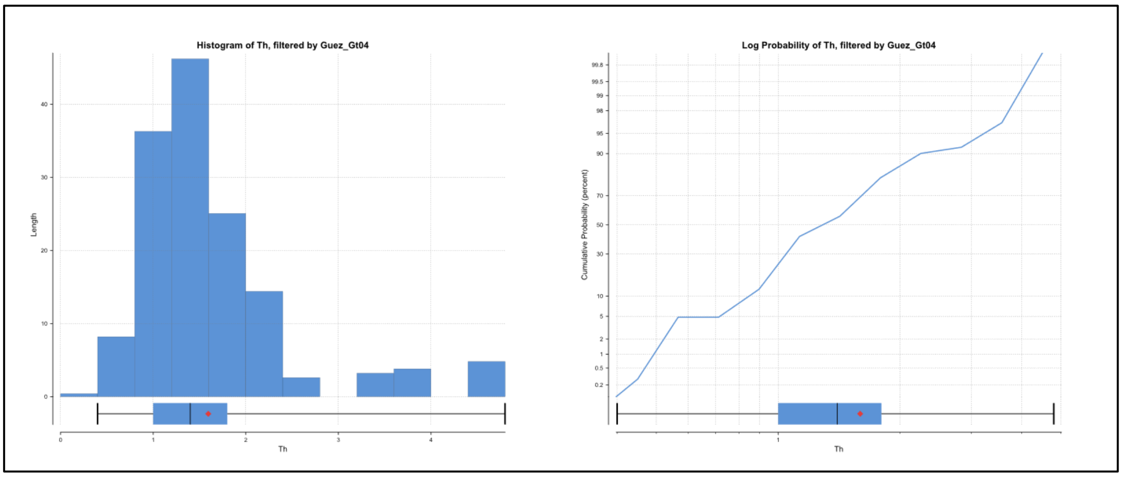


Figure 14-41: Log histogram and Log Probability plots for Th (Mo) in the Guez_Min_GT04 domain.

Table 14-17: Composite statistics for Molybdenum HG domain

Statistic	GTh	Th
Count	111	111
Length	144.94	144.94
Mean	709.69	1.59
CV	0.81	0.54
Minimum	58.02	0.4
Maximum	3,182.14	4.8

Treatment of high-grade outliers

For eU, all domains have low CoV and SRK have determined that no capping of eU grades is required. Molybdenum was not capped, although a distance restriction was set in the estimation above a Molybdenum threshold of 900 ppm within the Guez_Min_GT04 domain.

Density

76 density measurements are available for the M&M deposit (Figure 14-42). The concentration and distribution of the density data is such that SRK determined estimation of density to not be viable. The variance of the density results is extremely low and therefore a mean of 2.3 t/m^3 has been applied to each of the blocks in the Guez_Min_GT04 domain and 2.1 t/m^3 in the Guez_HW_LT04 domain (Table 14-18).

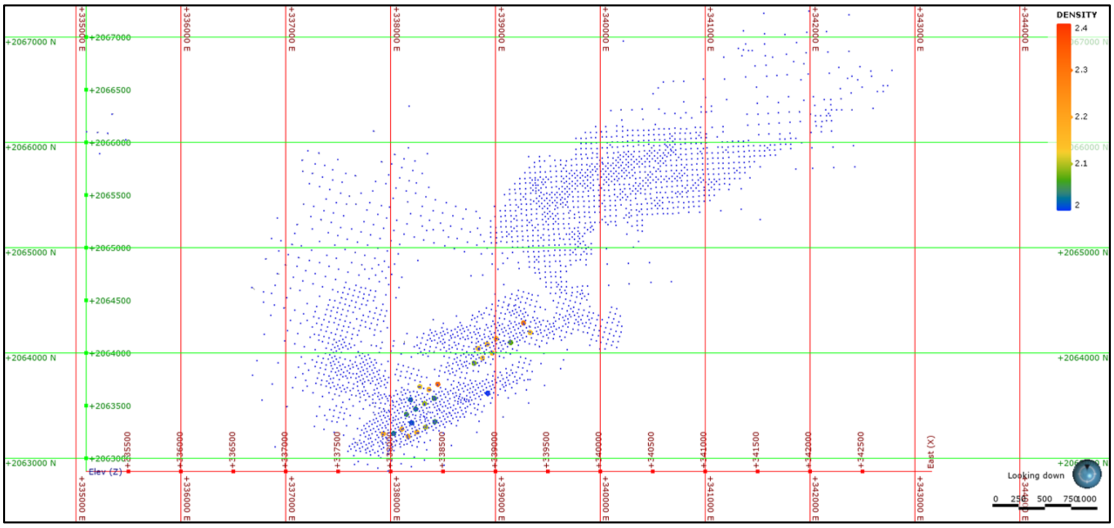


Figure 14-42: Plan view of M&M drill hole collars and Density data coloured by density (t/m^3).

Table 14-18: Density data for Guez domains

Statistic	GT04 Guez	Guez WASTE	Guez LT04 HW
Count	21	52	3
Length	4.2	10.4	0.6
Mean	**2.3**	**2.1**	**2.1**
CV	0.06	0.03	0.04
Minimum	2.05	2	2.1
Maximum	2.53	2.27	2.27

14.4.5 Geostatistical analysis

Contact Analysis

SRK investigated the contact conditions of uranium and molybdenum grades within the modelled mineralisation domains by visualizing composite grades at various distances from the modelled contacts. For uranium and molybdenum the bottom contact, with the Talak formation, is quite sharp while the hanging wall contact of the Guez_Min_GT04 is more gradational. The Guez_Min_LT04 domain was modelled to capture this lower grade in the hanging wall. SRK have employed hard boundary conditions for all domains for both uranium and molybdenum based on these observations.

Grade Continuity

For each modelled domain, SRK investigated the grade continuity for GTh and Th for eU and molybdenum. Variography has been completed on non-transformed data in unfolded space. SRK noted a very consistent direction of major continuity at a bearing roughly 60 degrees, which is coincident with the strike of the channels. Modelled variograms are well structured with strong anisotropy, typically in the 2.5:1 ratio (examples provided in Figure 14-43 to Figure 14-45).

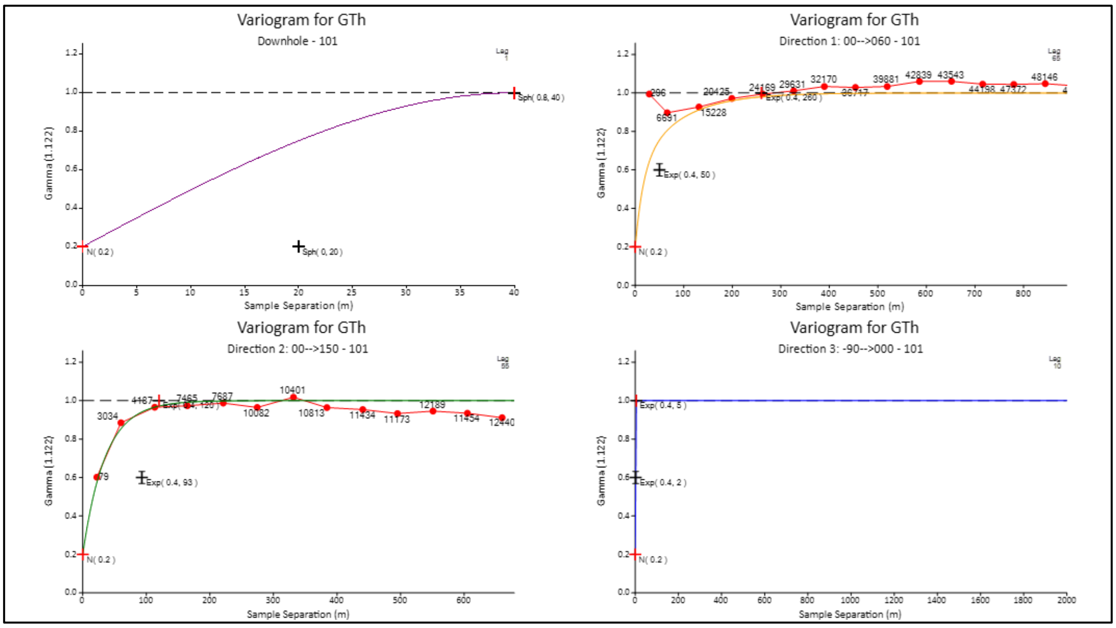


Figure 14-43: Experimental and modelled variograms for GTh (eU) in the 101 domain.

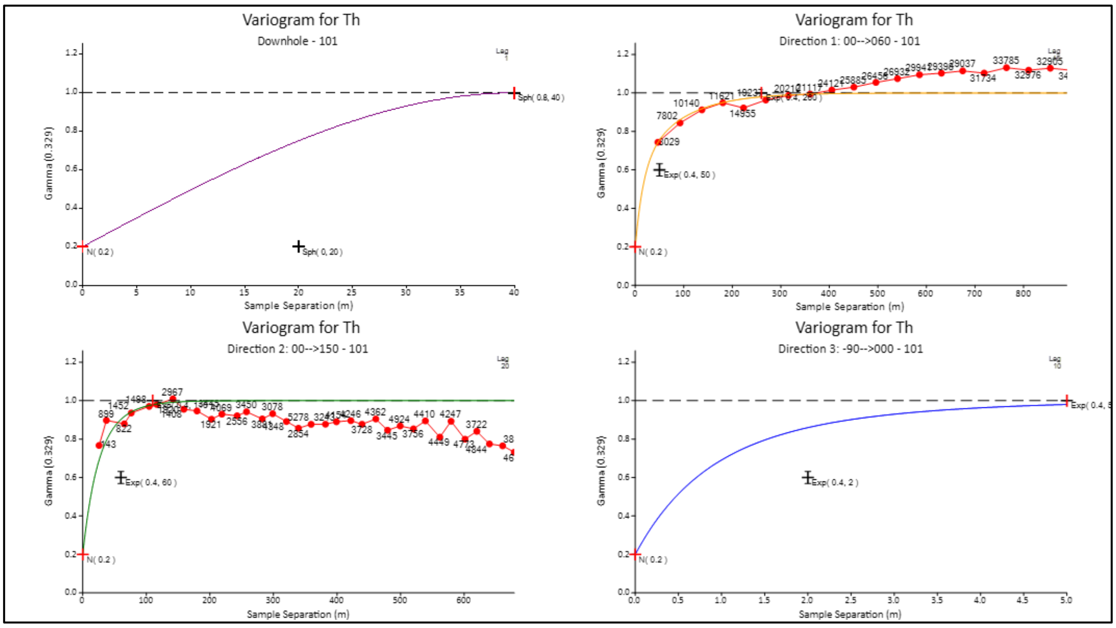


Figure 14-44: Experimental and modelled variograms for Th (eU) in the 101 domain.

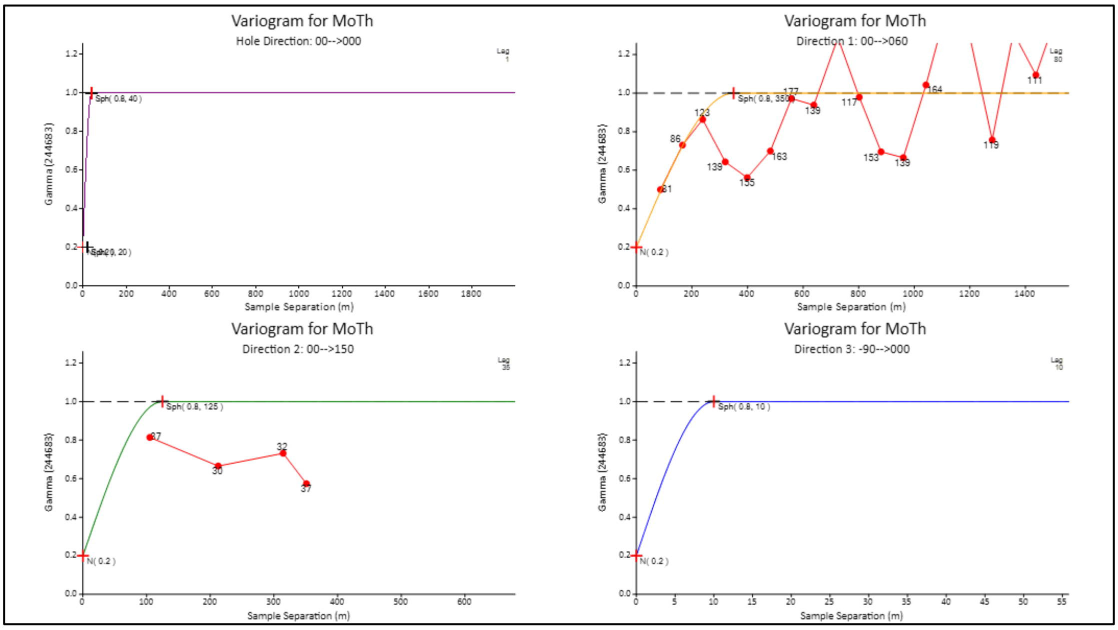


Figure 14-45: Experimental and modelled variograms for GTh (Mo) in the 101 domain. Grade Interpolation

Kriging Neighbourhood Analysis (KNA)

Kriging variance and slope of regression are both measures of the performance of the kriging that are written to each block. These parameters are often used to evaluate different model runs in tests that aim to optimise the kriging search parameters. Although SRK did not complete a formal KNA study for the M&M estimate, SRK did visually assess the estimation quality resulting from sensitivity testing of sample search parameters.

14.4.6 Grade Interpolation

Resource estimation was completed using an unfolding technique in an area encompassing the modelled M&M mineralisation with a final block model geometry and extents as presented in (Table 14-19). The block model is rotated to an azimuth of 338 degrees to optimize the alignment of blocks with the mineralisation. The grade interpolation methodology is based on the following:

- Composited data were not capped and distance restrictions on high-grade populations were applied as described in Section 14.4.4;
- During estimation, domain boundaries for the selection of composites were treated as hard boundaries;
- Search Volumes were aligned according to the modelled variograms with dimension of 260 x 120 x 20 m for the first pass, and doubled for the second pass;
- Minimum and maximum sample selection parameters were set at 3 and 9 respectively and 1 and 9 in the second pass;
- Block discretization of 5 x 5 x 1;
- GTh and Th was estimated by Ordinary Kriging and Grade eU was calculated by GTh/Th; and
- Density of 2.3 t/m^3 and 2.1 t/m^3 was assigned to the 101 and 100 domains respectively.

Table 14-19: Block model parameters for M&M

Parameter	X	Y	Z
Origin (block centroid)	336,500	2,060,600	480
Block Size	60	60	6
Number of Blocks	150	100	55
Sub-block Count	16	16	32
Sub-block Minimum Size	3.75	3.75	0.1875

14.4.7 Block Model Validation

SRK validated the block model estimates through visual and statistical checks of block grades compared with composited drillhole data in plan view and by comparing mean block model grades with mean composite data. The validation is designed to confirm that the block model is representative of the underlying sample data at both local and global scales and to check that the estimate is not biased.

SRK believes that the block model reflects the current understanding of the distribution of mineralisation and is an acceptable basis for a Mineral Resource statement.

Visual Validation

SRK visually compared block grades to composite grades in in plan views to assess the correlation of the interpolated block model to the composite data on a local scale. SRK found that local block estimates were similar to nearby composite samples and that the block model reflected the patterns in grade variability with depth observed in the drillhole composites without over-smoothing in the vertical direction and without excessive lateral smearing of high grades. Example validation cross sections are shown in Figure 14-46 to Figure 14-49.

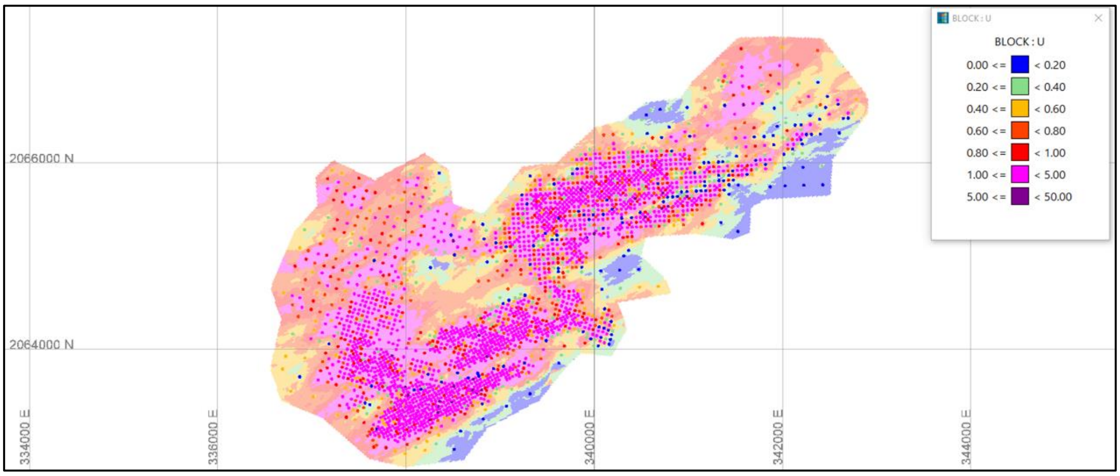


Figure 14-46: Plan view of GTh sample data and GTh block estimates (eU).

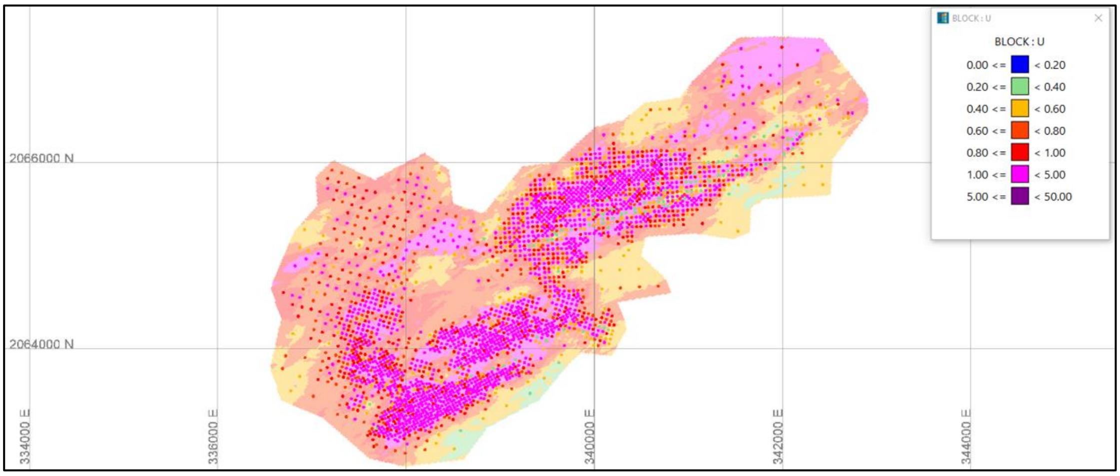


Figure 14-47: Plan view of Th sample data and Th block estimates (eU).

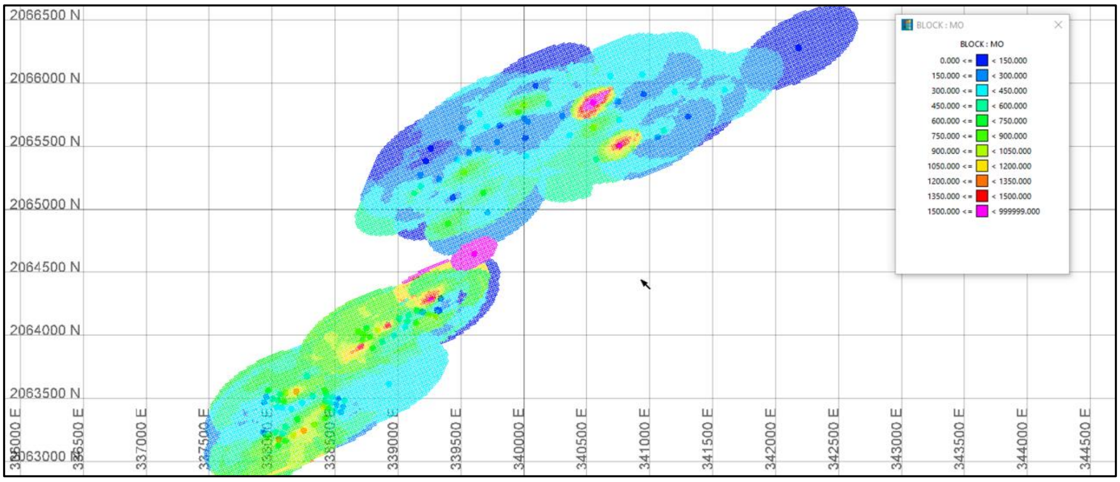


Figure 14-48: Plan view of GTh sample data and GTh block estimates (Mo).

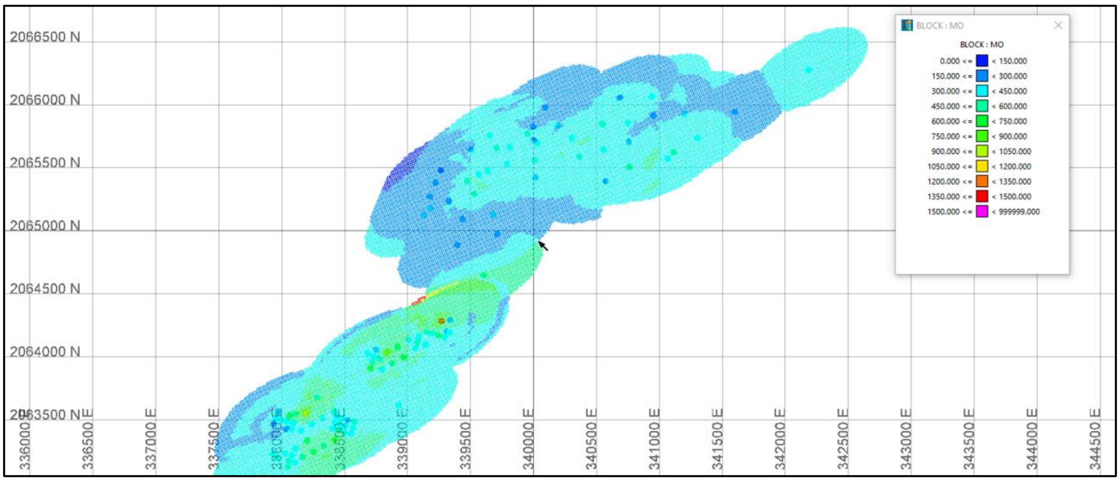


Figure 14-49: Plan view of Th sample data and Th block estimates (Mo).

Statistical Validation

The mean estimated block grades are compared to the mean of the composite samples for each domain in Table 14-8 and Table 14-9 to assess the global fit of the block model to the composite data. The OK block estimate shows some degree of smoothing compared to sample grades, as would be expected, and the domain variance is significantly lower for the block model compared with the samples.

The results show a satisfactory correlation between block model and sample at a global scale. SRK is confident that the model reflects the current understanding of the deposit.

Table 14-20: Validation of block model versus composite grades (eU).

Domain	GTh Mean (ppm)	Th Mean (ppm)	% difference (block model compared to samples) GTh	% difference (block model compared to samples) Th
Blocks				
101	1.18	1.01		
100	0.121	1.09		
201	0.45	0.697		
202	0.49	0.699		
Composites				
101	1.36	1.06	-15%	-5%
100	0.125	0.88	-3%	19%
201	0.4	0.655	11%	6%
202	0.44	0.611	10%	13%

Table 14-21: Validation of block model versus sample composite grades (Mo).

Domain	GTh Mean (ppm)	Th Mean (ppm)	% difference (block model compared to samples) GTh	% difference (block model compared to samples) Th
Blocks				
101	499	1.23		
Composites				
101	584	1.31	-14%	-6%

Swath Plots

As part of the validation process swath plots were generated in the X (easting) and Y (northing) coordinate directions. Average grades for input samples and estimated blocks are calculated along a series of vertical slices (swaths) and plotted on graphs. In effect, a moving average is calculated for blocks and samples along three coordinate axes; this enables the fit of the block model to the underlying data to be assessed at an intermediate scale and the block model can be checked for spatial biases in estimated grade.

Figure 14-50 and Figure 14-51 show examples of the swath plots for GTh and Th for eU in the 101 domain respectively.

Figure 14-52 and Figure 14-53 show examples of the swath plots for GTh and Th for Molybdenum in the 101 domain respectively.

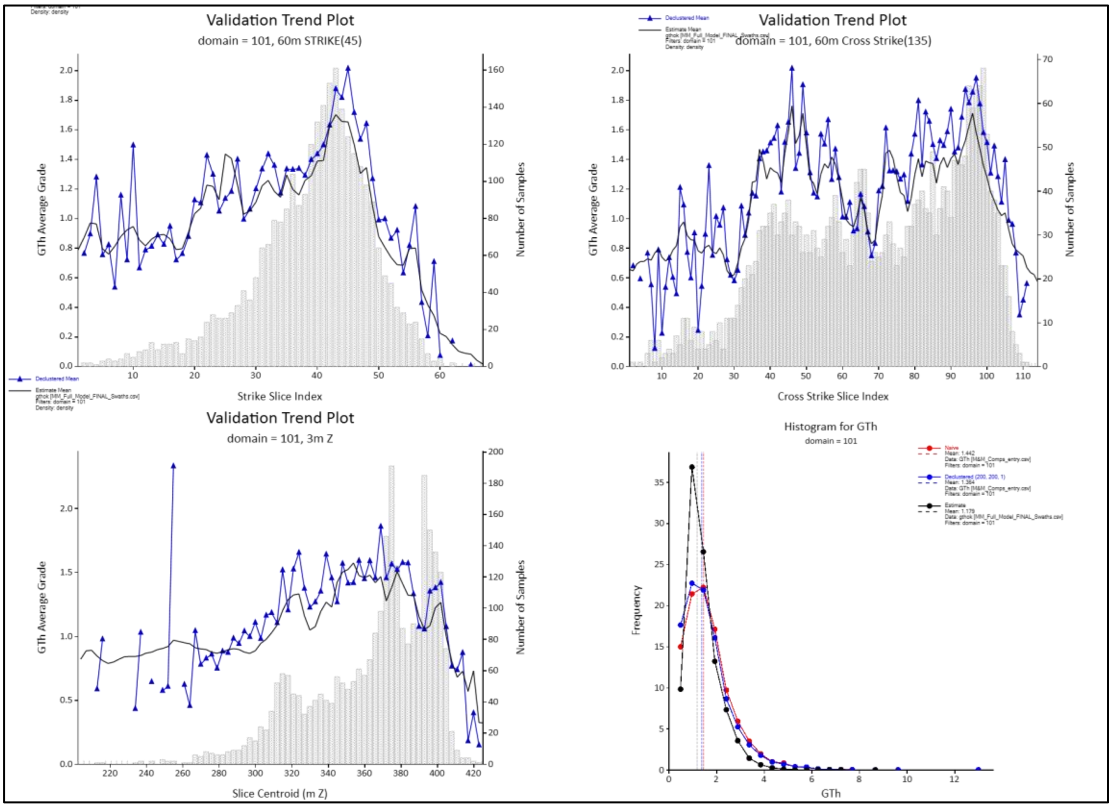


Figure 14-50: Swath plots for GTh (eU) Domain 101

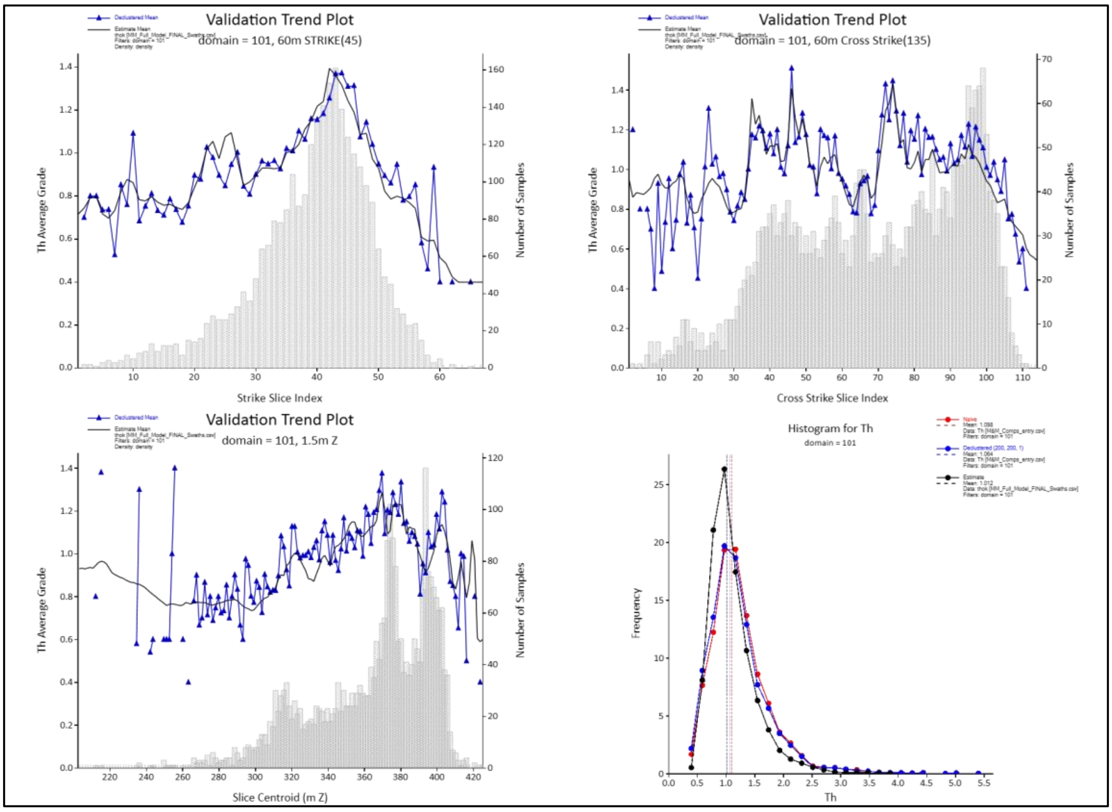


Figure 14-51: Swath plots for Th (eU) Domain 101

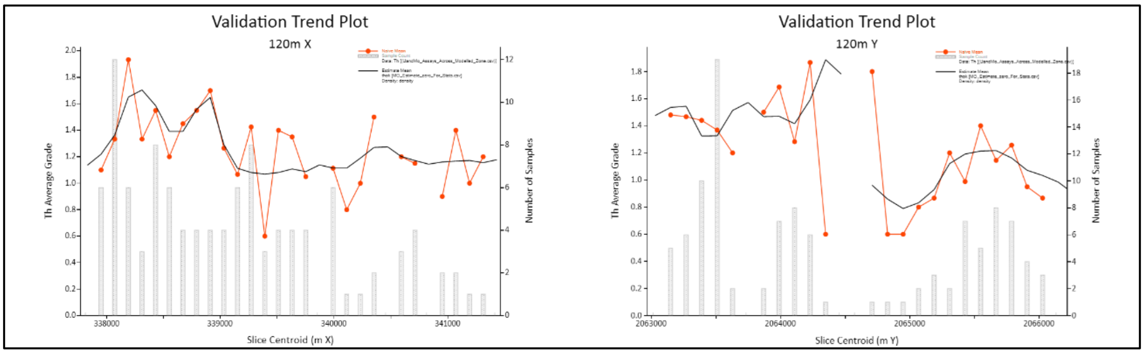


Figure 14-52: Swath plots for GTh (Mo) Domain 101

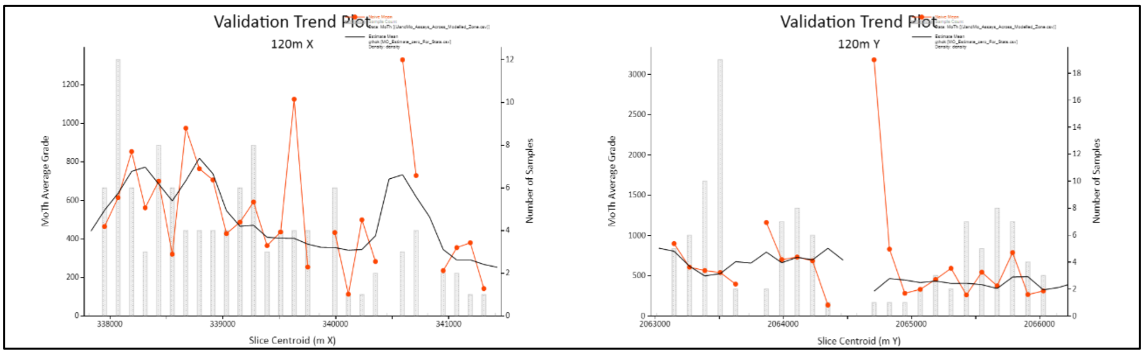


Figure 14-53: Swath plots for Th (Mo) Domain 101

14.4.8 Mineral Resource Classification

The Mineral Resources have been classified according to the definitions and guidelines of the CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Standard).

After the drilling campaigns, a significant amount of the deposit is explored at or near a 40 m x 40 m grid. SRK considers that this drilling density, along with consideration of data quality, geological continuity and complexity, and estimation quality is sufficient to classify the estimated blocks in the Measured, Indicated and Inferred categories.

For eU, SRK applied the following criteria:

- Measured = 40 m or better drill spacing. (*No measured applied in channel domains)
- Indicated = 100 m or better drill spacing
- Inferred = all remaining modelled mineralisation, extrapolated to max of 75m on basal contact of Guez.

For Mo, SRK applied the following criteria:

- Measured = None
- Indicated = 150 m or better drill spacing
- Inferred = all remaining modelled mineralisation, extrapolated to max of 75m on basal contact of Guez.

Blocks located in the Guez_Min_GT04 and Guez_HW_LT04 domains well within the channels have not been classified, as they are believed to be non-recoverable with the proposed mining techniques.

SRK used this data density criteria assessment, along with consideration of data quality, geological continuity and complexity, and estimation quality to define wireframes to outline contiguous zones of blocks with similar levels of confidence. In this process, some isolated blocks that satisfy the criteria are excluded from the final assignment, while some blocks are included (Figure 14-54 and Figure 14-55).

To ensure the final volumes have captured blocks with high estimation quality, SRK have verified the slope of regression (SoR) of the Measured and Indicated blocks for eU and found the majority of blocks in the Measured and Indicated volumes have SoR greater than 0.8 and 0.5 respectively.

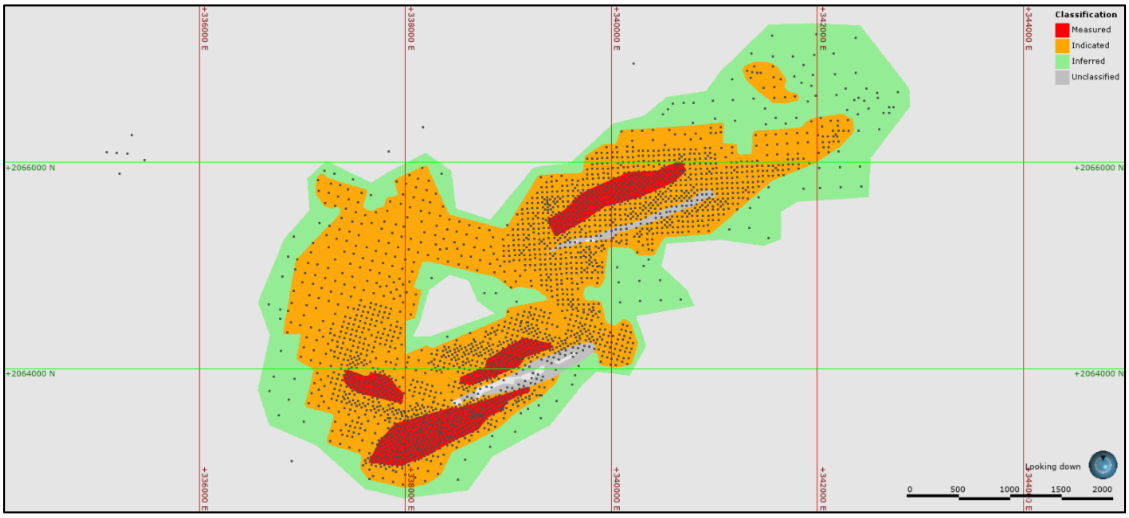


Figure 14-54: M&M deposit coloured by classification for eU

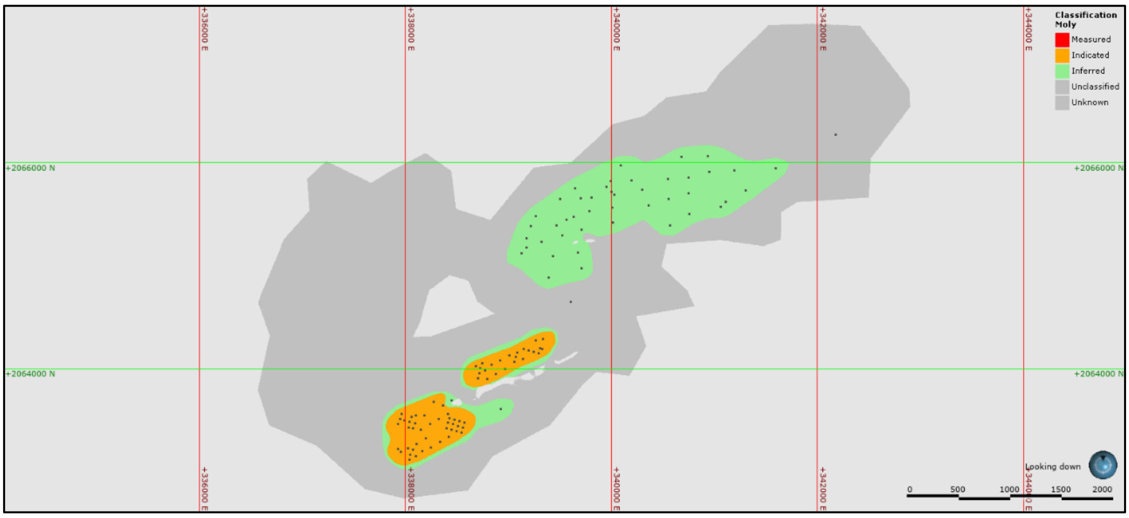


Figure 14-55: M&M deposit coloured by classification for Mo

14.4.9 Depletion

CEA implemented some test mining work in 1965 to further explore the Marilyn area. They sunk a shaft (67 m deep) and excavated a network of galleries (330 m lateral development) to sample the mineralisation and better understand the mineralisation distribution. CEA stockpiled two ore grade categories and waste rock. The quantity of mineralized material was estimated be more than 2,000 t in total (some has been collected previously by OURD to realize their feasibility study). SRK visited the stockpiles of mineralisation and noted that one pile was hand sampled by GoviEx on one end for metallurgical samples. It is not known by SRK what cut-off was used to categorize the stockpiles.

SRK have taken an as-built map of the CEA workings, and used the location of the shaft collar, and three drill hole collars referenced on the CEA map, to georeference this map in UTM coordinates. From the map, and descriptions in the historic reports, SRK have created a 3-dimensional as-built approximation of the underground workings (Figure 14-56). SRK note that the accuracy of this 3-d as-built is not reliable, as this has been built using rough georeferencing techniques as assumptions of the elevations and grade of the cross cuts. From this approximation, there is approximately 1,800 m^3 of the GT04 material removed, or approximately 3,600 tonnes.

SRK considers that the quantum of mineralisation removed is insignificant to the MRE and has not removed these tonnages from the statements. These as-built approximations have been used in the mining study though to approximate the location of these open workings and identify that they must be considered when mining re-commences.

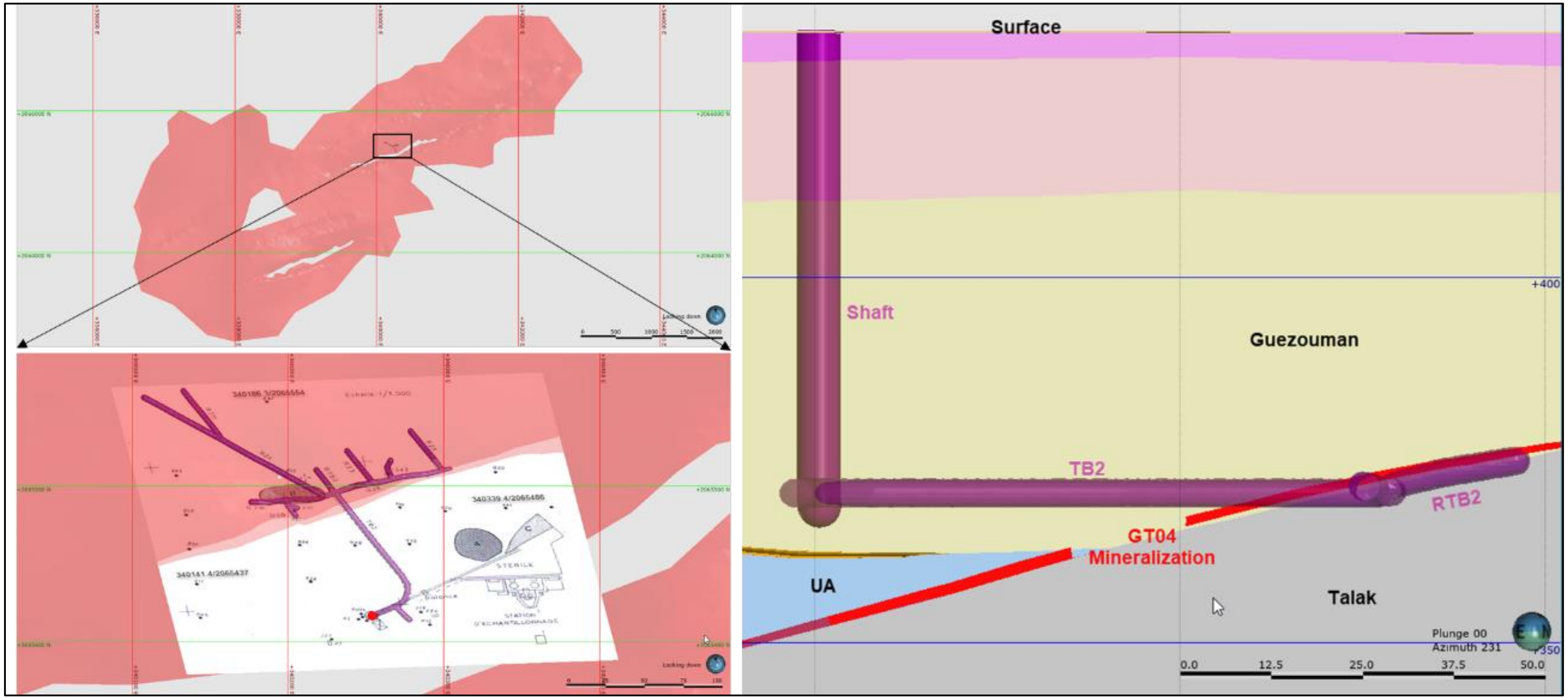


Figure 14-56: Plan view (upper left) of M&M modelled mineralisation and location of the CAE test mine, with zoom view (bottom left). The cross section (right), looking westerly, is positioned along the main cross-cut named TB2 in the CAE map.

14.4.10 Reasonable Prospects for Eventual Economic Extraction

SRK has reported the Mineral Resource as that portion of the block model which has been included in an optimised underground mining volume, considering the appropriate mining, processing and general and administrative cost, geotechnical parameters and processing recoveries, as discussed with the Company and determined in the TEM (Table 14-10). SRK considers that the material reported as a Mineral Resource fulfils the requirement by the CIM Guidelines of having "…reasonable prospects for eventual economic extraction" (RPEEE), through underground mining, which is supported by a Feasibility Study for the project. The optimised underground mining outline is presented relative to the eU and Molybdenum classified block model in Figure 14-57 and Figure 14-58 respectively.

Table 14-22: Summary of key assumptions for conceptual underground optimisation and cut-off grade calculation

Parameters	Units	Number		Comment
Production				
Production Rate - Ore	(Mtpa)	1.2		Production Rate
Mining Factors				
Dilution	(%)	0		
Recovery	(%)	100		
Processing				
Processing Recoveries to Concentrate				
Recovery U	(%)	88.4		
Operating Costs				
Mining Costs				
Base Mining Cost	US$/t mined	29.8		From TEM
Processing Costs				
Processing Cost	US$/t ore	36.83		From TEM
Transport Costs				
Concentrate Transportation Costs	US$/lb U_3O_8	0.97		From TEM
Infrastructure and Site Management				
Infrastructure	US$/t ore	0.59		From TEM
Tailings	US$/t ore	0.74		From TEM
G&A	US$/t ore	3.56		From TEM
Royalty				
U	(%)	5		Minimum royalty applied
Metal Prices				
U	US$/lb U_3O_8	70		
	US$/kg U_3O_8	154		
	US$/kg U	182		
Cut-Off Grade				
Marginal Costs	US$/t ore	63.98		SRK Calculation
U Calculated In-Situ	kg/t U	0.4		

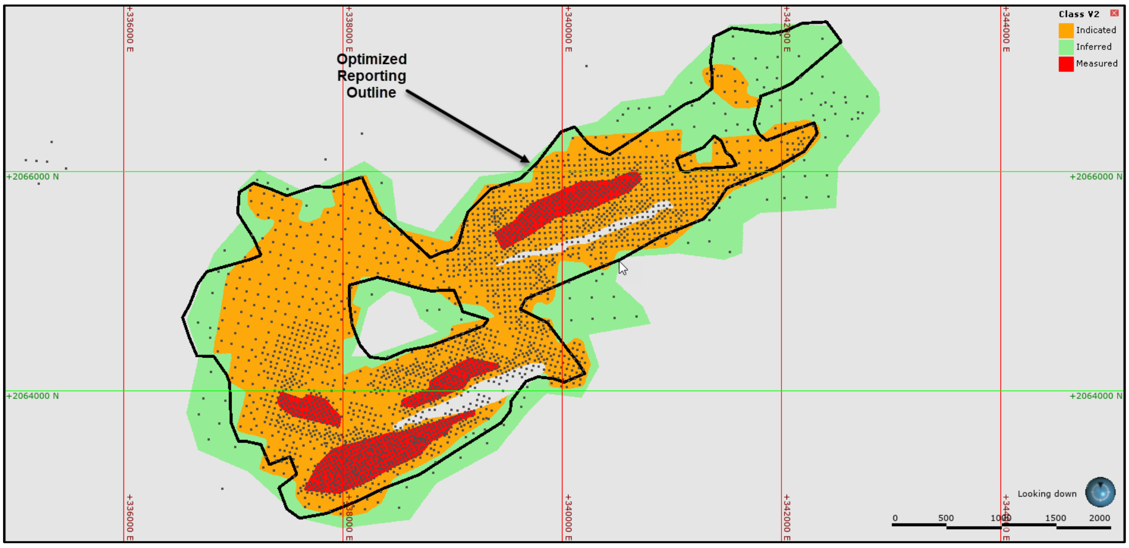


Figure 14-57: Mineral Resources coloured by eU classification showing outline of Optimised Mineral Resource Reporting Shell

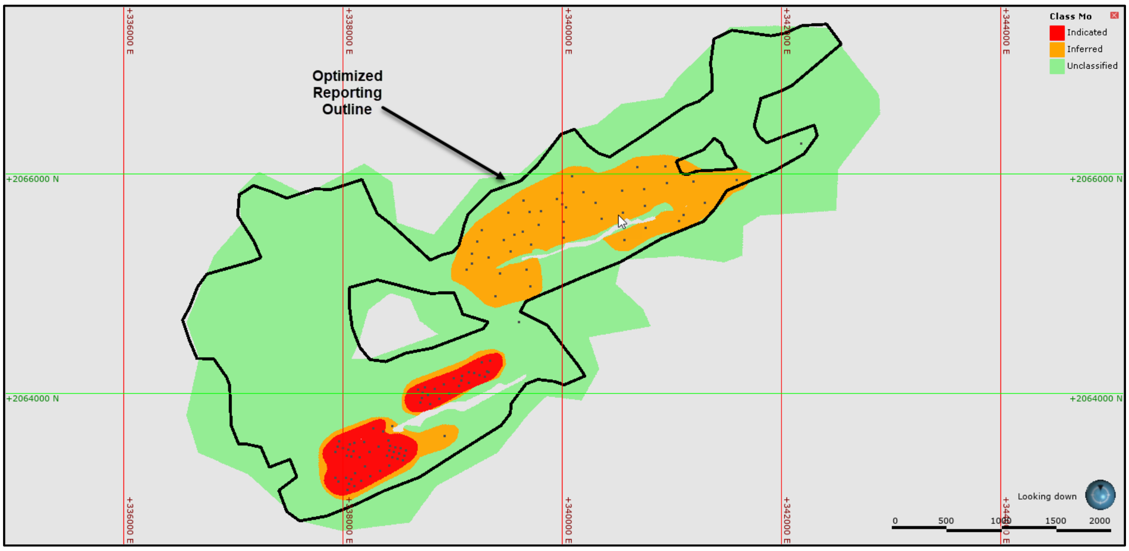


Figure 14-58: Mineral Resources coloured by Molybdenum classification showing outline of Optimised Mineral Resource Reporting Shell

14.4.11 Mineral Resource Statement

The CIM Definition Standards defines a Mineral Resource as:

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."

The "reasonable prospects for eventual economic extraction" requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade taking into account extraction scenarios and processing recoveries.

The Mineral Resource Statement for the M&M Deposit is presented in Table 14-23 and Table 14-24. Note that the Mineral Resources for molybdenum are contained entirely within the volumes reported as uranium Mineral Resources, and the tonnages are not additive.

Table 14-23: Mineral Resource Statement for Uranium at the M&M deposit effective July 01, 2022.

Classification Category	Tonnage (Mt)	Grade		Metal	
		eU (kg/t)	eU_3O_8 (kg/t)	eU_3O_8 (Tonnes)	eU_3O_8 (M lbs)
Measured	3.0	1.50	1.77	5,257	11.6
Indicated	14.0	1.19	1.41	19,726	43.5
Measured & Indicated	17.0	1.24	1.47	24,983	55.1
Inferred	3.1	0.96	1.14	3,477	7.7

In reporting the Mineral Resource statement, SRK notes the following:

- *Mineral Resources have an effective date of July 01, 2022*
- *Mineral Resources are classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 29, 2019).*
- *Mineral Resources are reported here are Inclusive of Mineral Reserves and are reported as undiluted, with no mining recovery applied in the Statement.*
- *Technical and economic assumptions were agreed between SRK and GoviEx for mining factors (mining and processing costs) and processing factors (metal recovery, processing costs), which were used for to determine minimum mining width and cut-off grade.*
- *SRK considers there to be reasonable prospects for economic extraction by constraining the resources within contiguous volumes where grade diluted to a minimum thickness of 1.8 m is above 0.40 kg/t assuming a Uranium price of US$70/lb U_3O_8.*
- *Tonnages are reported in metric units, grades in kilograms-per-tonne (kg/t) and parts-per-million (ppm), and the contained metal in Tonnes and Million pounds (M lbs). Tonnages, grades, and contained metal totals are rounded appropriately.*

Table 14-24: Mineral Resource Statement for Molybdenum at the M&M deposit effective July 01, 2022.

Classification Category	Tonnage (Mt)	Grade	Metal
		Mo (ppm)	Mo (Tonnes)
Measured	-	-	-
Indicated	1.9	486	914
Measured & Indicated	1.9	486	914
Inferred	4.9	388	1,897

In reporting the Mineral Resource statement, SRK notes the following:

- *Mineral Resources have an effective date of July 01, 2022*
- *Mineral Resources are classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 29, 2019).*
- *Mineral Resources are reported here are Inclusive of Mineral Reserves and are reported as undiluted, with no mining recovery applied in the Statement.*
- *Technical and economic assumptions were agreed between SRK and GoviEx for mining factors (mining and processing costs) and processing factors (metal recovery, processing costs), which were used for optimisation, and which were developed to a Feasibility Study level of detail and accuracy.*
- *SRK considers there to be reasonable prospects for economic extraction by constraining the resources within an optimised underground mining shape constructed assuming a Uranium price of US$70/lb U_3O_8.*
- *Mineral Resources are reported within volumes defined by the Optimised underground shell above a eU cut-off of 0.40 kg/t. The tonnage reported as Molybdenum resource is entirely within the volume reported as Uranium resource, thus the tonnages are not additive.*
- *Tonnages are reported in metric units, grades in parts-per-million (ppm), and the contained metal in Tonnes. Tonnages, grades, and contained metal totals are rounded appropriately.*

14.4.12 Sensitivity Analysis

The mineral resources of the M&M deposit are sensitive to the selection of the reporting cut-off eU kg/t value. To illustrate this sensitivity, the block model quantities in the Measured, Indicated, and Inferred class within the underground optimised volume used to constrain the mineral resources are presented in Table 14-25 at different eU kg/t cut-off values. The reader is cautioned that the figures presented in these tables should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of the eU kg/t cut-off value. Figure 14-59 presents the sensitivity as a grade tonnage curve.

Table 14-25: Block model quantities and grade estimates within the optimised pit shell at Various eU kg/t cut-off values for M&M

eU Cut-off (kg/t)	Tonnage (Mt)	Grade eU (kg/t)
0	17.0	1.25
0.1	17.0	1.25
0.2	17.0	1.25
0.3	17.0	1.25
0.4	17.0	1.25
0.5	16.9	1.25
0.6	16.7	1.26
0.7	16.4	1.27
0.8	15.7	1.29
0.9	14.6	1.33
1	13.0	1.37
1.1	10.8	1.44
1.2	8.6	1.51
1.3	6.4	1.60

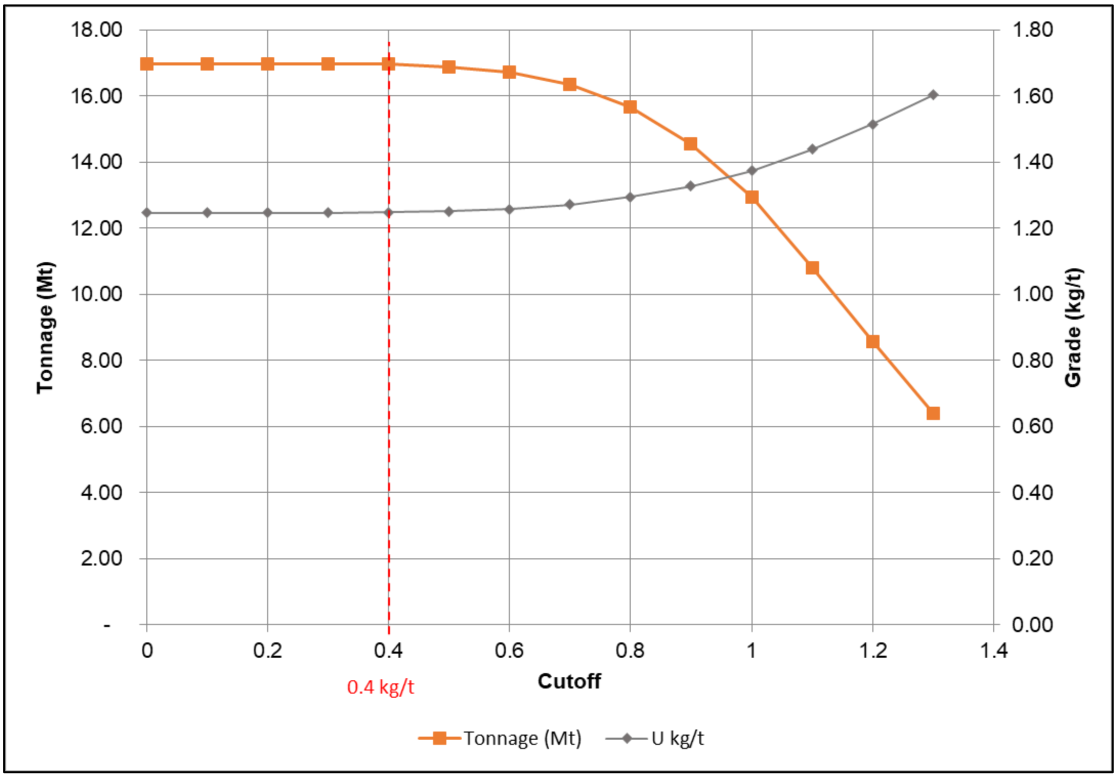


Figure 14-59: Grade tonnage curve for the M&M deposit

14.4.13 Comparison with Previous Estimate

The Mineral Resource presented here includes a number of factors that have led to changes compared to the previous Mineral Resource, effective date March 02, 2016. At M&M, a number of drill holes were added which led to remodelling of the mineralized zones. In addition to the remodelling, an underground mining optimization was used to restrict the reportable Mineral Resources considering RPEEE, something that was not considered for the March 02, 2016 Mineral Resource. These factors combined have led to the following key changes:

- Increase in Measured eU_3O_8 Tonnes and Metal due to increased data available; and
- Decrease in Inferred eU_3O_8 Tonnes and Metal due to RPEEE considerations.

There were no previous estimates of Molybdenum at the M&M deposit.

Table 14-26: M&M Comparison with previous estimate (2016 vs 2021)

Category	2016			2021			Difference (%)		
	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes	eU_3O_8	eU_3O_8 Metal
Measured	2.14	1.79	8.45	2.97	1.77	11.59	+39%	-1%	+37%
Indicated	14.72	1.43	46.30	13.99	1.41	43.49	-5%	-1%	-6%
M&I	16.86	1.48	54.75	16.96	1.47	55.08	+1%	-0%	+1%
Inferred	5.04	1.17	13.02	3.05	1.14	7.67	-39%	-3%	-41%
All	21.90	1.41	67.77	20.01	1.40	62.74	-9%	-1%	-7%

14.5 MSEE

14.5.1 Supporting Data

The MSEE deposit has been defined by a generally regular grid of vertical drill holes at 100 x 100 m (Figure 14-60). A total of 275 drill holes, with total length of 33,730 m, support this Mineral Resource estimate. The key uranium mineralised horizon at MSEE is the Guezouman Sandstone, which is locally deformed by the Madaouela fault. The vertical drilling grid is appropriate to adequately define the flat-lying, Guezouman parallel, mineralisation (Figure 14-61).

All drill holes have been radiometrically probed, and after processing, provide eU (referred to as 'teneur' at the project) data for the full length of holes.

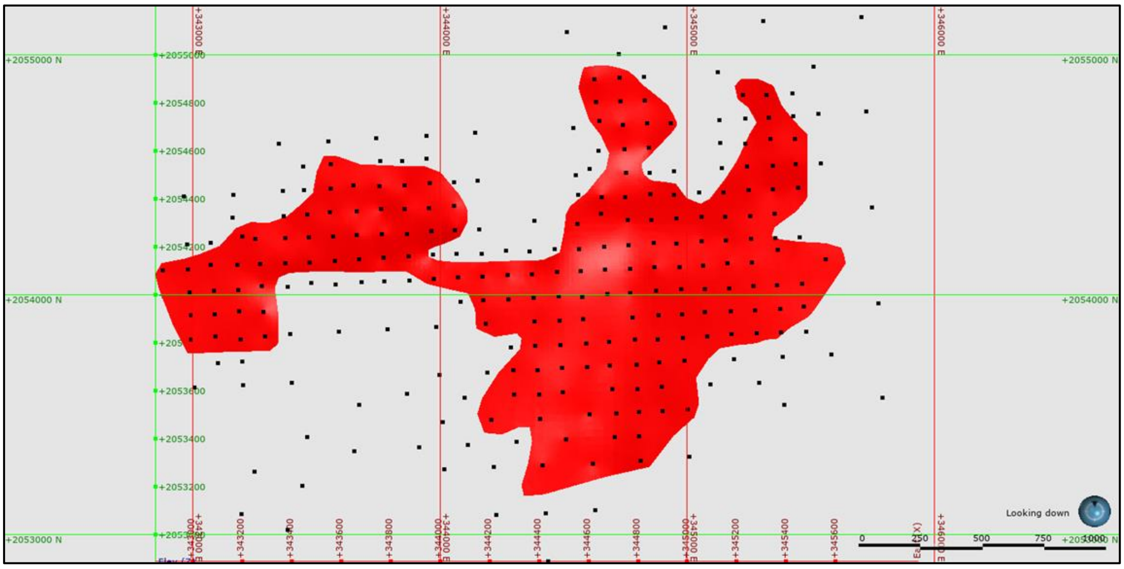


Figure 14-60: Plan view of final modelled MSEE mineralisation model and drill hole collars.

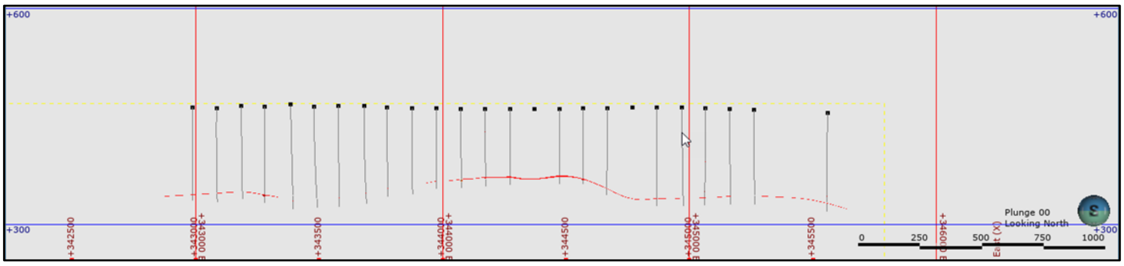


Figure 14-61: Cross section view of final modelled MSEE mineralisation model and vertical drill holes (vertical exaggeration x3)

Table 14-27: Summary of drilling at MSEE

Sampling Type	Number of holes	Total Meters
Radiometric Assay (eU)	275	33,730

14.5.2 Geological Modelling

The stratigraphy at MSEE has been logged in drill holes and is consistent across the project area, although is deflected down in the east of the deposit by the Madaouela fault. SRK have built a stratigraphic model based on the drill hole logging.

14.5.3 Mineralisation Model

eU Models

The distribution of uranium mineralisation at MSEE is controlled by the reducing formation (Talak) at the base of the Guezouman sandstone. There is no clear, or visible boundary that defines the uranium mineralisation so the distribution of eU grades in the Guezouman Sandstone was investigated and a modelling cut-off of 0.4 kg/t eU was chosen to represent mineralised material (Figure 14-60 and Figure 14-61). The modelled mineralisation results in a thin layer immediately above the Talak contact and is referred to in this sub-section as the 'basal' mineralisation.

14.5.4 Data Conditioning and Statistical Analysis

Prior to undertaking any grade interpolation, SRK performed a statistical study on composited eU assay data within the modelled mineralisation wireframe to assess its suitability for grade estimation and to confirm that appropriate estimation domains had been modelled.

Compositing

The typical sample length for eU analyses is 0.2 m. Since the mineralisation forms a single thin and continuous layer, samples were composited to the thickness of the modelled mineralisation, resulting in 1 composite per drill hole with the following fields (see 2-dimensional approach described in Section 14.2):

- Grade – eU kg/t
- Thickness – m
- GTh – Grade x Thickness

The grade distribution of GTh and Th are presented in Figure 14-62 and Figure 14-63 respectively, and summarised statistics in Table 14-27.

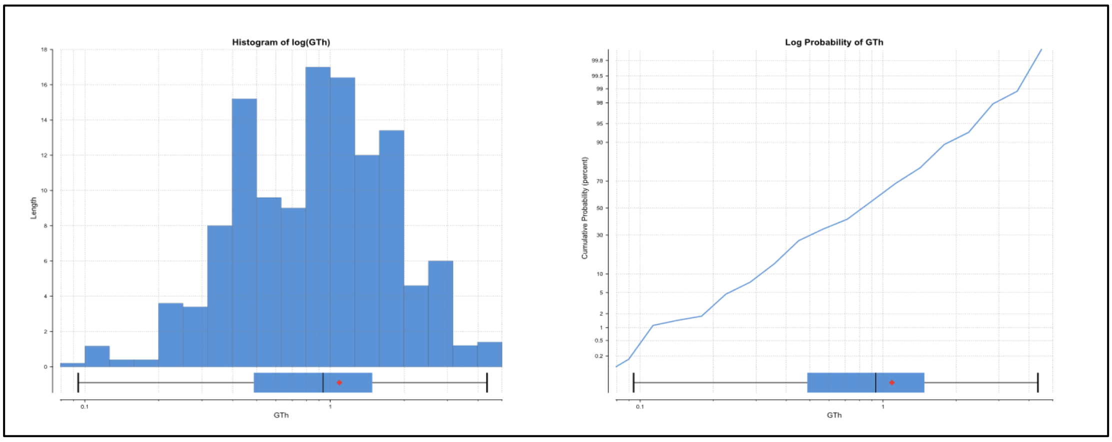


Figure 14-62: Log Histogram and Log Probability plot for GTh - BASAL

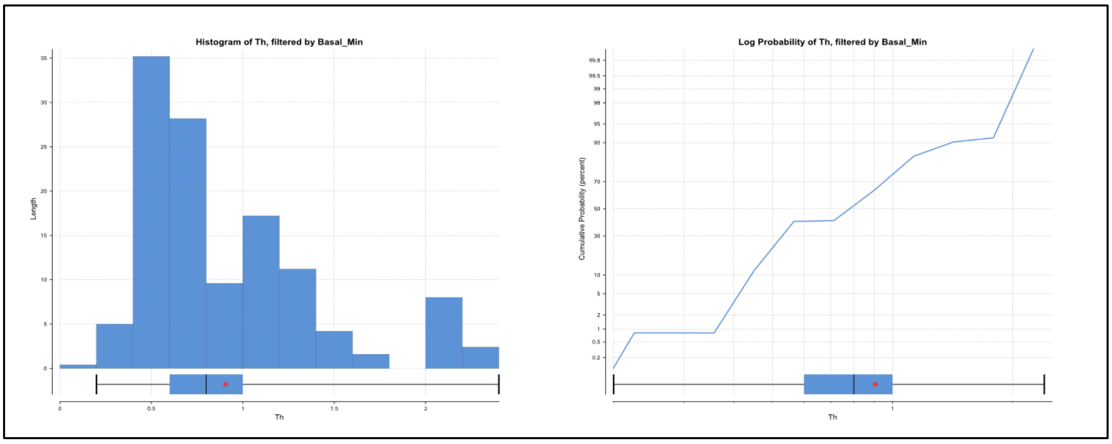


Figure 14-63: Log Histogram and Log Probability plot for Th – BASAL

Table 14-28: Composite statistics for MSEE

Basal_Min	Count	Length	Mean	Coefficient of variation	Minimum	Maximum
Teneur (eU kg/t)	168	122.973	1.09	0.44	0.13	3.11
Th (m)	168	122.973	0.73	0.49	0.20	2.40
GTh	168	122.973	0.85	0.78	0.09	4.35

Treatment of high-grade outliers

Capping, or 'top-cuts', are applied to high grades in order to reduce the influence they may have on the estimate and prevent smearing high grades into adjacent blocks. High grades can be treated by applying a cap to the assay, in this case GTh and Th, values in the database based on an assessment of the histograms and log probability plots, but they can also be treated by applying a distance restriction on the grades in order to limit the influence of the very high grades at the kriging stage.

Based on an analysis of the GTh and Th grade distribution statistics, SRK decided that no capping would be applied. High grades, above the determined threshold as per Table 14-29, have been limited to 100 m extrapolation in the estimate.

Table 14-29: Distance restrictions for MSEE

Domain	Threshold		
	GTh	Th	Ten
BASAL	NA	2	2.5

Density

There are no density measurements available for the MSEE deposit. The host lithology, and mineralisation is consistent with the M&M and Miriam deposits where density data is available. Due to the similarity, SRK feel it is appropriate to assign a density of 2.3 t/m^3 for the MSEE mineralisation.

14.5.5 Geostatistical Analysis

For the MSEE Basal domain, SRK investigated the grade continuity for eU. Variography has been completed on non-transformed data in unfolded space. SRK noted a very consistent direction of major continuity in a north-easterly direction (Figure 14-64 and Figure 14-65).

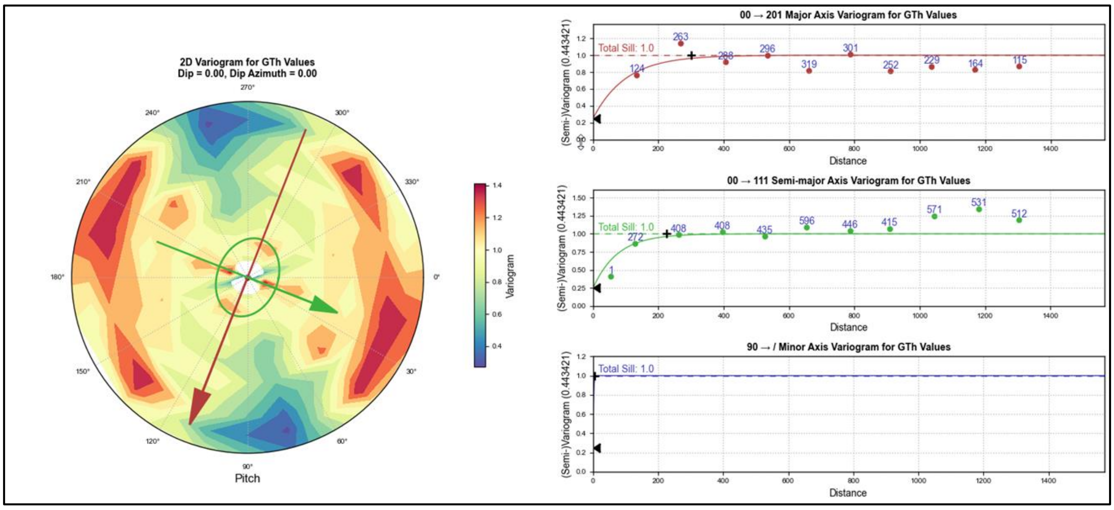


Figure 14-64: Experimental semi variograms for GTh

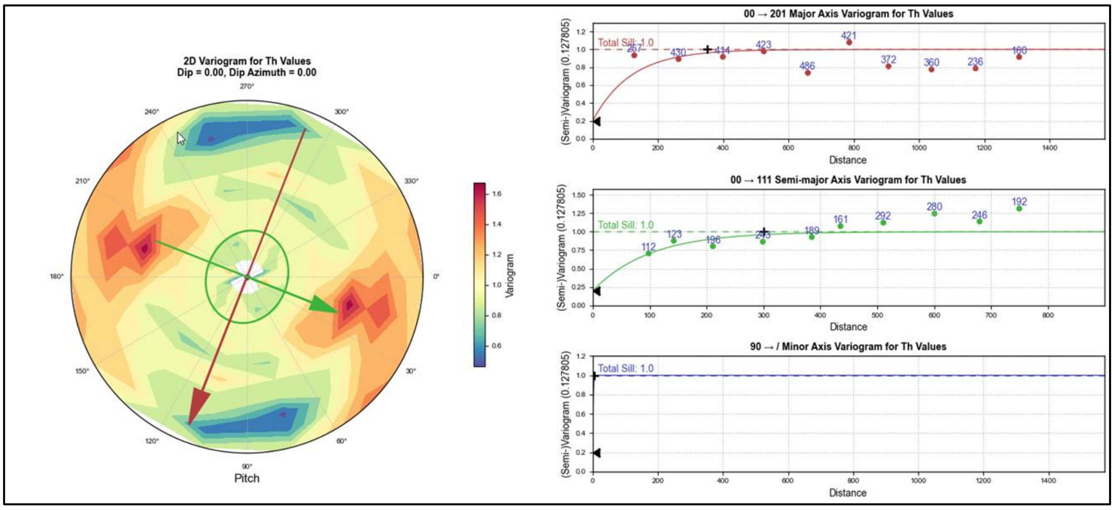


Figure 14-65: Experimental semi variograms for Th

14.5.6 Grade Interpolation

Resource estimation was completed using an unfolding technique in an area encompassing the modelled MSEE mineralisation with a final block model geometry and extents as presented in (Table 14-30). The block model is rotated to an azimuth of 177.5 to optimize the alignment of blocks with the drilling grid. The grade interpolation methodology is based on the following:

- Composited data were not capped and distance restrictions on high-grade populations were applied as described in Section 14.5.4;
- During estimation, domain boundaries for the selection of composites were treated as hard boundaries;
- The single pass search volumes were aligned according to the modelled variograms with dimension of 300 x 185 x 5 m;
- Minimum and maximum sample selection parameters were set at 1 and 6 respectively and allowed a maximum of 2 composites per quadrant;
- Block discretization of 5 x 5 x 1;

- GTh and Th was estimated by Ordinary Kriging and Grade eU was calculated by GTh/Th; and
- Density of 2.3 t/m^3 was assigned to all blocks.

Table 14-30: Block model parameters for MSEE

Parameter	X	Y	Z
Origin (block centroid)	346,043.862	2,055,429.566	490.00
Block Size	50	50	0.4
Number of Blocks	75	54	550
Sub-block Count	4	4	4
Sub-block Minimum Size	12.5	12.5	0.1

14.5.7 Block Model Validation

SRK validated the block model estimates through visual and statistical checks of block grades compared with composited drillhole data in plan and by comparing mean block model grades with mean composite data. The validation is designed to confirm that the block model is representative of the underlying sample data at both local and global scales and to check that the estimate is not biased.

SRK believes that the block model reflects the current understanding of the distribution of mineralisation and is an acceptable basis for a Mineral Resource statement.

Visual Validation

SRK visually compared block grades to composite sample grades in plan view (unfolded space) to assess the correlation of the interpolated block model to the composite data on a local scale (Figure 14-66, Figure 14-67, and Figure 14-68). SRK found that local block estimates were similar to nearby composite samples and that the block model reflected the patterns in grade variability without excessive lateral smearing of high grades.

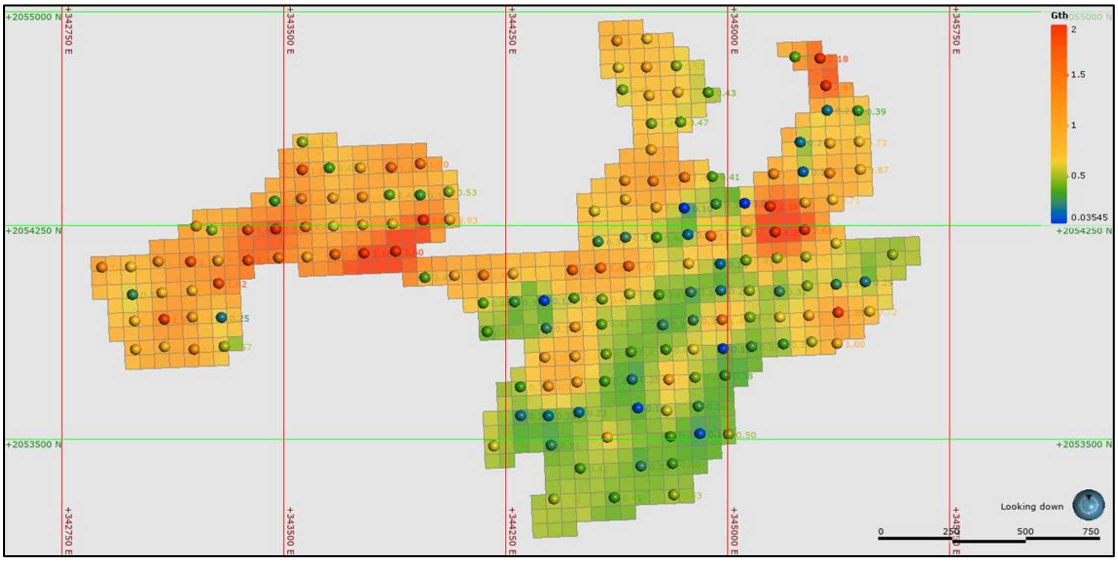


Figure 14-66: Plan views showing samples and OK block model grades for GTh Basal

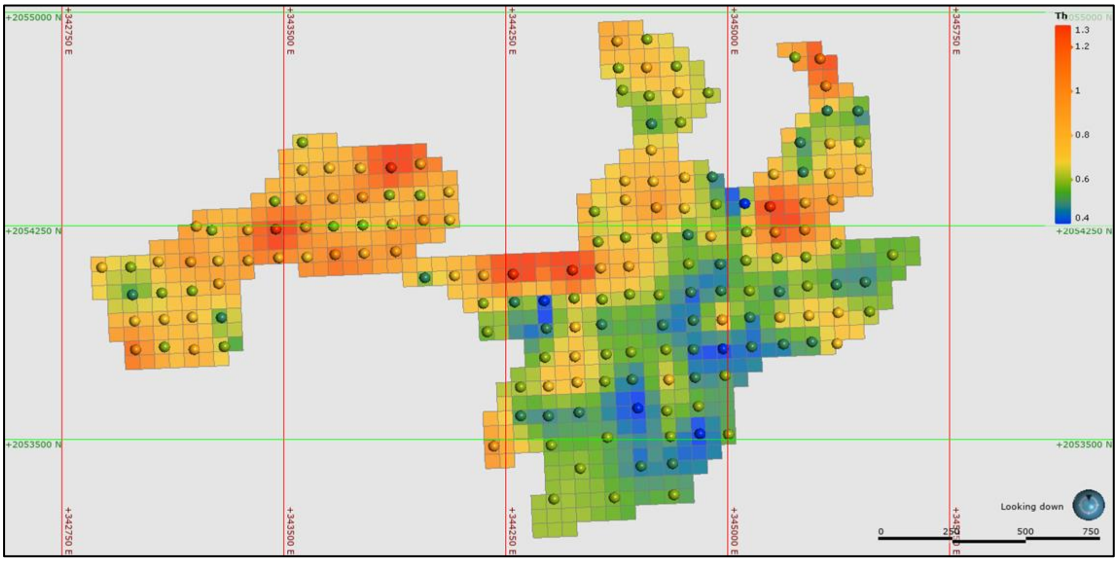


Figure 14-67: Plan views showing samples and OK block model grades for Thickness

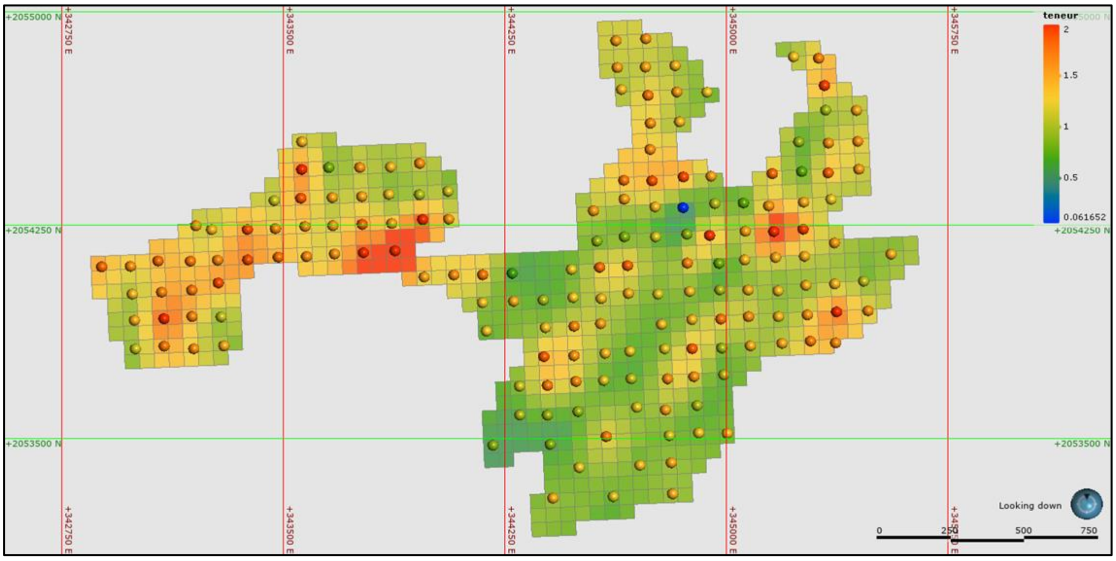


Figure 14-68: Plan views showing samples and OK block model grades for Teneur

Statistical Validation

The mean estimated block grades are compared to the mean of the composite samples for the basal domain in Table 14-31. The results show a satisfactory correlation between block model and sample at a global scale. SRK is confident that the model reflects the current understanding of the deposit.

Table 14-31: Validation of block model versus sample uranium grades

Mineralisation	Mean Composite Grade	Mean Estimated Grade	% Difference
GTh	0.85	0.83	3%
teneur	1.09	1.06	2%
Th	0.73	0.72	1%

Swath Plots

As part of the validation process swath plots were generated in the X (easting) and Y (northing) coordinate directions. Average grades for input samples and estimated blocks are calculated along a series of vertical slices (swaths) and plotted on graphs. In effect, a moving average is calculated for blocks and samples along three coordinate axes; this enables the fit of the block model to the underlying data to be assessed at an intermediate scale and the block model can be checked for spatial biases in estimated grade.

Figure 14-69 and Figure 14-70 show the swath plots for Gth and Th for the basal domain respectively.

In general, the plots show a good correlation between the OK block model and sample grades. There is no indication that any bias has been introduced, and the OK block models display an adequate degree of smoothing with respect to the samples.

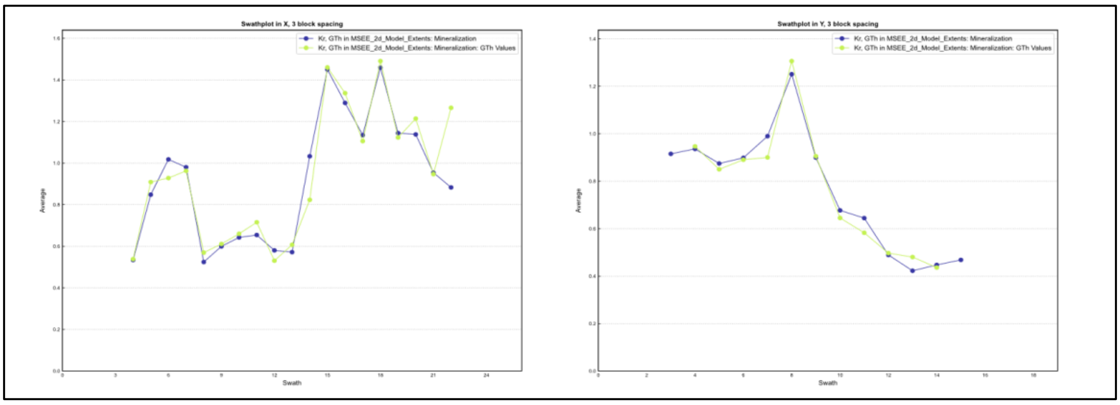


Figure 14-69: Swath plots for GTh - Basal

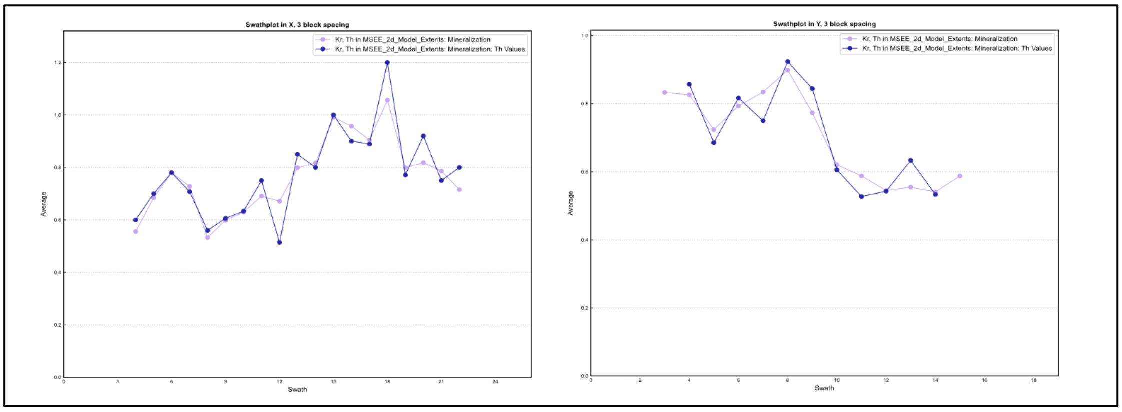


Figure 14-70: Swath plots for Th Basal

14.5.8 Mineral Resource Classification

The Mineral Resources have been classified according to the definitions and guidelines of the CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Standard). The MSEE deposit has been defined by a regular 100 x 100 m grid of drilling (Figure 14-71). SRK considers that this drilling density, along with consideration of data quality, geological continuity and complexity, and estimation quality is sufficient to classify the estimated blocks in the Inferred category.

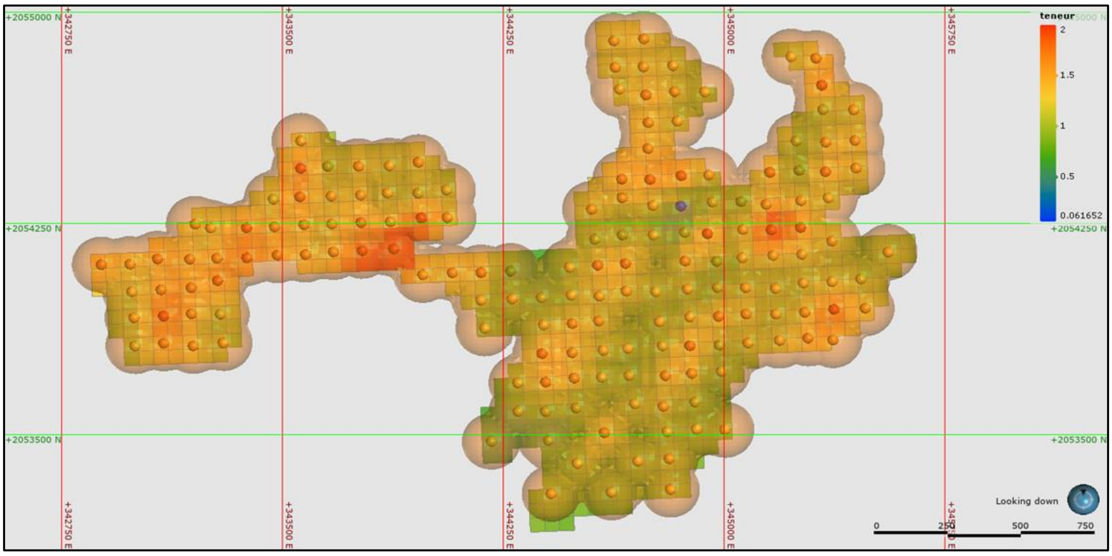


Figure 14-71: MSEE deposit coloured by teneur – 100 m Buffers on composites

14.5.9 Reasonable Prospects for Eventual Economic Extraction

SRK has reported the Mineral Resource as that portion of the block model which satisfies an appropriate eU cut-off grade over an underground minimum mining thickness on 1.8 m, considering the appropriate mining, processing and general and administrative cost, geotechnical parameters and processing recoveries, as discussed with the Company and determined in the TEM (Table 14-22). SRK considers that the material reported as a Mineral Resource fulfils the requirement by the CIM Guidelines of having "…reasonable prospects for eventual economic extraction" (RPEEE), through underground mining methods, which is supported by a Feasibility Study for the project. The areas of the block model which satisfy a 0.4 kg/t eU cut-off over 1.8 m minimum mining thickness is presented relative to the estimated block centroids in Figure 14-72.

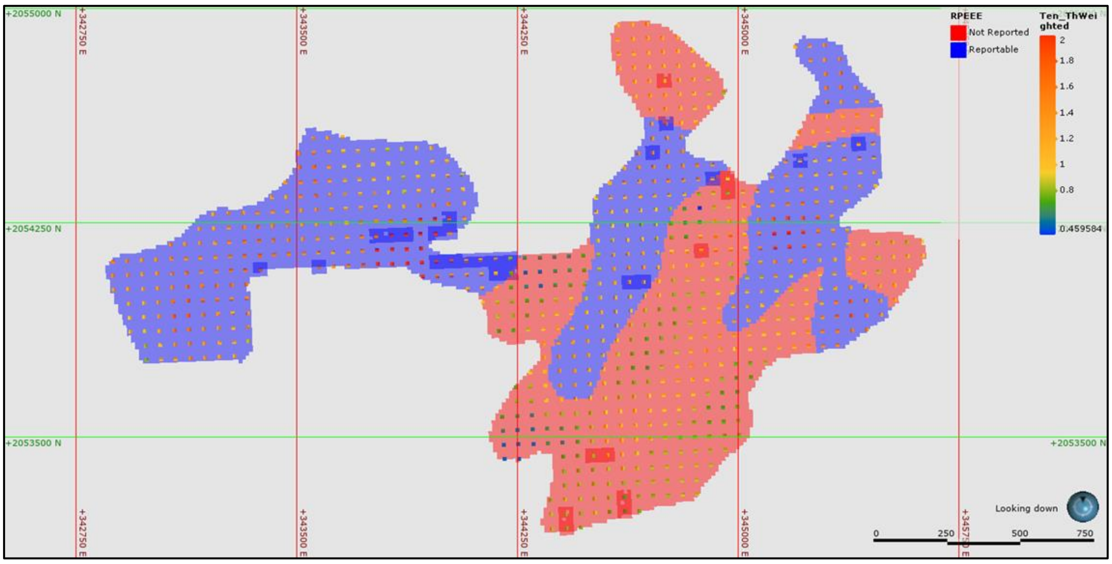


Figure 14-72: MSEE deposit coloured by 'Reportable' areas (blue) where the eU grade exceeds 0.4 kg/t over a minimum mining thickness of 1.8 m.

14.5.10 Mineral Resource Statement

The CIM Definition Standards defines a Mineral Resource as:

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.”

The “reasonable prospects for eventual economic extraction” requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade taking into account extraction scenarios and processing recoveries.

The Mineral Resource Statement for the MSEE Deposit is presented in Table 14-32.

Table 14-32: Mineral Resource Statement for the MSEE Deposit effective July 01, 2022

Classification Category	Tonnage (Mt)	Grade		Metal	
		eU (kg/t)	eU_3O_8 (kg/t)	eU_3O_8 (Tonnes)	eU_3O_8 (M lbs)
Measured & Indicated	-	-	-	-	-
Inferred	1.95	1.31	1.54	3,003	6.6

In reporting the Mineral Resource statement, SRK notes the following:

- *Mineral Resources have an effective date of July 01, 2022*
- *Mineral Resources are classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 29, 2019).*
- *Mineral Resources are reported here are Inclusive of Mineral Reserves and are reported as undiluted, with no mining recovery applied in the Statement.*
- *Technical and economic assumptions were agreed between SRK and GoviEx for mining factors (mining and processing costs) and processing factors (metal recovery, processing costs), which were used for to determine minimum mining width and cut-off grade.*
- *SRK considers there to be reasonable prospects for economic extraction by constraining the resources within contiguous volumes where grade diluted to a minimum thickness of 1.8 m is above 0.40 kg/t assuming a Uranium price of US$70/lb U_3O_8.*
- *Tonnages are reported in metric units, grades in kilograms-per-tonne (kg/t) and parts-per-million (ppm), and the contained metal in Tonnes and Million pounds (M lbs). Tonnages, grades, and contained metal totals are rounded appropriately.*

14.5.11 Sensitivity Analysis

The mineral resources of the MSEE deposit are sensitive to the selection of the reporting cut-off eU kg/t value. To illustrate this sensitivity, the block model quantities and grade estimates within the conceptual pit used to constrain the mineral resources are presented in Table 14-33 at different eU kg/t cut-off values. The reader is cautioned that the figures presented in these tables should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of the eU kg/t cut-off value. Figure 14-73 presents the sensitivity as a grade tonnage curve.

Table 14-33: Block model quantities and grade estimates within the optimised pit shell at Various eU kg/t cut-off values for MSEE

eU Cut-off (kg/t)	Tonnage (Mt)	Grade eU (kg/t)
0	2.0	1.31
0.1	2.0	1.31
0.2	2.0	1.31
0.3	2.0	1.31
0.4	2.0	1.31
0.5	2.0	1.31
0.6	2.0	1.31
0.7	2.0	1.31
0.8	1.9	1.31
0.9	1.8	1.34
1	1.7	1.38
1.1	1.5	1.42
1.2	1.2	1.47
1.3	0.9	1.55

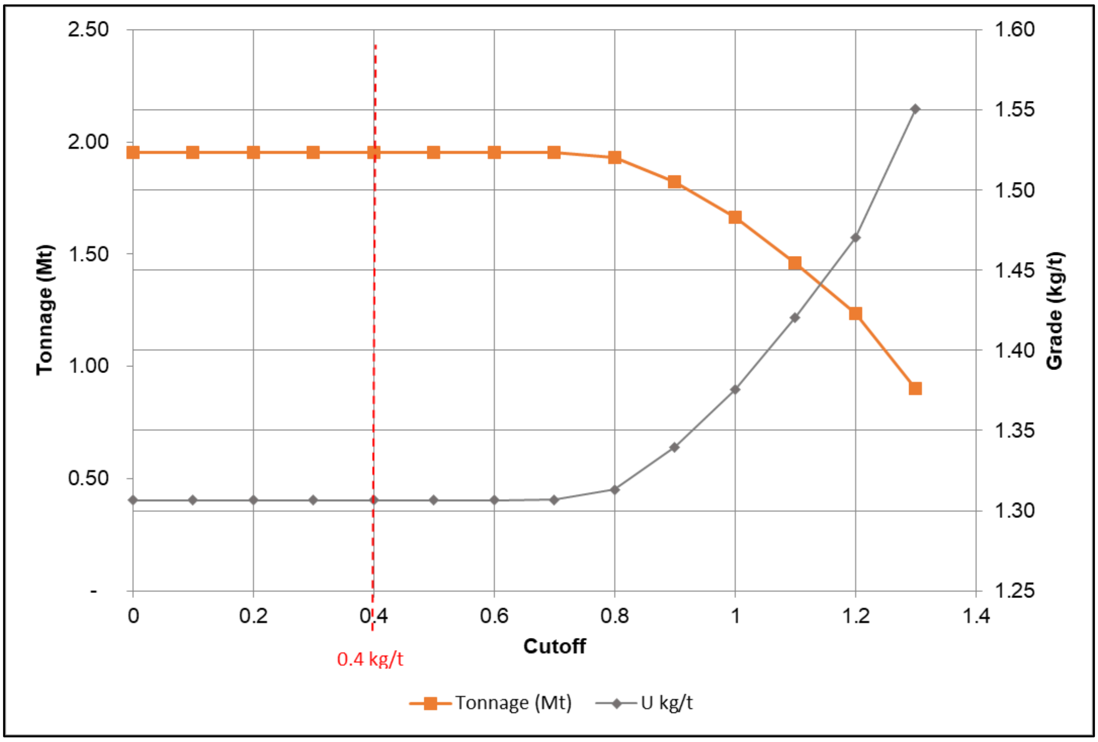


Figure 14-73: Grade tonnage curve for the MSEE deposit

14.5.12 Comparison with Previous Estimate

The Mineral Resource presented here includes a number of factors that have led to changes compared to the previous Mineral Resource, effective date, March 02, 2016. At MSEE, a number of drill holes were added which led to remodelling of the mineralized zones. In addition to the remodelling, an underground mining optimization was used to restrict the reportable Mineral Resources considering RPEEE, something that was not considered for the March 02, 2016 Mineral Resource.

These factors combined have led to the following key changes:

- Increase in Inferred eU_3O_8 Tonnes and Metal due to increased data available and remodelling; and
- Decrease in Inferred eU_3O_8 grade due to additional data and remodel.

Table 14-34: MSEE Comparison with previous estimate (2016 vs 2021)

Category	2015			2021			Difference (%)		
	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes	eU_3O_8	eU_3O_8 Metal
Measured	-	-	-	-	-	-	-	-	-
Indicated	-	-	-	-	-	-	-	-	-
M&I	-	-	-	-	-	-	-	-	-
Inferred	1.45	1.64	5.23	1.95	1.54	6.60	+34%	-6%	+26%
All	1.45	1.64	5.23	1.95	1.54	6.60	+34%	-6%	+26%

14.6 MSCE

14.6.1 Supporting Data

The MSCE deposit has been defined by a generally regular grid of vertical drillholes, with a general spacing of 100 x 100 m (Figure 14-74). A total of 110 drillholes have been drilled in the deposit to support this Mineral Resource Estimate, for a total of 17,302 m (Table 14-35). The key uranium mineralised horizon at MSCE is the Guezouman Sandstone, which is locally deformed by the Madaouela fault. The vertical drilling grid is appropriate to define the flat lying mineralisation, which is parallel to the Guezouman Sandstone (Figure 14-75).

All drillholes have been radiometrically probed, and after processing, provide eU (referred to a 'teneur' at the project) data for the full length of holes.

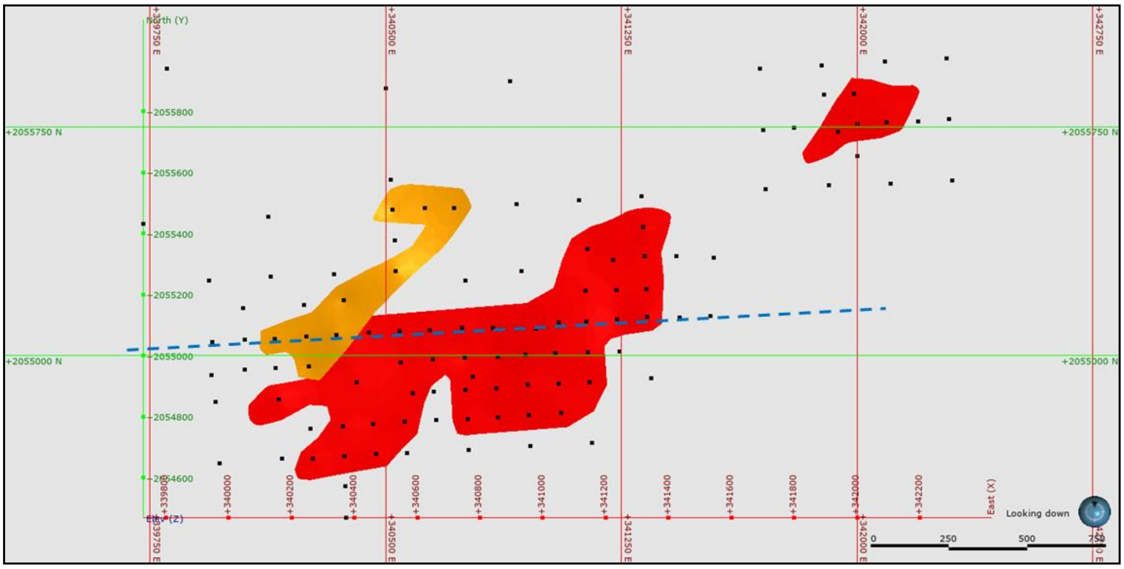


Figure 14-74: Plan view of final MSCE mineralisation model (Basal mineralisation in Red and Upper mineralisation in Orange). Figure 14-75 section location is blue dashed line.

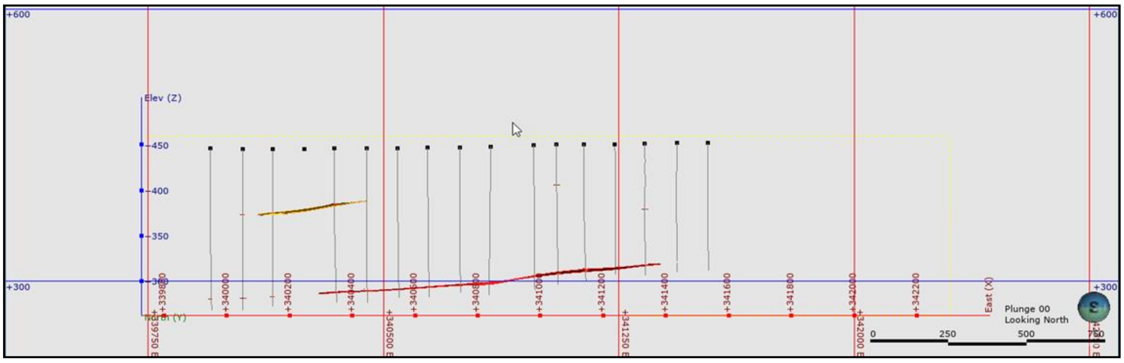


Figure 14-75: Cross section view of final MSCE mineralisation model (vertical exaggeration x3)

Table 14-35: Summary of drilling at MSCE

Sampling Type	Number of holes	Total Meters
Radiometric Assay (eU)	110	17,302
Total	**110**	**17,302**

14.6.2 Geological Modelling

The stratigraphy at MSCE has been logged in drillholes, and is consistent across the project area, though, to the east the deposit is deflected downwards by the Madaouela fault. SRK have built a stratigraphic model based on the drillhole logging data.

14.6.3 Mineralisation Model

eU Models

The distribution of uranium mineralisation at MSCE is present at two horizons, representing the contact between reducing stratigraphy and porous sandstones. The most prominent mineralisation at MSCE is controlled by the reducing Talak formation at the base of the Guezouman sandstone, with weaker mineralisation also present at the upper contact between the Tchinezogue sandstone and overlying Tarat formation.

There is no clear or visible boundary that defines uranium mineralisation, and so the distribution of eU grades in the Guezouman and Tchinezogue sandstones were investigated and a modelling cut-off of 0.4 kg/t eU selected to represent mineralised material (Figure 14-74 & Figure 14-75). Three zones of uranium mineralisation have been modelled, two representing a thin layer within the Guezouman Sandstone and immediately above the Talak contact (referred to in this sub-section as the 'basal' mineralisation), and the second thin layer within the Tchinezogue Sandstone immediately below the Tarat contact (referred to in this sub-section as the 'upper' mineralisation.

14.6.4 Statistical Analysis

Prior to undertaking a grade interpolation, SRK performed a statistical study on composited eU assay data within the modelled mineralisation wireframes to assess its suitability for grade estimation and to confirm that appropriate estimation domains had been modelled.

Compositing

The typical sample length for eU analyses is 0.2 m. Since the mineralisation forms a series of thin and continuous layers, samples were composited to the thickness of the modelled mineralisation, resulting in single composites per drill hole with the following fields (see 2-dimensional approach described in Section 14.2):

- Grade – eU kg/t
- Thickness – m
- GTh – Grade x Thickness

The grade distribution of GTh and Th for the basal mineralisation are presented in Figure 14-76 and Figure 14-77 respectively, and for the upper mineralisation in Figure 14-78 and Figure 14-79 respectively. Summary statistics for both domains are presented in Table 14-36. Please note that both basal mineralisation wireframes have been treated as a single domain.

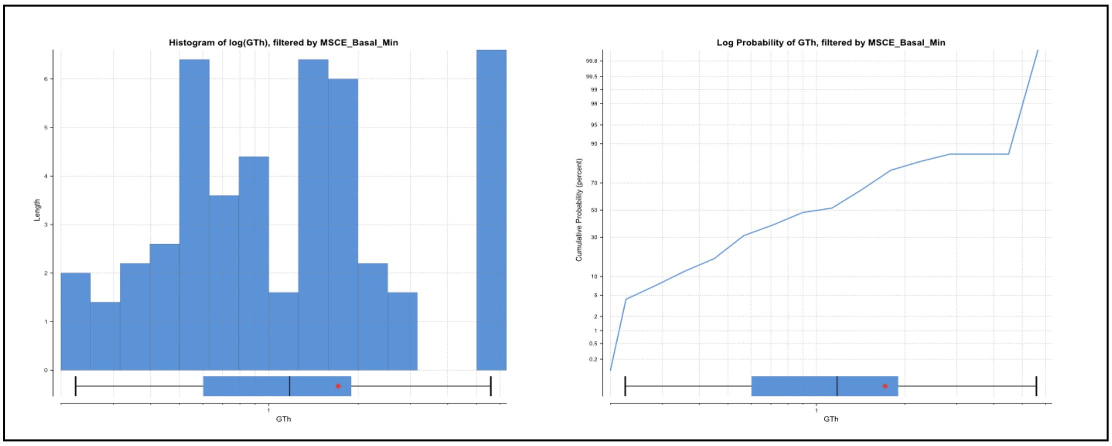


Figure 14-76: Log Histogram and Log Probability plot for GTh - BASAL

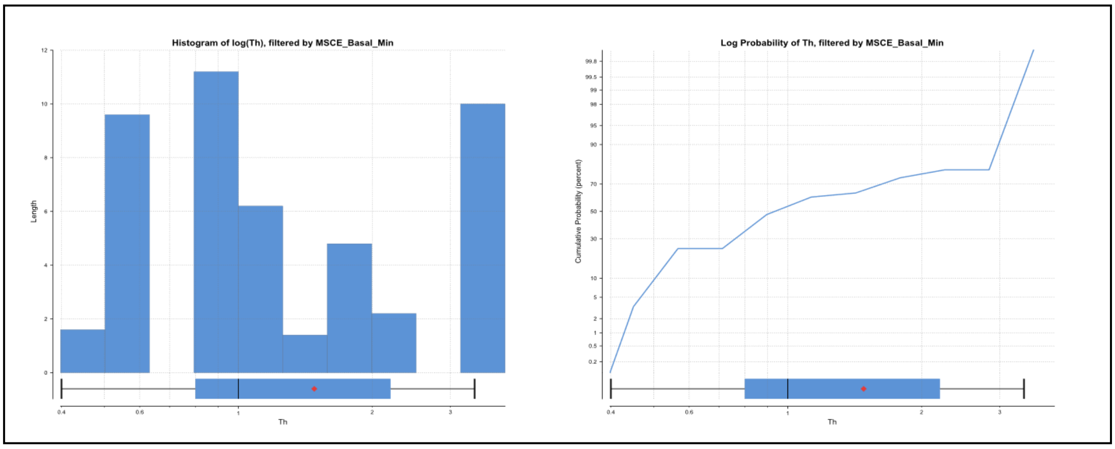


Figure 14-77: Log Histogram and Log Probability plot for Th – BASAL

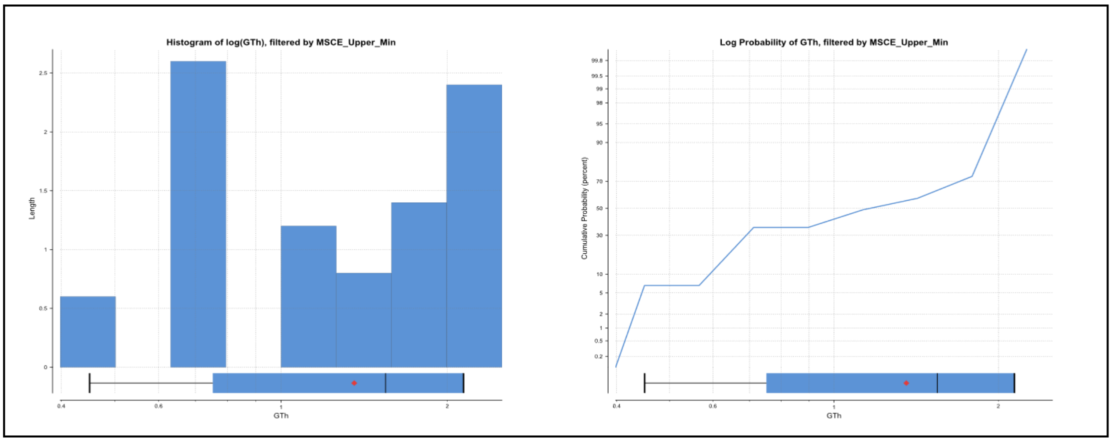


Figure 14-78: Log Histogram and Log Probability plot for GTh - UPPER

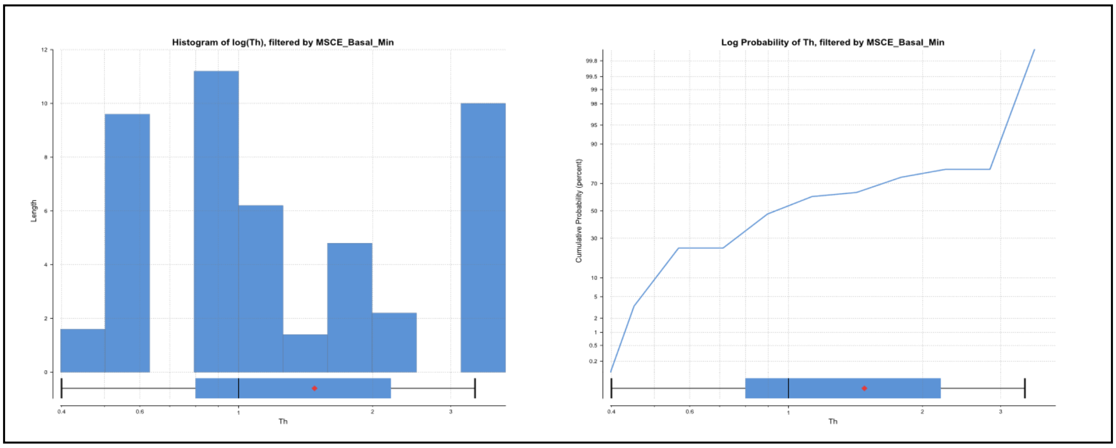


Figure 14-79: Log Histogram and Log Probability plot for Th –UPPER

Table 14-36: Statistical analysis for MSCE

	Count	Length	Mean	Coefficient of variation	Minimum	Maximum
MSCE_Basal_Min						
teneur	48	47	1.07	0.54	0.28	3.01
Th	48	47	0.98	0.72	0.40	3.40
GTh	48	47	1.09	1.01	0.22	5.59
MSCE_Upper_Min						
teneur	8	9	1.04	0.39	0.69	1.93
Th	8	9	1.13	0.52	0.60	2.40
GTh	8	9	1.13	0.53	0.45	2.14

Treatment of high-grade outliers

Capping, or ‘top-cuts’, are applied to high grades in order to reduce the influence they may have on the estimate and prevent smearing high grades into adjacent blocks. High grades can be treated by applying a cap to the assay, in this case GTh and Th, values in the database based on an assessment of the histograms and log probability plots, but they can also be treated by applying a distance restriction on the grades in order to limit the influence of the very high grades at the kriging stage.

Based on an analysis of the GTh and Th grade distribution statistics, SRK decided that no capping would be applied. High grades, above the determined threshold (see Table 14-37) have been limited to 100 m extrapolation in the estimate.

Table 14-37: Distance restrictions for MSCE

Domain	Threshold		
	GTh	Th	Ten
BASAL	4	3	2
UPPER	NA	NA	NA

Density

There are no density measurements available for the MSCE deposit. The host lithology, and mineralisation is consistent with the M&M and Miriam deposits where density data is available. Due to the similarity, SRK feel it is appropriate to assign a density of 2.3 t/m^3 for the MSCE mineralisation.

14.6.5 Geostatistical Analysis

For the MSCE domains, SRK investigated the grade continuity for eU. Variography has been completed on non-transformed data in unfolded space. SRK noted a very consistent direction for major continuity in the north-easterly direction, as seen in Figure 14-80 and Figure 14-81. The variogram support for the upper domain is low and the direction of continuity and ranges have been established by considering the basal model in conjunction with the available pairs.

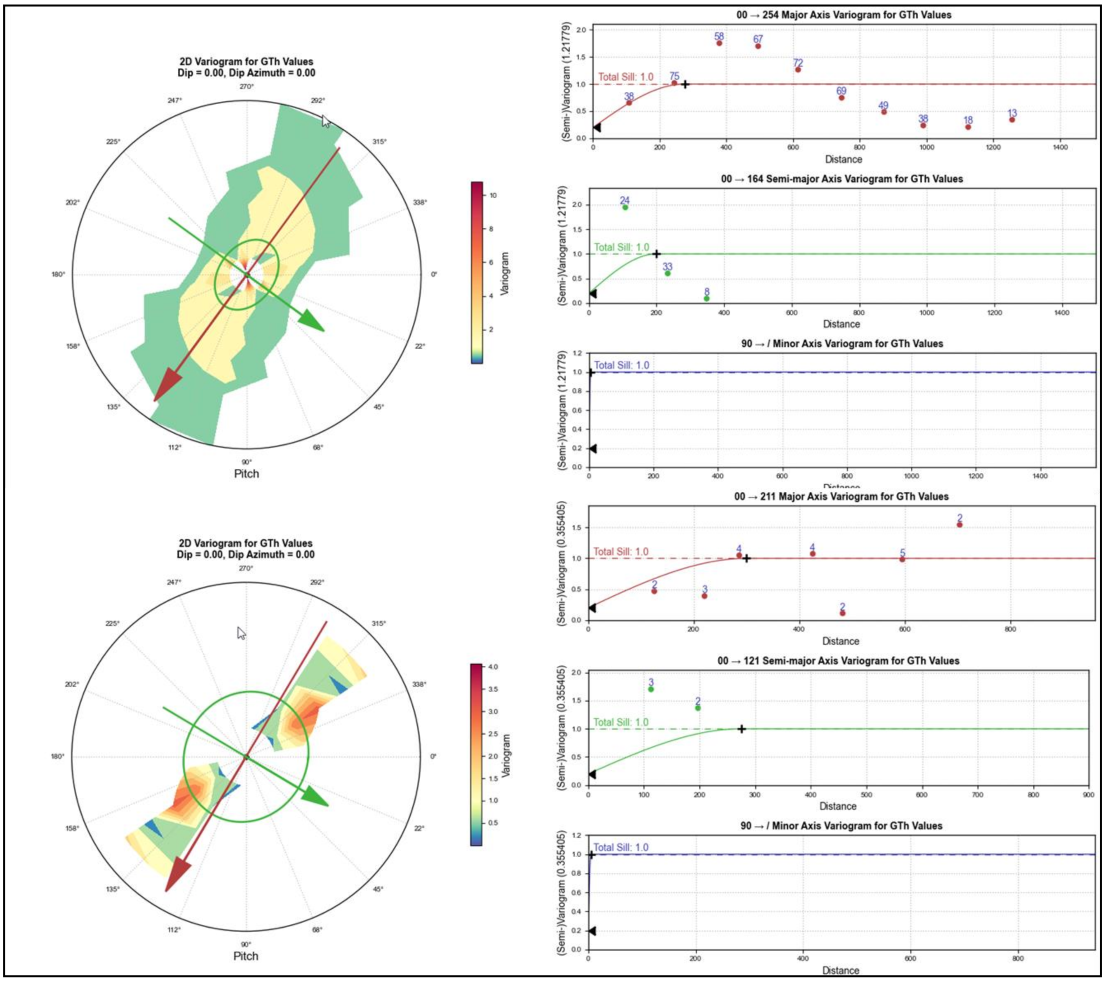


Figure 14-80: Experimental semi variograms for GTh Basal and Upper

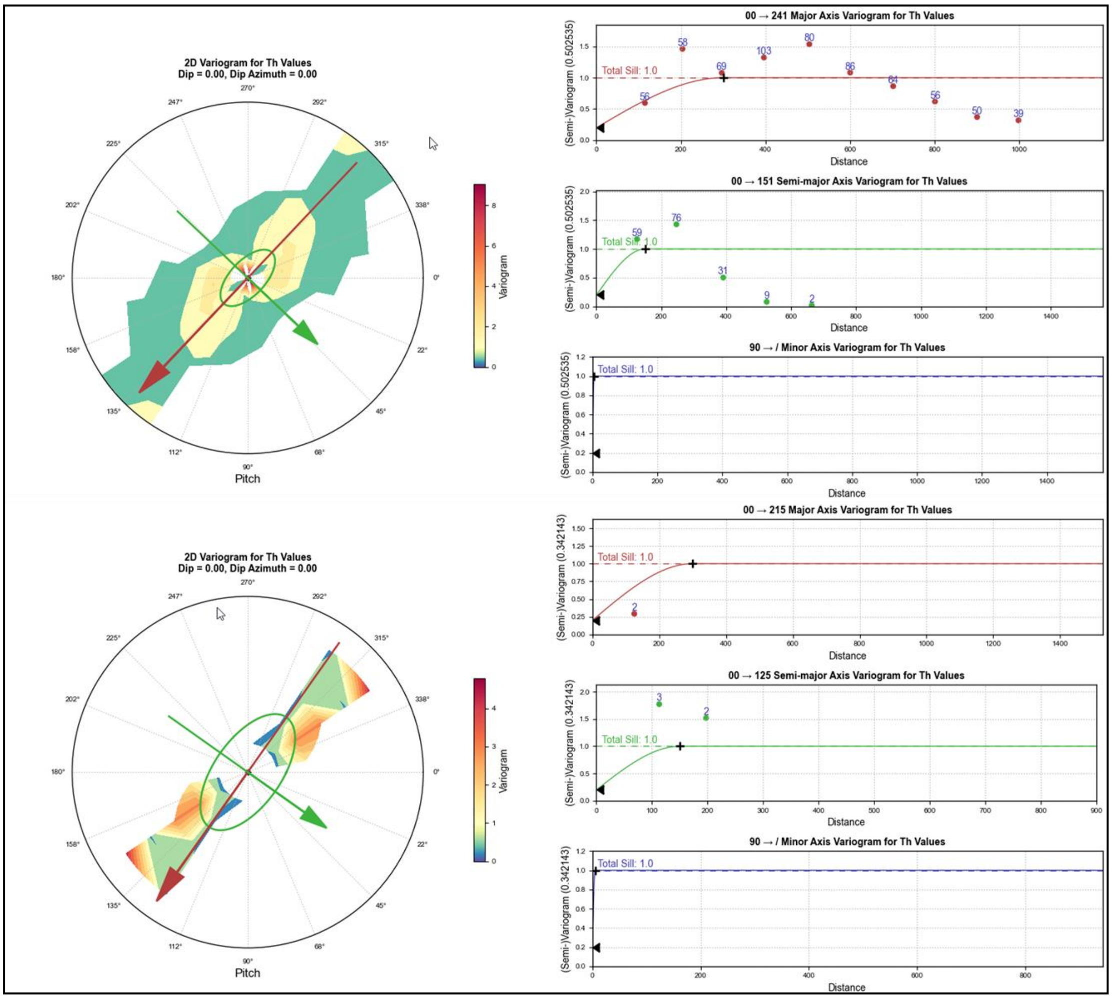


Figure 14-81: Experimental semi variograms for Th Basal and Upper

14.6.6 Grade Interpolation

Resource estimation was completed using an unfolding technique in an area encompassing the modelled MSCE mineralisation, with a final block model geometry and extents as presented in Table 14-38. The block model is rotated to an azimuth of 177.5 to optimise the alignment of the blocks with the drilling grid.

Grade interpolation methodology is based on the following:

- Composited data were not capped and distance restrictions on high-grade populations were applied as described in Section 14.6.4.
- During estimation, domain boundaries for the selection of composites were treated as hard boundaries;
- The single pass search volumes were aligned according to the modelled variograms with dimension of 300 x 200 x 5 m;
- Minimum and maximum sample selection parameters were set at 1 and 5 respectively and allowed a maximum of 2 composites per quadrant;
- Block discretization of 5 x 5 x 1;

- GTh and Th was estimated by Ordinary Kriging and Grade eU was calculated by GTh/Th; and
- Density of 2.3 t/m^3 was assigned to all blocks.

Table 14-38: Block model parameters for MSCE

Parameter	X	Y	Z
Origin (block centroid)	342,780.10	2,056,613.76	490
Block Size	50	50	0.4
Number of Blocks	74	54	600
Sub-block Count	4	4	4
Sub-block Minimum Size	12.5	12.5	0.1

14.6.7 Block Model Validation

SRK validated the block model through visual inspection of block grades compared with composited drillhole data in 3D and cross-section and by comparing mean block model grades with mean composite data. The validation is designed to confirm that the block model is representative of the underlying sample data at both local and global scales and to check that the estimate is not biased.

SRK believes that the block model reflects the current understanding of the distribution of mineralisation and is an acceptable basis for a Mineral Resource statement.

Visual Validation

SRK visually compared block grades to composite sample grades in plan view (unfolded space) to assess the correlation of the interpolated block model to the composite data on a local scale (see Figure 14-82and Figure 14-83). SRK found that local block estimates were similar to nearby composite samples and that the block model reflected the patterns in grade variability without excessive lateral smearing of high grades.

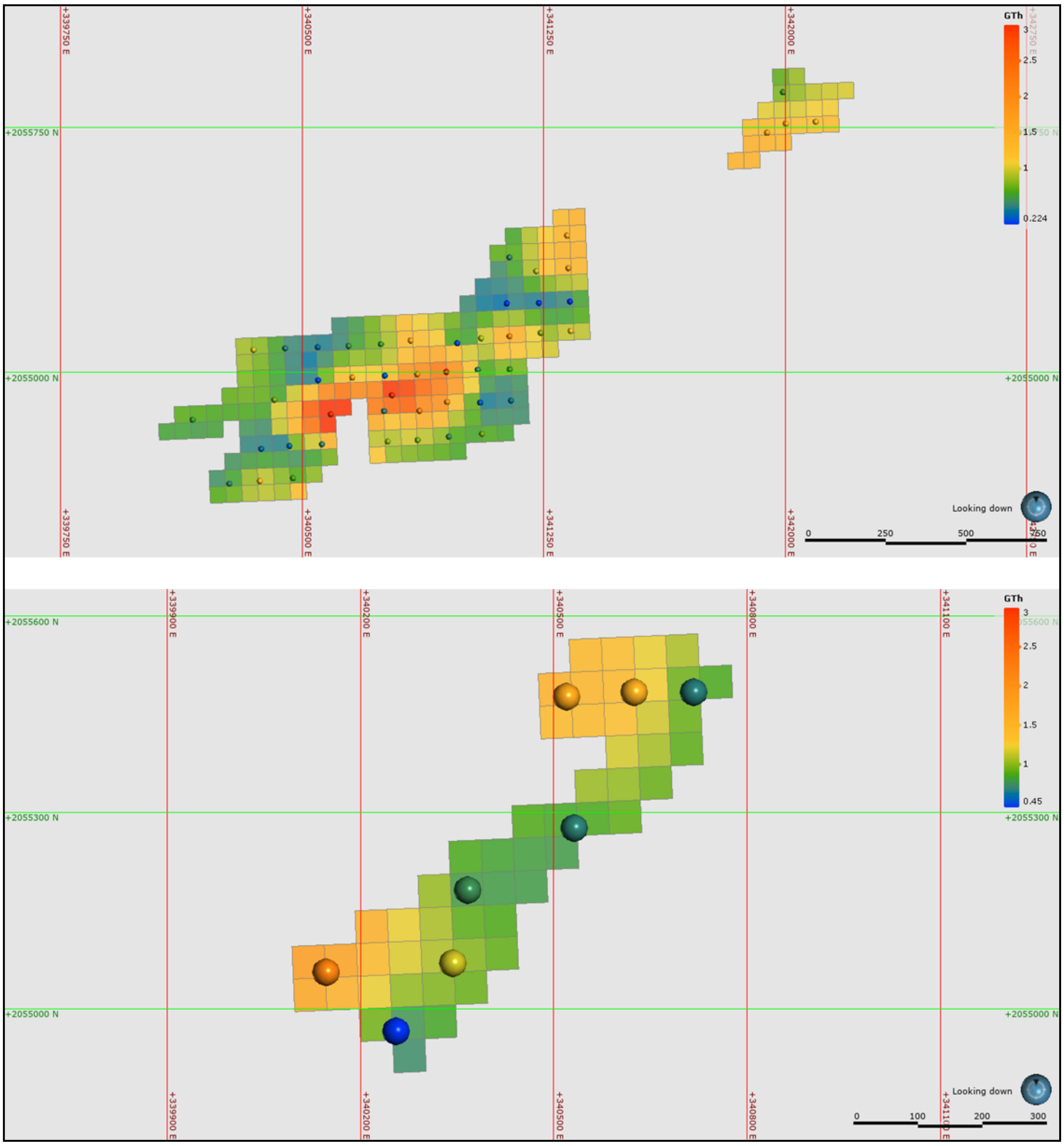


Figure 14-82: Plan views showing samples and OK block model grades for GTh Basal and Upper

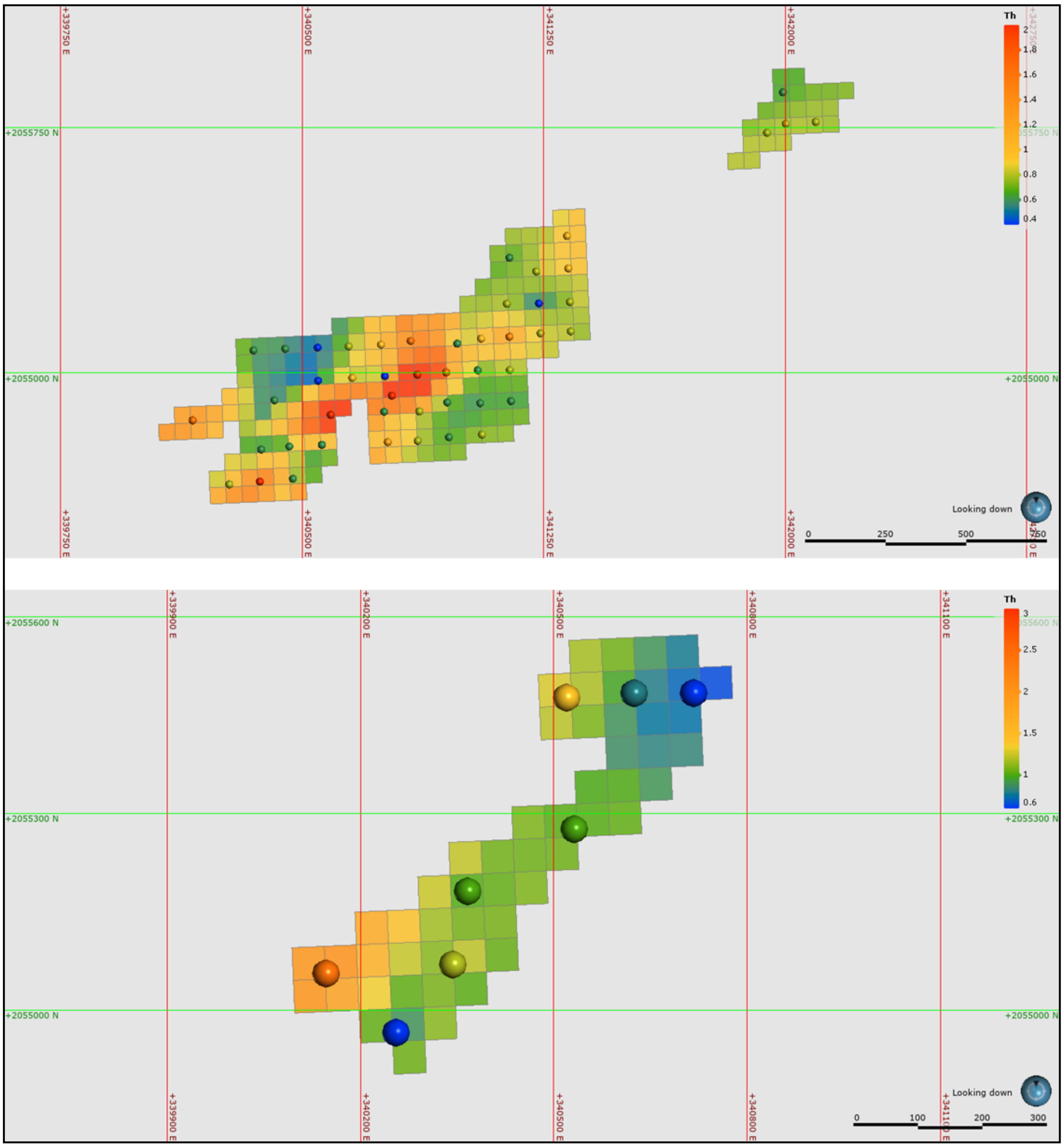


Figure 14-83: Plan views showing samples and OK block model grades for Thickness Basal and Upper

Statistical Validation

The mean estimated block grades were compared to the mean of the composite samples for the basal and upper domains, as shown in Table 14-39 and Table 14-40 respectively. The results show a satisfactory correlation between block model and sample grades at a global scale. SRK is confident that the model reflects the current understanding of the deposit.

Table 14-39: Validation of block model versus sample uranium grades MSCE Basal

Mineralisation	Block Count	Block Mean	Composite Mean	% Difference
GTh	234	1.02	1.09	7%
teneur	234	1.26	1.07	-17%
Th	234	0.95	0.98	3%

Table 14-40: Validation of block model versus sample uranium grades MSCE Upper

Mineralisation	Block Count	Block Mean	Composite Mean	% Difference
GTh	55	1.10	1.13	3%
teneur	55	1.02	1.04	2%
Th	55	1.12	1.13	0%

Swath Plots

As part of the validation process, swath plots were generated in the X (easting) and Y (northing) coordinate directions. Average grades for input samples and estimated blocks are calculated along a series of vertical slices (swaths) and plotted on graphs. In effect, a moving average is calculated for blocks and samples along three coordinate axes; this enabled the fit of the block model to the underlying date to be assessed at an intermediate scale and the block model can be checked for spatial biases in estimated grade.

Figure 14-84 and Figure 14-85 show the swath plots for GTh and Th for the basal domain respectively.

In general, the plots show a good correlation between the OK block model and sample grades. There is no indication that any bias has been introduced, and the OK block modelled display an adequate degree of smoothing with respect to the samples.

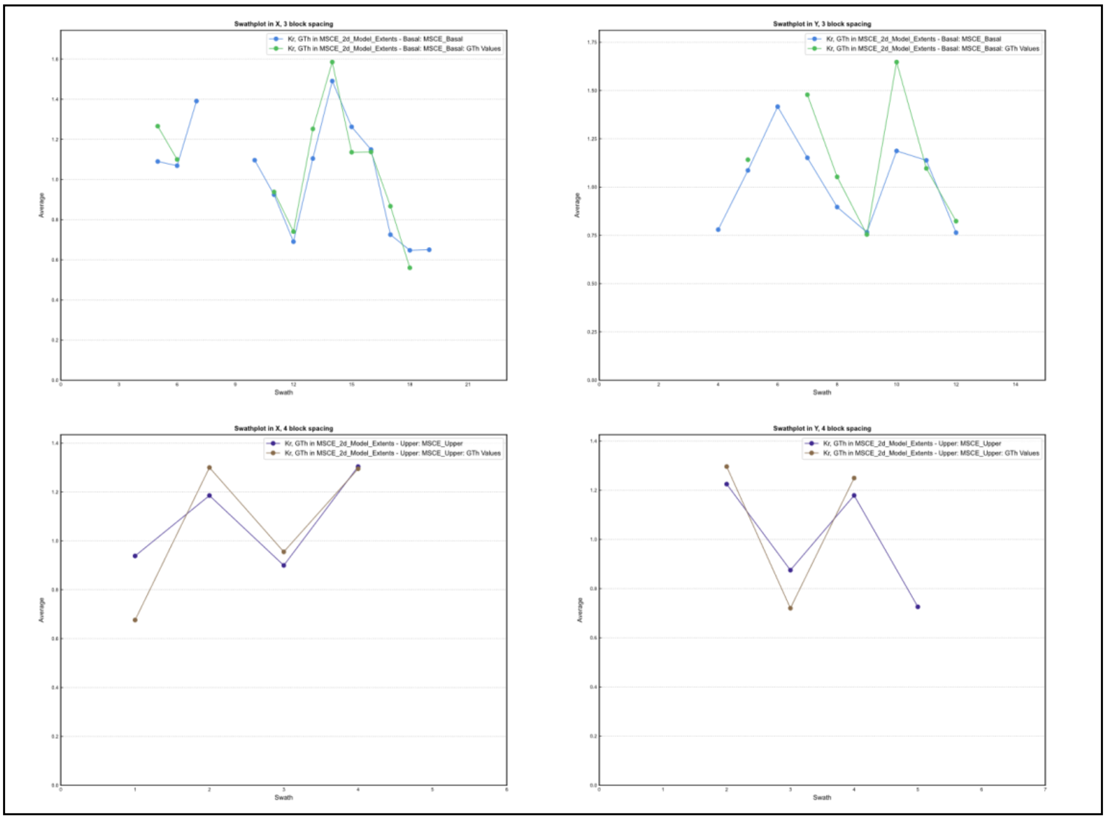


Figure 14-84: Swath plots for GTh – Basal and Upper

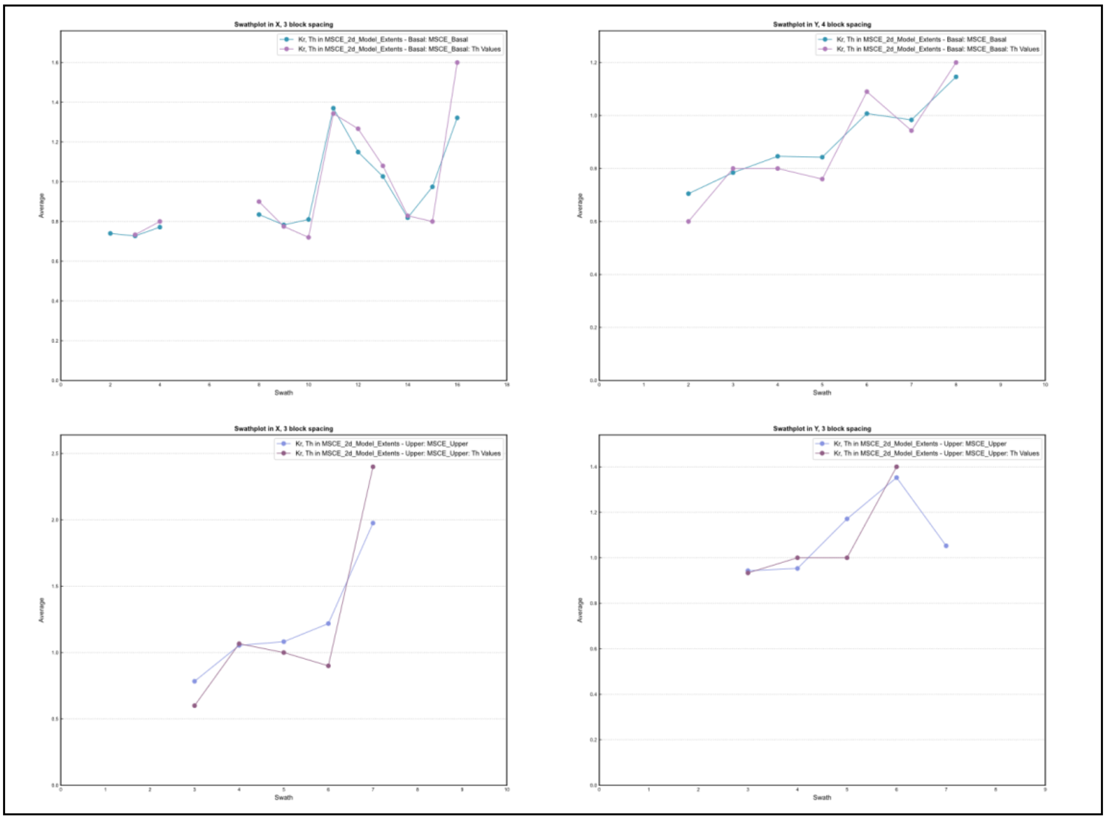


Figure 14-85: Swath plots for Th Basal and Upper

14.6.8 Mineral Resource Classification

The Mineral Resources have been classified according to the definitions and guidelines of the CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Standard). The MSCE deposit has been defined by a regular 100 x 100 m grid of drilling (Figure 14-86). SRK considers that this drilling density, along with consideration of data quality, geological continuity and complexity, and estimation quality is sufficient to classify the estimated blocks in the Inferred category.

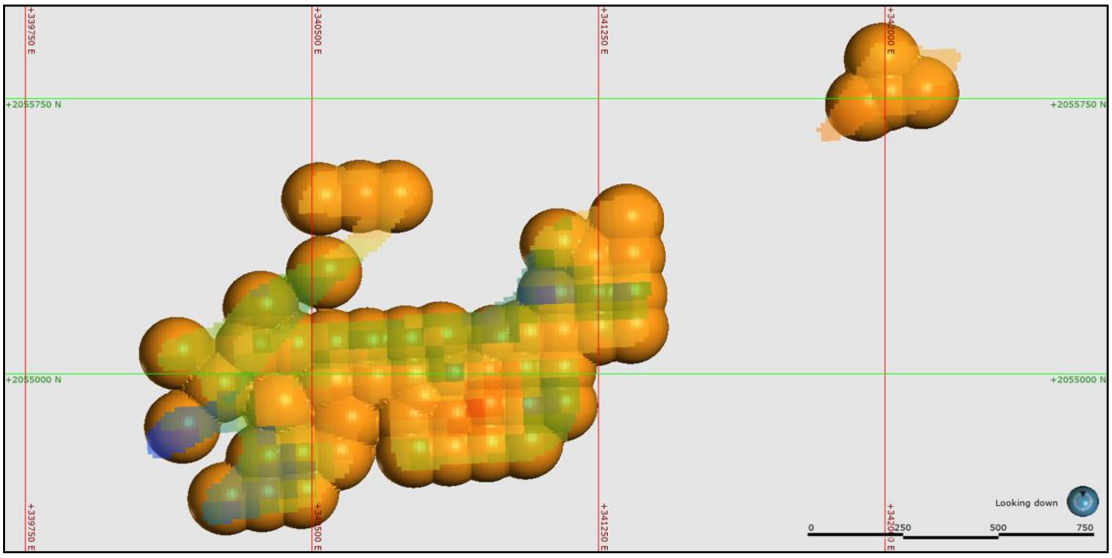


Figure 14-86: MSCE deposit coloured by teneur – 100 m Buffers on composites

14.6.9 Reasonable Prospects for Eventual Economic Extraction

SRK has reported the Mineral Resource as that portion of the block model which satisfies an appropriate eU cut-off grade over an underground minimum mining thickness on 1.8 m, considering the appropriate mining, processing and general and administrative cost, geotechnical parameters and processing recoveries, as discussed with the Company and determined in the TEM (Table 14-22). SRK considers that the material reported as a Mineral Resource fulfils the requirement by the CIM Guidelines of having "…reasonable prospects for eventual economic extraction" (RPEEE), through underground mining methods, which is supported by a Feasibility Study for the project. The areas of the block model which satisfy a 0.4 kg/t eU cut-off over 1.8m minimum mining thickness is presented relative to the estimated block centroids in Figure 14-87.

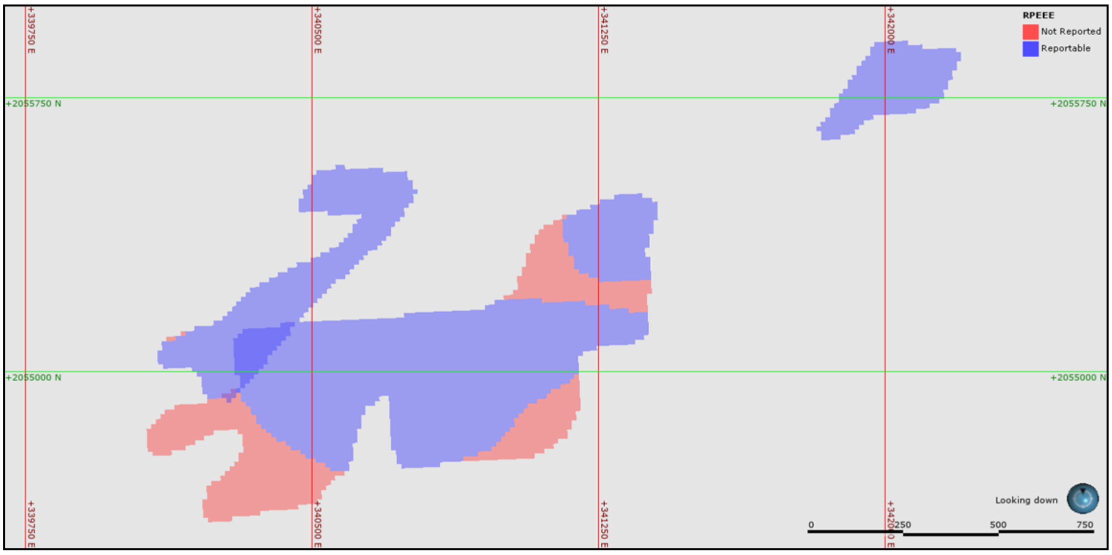


Figure 14-87: MSCE deposit coloured by RPEEE

14.6.10 Mineral Resource Statement

The CIM Definition Standards defines a Mineral Resource as:

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."

The "reasonable prospects for eventual economic extraction" requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade taking into account extraction scenarios and processing recoveries.

The Mineral Resource Statement for the MSCE Deposit is presented in Table 14-41.

Table 14-41: Summary of the classified mineral resources in accordance with CIM guidelines for MSCE uranium (cut-Off: 0.40 kg/t eU) as of July 01, 2022

Classification Category	Tonnage (Mt)	Grade		Metal	
		eU (kg/t)	eU_3O_8 (kg/t)	eU_3O_8 (Tonnes)	eU_3O_8 (M lbs)
Measured & Indicated	-	-	-	-	-
Inferred	1.16	1.15	1.35	1,571	3.5

In reporting the Mineral Resource statement, SRK notes the following:

- *Mineral Resources have an effective date of July 01, 2022*
- *Mineral Resources are classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 29, 2019).*
- *Mineral Resources are reported here are Inclusive of Mineral Reserves and are reported as undiluted, with no mining recovery applied in the Statement.*
- *Technical and economic assumptions were agreed between SRK and GoviEx for mining factors (mining and processing costs) and processing factors (metal recovery, processing costs), which were used for to determine minimum mining width and cut-off grade.*
- *SRK considers there to be reasonable prospects for economic extraction by constraining the resources within contiguous volumes where grade diluted to a minimum thickness of 1.8 m is above 0.40 kg/t assuming a Uranium price of US$70/lb U_3O_8.*
- *Tonnages are reported in metric units, grades in kilograms-per-tonne (kg/t) and parts-per-million (ppm), and the contained metal in Tonnes and Million pounds (M lbs). Tonnages, grades, and contained metal totals are rounded appropriately.*

14.6.11 Sensitivity Analysis

The mineral resources of the MSCE deposit are sensitive to the selection of the reporting cut-off eU kg/t value. To illustrate this sensitivity, the block model quantities and grade estimates within the conceptual pit used to constrain the mineral resources are presented in Table 14-42 at different eU kg/t cut-off values. The reader is cautioned that the figures presented in these tables should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of the eU kg/t cut-off value. Table 14-42 presents the sensitivity as a grade tonnage curve.

Table 14-42: Block model quantities and grade estimates within the optimised pit shell at Various eU kg/t cut-off values for MSCE

eU Cut-off (kg/t)	Tonnage (Mt)	Grade
		eU (kg/t)
0	1.2	1.15
0.1	1.2	1.15
0.2	1.2	1.15
0.3	1.2	1.15
0.4	1.2	1.15
0.5	1.2	1.15
0.6	1.2	1.15
0.7	1.1	1.16
0.8	1.0	1.20
0.9	0.8	1.28
1	0.7	1.37
1.1	0.6	1.41
1.2	0.5	1.46
1.3	0.4	1.52

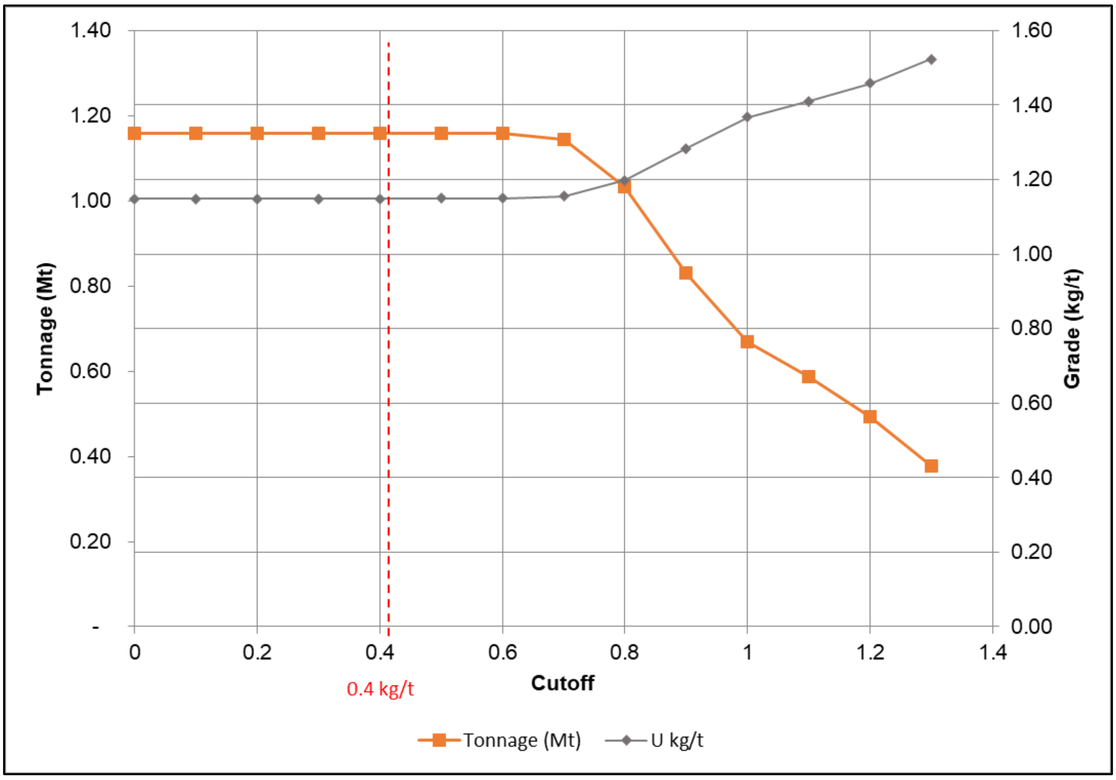


Figure 14-88: Grade tonnage curve for the MSCE deposit

14.6.12 Comparison with Previous Estimate

The Mineral Resource presented here includes a number of factors that have led to changes compared to the previous Mineral Resource, effective date March 02, 2016. At MSCE, a number of drill holes were added which led to remodelling of the mineralized zones. In addition to the remodelling, an underground mining optimization was used to restrict the reportable Mineral Resources considering RPEEE, something that was not considered for the March 02, 2016 Mineral Resource. These factors combined have led to the following key changes:

- Increase in Inferred eU_3O_8 Tonnes and Metal due to increased data available and remodelling; and
- Decrease in Inferred eU_3O_8 grade due to additional data and remodel.

Table 14-43: MSCE Comparison with previous estimate (2016 vs 2021)

Category	2015			2021			Difference (%)		
	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes (Mt)	eU_3O_8 kg/t	eU_3O_8 Mlbs	Tonnes	eU_3O_8	eU_3O_8 Metal
Measured	-	-	-	-	-	-	-	-	-
Indicated	-	-	-	-	-	-	-	-	-
M&I	-	-	-	-	-	-	-	-	-
Inferred	0.72	1.81	2.88	1.16	1.35	3.50	+61%	-25%	+22%
All	0.72	1.81	2.88	1.16	1.35	3.50	+61%	-25%	+22%

14.7 MYVE

14.7.1 Supporting Data

The drilling density at MYVE is very uniform at 100 m x 100 m (Figure 14-89). A total of 91 drillholes have been drilled in the deposit to support this Mineral Resource Estimate, for a total of 11,551 m (Table 14-44). The key uranium mineralised horizon at MYVE is the Guezouman Sandstone, which is locally very consistent and flat. The vertical drilling grid is appropriate to define the flat lying mineralisation, which is parallel to the Guezouman Sandstone (Figure 14-75).

All drillholes have been radiometrically probed, and after processing, provide eU (referred to a ‘teneur’ at the project) data for the full length of holes.

Table 14-44: Summary of drilling at MYVE

Sampling Type	Number of holes	Total Meters
Radiometric Assay (eU)	91	11,551
Total	**91**	**11,551**

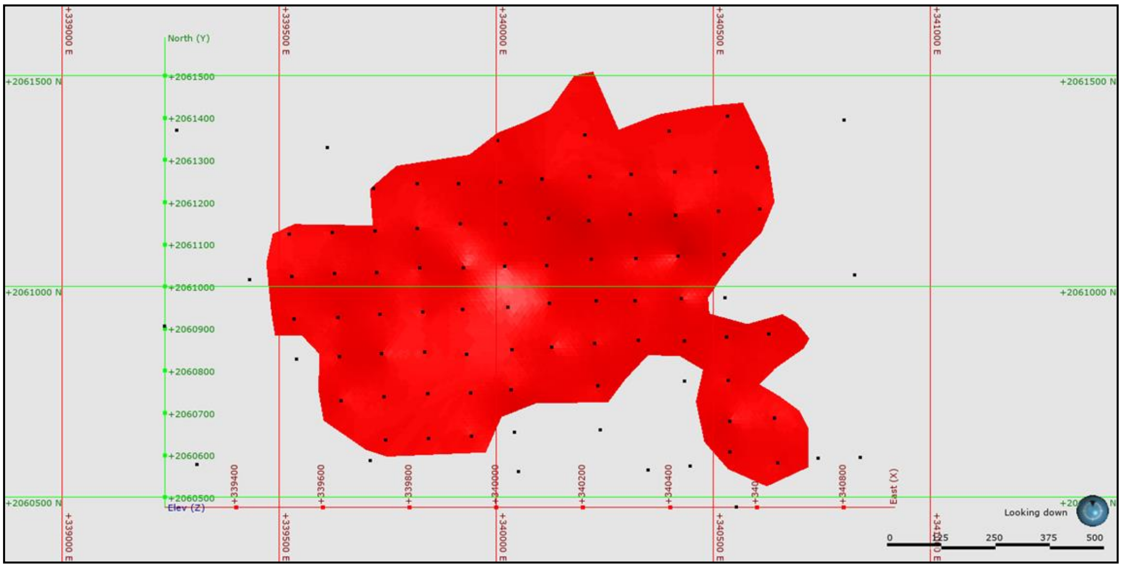


Figure 14-89: MYVE: data location and mineralisation envelopes

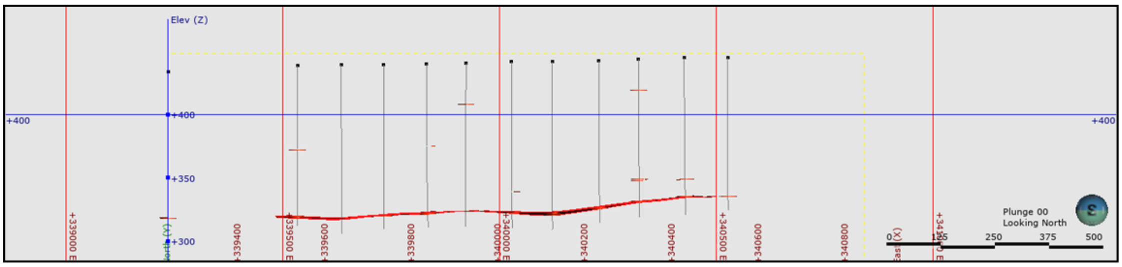


Figure 14-90: Cross section view of final MYVE mineralisation model (vertical exaggeration x3)

14.7.2 Geological Modelling

The stratigraphy at MYVE has been logged in drillholes, and is consistent across the project area, though, to the east the deposit is deflected downwards by the Madaouela fault. SRK have built a stratigraphic model based on the drillhole logging data.

14.7.3 Mineralisation Model

eU Models

The distribution of uranium mineralisation at MYVE is controlled by the reducing formation (Talak) at the base of the Guezouman sandstone. There is no clear, or visible, boundary that defines the uranium mineralisation so the distribution of eU grades in the Guezouman Sandstone was investigated and a modelling cut-off of 0.4 kg/t eU was chosen to represent mineralised material (Figure 14-89 and Figure 14-90). The modelled mineralisation results in a thin layer immediately above the Talak contact and is referred to in this sub-section as the 'basal' mineralisation.

14.7.4 Statistical Analysis

Prior to undertaking any grade interpolation, SRK performed a statistical study on composited eU assay data within the modelled mineralisation wireframe to assess its suitability for grade estimation and to confirm that appropriate estimation domains had been modelled.

Compositing

The typical sample length for eU analyses is 0.2 m. Since the mineralisation forms a single thin and continuous layer, samples were composited to the thickness of the modelled mineralisation, resulting in 1 composite per drill hole with the following fields (see 2-dimensional approach described in Section 14.2):

- Grade – eU kg/t
- Thickness – m
- GTh – Grade x Thickness

The grade distribution of Th and GTh are presented in Figure 14-91 and Figure 14-92, and summarised statistically in Table 14-45.

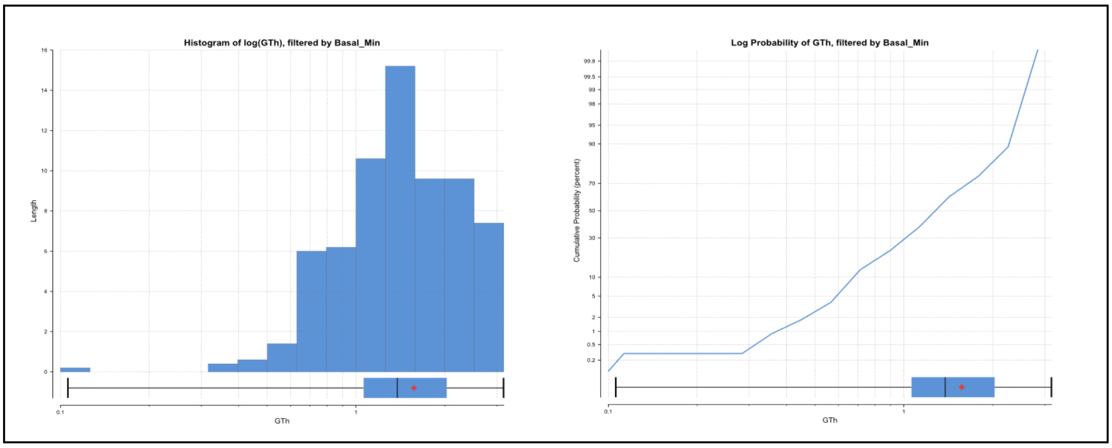


Figure 14-91: Log Histogram and Log Probability plot for MYVE GTh

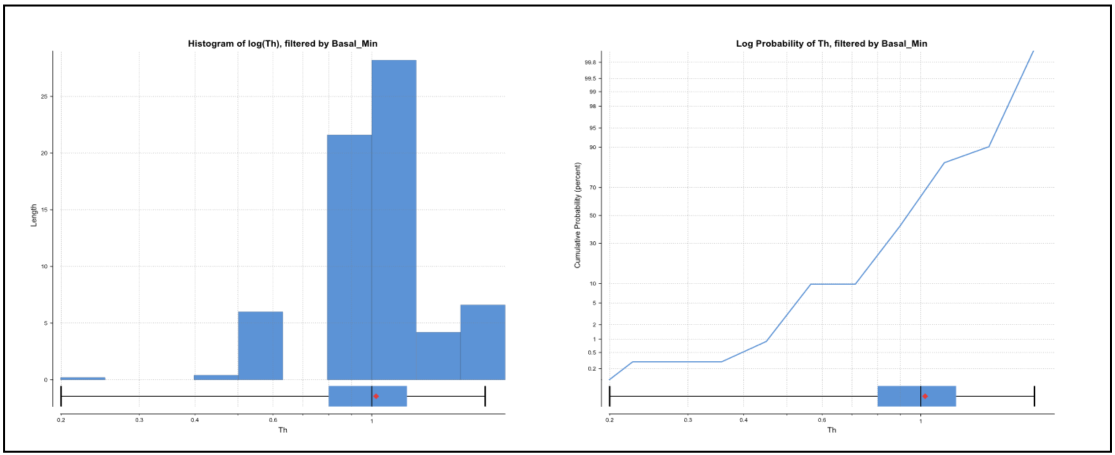


Figure 14-92: Log Histogram and Log Probability plot for MYVE Th

Table 14-45: Composite statistics for MYVE

Basal_Min	Count	Length	Mean	Coefficient of variation	Minimum	Maximum
Teneur	73	67.2	1.46	0.36	0.0	3.08
Th (m)	73	67.2	0.98	0.34	0.4	2.20
GTh	73	67.2	1.44	0.48	0.0	3.16

Treatment of high-grade outliers

Capping, or 'top-cuts', are applied to high grades in order to reduce the influence they may have on the estimate and prevent smearing high grades into adjacent blocks. High grades can be treated by applying a cap to the assay, in this case GTh and Th, values in the database based on an assessment of the histograms and log probability plots, but they can also be treated by applying a distance restriction on the grades in order to limit the influence of the very high grades at the kriging stage.

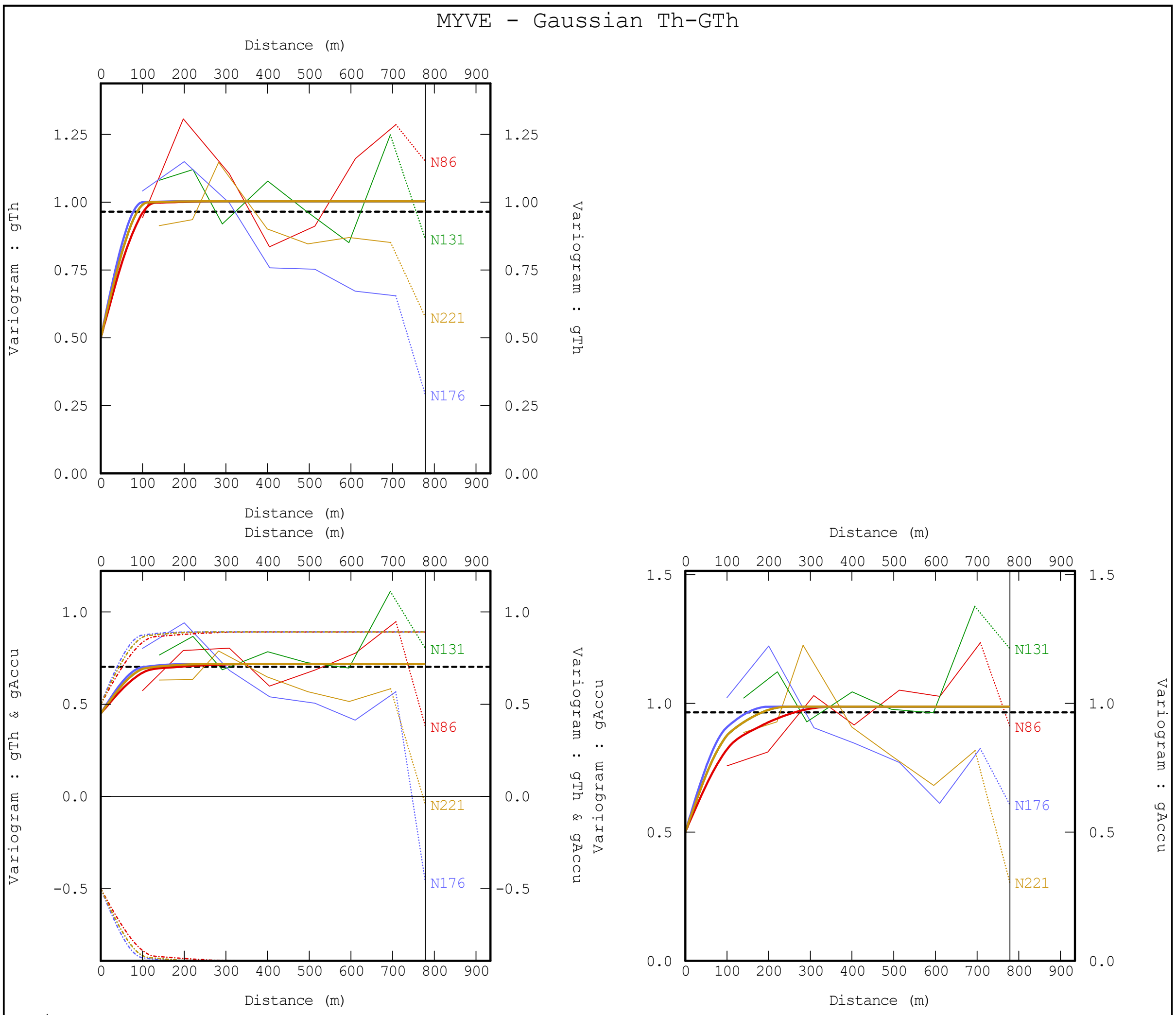
Based on an analysis of the GTh and Th grade distribution statistics, SRK decided that no capping or distance restrictions were required.

Density

There are no density measurements available for the MYVE deposit. The host lithology, and mineralisation is consistent with the M&M and Miriam deposits where density data is available. Due to the similarity, SRK feel it is appropriate to assign a density of 2.3 t/m^3 for the MYVE mineralisation.

14.7.5 Geostatistical Analysis

For the MYVE domain, SRK investigated the grade continuity for components of Th and GTh as co-variables. Variography has been completed in gaussian transformed data, as the retained high grades in certain domains has resulted in a right skew to the distributions and untransformed variograms show little discernible structure. The gaussian transformed models for Th and GTh are shown in Figure 14-93.



Isatis
Maryvonne_2013/Accus_2D(Within Poly_sel)
- Variable #1 : gAccu
- Variable #2 : gTh
Variogram : in 4 direction(s)
D1 : N86
D2 : N131
D3 : N176
D4 : N221

Model : 3 basic structure(s)
Global rotation = Azimuth=86.42 (Geologist Plane)
S1 - Nugget effect
Coregionalization matrix
0.5 0.45
0.45 0.5
S2 - Spherical -
Ranges = (130.0000m, 100.0000m)
Coregionalization matrix
0.2318 0.214
0.214 0.4923
S3 - Spherical -
Ranges = (350.0000m, 200.0000m)
Coregionalization matrix
0.2554 0.05347
0.05347 0.01119

Figure 14-93: GTh and Th bivariate model for MYVE

14.7.6 Grade Interpolation

Resource estimation was completed using an unfolding technique in an area encompassing the modelled MYVE mineralisation with a final block model geometry and extents as presented in (Table 14-52). The block model is rotated to an azimuth of 177.26 to optimize the alignment of blocks with the drilling grid. The grade interpolation methodology is based on the following:

- Composited data were not capped and distance restrictions on high-grade populations were applied as described in Section 14.7.4;
- During estimation, domain boundaries for the selection of composites were treated as hard boundaries;
- The single pass search volumes were aligned according to the modelled variograms with dimension of 420 x 325 x 5 m;
- Minimum sample selection parameters were set at 1 with no maximum, with an optimum of 9 samples per sector;
- Block discretization of 10 x 10 x 1;
- GTh and Th were estimated by Co-Kriging and Grade eU was calculated by GTh/Th; and
- Density of 2.3 t/m^3 was assigned to all blocks.

Table 14-46: Block model parameters for MYVE

Parameter	X	Y	Z
Origin (block centroid)	338,330	2,055,645	
Block Size	50	50	0.4
Number of Blocks	36	28	

14.7.7 Block Model Validation

SRK validated the block model estimates through visual and statistical checks of block grades compared with composited drillhole data in 3D and cross-section and by comparing mean block model grades with mean composite data. The validation is designed to confirm that the block model is representative of the underlying sample data at both local and global scales and to check that the estimate is not biased.

SRK believes that the block model reflects the current understanding of the distribution of mineralisation and is an acceptable basis for a Mineral Resource statement.

Visual Validation

SRK visually compared block grades to composite sample grades in plan view (unfolded space) to assess the correlation of the interpolated block model to the composite data on a local scale (Figure 14-103). SRK found that local block estimates were similar to nearby composite samples and that the block model reflected the patterns in grade variability without excessive lateral smearing of high grades.

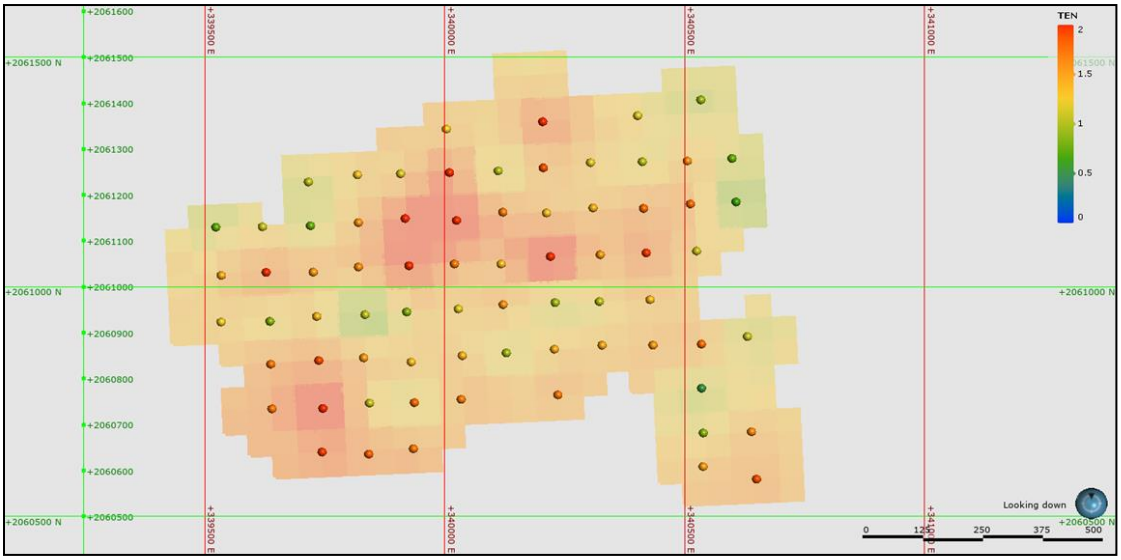


Figure 14-94: eU (kg/t) estimated by co-kriging of Th and GTh for MYVE

Statistical Validation

The mean estimated block grades were compared to the mean of the composite samples for the basal domain, shown in Table 14-39. The results show a satisfactory correlation between block model and sample grades at a global scale. SRK is confident that the model reflects the current understanding of the deposit.

Table 14-47: Validation of block model versus sample uranium grades MYVE

Type	Block Count	Mean	Coefficient of variation	Minimum	Maximum	Composite Mean	% Difference
eU	137,824	1.47	0.16	0.95	2.26	1.50	1.7%
Th	137,824	0.99	0.10	0.76	1.39	0.93	-5.8%

Swath Plots

As part of the validation process swath plots were generated in the X (easting) and Y (northing) coordinate directions. Average resulting eU grades for input samples and estimated blocks are calculated along a series of vertical slices (swaths) and plotted on graphs (Figure 14-95). In effect, a moving average is calculated for blocks and samples along three coordinate axes; this enables the fit of the block model to the underlying data to be assessed at an intermediate scale and the block model can be checked for spatial biases in estimated grade.

In general, the plots show a good correlation between the CoK block model and sample grades. There is no indication that any bias has been introduced, and the CoK block models display an adequate degree of smoothing with respect to the samples.

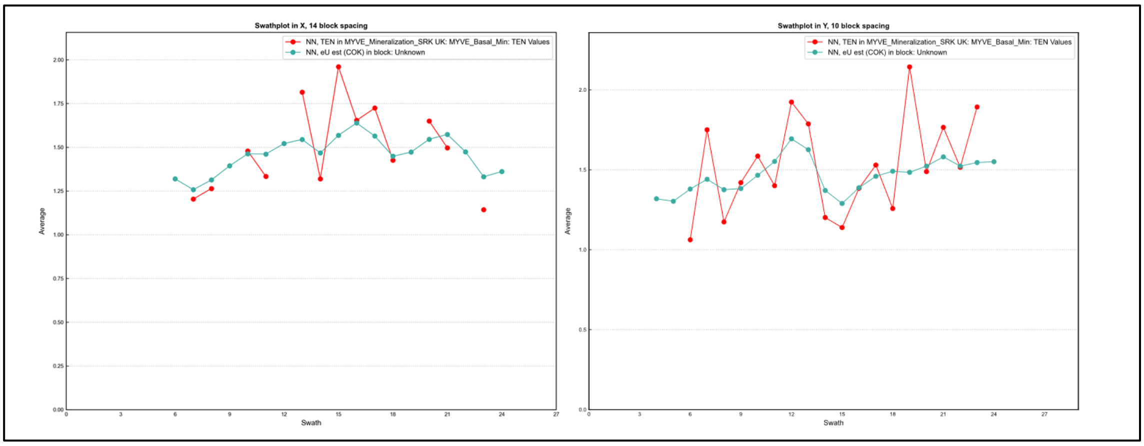


Figure 14-95: Swath plots for MYVE eU

14.7.8 Mineral Resource Classification

The Mineral Resources have been classified according to the definitions and guidelines of the CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Standard). Classification of MSNE is based on the quality of the GTh and Th estimated by Co-Kriging, and evaluated based on the slope of regression of the estimate. The estimation quality is somewhat improved in areas defined by the regular 100 x 100 m grid of drilling, and roughly corresponds to the area delineated by SRK as Indicated classification.

SRK considers that this drilling density, along with consideration of data quality, geological continuity and complexity, and estimation quality is sufficient to classify the estimated blocks in the Indicated and Inferred categories. Classification is shown in Figure 14-96.

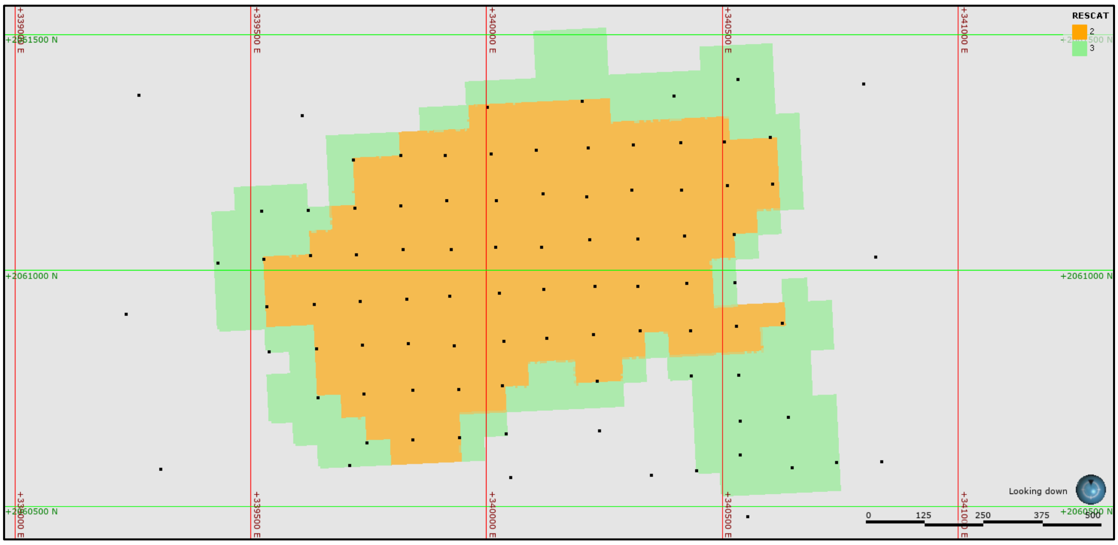


Figure 14-96: Classification (Indicated=orange, Inferred=green) for MYVE

14.7.9 Reasonable Prospects for Eventual Economic Extraction

SRK has reported the Mineral Resource as that portion of the block model which has been included in an optimised underground mining volume, considering the appropriate mining, processing and general and administrative cost, geotechnical parameters and processing recoveries, as discussed with the Company and determined in the TEM (Table 14-10). SRK considers that the material reported as a Mineral Resource fulfils the requirement by the CIM Guidelines of having "…reasonable prospects for eventual economic extraction" (RPEEE), through underground mining, which is supported by a Feasibility Study for the project. The optimised underground mining outline is presented relative to the eU classified block model in Figure 14-97.

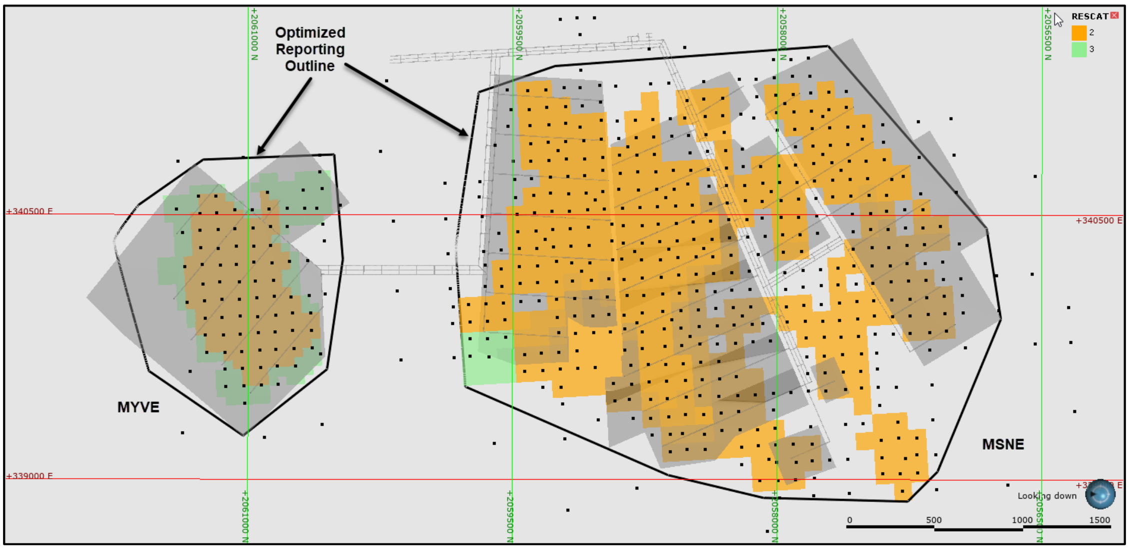


Figure 14-97: Plan view of MYVE and MSNE blocks coloured by eU classification showing outline of Optimised Mineral Resource Reporting Shell.

14.7.10 Mineral Resource Statement

The CIM Definition Standards defines a Mineral Resource as:

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."

The "reasonable prospects for eventual economic extraction" requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade taking into account extraction scenarios and processing recoveries.

The Mineral Resource Statement for the MYVE Deposit is presented in Table 14-48.

Table 14-48: Mineral Resource Statement for the MYVE Deposit effective July 01, 2022

Classification Category	Tonnage (Mt)	Grade		Metal	
		eU (kg/t)	eU_3O_8 (kg/t)	eU_3O_8 (Tonnes)	eU_3O_8 (M lbs)
Measured	-	-	-	-	-
Indicated	1.23	1.52	1.79	2,195	4.84
Measured & Indicated	1.23	1.52	1.79	2,195	4.84
Inferred	0.42	1.41	1.66	703	1.55

In reporting the Mineral Resource statement, SRK notes the following:

- *Mineral Resources have an effective date of July 01, 2022*
- *Mineral Resources are classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 29, 2019).*
- *Mineral Resources are reported here are Inclusive of Mineral Reserves and are reported as undiluted, with no mining recovery applied in the Statement.*
- *Technical and economic assumptions were agreed between SRK and GoviEx for mining factors (mining and processing costs) and processing factors (metal recovery, processing costs), which were used for to determine minimum mining width and cut-off grade.*
- *SRK considers there to be reasonable prospects for economic extraction by constraining the resources within contiguous volumes where grade diluted to a minimum thickness of 1.8 m is above 0.40 kg/t assuming a Uranium price of US$70/lb U_3O_8.*
- *Tonnages are reported in metric units, grades in kilograms-per-tonne (kg/t) and parts-per-million (ppm), and the contained metal in Tonnes and Million pounds (M lbs). Tonnages, grades, and contained metal totals are rounded appropriately.*

14.7.11 Sensitivity Analysis

The mineral resources of the MYVE deposit are sensitive to the selection of the reporting cut-off eU kg/t value. To illustrate this sensitivity, the block model quantities and grade estimates within the conceptual underground outline to constrain the mineral resources are presented in Table 14-49 at different eU kg/t cut-off values. The reader is cautioned that the figures presented in these tables should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of the eU kg/t cut-off value. Figure 14-98 presents the sensitivity as a grade tonnage curve.

Table 14-49: Block model quantities and grade estimates within the optimised pit shell at Various eU kg/t cut-off values for MYVE

eU Cut-off (kg/t)	Tonnage (Mt)	Grade
		eU (kg/t)
0	1.77	1.49
0.1	1.77	1.49
0.22	1.77	1.49
0.3	1.77	1.49
0.4	1.77	1.49
0.5	1.77	1.49
0.6	1.77	1.49
0.7	1.77	1.49
0.8	1.77	1.49
0.9	1.77	1.49
1	1.75	1.50
1.1	1.72	1.51
1.2	1.61	1.53
1.3	1.39	1.57

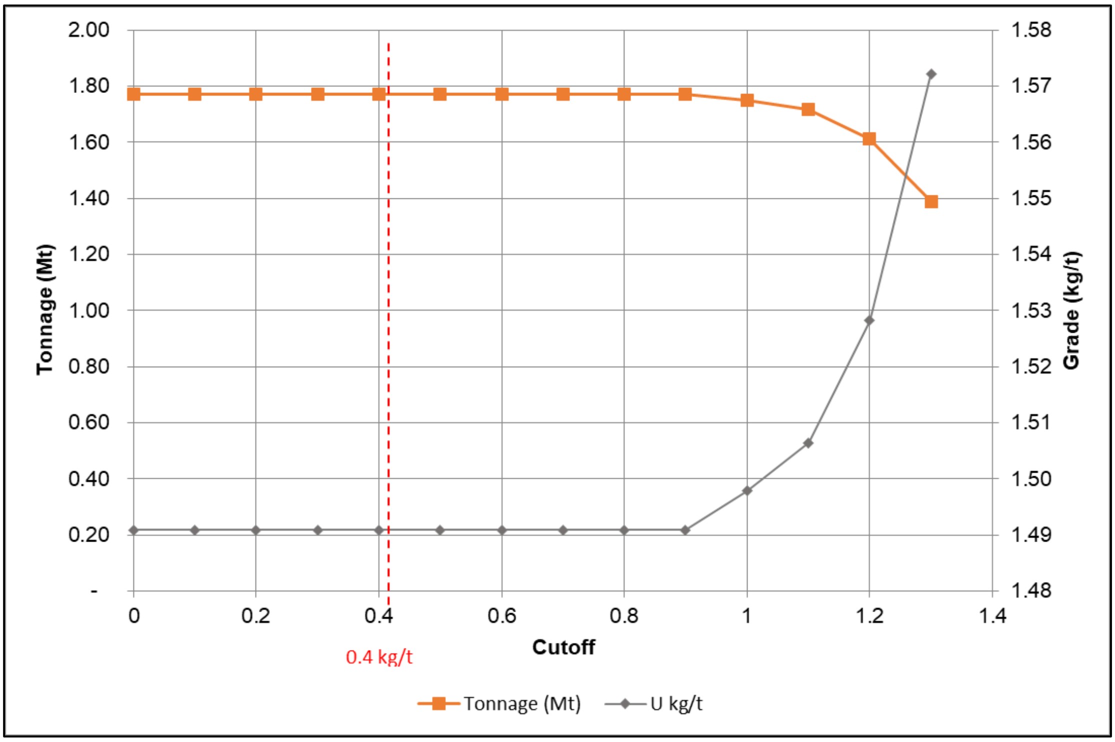


Figure 14-98: Grade tonnage curve for the MYVE deposit

14.7.12 Comparison with Previous Estimate

The Mineral Resources for MYVE were not updated in 2021 so there is no change to report to the March 02, 2016 MRE.

14.8 MSNE

Grade estimation for MSNE was prepared by GoviEx but has been reviewed by SRK.

14.8.1 Supporting Data

The MSNE deposit is defined by a variable drilling grid, with drill hole spacing varying from about 100 x 100 m to over 200 x 200 m in the west and south. A total of 110 drillholes have been drilled in the deposit to support this Mineral Resource Estimate, for a total of 17,302 m (Table 14-52). The key uranium mineralised horizon at MSNE is the Guezouman Sandstone, which is locally deformed by the channels. The vertical drilling grid is appropriate to define the flat lying mineralisation, which is parallel to the Guezouman Sandstone (Figure 14-75).

Only basal mineralisation has been estimated as part of this study.

All drillholes have been radiometrically probed, and after processing, provide eU (referred to a 'teneur' at the project) data for the full length of holes.

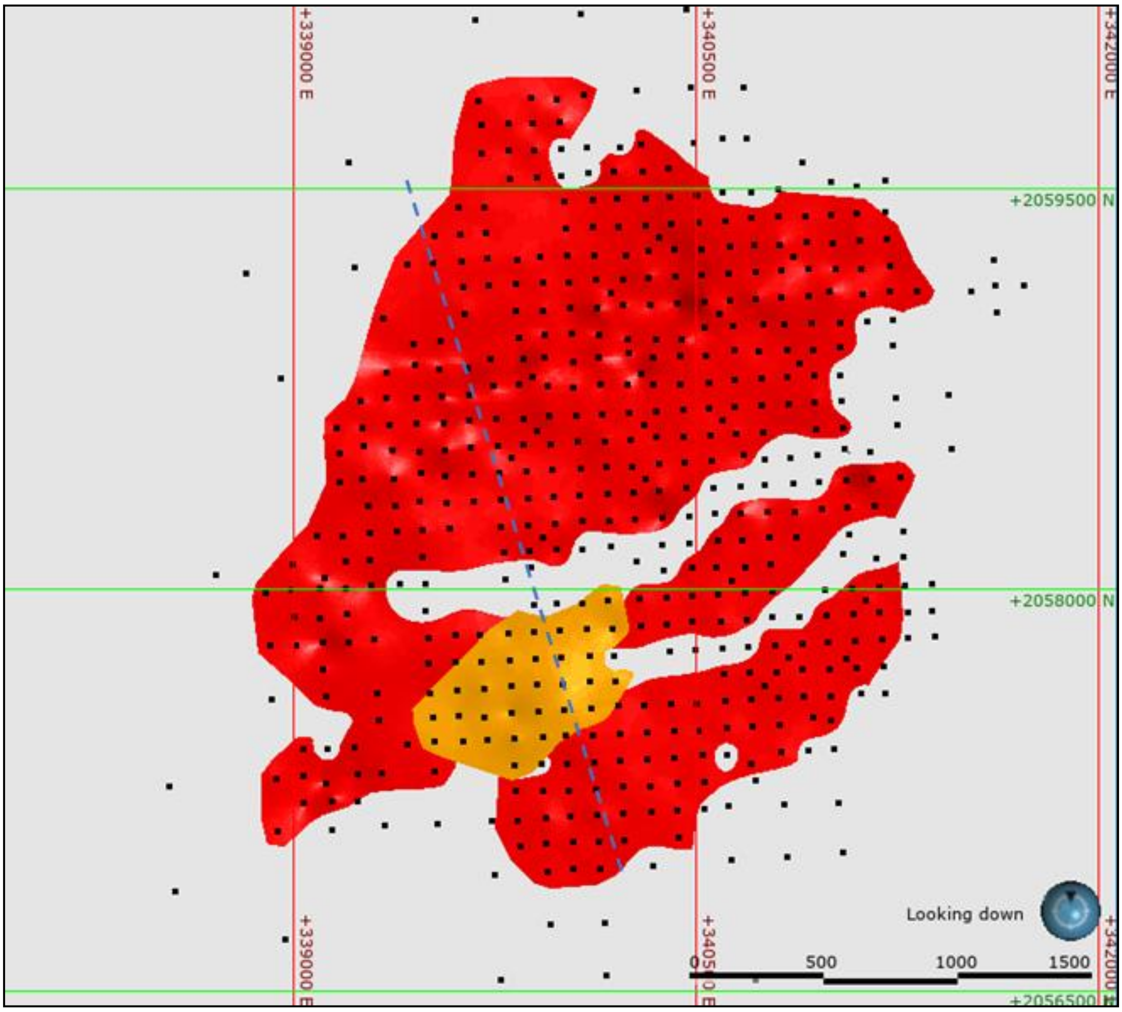


Figure 14-99: Plan view of final MSNE mineralisation model. (Basal mineralisation in Red and Upper mineralisation in Orange). Figure 14-100 section location is blue dashed line.

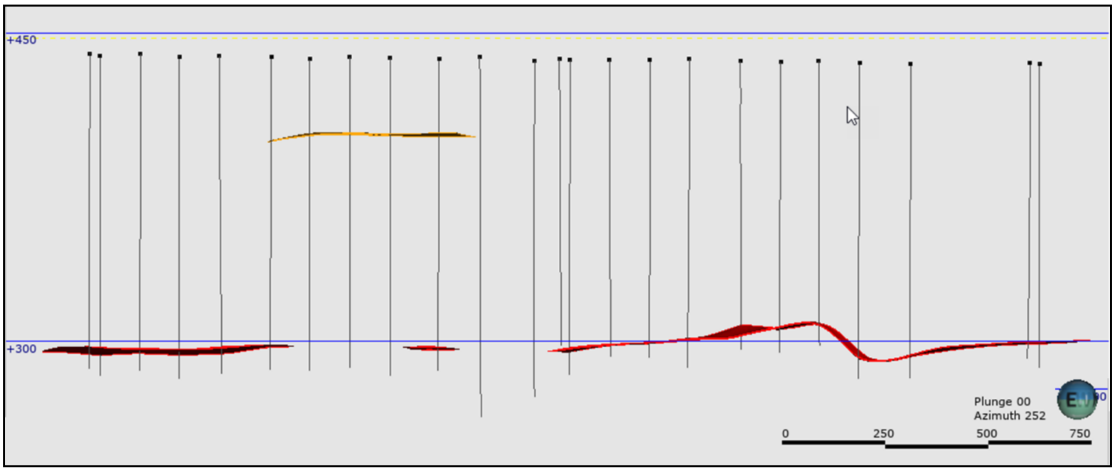


Figure 14-100: Cross section view of final MSNE mineralisation model

Table 14-50: Summary of drilling at MSNE

Sampling Type	Number of holes	Total Meters
Radiometric Assay (eU)	**110**	**17,302**
Total	**110**	**17,302**

14.8.2 Geological Modelling

The stratigraphy at MSNE has been logged in drill holes and is consistent across the project area, although is locally affected by channels (similar northeast-southwest trend as observed at M&M) deflecting the units. SRK have built a stratigraphic model based on the drill hole logging.

14.8.3 Mineralisation Model

eU Models

The distribution of uranium mineralisation at MSNE is present at two horizons, representing the contact between reducing stratigraphy and porous sandstones. The most prominent mineralisation at MSNE is controlled by the reducing Talak formation at the base of the Guezouman sandstone, with weaker mineralisation also present at the upper contact between the Tchinezogue sandstone and overlying Tarat formation.

There is no clear or visible boundary that defines uranium mineralisation, and so the distribution of eU grades in the Guezouman and Tchinezogue sandstones were investigated and a modelling cut-off of 0.4 kg/t eU selected to represent mineralised material (Figure 14-99 & Figure 14-100). Two zones of uranium mineralisation have been modelled, representing a thin layer within the Guezouman Sandstone and immediately above the Talak contact (referred to in this sub-section as the 'basal' mineralisation), and the second thin layer within the Tchinezogue Sandstone immediately below the Tarat contact (referred to in this sub-section as the 'upper' mineralisation.

14.8.4 Statistical Analysis

Prior to estimation, a statistical study was completed on composited eU assay data within modelled basal mineralisation wireframes to assess suitability for grade estimation and to confirm that appropriate estimation domains had been modelled.

Compositing

The typical sample length for eU analyses is 0.2 m. Since the basal mineralisation forms a thin and continuous layer, samples were composited to the thickness of the modelled mineralisation, resulting in single composites per drill hole with the following fields (see 2-dimensional approach described in Section 14.2):

- Grade – eU kg/t
- Thickness – m
- GTh – Grade x Thickness

The grade distribution of GTh and Th for the basal mineralisation are presented in Figure 14-101 and declustered statistics are shown in Table 14-51.

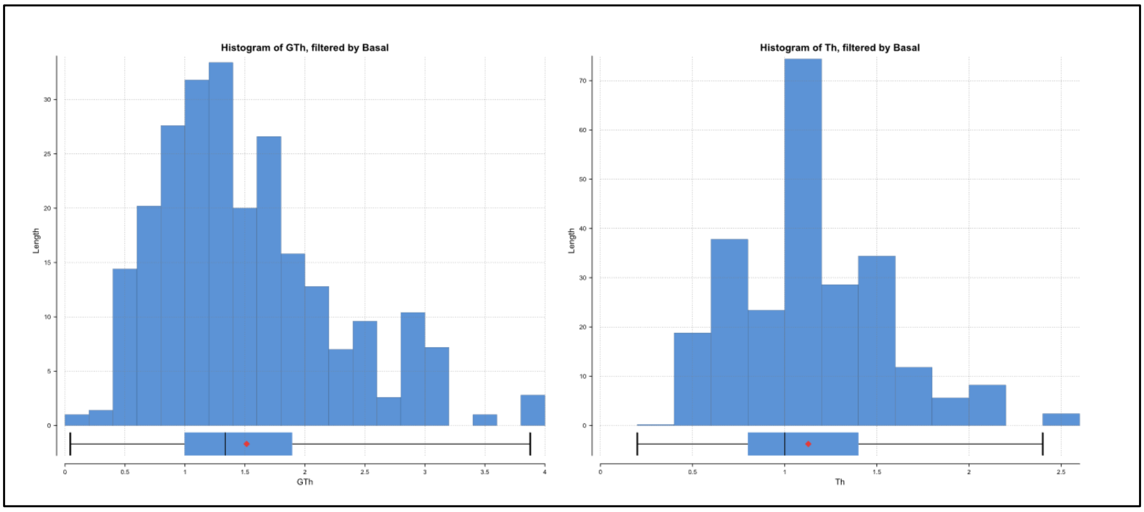


Figure 14-101: Log-histograms of GTh and Th for MSNE

Table 14-51: Declustered statistical analysis for MSNE

	Count	Length	Mean	Coefficient of variation	Minimum	Maximum
teneur	234		1.29	0.50	0.0	4.48
Th	234		0.96	0.41	0.4	2.40
GTh	234		1.28	0.58	0.0	3.88

Treatment of high grade outliers

Capping, or ‘top-cuts’, are applied to high grades in order to reduce the influence they may have on the estimate and prevent smearing high grades into adjacent blocks. High grades can be treated by applying a cap to the assay, in this case GTh and Th, values in the database based on an assessment of the histograms and log probability plots, but they can also be treated by applying a distance restriction on the grades in order to limit the influence of the very high grades at the kriging stage.

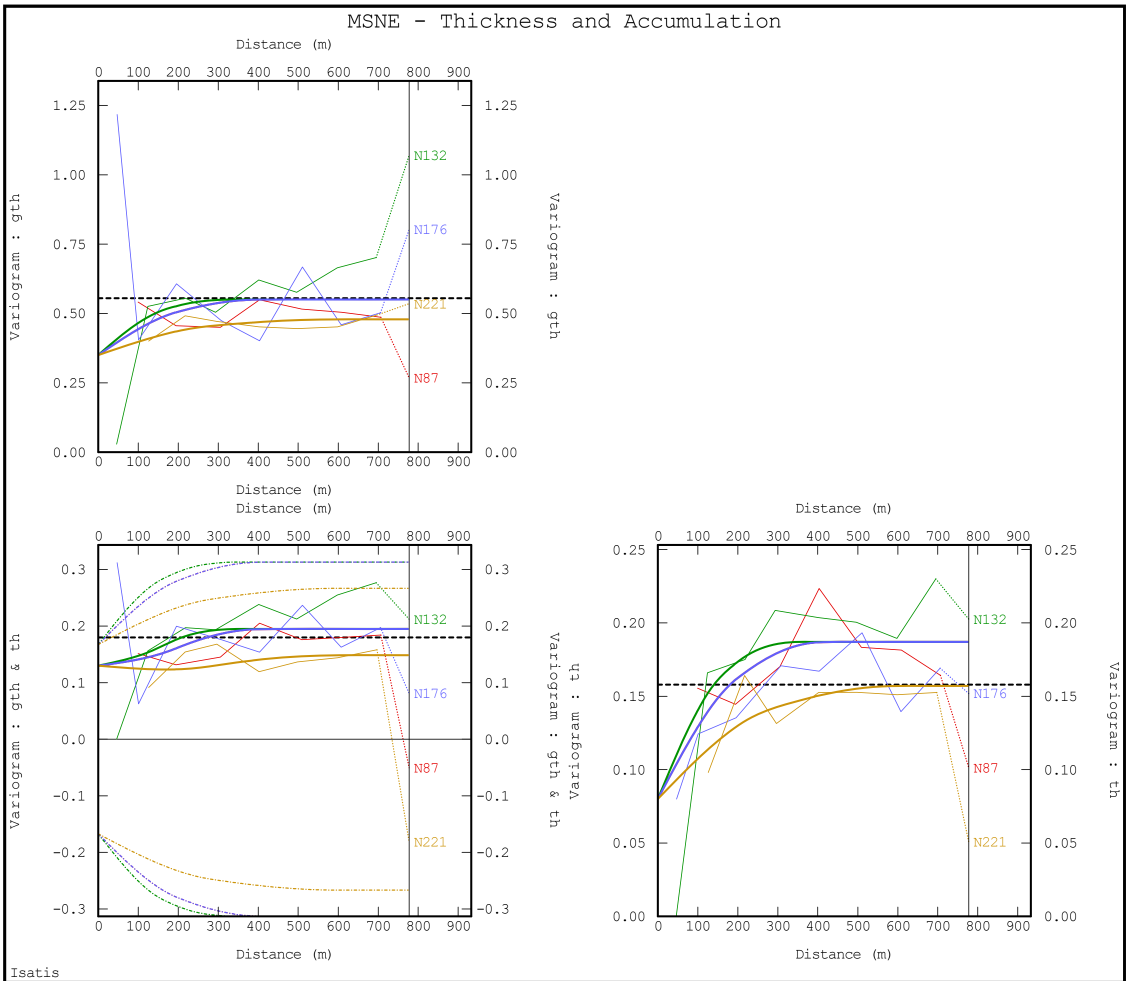
No capping or distance restrictions have been applied to the grade estimation of MSNE.

Density

There are no density measurements available for the MSNE deposit. The host lithology, and mineralisation is consistent with the M&M and Miriam deposits where density data is available. Due to the similarity, SRK feel it is appropriate to assign a density of 2.3 t/m^3 for the MSNE mineralisation.

14.8.5 Geostatistical Analysis

For the MSNE domain, grade continuity was investigated for components of Th and eU as co-variables. Variography has been completed on linearly combined data, and the resultant Th, GTh and GTh-Th cross variograms are shown in Figure 14-102.




```
MSNE_data/impacts(Extended Poly 2012)
- Variable #1 : th
- Variable #2 : gth
Variogram : in 4 direction(s)
D1  : N87
D2  : N132
D3  : N176
D4  : N221

Model : 4 basic structure(s)
Global rotation = Azimuth=131.50 (Geologist)
S1  - Nugget effect
      Coregionalization matrix
             0.08        0.13
             0.13        0.35
S2  - Spherical -
      Ranges = ( 160.0000m, 280.0000m)
      Coregionalization matrix
          0.03141    -0.03736
         -0.03736     0.06066
S3  - Spherical -
      Ranges = ( 350.0000m, 600.0000m)
      Coregionalization matrix
          0.04565     0.05577
          0.05577     0.06814
S4  - Spherical -
      Ranges = ( 270.0000m, N/A)
      Coregionalization matrix
             0.03     0.04642
          0.04642     0.07183
```

Figure 14-102: GTh and Th bivariate model for MSNE

14.8.6 Grade Interpolation

Resource estimation was completed using an unfolding technique in an area encompassing the modelled MSNE mineralisation with a final block model geometry and extents as presented in (Table 14-52). The block model is rotated to an azimuth of 176.5 to optimize the alignment of blocks with the drilling grid. The grade interpolation methodology is based on the following:

- Composited data were not capped and distance restrictions on high-grade populations were not applied as described in Section 14.8.4;
- During estimation, domain boundaries for the selection of composites were treated as hard boundaries;
- The single pass search volumes were aligned according to the modelled variograms with dimension of 500 x 300 x 5 m;
- Minimum sample selection parameters were set at 1 with no maximum, with an optimum of 8 samples per sector;
- Block discretization of 10 x 10 x 1;
- GTh and Th were estimated by Co-Kriging and Grade eU was calculated by GTh/Th; and
- Density of 2.3 t/m^3 was assigned to all blocks.

Table 14-52: Block model parameters for MSNE

Parameter	X	Y	Z
Origin (block centroid)	338,330	2,055,645	344
Block Size	100	100	0.4
Number of Blocks	45	50	200

14.8.7 Block Model Validation

SRK validated the block model estimates through visual and statistical checks of block grades compared with composited drillhole data in plan and section. The validation is designed to confirm that the block model is representative of the underlying sample data at both local and global scales and to check that the estimate is not biased.

SRK believes that the block model reflects the current understanding of the distribution of mineralisation and is an acceptable basis for a Mineral Resource statement.

Visual Validation

SRK visually compared block grades to composite sample grades in plan view (unfolded space) to assess the correlation of the interpolated block model to the composite data on a local scale (Figure 14-103). SRK found that local block estimates were similar to nearby composite samples and that the block model reflected the patterns in grade variability without excessive lateral smearing of high grades.

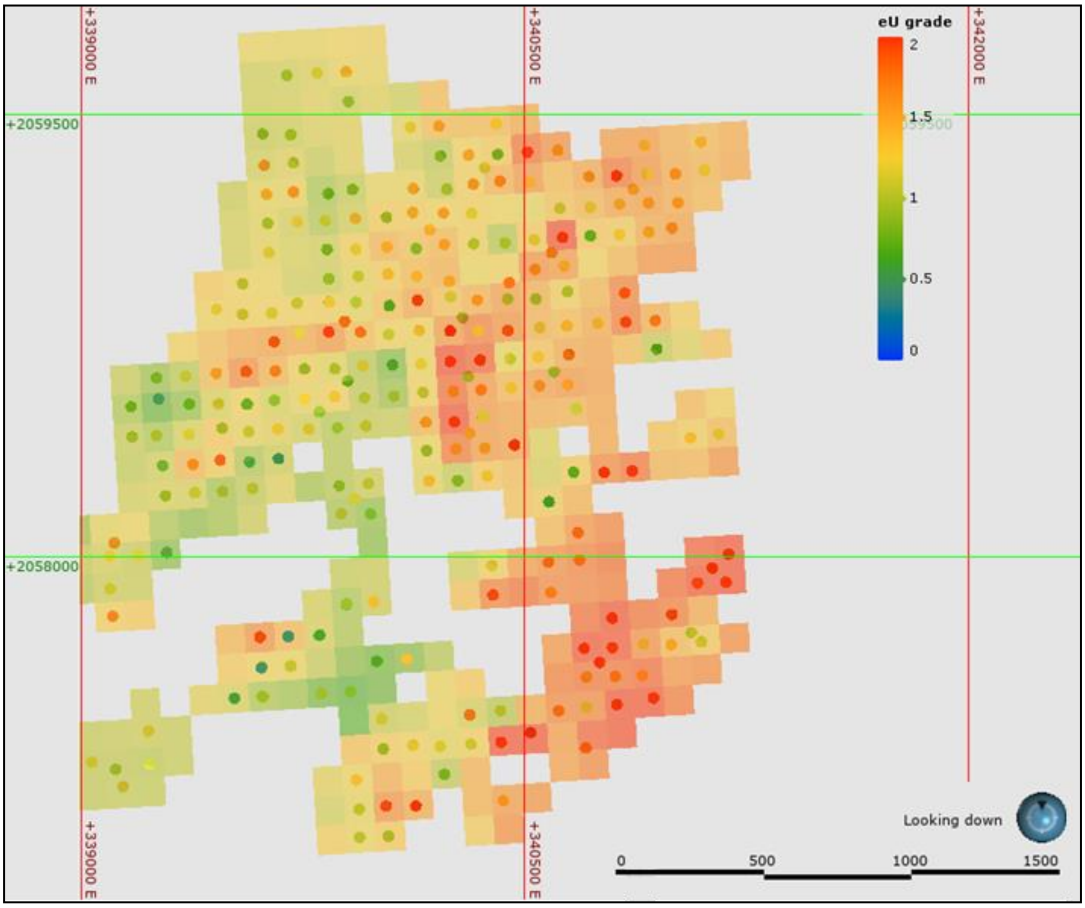


Figure 14-103: Plan views showing samples and CoK block model grades for GTh

Swath Plots

As part of the validation process swath plots were generated in the X (easting) and Y (northing) coordinate directions. Average grades for input samples and estimated blocks are calculated along a series of vertical slices (swaths) and plotted on graphs. In effect, a moving average is calculated for blocks and samples along three coordinate axes; this enables the fit of the block model to the underlying data to be assessed at an intermediate scale and the block model can be checked for spatial biases in estimated grade.

Figure 14-69 and Figure 14-70 show the swath plots for eU for the basal domain.

In general, the plots show a good correlation between the CoK block model and sample grades. There is no indication that any bias has been introduced, and the CoK block models display an adequate degree of smoothing with respect to the samples.

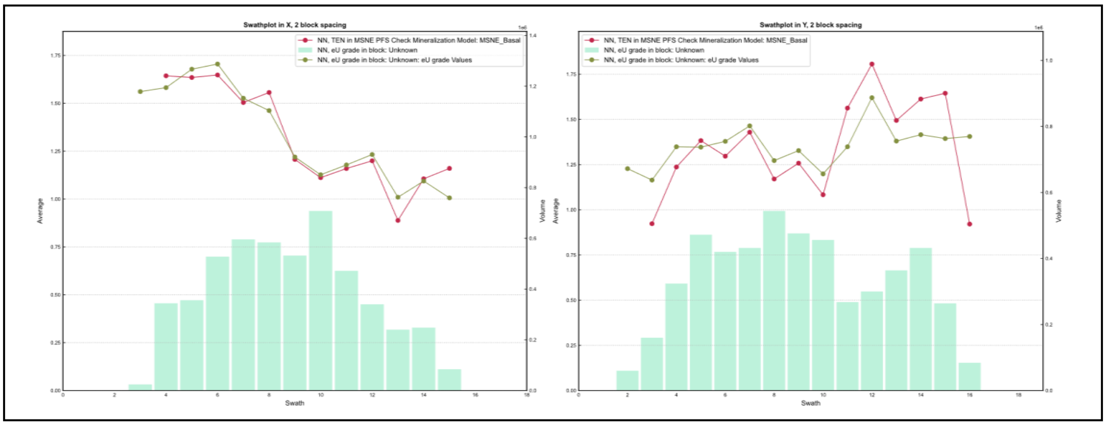


Figure 14-104: Swath plots for eU in the basal domain

14.8.8 Mineral Resource Classification

The Mineral Resources have been classified according to the definitions and guidelines of the CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Standard). Classification of MSNE is based on the quality of the Th estimated by Co-Kriging, and evaluated based on the slope of regression of the estimate. The estimation quality is somewhat improved in areas defined by the regular 100 x 100 m grid of drilling, and roughly corresponds to the area delineated by SRK as Indicated classification. SRK considers that this drilling density, along with consideration of data quality, geological continuity and complexity, and estimation quality is sufficient to classify the estimated blocks in the Indicated and Inferred categories. Classification is shown in Figure 14-105.

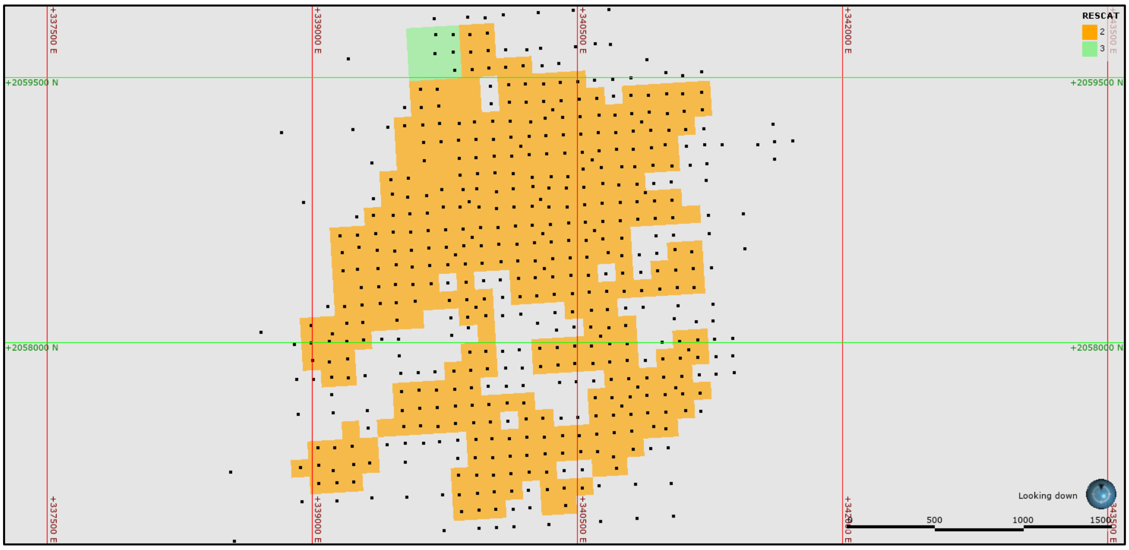


Figure 14-105: Classification (Indicated=green, Inferred=blue) for MSNE Reasonable Prospects for Eventual Economic Extraction

SRK has reported the Mineral Resource as that portion of the block model which has been included in an optimised underground mining volume, considering the appropriate mining, processing and general and administrative cost, geotechnical parameters and processing recoveries, as discussed with the Company and determined in the TEM (Table 14-10). SRK considers that the material reported as a Mineral Resource fulfils the requirement by the CIM Guidelines of having "…reasonable prospects for eventual economic extraction" (RPEEE), through underground mining, which is supported by a Feasibility Study for the project. The optimised underground mining outline is presented relative to the eU classified block model in Figure 14-97.

14.8.9 Mineral Resource Statement

The CIM Definition Standards defines a Mineral Resource as:

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."

The "reasonable prospects for eventual economic extraction" requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade taking into account extraction scenarios and processing recoveries.

The Mineral Resource Statement for the MSNE Deposit is presented in Table 14-32.

Table 14-53: Mineral Resource Statement for the MSNE Deposit effective July 01, 2022

Classification Category	Tonnage (Mt)	Grade		Metal	
		eU (kg/t)	eU_3O_8 (kg/t)	eU_3O_8 (Tonnes)	eU_3O_8 (M lbs)
Measured	-	-	-	-	-
Indicated	5.05	1.37	1.61	8,111	17.88
Measured & Indicated	5.05	1.37	1.61	8,111	17.88
Inferred	0.1	1.14	1.34	131	0.29

In reporting the Mineral Resource statement, SRK notes the following:

- *Mineral Resources have an effective date of July 01, 2022*
- *Mineral Resources are classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 29, 2019).*
- *Mineral Resources are reported here are Inclusive of Mineral Reserves and are reported as undiluted, with no mining recovery applied in the Statement.*
- *Technical and economic assumptions were agreed between SRK and GoviEx for mining factors (mining and processing costs) and processing factors (metal recovery, processing costs), which were used for to determine minimum mining width and cut-off grade.*
- *SRK considers there to be reasonable prospects for economic extraction by constraining the resources within contiguous volumes where grade diluted to a minimum thickness of 1.8 m is above 0.40 kg/t assuming a Uranium price of US$70/lb U_3O_8.*
- *Tonnages are reported in metric units, grades in kilograms-per-tonne (kg/t) and parts-per-million (ppm), and the contained metal in Tonnes and Million pounds (M lbs). Tonnages, grades, and contained metal totals are rounded appropriately.*

14.8.10 Sensitivity Analysis

The mineral resources of the MSNE deposit are sensitive to the selection of the reporting cut-off eU kg/t value. To illustrate this sensitivity, the block model quantities and grade estimates within the optimised underground outline to constrain the mineral resources are presented in Table 14-54 at different eU kg/t cut-off values. The reader is cautioned that the figures presented in these tables should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of the eU kg/t cut-off value. Figure 14-106 presents the sensitivity as a grade tonnage curve.

Table 14-54: Block model quantities and grade estimates within the optimised pit shell at Various eU kg/t cut-off values for MSNE

eU Cut-off (kg/t)	Tonnage (Mt)	Grade
		eU (kg/t)
0	5.15	1.36
0.1	5.15	1.36
0.22	5.15	1.36
0.3	5.15	1.36
0.4	5.15	1.36
0.5	5.15	1.36
0.6	5.15	1.36
0.7	5.14	1.36
0.8	5.05	1.37
0.9	4.92	1.38
1	4.61	1.41
1.1	4.02	1.46
1.2	3.35	1.53
1.3	2.40	1.64

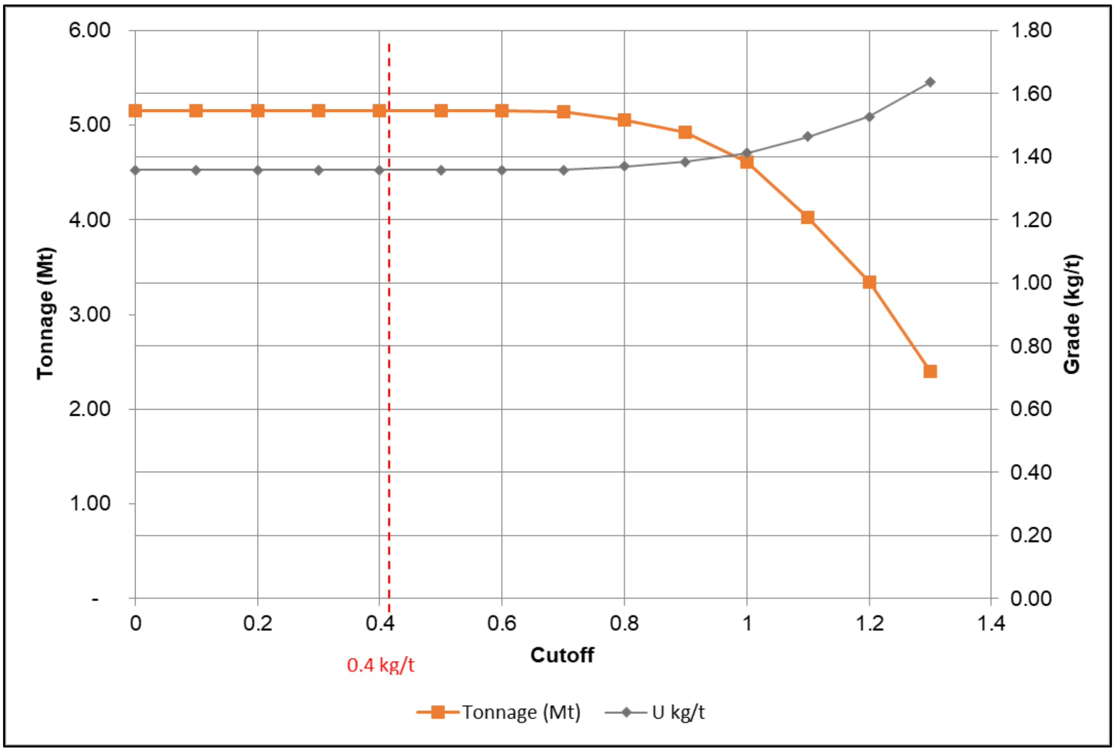


Figure 14-106: Grade tonnage curve for the MSNE deposit

14.8.11 Comparison with Previous Estimate

The Mineral Resources for MSNE were not updated in 2021 so there is no change to report to the March 02, 2016 MRE.

14.9 Summary of the Mineral Resources for the Madaouela Project

The Mineral Resources for the Madaouela Project, comprising the deposits Miriam, M&M, MSNE, MYVE, MSEE, and MSCE have been classified according to the definitions and guidelines of the CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Standard). SRK has reported the Mineral Resource as that portion of the block models which has been included in an optimised underground mining volume, or open pit mining volume in the case of Miriam, considering the appropriate mining, processing and general and administrative cost, geotechnical parameters and processing recoveries, as discussed with the Company and determined in the TEM (Table 14-10 and Table 14-22). SRK considers that the material reported as a Mineral Resource fulfils the requirement by the CIM Guidelines of having "…reasonable prospects for eventual economic extraction" (RPEEE), through underground and open pit mining techniques, which is supported by a Feasibility Study for the project.

A summary of the Mineral Resources for all deposits comprising the Madaouela Project are presented in Table 14-55 for eU and Table 14-56 for molybdenum. Note that the tonnages reported as Molybdenum Mineral Resources are contained entirely within the volume reported as Uranium Mineral Resources, and thus the tonnages are not additive.

Table 14-55: Summary of the Madaouela Uranium Mineral Resources, effective date July 01, 2022

Classification	Tonnes (Mt)	Grade		Metal	
		eU (kg/t)	eU_3O_8 (kg/t)	eU_3O_8 (t)	eU_3O_8 (Mlb)
Marianne/Marilyn					
Measured	3.00	1.50	1.77	5,257	11.6
Indicated	14.00	1.19	1.41	19,726	43.5
Inferred	3.10	0.96	1.14	3,477	7.7
Miriam					
Measured	10.70	0.67	0.79	8,384	18.5
Indicated	0.50	0.46	0.54	281	0.6
MSNE					
Indicated	5.05	1.37	1.61	8,111	17.9
Inferred	0.10	1.14	1.34	131	0.3
Maryvonne					
Indicated	1.23	1.52	1.79	2,195	4.8
Inferred	0.42	1.41	1.66	703	1.6
MSCE					
Inferred	1.16	1.15	1.35	1,571	3.5
MSEE					
Inferred	1.95	1.31	1.54	3,003	6.6
TOTAL MEASURED	13.70	0.85	1.00	13,641	30.1
TOTAL INDICATED	20.78	1.24	1.46	30,313	66.8
TOTAL INFERRED	6.73	1.12	1.33	8,885	19.6

Table 14-56: Summary of the Madaouela Molybdenum Mineral Resources, effective date July 01, 2022

Classification	Tonnes (Mt)	Grade	Metal
		Mo (ppm)	Mo (Tonnes)
Marianne/Marilyn			
Indicated	1.90	486.00	914
Inferred	4.90	388.00	1,897
Miriam			
Measured	10.70	101	1,076
Indicated	0.50	38	20
TOTAL MEASURED	10.70	101	1,076
TOTAL INDICATED	2.40	393	934
TOTAL INFERRED	4.90	388	1,897.00

14.10 Conclusions

SRK has reviewed the exploration data currently available for the Madaouela project. All items identified in the review by SRK, considered to be material to Mineral Resource estimates, were corrected by GoviEx and checked by SRK before use the in estimation. SRK is of the opinion that the project data adequately support the geological interpretations and models, and that the analytical and database quality is sufficient to support the use of the data in Mineral Resource estimation.

The quantity and quality of the lithological, grade (eU, U, and Mo), density, and collar and downhole survey data collected in the exploration drilling and mapping programs are sufficient to support Mineral Resource estimation. In the opinion of SRK, the sampling preparation, security and analytical procedures used by GoviEx are consistent with generally accepted industry best practices, for sandstone-hosted uranium deposits, and are sufficient to support Mineral Resource estimates.

The deposits of the project area are considered to be examples of sandstone-hosted uranium deposits. SRK has worked with GoviEx, with a holistic approach, to further develop the geologic model for the project. Resource estimation domains were designed based on a combination of structural, lithological, and grade (eU and Mo) data. SRK considers that the knowledge of the deposit settings, lithology and structural controls on mineralisation, and the mineralisation style and setting, is sufficient to support Mineral Resource estimation.

Mineral Resources for the Madaouela project have been estimated in conformity with generally accepted CIM "Estimation of Mineral Resource and Mineral Reserves Best Practices" Guidelines. The accuracy of spatial data is sufficient for definition of Inferred, Indicated and Measured Mineral Resources. The quality of the estimation is improved where the drilling grid is between 30 x 30 m and 40 x 40 m, which is where Measured Resources have been classified at Miriam and M&M respectively. The areas of the deposits drilled at wider spacings, typically 100 m x 100 m allows will need to be infilled to improve local accuracy of the models and upgrade Indicated and Inferred classified Resources.

Factors which may affect the Mineral Resource estimate include uranium commodity price and exchange rate assumptions, estimated metallurgical recoveries and geotechnical conditions.

There is exploration potential to discover new and expand upon known zones on the Madaouela property. Also, Mineral Resources presented here largely exclude "secondary" intersections higher up in the stratigraphic sequence, where the continuity of uranium mineralisation is more difficult to assess. Some of these areas are exploration targets and further exploration may identify zones that might give rise to future Mineral Resources.

15 MINERAL RESERVE ESTIMATES

The Qualified Persons accepting the professional responsibility for the open pit and underground Mineral Reserve estimates section are Ms. Colleen MacDougall, PEng (PEO#100530936) and Mr. Jurgen Fuykschot, MAusIMM (CP) (#306269). Ms. MacDougall undertook open pit mine planning work supporting the preparation of the Mineral Reserve Statement for the Miriam open pit. Mr. Fuykschot supervised the underground mine planning work supporting the preparation of the Mineral Reserve Statement for the Madaouela underground mine. Mineral Reserves are derived from Measured and Indicated Mineral Resources after applying economic parameters and other modifying factors following with the "CIM Definition Standards for Mineral Resources & Mineral Reserves (May 10, 2014) and the "CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines" (Nov 29, 2019). Inferred Mineral Resources were treated as waste in the life of mine (LoM) plan. Mineral Reserves are classified using the following criteria:

- Proven Mineral Reserves are the Measured Mineral Resources where development work for mining and information on processing, metallurgy and other relevant factors demonstrate that economic extraction is achievable. A Proven Mineral Reserve implies a high degree of confidence in the modifying factors.
- Probable Mineral Reserves are those Measured and Indicated Mineral Resources where development work for mining and information on processing/metallurgy and other relevant factors demonstrate that economic extraction is achievable. The confidence in the modifying factors applying to a Probable Mineral Reserve is lower than that applying to a Proven Mineral Reserve.

The Mineral Reserves for the Madaouela project consist of open pit Mineral Reserves at Miriam, and underground Mineral Reserves at M&M, MSNE and Maryvonne, with an effective date of July 01, 2022. The reference point at which the Mineral Reserve is identified is where the ore is delivered to the processing plant referred to as plant feed.

Project base case economic analysis presented in Section 22 shows that the Madaouela LoM plan founded on the Mineral Reserve estimates in Table 15-1 and Table 15-2 provides a positive present value of the net cash flow, confirming that the Mineral Reserves are economically viable, and that economic extraction can be justified.

The author is not aware of any additional mining, metallurgical, infrastructure, permitting, or other factors not presented in this report that could materially affect the Mineral Reserve estimate.

The Mineral Reserve estimate is presented in Table 15-1 for the open pit and Table 15-2 for the underground.

Table 15-1: Mineral Reserve Estimate for the Madaouela Project Miriam Open Pit Deposit, Niger, July 01, 2022

Classification	Quantity (kt)	U Grade (kg/t)	Mo Grade (ppm)	U Contained (t)	U_3O_8 Contained (Mlb)	Mo Contained (t)
Open Pit Miriam						
Proven	5,344	0.88	124.3	4,696	12.21	664
Probable	55	0.40	0.0	22	0.06	0
Sub-Total	**5,399**	**0.87**	**123.1**	**4,718**	**12.27**	**664**

Notes:

1. All figures are rounded to reflect the relative accuracy of the estimate and have been used to derive sub-totals, totals and weighted averages. Such estimates inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, SRK does not consider them to be material.
2. The standard adopted in respect of the reporting of Mineral Reserves for the Project, following the completion of required technical studies, is in accordance with the NI 43-101 guidelines and the 2014 CIM Definition Standards, and have an Effective Date of July 01, 2022.
3. The Open Pit Mineral Reserves are reported with engineered pit designs using a cut-off grade of 0.28 kg/t U, which is based on a selling price of US$55/lb U_3O_8, operating costs of US$33.48/t feed, recovery of 94.5 %, royalty of 9 % and transportation costs of 0.97/lb U_3O_8.
4. The Open Pit Mineral Reserves are derived from a regularized block model of 7.5 m x 7.5 m x 0.75 m and include an additional 2 % dilution and no mining loss.

Table 15-2: Mineral Reserve Estimate for the Underground Deposits, Madaouela Project, Niger, July 01, 2022

Classification	Quantity (kt)	U Grade (kg/t)	Mo Grade (ppm)	U Contained (t)	U_3O_8 Contained (Mlb)	Mo Contained (t)
Underground M&M						
Proven	3,149	1.06		3,353	8.72	
Probable	10,602	0.81	79	8,629	22.43	834
Sub-Total	**13,750**	**0.87**	**61**	**11,981**	31.15	**834**
Underground MSNE + Maryvonne						
Proven						
Probable	6,652	0.79		5,273	13.71	
Sub-Total	**6,652**	**0.79**		**5,273**	13.71	
Total						
Proven	3,149	1.06		3,353	8.72	
Probable	17,254	0.81	48	13,902	36.14	834
Total	**20,403**	**0.85**	**41**	**17,255**	44.86	**834**

Notes:

1. All figures are rounded to reflect the relative accuracy of the estimate and have been used to derive sub-totals, totals and weighted averages. Such estimates inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, SRK does not consider them to be material.
2. The Concession is wholly owned by and exploration is operated by GoviEx.
3. The standard adopted in respect of the reporting of Mineral Reserves for the Project, following the completion of required technical studies, is in accordance with the NI 43-101 guidelines and the 2014 CIM Definition Standards, and have an Effective Date of July 01, 2022.
4. The Underground Mineral Reserves are reported using a variable cut-off grade ranging between 0.5 and 0.6 kg U/t to account for the effect of ore sorting to reduce the dilution associated with varying seam thicknesses in different underground panels. This is based on a selling price of US$55/lb$U_3O_8$, operating costs of US$29.28/t feed, recovery of 94.5 % and transportation costs of 0.97/lb U_3O_8.

16 MINING METHODS

16.1 Open Pit Mining – Miriam

16.1.1 Mining Modifying Factors

Resource Model

An updated resource model for Miriam was completed in April 2022 by SRK, ‘31342 Miriam MRE 2021 075 V2.dm’. The model framework is shown in Table 16-1 and the model fields are shown in Table 16-2.

Table 16-1: Miriam Resource Model Framework

Type	Units	X	Y	Z
Model Origin	m	343050	2050000	249.5
Parent Cell Size	m	15	15	0.75
Number of Cells	#	127	194	334
Model Extents	m	344955	2052910	500
Rotation	°			315

Table 16-2: Miriam Resource Model Fields

Field	Type	Description
U_kgt	NUMERIC	Uranium grade (kg/tonne): U estimate from ordinary kriging
U_3O_8_kgt	NUMERIC	Uranium Oxide grade (kg/tonne): U estimate from ordinary kriging
Mo_ppm	NUMERIC	Mo grade (ppm)
DENSITY	NUMERIC	In situ dry bulk density (t/m^3): coded by lithology, all rock = 2.3, air = 0
CLASS	ALPHA/ CHARACTER	Mineral Resource classification categories: 1 = Measured 2 = Indicated 3 = Inferred 0 = Unclassified
LITHO	ALPHA/ CHARACTER	Lithology domains: Izegouande Tarat Tchinezogue - UTT Tchinezogue Guezouman – ALT Guezouman Talak
DOMAIN	ALPHA/ CHARACTER	Coding of estimation domains: Guez_HG – high-grade (>1.0 kg/t U model cut-off) in Guezouman Guez_LG – low-grade (>0.2 kg/t U model cut-off) in Guezouman Guez_Waste – waste (<0.2 kg/t model cut-off) in Guezouman Tchi_LG – low-grade (>0.2 kg/t U model cut-off) in Tchinezogue Tchi_Waste – waste (<0.2 kg/t U model cut-off) in Tchinezogue UNK – all other rock

Ore Loss & Dilution Assessment

The ore loss and dilution assessment was undertaken in two steps: (1) regularization to selective mining unit (SMU); and (2) adjacent block assessment.

The resource block model was regularized to an SMU 7.5 m (X) x 7.5 m (Y) x 0.75 m (Z). The regularization process involves combining the sub-blocks to the SMU size.

A block assessment was conducted which evaluates the adjacent blocks to identify isolated ore blocks, internal waste and measure the number of adjacent waste blocks (Figure 16-1). The block assessment was completed at a cut-off grade (CoG) of 0.28 kg/t uranium. A dilution skin was estimated based on the block size, the number of adjacent waste blocks, and a dilution skin of 0.6 m. The results of the block assessment within the ultimate pit design are shown in Table 16-3. The internal dilution and isolated ore blocks are minimal and have a negligible impact. The impact of the dilution skin is approximately 2 %.

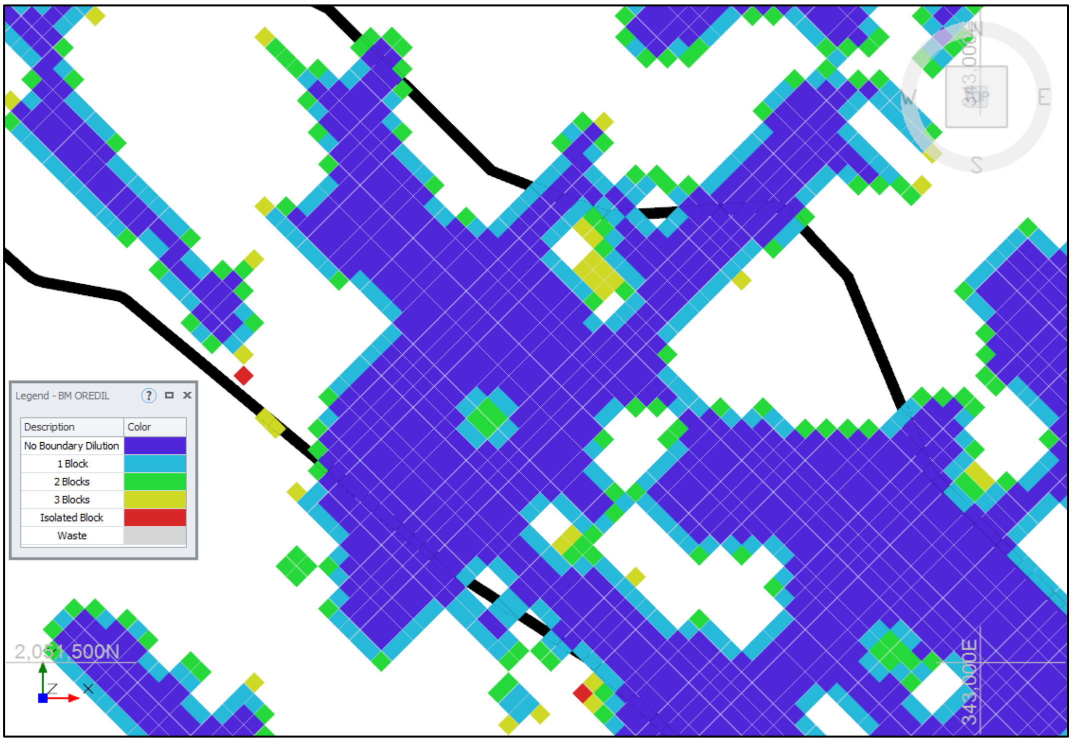


Figure 16-1: Miriam Block Assessment Plan View Cross-Section

Table 16-3: Miriam Block Assessment Results

Parameter	Quantity (kt)	U (kg/t)	U (t)
Mineral Resources			
Total	5,374	0.89	4,802
Regularized Model			
No Boundary Dilution	4,190	0.98	4,105
1 Block	720	0.63	456
2 Blocks	333	0.42	139
3 Blocks	42	0.36	15
Total	**5,285**	**0.89**	**4,715**
Internal Dilution & External Loss			
Internal Dilution	2	0.26	1
Isolated Blocks (Loss)	0	0.00	0
Total	**5,287**	**0.89**	**4,716**
Dilution Skin			
Dilution Skin	121	0.16	20
Total	**5,408**	**0.88**	**4,735**

An additional 2 % dilution and 0 % loss adjustment was applied to the regularized model inventory.

16.1.2 Pit Geotechnical

The pit slope geotechnical parameters applied in the pit optimization and designs for Miriam are shown in Table 16-4. A minimum of one 21.5 m ramp or berm was designed along each section of wall.

Table 16-4: Miriam Pit Slope Geotechnical Parameters

Zone	Bench Height (m)	Berm Width (m)	Face Angle (°)
Weathered	12	6.6	75
Fresh	12	6.6	85

16.1.3 Pit Optimization

Pit Optimization Parameters

The pit optimization parameters have been based on the PFS (SRK, 2021) and considered updated studies, including a strategic assessment completed in late 2021 by SRK. The parameters are summarised in Table 16-5. Only Measured and Indicated classified Mineral Resources were considered in the pit optimization. Molybdenum was not assigned any value in the pit optimization, as the Molybdenum grades were not available when the pit optimization was initially undertaken. Molybdenum value is not expected to have a significant impact on the pit optimization results.

Table 16-5: Miriam Pit Optimization Parameters

Parameters	Units	Value
Production		
Production Rate	Mtpa	1
Discount Rate	%	10
Geotechnical		
Weathered	°	51
Fresh	°	54
Mining Factors		
Dilution	%	2
Ore Loss	%	0
Limits		None
Processing		
Recovery U	%	94.5
Costs		
Base Mining	USD/t mined	3.05
Incremental Mining	USD/t/6m	0.008
Reference Bench	mRL	465
Rehandle	USD/t ore	0.03
Processing	USD/t ore	25.40
Infrastructure	USD/t ore	3.97
Tailings	USD/t ore	1.21
Water Management	USD/t ore	0.58
Environment & Social	USD/t ore	0.10
G&A	USD/t ore	2.19
Royalty	%	9.0
Product Transportation	USD/lb U_3O_8	0.97
Price		
U	USD/lb U_3O_8	55
Cut-off Grade		
Marginal Costs	USD/t ore	33.48
Cut-off Grade	kg/t U	0.28

G&A: General and administrative costs

Pit Optimization Results

The pit optimization results are shown in Table 16-6 for selected revenue factors (RF). The pit optimization price sensitivity results are shown in Figure 16-2. A discounted cashflow (DCF) analysis was undertaken on the optimization results to identify an optimal pit shell. The pit optimization software applies discounting based on the selected production rate. Three scenarios are evaluated:

- Best Case: Mine sequence based on mining each RF as a sequential pushback.
- Worst Case: Mine sequence based on a bench-by-bench mining approach with no pushbacks.
- Average Case: The average DCF between the Best and Worst cases. This generally provides a more realistic assessment of the DCF.

The pit optimization results show RF0.73 (USD 40 /lb) represents the highest 'Worst Case' DCF, while RF1.0 (USD 55 /lb) represents the highest 'Best Case' DCF. RF0.82 (USD 45 /lb) produces the highest 'Average Case' DCF. SRK selected the RF0.93 (USD 51 /lb) pit shell to maximize resources and achieve a mine life greater than 5 years.

Table 16-6: Miriam Pit Optimization Results

Results	Units	RF0.53 29 USD/lb U_3O_8	RF0.73 40 USD/lb U_3O_8	RF0.76 42 USD/lb U_3O_8	RF0.82 45 USD/lb U_3O_8	RF0.93 51 USD/lb U_3O_8	RF1.0 55 USD/lb U_3O_8
Inventory							
Total Material	Mt	22.1	32.3	34.3	41.1	49.9	53.9
ROM Ore	Mt	1.6	2.8	3.1	4.0	5.4	6.1
ROM U Contained	t U	2,411	3,346	3,508	4,046	4,769	5,070
ROM U Grade	kg/t U	1.48	1.19	1.15	1.02	0.88	0.83
ROM Waste	Mt	20.5	29.5	31.3	37.2	44.5	47.8
Strip Ratio	t:t	12.6	10.5	10.2	9.4	8.2	7.8
Processing							
Recovered U	t U	2,279	3,162	3,315	3,823	4,507	4,791
Recovery	%	94.5	94.5	94.5	94.5	94.5	94.5
Operating Costs							
Mining Cost	USDm	68.6	100.4	106.6	127.8	155.4	167.9
Mining Cost	USD/t mined	3.11	3.11	3.11	3.11	3.11	3.11
Mining Cost	USD/t ore	42.24	35.82	34.93	32.34	28.63	27.50
Mining Cost	USD/lb U_3O_8	11.6	12.2	12.4	12.9	13.3	13.5
Processing Cost	USDm	54	94	102	132	182	204
Processing Cost	USD/t ore	33.48	33.48	33.48	33.48	33.48	33.48
Processing Cost	USD/lb U_3O_8	9.18	11.42	11.86	13.32	15.51	16.41
Selling Cost	USDm	35	49	51	59	69	74
Selling Cost	USD/lb U_3O_8	5.92	5.92	5.92	5.92	5.92	5.92

Results	Units	RF0.53 29 USD/lb U_3O_8	RF0.73 40 USD/lb U_3O_8	RF0.76 42 USD/lb U_3O_8	RF0.82 45 USD/lb U_3O_8	RF0.93 51 USD/lb U_3O_8	RF1.0 55 USD/lb U_3O_8
Inventory							
Cashflow							
Revenue	USDm	326	452	474	547	644	685
Cashflow	USDm	168	209	214	228	238	239
Cash Cost	USD/lb U_3O_8	26.68	29.56	30.15	32.10	34.70	35.81
Profit Margin	USD/lb U_3O_8	28.32	25.44	24.85	22.90	20.30	19.19
DCF Best Case	USDm	157	191	194	204	210	211
DCF Average Case	USDm	153	178	180	183	178	172
DCF Worst Case	USDm	148	166	166	161	145	134
Mine Plan							
Production Rate	Mtpa	1.0	1.0	1.0	1.0	1.0	1.0
Mine Life	yrs	1.6	2.8	3.1	4.0	5.4	6.1

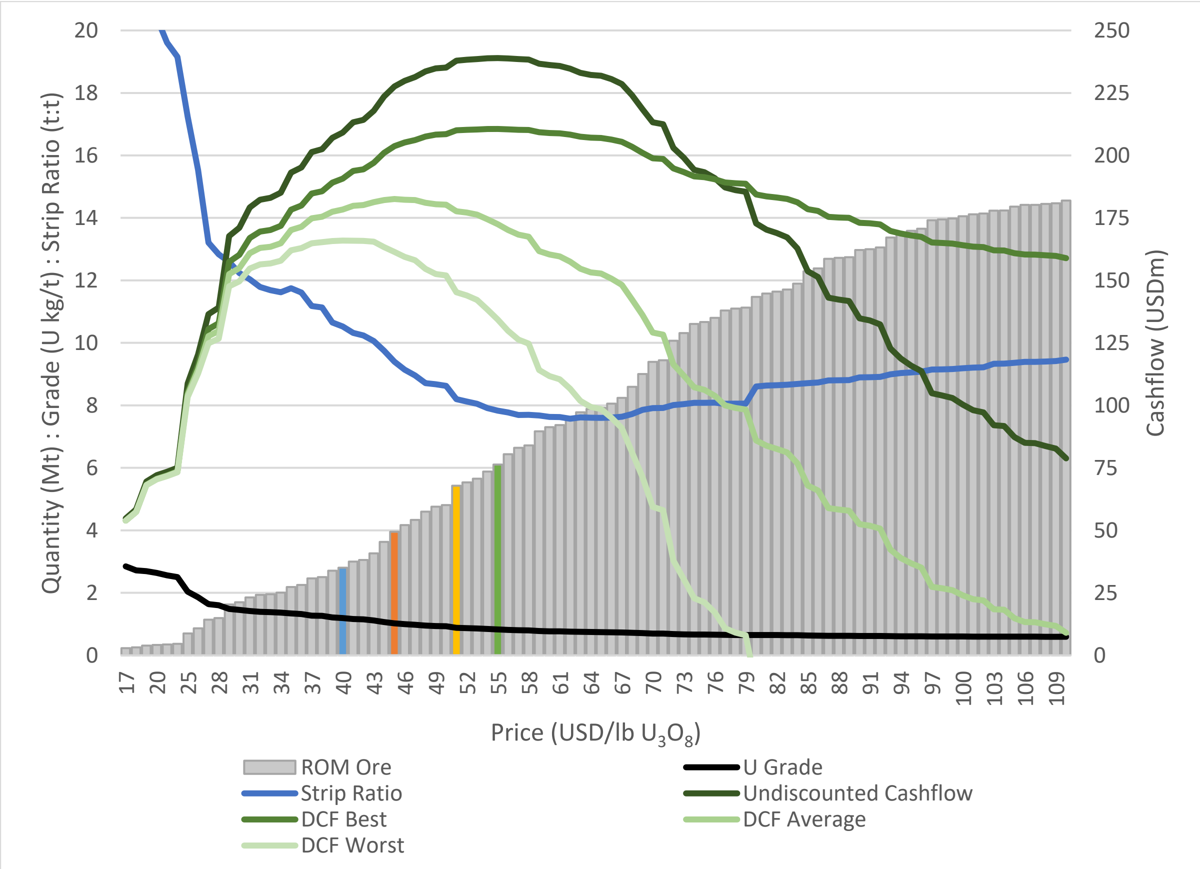


Figure 16-2: Miriam Pit Optimization Price Sensitivity

16.1.4 Mine Design

Pit Designs

The pit slope geotechnical parameters are shown in Table 16-4. The ramp width has been based on the Caterpillar (CAT) 777E haul truck. Road and ramps have been designed at a width of 21.5 m and a gradient of 10 %. The last two to three benches have single lane ramps with 16 m widths.

The ultimate pit design is shown in Figure 16-3. A comparison between the selected optimization pit shell and the ultimate pit design is shown in Figure 16-4 and Table 16-7. There is an increase in waste included in the final design, due to the 21.5 m ramps to accommodate CAT 777E haul trucks. A trade-off to assess small truck sizes indicated the additional waste was offset by expected lower operating costs by using the larger CAT 777E trucks. The differences between the design and shell are within acceptable tolerances.

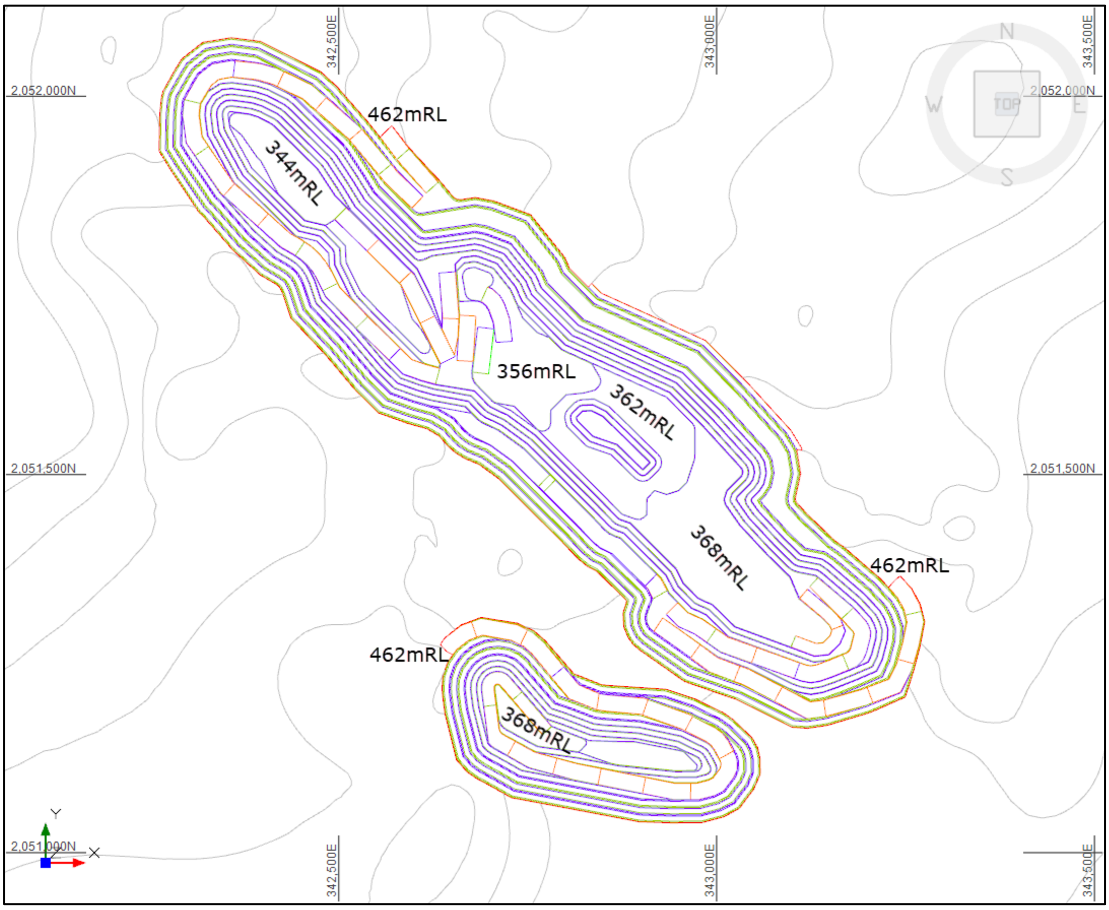


Figure 16-3: Miriam Pit Design

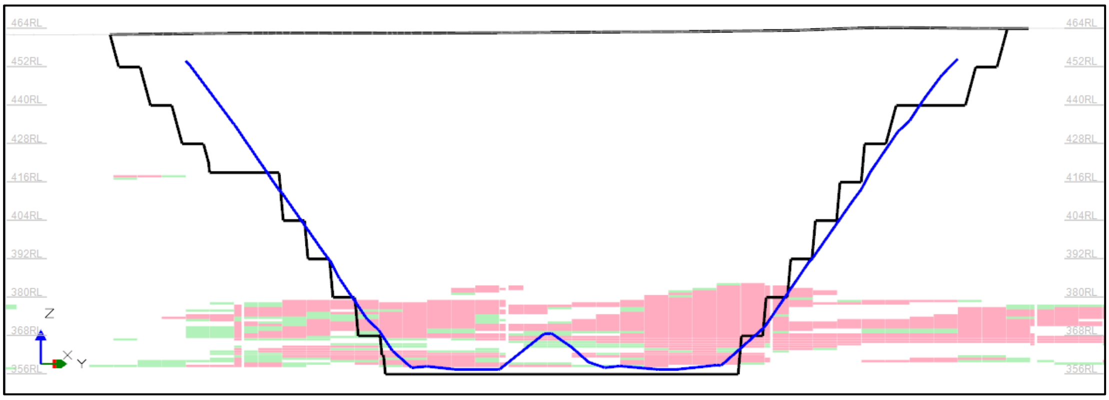


Figure 16-4: Comparison Cross Section of the Selected Pit Shell & Ultimate Pit Design

Table 16-7: Comparison of the Selected Pit Shell Inventory & Ultimate Pit Design

Pit Inventory	Units	Design	Selected Shell	Delta	Delta (%)
Total Material	kt	55,349	50,562	4,787	9.5%
Waste	kt	49,951	45,137	4,814	10.7%
Total Ore	kt	5,399	5,425	-26	-0.5%
U Grade	kg/t	0.87	0.88	0.00	-0.6%

The Miriam pit has been divided into six mining stages, starting in the shallower south-east and moving towards to the deeper north-west, with the separate south pit as the last stage (Figure 16-5). A starter ramp is established on the south wall in Stage 1. Stage 2 and Stage 3 have initial access along the north wall. Once the stages reach the 416 mRL bench, access is re-established to the south ramp. Stage 4 access is from the north wall. Stage 5 access ramps along the north wall and exits on the north part of the pit. Stage 6 is south pit and exits in the west. The pit inventory by stage is shown in Table 16-8. The cut-off grade is 0.35 kg/t uranium for HG material, and 0.28 kg/t uranium for low grade (LG) material.

Table 16-8: Miriam Pit Inventory by Stage

Pit Inventory	Units	Total	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Total Material	kt	**55,349**	8,985	8,792	10,265	7,766	12,327	7,214
Waste	kt	**49,951**	8,052	7,878	9,009	6,946	11,270	6,796
Total Ore	kt	**5,399**	933	914	1,256	820	1,058	418
U Grade	kg/t	**0.87**	0.82	0.65	0.78	0.65	1.40	0.88
Mo Grade	ppm	**123.1**	50.8	49.7	113.7	110.9	227.2	233.1
High Grade	kt	**4,670**	803	770	1,081	686	960	371
U Grade	kg/t	**0.96**	0.90	0.72	0.86	0.71	1.51	0.96
Mo Grade	ppm	**129.2**	53.32	51.32	119.44	111.30	234.43	243.92
Low Grade	kt	**729**	130	144	175	134	98	47
U Grade	kg/t	**0.31**	0.31	0.31	0.31	0.31	0.31	0.31
Mo Grade	ppm	**84.0**	35.4	41.2	78.4	108.7	156.7	148.1
Strip Ratio	t:t	**9.3**	8.6	8.6	7.2	8.5	10.7	16.3

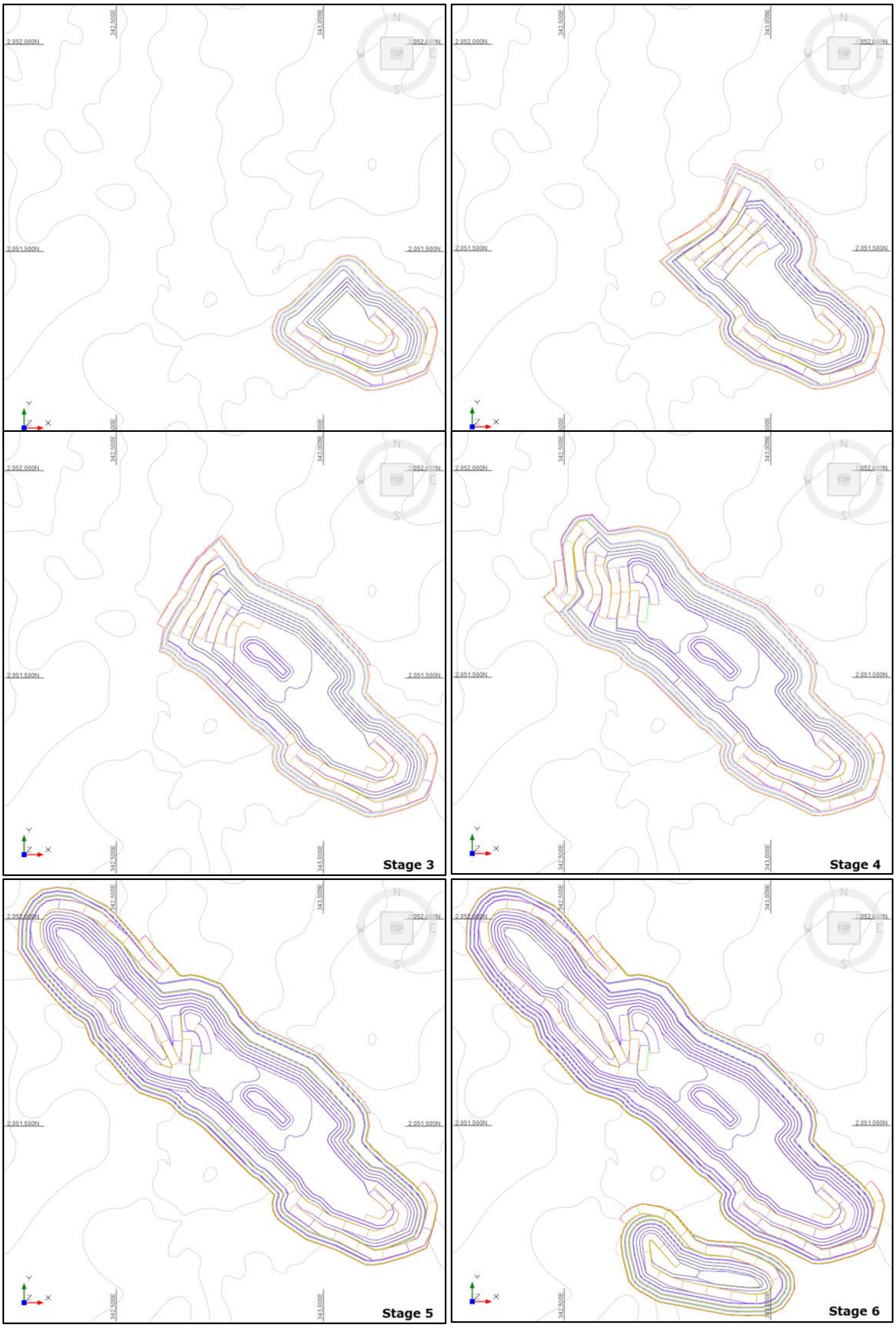


Figure 16-5: Plan view of Miriam Pit Stage Designs

Waste Rock Storage

The open pit mine waste storage areas are shown in Figure 16-6. The external rock storage areas were designed based on a rehabilitation angle of 2.5:1 (21.8°). The lift height is 20 m, rill angle is 35°, and the berm width is 22 m. Some waste is backfilled into the pit void at 35°. The pre-strip waste is used to build the tailings storage facility (TSF) berms as described in Section 24.7. The waste inventory is shown in Table 16-9, based on a swell factor of 40 %.

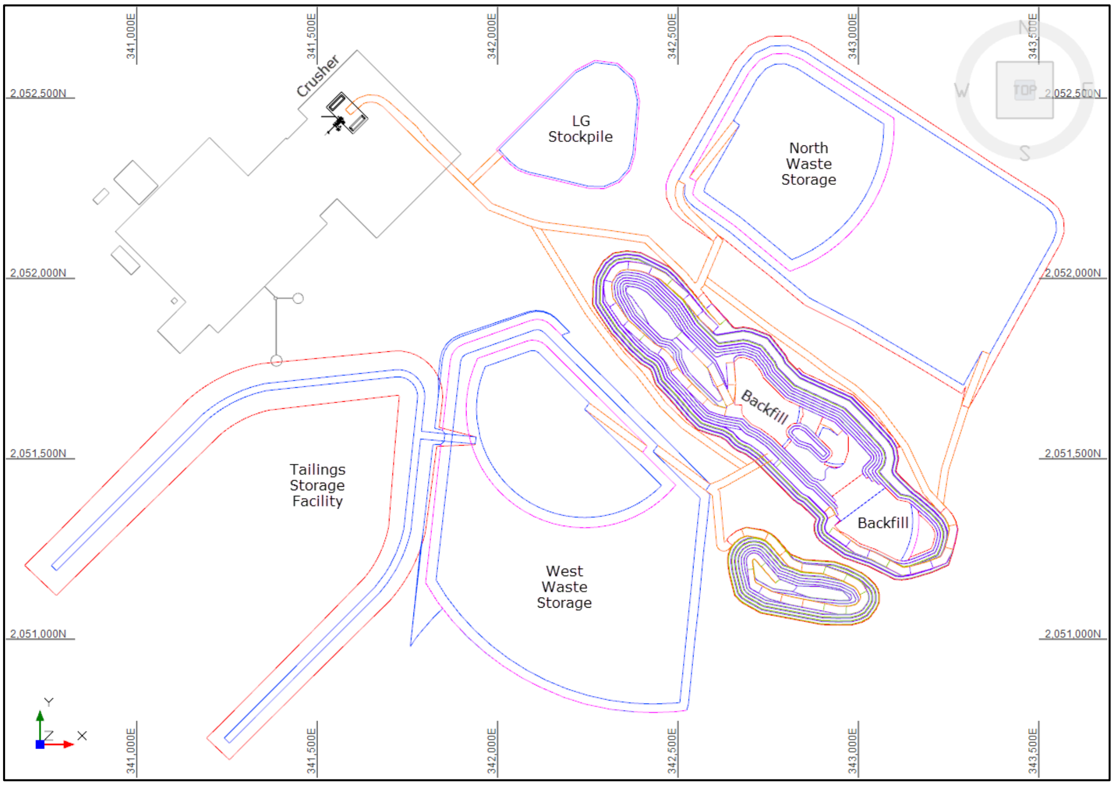


Figure 16-6: Plan view of Miriam Waste Storage Areas

Table 16-9: Miriam Waste Storage Capacity

Waste Storage Area	Quantity (Mt)	Volume (m^3)
Tailings Storage Berms	4.3	2.6
LG Stockpile Base	0.1	0.1
External North	19.8	12.1
External West	22.8	13.9
Backfill	2.9	1.8
Total	**50.0**	**30.5**

Low Grade Stockpile

The LG stockpile will provide storage for all 729 kt of LG. The stockpile has a single 6 m lift at a 35° rill angle.

16.1.5 Mine Schedule

The open pit mine schedule has been based on the following criteria:

- Monthly periods.

- Ore production rate: 1 Mtpa.
- Stockpile LG and feed towards the end of the open pit and underground mine life.
- Delay Stage 6 (South pit) until the end of the mine schedule.

The open pit material movement and plant feed schedule are shown in Figure 16-7. The mine schedule begins in Stage 1 in the south-east corner and progresses north. There is a 9-month pre-stripping period prior to ore production. The pre-stripping amounts to 7.6 Mt of waste with some stockpiled HG material. LG material is stockpiled and then fed to the crusher at the end of mine life. The stockpile balance and vertical advance rate are shown in Figure 16-8 and Figure 16-9 respectively. The annual vertical advance rate reaches 7 benches in Stage 3 and all other Stages have been limited to 6 benches per annum.

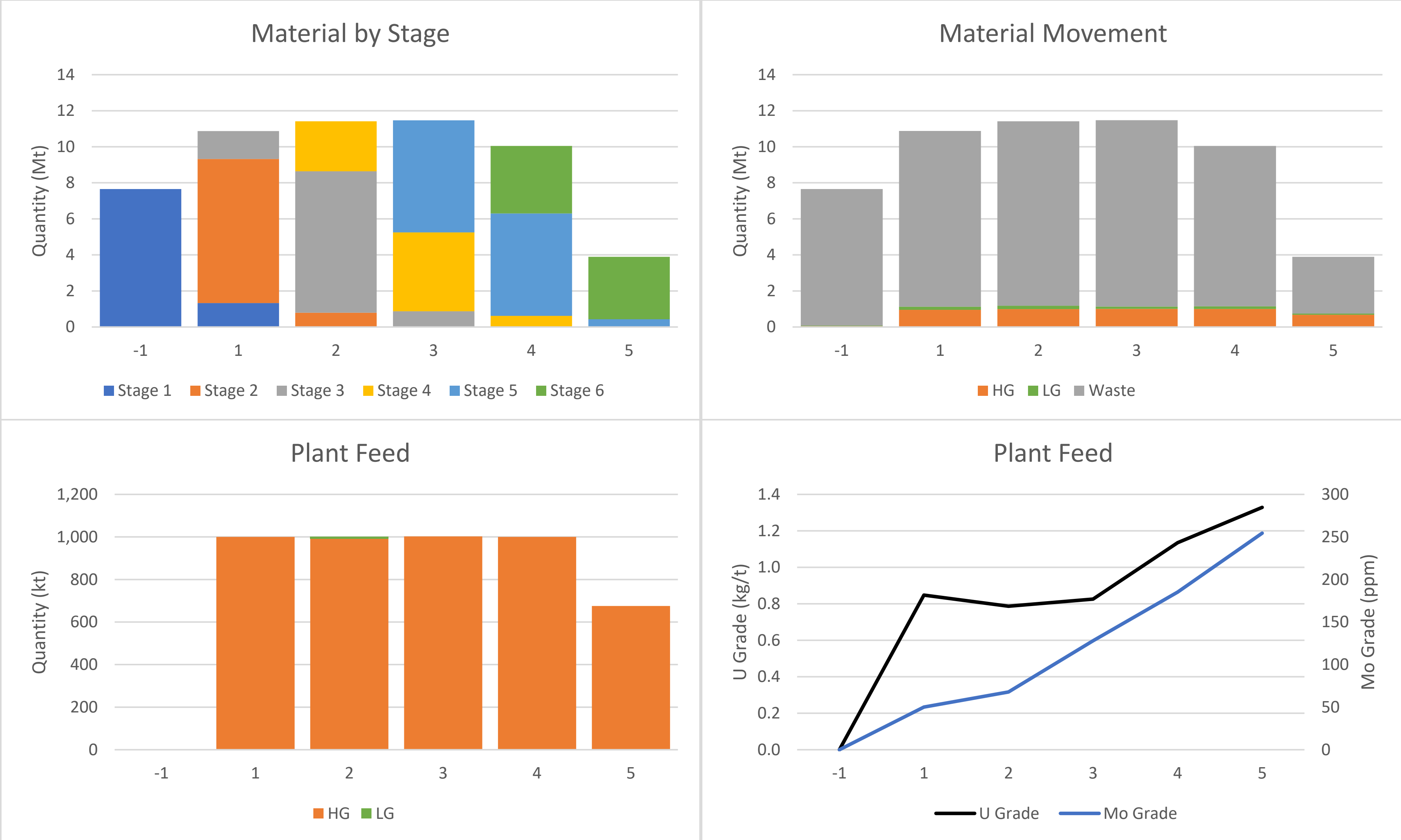


Figure 16-7: Miriam Annual Mine Schedule

Table 16-10: Miriam Mine Schedule

Mining Schedule	Units	Total	-1	1	2	3	4	5
From Pit								
Total Material	kt	**55,349**	7,657	10,874	11,411	11,468	10,045	3,894
Waste	kt	**49,958**	7,584	9,752	10,233	10,340	8,901	3,149
Total Ore	kt	**5,399**	73	1,124	1,179	1,132	1,145	745
U Grade	kg/t	**0.87**	0.49	0.78	0.71	0.77	1.03	1.23
Mo Grade	ppm	**123.1**	18.0	49.0	66.3	126.0	177.4	246.9
High Grade	kt	**4,670**	48	953	991	1,003	1,000	676
U Grade	kg/t	**0.96**	0.59	0.86	0.79	0.83	1.13	1.33
Mo Grade	ppm	**129.2**	18.3	51.6	68.2	128.0	185.3	254.5
Low Grade	kt	**729**	25	171	189	129	145	70
U Grade	kg/t	**0.31**	0.31	0.31	0.31	0.31	0.31	0.31
Mo Grade	ppm	**84.0**	17.5	34.7	56.2	110.3	122.8	173.8
Strip Ratio	t:t	**9.3**	104.1	8.7	8.7	9.1	7.8	4.2
To Stockpile								
High Grade	kt	**48**	48			0		0
U Grade	kg/t	**0.59**	0.59			1.04		2.62
Mo Grade	ppm	**18.3**	18.3			165.9		440.8
Low Grade	kt	**729**	25	171	189	129	145	70
U Grade	kg/t	**0.31**	0.31	0.31	0.31	0.31	0.31	0.31
Mo Grade	ppm	**84.0**	17.5	34.7	56.3	110.3	122.8	173.8
Stockpile to Plant								
High Grade	kt	**48**		47	1	0	0	0
U Grade	kg/t	**0.59**		0.59	0.59	1.29	1.02	2.14
Mo Grade	ppm	**18.3**		18.3	18.4	138.8	179.4	367.7
Low Grade	kt							
U Grade	kg/t							
Mo Grade	ppm							
Stockpile Balance								
High Grade	kt		48	1	0	0		
U Grade	kg/t		0.59	0.59	1.56	0.00		
Mo Grade	ppm		18.3	18.3	108.8	0.0		
Low Grade	kt		25	195	376	505	651	720
U Grade	kg/t		0.31	0.31	0.31	0.31	0.31	0.31
Mo Grade	ppm		17.5	32.5	44.3	61.2	75.0	84.6
Plant Feed								
Total	kt	**4,678**		1,000	1,000	1,003	1,000	676
U Grade	kg/t	**0.96**		0.85	0.79	0.83	1.13	1.33
Mo Grade	ppm	**129.0**		50.0	67.9	128.0	185.3	254.5
High Grade	kt	**4,670**		1,000	991	1,003	1,000	676
U Grade	kg/t	**0.96**		0.85	0.79	0.83	1.13	1.33
Mo Grade	ppm	**129.2**		50.0	68.2	128.0	185.3	254.5
Low Grade	kt	**9**			9			
U Grade	kg/t	**0.31**			0.31			
Mo Grade	ppm	**36.5**			36.5			

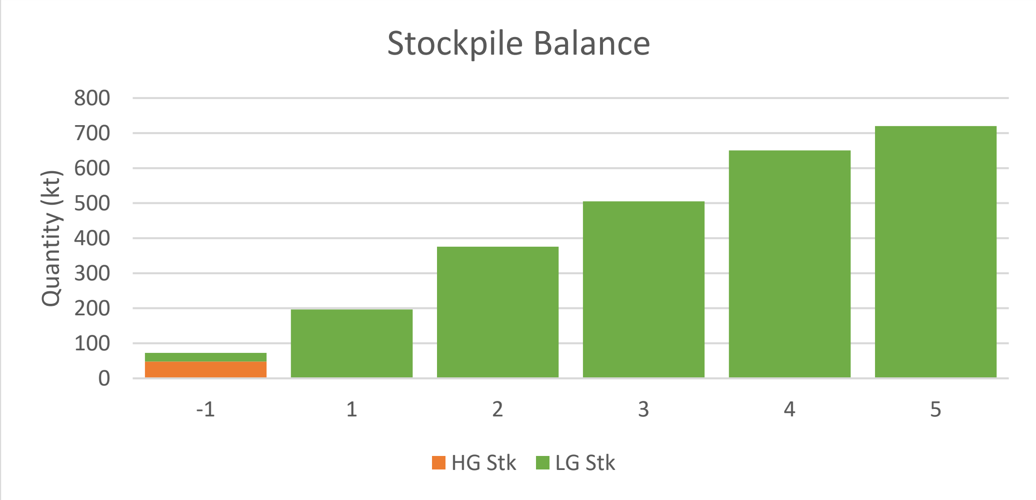


Figure 16-8: Miriam Stockpile Balance

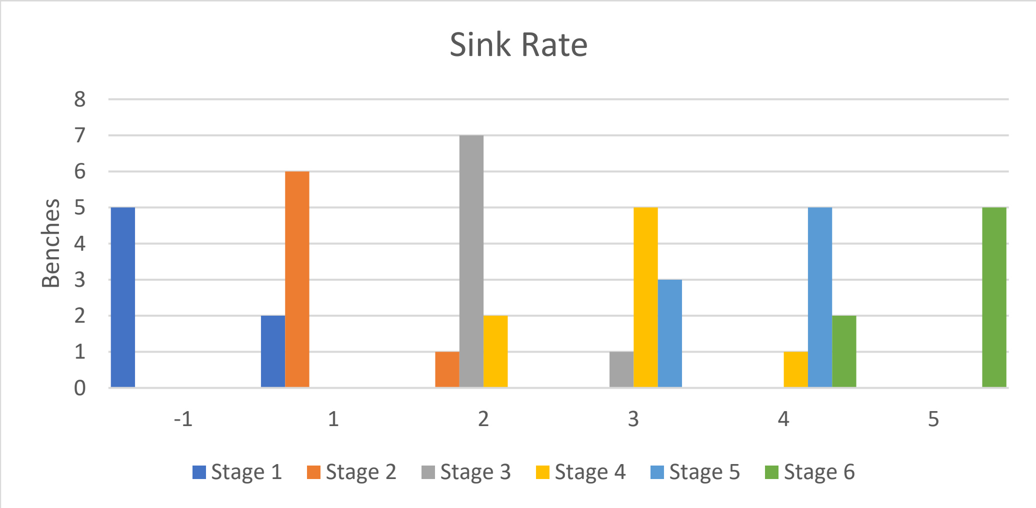


Figure 16-9: Miriam Pit Vertical Advance Rate

16.1.6 Operating Strategy

The Miriam open pit mine will be a conventional drill, blast, truck and shovel operation. The mining operation work pattern will follow similar operations in the area, which include two 9 hour mining shifts, with one 6 hour maintenance shift. There will be three mine operations crews and two maintenance crews. The mine is planned to be in operation for 350 days per year.

It is planned that all open pit material will require drilling and blasting. Drilling and blasting will be undertaken on 12 m benches in the waste for the upper benches above the orebody. Within the orebody, both ore and waste will be drilled and blasted on 6 m benches. The ultimate pit walls will be pre-split on 12 m benches. Infill drilling will be undertaken on 24 m benches. All blasting activities will be undertaken by a contractor.

Loading will be undertaken in a similar approach to nearby operations, on 6 m benches with mining to the orebody contacts, down to 0.75 m flitches in ore where required for grade control. Two 12 m^3 excavators will be paired with 91 t haul trucks in the pit, with a 6.4 m^3 front-end loader on the stockpiles and for backup in the pit.

Most HG material is direct fed to the crusher, with an expected 10 % ROM rehandle. 1 % of HG is stockpiled short-term due to the mine planning objectives. Almost all LG material is stockpiled up to 720 kt, and fed to the crusher in batches over the last two years of the mine life.

Water management for the Miriam pit is described in Section 16.2.

16.1.7 Equipment & Labour

The following equipment list (Table 16-11) specified the planned open pit mining equipment. Although this study has used various makes and models of equipment, this report does not recommend one particular manufacturer or equipment model over any others. Where specific equipment models or manufacturers have been referred to, it is merely to acknowledge where information has been derived, or to provide the reader with an example of the type of equipment being discussed. The equipment trade-off decisions were based on the CAT equipment.

Table 16-11: Miriam Mining Equipment List

Equipment	Make	Model	Description
Primary Shovel	CAT	6020B	12 m^3 backhoe excavator
Stock Loader	CAT	988	6.4 m^3 front end loader
Primary Truck	CAT	777E	91 t haul truck
Primary Drill	Epiroc	FlexiROC D65 10LF	Down-the-hole drill 110 to 229 mm
Secondary Drill	Epiroc	FlexiROC D60 10LF	Down-the-hole drill 110 to 178 mm
Track Dozer	CAT	D8	Track Dozer 300 hp
Wheel Dozer	CAT	834K	Wheel dozer
Wheel Loader	CAT	962	Wheel loader
Tire Handler	CAT	TH417	Tire handler
Grader	CAT	14M	Motor grader 240 hp, 4.2 m
Rockbreaker	CAT	H160	Hammer for Hex 374 or 349
Water Truck	Komatsu	HD465-7R WT	HD465 chassis + Mega Tank MTT13 (49 m^3)
Fuel/Lube Truck	Komatsu	HM400-3R ST	Fuel and lubricant mobile truck

The mining equipment operating time has been developed from first principles, based on mechanical losses, operating standby and operational delays and is shown in Table 16-12. Mechanical availability during the mining shifts is expected to be high as the planned maintenance occurs during the 6-hour maintenance shift.

Table 16-12: Miriam Mining Equipment Operating Time

Equipment List	Availability (%)	Operating Time (hr/yr)	Use of Availability (%)	Direct Operating Time (hr/yr)	Operating Efficiency (%)	Effective Utilisation (%)
Primary Shovel	95	5,257	88	4,207	80	67
Stock Loader	95	5,257	88	3,157	60	50
Primary Truck	95	5,257	88	4,550	87	72
Primary Drill	95	5,257	88	4,375	83	69
Secondary Drill	95	5,257	88	4,375	83	69
Track Dozer	95	4,592	77	3,360	73	53
Wheel Dozer	95	3,927	66	2,695	69	43
Wheel Loader	95	3,927	66	3,045	78	48
Tire Handler	95	3,927	66	3,220	82	51
Grader	95	4,592	77	3,885	85	62
Rockbreaker	95	2,597	43	1,890	73	30
Water Truck	95	4,592	77	2,611	57	41
Fuel/Lube Truck	95	3,595	60	3,063	85	49
Lighting Plant	95	1,944	32	1,587	82	25
Light Vehicle	95	1,944	32	1,587	82	25

The loading productivity of the excavators is 1,500 t per direct operating hour (doh) or 1,200 t per machine operating hour (op hr). Haulage travel times were estimated in Deswik's LHS module. A haulage network consisting of design strings was used to represent in-pit haulage, pit ramps, ex-pit or backfill haulage, and on-dump haulage. This network was used to estimate haulage distances and travel times between mining solids, crusher, external waste dump blocks, and backfill blocks. The maximum haulage gradient was limited to 10 %. The rolling resistance was estimated at 3.0 %. The average haulage cycle times are shown in Figure 16-10.

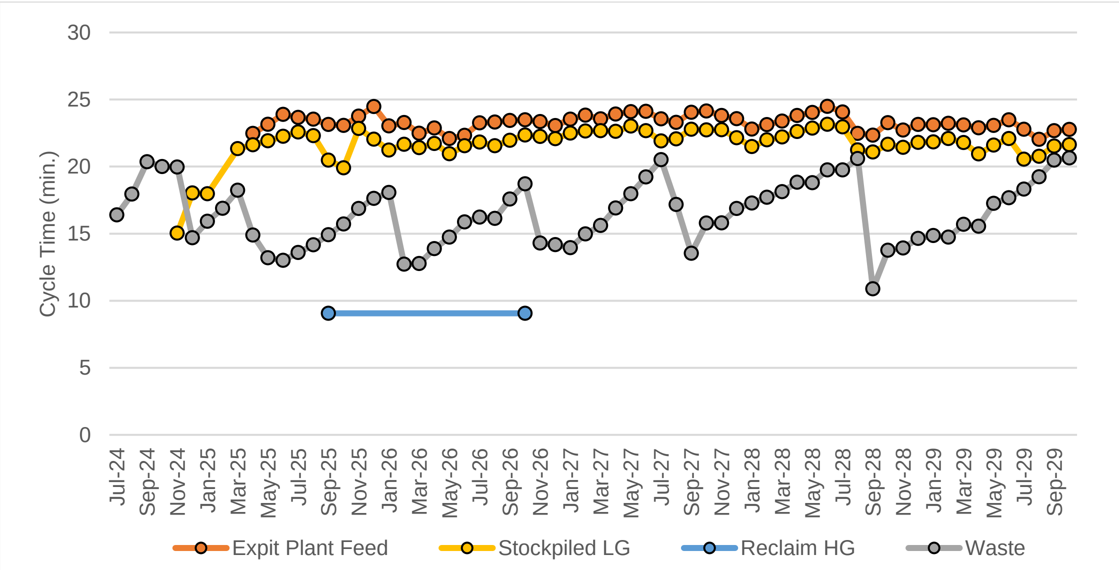


Figure 16-10: Miriam Haulage Cycle Times

The mining equipment estimated at the Miriam open pit are shown in Table 16-13. The Wheel Loader is purchased and used from Y-2 for use in the early works required at the TSF.

Table 16-13: Miriam Mining Equipment Annual Requirements

Equipment	Units	Maximum	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5
Primary Shovel	(#)	**2**	-	2	2	2	2	2	2
Stock Loader	(#)	**1**	-	-	1	1	1	1	1
Primary Truck	(#)	**9**	-	8	8	9	9	9	7
Primary Drill	(#)	**1**	-	1	1	1	1	1	1
Secondary Drill	(#)	**2**	-	2	2	2	2	2	2
Track Dozer	(#)	**2**	-	1	2	2	2	2	2
Wheel Dozer	(#)	**1**	-	1	1	1	1	1	1
Wheel Loader	(#)	**1**	1	1	1	1	1	1	1
Tire Handler	(#)	**1**	-	1	1	1	1	1	1
Grader	(#)	**1**	-	1	1	1	1	1	1
Rockbreaker	(#)	**1**	-	1	1	1	1	1	1
Water Truck	(#)	**1**	-	1	1	1	1	1	1
Fuel/Lube Truck	(#)	**1**	-	1	1	1	1	1	1
Lighting Plant	(#)	**8**	-	6	8	8	8	8	7
Light Vehicle	(#)	**13**	-	13	13	13	13	13	12

The mining management and workforce estimated for the Miriam open pit is shown in Table 16-14.

Table 16-14: Miriam Mining Personnel Annual Requirements

Personnel Requirements	Maximum	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5
Total Mining	**142**	**14**	**130**	**139**	**142**	**142**	**142**	**127**
Mine Operations	**85**	**10**	**73**	**82**	**85**	**85**	**85**	**72**
Mine Manager	**1**	1	1	1	1	1	1	1
Mine Operations Superintendent	**1**	-	1	1	1	1	1	1
Mine Operations Supervisor	**3**	3	3	3	3	3	3	3
Production Engineer	**2**	-	2	2	2	2	2	2
Trainer	**1**	-	1	1	1	1	1	-
Truck Operators	**27**	-	24	24	27	27	27	21
Shovel Operators	**6**	-	6	6	6	6	6	6
Loader Operators	**3**	-	0	3	3	3	3	3
Track Dozer Operators	**6**	-	3	6	6	6	6	6
Ancillary Operators	**15**	3	15	15	15	15	15	15
Dispatch Operators	**3**	-	3	3	3	3	3	3
Drillers	**9**	-	9	9	9	9	9	6
Dewatering Crew	**2**	-	2	2	2	2	2	2
Mine Ops Coverage	**6**	3	3	6	6	6	6	3
Mine Maintenance	**28**	**4**	**28**	**28**	**28**	**28**	**28**	**26**
Maintenance Superintendent	**1**	-	1	1	1	1	1	1
Maintenance Supervisor	**2**	2	2	2	2	2	2	2
Maintenance Planner	**1**	-	1	1	1	1	1	1
Mechanic	**10**	2	10	10	10	10	10	8
Electrician	**4**	-	4	4	4	4	4	4
Welder	**4**	-	4	4	4	4	4	4
Drill Maintainer	**2**	-	2	2	2	2	2	2
Maintenance Assistants	**2**	-	2	2	2	2	2	2
Mine Maintenance Coverage	**2**	-	2	2	2	2	2	2
Technical Services	**29**	**-**	**29**	**29**	**29**	**29**	**29**	**29**
Technical Services Superintendent	**1**	-	1	1	1	1	1	1
Senior Mine Planning Engineer	**1**	-	1	1	1	1	1	1
Planning Engineer	**1**	-	1	1	1	1	1	1
Senior Mine Geologist	**1**	-	1	1	1	1	1	1
Mine Geologist	**2**	-	2	2	2	2	2	2
Samplers	**9**	-	9	9	9	9	9	9
Geology Technicians	**9**	-	9	9	9	9	9	9
Mine Surveyor	**2**	-	2	2	2	2	2	2
Surveyor Assistant	**2**	-	2	2	2	2	2	2
Administrative Assistant	**1**	-	1	1	1	1	1	1

16.1.8 Cost Estimate

A mining cost model has been developed to estimate the open pit mining capital and operating expenditures based on an owner-operation. The capital cost estimate has been completed to a FS level. The cost estimate is in USD and has been developed by SRK based on quotes obtained from local manufacturers and suppliers, SRK's internal cost database and the 2020-2021 Costmine database.

The Miriam open pit mining costs are based on the following:

- Exchange rates:
  - 650 XOF (West African CFA franc) to USD
  - 0.916 EUR to USD
- Diesel fuel price of 540 XOF/l (USD 0.87/l)

- No contingency applied to capital or operating costs
- All costs are exclusive of engineering, procurement, and contract management (EPCM).

The open pit mining capital cost estimate is shown in Table 16-15.

Table 16-15: Miriam Open Pit Mining Capital Cost Estimate

Capital Costs	Units	Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5
Equipment Capital	USDm	**24.9**	0.0	22.4	1.4	1.1	-	-	-
Blasting Contract	USDm	**0.3**	-	0.2	-	-	-	-	0.1
Miscellaneous	USDm	**3.2**	-	3.1	-	0.1	-	-	-
Total	**USDm**	**28.4**	**0.0**	**25.6**	**1.4**	**1.2**	-	-	**0.1**

The open pit mining operating cost estimate is shown in Table 16-16. The LG rehandle at the end of the mine life has assumed to be undertaken by contractor at a rate of USD 2.15/t.

Table 16-16: Miriam Open Pit Mining Operating Cost Estimate

Parameter	Units	Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5
Operating Costs	**USDm**	**114.1**	**-**	**14.8**	**21.5**	**22.0**	**23.2**	**21.9**	**10.6**
Labour	USDm	**9.6**	-	1.3	1.8	1.8	1.8	1.8	1.0
Maintenance	USDm	**17.0**	-	2.3	3.2	3.3	3.5	3.2	1.5
Explosives	USDm	**32.7**	-	4.0	6.1	6.1	6.5	6.5	3.3
Fuel	USDm	**19.9**	-	2.6	3.8	3.9	4.1	3.7	1.8
Lubricants	USDm	**17.9**	-	2.4	3.4	3.5	3.7	3.3	1.5
Tires	USDm	**8.7**	-	1.2	1.6	1.7	1.8	1.6	0.8
Wear Parts	USDm	**7.7**	-	0.9	1.5	1.5	1.6	1.6	0.6
Miscellaneous	USDm	**0.8**	-	0.1	0.1	0.1	0.1	0.1	0.1
Operating Costs	**USD/t**	**2.06**	**-**	**1.93**	**1.98**	**1.93**	**2.03**	**2.18**	**2.73**
Labour	USD/t	**0.17**	-	0.17	0.17	0.16	0.16	0.18	0.27
Maintenance	USD/t	**0.31**	-	0.29	0.29	0.29	0.31	0.32	0.38
Fuel	USD/t	**0.36**	-	0.34	0.35	0.34	0.36	0.37	0.45
Lubricants	USD/t	**0.32**	-	0.32	0.31	0.31	0.33	0.33	0.38
Tires	USD/t	**0.16**	-	0.15	0.15	0.15	0.16	0.16	0.21
Wear Parts	USD/t	**0.14**	-	0.11	0.14	0.13	0.14	0.16	0.16
Explosives	USD/t	**0.59**	-	0.53	0.56	0.54	0.57	0.65	0.85
Miscellaneous	USD/t	**0.01**	-	0.01	0.01	0.01	0.01	0.01	0.03

Parameter	Units	Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5
Operating Costs	**USDm**	**114.1**	**-**	**14.8**	**21.5**	**22.0**	**23.2**	**21.9**	**10.6**
Management	USDm	**5.7**	-	0.9	1.1	1.1	1.1	1.0	0.7
Loading	USDm	**14.9**	-	1.9	3.0	3.1	3.1	2.7	1.1
Hauling	USDm	**30.4**	-	4.4	5.5	6.0	6.6	5.6	2.3
Ancillary	USDm	**17.8**	-	2.2	3.3	3.3	3.4	3.3	2.1
Drilling	USDm	**11.5**	-	1.2	2.3	2.2	2.4	2.4	0.9
Blasting	USDm	**32.7**	-	4.0	6.1	6.1	6.5	6.5	3.3
Grade Control	USDm	**0.2**	-	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous	USDm	**0.8**	-	0.1	0.1	0.1	0.1	0.1	0.1
Operating Costs	**USD/t**	**2.06**	**-**	**1.93**	**1.98**	**1.93**	**2.03**	**2.18**	**2.73**
Management	USD/t	**0.10**	-	0.11	0.10	0.09	0.09	0.10	0.17
Loading	USD/t	**0.27**	-	0.25	0.27	0.27	0.27	0.27	0.29
Hauling	USD/t	**0.55**	-	0.57	0.51	0.52	0.57	0.56	0.60
Ancillary	USD/t	**0.32**	-	0.29	0.31	0.29	0.29	0.33	0.54
Drilling	USD/t	**0.21**	-	0.16	0.21	0.19	0.21	0.24	0.24
Blasting	USD/t	**0.59**	-	0.53	0.56	0.54	0.57	0.65	0.85
Grade Control	USD/t	**0.00**	-	0.00	0.00	0.00	0.00	0.00	0.01
Miscellaneous	USD/t	**0.01**	-	0.01	0.01	0.01	0.01	0.01	0.03

16.2 Open Pit Dewatering

16.2.1 Approach

Open pit dewatering for Miriam has been designed and costed to an FS level (±15 %). Pit dewatering systems should:

- ensure that groundwater inflows do not become a constraint to mining production;
- be simple, robust and easily scalable to adapt easily (either adding or removing capacity) to actual inflows, and;
- be able to pump "dirty" water therefore removing the need for in-line sediment ponds or lamellar thickeners.

16.2.2 Open Pit Dewatering at Miriam

16.2.3 Duty Pumping System

The basic design principle is the provision of sumps in the pit, with a pump to transfer water to the pit crest. Dewatering flow rates for Miriam have been determined from the site wide water balance which considers groundwater inflows and direct precipitation (SRK, 2022c). The average annual P10, P50 and P90 percentile dewatering rates are shown in Figure 16-11. The installed pumping capacity is 65 m^3/hr.

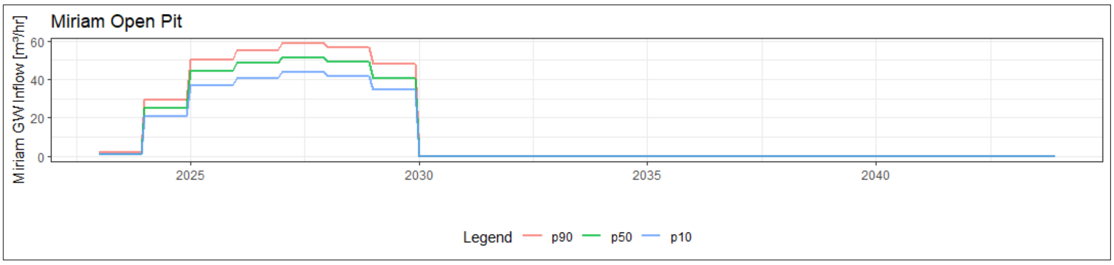


Figure 16-11: Miriam Dewatering Volume Estimate (SRK, 2022c)

The design has been based on a single make and model of pump and motor for the entire LOM. This eases operational requirements and decreases maintenance costs. The pump selected is a Cornell "Redi-Prime" dewatering self-priming centrifugal type pump Model 3419MXRP-EM18DB SAE 3 coupled to a Perkins four-cylinder, electric start, turbo charged engine model 1106D-E70TA. The pump and engine are trailer mounted with an integrated fuel tank, control panel, batteries, cables and central lifting beam.

The pump will draw water from the sump from a Centex floating intake pontoon drawing water from ±800 mm of the pond thereby reducing the volume of solids. Nevertheless, the pump is designed to handle solids up to 19 mm in size. HDPE pipe leading from the pits to the sediment pond will be utilised. 140 OD, PE100, PN25 pipe with an internal diameter of 100 mm has been selected for the dewatering of both pits. This includes the south pit where, although inflows will be much lower, the pump will start-stop at the same pumping rate periodically when the water level in the sump reaches a pre-determined height.

A schematic layout of the pipeline route between the pits and the settlement pond (SRK, 2022d) is presented in Figure 16-12. From the settlement pond water will be transferred to the plant for use in process.

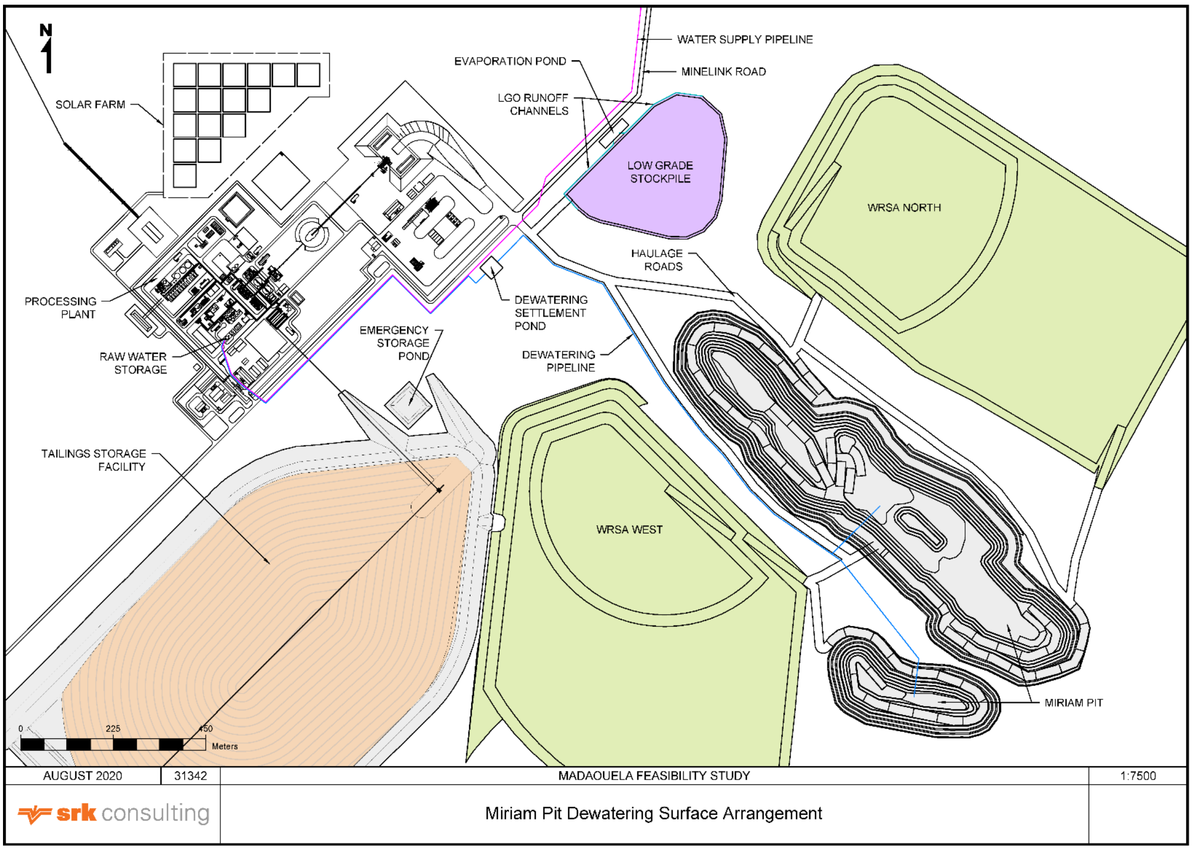


Figure 16-12: Miriam Pit Dewatering Surface Arrangement

16.2.4 Standby Pumping System

In addition to average precipitation and groundwater inflows, extreme rainfall events (>50mm/day) have the potential to impact mining operations. Table 16-17 shows the estimated number of days to pump out water from a given extreme rainfall event, which considers the addition of daily groundwater inflows along with potential evaporation from ponded water.

Table 16-17: Extreme rainfall magnitudes for a 24-hour storm with produced volume of water (m^3)

Return Period (years)	2	5	10	20	25	50	100
Rainfall (mm)	21	36	49	62	66	81	97
North Pit (m^3)	7,182	12,312	16,758	21,204	22,572	27,702	33,174
South Pit (m^3)	1,696	2,908	3,958	5,008	5,331	6,542	7,834
Days to pump out @ 100 m^3/hr							
Main	5	8	11	14	15	19	22
South	1	1	2	2	2	3	3

It is assumed that water from each event will be pumped from the pit utilising the existing pipeline arrangements. This results in a maximum flow rate of 100 m^3/hr for the entire system, comprised of 65 m^3/hr duty flow and 35 m^3/hr standby. It will take between 5 and 22 days to pump water from the main pit at 100 m^3/hr depending on the return period. This poses a risk to mine production where access to the deepest parts of the pits may be temporarily lost. Instead, mining may need to move other areas of the pits that are at greater elevation until water is pumped out and access can be regained.

Two standby pumps have been allowed for following the same duty pump specification. These will also provide cover for breakdown and/or maintenance of duty pumps.

Mine development might take place at multiple locations within the pit at any one time as the as the pit sizes increase in surface area, and the excavations deepen. Depending on operations the short-term mine planning process must allow for drainage towards the collection sump. Alternatively additional sumps may need to be excavated to pump the collected water to the main sump.

16.2.5 Sedimentation Pond (Miriam)

Dewatering water pumped from the Miriam pit will be sent to a dewatering pond nearby to the process plant as shown in Figure 16-12.

The dewatering pond is essentially a duplicate of the LG stockpile evaporation pond which is described in Section 18.9. The evaporation pond was originally sized to deal with dewatering water as well as runoff from the LG stockpile, therefore the pond for dewatering water only is oversized. For the purposes of the FS this has not been changed and it is recommended the pond is resized during detailed design.

16.2.6 Cost Estimation

Assumptions

For Miriam, the capital cost estimate has been completed to an FS level and has an estimated level of confidence of ±30 %.

The following assumptions and parameters apply to Miriam pit dewatering estimates, changes of which will affect the level of accuracy:

- 17 % installation factor for all equipment.
- 17 % factor for Preliminary and Generals (P and G's).
- Cost of delivery based on cost per container of USD 9,000 with a capacity of 20 tonnes. Equipment weights have been estimated.
- Project diesel cost of 0.95 USD/l where equipment is powered by a generator.
- Pump maintenance cost of 0.06 USD for every m^3 pumped.
- Excavation of the pit collection sumps will be considered as a mining operation and the associated costs are excluded.
- Labour costs for maintenance and operation of the dewatering systems are included in the mining section of this study.

Capital Costs

A summary of dewatering related capital costs is shown in Table 16-18. Total dewatering capital costs are nearly USD 0.8 M.

Table 16-18: Summary of dewatering related Capital Costs (USD)

Purchase Description	Unit	QTY	Rate	Rate Source	Cost	Markups	Total (USD)
Miriam Dewatering							
Cornell Model 3419MXRP-EM18DB SAE 3, supplied and delivered to Niger	No.	4*	100,000	Q	400,000	141,400	541,400
Suction intake pontoon, supplied and delivered to Niger	No.	4*	7,900	Q	31,600	10,924	42,524
140 OD / 100MM ID, PE100, PN25 HDPE	Mt.	3,500	18	Q	63,000	33,563	96,563
Valves and fittings for 140mmOD HDPE	Mt.	3,500	11	F	37,800	16,002	53,802
Dewatering settlement pond	No.	1	44,000	SW	44,000	14,960	58,960
TOTAL CAPITAL FOR MIRIAM DEWATERING							**793,249**

** Q = Quote obtained for the study.*

F = Estimated from manufacturer price lists or historical quotes from similar projects.

SW = Stormwater management study.

Operating Costs

A summary of dewatering related operating costs is summarised in Table 16-19. The cumulative cost of capital and operating after 20 years is nearly USD 2.4 M.

Table 16-19: Dewatering Costs and LOM summary (USD)

Year	Capital Costs (USD)	Operating Costs (USD)	Total Annual (USD)	Total Cumulative (USD)
1	793,249		793,249	793,249
2	-	255,523	255,523	1,048,773
3	-	255,523	255,523	1,304,296
4	-	255,523	255,523	1,559,819
5	-	255,523	255,523	1,815,343
6	-	276,198	276,198	2,091,541
7	-	276,198	276,198	2,367,739

16.3 Underground Mining M&M and MSNE-Maryvonne

16.3.1 Mining Method Selection

There are four main geological formations at Madaouela; Tchinezogue, Guezouman, Unite d'Akokan (UA) and Talak formations. The ore body sits in the Guezouman sandstones, a series of sub-horizontal sedimentary beds with varying mineralised thicknesses, with minor domes and some fault structures causing minor localised increases in bedding dip (up to a maximum of 20°) and slight increases in fracture frequency.

Following the previous studies and latest PFS work (SRK, April 2021), the underground mining method favoured for M&M and MSNE-Maryvonne is room and pillar mining. The main reasons for this selection are:

- Shallow depth tabular geometry of the ore body.
- Limited ore body dip variation and the dip is significantly below the limit for conventional steep-dip stoping methods.
- Possibility to leave pillars in low grade areas, i.e., selective mining.

- Mining height can be adjusted to follow the variable nature of the mineralisation.
- Flexibility to react to localised variations in the deposit.
- No need for specialised mining equipment with complex training requirements.
- Demonstrated as being an effective method in nearby operations and in similar conditions.
- Skilled labour available in the region and familiar with the method.

16.3.2 Mining Method Description

Room and pillar mining is generally applied in tabular deposits with shallow dips and deposits with a large footprint (up to several kilometres) and can enable simultaneous operations in multiple and independent active mining districts, which makes it suitable for M&M and MSNE.

Mechanical excavation has been excluded in the previous studies due to the abrasive nature of the deposit, and the high capital cost of the equipment. Therefore, a conventional drill and blast excavation is considered for both the main development accesses and production, with the mining rooms being developed using low profile equipment.

Rooms are developed within the mineral horizon to leave pillars in-situ to act primarily as regional support for the roof and overlying strata. The target mineral horizon is located within the Guezouman sandstones and consists of sandstone beds interspersed with thin bands of mineralisation.

In order to facilitate mining, a minimum mining height of 1.8 m is required to allow the mining equipment and workforce to undertake all necessary tasks. The 1.8 m high mining room is planned to extract all the mineralised bands within the Guezouman host but will, therefore, introduce portions of waste dilution material into the Run-of-Mine (RoM) ore where the mineralized layers are thinner.

The expected operating range for the mining equipment selected is from 1.8 m to 2.5 m seam thickness. In thicker areas of the deposit benching can be used to extract the mineral (Figure 16-13), however this will have a negligible impact as less than 1 % of the mineable area of the deposit has a mining height greater than 1.8 m.

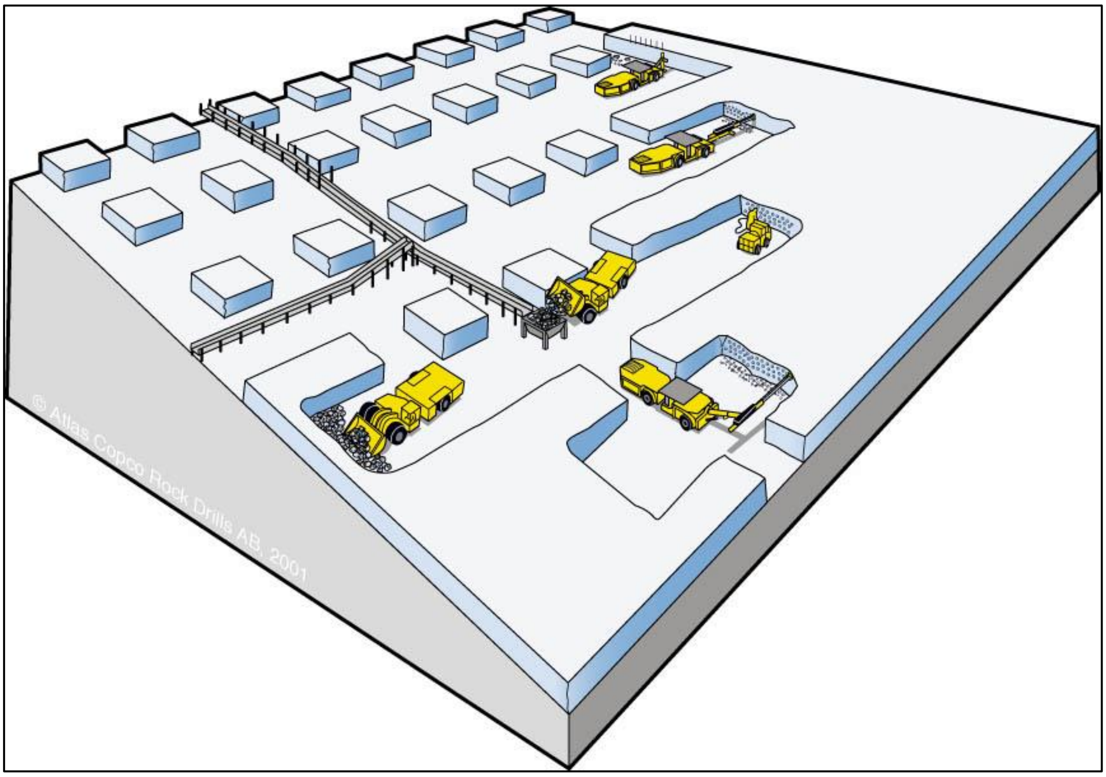


Figure 16-13: Schematic of room and pillar mining (Epiroc 2008)

The footwall of the mineralisation, known as the Talak Shale, has a clay like nature. Except for Miriam (open pit), the ore body mineralisation is formed along the Guezouman-Talak contact and concentrates on the edges of the UA[14] channel and along structures within the rock.

To account for the range of ore body dip angles (θ), SRK has proposed three variations of room and pillar mining method:

- θ<7° - traditional room and pillar mining (TR&P);
- 7°<θ<10° - apparent room and pillar mining (AR&P); and
- θ >10° - step room and pillar mining (SR&P).

AR&P is similar to TR&P, but the rooms and the pillars are angled at 45° to the dip direction to minimise the effective gradient of mining and follow what is known as an "apparent gradient". Although conventional conditions would allow for mining on gradients steeper than 7°, the clay like nature of the Talak shale footwall is expected to have a negative impact on roadway conditions and, as a result, a conservative approach was taken to limit the operating gradient to the acceptable 7°.

To simplify the transition between TR&P and AR&P, the panels are to be oriented at 45° to the main structures intersecting the Mineral Resources that create the zones of higher dips.

[14] Unité Akokan or Akokan Unit

A 10° cut-off was used for the SR&P as at this dip angle the gradient of development at 45° to the dip direction remains above 7°. The SR&P method is to be applied in the isolated zones of higher dip angles and, where this occurs, the room and pillar pattern will require re-orientation in line with the strike and dip of the geology. Step room and pillar is a variant of the traditional room and pillar method that allows the mining to take place at dips between 8° and 30°. Traditional room and pillar methods struggle in this environment as the gradients become too great for the efficient operation of production loaders (LHD) to clean the faces. Where the dip is greater than 30°, there is a risk of roadways deteriorating adjacent to the excavated rooms causing a safety hazard.

In SR&P, the orebody is developed along strike, with rooms mined connecting the parallel drives down-dip. Where geotechnical conditions allow, multiple drives can be developed along strike to increase the room width (Figure 16-14).

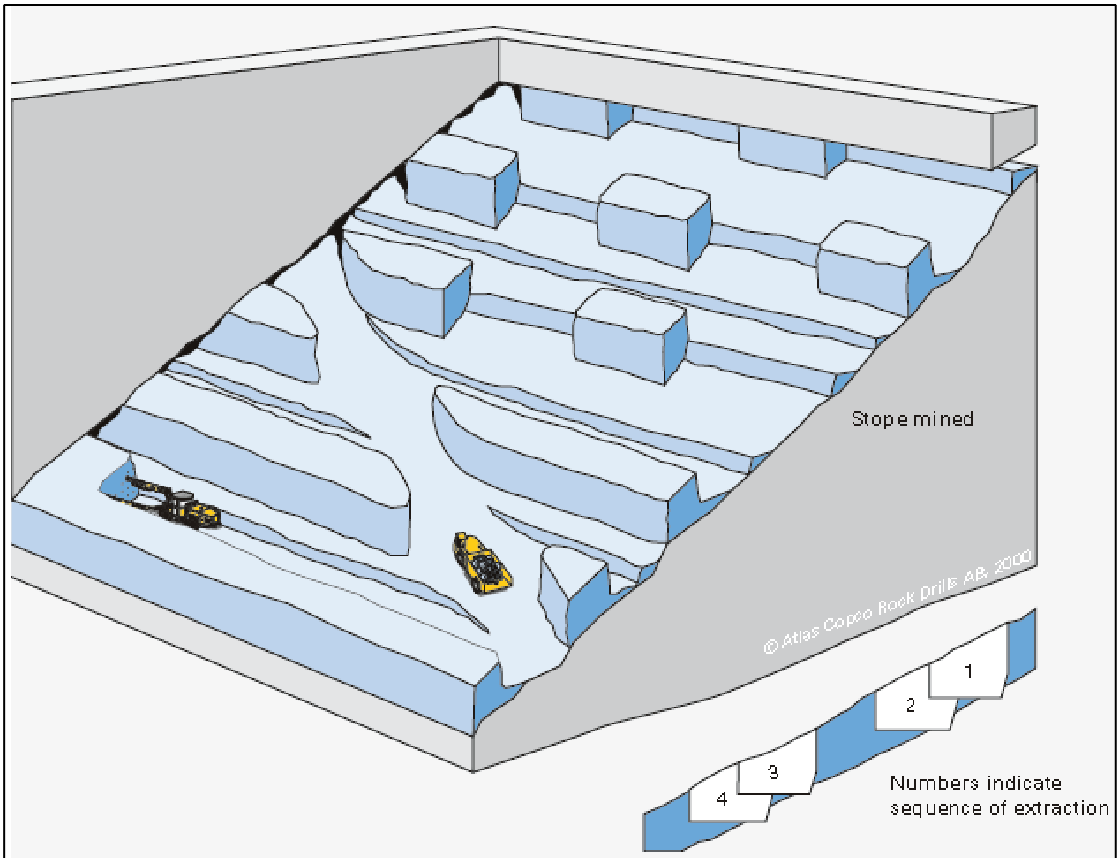


Figure 16-14: Schematic of step room and pillar mining (Atlas Copco 2008)

The advantage of SR&P is that it is compatible with other forms of room and pillar mining, allowing the same fleet of equipment to be used in varying conditions and sharing many of the advantages of TR&P. However, the method has greater mining losses and potentially dilution, due to the need to maintain a flat floor for tramming, and pillar recovery can be difficult. Most notably, the prevalent dip angle with this method is such that blasted pillar material tends not to rill naturally into the development below for loading, potentially requiring application of dedicated equipment.

Given the same orebody characteristics, the same mining approach for M&M and MSNE-Maryvonne has been assumed to allow the same labour skills and equipment to be applied across both operations.

16.3.3 Drill and Blast

The key advantage of drill and blast is its wide application in different types of ground, with drill and blast patterns being changeable to suit different rock types and ground conditions. The process is cyclical (rather than continuous) which enables equipment to be used to advance multiple headings concurrently. However, the advance rates of individual headings will depend on the number of activities in the production cycle, the duration of each activity, and the waiting time between activities (face utilisation).

Room and pillar production can be divided into two zones, swings and slabbing (also known as slashing). The swings are where there is only one free face, so mining is undertaken in a similar style as conventional development advance. Slabbing is where there are two free faces, so a benching-style blast pattern can be applied, reducing the required powder factors and increasing productivity. In a well scheduled room and pillar mine, around half of the production can be mined using slabbing.

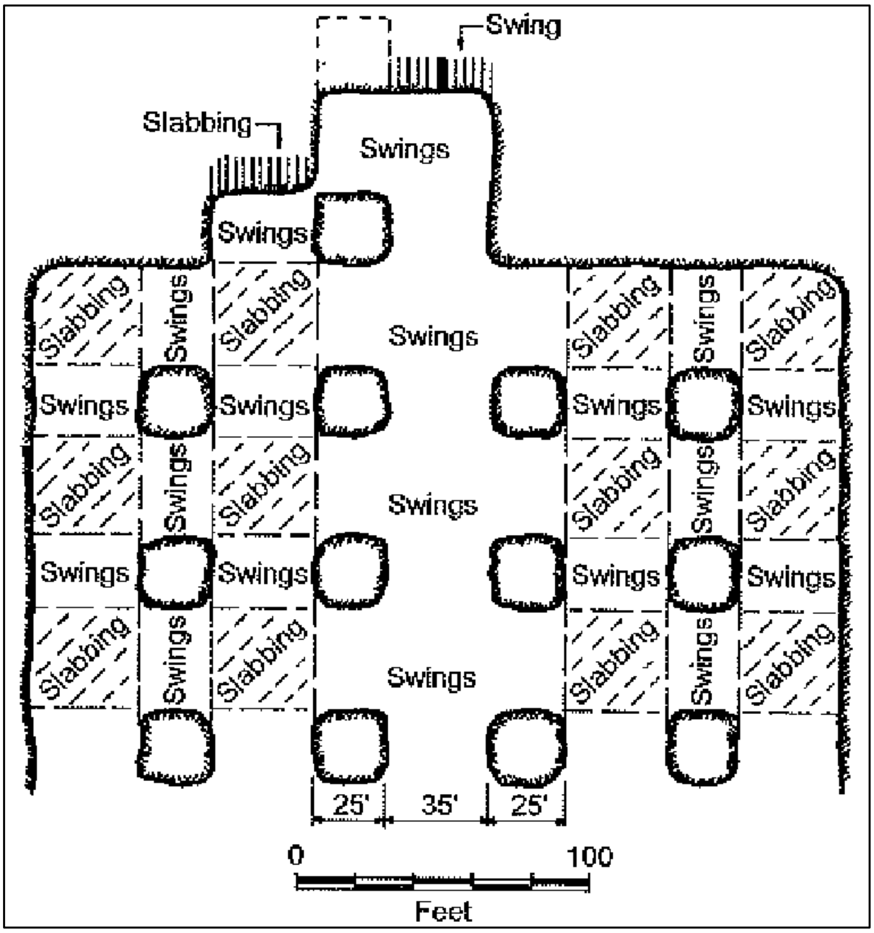


Figure 16-15: Plan view of panel advance example using swings and slabbing (Bullock 1998)

There are two common drill patterns used for mining the swings in room and pillar mining: vcuts and burn cuts. V-cuts are most commonly applied in softer rocks and it involves angled blasting in a development/production face to create an initial free face without the use of void holes (Figure 16-16). Blasthole drilling is minimised, however, as there is a poor distribution of explosives, it can lead to poor fragmentation. Drilling v-cuts rather than burn-cuts reduces cycle times improving advance rates, but there is a significant potential for fly rock to be thrown over large distances from the face. In these situations, drilling and bolting equipment needs to be moved further away from the face for blasting and there is potential impact in installed services nearby (air, water and electrical distribution).

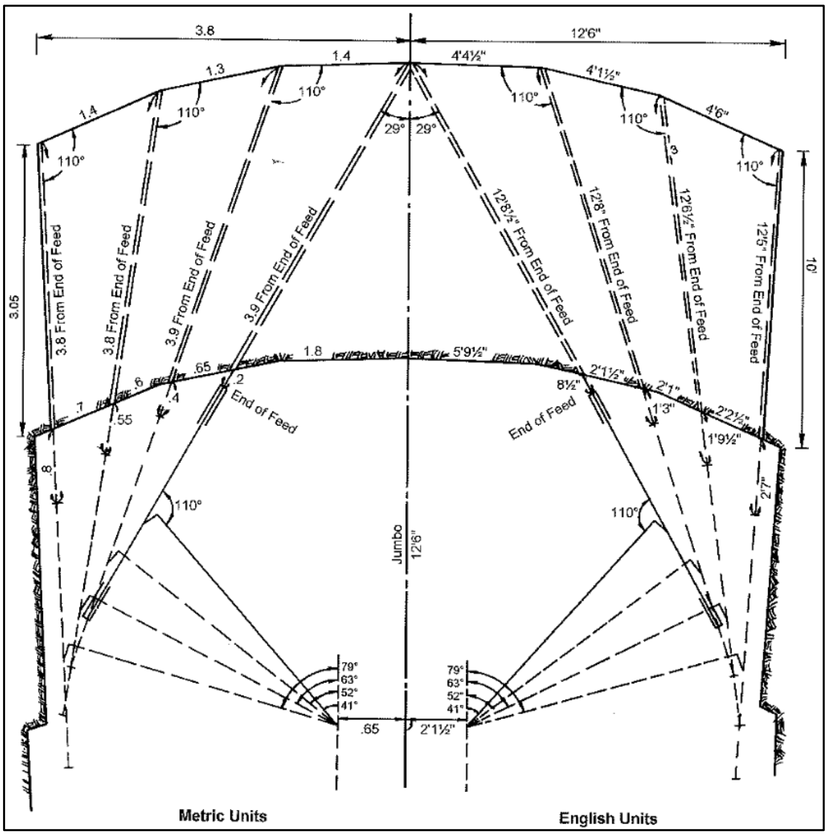


Figure 16-16: Typical v-cut design (Bullock 1998)

Due to this, it was assumed that a standard indicative burn cut patterns will be used instead of v-cut, with a detailed drill patterns to be determined in future studies in order to optimise fragmentation, prevent excessive fines and minimise overbreak.

16.3.4 Explosives

Three types of explosives have been considered in previous studies for the proposed Madaouela operations:

- Ammonium nitrate-fuel oil (ANFO);
- Bulk emulsion; and
- Packaged emulsion.

ANFO and bulk emulsion are blasting agents that require primers to initiate, whereas packaged emulsion is essentially the same product as a bulk emulsion but can be made to be ‘detonator sensitive’ and used as a primer or as an explosive without the use of a primer.

Emulsion provides a higher velocity of detonation (VOD) than ANFO which provides better fragmentation from fracture generation during blasting. However, ANFO allows for better propagation of gases after the initial shock (heave), which can assist with the generation of void and movement of the fractured rock during a blast (Table 16-20). Because of these characteristics, ANFO is generally favoured for softer or fractured rock and emulsion is generally favoured for stronger, unfractured rock. Bulk emulsion properties can be fine-tuned during loading to change the physical properties to provide different blasting properties.

Table 16-20: Characteristics of underground bulk explosives (Orica 1998)

Explosive Type	Density (t/m^3)	VOD (km/s)	Relative Energy	
			Fragmentation	Heave
ANFO (Poured)	0.8	3.7	100	100
ANFO (Blow-Loaded)	0.95	4.3	134	125
Bulk Emulsion	1.2	6.2	140	115

Water

The presence of water within a blasthole will affect the performance of a blast when loaded with ANFO as ammonium nitrate is water soluble. Emulsions provide an oil-based matrix for the ammonium nitrate providing water resistance. Emulsions are therefore preferred in wet conditions, especially when residence times are higher. Plastic hole liners can be used to isolate the ANFO from the water, however, these can be difficult to use and will affect the productivity of loading. Conventionally, for predominantly ANFO mines with minor water issues, localised wet holes will use packaged emulsion while dry holes will use ANFO. Mixtures of bulk ANFO and emulsion can provide the optimum combination of explosive performance, water resistance and cost.

Transportation and Storage

Packaged emulsion is a simpler product to handle, though the pumpable nature of ANFO and bulk emulsions allows for faster loading of the blastholes. Packaged emulsion comes in boxes that need to be transported around the site and to the faces.

ANFO is generally transported underground as either 25 kg bags or in a 1 t hessian or woven plastic bag. ANFO is then loaded into a venturi loader for loading the blastholes, either in the magazine from 1 t bags (a crane will be required) or at the face from the smaller bags. When the 1 t bulk bags are used, the ANFO can be mixed at the face allowing for the 94 % component ammonium nitrate to be transported as a chemical, rather than an explosive.

Bulk emulsion has a similar advantage over packaged emulsion. The emulsion is loaded using re-pump units, also referred to as mobile mixing units (MMU). The emulsion doesn’t become an explosive until it is mixed with a gassing agent at the face as it is being loaded into a hole. MMUs can be large in size and difficult to apply in smaller mines, ranging in size from 2 t to 10 t capacity units.

Cost

As a general rule, ANFO is the cheapest option, followed by bulk emulsion and then packaged emulsion.

From an operational perspective, Madaouela is seen as a reasonably dry deposit with low rock strength properties. Conventionally, ANFO would be expected to perform better than emulsions under these conditions as it generates greater heave energy.

ANFO has been therefore selected as the bulk explosive for both production and development. However, packaged explosives have been assumed for the primers, lifters and an allowance has been made for wet holes. The use of ANFO means the constituent chemicals are transported separately greatly simplifying the delivery and storage on site as the reduced security requirements for the non-explosive components allows for more frequent deliveries and therefore a reduced storage capacity requirement.

16.3.5 Vertical Development

Given the sub-horizontal orebody geometry, the need for vertical development is limited to providing for ventilation (Section 16.18) and not for materials handling or haulage. The generation of radon daughters that require primary ventilation of working areas, and the proximity of the mine workings to the surface, makes the use of many small diameter raises regularly distributed throughout the orebody a practicable alternative to fewer, more isolated, large diameter raises.

The significant number of raises required and the need to have them in place as soon as possible to manage radiation, means the approach to vertical development has a significant impact on the achievable development advance and production rates. Raise boring has been assumed as the main method for vertical development in the Madaouela, using owner-operated equipment. The advance rates are expected to be relatively high due to the soft nature of the rock and the average short length of the raises. However, having a few raise boring units operating simultaneously on surface might pose additional challenges as these would be widely dispersed and will require an independent “off grid” supply of power and water.

SRK recommends that alternative methods of vertical development are investigated further to allow early raise installation (blind sink). Blind sinking would allow early stage raise excavation and minimise delays in mine development, as the horizontal development would not be delayed waiting for the raises to be completed before advancing further. High-level research identified the foundation drill rigs (also known as “pylon rigs”) as a potentially viable option, given ready availability and widespread use in all civil engineering works. Such equipment shows achievable depths of around 120 m with diameters up to 3.5 m

Recent hydrological work conducted by SRK also identified the potential for 45 ventilation raises, located in the SW of M&M, to intersect the Tarat aquifer (see Section 24.4). SRK considers that this represents additional risks, not only in terms of water inflows and aquifer contamination, but also in terms of raise excavation and stability over time. An allowance has been made in the mine cost model for additional cover drilling and pressure grouting of 45 raises as a possible mitigation, but it is recommended that this, or other potential mitigation solutions, are investigated and included in future studies.

16.3.6 Materials Handling

Previous options analysis for the total cost of materials handling from different mining districts demonstrated that for those with tonnages greater than 400,000 t, conveyor haulage has the lowest overall cost (combining operating and capital costs). At tonnages lower than 400,000 t, the preferred method is dependent on the haulage distance and the ability to maximise equipment life. The use of conveyor haulage, as opposed to diesel trucks, greatly benefits the ventilation requirements for the mine as the need to dilute and remove diesel fumes and the heat produced by engines is removed.

Both mine layouts have been prepared using a conveyor haulage strategy. This strategy consists of a central conveyor network which is fed at different locations through a feeder breaker that is loaded by trucks that haul from the mining panels and development faces (Figure 16-17 and Figure 16-18).

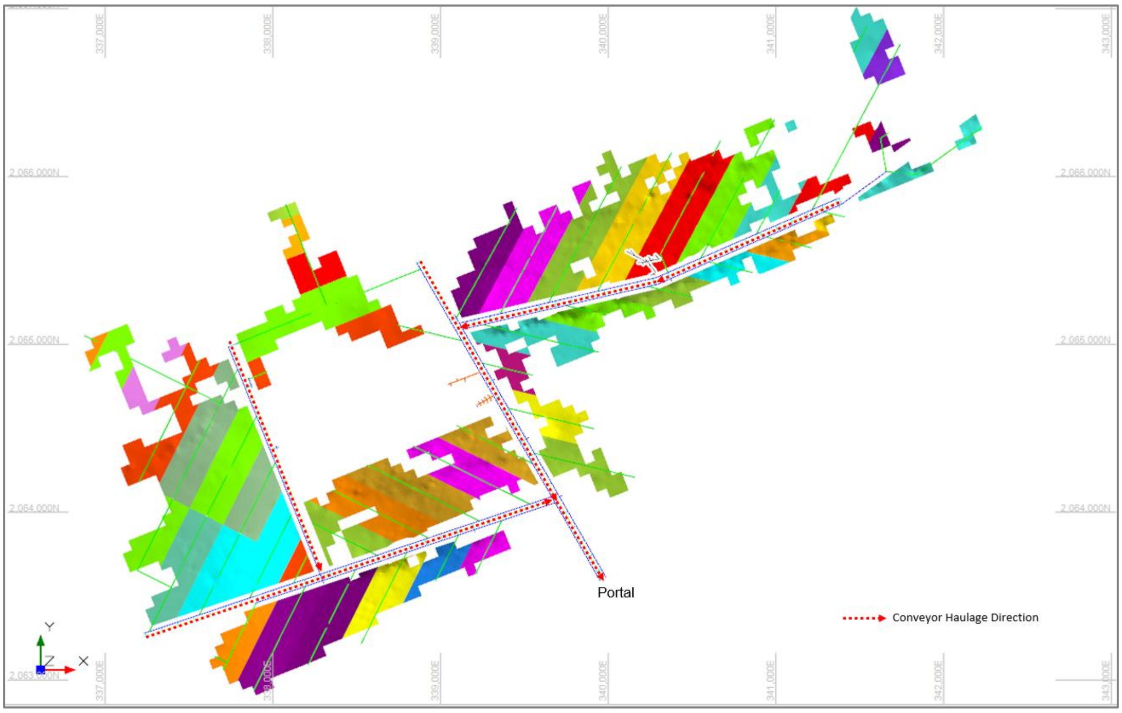


Figure 16-17: Overview of M&M mine materials handling infrastructure

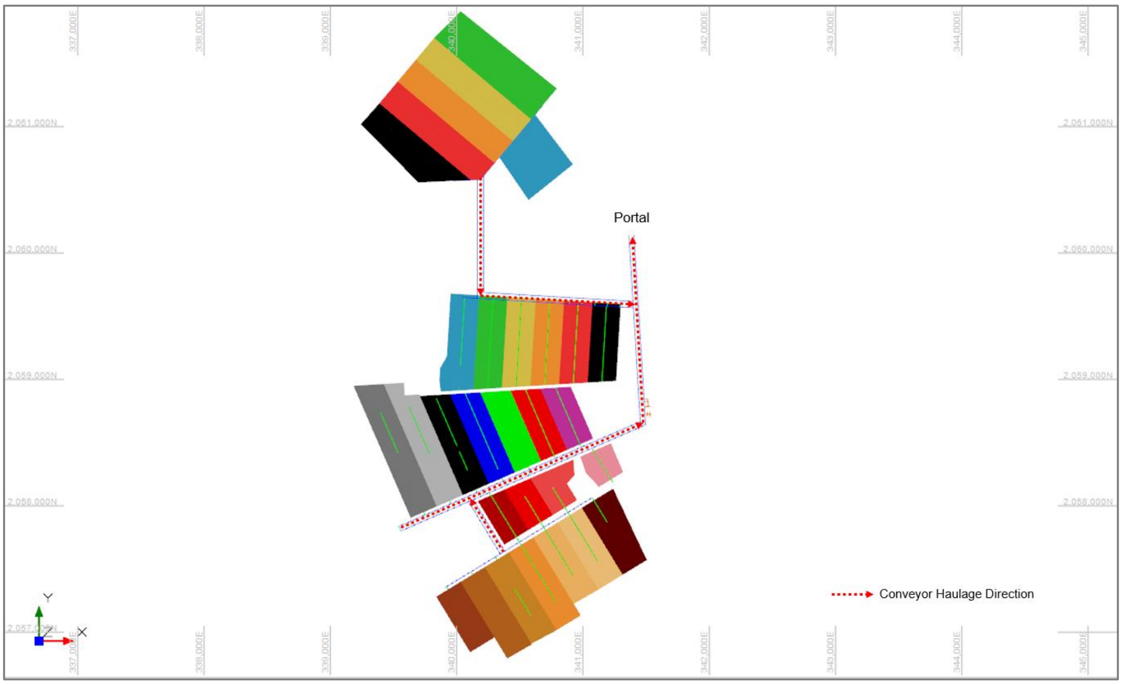


Figure 16-18: Overview of MSNE mine materials handling infrastructure

Given the required long haul distances between the mining panels and the portal, this approach minimises the number of trucks required on the mine, which improves the ventilation requirements of the operation. The use of trucks to haul from the panels to the feeder breakers and central conveyors is a very flexible approach. This allows ore production to transition between panels without the need to establish new conveyor infrastructure, only by moving the feeder breaker to another crosscut closer to the new panel. Where mining districts have relatively small tonnages, no conveyor is installed and a single end access into the panel is developed.

The existence of a dedicated conveyor tunnel is also highly beneficial while in production in order to better manage the radon emissions during haulage and removing them from the main access tunnels, where most of the fresh air will circulate.

Conveyor specifications are outlined in Table 16-21 and Figure 16-19.

Table 16-21: Main conveyor belt specifications

	Unit	
Design Capacity	tph	380
Designed Belt width	mm	1,000
Designed Belt Speed	m/s	1.0
Max feed size	mm	375

It is anticipated that conveyors will be floor mounted (Figure 16-19) and an under-passage will be created at regular spacing (300 m) to allow personnel, low profile equipment and light vehicles to pass under the conveyor and cross from one access tunnel to the other.

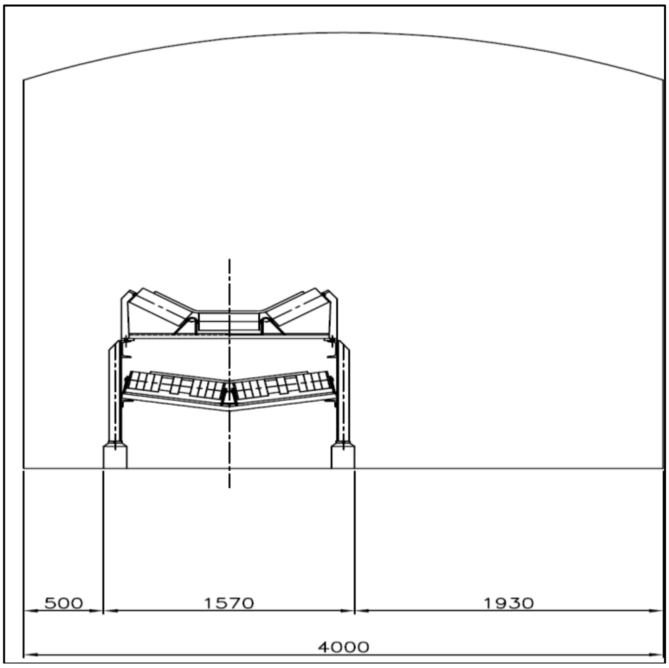


Figure 16-19: Conveyor dimensions

Ore Handling

A balance is achieved between maximising the size of the loader for production efficiency and minimising the operating height to minimise the amount of waste dilution. Low-profile equipment is required to minimise the waste rock excavated from underground; however, smaller bucket sizes result in longer truck loading times which increases the cycle time and reduces the productivity of the trucking fleet.

To mitigate this issue, faces will be cleaned to stockpiles in central locations in each panel, from where ore and waste will be rehandled by a larger loader into the trucks. The room and pillar method will create many opportunities for stockpiling locations close to the load points and increasing flexibility while in operation.

The loaded trucks will tip onto feeder breakers which will load the conveyors. Feeder breakers are mobile to allow loading points to be moved quickly and simply along the conveyor length, as production areas advance, and conveyors are extended. Previous discussions with equipment suppliers have suggested that the properties of the Madaouela rock make amenable to using a conventional feeder breaker. As the projected passing size from the feeder breaker is in the order of 150 mm, no further crushing is envisaged prior to transporting to the surface.

Waste Handling

The generation of radon and its daughters from the excavation of silos and ore stockpiles needs to be minimised and mined out panels will be barricaded off to prevent leakage into the fresh air network. SRK has assumed that there will be limited underground storage of waste and that the conveyor system should be capable of transporting all ore and waste to surface.

There is potential to store waste in mined out areas of active panels, however, this is expected to be an ad-hoc activity by LHD only, as trucks will only be able to travel in the central panel access. For the purpose of this study, it was assumed that all waste will be hauled to surface and put into the waste rock dump (WRD).

Ore and most of the development waste will need conveying to the surface in separate batches to minimise the amount of waste being fed to the ore sorter . For this reason, it is important that proper instrumentation and controls are put in place to manage the conveyor system and minimise the possibilities for waste contamination and ore losses. At the surface, the waste will be diverted and stacked in a stockpile to be rehandled and transported to the waste rock dump (WRD). and the ore will be sent to a radiometric ore sorter. Sorted ore is delivered to an ore bin, and the rejected waste fraction is off-loaded to a temporary stockpile. Dedicated surface trucking fleets will transport the two waste streams to the WRD and the sorted ore to the plant located near the Miriam pit.

SRK notes that, although not considered in the current study, there is an opportunity to retain development waste underground and deposit this into mined out panels as backfill. However, such option should be carefully evaluated for potential impacts on the production rate and mine ventilation as it will require additional equipment and an assessment of any interface with production areas.

16.3.7 Materials Handling Benchmark

Akouta Mine - Niger

Akouta Mine primarily uses conveyors for underground transport. Ore is delivered to the conveyor from the production face using a loader. Crusher stations are used to transfer the material onto the conveyor and ensure no oversize is advanced. Trucks are used for development where conveyor systems are not yet extended.

The primary belt is 1 m in width, 1,450 m long with a belt speed of 1 m/s. Secondary conveyors are used to connect the panels and generally are limited to 50 m in length. Conveyor feed is via a rolls crusher to reduce oversize; the main conveyor feeds a central jaw crusher before ore is finally conveyed to the surface.

Global

Trends in underground material handling were identified by Pratt (2008) which benchmarked numerous operations around the world (Figure 16-20).

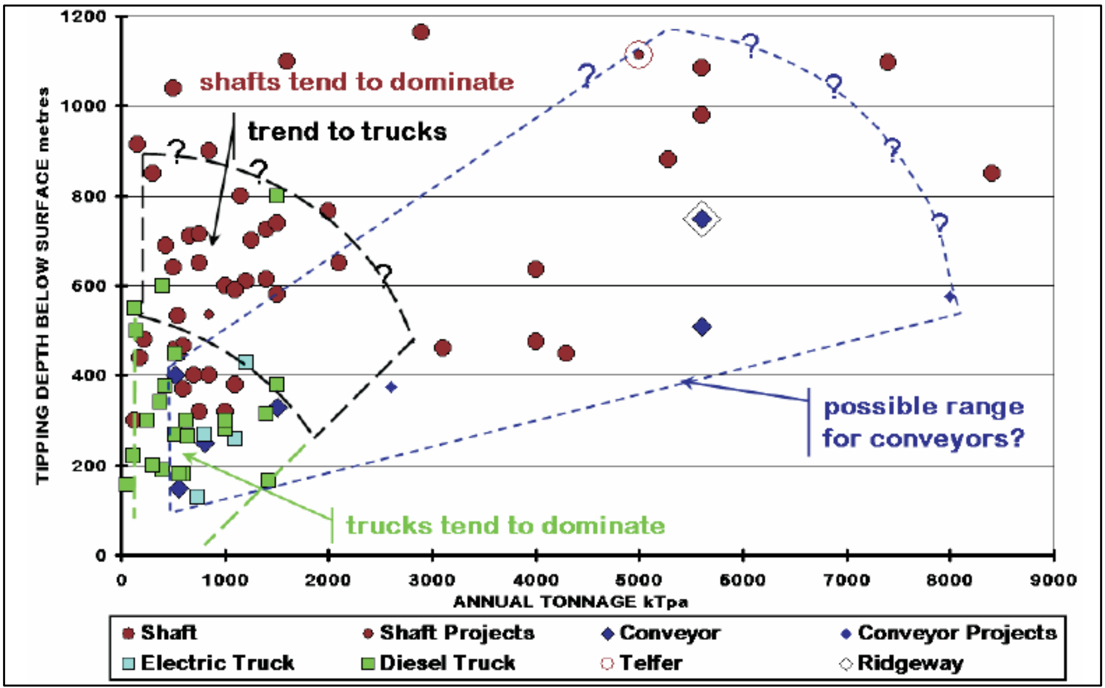


Figure 16-20: International trends for materials handling from underground to surface (Pratt 2008)

16.3.8 Radiometric Ore Sorting

Radiometric ore sorter units (supplied as vendor packages) and associated screens will be located adjacent to the portal of each underground mine. The ore will be sorted to remove waste dilution and the ore sorter rejects (waste) will report to the WRD. The ore will be transported to the plant by dedicated truck fleet.

The process is summarised in this sub-section and is described in more detail in Section 18.10.4. The mining production rate and the sorted ore production rate are summarised in Section 16.17 (LOMP).

Underground ore will be screened using a radiometric overhead sorter. This will screen material into three fractions, coarse, medium and fine using a double deck screen. Individual radiometric ore sorter (ROS) modules will result in the concentration of the coarse and medium material, while the fines (defined as less than 19 mm) will bypass the sorters as an underflow into the plant feed storage bin. Based on initial test work done on drill core samples and expected particle size distribution (PSD) after production blasting and passing through the primary ore sizer, it was assumed that approximately 25 % of the underground feed would report to the undersize. The +19 mm passes through a secondary crushing and screening station resulting in two size fractions (-75 mm to +47 mm, and -47 mm to +19 mm) feeding to their respective ROS units. Rejects from the ROS units are transferred to the rejects bin.

ROS rejects from all modules are combined on the ROS discard conveyor and transferred to the rejects stockpile. Concentrate from all ROS modules is collected and transferred onto the concentrate conveyor and combined with screen undersize material to be transferred to the ROM stockpile in the processing plant by truck.

16.3.9 Ground Control

16.3.10 Ground Control Benchmarking

Similar to the Madaouela deposits, the nearby Akouta Mine is composed of flat lying, bedded sandstones with some parting between layers. Here, 1.8 m tensioned anchor bolts were installed on a regular one metre square pattern. The bolts required re-tensioning after the face has advanced some 20 metres due stress relaxation and loosening caused by blast vibrations.

Swellex bolts had previously been trialled but were found to fracture the rock surrounding the holes and thereby deteriorating the ground conditions. There are also areas of the mine where interstitial clay is present between the sandstone layers. Here, 1.8 m resin bolts and grouting of the anchor bolts were found to be most successful in these zones.

Caving of the roof at the Akouta Mine is not allowed due to the potential disturbance of overlying aquifers. In areas of high grade, backfill is used to recover the high-grade pillars. The backfill comprises 75 % crushed sandstone, 3 % to 6 % cement, sand and water. The fill is mixed on the surface and transported underground via a purpose-built raise. Loaders transport and place the fill at the required locations, pushing tools are used to get the backfill close to the roof and to maximise the rill angle of the fill.

Trials by COMINAK were undertaken on pumping the fill from the surface, however, the results suggested this method, which requires installation of pipes to the fill site, was labour intensive and time consuming.

16.3.11 Applied Design

Scaling

Scaling of roof and sidewalls is required for all workplaces following blasting and subsequent check scaling is used to re-test the integrity of the ground over time. Scaling is assumed to be undertaken using manual methods due to the low-profile production areas limiting the application of mechanical scaling while providing good accessibility. The sub-horizontal nature of the sedimentary bedding should result in manual scaling being simple and effective.

Rock Bolting

A bolting pattern has been applied to underground mining using 1.8 m resin bolts with a bolt spacing of 1.0 m with 1.5 m between rings. For production areas, the resin bolt lengths are reduced to 1.5 m to account for the limited roof height. No mesh is applied as the sub-horizontal bedding planes provide favourable roof conditions.

Resin bolts have been selected due their suitability for weaker rock conditions. Their ability to hold higher stresses means that bolting density can be decreased which partially offsets their higher unit costs. The bolts will be installed with face plates to provide localised support. No cable bolting is assumed.

Shotcreting

The low mining height of the production areas means that a conventional shotcreter would not be able to access the production areas of the mine. However, a shotcreter and low-profile transmixer have been allowed for in the equipment schedules.

A shotcrete allowance of 50 mm thickness has been considered in this study update to account for the probable need to add a shotcrete layer in most of the mine infrastructure, excluding the production room and pillar areas. Although not deemed critical by the geotechnical assessment, it is considered best practice and will aid in maintaining walls and roof integrity as well as assisting and covering for the following:

- Areas of unexpected uncharacteristically poor ground conditions such as near the regional faults.
- Areas of high radon emission in the central access drives and panel accesses.
- Construction of ventilation barricades to prevent leakage from previously mined panels.
- Providing protection for pillars (adjacent to panel drives) where truck traffic erodes the shale floor, exposing or undercutting shale in the pillars.

Protection against Roof Failure

SRK considers that particular attention against roof failure and related potential subsidence issues at the Madaouela deposits is critical for a variety of reasons, including:

- Impact on local aquifers: The Guezouman Sandstone hosts a number of water-bearing units. There is a risk that a caved zone would extend through these units which would significantly increase water inflows into the mine and effect other users of the local aquifers. Of particular concern is the Tarat Aquifer, which is a main source of water supply in the area.
- Ventilation: As the roof fails, radon/radiation would emit from low grade material within the overlying strata and unrecovered mineralisation. Radon gas would collect in roof voids where the ventilation will be poor and ultimately 'leak' into active workings. There is also a risk that the failures will open fractures in the regional pillars providing a pathway for radon gas to leak into neighbouring panels.
- Poor understanding of the failure mechanism of local rock mass: No assessment of how the rock mass would fail has been undertaken as part of this study, by considering the hydraulic radius (area divided by perimeter) at which failure is induced or the stress concentrations that would arise in the surrounding pillar zones. There is also some risk that pillars would penetrate into the softer shale floor.

Pillar Recovery

No pillar recovery has been included in the mine plan of M&M and MSNE-Maryvonne. The low average mining height will make the distribution of backfill difficult and therefore the study does not include a cost-benefit analysis of pillar recovery using backfill. If further investigated and proved feasible it would provide potential upside for the higher-grade sections of the deposit by increasing extraction.

16.3.12 Equipment

As the planned approach to mine M&M and MSNE-Maryvonne is consistent for all the proposed underground activities, the planned equipment is assumed to be common to both operations. The concept is for the fleet of equipment to move from one operation to the next, balancing utilisations and maintaining a constant combined production rate. This will limit the purchase of additional equipment during the life of the operations.

The mobile fleet requirements are split into four categories:

- Development fleet.
- Production fleet.
- Materials handling.
- Auxiliary fleet.

The production rates for all development and production equipment have been built up from first principles applying both the experience of GoviEx and SRK, and information provided from equipment suppliers where available.

Development Fleet

The main mine access, infrastructure and panel access development are treated separately from the production activities due to the greater mining heights. The higher tunnels allow a conventional fleet of mobile equipment to be used. It is estimated that the maximum annual development requirement is 9,120 m per year (though a typical year would be closer to 8,000 m per year), which requires dedicated crews and equipment. A summary of the required equipment for development mining is summarised in Table 16-22.

Table 16-22: Overview of development mining fleet and models used for reference

Equipment	Make	Model	Units	Unit Cost (USDk)	Productivity
Jumbo	Epiroc	Boomer 282	3	914	280 (m/month)
Loader	Epiroc	ST 1030	2	881	32,000 (t/month)
Rockbolter	Epiroc	Boltec 235	3	790	matched to jumbo
Haultruck	Epiroc	MT436LP	4	1,028	14,000 (t/month)
ANFO Loader	Normet	Charmec 605 DA	1	418	900 (m/month)

Production Fleet

The production fleet is constrained by the low working height of the proposed excavations. As most of the mineralisation has a thickness less than the minimum mining height of 1.8 m, the production fleet will be largely comprised of low-profile equipment. Low profile mining equipment was developed mainly in South African platinum and chrome operations where it is used extensively. It is specifically designed to reduce the practical mining height to reduce waste dilution in low seam environments using mechanised methods.

The annual production rate of RoM sent to the radiometric sorting plant is around 1.45 Mtpa, which equates to 4,000 tpd, with the rate varying occasionally with the mining height. The processing plant is designed for 1.0 Mtpa (2,860 tpd) after concentration by the radiometric sorter and the quantity of waste dilution and reject varies with the thickness of the mineralised zone.

A summary of the estimated production fleet requirements is shown in Table 16-23.

Table 16-23: Overview of production mining fleet and models used for reference.

Equipment	Make	Model	Units	Unit Cost (USDk)	Productivity
Jumbo	Sandvik	DD220L	7	984	23,450 (drm/month)
Low-Profile Loader	Epiroc	Scooptram ST7LP	6	580	25,500 (t/month)
Rockbolter	Epiroc	Boltec SL	5	809	6,400 (drm/month)
ANFO Loader	Normet	Charmec 605 DA	4	772	1,540 (m/month)

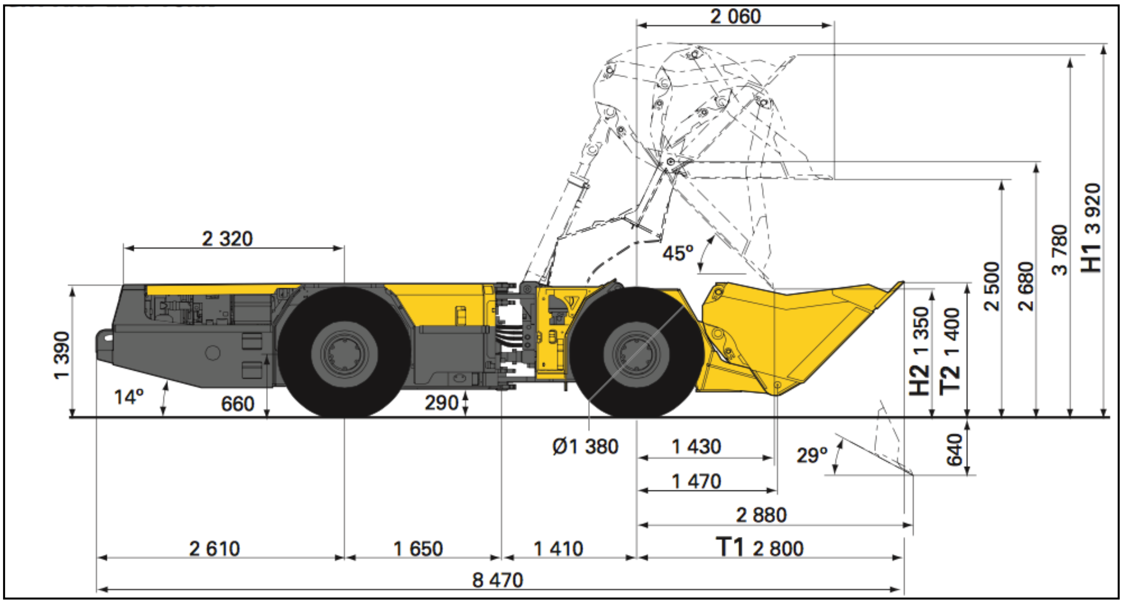


Figure 16-21: Low Profile Loader (Scooptram ST7LP)

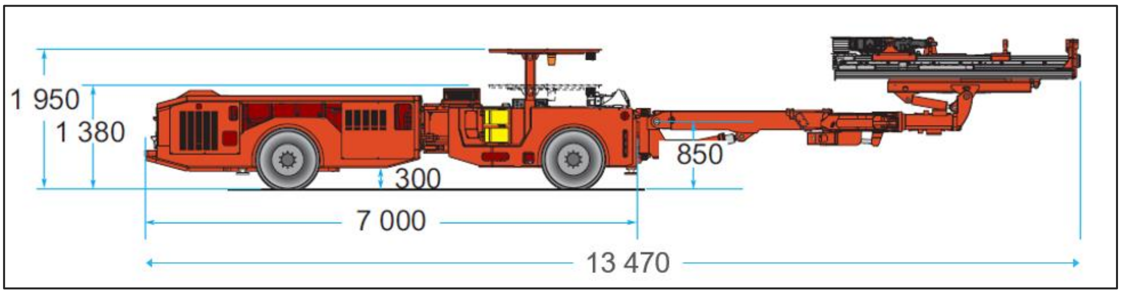
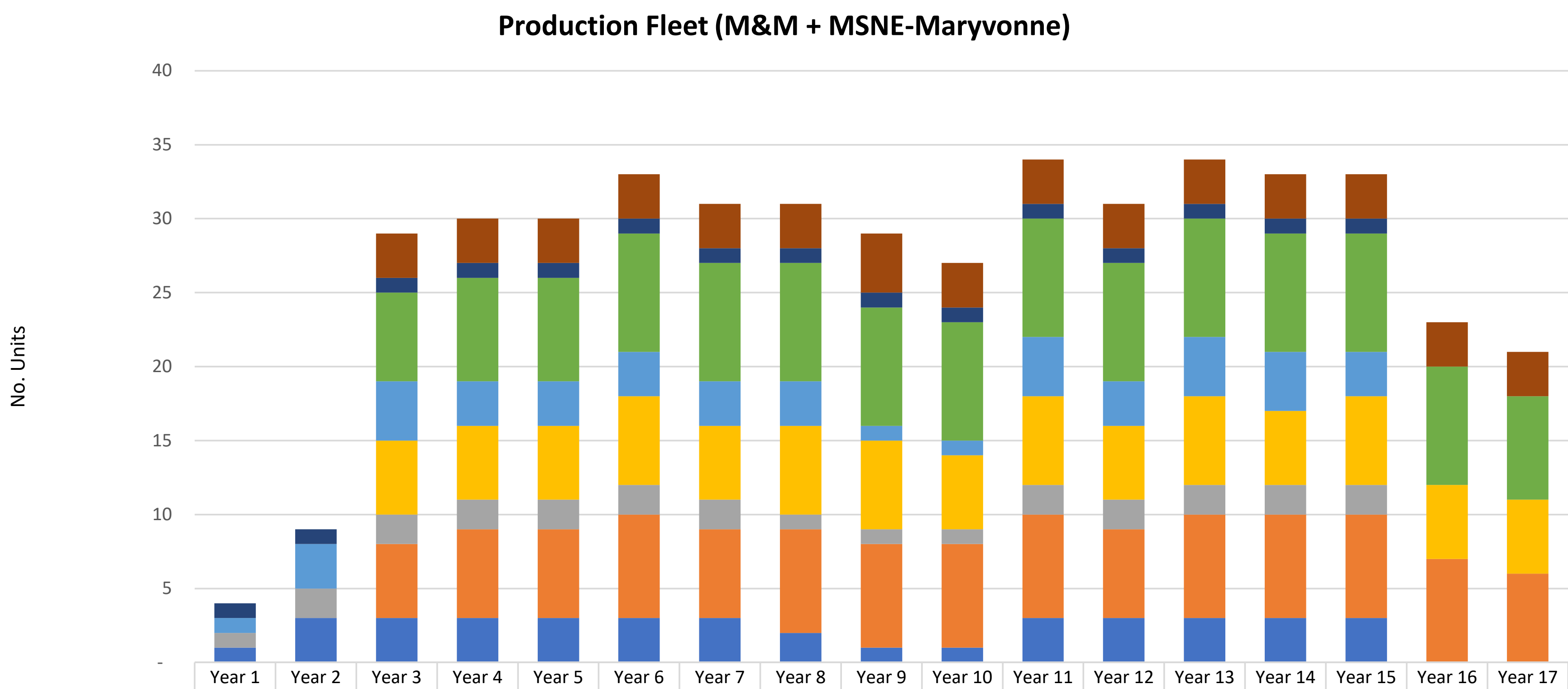


Figure 16-22: Low Profile Twin Boom Jumbo (DD 220L)



	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17
Prod. ANFO Loader	-	-	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3
Dev. ANFO Loader	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
Prod. Truck	-	-	6	7	7	8	8	8	8	8	8	8	8	8	8	8	7
Dev. Truck	1	3	4	3	3	3	3	3	1	1	4	3	4	4	3	-	-
Prod. LHD	-	-	5	5	5	6	5	6	6	5	6	5	6	5	6	5	5
Dev. LHD	1	2	2	2	2	2	2	1	1	1	2	2	2	2	2	-	-
Prod. Jumbo	-	-	5	6	6	7	6	7	7	7	7	6	7	7	7	7	6
Dev. Jumbo	1	3	3	3	3	3	3	2	1	1	3	3	3	3	3	-	-

Figure 16-23: Annual production fleet requirements for M&M and MSNE-Maryvonne.

Materials Handling Infrastructure

As described in Section 16.3.6, primary materials handling from underground to surface will be through a conveyor system. The ore and waste from the development and production faces is loaded into mine trucks and hauled to the nearest feeder breaker and onto the conveyor. An exception to this is during the decline construction and while the main conveyor tunnels and accesses are being developed. The decline waste will be hauled directly with trucks to the designated WRD, as well as the initial meters of both central tunnels, until the conveyor is installed in the decline tunnel. From this point on, the development of the next consecutive conveyor tunnel and accesses will be dumped into the latest conveyor installed at dedicated transfer points.

Figure 16-24 and Figure 16-25 show an overview of the conveyor system of the two underground mines, with a summary of the individual conveyor main characteristics shown in Table 16-24.

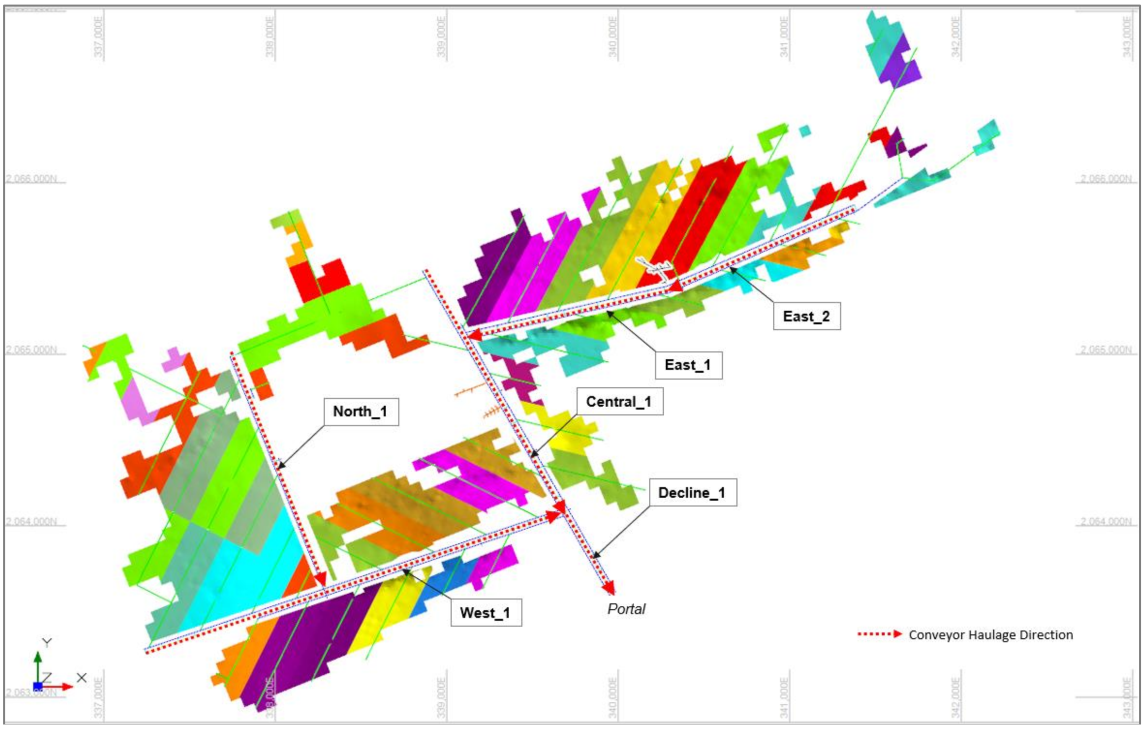


Figure 16-24: M&M conveyor network and nomenclature.

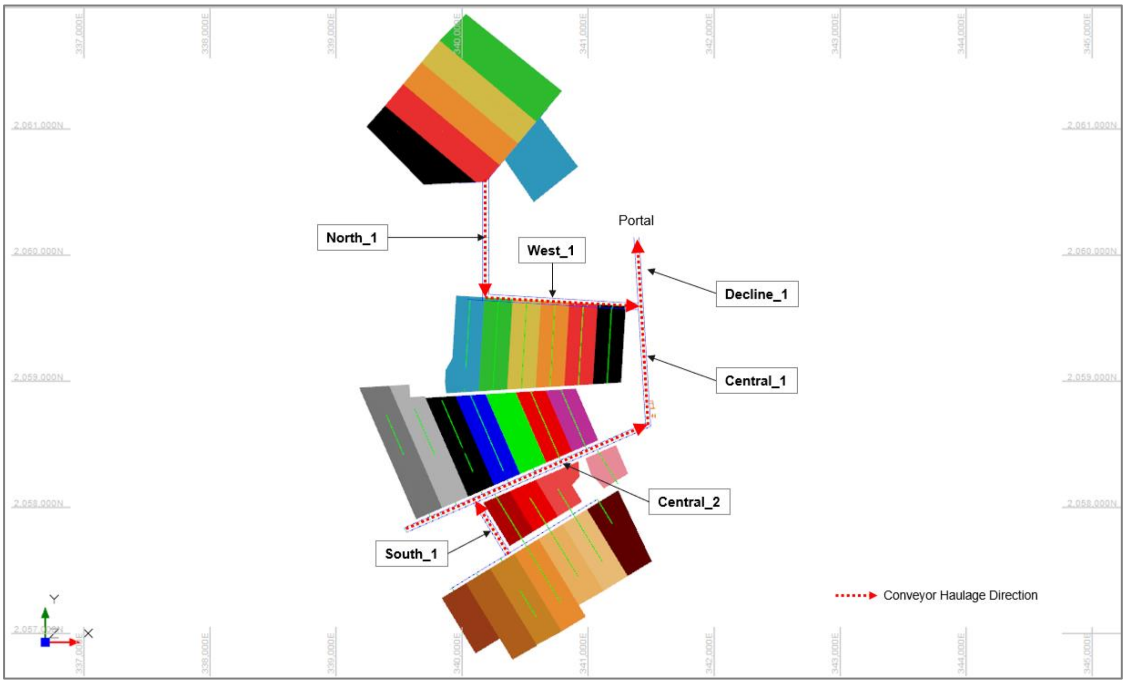


Figure 16-25: MSNE-Maryvonne conveyor network and nomenclature.

Table 16-24: Summary of installed conveyors in each mine.

Branch	Conveyor Length (m)	Lift (m)	Avg. Gradient (°)	Installed Power[1] (kW)
Marianne-Marilyn				
Decline_1	630	89	8.13	104
Central_1	1,633	75	-2.63	203
West_1	2,586	42	0.84	248
North_1	1,490	76	2.17	198
East_1	1,220	18	0.87	161
East_2	1,172	10	-0.5	234
MSNE-Maryvonne				
Decline_1	561	79	8.13	95
Central_1	988	19	1.06	130
Central_2	1,533	30	1.12	202
West_1	1,231	35	1.62	162
South_1	501	5	-0.39	66
North_1	917	17	-0.79	121

[1] Factored according to length from reference conveyor.

The conveyor belt estimates are based on a 1 m wide belt travelling at a speed of 2 m/s and the system is rated to deliver 380 t/h.

As described above, both materials handling systems discharge at surface into an ore sorter located at the portal and is then rehandled it is rehandled by trucks to the respective final location (WRD or processing plant).

Auxiliary Fleet

To facilitate the development and production activities, numerous auxiliary processes need to be undertaken, including (but not limited to) the installation of air and water services, communications, ventilation controls, refuelling, maintenance and materials and consumables supply to the underground stores. A list of the main auxiliary equipment necessary to undertake these services is provided in (Table 16-25).

Table 16-25: Overview of main auxiliary equipment fleet and models used for reference

Equipment	Make	Model	Units	Unit Cost (USDk)
Shotcreter	Normet	Spraymec 6050 WP	1	467.1
Transmixer	Normet	Ultimec LF500	2	424
Toolcarrier/MPV	-	Loader with Platform	2	277.1
Grader	Caterpillar	120H	1	351.3
Light Vehicle	Toyota	Landcruiser 70	19	60.5
Personnel Carrier	*NS*	*NS*	9	431.5
Lubricant Truck	*NS*	*NS*	3	444.5
Store Truck	*NS*	Flat Bed Truck	3	281
Scissor Lift	*NS*	*NS*	2	524.7

(NS – Not Specified)

Two tool carriers are included, one for the service crew and another for the ventilation crew. As much of the production areas will be 1.8 m high it is assumed that this type of work in the production areas will be undertaken from ground level or using work platforms on light vehicles.

16.3.13 Services

Air

Although most of the drilling and auxiliary equipment models considered for this Project are currently supplied with their own onboard compressors, a compressed air system was assumed for M&M and MSNE-Maryvonne. This allowance can provide backup air supply capacity for potential equipment breakdowns as well as added flexibility to consider alternative equipment that relies on connecting to a compressed air grid.

Previous PFS assumptions were kept for the maximum air consumption and reticulation requirements. From the mining fleet considered in the 2021 PFS, it was estimated that 223 l/s would be required (Table 16-26) This assumes all equipment operates simultaneously, but realistic instantaneous demand is likely to be much lower. An additional 10 % is allowed for miscellaneous consumption and 15 % for pipe leakage.

Table 16-26: Estimated peak compressed air requirements

	Units	Consumption (l/s)	Total (l/s)
Production Jumbo	4[15]	11.7	46.8
Development Jumbo	1	12.5	12.5
Production Rockbolter	4	11.7	46.8
Development Rockbolter	1	12.5	12.5
Production ANFO Loader	3	10.0	30.0
Development ANFO Loader	1	10.0	10.0
Shotcreting	1	20.0	20.0
Miscellaneous Consumption	10%		17.9
Leakage	15%		26.8
Total			**223.3**

Reticulation of compressed air is assumed to be via 63 mm high-density polyethylene (HDPE) piping which is installed as part of the development cycle. Rolls of 100 m length HDPE are assumed to be used to reduce the time required to hang the pipe, reduce labour requirements and minimise the number of pipe connectors required.

Service air is assumed to be supplied via two 1,200 l/s air compressors located at the surface. Whilst this is substantially higher than the estimated requirements, two compressors are required to ensure 100 % availability at all times (i.e. during maintenance periods) and no detailed calculations to account for leakage in pipes across the entire network have been undertaken.

Water

a. Potable Water

SRK has assumed that there is no requirement for reticulation of potable water underground. Drinking water is assumed to be stored in a small tank underground, to be kept full by the store workers, and that workers will be supplied with drinking vessels.

b. Service Water

Based on the equipment discussed in Section 16.3.12, the maximum service water consumption from the mining fleet is estimated at 24 l/s (Table 16-27). 10 % is allowed for miscellaneous consumption and 5 l/s for pipe leakage.

[15] Note there will be 7 jumbo rigs but only 4 have been assumed for compressed air requirements as newer equipment has independent on-board compressors.

Table 16-27: Estimated peak service water requirements

	Units	Consumption (l/s)	Total (l/s)
Production Jumbo	4	1.1	4.4
Development Jumbo	1	1.7	1.7
Production Rockbolter	4	1.2	4.8
Development Rockbolter	1	1.3	1.3
Production Loader	5	0.5	2.5
Development Loader	4	0.5	2.0
Pipe Leakage	1	5.0	5.0
Miscellaneous Consumption	10%		2.2
Total			**23.9**

The service water is to be distributed throughout the mine using HDPE piping with a diameter of 100 mm.

The service water supply is discussed further in Section 16.13.

Dewatering

The current update of the Project mining study and cost model only includes a provision for mine dewatering pipes and accessories through the mine and as per the previous studies assumptions (SRK, 2021). The detailed water inflows, dewatering strategy, pumping requirements and dewatering cost estimations (capital costs and operating costs) are discussed separately and in detail in Section 16.13.

Power

Main power is to be distributed at 10 kV to mine transformers located in mining districts and stepped down to 0.5 kV for distribution to mining equipment.

Figure 16-26 shows the monthly variation of the installed power in megawatts (MW), split by major equipment groups, and compared with the RoM production for M&M and MSNE-Maryvonne. It is estimated that the total peak power requirement for M&M is 5.6 MW and for MSNE-Maryvonne 5.5 MW. Note that these figures assume all equipment is operating simultaneously and that the typical instantaneous load is assumed to be 80 %.

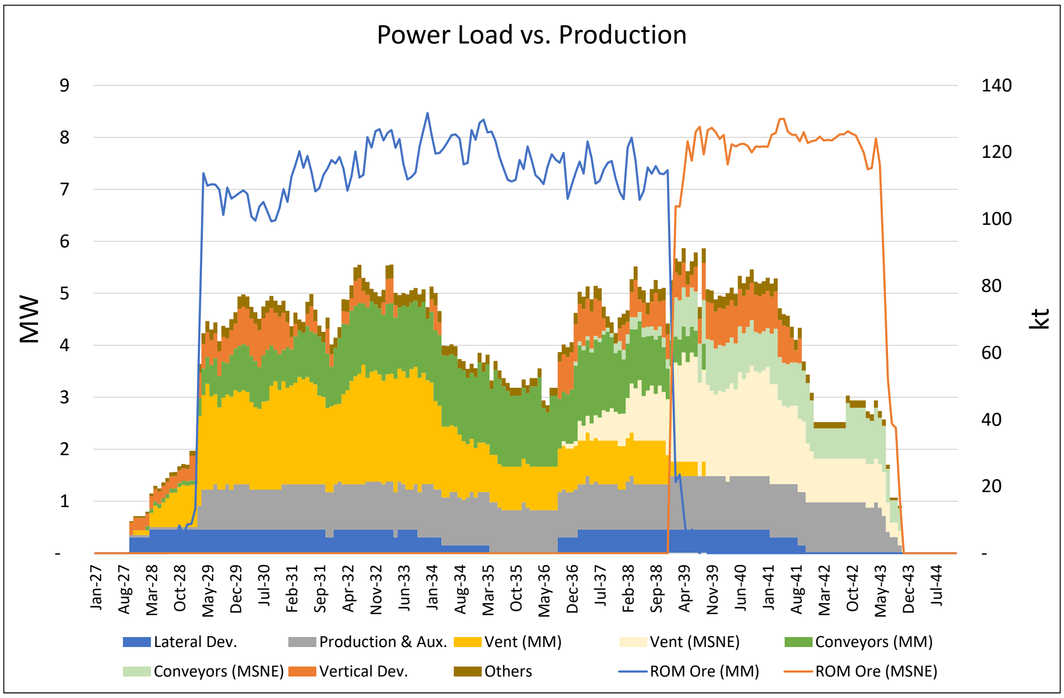


Figure 16-26: Installed power monthly variation compared with RoM production.

SRK recommends that future studies should include a detailed underground power reticulation network and cost estimation for the two mines.

Communications

The mine communications system proposed for the Madaouela operations comprises a leaky feeder network throughout the mine with mobile radios located in each vehicle and a limited number of handheld radios. Communication will also be provided at designated fresh air bases (FAB) with an independent connection to the surface to provide backup communications in the event of an emergency.

The leaky feeder cable is to be installed and extended as the mine develops.

16.3.14 Road Works

To overcome the poor road conditions expected in the Talak Shale, the central access development is to be raised above the sandstone-shale contact providing a better floor upon which to build a road.

Road building will use crushed road base spread and levelled with a grader. In panel development, located on the Talak-Guezouman contact, a road construction material is essential to provide a good floor for trucking to take place. Waste rock can be taken from development blasting and crushed waste rock from the surface can be transported underground through ventilation raise bores that are no longer used.

Within the production zones, the limited working height will mean production loaders will be responsible for maintaining roads. The limited amount of traffic and relatively short time that production development areas will remain active limits the amount of road maintenance required in these areas. However, maintaining a dry floor along transportation routes is critical to minimise road maintenance. Should the roads in the production zone start to wear, they risk exposing the Talak shale at the base of the mining pillars, which will have a detrimental impact on the geotechnical integrity of the pillars.

16.3.15 Grade Control

The nearby Akouta Mine uses radiation detectors hanging from the roof of the development to estimate the grade of each loader bucket before it is loaded into the underground crusher. In this way, any excessive waste material is identified prior to being sent to the plant. This approach limits the need to sample and assay production faces. The use of radiation detectors is designed to inform the processing plant of the material that is being dispatched to the plant to allow it to divert it to the appropriate stockpile.

Given the minimum 1.8 m height restriction, it is anticipated that this approach will not be as effective at Madaouela as there will be up to 40 % waste per truck load which will impact the ability of the radiation detector to accurately determine the contained minerals. This could potentially result in one of two negative impacts:

- Incorrect grade assignation of mined minerals resulting in mineral discharge as grade material is sent to the waste stockpile.
- Underestimation of face grade resulting in the premature stopping of mining headings and a loss of resource.

As a result, radiation detectors will not be used at Madaouela. The Madaouela process strategy is based on a single feed and waste material being separated during the radiometric sorting processes. It is therefore less important to accurately determine the mineral content of the trucks and more important that the face grade is accurately determined to allow for accurate dispatch to the waste or ore stockpiles and to ensure that faces are not stopped prematurely. It is therefore envisaged that the following methods be adopted as part of the grade control strategy:

- Probing of drillholes prior to loading; and
- Face assaying.

16.3.16 Underground Labour

Labour Sources

The Arlit region has an extensive history of mining and provides a workforce familiar with the techniques and skills required for the proposed underground operations. In addition, the closing of Akouta Mine may result in trained workers becoming available for the proposed operations in advance of requirements.

Niger has its own mining school and the experience of the Akouta Mine is that it provides competent professionals ready for the industry. Consequently, only a small expatriate workforce is maintained at the two Orano subsidiaries (please name them) and mainly in management roles.

GoviEx and SRK have assumed that the Madaouela Project can be staffed entirely with Nigerien labour for both technical and operational functions. It is assumed any requirement for expatriate assistance will be provided for in the general and administrative budgets.

Shift Structure

The Project schedule is based on 4 work crews working three 8 hr shifts per day.

This shift structure complies with Nigerien legislation and removes any requirement for overtime payments.

Office staff are assumed to work a standard 40-hour work week.

Office and Administrative Staff

All labour requirements for the administration of the underground operations, including the Mine Manager, are provided for in the general and administrative costs so are not included in the evaluation.

Technical Staff

Technical staff requirements are derived from SRK's experience in similar operations and discussions with the Client (Table 16-28).

Table 16-28: Technical staff requirements

Position	No. Shifts	Workers per Shift	Total
Senior Mining Eng.	1	1	1
Mining Eng.	4	1	4
Senior Geotech.	1	1	1
Geotechnical Eng.	1	1	1
Senior Mech. Eng.	1	1	1
Mechanical Eng.	1	1	1
Senior Elec. Eng.	1	1	1
Electrical Eng.	1	1	1
Vent./Radiation	3	2	6
Surveyors	1	3	3
Draftsmen	1	1	1
Senior Geology	1	1	1
Geology	1	2	2
Grade Control	3	8	24
Core Farm	3	2	6
	Total	**30**	**54**

Underground Workforce

Estimates of underground workforce requirements are derived from SRK's experience in similar operations, estimated equipment requirements and discussions with the Client and COMINAK. Consideration has been given to local conditions that include the following:

- Annual leave requirements for workers.
- Additional leave taken by some workers for pilgrimage during the Eid festival that is traditionally taken in addition to the annual leave allowance in the Arlit region.
- Reduced worker productivity during Ramadan.
- High levels of sick leave to account for workers who may contract malaria whilst on leave in the south of Niger (whilst not a malaria region itself, this is a noticeable trend in the nearby mines).

An updated overview of the envisaged underground workforce at full production, including provision for leave, is provided in Table 16-29.

Table 16-29: Underground production workforce

Position	No. Shifts	Workers per Shift	Total
Mine Captain	4	1	4
Shift Boss	4	1	4
Loader Operators	4	8	32
Truck Drivers	4	12	48
Dev. Drillers	4	3	12
Production Drillers	4	7	28
Raiseboring Operator	4	3	12
Nippers	4	4	16
Services	4	3	12
Ventilation	4	2	8
Mechanics	4	8	32
Electricians	4	2	8
Rockbolters	4	8	32
Scaling Crew	4	3	12
Shotcreter	4	1	4
Transmixer	4	2	8
Charge Up	4	8	32
Belt Runner	4	2	8
Crusher Operator	4	1	4
Stores	4	2	8
Road Crew	4	1	4
Medical	4	1	4
Mines Rescue	4	1	4
Other	4	3	12
	Total	**147**	**348**

16.4 Underground Maintenance

Only a small service workshop is included underground as equipment can be readily trammed to surface for repairs due to the shallow depth of the working. Workshops on surface have the advantage of additional space, better light and more potential to establish clean rooms for high quality maintenance of sensitive components.

Equipment would only be taken to the surface workshop for planned maintenance and when broken down. If equipment is unable to transport itself to the workshop, development loaders or trucks will tow the equipment.

Shift servicing (i.e. lubricating, oil refills) and refuelling of the equipment is to be undertaken underground either in the service bay or in the production areas using a dedicated service vehicle and crew.

16.5 Underground Mine Planning

16.5.1 Introduction

Mine design for M&M was undertaken using the Deswik suite of mining software to develop the mine design, generate the mining volumes, interrogate the resource model, and create the mine schedule. For MSNE-Maryvonne the mine design and production panels tonnages were not changed from the previous work, with grades being calculated individually in spreadsheets and linked to solids in Deswik.

16.6 Underground Design Parameters

SRK has applied four development profiles to the mine design (Table 16-30). The dimensions of the profiles have been selected based on the requirements of the equipment to be used underground and the ventilation requirements.

Table 16-30: Horizontal development profile design parameters

Profile	Width (m)	Height (m)	Area (m^2)
Main Access Tunnels	5	4.5	22.5
Conveyor Tunnel	4	3.2	12.8
Cross Cuts (Main Access)	5	4.5	22.5
Panel Development	7	3.5	24.5
Production (Conventional)	7	1.8	12.6

Main access development is applied to all the central infrastructure development in the mine, including declines and central accesses, from where all the panel developments start and with cross cuts connecting it to the central conveyor drive.

Conveyor tunnel will only serve the conveyor network applied underground and usually in the middle of two main accesses.

Crosscuts connect the access tunnels to the conveyor tunnel and are spaced every 100 m. These can be used to place the feeder breakers and load the conveyor, as well as for temporary stockpiles during development. Although not in the detailed design, it was considered in the schedule and material balance that one crosscut every 300 m was going to be excavated in a way that allows low profile vehicles to go under the conveyor. Given the long conveyor distances, this acts as an under passage and allows personnel and light vehicles to cross form one side of the conveyor to the other to help traffic or in case of an emergency.

Panel development is a central access for each panel to allow access to the room and pillar faces and be used for trucking ore to the feeder breakers located in the main access. SRK notes that due to the variability of the mineralised thickness, there will be sections of the mines where the mining height will be larger than discussed in the report.

The mining height for the mining panels is assumed to be 1.8 m high. Where the mineralised thickness is greater than the estimated thicknesses, the overall height is assumed to increase in line with the mineralised thickness. However, although the mining tonnes account for variable thicknesses, for the purposes of producing estimates for cost and productivity, it has been assumed the single design for the room and pillar faces of 7 m wide by 1.8 m mining height.

Room/drive widths of 7 m are applied to both the production and panel development to remove the need for slashing cuts when mining at 90° to an existing heading. Sufficient room will be available for the jumbo drill booms to position without affecting the blast pattern or reducing the advance per cut.

Development and production development will have a square profile due to the small mining heights. Overbreak of 5 % is allowed for from both production and development profiles.

Powder factors are calculated assuming a blasthole diameter of 45 mm and five uncharged void holes. No blast patterns have been designed in detail for the individual headings, rather specific powder factors have been estimated based on experience and typical blast patterns allowed for each profile. SRK notes that these estimates are considered conservative, as detailed blast design can be optimised and adjust the powder factor to the expected "soft ground". No allowance has been made for the differential between swings and slashing as discussed in Section 16.3.3.

Based on an updated ventilation assessment detailed in Section 16.18, the vertical development can range between:

- 1.6 m Ø – intermediate exhaust/intake raise during single entry panel development.
- 3.0 m Ø – Main exhaust/intake raises for panel development and production, as well as for the main accesses.

16.7 Underground Modifying Factors

16.7.1 Mining Losses and Recovery

Mining losses considered for the Madaouela design are:

- Mine Planning losses
- Geotechnical losses
- Operational losses

Planned losses are incorporated into the design and include outliers (Resources that fall outside of the panel designs) and regional pillars around the central development. They are a function of the design processes rather than a factor applied to the RoM tonnage calculations.

Geotechnical losses result from the geotechnical design parameters estimated for the Madaouela deposits. From the geotechnical work presented in Section 24.3 three pillar sizes need to be applied to the panels (depending on the geotechnical characteristics of the rock mass) as well as the consideration for inter-panel pillars to provide regional stability. A summary of the geotechnical design parameters are shown in Table 16-31, Figure 16-27 and Figure 16-28. Detailed geotechnical analysis can be found in Section 24.1

Table 16-31: Summary of geotechnical design parameters

Geotechnical Zone	Room Width (m)	Pillar Dimensions (m)	Mining Recovery	Mining Recovery Inc. Inter-Panel Pillars
1	7	4 x 4	87%	78%
2	7	5 x 5	83%	74%
3	7	6 x 6	79%	70%

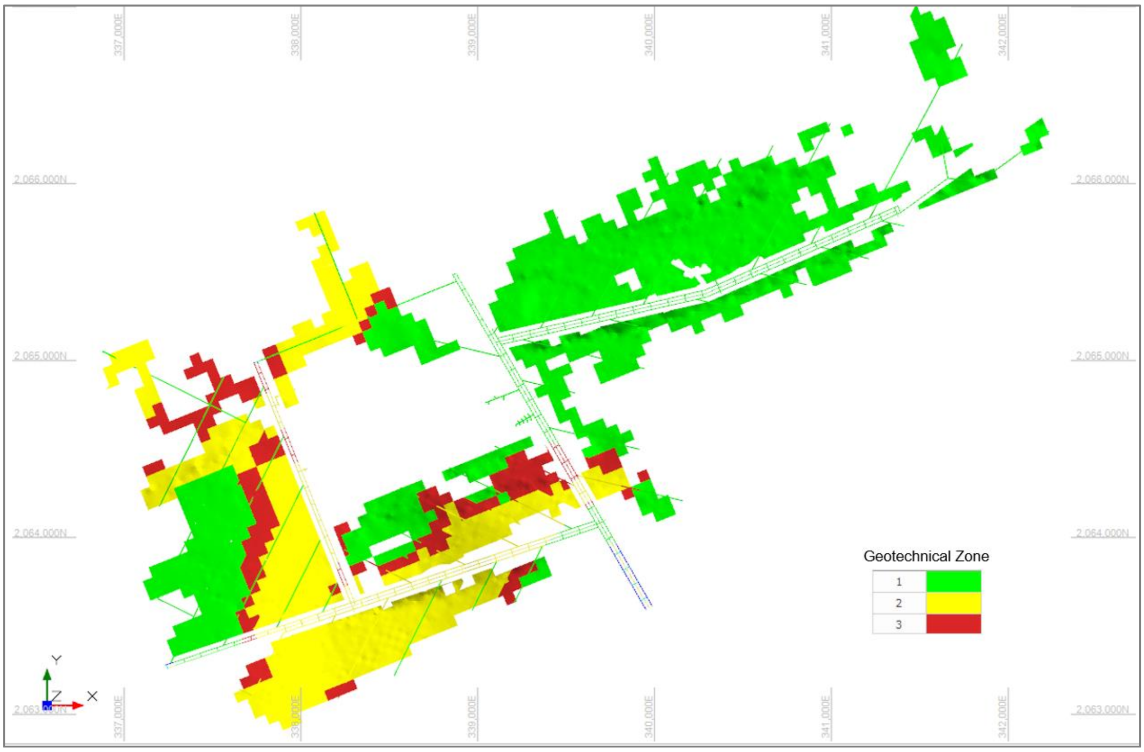


Figure 16-27: Geotechnical zones for Marianne-Marilyn deposit.

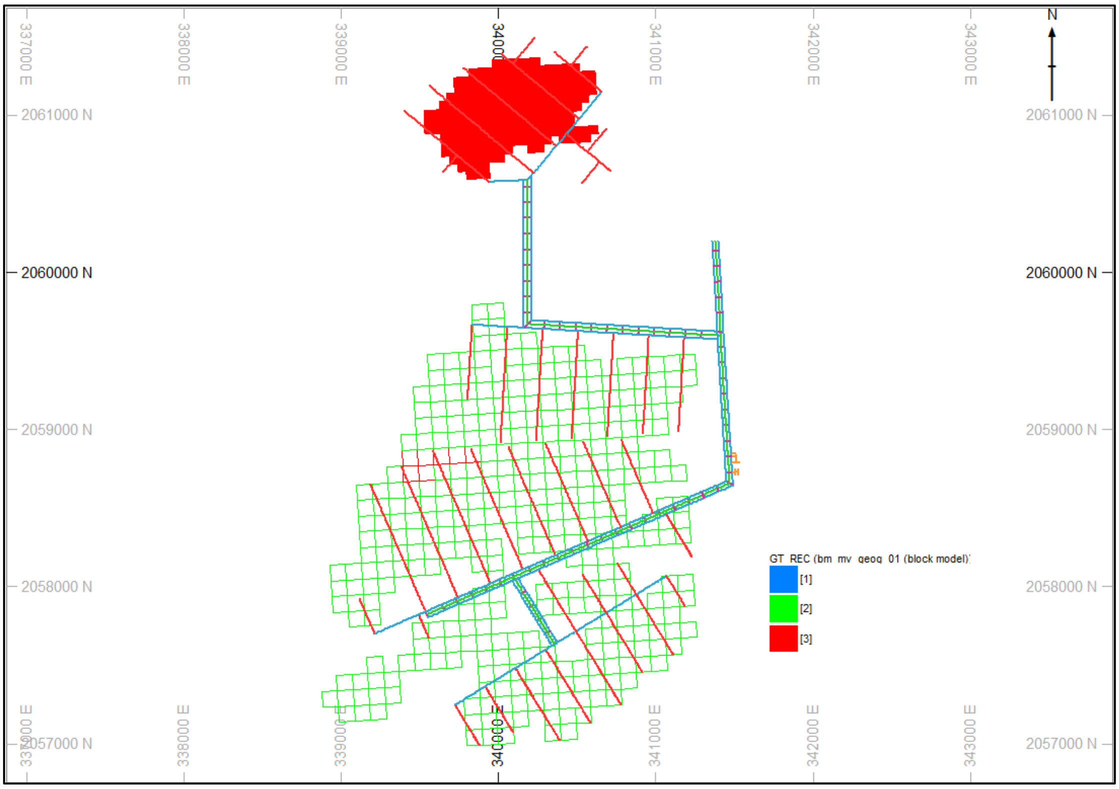


Figure 16-28: Geotechnical zones for MSNE-Maryvonne deposit.

Operational losses assume that there will be losses of ore resulting from underbreak, flyrock and spillage that causes incomplete recovery of ore from the face and loss of ore into the waste stream during the course of mining.

SRK has assumed that overbreak in the pillars, which introduces additional mineralised materials to mine production, will balance out operational losses.

16.7.2 Dilution

Room and pillar mining in a bedded deposit is considered a selective mining method. Bedding planes can be used as natural partings to minimise the amount of overbreak from development. The underlying Talak Shale is, however, soft and dilution caused by digging into this layer when loading is possible. External dilution is assumed to be minimal with a 2.5 % applied to the designed tonnages for M&M and 5 % for MSNE-Maryvonne.

Internal dilution will be a significant contributor to the overall production tonnages with internal dilution coming from the interstitial layers of waste within the mineralised horizon, and waste rock that make the difference between the thickness of the mineralisation and the 1.8 m mining height. This planned dilution will be variable and is incorporated into the panel tonnes for the M&M mine as part of the mineral optimisation process. The internal dilution for Maryvonne has been calculated at a localised level for each column of blocks within the model.

16.7.3 Cut-Off Grade

The cut-off grade approach for M&M was updated from the previous study and mine plan. For this study, instead of a constant cut-off grade being applied to the diluted grade of each mining solid, a variable cut-off was applied based on the individual waste to mineralised thickness ratio. The mineralised horizon is generally thinner than the minimum mining height, which means that most blocks have some waste dilution included. With this updated approach, the cut-off grade increases with a higher waste ratio inside a solid. This method allows to replicate the beneficial effect of the sorter on the +8 mm material, so thinner mineralized zones with higher grades are still included in the mining schedule, thus increasing the Reserves. The -8 mm fines are passing the sorter and go straight to the sorter accept. Including the sorter logic within the Deswik schedule also allows scheduling on the sorter accepts rather than the RoM level, creating an even feed to the plant of 1.0 Mtpa, despite the varying waste ratios of the mining blocks.

First principals' calculations were undertaken based on previous cost assumptions to estimate the required increase in cut-off grade to compensate for the potential effects on ore sorter recovery by the different waste/ore ratios. Table 16-32 shows the assumptions used for the variable cut-off calculations. Figure 16-29 shows the cut-off grade pending the waste ore ratio in a mining block.

Table 16-32: Variable cut-off grade assumptions

Assumptions		Units	
Costs			
	Mining Costs	USD/t (RoM)	27.17
	Ore Sorting Costs	USD/t (RoM)	0.83
	Transport Costs (Sorter to Plant)	USD/t (Sorted)	1.50
	Sorter Waste Handling	USD/t (Waste)	0.74
	Processing	USD/t (Sorted)	23.00
	Infrastructure	USD/t (RoM)	0.59
	Tailings	USD/t (Sorted)	0.74
	G&A	USD/t (RoM)	3.56
Metal Prices			
	Uranium (with transport)	USD/kg U	143
	Uranium (without transport)	USD/kg U	133
Ore Sorting			
	Fines (-8mm) passing sorter	%	25.0%
	Sorter – Waste reduction	%	95.0%
	Sorter – Recovery	%	93.5%
	Sorter – Waste in accept	%	1.0%
Processing			
	Recovery	%	93.0%

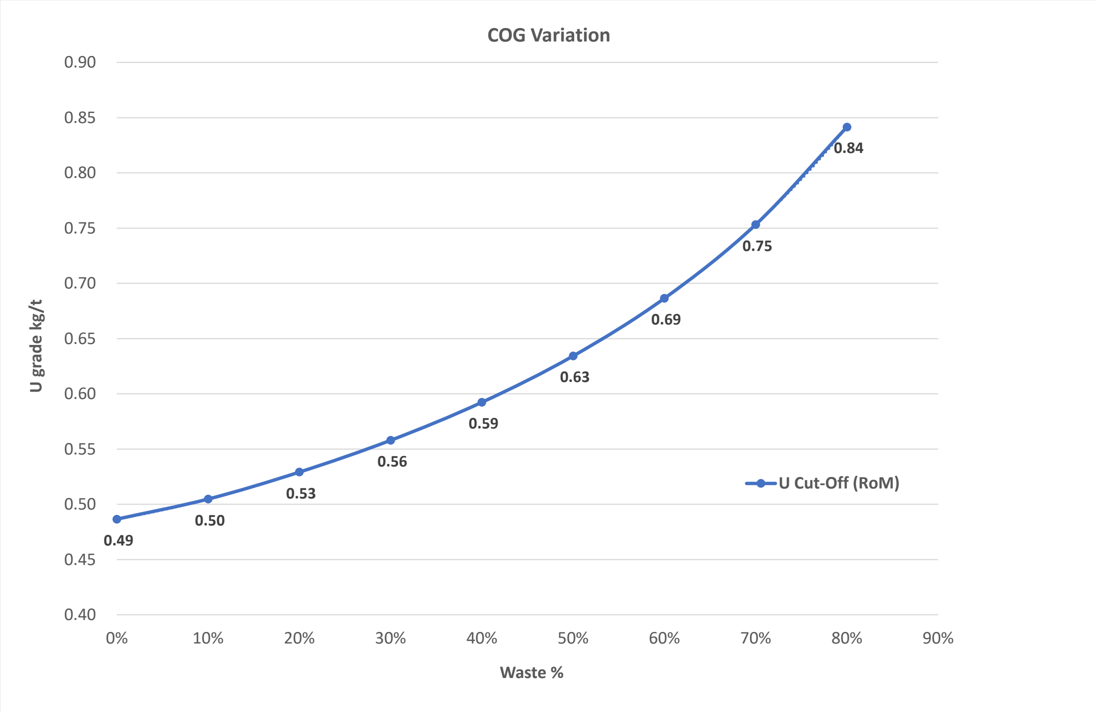


Figure 16-29: Calculated cut-off grade variation

An approximated polynomial trend line was generated by spreadsheet to replicate this relationship, with the following formula:

$$y = 1.489\,x^6 - 3.462\,x^5 + 3.566\,x^4 - 1.674\,x^3 + 0.606\,x^2 + 0.135\,x + 0.487$$

This formula calculates individual cut-off grades for each individual mining solid, based on its waste ratio. Both waste ratio and cut-off grade formula were coded in Deswik and applied to all of the ore mining solids in the design as attributes.

The final step for mining solid selection was the comparison of each mining solid diluted ore grade with the calculated cut-off grade. A few exceptions were made to include individual “uneconomic” solids that were completely encircled by economic solids, or located right next to panel developments, and where the difference between the diluted grade and the cut-off was less than 0.1 kg U/t.

The cut-off grade approach for MSNE was not updated and follows the same approach as in the PFS study (SRK, 2021), which applied a 0.60 kg/t constant cut-off.

16.8 Underground Molybdenum By-Product

The mineral resource for M&M includes some areas where molybdenum was estimated and classified. Although a background grade of molybdenum is present throughout the M&M mine, it was only possible to estimate and classify this resource in limited locations after a dedicated drilling campaign was completed to better define the known areas with higher molybdenum grades. Therefore, only a limited number of mining solids could be used to estimate the mineable molybdenum grade, which are reported separately in the life of mine plan.

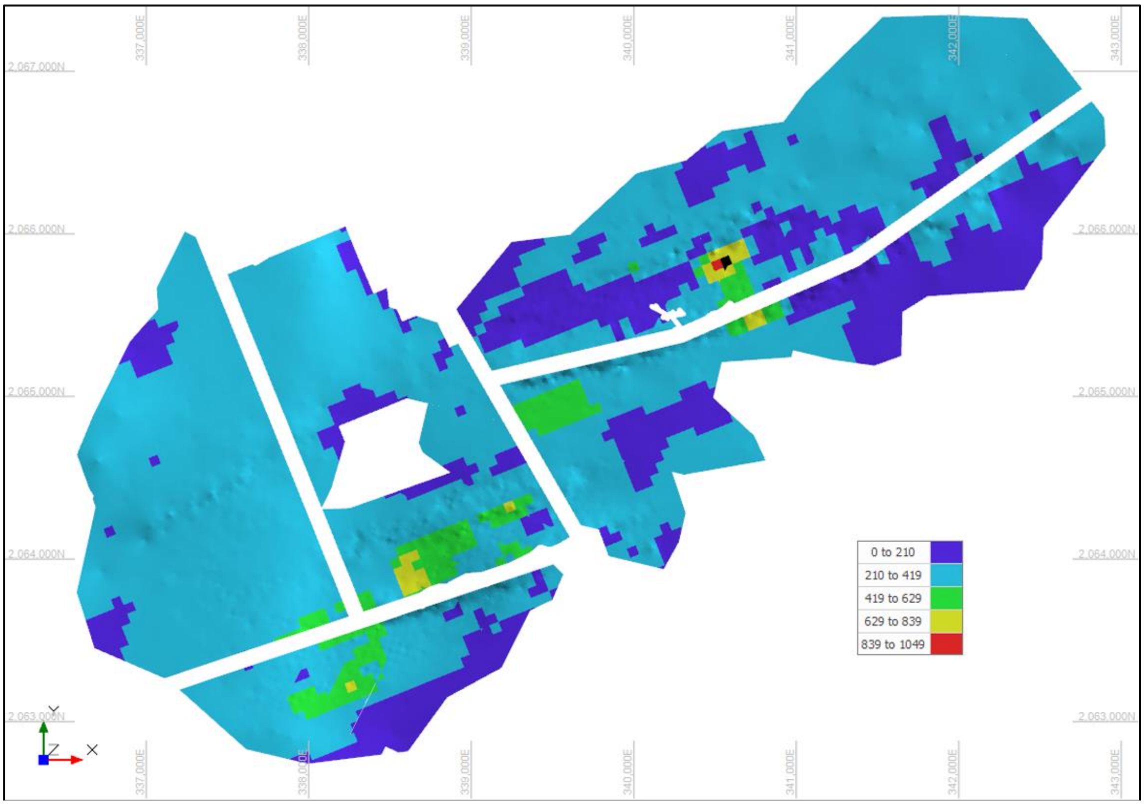


Figure 16-30: Molybdenum grade distribution in the M&M mining solids (ppm)

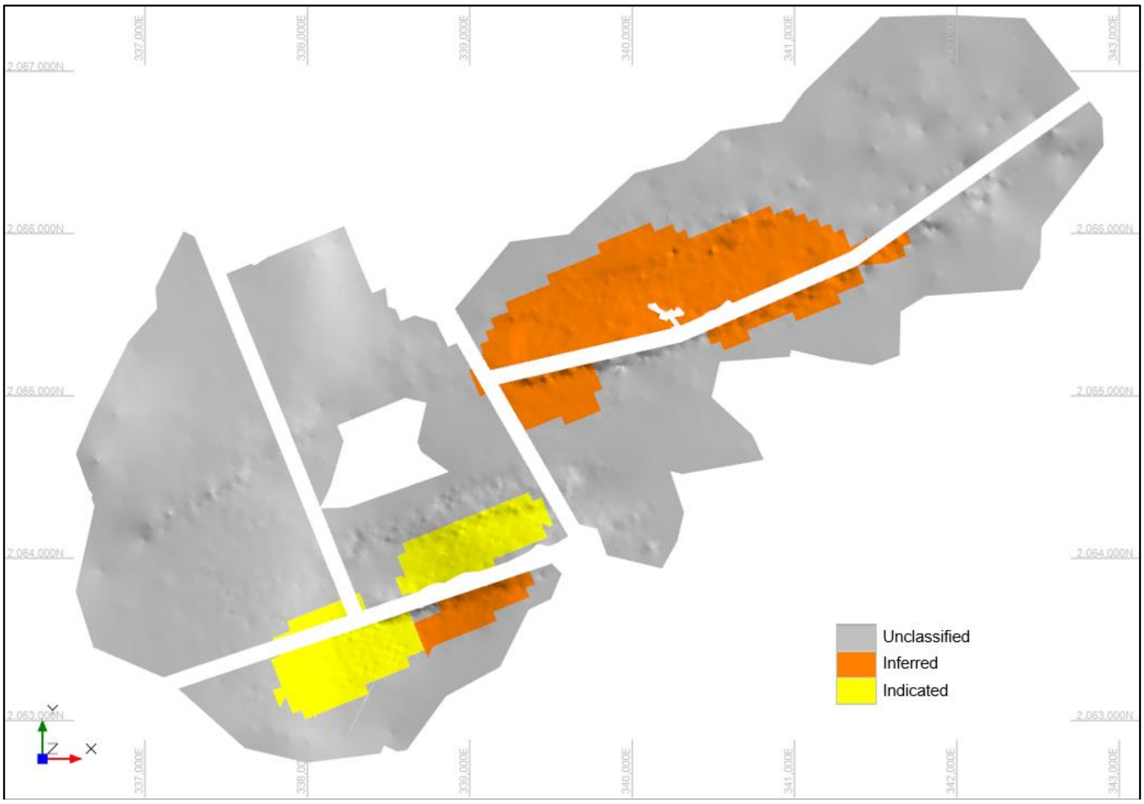


Figure 16-31: Molybdenum resource classification for M&M.

SRK notes that the resource classifications for uranium and molybdenum are not consistent as they were derived from different sets of dedicated drilling campaigns and estimations (Section 14.4.8). Nevertheless, it was the uranium grades and cut-off that were used as the only driver for the selection and estimation of the RoM uranium ore tonnes and grade. The molybdenum was considered only as a by-product that would report to the processing plant if present in any selected uranium mining solid.

For life of mine plan and ore reserves estimation purposes, only the molybdenum grades with an Indicated classification were reported and included in the life of mine totals and the reserve statement (Table 16-33).

Table 16-33: Estimated Molybdenum resource included in M&M uranium LoMP.

Classification	Quantity (kt)	Mo Grade (ppm)	Mo Contained (t)
M&M			
Measured	-	-	-
Indicated	2,134	391	834
Total	**2,134**	**391**	**834**

No molybdenum was estimated for MSNE-Maryvonne and therefore was not considered in the reported RoM tonnes.

16.9 Underground Mine Optimisation

The resource block model used for the M&M deposit estimation is a sub-blocked Datamine model which was created from the SRK resource model. The mine planning approach to determine the mineable shapes was updated for M&M and used the interpreted geological ore solid (wireframe). This wireframe was cut in 60 m x 60 m mining shapes which were then interrogated against the resource block model to determine the individual uranium grades (Figure 16-32).

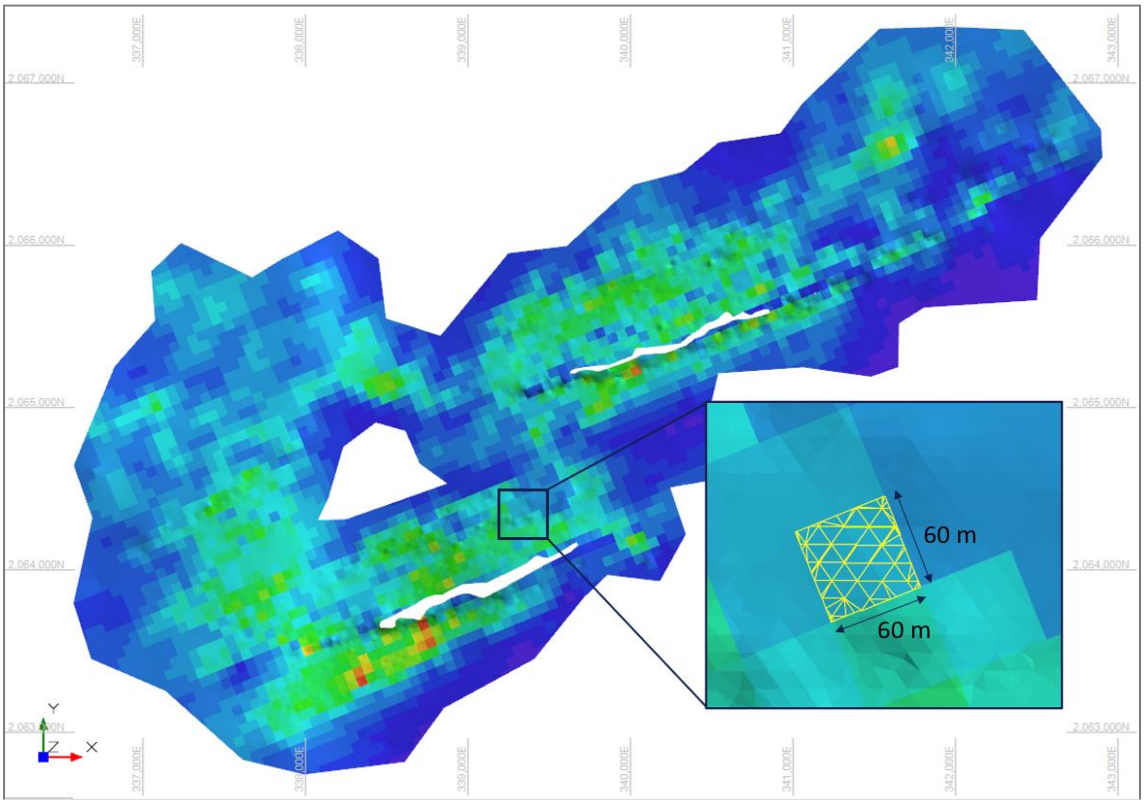


Figure 16-32: Plan view of the ore wireframe cut in regular mining units

As the solid only represents the ore layer, which is thinner than the minimum mining height in most places, a diluted grade had to be calculated from the in-situ grade. This diluted grade and the calculated variable cut-off grade (Section 16.7.3) were then used to filter the mining solids that would be scheduled in the mine plan (Figure 16-33).

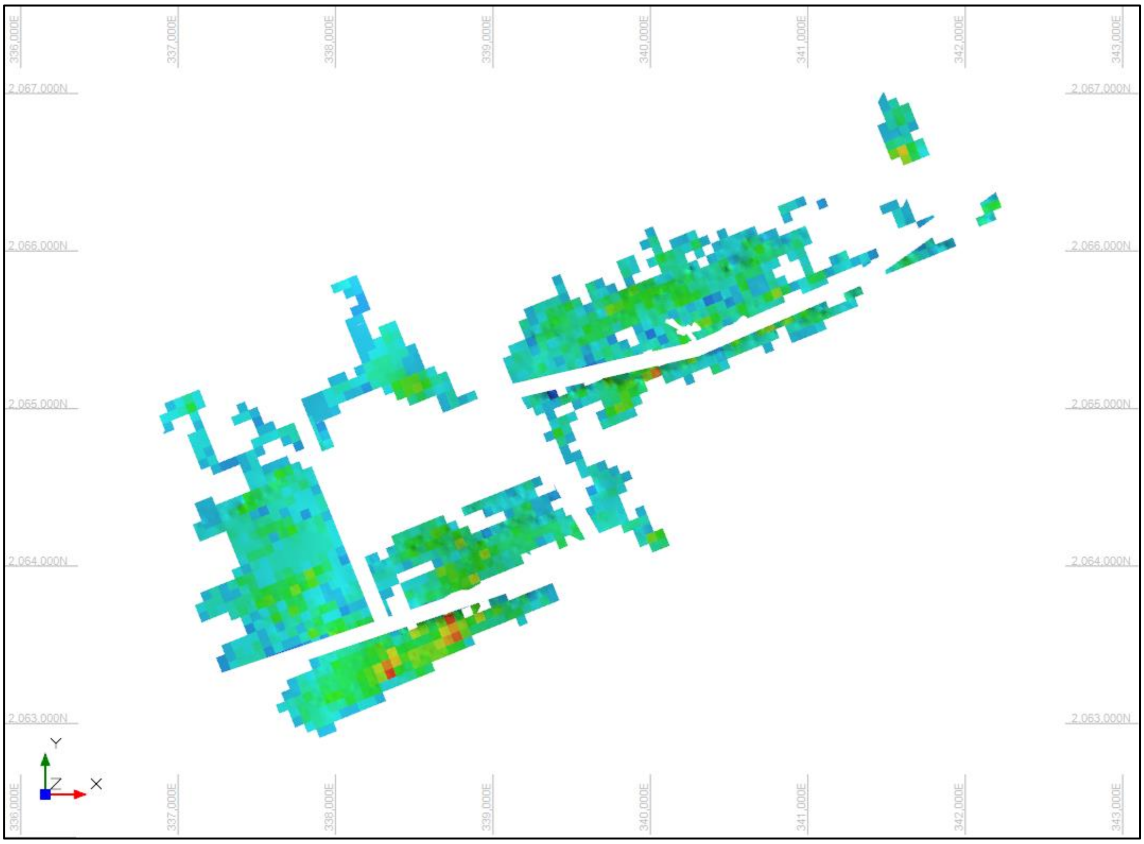


Figure 16-33: Mining units selected for M&M LoMP.

The diluted grades were calculated in Deswik.CAD as attributes and used directly in Deswik.Sched as “custom fields”, with no further interrogation at the scheduling phase. Some additional attributes were also calculated and imported directly from Deswik.CAD such as seam thickness, surface area, seam dip angle, etc.

As per the 2021 PFS study (SRK, 2021), the resource block model used for MSNE-Maryvonne was regularised using a percentage for both the mineralised thickness within each block and the footprint within each block included in the mineral resources. The blocks have the following dimensions:

- MSNE: 100 m x 100 m x 0.4 m
- Maryvonne : 5 m x 5 m x 0.4 m.

For MSNE-Maryvonne each column of blocks in the block model is consolidated and expanded to the minimum mining height of 1.8 m assuming non-mineralised waste (internal dilution) is added to achieve that height. The cut-off grade is applied to the resulting mining unit leaving only the areas to be targeted for mining. The results of this exercise are shown in Figure 16-34.

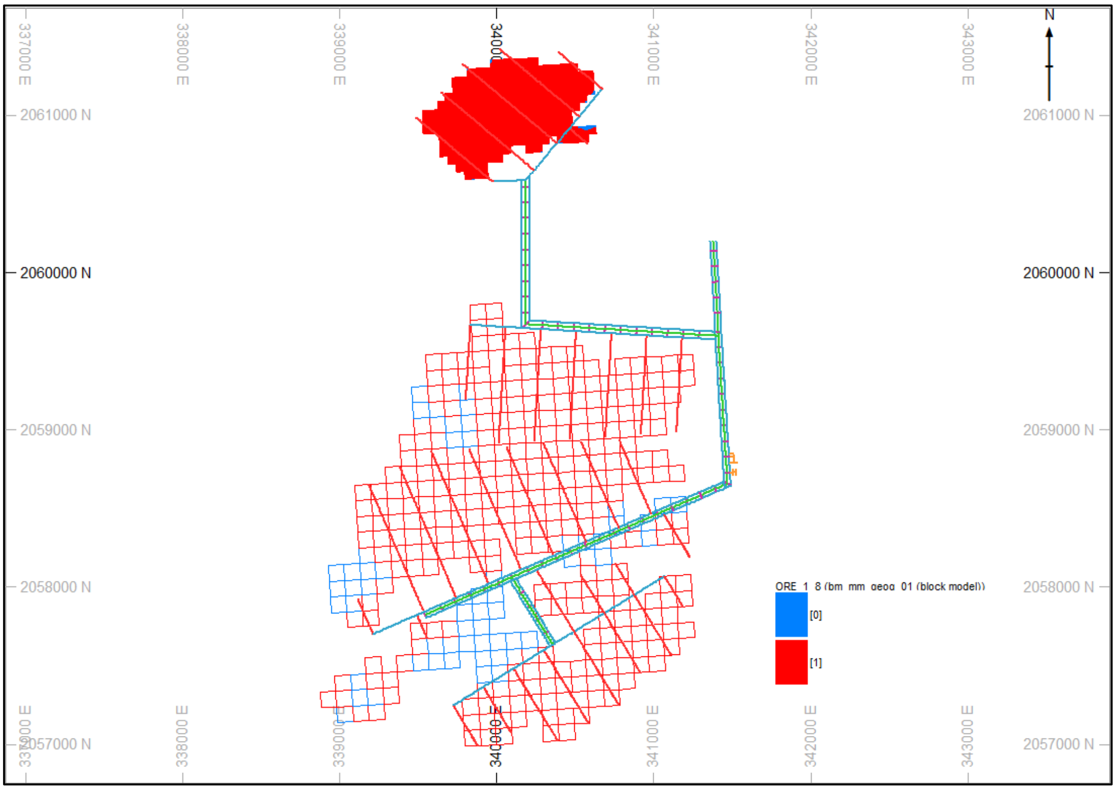


Figure 16-34: Mining units above cut-off grade for MSNE-Maryvonne at a mining height of 1.8 m

16.10 Underground Mine Layout

The mine layout principle consists of a central conveyor network that links the production panels to the surface via a decline. Where possible, conveyor drives are located in or moved to be located more centrally to the panels and to maximise scheduling flexibility.

On each side of the central conveyor drive is an access drive for equipment movement and truck haulage, allowing easy access to mining panels on both sides. However, and to allow crossing from one side to the other, it was considered that one out of every third crosscut (approx. 300 m spacing) would be lowered to allow low profile equipment and light vehicles to cross below the conveyor. As a secondary advantage, the triple heading development is useful from a ventilation point of view, allowing the delivery of fresh air throughout the lateral main accesses without risking contamination with radon daughters by passing over ore, and keeping the return air isolated and flowing through the conveyor tunnel (where possible).

Access and conveyor development profiles are assumed to be located above the contact with the Talak Shale as it:

- Prevents the Talak Shale from affecting road conditions in the major transportation routes.
- Locates the development above the ore zone, minimising the generation of radon daughters and its by-products, simplifying the ventilation design and increasing the allowable residence time of air underground.

Where possible, the accesses are located within the UA channels to provide a central access whilst minimising the Resources sterilised by the regional pillars.

The production panels development will ramp down from the main access to the Talak/Guezouman contact (Figure 16-35).

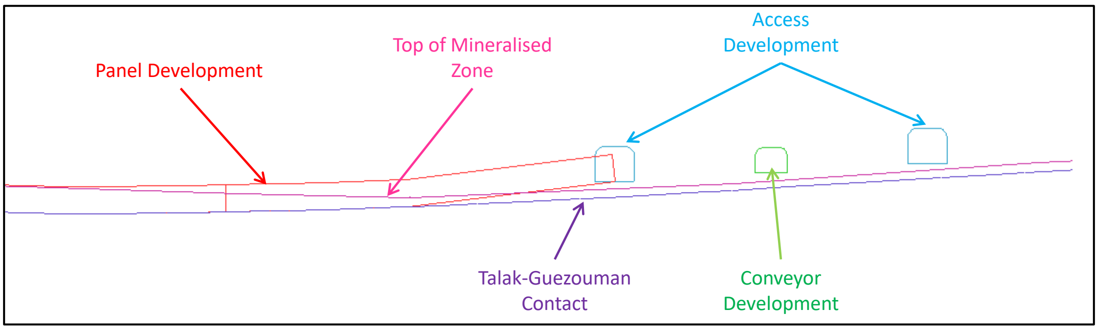


Figure 16-35: Schematic cross-section showing the central infrastructure above the mineralised horizon

Mining panels, accessed from the central infrastructure, are 225 m wide and comprising 200 m for production mining and 25 m for inter-panel pillars (Figure 16-36 and Figure 16-37).

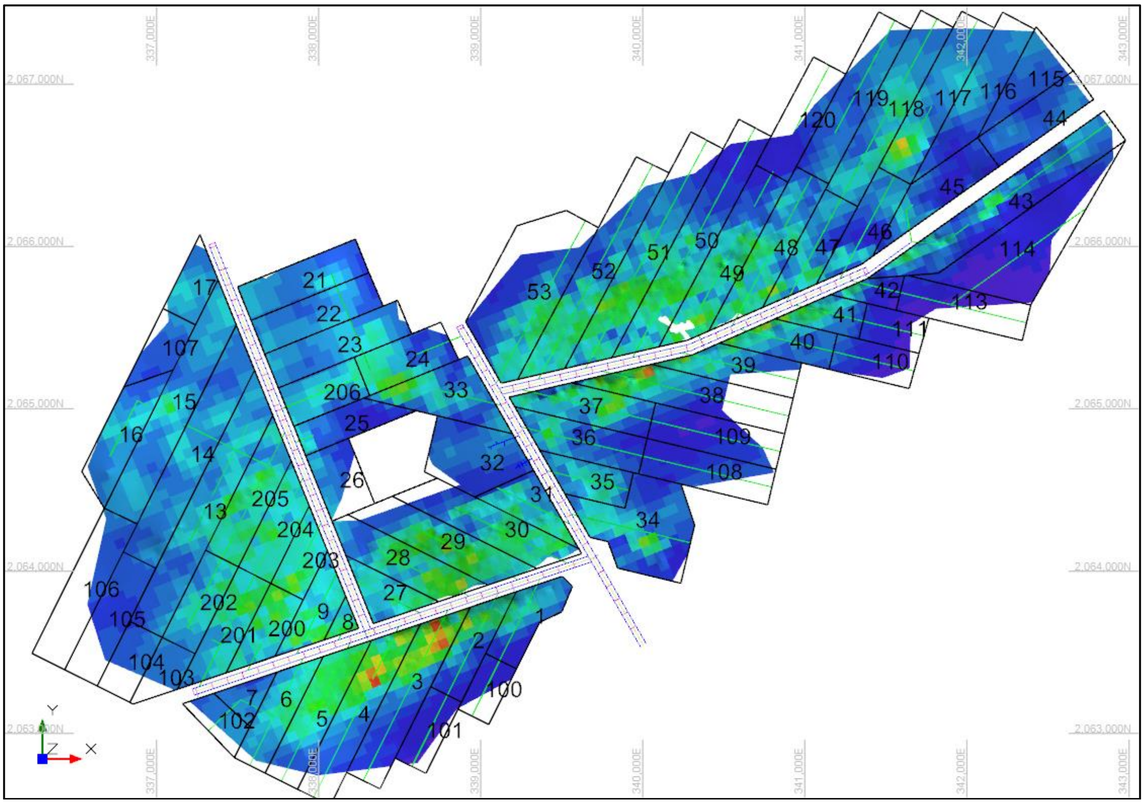


Figure 16-36: Plan view showing the production panel layout for Marilynn-Marianne

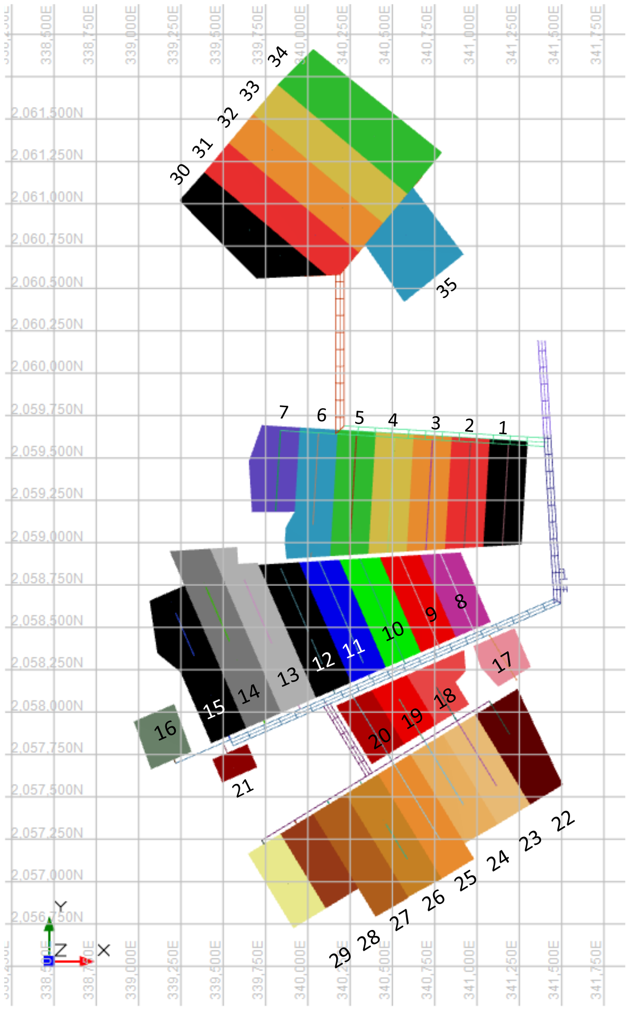


Figure 16-37: Plan view showing the production panel layout for MSNE-Maryvonne

Each panel is to be split into two production zones on each side of the panel access and divided by a 10 m pillar to make 100 m wide production zones. A 15 m pillar is also to be left between each panel to provide a regional pillar for ground stability and to separate ventilation circuits from adjacent panels. The panel access drive is to be located adjacent to the central pillar providing access to both production zones (Figure 16-38).

The panel access development has a higher profile than the production zones to allow sufficient clearance for trucks to be loaded with the mined material. In most of the M&M layout, production panels are accessed at an angle from the central conveyor development giving much of the design a fishbone appearance. This is because most of the panels are designed at 45° to the maximum dip of the mineralised horizon to minimise the need to change the mining direction due to localised zones of high gradient.

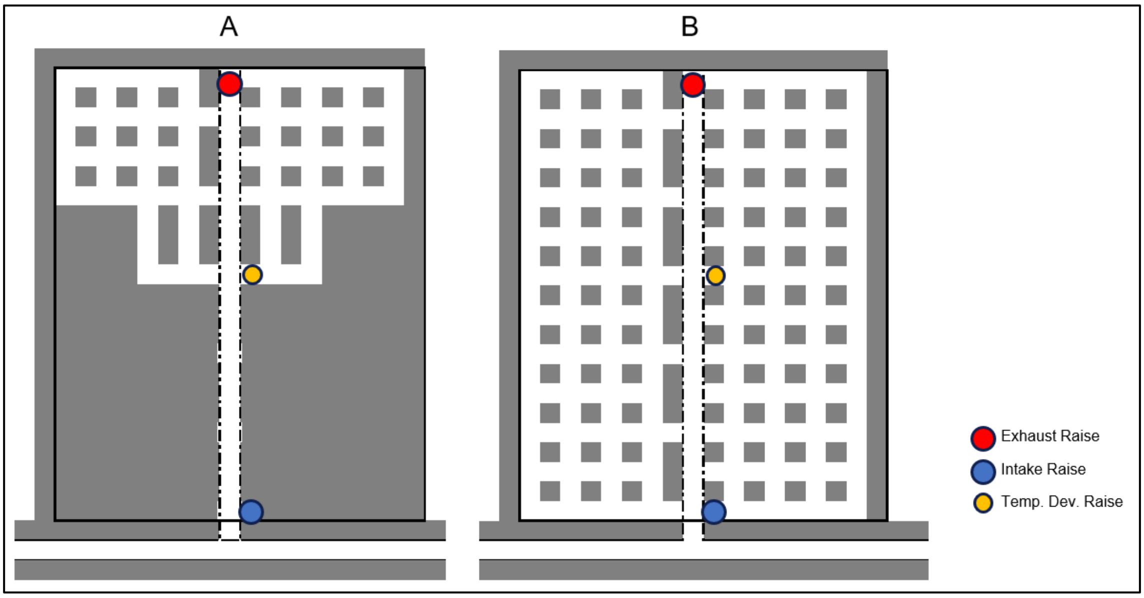


Figure 16-38: Plan view showing a schematic of a panel layout during production (A) and after depletion (B).

Each panel is mined only after the development is completed to its full extent and a ventilation raise is installed at the end of the panel. This creates a primary ventilation circuit with fresh air entering the panel at the panel entry and return air being exhausted to surface through the mined-out area. This approach has the significant benefit of minimising exposure of the crews and the whole panel access to radiation by reducing the transient time of radon, as well as keeping potential ground instability after mining away from panel access points.

16.11 Underground Infrastructure

16.11.1 Explosives Storage Facility

Underground storage of explosives will be minimal, with regular delivery from the surface Explosives Storage Facility (ESF) to underground The ESF incorporates three development bays allowing a physical separation of detonators, primers and bulk explosives and components. A hand operated chain crane will be mounted on the roof to assist with the handling of ANFO bulk bags within the ESF. A lockable gate will be mounted to the walls to restrict access to the underground ESF.

The ESF is to be centrally located with an independent and dedicated exhaust raise to isolate the impact of any fire or other catastrophic events.

16.11.2 Fuel Bay

A fuel bay is assumed be located within the same area as the underground stores, workshop and ESF, although it has not been designed at this stage. Diesel is envisaged to be stored at the surface and transported underground through lined boreholes with pressure reducers to control flow. Surface storage of the diesel allows for simple resupply and removes the need of having significant diesel storage in the underground environment. Oils and lubricants would be pumped from drums stored within the fuel bay.

The fuel bay could share the same exhaust raise as the workshop with a safe distance separation between the two. SRK notes that the fuel storage and distribution methodology need to be detailed in future studies and confirmation is required to ensure such configurations and solutions are consistent with Nigerien regulations and industry best practices.

16.11.3 Workshops

The shallow nature of the deposits allows the equipment to be transported (self-powered or towed) to surface for maintenance and repair. Simple repairs and checks can be undertaken underground at the workplace or in an underground workshop equipped with lights and a good floor. The diesel equipment will be fuelled up using a refuelling truck or at the fuel bay.

Weekly services should be undertaken at the underground workshops (M&M or MSNE), with main equipment and utilities moved to from M&M to MSNE once production starts there.

The main maintenance workshop will be located on the surface near Miriam and all required major overhauls should take place at Miriam close to the centralised stores.

16.11.4 Stores

There will be minimal storage of consumables underground (i.e. pipes, ventilation accessories, rockbolts, fittings, etc.) as regular deliveries will be made and controlled from a central storage facility at the surface.

16.11.5 Offices and Lunch Rooms

Offices and lunchrooms will be located on the surface near the workshop. A fleet of light vehicles and personnel carriers have been included to transport workers, to and from the underground workings.

Strict health and safety rules will be in place and eating in the production areas will be discouraged due to the risk of ingesting uranium minerals. Small areas with washing facilities will be established close to the fresh air intakes of the mining panels for rest breaks and eating. This will prevent excessive time lost for travelling from and to the work faces. Such areas will have hygiene facilities and require regular cleaning.

16.12 M&M Old Mine Workings

During the latest documents review and resource update, SRK received a report from 1967 containing a drawing referring to the old mining works at M&M, and from where some bulk samples were taken (Figure 16-39).

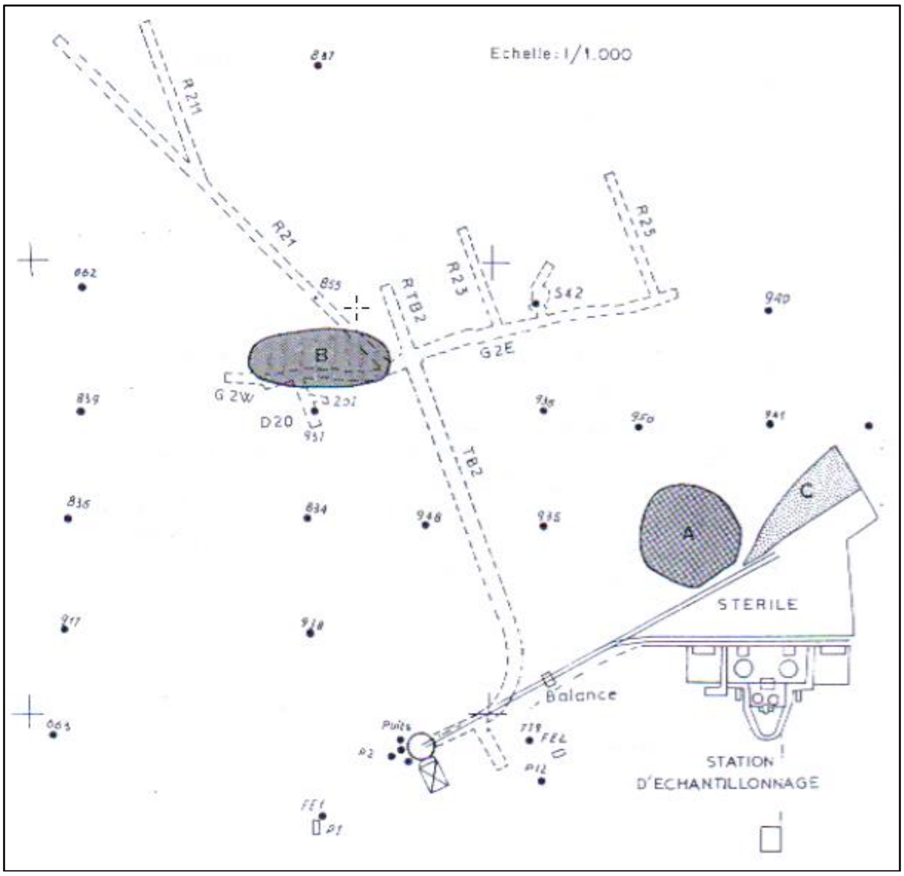


Figure 16-39: Plan view of the old mine workings (Ref: Commissariat a L'Energie Atomique - Direction Des Productions Afrique – Madagascar, 1967)

In the absence of a better georeferenced image or drawing, the position and extension of the workings was estimated using the old drill hole numbering and where coordinates could be located in the resource drill hole database. The mine workings were then recreated in Leapfrog based on the report descriptions and imported to Deswik.CAD. Given the described mine workings width of 4 m, a buffer zone of 3 times the mining width (12 m) was generated and used to cut and deplete the mining solids. The main access and conveyor tunnel location was also adjusted to avoid the location of these workings and minimise any additional risks during development.

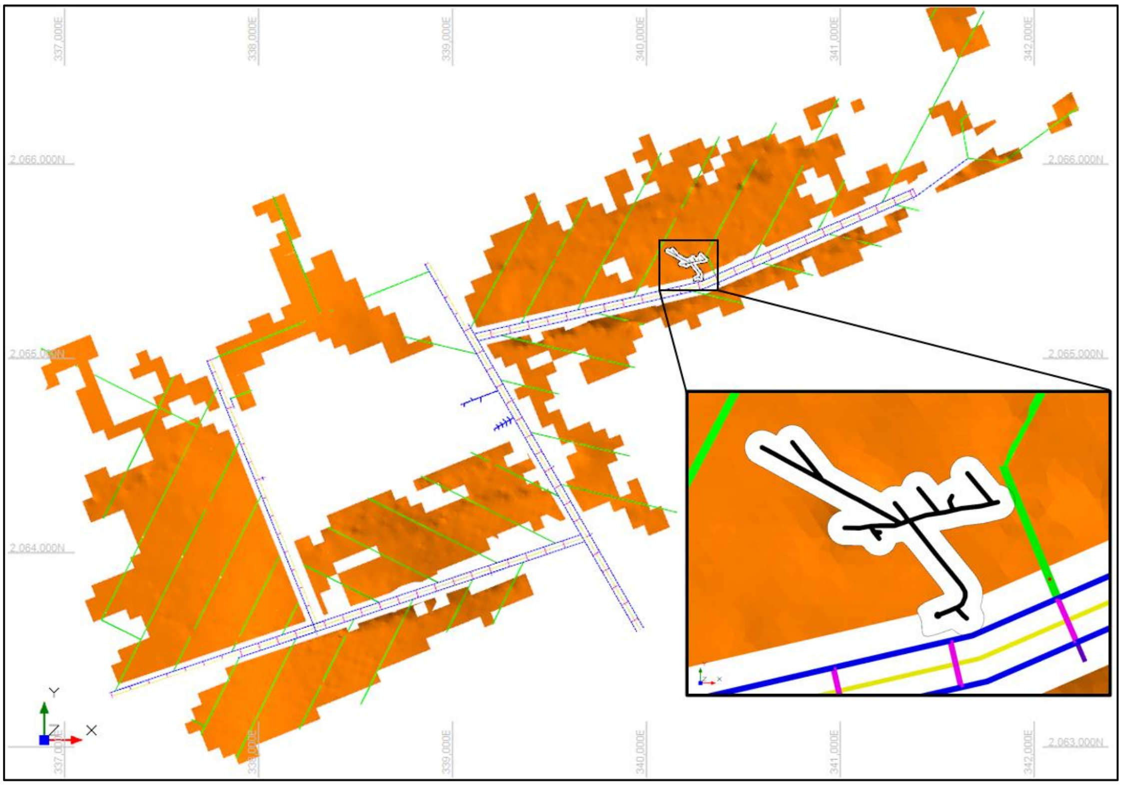


Figure 16-40: Plan view of M&M mine design with the estimated excluded area around the old mine workings.

SRK recommends that in future studies the location of these workings is refined, and a more accurate methodology is used to specify their location. In addition to this, it is recommended that, prior to construction, these workings are located, and the shaft location is surveyed to allow any necessary adjustments to the mine design and to assess any additional risks.

16.13 Underground Dewatering

16.13.1 Approach

Dewatering systems have been designed and costed to a PFS level (±25 %) for M&M and MSNE underground mines. These systems should:

- ensure that groundwater inflows do not become a constraint to mining production;
- be simple, robust and easily scalable to adapt easily (either adding or removing capacity) to actual inflows, and;
- be able to pump “dirty” water therefore removing the need for in-line sediment ponds or lamellar thickeners.

16.13.2 Pumping System

Groundwater inflows to the underground mine workings will be collected in small ditches and sumps before being transferred to larger sumps from where water will be pumped via pumping stations up the decline and via the portal to a settlement pond at the surface.

The predicted groundwater inflows (SRK, 2022e) for M&M and MSNE are shown in Figure 16-41 and Figure 16-42, respectively. Based on the results of these various inflow predictions, SRK has designed the dewatering system to a conservative inflow estimate. For M&M the duty and standby system is based on P50 and P90 inflow estimates, respectively. For MSNE, the duty and standby system is based on P10 and P50 percentile inflow estimates, respectively. More information for the rationale for these selections can be found in the numerical groundwater model report (SRK, 2022e).

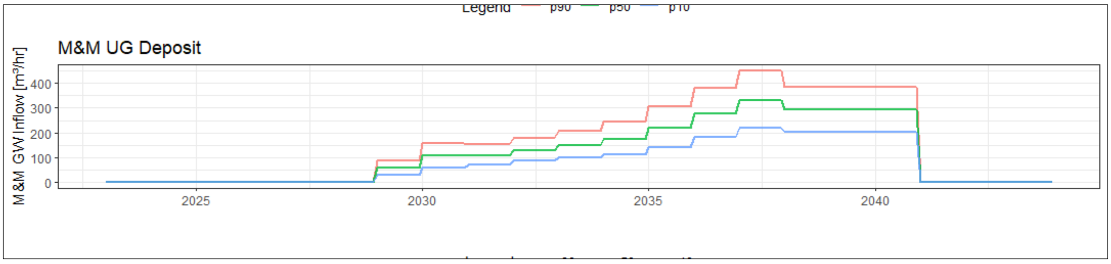


Figure 16-41: Predicted Inflows (m^3/hr) for M&M

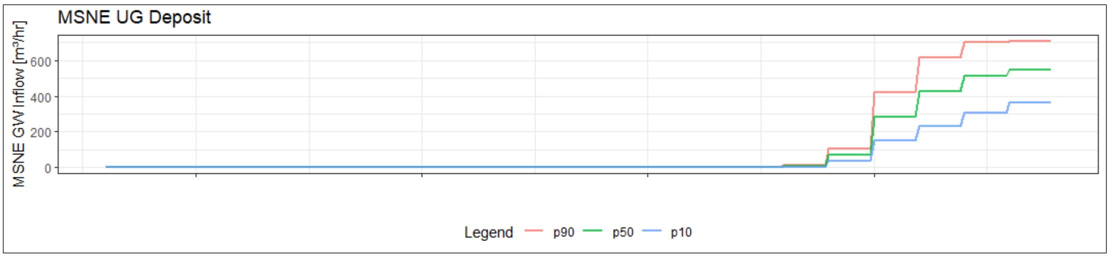


Figure 16-42: Predicted Inflows (m^3/hr) for MSNE

For the advance of the declines/ore drives, Challenge WEARTUFF WTX3 pumps will be used fed by electrical submersible pumps. These pumps can be used in parallel for higher flows and/or in series to overcome higher heads, with each WTX3 discharging to an open water tank which feeds the next WTX3 in line. Once the decline/ore drive is completed, the WTX3 decline pumps can be incorporated into a permanent pump station.

Dewatering in a room and pillar mine with an undulating floor can lead to many areas where water collects necessitating small scale pumping. In addition to the major pumping infrastructure items outlined above, small electrical submersible "trash" pumps should be used to manage water at the face of advancing declines and around active mining areas. These will be used to pump water to back from the decline face to the WTX03 pumps or from the active mining areas to the nearest main pumping station.

A proposed system layout assumed for the purposes of PFS costing for M&M and MSNE is shown in Figure 16-43 and Figure 16-44, respectively.

The layout of surface sediment ponds, pipelines and the recharge trench is presented in Figure 16-45.

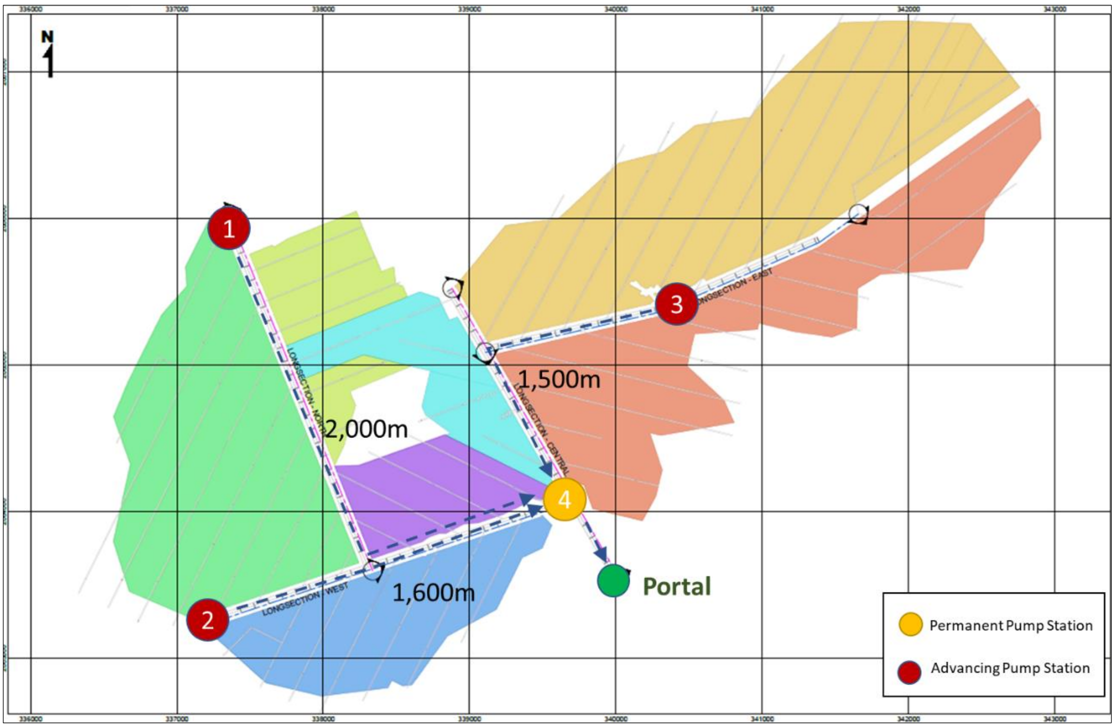


Figure 16-43: M&M Pump Station Layout assumed for PFS Level Costing (red circles denote pumping stations; green denote the portal)

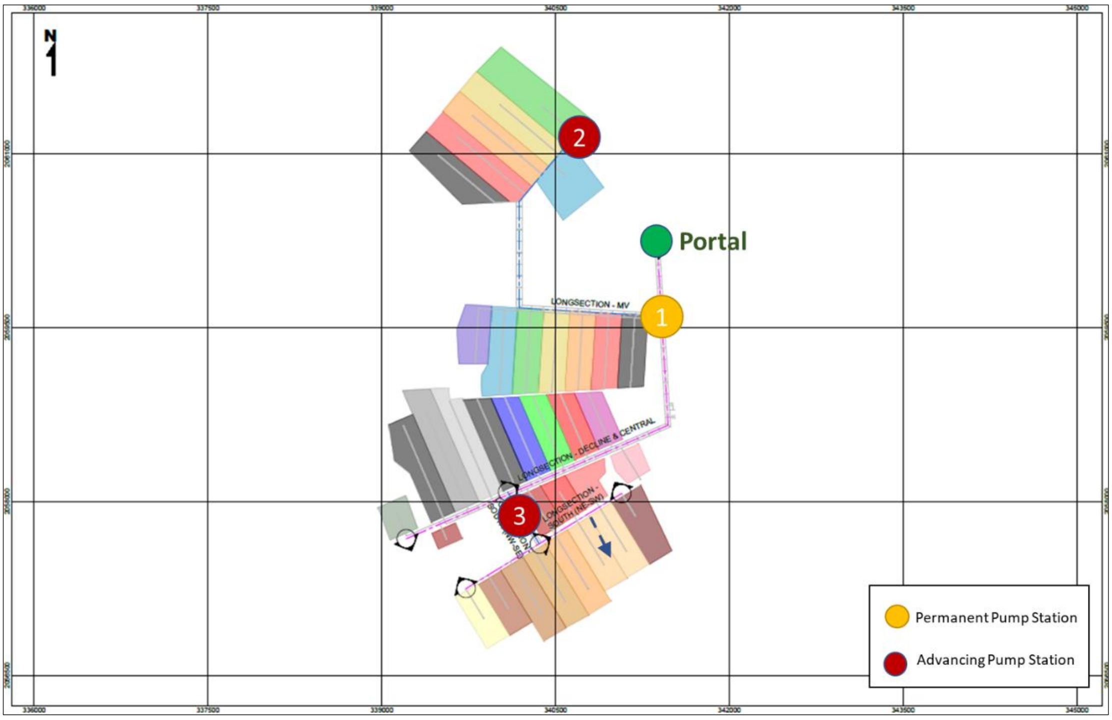


Figure 16-44: MSNE Pump Station Layout assumed for PFS Level Costing (red circles denote pumping stations; green denote the portal)

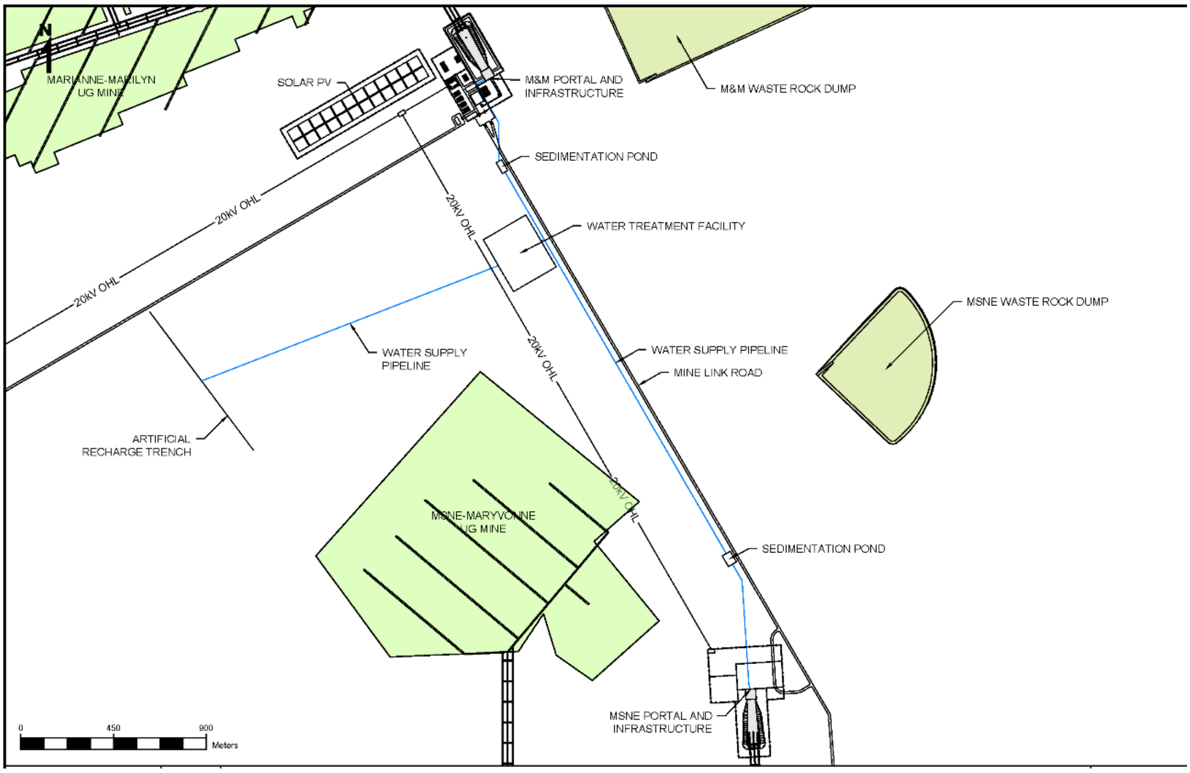


Figure 16-45: Layout of Surface Sediment Ponds, Pipelines and Recharge Trench

16.13.3 Emergency Water Management

Emergency storage capacity is required in case of power failure or sudden unexpected inflows leading to flooding. A general rule of thumb is to provide capacity for 24-hours of inflow at the maximum predicted inflow rate to the mine. This equates to around 6,000 m^3 of emergency storage at M&M and around 10,000 m^3 of emergency storage at MSNE. This storage space either needs to be located at an elevation below the lowest most pumping station or the pumping station needs to be installed with water doors and remote start/stop operation.

Currently, it is assumed that freeboard (>0.5 m) from the access declines to production areas will allow flooding of the room and pillar production areas without flooding the decline. For example, assuming a panel dimension of 280 x 600 m, of which 80 % is mined and a freeboard of 30 cm this would provide 40,320 m^3 of potential emergency water storage.

A nominal area of mine workings has been allocated to emergency water storage for the purposes of this study but modifications to working elevation versus development of a water-tight pumping station should be finalised at the detailed design stage.

16.13.4 Exploration Drill Holes and Vent Raises

It is recommended that all exploration holes are sealed, either by pre-grouting or capping one intercepted during the mining development.

The underground mine plans include provision for a large number of vent raises. There is potential for inflows to occur where the raise intercepts saturated portions of the overlying Tarat aquifer. Based on a comparison of the vent raise locations against the lithological model and groundwater elevation, it is possible that approximately 45 of the vent raises could intercept partially or fully saturated portions of the Tarat aquifer.

It is understood that these raises will likely be constructed by the raised bore method and no more than 4 will be constructed at any one time which has the potential to add an additional 40 m^3/hr total of short-term inflow during vent construction (based on preliminary analytical inflow calculations). Such inflows should be easily managed by the duty pumping systems or, as a worst case, by the standby pumps. However, it is assumed that all vent raises, where producing inflows, will eventually be sealed across permeable aquifer horizons.

16.13.5 Sedimentation Ponds (M&M and MSNE)

The M&M and MSNE underground workings will include operational areas from which 'dirty water' runoff is anticipated to have high suspended solids concentrations. Dewatering water from the underground mines will report to sedimentation ponds to settle out these solids. Sedimentation ponds are cost-effective and there is adequate space available for their construction. The following section summarises the sizing of these ponds, with more detailed reporting available in SRK (2022d).

Design Criteria

Horizontal flow settling pond installations were selected for use in the project with dimensions to ensure sufficient retention time to settle the solids. Figure 16-46 below shows a typical plan view of a horizontal flow settling installation with the three flow zones, namely the inlet zone, sedimentation zone and outlet zone.

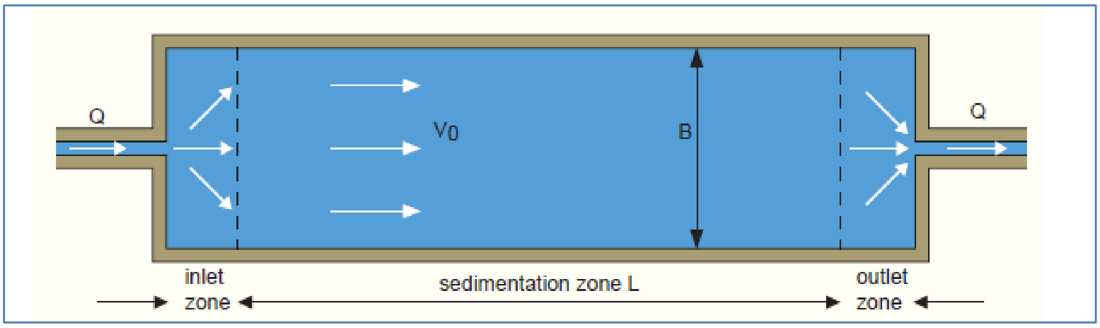


Figure 16-46: Typical Plan View of a Horizontal Flow Settling Pond

The design of the sedimentation ponds was guided by the principles stipulated in the British Columbia Ministry of Environment technical guidance[16]. Based on these principles, the following design criteria was applied to the pond designs:

- designed as a horizontal flow settling installation
- the capacity needs to satisfy the 1 in 10-year, 24- hour storm event
- provides settlement for a particle size diameter of 35E-3 mm (sensitivity analysis was also carried out for a 20E-3 mm particle size)
- operates at solution temperature is at 29.6°C which is the average climatic temperature for the site.

[16] British Columbia Ministry of Environment, 2015. *Assessing the design, size and operation of sedimentation ponds used in Mining; Technical Guidance 7 Environmental Management Act.* Ministry of Environment.

Design Results

Table 16-34 summarises the flows used to size the MM and MSNE sedimentation ponds and Table 16-35 summarises the design dimensions for the ponds. Settling occurs at the end of the tank and therefore resuspension of settled solids must be prevented and the flow velocity in the upward direction will then be limited.

The inlet flow is assumed to be 'ideal' implying that the flow across the cross section of the pond is evenly distributed. To achieve this, a diffuser wall is recommended for all sedimentation ponds. There are many types of diffuser wall layouts that may be implemented to achieve the objective of even distribution of flow. The type and construction of diffuser wall is recommended at detail design phase. A bypass channel that conveys higher flow peaks, in excess of the 1:10 year storm event, is included in the design.

Table 16-34: MM Inflow and Outflow Peak Flows for the 1 in 10-Year 24-Hour Storm Event

	MM	MSNE
Inflow		
$Area_{Pond}$ (ha)	0.18	0.27
$Q_{GWinflow}$ (m^3/s)	0.04	0.08
Q_{in} (m^3/s)	0.04	0.08
Volume (m^3)	2,902	6,480
Outflow		
$Area_{Pond}$ (ha)	0.18	0.27
Runoff Coefficient	1	1
Rainfall Intensity (mm/hr)	31	31
Q_{pond} (m^3/s)	0.02	0.02
Q_{out} (m^3/s)	0.06	0.10

Table 16-35: Design Dimensions Summary for MM and MSNE Sedimentation Ponds

	MM	MSNE
Pond Dimensions		
Operating Volume (m^3)	3,600	6,750
Length (m)	60	60
Width (m)	30	45
Height (m)	2	2.5
Freeboard (m)	0.5	0.5
Total Depth (m)	2.5	3
Side Slope (V:H)	1:1	1.1
Outlet Details		
Overflow Weir (m)	180	216
Spillway Length (m)	0.5	0.5
Spillway Depth (m)	0.5	0.5
No of Troughs	14	21
Trough Spacing (m)	1	1
Trough Depth (m)	2	2.5

16.13.6 Excess Water Discharge

Excess water will exist for periods during the mine life where the water entering the operations from groundwater and rainfall will exceed the mines water demand. The volume of excess water through the life of the mine has been estimated using the site water balance (SRK, 2022c).

For the purposes of design and costing to a PFS level the following is assumed:

- excess water from M&M will be discharged via a seepage recharge trench, and;
- excess water from MSNE will be discharged into the vacant M&M workings (note: it is important that the size of the recharge trench is reviewed based on the actual overlap period of M&M/MSNE mining and the actual dewatering).

The trench (refer to Figure 16-45) is designed for the P90 excess inflow from M&M, approximately 350 m^3/hr. Trenches are constructed with backhoes or other trenching equipment and backfilled with fine gravel or coarse sand. For trenches, water is supplied with a perforated pipe on top of the backfill and the trench can be covered to avoid exposure to sunlight and public access. Estimated recharge trench dimensions of 3 x 840 m has been estimated for a 5m deep trench.

More detailed information on the trench design assumed for the PFS can be found in SRK (2022f). The trench has been designed to a conceptual level only and further assessment is required as a priority for the FS. A trade-off against other methods, such as reinjection wells, is required along with supporting field investigations and modelling.

16.13.7 Water Treatment

Water from the underground workings is likely to exceed PSG[17] standards for drinking water for pH, sodium, uranium and radiation (gross alpha/beta) based on groundwater quality monitoring (SRK, 2022g). In addition, it is likely that treatment will be required for parameters generated as part of the mining operations including nitrates (from explosives), oils/greases and sediment load (suspended solids).

Sediment load is a cause of concerns in the underground workings due to the erodibility of the argillite and silty clay of the Talak, and of the silts and clays of the Unite Akokan (UA). The development drives have been located within the Guezouman above the UA contact in order to reduce erosion along the base of the drives. Suspended sediment will however be generated within the mining areas which are located on the contact.

For the purposes of the design and costing a treatment system comprises settlement ponds near the portal of each deposit. From this, water will be pumped to a shared water treatment facility which will comprise oil water separators and rotating biological contactors (RBCs) for nitrate removal.

The treatment plant has been designed for a treatment volume of 125m^3/hr. This is less than the predicted peak volume of reinjection (350m^3/hr) and assumes treatment will only be required for active panel areas.

[17] Environmental and Social Design Criteria and Guidance

Further work will be required to evaluate in detail additional treatment requirements, including volumetric capacity of the plant. This is particularly important given the receiving aquifer of infiltrated water will likely be the Tarat which typically has a better water quality. The additional study work may also need to consider treatment of parameters such as sodium, uranium and radiation, which can be achieved with methods such as iron exchange and/or reverse osmosis. Such methods have not been costed as part of the current study. The study will also need to consider the quality of MSNE waters and the degree of treatment required to dispose of within vacant M&M workings.

16.13.8 Cost Estimation

Assumptions

For M&M and MSNE, the capital cost estimate has been completed to a PFS level and has an estimated level of confidence of ±30 %.

The following assumptions and parameters are common to all cost estimates, changes of which will affect the level of accuracy:

- 30 % installation factor for all equipment.
- 17 % factor for Preliminary and Generals (P and G's).
- Cost of delivery based on cost per container of USD 9,000 with a capacity of 20 tonnes. Equipment weights have been estimated.
- Project power cost of 0.159 USD/kW where equipment is powered by mains (solar power grid, see Section 18 for more information).
- Pump maintenance cost of 0.06 USD for every m^3 pumped.
- Labour costs for maintenance and operation of the dewatering systems are included in the mining section of this study.
- Costs are not adjusted for potential inflation.

Capital Expenditure

A summary of underground dewatering related capital costs are shown in Table 16-36. Total dewatering capital costs are nearly USD 8.4 M.

It is assumed that pumps purchased for M&M dewatering can be transferred to MSNE. However, MSNE commences 3-4 years before M&M finishes to allow for development of decline and ore drives. Therefore, the capital costs include provision for 2 x WT3X and 1 x WT114 pumps to allow early development of MSNE during this overlap period. This should be carefully reviewed during subsequent studies and detailed design as more pumps may be required.

For the purposes of costing the required quantity of trash pumps and pipelines has been reduced by 50 % assuming these items can also be obtained from M&M dewatering infrastructure.

Table 16-36: Summary of Underground Dewatering Related Capital Costs (USD)

Purchase Description	Unit	QTY	Rate	Rate Source	Cost	Markups	Total (USD)
M&M Dewatering							
WTX3 (Duty)	No.	3	83,672	Q	251,016	230,935	481,951
WTX3 (Standby)	No.	3	83,672	Q	251,016	230,935	481,951
WT114 (Duty)	No.	2	119,650	Q	239,301	220,157	459,458
WT114 (Standby)	No.	2	119,650	Q	239,301	220,157	459,458
Grindex Mini Auto	No.	35	1,227	F	42,945	39,509	82,454
6" pipeline	No.	6,100	27	F	164,700	151,524	316,224
2" pipeline	Mt.	4,000	3	F	12,000	11,040	23,040
TOTAL CAPEX FOR M&M DEWATERING							**2,304,536**
MSNE Dewatering							
WTX3 (Duty)	No.	2	83,672	Q	167,344	81,352	248,696
WTX3 (Standby)	No.	0	83,672	Q	-	-	-
WT114 (Duty)	No.	1	119,650	Q	119,650	57,586	177,236
WT114 (Standby)	No.	0	119,650	Q	-	-	-
Grindex Mini Auto	No.	15	1,227	F	18,405	8,947	27,352
6" pipeline	Mt.	2825	27	F	76,275	45,651	121,926
2" pipeline	Mt.	500	3	F	1,500	928	2,428
TOTAL CAPEX FOR MSNE DEWATERING							**577,638**
Infiltration Trench							
Excavation	m^3	12,600	12.5	F	157,500	74,025	231,525
Perforated PVC Pipe	m	840	30	F	25,200	11,844	37,044
Gravel	m^3	12,600	27	F	340,200	159,894	500,094
Pump (water treatment facility to trench - c.31kW)	No.	2	60,000	F	120,000	56,400	176,400
HDPE Pipeline (Settlement Pond to trench - 280mm)	m	3,000	69	F	207,000	97,290	304,290
TOTAL CAPEX FOR INFILTRATION TRENCH							**1,249,353**
Water Treatment							
Oil Water Separator	No.	1	200,000	F	200,000	94,000	294,000
Rotating biological contactor (nitrate removal)	No.	1	2,000,000	F	2,000,000	940,000	2,940,000
M&M Settlement Pond	No.	1	44,000	SW	44,000	20,680	64,680
MSNE Settlement Pond	No.	1	70,000	SW	70,000	32,900	102,900
TOTAL CAPEX FOR WATER TREATMENT							**3,401,580**
TOTAL UNDERGROUND DEWATERING CAPEX							**7,533,107**

** Q = Quote obtained for the study.*

F = Estimated from manufacturer price lists or historical quotes from similar projects.

SW = Stormwater management study.

Operating Expenditure

A summary of underground dewatering related operating costs is summarised in Table 16-37. This table also includes a breakdown of capital costs across the mine life. The cumulative cost of capital + operating after 20 years is nearly USD 14 M.

Table 16-37: Underground Dewatering Operating Costs and Life of Mine Summary (USD)

Year	CAPEX	OPEX				ANNUAL TOTAL (USD)	CUMULATIVE (USD)
		M&M	MSNE	Infiltration Trench	Water Treatment		
-1	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	428,379	82,147	-	-	-	510,526	510,526
7	-	82,147	-	-	-	82,147	592,673
8	1,000,073	82,147	-	-	-	1,082,220	1,674,893
9	4,650,933	148,862	-	85,698	7,008	4,892,500	6,567,393
10	-	148,862	-	85,698	7,008	241,567	6,808,961
11	433,563	148,862	-	85,698	7,008	675,130	7,484,091
12	-	369,526	-	85,698	7,008	462,232	7,946,323
13	-	369,526	-	85,698	7,008	462,232	8,408,555
14	1,020,157	369,526	62,860	85,698	7,008	1,545,249	9,953,804
15	-	426,678	62,860	85,698	7,008	582,244	10,536,048
16	-	426,678	268,833	85,698	7,008	788,217	11,324,265
17	-	426,678	268,833	85,698	7,008	788,217	12,112,482
18	-	-	268,833	-	7,008	275,841	12,388,323
19	-	-	562,480	-	7,008	569,488	12,957,811
20	-	-	562,480	-	7,008	569,488	13,527,299

16.14 Underground Run of Mine Ore

For the updated M&M design and schedule, the mine design and mining solids were imported from Deswik.CAD to Deswik.Sched, where the required mining sequence was implemented. After this, a life of mine schedule based only on Indicated and Measured resources was created and reports for the various scheduled physicals and total quantities were generated. The mining solids were selected by applying the resource classification and the cut-off grade methodology, and the modifying factors as described in Section 16.7.

For MSNE and Maryvonne the approach is the same as in the previous study. The RoM was estimated for each column of blocks intersecting the Mineral Resource. Each column is diluted to the minimum mining height before the mining factors are applied (i.e. mining losses, dilution, and cut-off grade). Further adjustments were made to verify that the estimated revenue for each panel is not only sufficient to cover the production costs, but also the cost of the panel access development and raises designed for each panel.

Table 16-38 shows the total estimated RoM ore for M&M and MSNE-Maryvonne, split by production ore and development ore, where estimated.

Table 16-38: Estimated total RoM ore.

M&M		Tonnes (Mt)	U Grade (kg U/t)
	Production Ore	13,508	0.88
	Development Ore	242	0.66
	RoM Total Ore	13,750	0.87
MSNE-Maryvonne		**Tonnes (Mt)**	**U Grade (kg U/t)**
	Production Ore	6,652	0.79
	Development Ore	-	-
	RoM Total Ore	6,652	0.79
Total		**Tonnes (Mt)**	**U Grade (kg U/t)**
	Production Ore	20,160	0.85
	Development Ore	242	0.66
	RoM Total Ore	20,403	0.85

16.15 Underground Sequencing

Both M&M and MSNE-Maryvonne orebodies are sequenced based on their proximity to the declines, aiming to mine higher grade ore early in the mine life and following the development of the main infrastructure. Flat lying orebodies such as these reduce the flexibility to target different zones of the mine simultaneously, with all the panels being constrained by the time required to develop access and have the conveyor system ready to start production.

At the panel level, mine ventilation is a key driver of the mining sequence to achieve good radiation control by minimising the transient time of the radon gas and its daughter products. This becomes critical when in production, with every panel development requiring an initial raise to be completed at the panel entrance before it continues to the end of the panel and into production. Given the length of the mining panels and the single-entry configuration, additional raises are required along the panel development (approx. every 400 m) as it develops to keep exhausting the return air and the radon gas, without having it mixed with the fresh air coming from the panel entrance. Production then starts at the end of the panel development and retreats towards the panel entrance. This way, all the mined-out zones are kept away from the panel entrance and travel route to and from the working faces, minimising exposure to radiation and potential falls of ground in the mined-out rooms.

In the early years of operation, general panel sequencing is based on the panel proximity to the decline and the shortest duration possible to bring the panel into production. Once a district is established and a conveyor is commissioned, production remains concentrated within that district. As more ore is required, production moves outside the district with a priority given in Deswik.Sched by the phasing sequence.

Figure 16-47 and Figure 16-48 show a few snapshots taken from of both M&M and MSNE-Maryvonne schedule as shown in Deswik.CAD.

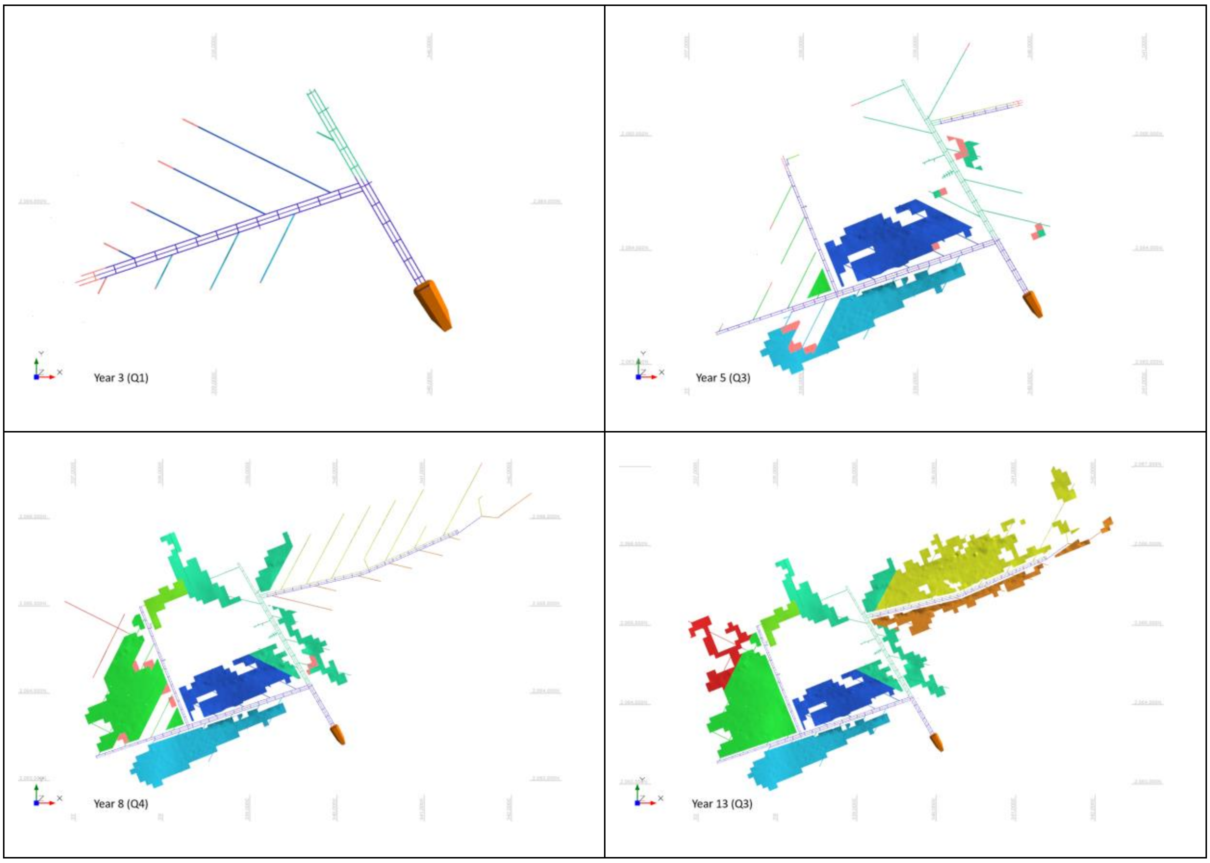


Figure 16-47: Snapshots of M&M mining sequence.

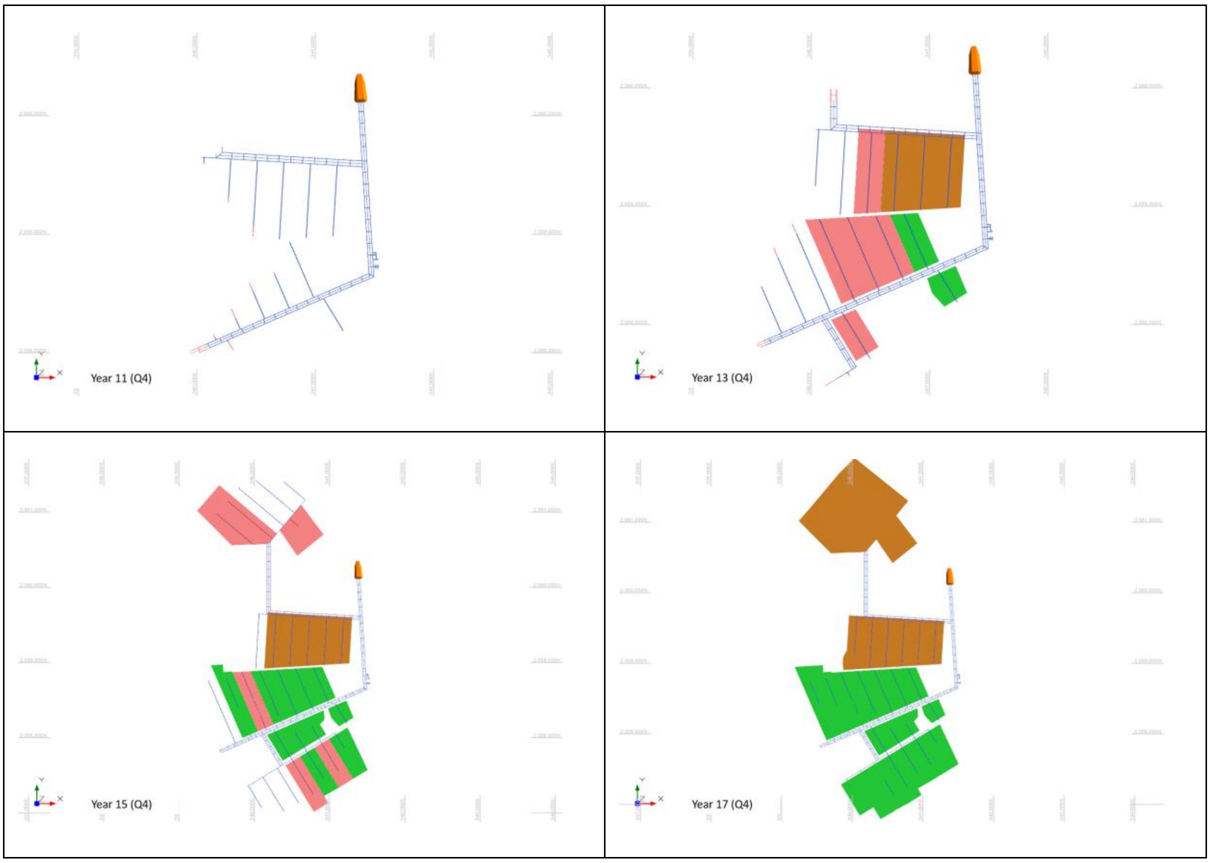


Figure 16-48: Snapshots of MSNE-Maryvonne mining sequence.

16.16 Underground Production Rate

16.16.1 Production Constraints

A modular approach to mining of the Madaouela deposits is assumed for production modelling. Each panel is considered to be largely independent of the next as it can be mined with a dedicated mining crew with independent ventilation. Therefore, panel production rates are determined by the productivity of the mining crew, and so mine production is determined by the number of panels to be worked concurrently.

The advantage of this approach is that it provides flexibility while in operation, should there be an issue in one panel (e.g. ventilation, ground control), production can be sourced from another panel with minimal delay (provided the panel is prepared in advance).

Material handling is limited by the conveyor network to a capacity of 380 t/h (approximately 7,600 t/d based on a 20 operating hours per day).

Cultural aspects of the local workforce are considered in the estimation of productivity and labour requirements. Staff are expected to be predominantly Muslim and observance of prayer times and reduced worker productivities during fasting (Ramadan) are considered.

16.16.2 Production Rate Benchmark

COMINAK's Akouta Mine applies a similar modular approach to mining as that proposed for Madaouela. Five production crews are producing approximately 90,000 tpa each, which includes an element of backfilling. A typical production rate for the mine is 1,500 t/d.

16.16.3 Applied Rates

Mine production rate assessment was conducted in the previous studies and concluded that a sorted feed rate of 2,780 tpd to the processing plant, up to 4,390 tpd of RoM, is required from the mining panels. The production rates are based on providing the same quantity of mineralised material in the RoM feed for each mine.

16.16.4 Ramp Up

At M&M, the first 1.5 years of mining is to establish underground mine infrastructure, including the Decline and West conveyors and a necessary panel length to provide sufficient faces to start production. This will be scheduled to coincide with the decline of ore production from the Miriam open pit. Priority was given to the West panels and the ramp up is constrained by the panel availability. Once a panel is available, it is mined at its full production rate.

At MSNE-Maryvonne, development is expected to take 2.5 years and is timed to start covering for the M&M decrease and maintain a constant ore feed to the plant. The lower development rate is due to the assumed resource sharing between the two mines and the lower demand for rapid development rates and access to ore.

For a panel to be considered available the trunk conveyor servicing the panel and the first ventilation raise within the panel to allow for through ventilation must be installed and commissioned.

16.16.5 Mining Equipment Productivities

Scheduling parameters for underground mining have been built up from first principles using information sourced from equipment suppliers, benchmark operations, GoviEx and SRK's own databases and experience.

The calculated productivities for selected equipment are shown in Table 16-39. The productivities assume three 8 hr shifts per day with a mechanical availability ranging from 80 % to 85 % and utilisations ranging from 55 % to 80 % depending on the equipment and allocated fleet.

Table 16-39: Equipment productivities used

Equipment	Units	
Jumbo – Development	$m_{advance}$/month	280
Jumbo – Production	$m_{drilling}$/month	23,500
Rockbolter - Development	units	1 for each Jumbo
Rockbolter - Production	$m_{drilling}$/month	6,400
Loader – Development	t_{RoM}/month	32,000
Loader – Production	t_{RoM}/month	25,500
Truck - Development	t_{RoM}/month	14,000
Truck - Production	t_{RoM}/month	16,800

The rates applied in the updated mine schedule for M&M and MSNE-Maryvonne were based on previously calculated first principles equipment productivities and cycle times for the various development profiles. Development drilled using the larger development jumbo is expected to achieve 3.6 m of advance per firing, whilst the low-profile production jumbo is expected to achieve and advance of 3.4 m. Table 16-40 outlines the advance rates applied to the mining schedules.

Table 16-40: Estimated development advance rates used in Deswik scheduler

Development Profile	Units	
Decline/Access	$m_{advance}$/month	120
Conveyor	$m_{advance}$/month	120
Panel	$m_{advance}$/month	75
Production	$m_{advance}$/month	50
Raiseboring	$m_{advance}$/month	150

SRK understands that penetration rates for the drilling are expected to be high and similar to those observed at the nearby Akouta Mine. However, although schedule advance and mining rates were kept the same as in the previous PFS (Table 16-40), for cost estimation purposes, more conservative productivities were assumed and in line with comparable benchmarks and internal SRK references (Table 16-38).

16.16.6 Mine Production

Up to 43 production blasts are estimated to be required each day, approximately 14 per shift, two per drill, to meet the production targets for each mine of up to 4,400 tpd. The productivity of the room and pillar mining method is estimated to be close to 30 $t_{RoM}/m_{advance}$, which is considered to be low but justified by the low profile mining height (1.8 m). As a comparison, the productivity of the 5 mW x 4.5 mH main access tunnel is close to 55 $t_{RoM}/m_{advance}$.

16.16.7 Construction

Construction of the portal is estimated to take six months from commencement of works before development of the decline can begin. The mine construction and surface infrastructure are detailed in Section 18.4.

Ideally conveyor construction is completed prior to mine production commencing to keep haulage costs down. However, in practice, truck haulage is available to commence production earlier by hauling straight from the mining face to the portal and the ore sorter No allowances for additional trucks to cover this additional haulage duty have been provided and SRK recommends that conveyor installation times and integration with production ramp-up are better detailed and optimised in future studies.

16.17 Underground Life of Mine Plan

LoMPs were produced for M&M and MSNE-Maryvonne in Deswik.Sched. The two mine designs were combined in one single Deswik project file and scheduled together in Deswik.Sched following the sequencing strategy described in Section 16.15. The focus for the latest mining study update was to increase the scheduling detail only in M&M as it represents the greater portion of the underground mine life and it is planned to follow the Miriam open pit. MSNE-Maryvonne was integrated into the combined schedule with the same tonnes and grades as in the previous studies but to which the same sequence and mining rates for M&M were applied.

The LoMP integrates the underground designs from both M&M and MSNE-Maryvonne into a single schedule. All panel and infrastructure development in M&M is scheduled to be completed before the decline commences in MSNE-Maryvonne.

A summary of the LoMPs for each mine and total is provided in Table 16-41, with a visual representation of the production profile in Figure 16-49.

Table 16-41: Summary of underground Life-of-Mine plan

	M&M	MSNE-Maryvonne	Total
Production (kt RoM)	13,750	6,652	**20,403**
Grade (kg/t eU)	0.87	0.79	**0.85**
Metal (t eU)	11,981	5,273	**17,255**
Lateral Development (km)	53.8	40.5	**94.3**
Vertical Development (km)	7.2	10.0	**18.4**
Years of Production (Years)	11.1	4.8	**15***

(*) Combined Production

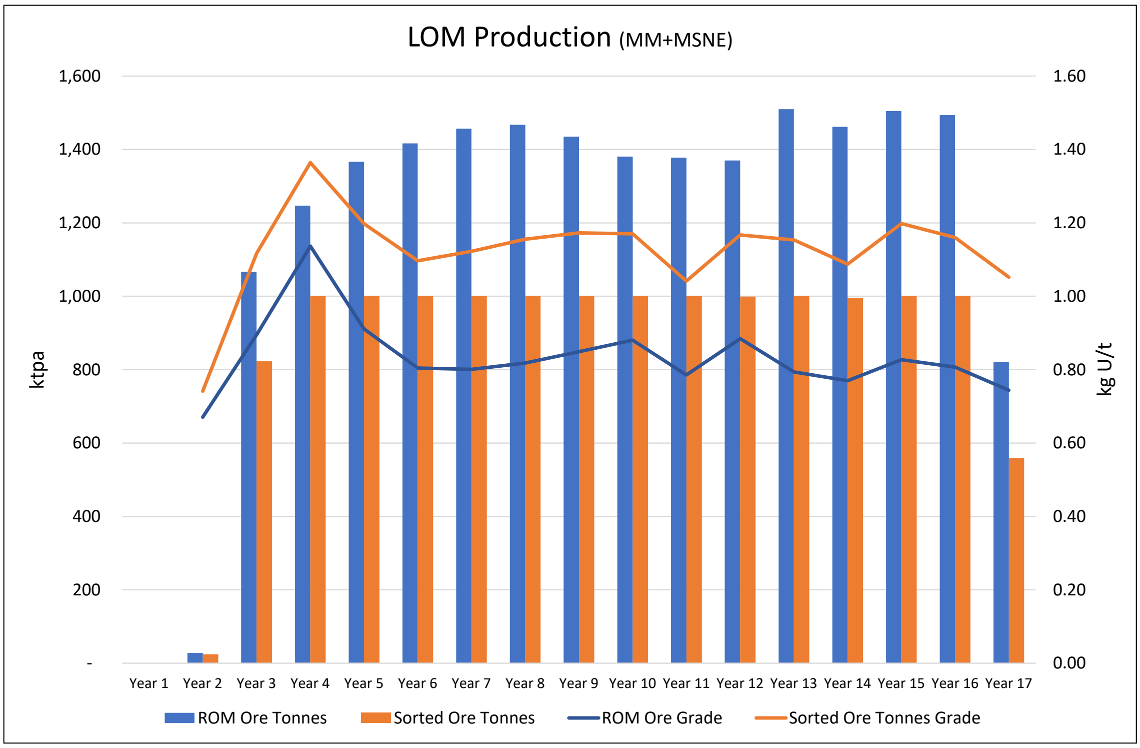


Figure 16-49: Combined production profile for M&M and MSNE LoMP

Table 16-42: Life of mine production plan for M&M and MSNE Maryvonne combined

			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17
Mine Source			M&M									Combined				MSNE - Maryvonne			
Mine Development	Total	Units																	
Lateral Development	94,322	m	1,190	8,523	9,257	8,924	8,247	8,138	7,279	2,106	150	1,553	9,103	9,106	8,689	8,362	3,694	-	-
Vertical Development	18,385	m	270	1,080	2,160	3,240	637	469	282	194	-	1,080	1,928	1,493	1,680	2,405	1,466	-	-
Waste Tonnes	4,981	kt	55	393	411	426	427	415	368	128	26	74	479	514	508	514	243	-	-
Production RoM	Total	Units																	
Ore Mined Tonnes	20,403	kt	-	28	1,066	1,247	1,366	1,417	1,457	1,467	1,435	1,381	1,378	1,370	1,510	1,462	1,505	1,494	821
Ore Grade (U)	0.85	kg/t eU	-	0.67	0.90	1.14	0.91	0.80	0.80	0.82	0.85	0.88	0.79	0.88	0.79	0.77	0.83	0.81	0.74
Metal (U)	17,255	t	-	19	955	1,417	1,244	1,140	1,166	1,200	1,218	1,216	1,082	1,212	1,199	1,125	1,245	1,205	611
Production After Sorter	Total	Units																	
Sorted Ore Tonnes	14,401	kt	-	24	823	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	999	1,000	996	1,000	1,000	559
Sorted Ore Grade (U)	1.15	kg/t eU	-	0.74	1.12	1.36	1.20	1.10	1.12	1.16	1.17	1.17	1.04	1.17	1.15	1.09	1.20	1.16	1.05
Sorted Metal (U)	16,607	t	-	18	919	1,364	1,198	1,097	1,123	1,155	1,173	1,170	1,042	1,166	1,154	1,083	1,198	1,160	588

16.18 Underground Mine Ventilation

16.18.1 Introduction

Ventilation is a key consideration for a uranium mine as it is the main measure to manage the radon released into the atmosphere and the removal of its progenies and to reduce the exposure of all mine personnel. For this reason, specific attention is given to the ventilation considerations for the Madaouela Project.

For this mining study update, SRK conducted an internal review and update of the previous M&M and MSNE-Maryvonne mine ventilation approach through its mine ventilation specialists from SRK Consulting (U.S.). The review was based on the PFS mine ventilation report and was performed based on desktop calculations and industry best ventilation practices for similar uranium mining operations. Fan duties were estimated using spreadsheets to determine ventilation "loops" for the purposes of calculating required total fan pressure and airflows. Ventilation cost estimation was based on a manufacturer quote requested for the purpose of this review and for the updated list of ventilation requirements.

16.18.2 Radiation

In addition to the conventional need to dilute diesel exhaust fumes and diesel particulate matter, the uranium content of the deposit introduces radon gas and its progeny into the mine ventilation stream. Because the rate of decay of radon into its radioactive daughter elements increases with time, very small quantities of radon gas can become problematic if not removed.

Removal of contamination at the source is regarded as the most effective strategy for dealing with radon progenies. If radon daughters are released into the mine atmosphere during operations, the methods currently available are to remove the contaminated air or dilute it to acceptable levels. Effective management of the measurement and control system is critical, especially in working areas located near the mineralised zones. Single-pass (primary) ventilation should be used to minimise residence time of radon gases in the mine and limit the exposure to personnel.

Radon is highly soluble in water and there is usually a high occurrence of radon in the groundwater located near the orebody. Water will be monitored prior to discharge to the planned seepage trench.

16.18.3 Design Requirements

As described in Section 16.6, the access to the mining panels and the production faces is provided by a network of two main access tunnels, with a central conveyor tunnel for materials handling. From a ventilation perspective, this means that airflow needs to be pulled from the main access tunnels for each panel. However, the main access tunnels are limited in ventilation capacity since each access tunnel is 5 m wide x 4.5 m high which, with rounded corners, gives an area of 21.4 m^2. The maximum recommended velocity is 6 m/s for haulage and access drives which results in a total maximum flow of 128.4 m^3/s. Figure 16-50 shows the cross-sectional areas for the panel development and main access tunnel, along with indicative ventilation duct and equipment dimensions.

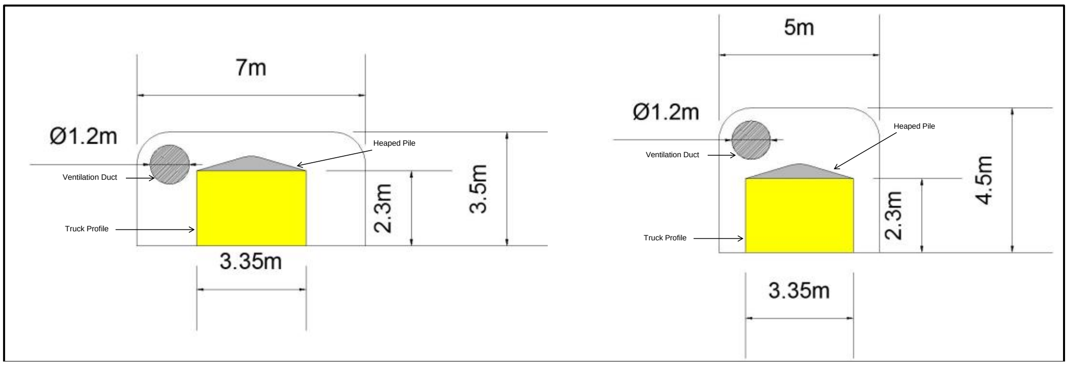


Figure 16-50: Cross sections of panel development (left) and main access tunnel (right) with indicative equipment dimension.

It is expected that between 90 to 100 m^3/s of air will be required, based on a scenario where the following diesel equipment operating at the same time:

- 2 Mining Trucks (298 kW each)
- 2 LHDs (144 kW each)
- 4 Ancillary Units (100 kW each)
- 1 Ancillary Units (200 kW)

Given the access tunnel is limited to 128.4 m^3/s, it means that only one panel at a time could be ventilated from this tunnel without the addition of ventilation raises near the panel entry.

16.18.4 Updated Ventilation Approach

Main Access Development

The mine schedule assumes two main access developments and the main access and conveyor tunnel being developed concurrently. This triple tunnel arrangement assumes two headings to be intake airways and one to be exhaust. An auxiliary fan/duct arrangement is envisioned for the three mining faces consisting of a manifold exhausting air from each heading through a single 100 kW fan located in the exhaust tunnel and directing the air to the nearest raise. To assist the rapid removal of radon gas, three over-lap fans are assumed at each working face forcing air to the mining face.

Panel Development

To develop the single panel access drive, it is assumed that a 3 m diameter raise would be installed close to the panel entry and prior to the panel development. This is required to create an exhaust way and avoid the return air from exhausting to the access drives. To further assist panel development and to keep an exhaust close to the development face, an additional 1.4 m diameter raise is to be installed every 400 m. This, in conjunction with rigid spiral ventilation ducts and auxiliary fans pulling air from the face and directing it to the closest exhaust raise, should minimise personnel exposure to radon gas. The ventilation construction sequence to develop the single panel drives is shown in Figure 16-51.

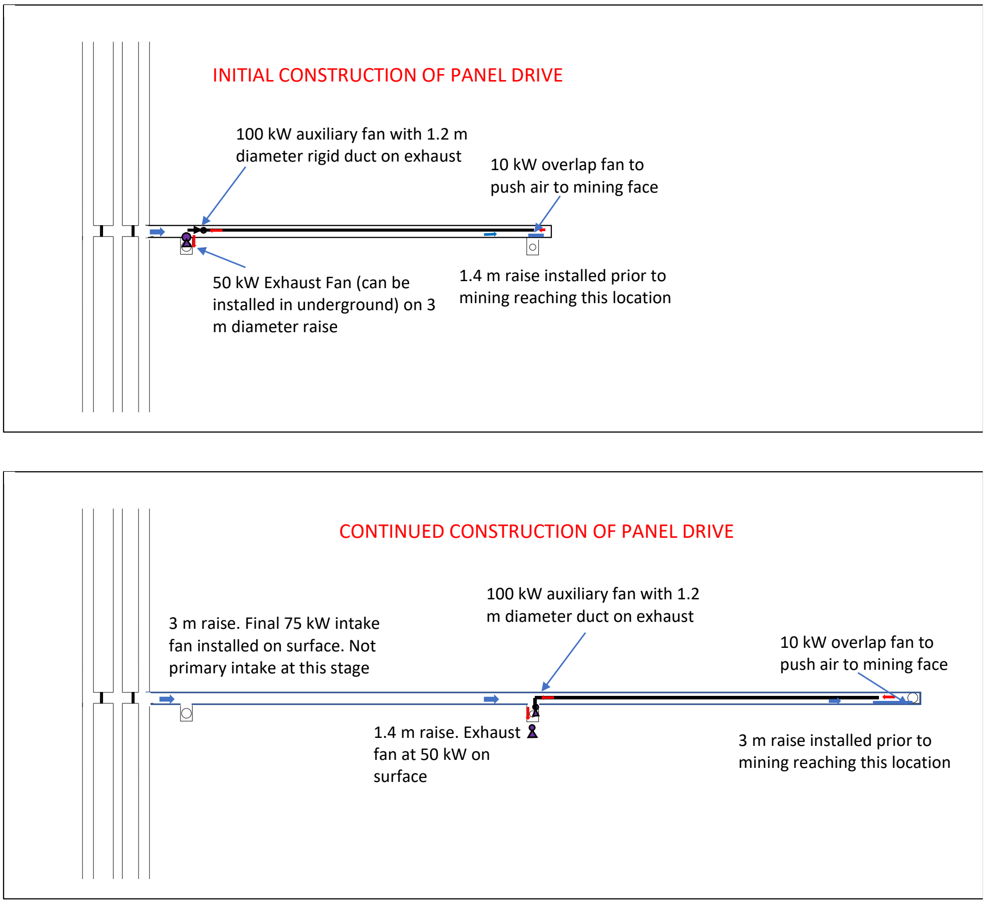


Figure 16-51: Ventilation approach for panel development sequence.

Production Panels

Mining sequencing inside each panel will be in retreat towards the access drives as shown in Figure 16-52. This figure (not to scale) assumes an average panel length of 800 m and shows the anticipated secondary circuits for each production face, on each side of the panel access, as well as the airflow calculation and recommended location of ventilation raises and the refuge station.

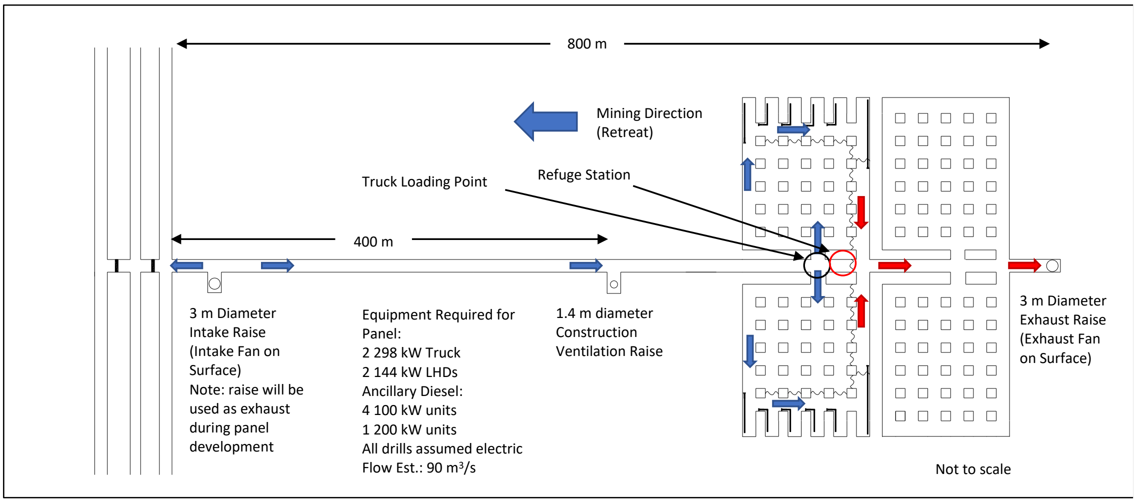


Figure 16-52: Schematic mining sequence for each panel, with secondary ventilation circuits, raises location and airflow requirements.

Given the low profile of the mining rooms and the mining equipment dimensions it was determined that there was insufficient clearance for an LHD to pass under an auxiliary duct. Hence, the typical auxiliary fan and duct arrangement for face ventilation had to be replaced by an alternative method that consists of independent small overlap fans. These fans force air to flow through each face, with all the air then being exhausted through a single fan located in a dedicated exhaust room and connected to the panel development.

Figure 16-53 shows the ventilation approach for each production face on each side of the panel development. The exhaust circuit is separated from the fresh air intake with the use of ventilation brattices which can be added and relocated as the room and pillar production advances. The grey path represents a potential path for the mining equipment to access the faces without the need to cross under larger diameter ventilation ducts.

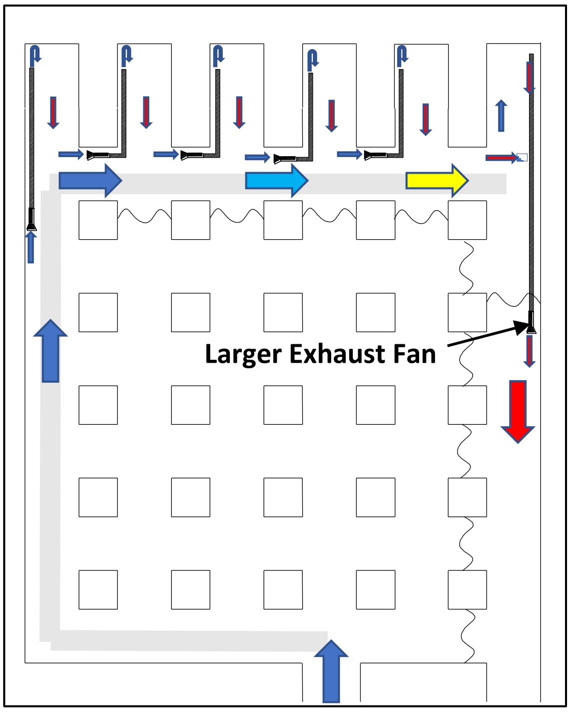


Figure 16-53: Ventilation approach for the production faces.

While in production, mining trucks will be loaded by LHDs in the panel development and will haul the ore to the nearest feeder breaker and discharge it on the conveyor. This means that a concept will need to be in place to adequately manage the airflows and allow the trucks to cross from fresh air intakes (panel development and access tunnel) while maintaining ventilation isolation in the conveyor tunnel. A potentially viable concept for achieving separation is shown in Figure 16-54.

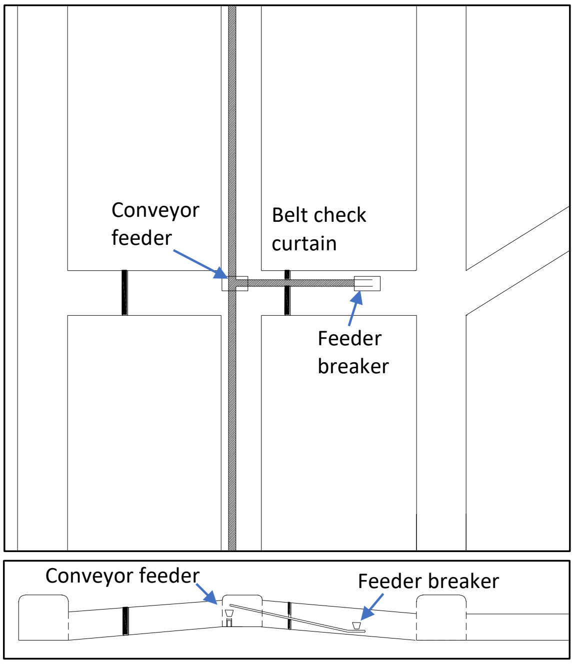


Figure 16-54: Concept for loading conveyor while maintaining conveyor ventilation.

16.18.5 Ventilation Requirements

For the total underground ventilation requirements, the reviewed calculations assumed an operation at a steady state with the following:

- 2 main accesses being developed (2 access tunnels and 1 conveyor tunnel).
- 10 mining panels being developed.
- 3 active panels in production (6 room and pillar working faces).

The ventilation requirements for each main ventilation circuit or mining activity is detailed below. This was used as a basis for the mining cost model.

Main Access Development

This circuit assumes the simultaneous development of the three headings and the existence of an exhaust raise at a distance not greater than 500 m. This can be achieved by using a dedicated development exhaust raise or reusing one of the dedicated panel intake raises after production is finished and the panel sealed (as long as the raise is kept accessible).

Table 16-43: Ventilation requirements for main access development.

Item	No.	Specification	Main Use
Auxiliary Fan	1	100 kW	Exhaust drive
Overlap Fans	3	10 kW	Force fresh air through each face and direct to exhaust drive
Rigid/Spiral Duct	1	Up to 500 m	Direct air from auxiliary fan to nearest exhaust raise
Overlap Duct	1	Up to 90 m	Direct air from faces to auxiliary fan

Panel Development

The largest fans in the system are the auxiliary fans during the panel development which are required to exhaust air approximately 400 m, which is the assumed spacing between panel development raised. The duct was limited to 1.2 m in diameter for the single drive due to the limited drive dimension (Figure 16-50). With a friction factor of 0.006 kg/ m^3, the resistance with shock losses was calculated to be at 6.255 Ns^2/m^8. An airflow of 20 m^3/s was estimated to be required for the exhaust end in order to achieve 15 m^3/s at the face. Calculations show the total fan pressure to be 3.0 kPa. This results in a fan requiring a 100 kW motor.

Table 16-44: Ventilation requirements for panel development.

Item	No.	Specification	Main Use
Main Fan	1	50 kW	Installed in exhaust raise
Auxiliary Fan	1	100 kW	Exhaust air from development face to nearest raise.
Overlap Fans	1	10 kW	Force fresh air through each face and direct to auxiliary fan.
Rigid/Spiral Duct	1	Up to 500 m	Direct air from auxiliary fan to nearest exhaust raise
Overlap Duct	1	Up to 90 m	Direct air from faces to auxiliary fan

Production Panels

The calculations show that for each panel ventilated with an intake raise and exhaust raise (each at 3 m diameter) and an estimated 800 m apart, two fans of 75 kW will be sufficient. This was calculated based on a single access drive of 7 m wide x 3.5 m high, with friction factors of 0.006 kg/m^3 for the raises and 0.01 kg/m^3 for the drive. Adding in shock losses (for air intaking and exhausting the raises, elbows, through fan structures, etc.), the total pressure for one room and pillar production face was estimated at 750 Pa. This resulted in intake and exhaust fans at 375 Pa each, at a flow of 90 m^3/s. To deliver this airflow, assuming a fan efficiency of 75 %, give a power requirement of 52 kW (rounded to 75 kW per fan). Once each panel will have two active production faces at each time, two 75 kW surface fans were estimated for each active panel.

Table 16-45: Ventilation requirements for panel production.

Item	No.	Specification	Main Use
Main Fan	2	75 kW	One in intake and one in exhaust raise
Auxiliary Fan	2	75 kW	Exhaust air from each production faces to exhaust raise.
Overlap Fans	10	10 kW	Force fresh air through each production face and direct to auxiliary fan.
Rigid/Spiral Duct	2	Up to 40 m	Direct air from auxiliary fan to nearest exhaust raise
Overlap Duct	2	Up to 80 m	Direct air from faces to auxiliary fan
Brattice Curtain	2	2 m high	Seal rooms and isolate exhaust circuit
Brattice Door	8	-	Allow passage through curtains

16.18.6 Monitoring

Mine ventilation management requires an effective monitoring system. Monitoring can be continuous, with fixed instrumentation providing “live” readings of ventilation parameters, or static, requiring regular ventilation surveys and manual monitoring.

Ventilation monitoring should have the capacity to cover the following:

- Radiation exposure.
- Airflow velocity.
- Mine gases (CO, CO_2, etc.).
- Temperature (wet and dry bulb), relative humidity and barometric pressure.
- Surface fan static pressure and remote on/off capability.
- Full time ventilation officers to undertake regular surveys throughout the mine and regulate airflows are included in the labour schedule.

16.18.7 Ventilation Controls

The principle means of controlling ventilation in the Madaouela underground deposits is to maximise the use of primary ventilation circuits and minimise the residency time of air underground. To manage air flows, a standard array of ventilation controls will be applied (i.e. brattices, parachutes, ventilation walls, regulators, etc.).

Local conditions where surface temperatures can reach 50 °C during the summer, suggest that heat will require special consideration. Due to the shallow nature of the mine and the presence of groundwater, it is anticipated that working conditions underground could be more comfortable than on the surface. However, the possibility for extreme heat on the surface suggests that policies should be implemented to regulate working hours to minimise the risk of heat stroke, in line with Nigerien legislation.

To monitor exposure to radiation over time, workers are required to wear thermoluminescent dosimetry (TLD) badges. These can be connected to cap lamps or self-rescuers to provide a continuous measurement of radiation exposure for each worker. Should the annual exposure limits be reached, individual workers would be removed from that environment for the remainder of the monitoring year. A similar system is in place at COMINAK's Akouta Mine. All attempts should be made to contain radiation exposure to levels where removal from the environment is not required.

Shotcrete is an effective way to contain radon emission at its source. The shotcrete acts as an airtight seal that can be sprayed on areas emitting high levels of radiation, creating a physical barrier and preventing the emission of radon gas.

Alpha radiation is simple to control as it has a low penetration distance. However, significant exposure can be experienced in the event that dust is ingested into the body. For this reason, smoking and eating underground should be discouraged unless in controlled areas, which are regularly cleaned and have facilities for washing hands. Dust control and respirators (in particular airstream helmets) will also play an important role in reducing the workers' exposure to radiation.

16.18.8 Ventilation Conclusions

The mine ventilation system for M&M and MSNE-Maryvonne is reasonable for a uranium mine and is based on providing single pass ventilation where feasible. Airflow rates are calculated for the rapid removal of radon and its progenies along with diluting diesel emissions such as carbon monoxide, nitrogen oxides and diesel particulate matter. Air velocity limits were adhered to in the design.

The concept is to mine panels in retreat where the airflow passes a working area and exhausts back to the development drive and to a raise with a surface fan. Airflow into an active mining panel is through a dedicated intake raise near the mains and exhaust at the end of the panel drive. This is feasible because the mining horizon is relatively close to the surface resulting in short vertical raises and follows a similar approach taken at the nearby COMINAK Akouta Mine.

The main access and conveyor tunnels are advanced simultaneously with air provided from the portals and intake raises, and exhausts to a raise constructed for either a panel advance or for the main development. Ventilation schemes were developed for panel face ventilation along with concepts on isolating the conveyor belt from the two adjacent haulage drives at conveyor transfer locations.

Costing for the ventilation system was determined by the number of fans, ducts, brattice, and other ventilation components required for an active mining panel, development heading and mains being developed concurrently. This modular costing approach was applied to the mine schedule to give ventilation costs over the life of the mine.

16.19 Underground Operating Costs

16.19.1 Introduction

SRK has updated the mine cost model for the M&M and MSNE-Maryvonne updated mining study. As most of the assumptions were still applicable and were not updated since the last work, the model update focused more on the calculation structure than a full review of all the assumptions and inputs. These were based on equipment and consumable cost databases, as well as data sourced from GoviEx, and SRK's own references and benchmarks from similar operations.

Main assumptions updated were the XOF to USD exchange rate, diesel and lubricants price, electricity price and labour costs, which were based on updated costs provided by GoviEx. As part of the review and update of the mine ventilation section, updated fan requirements and supplies make up another significant update from the previous study but which did not correspond with a significant change in the overall operating costs.

The great majority of the mining operating costs were estimated from the monthly scheduled physicals reported directly from the Deswik.Sched output reports. From these, equipment, power, labour, and consumable requirements were estimated based on equipment productivity and characteristics assumptions, drill and blast considerations, ground support, etc. This means that the estimated operating costs are different for each scheduling period and will reflect the variations in development, production and equipment availability and utilization across the full extent of the mine life.

16.19.2 Inputs and Assumptions

A summary of the main inputs used for the estimation of operating costs are provided in Table 16-46.

Table 16-46: Main Inputs used for operating cost estimation

Development Profile	Units	
Density	t/m^3	2.3
Operating Days per Year	No.	360
Shifts per Day	No.	3
Hours per Shift	hours	8
Electricity	USD/kWhr	0.152
Diesel	USD/L	0.83
Lubricant Oil	USD/L	9.87
Exchange Rate	(XOF to USD)	650

16.19.3 Operating Hours

A combination of data from internal SRK reference and commercial cost database subscription (Cost Mine 2022) was used for the individual equipment availability and utilisation assumptions. With this data, and the calculated equipment requirements, an estimation of the direct operating hours (DOH) was produced and then used as a basis of the time dependent operating costs such as diesel, power, lubricants, wear parts, etc.

16.19.4 Maintenance

Internal SRK reference and Cost Mine 2022 data was used to estimate individual equipment consumptions of diesel/power, lubricants, tyres, wear parts, as well as labour costs for maintenance and equipment overhaul. For maintenance in particular, a combination of reference data and previously quoted maintenance and repair contract costs (MARC) was used, depending on the equipment item and if it was included or not in the previous equipment list.

Item “Equipment Maintenance” in Table 16-50 and Figure 16-56 refers only to labour required for production equipment breakdowns, overhaul, and MARC costs (when available) from previous studies. SRK notes that the referred MARC costs can be used as a reference for the current study level but recommends that further contacts are made with potential contractors in order to get updated quotes and in line with the current financial situation for future studies.

16.19.5 Power Costs

A calculation of the total installed power and power demand estimation was produced based on the major mining equipment specifications and assumptions, as well as the individual calculated operating hours.

From the total power demand estimation for mobile and fixed equipment, and with the assumed unit cost for electricity of 0.152 USD/kWh (Table 16-46), a total monthly and yearly power cost was estimated and is shown in Figure 16-55.

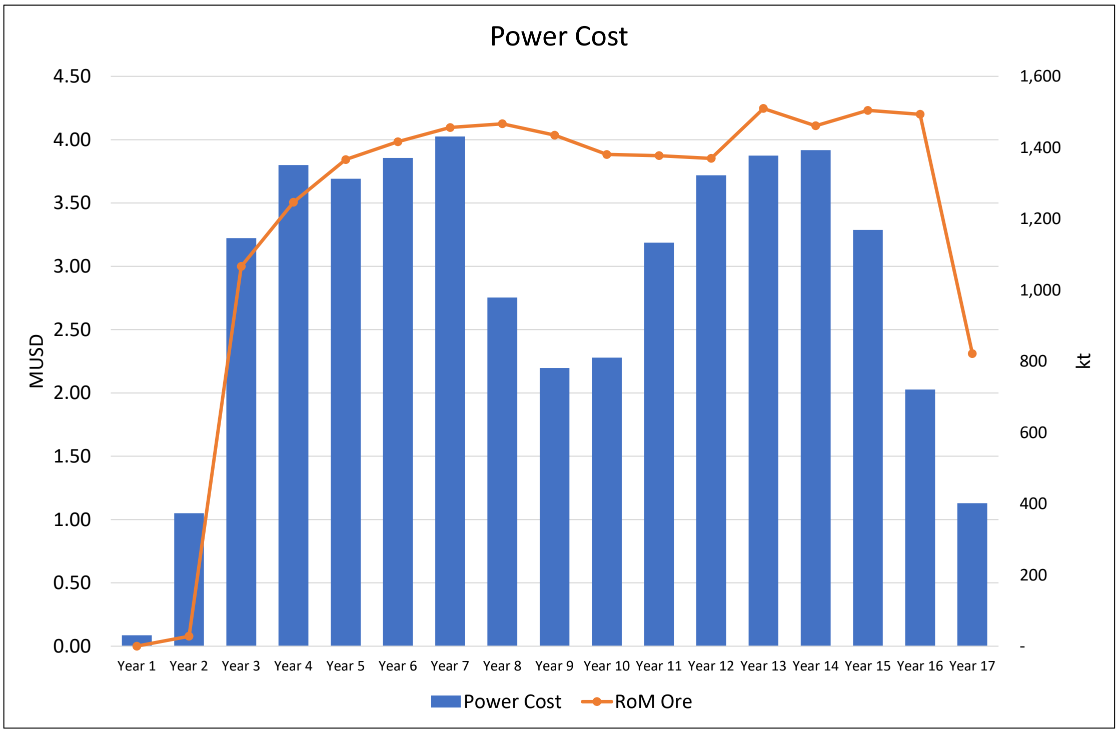


Figure 16-55: Yearly estimated power costs for combined M&M and MSNE-Maryvonne mine life.

16.19.6 Labour

Labour is applied in the cost model relative to mining activity. The labour schedule is linked to the equipment schedule to ensure that sufficient operators are provided to meet production requirements.

Labour numbers are based on a simplification of GoviEx's existing pay structure, and the costs are based on recent West African regional labour costs benchmark information requested by GoviEx (Table 16-47), including base salary, various allowances and taxes.

Table 16-47: Annual labour costs per pay level

Category	Pay Level	Annual Costs (USD)
General Manager	13	130,052
Senior Head of Department	12	103,468
Head of Department II	11	86,058
Head of Department I	10	56,742
Manager II	9	42,028
Manager I	8	36,637
Senior Professional, Supervisor High	7	30,729
Full Professional II, Supervisor II	6	25,191
Full Professional I, Supervisor I	5	19,283
Entry Level Professional Senior Admin/Support	4	17,282
Administration / Support II, Leading Hand / Senior Operator	3	13,449
Administration / Support I Operator II / Technician I	2	10,230
Operator I / Technician Assistant	1	7,467
Unskilled / Labourers	0	4,886

General and administrative roles for the mine, such as mine manager, secretaries, etc. are included in the general and administrative costs applied to mining in the financial model.

Table 16-48: Technical and underground shift personnel breakdown at peak requirement.

Position	Pay Level	No. Shifts	No. per Shift
Technical			
Senior Mining Eng.	11	1	1
Mining Eng.	2	1	4
Senior Geotech.	5	1	1
Geotechnical Eng.	5	1	1
Senior Mech. Eng.	5	1	1
Mechanical Eng.	2	1	1
Senior Elec. Eng.	1	1	1
Electrical Eng.	7	1	1
Vent./Radiation	2	3	2
Surveyors	0	1	3
Draftsmen	0	1	1
Senior Geology	0	1	1
Geology	10	1	2
Grade Control	6	3	8
Core Farm	10	3	2
Shift			
Mine Captain	6	4	1
Shift Boss	5	4	1
Loader Operators	4	4	8
Truck Drivers	3	4	12
Dev. Drillers	4	4	3
Production Drillers	4	4	7
Raiseboring Operator	4	4	3
Nippers	1	4	4
Services	2	4	3
Ventilation	2	4	2
Mechanics	4	4	8
Electricians	4	4	2
Rockbolters	3	4	8
Scaling Crew	2	4	3
Shotcreter	3	4	1
Transmixer	3	4	2
Charge Up	3	4	8
Belt Runner	2	4	2
Crusher Operator	2	4	1
Stores	1	4	2
Road Crew	3	4	1
Medical	3	4	1
Mines Rescue	3	4	1
Other	1	4	3
		Total	**117**

It was assumed that the same workforce will cover M&M and MSNE-Maryvonne and gradually and adequately be transferred from one operation to the other during overlap and ramp-up of MSNE.

16.19.7 Drill and Blast

Drill and blast costs were derived from indicative blast patterns for each development and production profiles as per previous studies. Updated quotes were used from the open pit potential supplier and supplemented with previously quoted prices when items were absent (detonating cord, firing line, etc).

Table 16-49 summarises the patterns considered, calculated consumables and cost breakdown for each profile.

Table 16-49: Drill and blast parameters considered and calculated consumables and costs breakdown.

	Units	Access Tunnel	Conv. Tunnel	Panel Dev.	Workshops	Sumps	Xcuts	Production
Profile								
Face Height	m	4.5	3.2	3.5	5.0	3.2	4.5	1.8
Face Width	m	5.0	4.0	7.0	7.0	4.0	5.0	7.0
Face Area	m^2	22.5	12.8	24.5	35.0	12.8	22.5	12.6
Rock Density	t/m^3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Face Drilling								
Drill steel length	m	4.3	4.3	4.3	4.3	4.3	4.3	4.0
Drilled length	drm	4.0	4.0	4.0	4.0	4.0	4.0	3.7
Advance per round	m	3.6	3.6	3.6	3.6	3.6	3.6	3.4
Blasthole diameter	mm	45.0	45.0	45.0	45.0	45.0	45.0	45.0
No. of blastholes	no.	32.0	20.0	35.0	50.0	20.0	32.1	25.0
No. of reamers	no.	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Contingency	%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Drilled metres	drm/m	44.0	29.7	47.6	65.4	29.7	44.2	34.9
Drilled metres per tonne	drm/t	0.2	0.3	0.2	0.2	0.3	0.2	1.1
Face Charging								
Explosive Density	t/m^3	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Charging Density	kg/drm	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Powder Factor	kg/t	0.8	0.9	0.8	0.8	0.9	0.8	1.1
Overbreak Factor	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Tonnes per Round	t	196	111	213	304	111	196	104
Estimated Usage								
Wastage Factor	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Primer	no.	32.0	20.0	35.0	50.0	20.0	32.1	25.0
Detonators	det	32.0	20.0	35.0	50.0	20.0	32.1	25.0
Initiating detonator	det	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Detonating cord	m	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Firing line	m	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Bulk explosive (ANFO)	kg	159.9	99.9	174.9	249.9	99.9	160.6	115.1
Cost Breakdown								
Cost per round	USD	488.0	322.4	529.4	736.4	322.4	490.0	380.6
Cost per tonne	USD/t	2.5	2.9	2.5	2.4	2.9	2.5	3.7
Cost per metre adv.	USD/m	135.6	89.6	147.1	204.5	89.6	136.1	111.9

Life of mine drill and blast costs were then estimated from the schedule physicals (development and production advance meters) and by applying the estimated costs per individual profile as calculated in Table 16-49.

16.19.8 Ground Support

Ground support requirements were calculated as per the previous study recommendations and based on schedule physicals. Individual ground support requirements have been assumed depending on the different development profiles and types of use and detailed in the mine cost model.

For this study update, an indicative shotcrete allowance was considered for the most sensitive developments (conveyor tunnel, crosscuts, workshops, etc), in terms of equipment and crews, and concrete quantity requirements and associated costs.

SRK recommends that in future studies the ground support requirements are reviewed and the need for cable bolting and wire mesh critically reviewed, as this capacity and consumable quantities are not currently considered and are very likely to be necessary once in operation.

16.19.9 Summary

Table 16-50 and Figure 16-56 show a summarised split of the total operating costs by main cost driver groups. The calculated USD/t refers to the cost per tonne of ore with M&M and MSNE-Maryvonne production combined.

Table 16-50: Main operating cost drivers split in total (MUSD) and in cost per tonne of ore (USD/t)

	OPEX (MUSD)	OPEX (USD/t)
Equipment Maintenance	135.37	6.64
Power	48.11	2.36
Fuel	30.63	1.50
Lube and Wear Parts	45.13	2.21
Ground Support	92.31	4.52
Drill and Blast	109.16	5.35
Services	37.45	1.84
Grade Control	4.42	0.22
Ore Sorting	16.93	0.83
Trucking and Rehandling	29.73	1.46
Labour and Management	82.09	4.02
Total	**631.34**	**30.94**

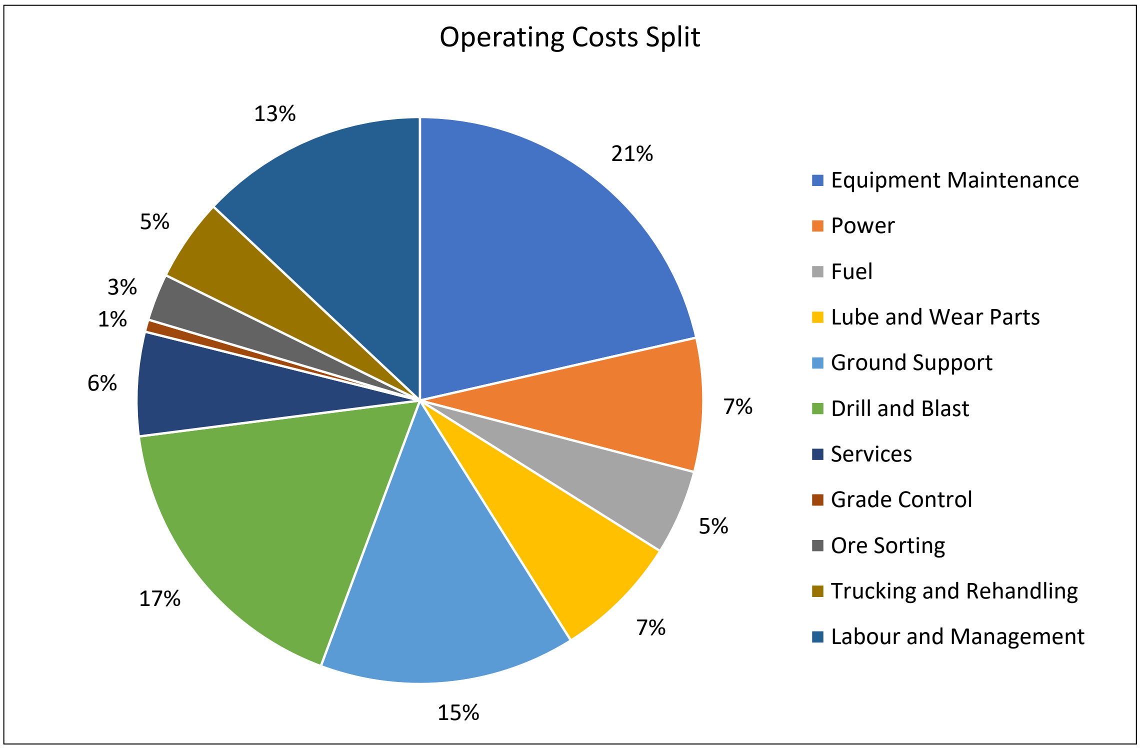


Figure 16-56: Operating costs split by major cost drivers (M&M and MSNE-Maryvonne)

16.20 Underground Capital Costs

Underground mining capital costs were estimated from a mixture of equipment quotes and reference costs from Cost Mine 2022 and SRK references. Whenever possible, the capital costs were directly linked to the mine schedule and derived from the equipment or infrastructure requirements and calculated for the whole M&M and MSNE-Maryvonne mine life.

Table 16-51 and Figure 16-57 shows a split of the estimated underground capital costs grouped by major categories

Table 16-51: Underground mining capital costs spit by main categories.

	CAPEX (MUSD)
UG Mining Equipment	95.68
UG Auxiliary Equipment	20.16
UG Materials Handling	28.86
Mine Ventilation	12.04
Mine Equipment Overhaul	20.22
Electrical, Air & Comm. Infra.	1.98
Mining Development	11.85
Ground Support and Treatment	11.96
UG Infrastructure	5.40
Health & Safety (Capital)	2.40
Sustaining Capital	8.06
Total	**218.63**

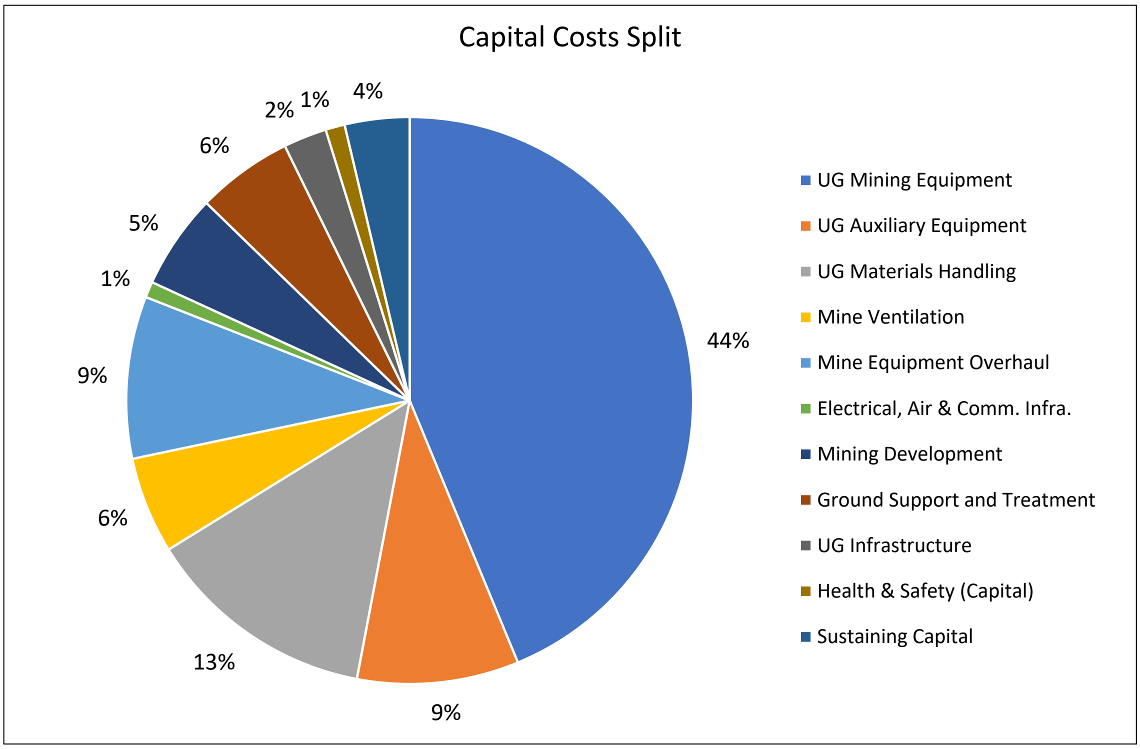


Figure 16-57: Chart showing capital costs split by major categories (M&M and MSNE-Maryvonne)

16.21 Underground Mining Conclusions

The updated mine plan shows a combined schedule for both deposits able to provide 20.4 Mt at 0.85 kg/t eU, with a total mine life of 17 years, with ore production over 16 years. Mine production commences at M&M then moves to MSNE-Maryvonne once production starts to reduce and additional capacity is required to keep a constant plant feed.

Underground mining of the M&M and MSNE-Maryvonne is demonstrated to be technically viable through room and pillar methods. Its depth below the surface, vein thickness and orientation preclude them from surface mining options. Access to the mines will be from a boxcut portal and via a three-drive decline at a gradient of 1:7, allowing a central conveyor and access tunnel to panels either side.

The life of mine schedule for both mines aims to achieve high grade ore early in the mine life and was mostly constrained by the development rates of the main infrastructure and the commission time of the materials handling system. Mine ventilation represents another major scheduling constraint given the singularities of a uranium mine and the necessary radiation exposure control.

RoM ore is mined at the mining panels and hauled to surface by a conveyor system. Once at surface it is put through a radiometric ore sorter which is assumed to have a constant ore throughput of 1 Mtpa. As the mineralised horizon is mostly thinner than the minimum mining height of 1.8 m, additional waste dilution needs to be mined along with the ore which results in a required mining rate of 1.4 Mtpa. The sorted ore is then trucked to the processing plant located near the Miriam open pit, approximately 14 km to the South.

A variable cut-off grade approach was applied and is based on individual waste to ore ratios. This aimed to compensate for the fluctuations in the RoM and cover the costs of mining variable amounts of waste and to maintain a constant sorted ore throughput.

An updated cost model shows an overall underground mining operating cost for M&M and MSNE-Maryvonne of 30.94 USD/t_{ore}, with an estimated total capital cost of 218.63 MUSD.

The underground mining capital and operational costs were provided to Cresco for input into the overall Financial Model for the Project (Section 22).

16.22 Combined Open Pit & Underground Mine Plan

The combined open pit and underground plant feed schedule is shown in Figure 16-58.

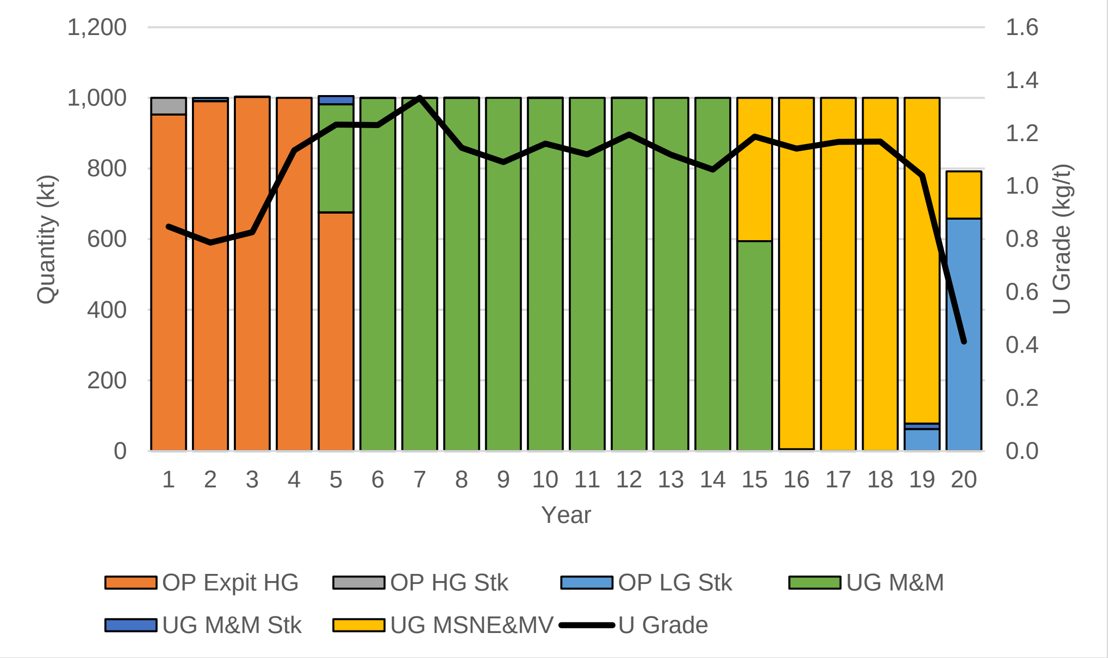


Figure 16-58: Combined Open Pit & Underground Plant Feed Schedule

17 RECOVERY METHODS

This document states or cross-references the basic specifications of plant performance and construction, and the engineering methodology, to which the feasibility was executed including all mandatory requirements which impact the design, i.e., those specified by the Client, and all applicable statutes and regulations or requirements needed to satisfy statutory bodies.

The detailed guidelines for feasibility studies were followed, and the Process Plant Equipment estimate meets the required accuracy levels with inconsequential issues due to changes at late stages during the study.

The guidelines and procedures for preparing the project cost estimate were in accordance with SGS Bateman Standards for a Class 2 Feasibility Study. This closely conforms to both the SGS Bateman Estimator's Best Practice Guide PCNG-0920-002 Rev 0 definition for a Class 2 estimate classification and the Association for the Advancement of Cost Engineering International (AACEI) Class 2 estimate classification guidelines.

All tenders from the market were commercially and technically adjudicated and recommendations were prepared in Technical Bid Evaluations (TBE) and Commercial Bid Adjudications (CBA). Short form enquiries were fast tracked with Technical Bid Evaluation incorporating pricing evaluations and recommendation with Procurement checking the proposed supplier. These recommendations formed the basis of pricing.

Equipment supply enquiries were issued through Procurement and Contracts with SGS Standard Procurement Terms as basis for the Madaouela Uranium's terms and conditions.

Construction contracts were prepared based on FIDIC (International Federation of Consulting Engineers) red book terms and conditions (for building and engineering works designed by the employer) and the VeRo was based on yellow book.

Export guidelines for containerized and break-bulk shipments M7534-0760-002 and packaging to suite the demanding journey to GS-109 packaging specification was issued to all the suppliers. However, some suppliers refrained from offering shipping and delivery to the very remote site location. Shipping was then estimated by the logistics department according to supplier equipment packaging requirements.

Detailed coating systems and painting and protective coatings specifications (GS-11-1) were incorporated into the packages. Where suppliers offered their standard coating system it was regarded as technically acceptable for the study.

Comprehensive Supplier Document and drawing Requirements (SDDR) were issued with all formal packages. All documents were required in English with only some documents like Operating Manuals also required in French. Qualifications on documents to be submitted by supplier were not further elucidated.

The level of design and for mechanical estimation was according to the project Basis of Estimate, document number M7534-4230-002.

17.1 Process Engineering

17.1.1 Process Overview

A traditional flowsheet has been chosen for the treatment of ore from the open pit (Miriam), which is relatively low in gangue acid consumers, with the exception of a novel dry milling process and the addition of a novel Ion Exchange (IX) process for the recovery of molybdenum. The flowsheet comprises Crushing, Milling, two stage Tank Leaching, molybdenum recovery by IX and uranium recovery by Solvent Extraction (SX) followed by precipitation of Ammonium Diuranate (ADU). A Flotation section can be added in later years, to reject carbonates and consequently decrease acid consumption, when underground ore is treated.

ROM ore is initially fed through a single stage open circuit primary crusher, where a product size of 100 mm (P_{80}) is achieved. The ore is then fed from the mill feed stockpile at an average rate of 3,223 tpd to milling. The ore is fed via apron feeders to discharge conveyers and transported to the milling circuit. The crushed ore is fed to a VeRo Liberator® milling circuit operated with a closed-circuit screen to produce a grind size of 300 µm (P_{80}) which proceeds to the leaching circuit after slurrying using process water. The VeRo circuit consists of 2 x 100 tph units, operated in parallel. Each VeRo mill will produce open circuit fines fed forward to leach, with oversized material recirculating back to the VeRo mill via wet vibrating screening. Both VeRo units will feed oversize material to a single vibrating screen.

The two-stage leaching circuit consists of primary and intermediate thickeners in combination with a primary and secondary agitated tank leach system. Tanks are agitated to allow the ore to react with concentrated sulfuric acid allowing dissolution of the contained uranium, while the redox potential is controlled by the addition of hydrogen peroxide. The leach tanks in both stages are sparged with steam to maintain 50°C in the leach circuit. The leach residue is then filtered on horizontal belt filters, with filtered solids residue discarded to the dry stacked tailing's storage facility.

The Pregnant Leach Solution (PLS) containing uranium, molybdenum as well as other metal contaminants undergoes clarification before being fed to a Continuous Ion Exchange plant (CIX) where molybdenum is selectively adsorbed onto the resin. Uranium remains in solution and is fed to a conventional uranium SX plant (Alamine 336) for uranium recovery. Molybdenum is eluted from the resin using a sodium hydroxide solution, from which a molybdenum sulfide product is precipitated as product via the rapid acidification process.

For purposes of determining reagent consumption related to molybdenum grades varied molybdenum feed grades were used, progressing as the pit (Miriam) ore is mined and the underground (M&M) ore is fed to the process. Molybdenum grades of the pit (Miriam) range from 55 ppm – 200 ppm molybdenum. Underground (M&M) grades are also expected to vary during the life of mine with an average of 472 ppm molybdenum.

In the SX circuit, uranium is extracted from the IX barren solution into the organic phase through a series of mixer settlers. The loaded organic is scrubbed to remove impurities and then stripped with ammonium sulfate to produce a uranium-rich liquor (OK Liquor) for the ADU precipitation stage and recirculated back to extraction. ADU precipitation is conducted in a series of agitated tanks with the addition of ammonia and air. The ADU precipitate is thickened, washed and filtered followed by drying and drum packaging of the yellow-cake product.

The SX raffinate is recirculated back as process water to recover acid to the circuit. The metal-ion tenor of the recirculating process water load in the circuit is controlled by bleeding a stream from the overflow to the neutralisation circuit. This prevents the metal-ion concentration in the recirculating water load from reaching critical levels. This bleed is largely used for dust suppression on the mine roads with excess deposited to the dry stack tailings facility.

Acid is supplied by a dedicated onsite acid plant for which solid sulfur supply is required as a raw feed. Lime is made up in a lime slaking plant from powdered lime. Ammonia gas is supplied via iso-tankers and stored in ammonia vessels on site. All other reagents are supplied in either bagged form or isotainers to the plant boundaries.

The processing plant battery limits are the following:

- ROM crushed ore feed to receiving bin
- Raw water feed to raw water tank and potable water treatment plant
- Sulfur supply to acid plant storage stockpile
- Fuel supply to storage tank
- Organic make-up supplies to make-up tanks

- Lime supply to milk of lime plant
- Hydrogen peroxide supply for leach dosing
- Sodium hydroxide supply to make-up tanks
- Sodium carbonate to the make-up area
- Sodium sulfide to make-up tanks
- Ammonia to the dedicated storage area
- Other reagents and consumables to the respective storage areas
- Drummed yellow-cake product in storage
- Drummed molybdenum product in storage

Key plant size parameters are summarised in Table 17-1 below:

Table 17-1: Key plant size parameters

Ore throughput	**t/year**	**1,000,000**			
Available operating hours	h/year	7,446			
Design plant feed	t/h	134.3			
			U	**U_3O_8**	**Mo**
Feed grade (Miriam)	g/t		850	1,003	200
Content in feed	kg/h		114.2	134.7	26.9
Content in product	kg/h		108.3	127.7	23.9
Recovery	%		94.79%	94.79%	88.9%
Annual Production	kg/y		810,125	950,854	177,959
Annual Production	lb/y		1,786,325	2,096,633	392,400

17.2 Design Basis

17.2.1 Process Design Basis

The specific area codes as defined by the project work breakdown structure (WBS) are given in Table 17-2. The process block flow diagram is shown in Figure 17-1, with all functional areas included with the exception of reagent make-up and services. The future process block flow diagram, updated to include additional areas required to treat the underground ore, is shown in Figure 17-2.

Table 17-2: Area codes according to project WBS

Area Code	**Area Description**
A3100	ROM stockpile, reclaim and crushing
A3200	Grinding
A3300	Leaching, thickening and filtration
A4100	Molybdenum precipitation, drying and packaging
A4200	Molybdenum IX
A4300	Uranium SX
A4400	Neutralisation
A4500	ADU precipitation, calcining and packing
A3700	Reagents
A6300	Plant services and utilities

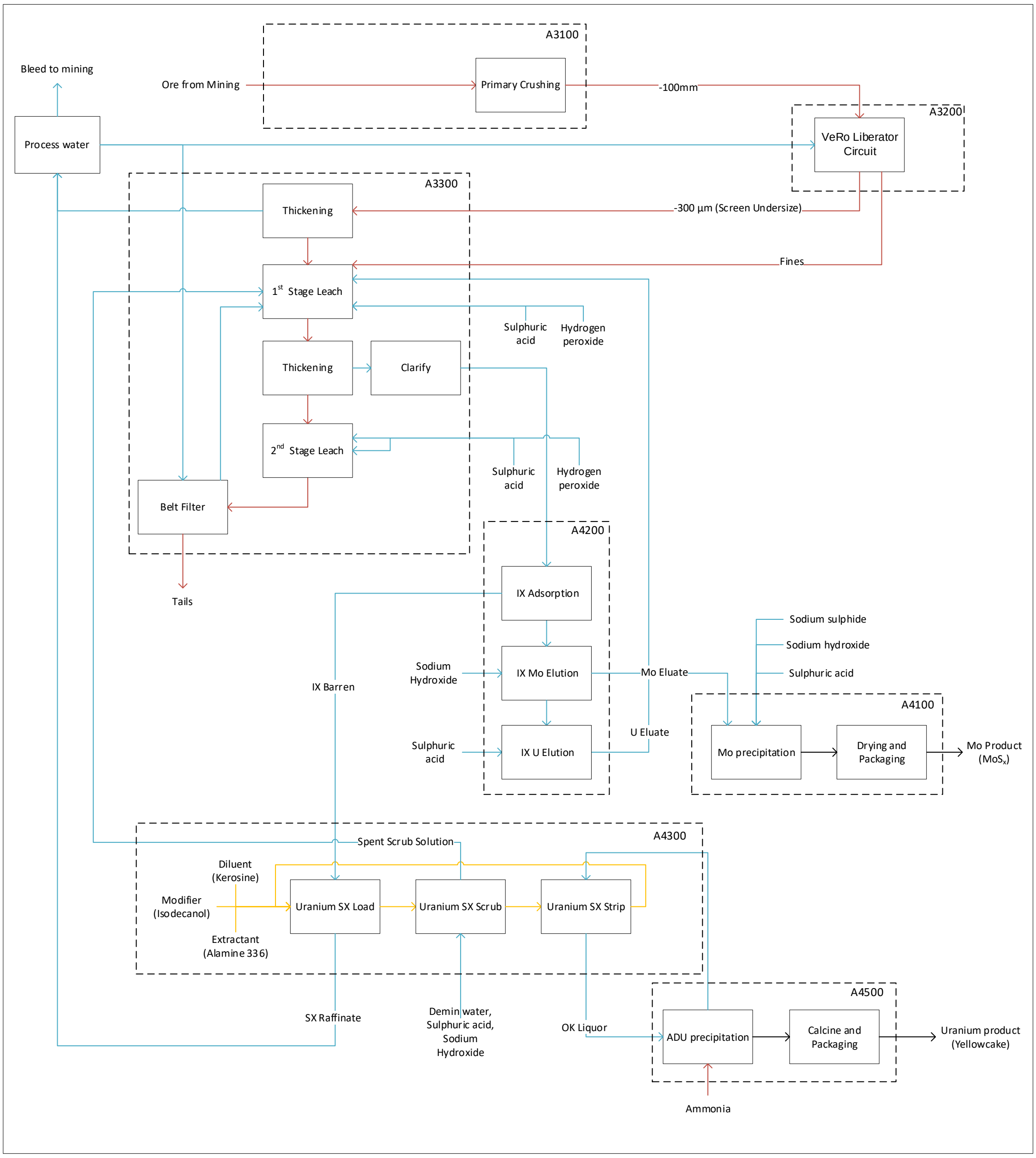


Figure 17-1: Block Flow Diagram (Open pit Ore)

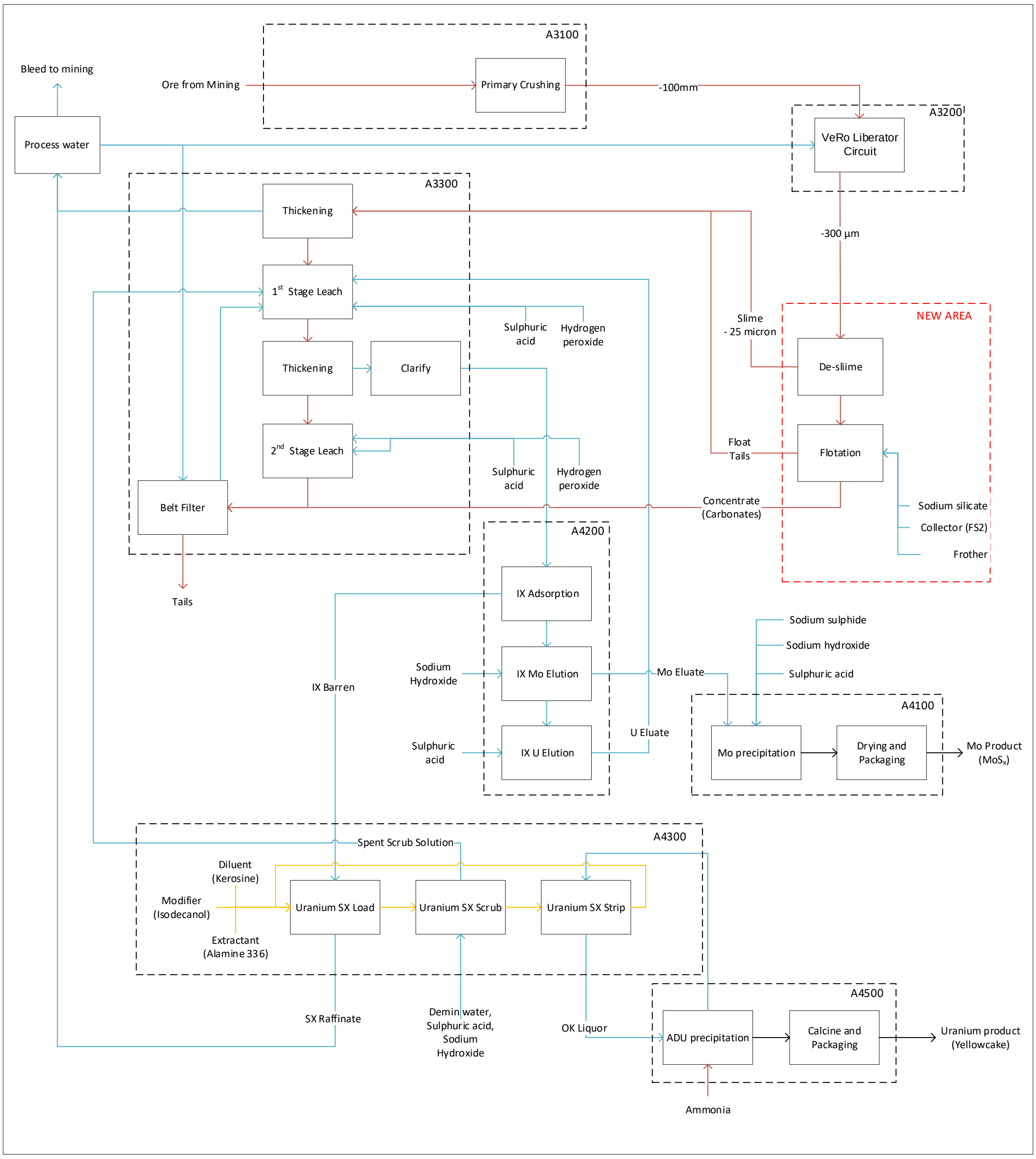


Figure 17-2: Block Flow Diagram (Underground Ore)

17.2.2 Process Design Criteria, Summary

Process design criteria (PDC) is compiled to provide guidance in terms of critical process design input, outputs and requirements associated with the global control and operational philosophy. Table 17-3 below presents the major design parameters used in the development of the process flow diagrams (PFDs).

The source of parameters and conditions adopted in the PDC includes:

- Client, i.e. GoviEx Uranium and SRK Consulting
- Testwork results performed by Mintek and SGS Lakefield
- Assumptions (by SGS Bateman) based on previous similar projects
- Recommendations from suppliers (vendors)

Table 17-3: Major design parameters

Description	Units	Value	Remarks
Global Plant Throughput (dry solids)	MTPA	1,000,000	GoviEx
Overall Availability	%	86.2	SGS Bateman
Nominal Plant Feed (dry solids) @ 85% Plant Availability	MTPH	134.3	Calculated
Operating Hours per Annum	hr	7446	Calculated
Life Of Mine (LOM) for High Grade Ore	Yrs.	15	SRK Consulting
eU_3O_8 Head Grade	%	0.1003	SRK Consulting
Ore Bulk Density	MT/m^3	1.77	SRK Consulting

AREA 3100 – Stockpile, crushing and screening

Description	Units	Value	Remarks
Stockpile			
Stockpile	Type	Conical and Covered	SGS Bateman
Nominal Dry Solids Feed Rate	MTPH	134.3	Calculated
PSD	F_{80}	100 mm	Vendor
Live Capacity	MT	9,670	SGS Bateman
Reclaim	Type	3 x Apron Feeder	
Primary Jaw Crusher			
Crusher	Type	Jaw Crusher	Vendor Recommended
Operating Close Size Setting	mm	100	Vendor Recommended

AREA 3200 – Grinding

Description	Units	Value	Remarks
VeRo			
VeRo Liberator®	Type	Dry Milling	Vendor
Nominal New Feed Rate	MTPH	134.3	
Recirculation Load (Screen Oversize and Cyclone Underflow)	%	20	Vendor
VeRo Product Fines	%	40	Vendor
VeRo circuit product, P_{80}	µm	300	Vendor
Closed Circuit Classification			
Classifier Type	Type	Wet Vibrating Screen	Vendor Recommended
Screen Feed F_{100}	mm	0.500	Vendor Recommended
P_{80} in the Underflow Stream	µm	300	
Flotation System (Future)			
Rougher Cells	#	6	SGS Bateman
Scavenging Cells	#	0	SGS Bateman
Overall Mass Pull	%	3.57	Mintek
Overall U Recovery	%	95.2	Mintek

AREA 3300 – Leaching and solid/liquid separation

Description	Units	Value	Remarks
Post-milling Thickening			
Underflow Solids	Mass %	50	Slurrytec
Flocculant Addition	g/ton	40	Slurrytec
Settling Rate	$m^3/m^2/day$	790	Slurrytec
First Stage Tank Leach			
Acid Consumption	kg/ton	20	Mintek
Total Leach Retention Solid concentration	h Mass %	12 30	SGS Bateman SGS Bateman
Operating Temperature	°C	50	Mintek
Intermediate Leach Thickening			
Underflow Solids	Mass %	50	Slurrytec
Flocculant Addition	g/ton	40	Slurrytec
Settling Rate	$m^3/m^2/day$	790	Slurrytec
Second Stage Tank Leach			
Acid Consumption	kg/ton	30	Mintek
Oxidant		Hydrogen Peroxide	
Peroxide consumption	kg/ton	2.45	Mintek
Total Leach Retention Solid concentration	h Mass %	12 50	SGS Bateman SGS Bateman
Operating Temperature	°C	50	Mintek
	Overall		
Total U Extraction	%	95.63	Mintek
Total Mo Extraction	%	90.22	Mintek
Belt Filtration			
Wet Cake Solids	weight %	85	Slurrytec
Filtrate Solids	weight %	9	Vendor
Wash Efficiency	%	99	SGS Bateman
Dry solids capacity	$kg/m^2/hr$	202	Slurrytec
Filtrate capacity	kg D.S/h	177,705	Vendor

AREA 4200 – Ion exchange

Description	Units	Value	Remarks
Adsorption			
Ion Exchange Resin	resin type	Purolite S970 (Large Bead)	Mintek
Resin Loading	gMo/l	20	Mintek
Adsorption Flow-rate	BV/h	4	Mintek
Elution			
Eluent Solution		1M H_2SO_4 for U 1M NaOH for Mo	Mintek Mintek
Elution Volume	BV	10 for U 15 for Mo	Mintek
Elution Flow-rate	BV/h	2	Mintek

AREA 4300 – Solvent extraction

Description	Units	Value	Remarks
Extraction			
Extraction Stages	#	3	SGS Bateman
Temperature	˚C	40	SGS Bateman
U Extraction	%	99	Mintek
Stripping			
Stripping Stages	#	3	SGS Bateman
U Stripping	%	99	Mintek
Operating pH		10.8	Mintek
Scrubbing			
Scrubbing Stages	#	2	SGS Bateman
Temperature	˚C	Ambient	SGS Bateman
Scrubbing Solution pH		Various	SGS Bateman

AREA 4500 – ADU precipitation

Description	Units	Value	Remarks
Precipitation			
Precipitant		Ammonia	
Ammonia consumption	g/l	1.85	Mintek
Operating pH		5.4 - 7.2	SGS Bateman
Thickening			
Underflow Solids	Mass %	40	SGS Bateman
Flocculant Addition	g/ton	0	SGS Bateman
Post Precipitation Washing		Dual Centrifuge	SGS Bateman

AREA 4100 – MoS_3 precipitation

Description	Units	Value	Remarks
Precipitation			
Pre acidification pH Precipitation temperature Post precipitation pH	ºC	5.5 80 2.5	SGS Bateman SGS Bateman SGS Bateman
Precipitant		Sodium sulfide	
Sodium sulfide consumption above stoichiometry	g/l	50	

17.3 Process Description

This section provides the description of individual unit process by functional area as presented in the PFDs.

17.3.1 Area-3100: ROM Stockpile and Crushing

ROM Receipt and Reclaim

ROM ore is received by truck into a feed bin and subsequently fed directly onto the Primary Jaw Crusher Static Grizzly screen. The ore will be fed through the primary crushing circuit in open circuit and stored on the plant stockpile. Dust extraction is located above the feed bin to manage dust generation in the area.

Primary Jaw Crusher

The Primary jaw crusher receives feed from the Primary Jaw Crusher Static Grizzly screen and operates in open circuit. The crusher feed is transferred via a chute to the crusher head opening. The crushed product (-100 mm) is transferred via a chute to the stockpile feed conveyor. The crusher discharge is fitted with a metal detector, tramp-metal belt magnet and a weightometer. The primary jaw crusher is fitted with dust extraction hoods that are located above dust generating areas, feeding to a section baghouse.

Stockpile

The ore is reclaimed from the stockpile using three apron type feeders that are located in the stockpile tunnel. Three apron feeders discharge onto a common stockpile discharge conveyor that transfers the ore to the VeRo milling circuit. The stockpile discharge conveyor is fitted with a weightometer.

The stockpile tunnel is fitted with a dust control system, with dust extraction hoods located above discharge of each apron feeder. A single spillage sump pump is installed in the stockpile tunnel. The recovered spillage and flood water will be transferred to the VeRo vibrating screen discharge sump. Two wash water points are installed in the stockpile tunnel and provided at the spillage sump pump.

A stockpile discharge conveyor maintenance hoist and stockpile tunnel hydraulics room that is equipped with a ventilation fan, fire suppression system and hydraulic power pack, are all provided for the ROM receive and reclaim area.

17.3.2 Area-3200: - Grinding

VeRo Liberator® and Classification

The two VeRo units receive fresh feed from the stockpile discharge conveyor and recirculating feed from the VeRo vibrating screen oversize. Each VeRo unit operates as a duty unit and in closed circuit with a single wet vibrating screen. Feed is split equally to each of the VeRo units at the VeRo feed hopper.

Each VeRo unit will discharge fine material to a fines Cyclone and Fine Filter, as part of the units. The fines will be slurried to 50 % solids and pumped directly to leaching. The coarse fraction from each VeRo unit will be fed via conveyor to the shared vibrating screen.

The VeRo vibrating screen will classify the material, sending oversize material back to the VeRo feed hopper for reprocessing in the VeRo units while undersize from the screen will be pumped forward to leach. The screen operates wet and thus a process water feed is supplied to the screen feed box and spray system.

A wet dust suppression system is used in the area to supply spray to conveyor systems in the area, wherever dust generation is expected.

A spillage sump pump is provided for the area. The collected spillage is transferred to the VeRo vibrating screen discharge sump and pumped forward to leach.

17.3.3 Area-3300: - Leaching Circuit

Feed Slurry Thickener

The leaching plant feed thickener receives a 30 % solids feed slurry from the VeRo vibrating screen discharge sump via the thickener feed box. The 50 % solids thickener underflow is transferred via pump to feed the first stage leaching tanks. The thickener overflow is returned to the process water reservoir via transfer tank and pump.

First Stage Tank Leach

The two-stage tank leach objective is to leach the fast-reacting gangue and uranium bearing minerals in a moderately low pH (<1.5) environment, with a target to leach a portion of the slow reacting uranium bearing minerals. Acid requirements for improved leaching of these slow reacting uranium bearing minerals causes higher acid consumptions for the benefit of increased recoveries. The first stage leaching tank reactors receive feed of the leach feed thickener underflow and the filtrate from the vacuum belt filters filtrate tanks.

The first stage leaching reactors operate at a pulp density of approximately 35 % solids and temperature at 50°C, maintained by steam injection via sparger to the leach tanks. The first stage leaching product is transferred to the intermediate leach thickener by pump. Hydrogen peroxide is added into the six reactors to provide the necessary oxidant for ferrous oxidation requirements.

Intermediate Leach Thickening

The objective of the intermediate leach thickener is to separate PLS from the solids. The thickener receives feed slurry from first stage leaching tank via a transfer pump. The 50 % solids thickener underflow is transferred via tank and pump to feed the second stage leaching tanks. The thickener overflow PLS is transferred to the leach clarifier via transfer tank and pump.

Second Stage Tank Leach

The second stage tank leach objective is to produce a high corrosive environment (pH < 1.5) for leaching of the slow reacting uranium bearing minerals. The leaching tank reactors receive feed of the intermediate thickener underflow and concentrated sulfuric acid from the acid storage area. Hydrogen peroxide is added into the leach reactors to provide the necessary oxidant for ferrous oxidation requirements. The leach tanks are sparged with steam to maintain 50°C in the leach circuit, as with the first leach stage.

The product from the second stage tank leach is pumped with slurry pumps to the belt filtration plant feed tank.

Belt Filtration Plant

The belt filtration section performs solid/liquid separation of slurry from the second stage leaching tank reactors. The vacuum belt filtration plant produces a 15 % moisture filter cake that is combined on the tailings conveyor and further handled for disposal via a dry stacking system.

Tailings Stacking

The belt filter cake final tailings are handled from the filtration section by means of overland conveying, which deposit the tails on a dry stack tailings storage facility, designed by others.

17.3.4 A4200 – Molybdenum Ion Exchange

Clarification and Filtration

Ion exchange operates best with a clear solution to prevent build-up of solids within the ion exchange columns. The continuous ion exchange system as selected for the Feasibility Study does have higher tolerances for solids breakthrough than that of a conventional fixed bed ion exchange, however upfront PLS clarification is still implemented. The PLS from the intermediate first stage leach thickener is consequently clarified using a pinned bed clarifier, before being pumped to the IX plant vendor package, where continuous ion exchange is introduced (CIX). Solids that collect in the clarifier are periodically pumped back to the leaching circuit.

IX Adsorption and Wash

Prior to feed into the CIX vendor package the feed stream is heated to 50°C in a shell and tube heat exchanger, this is done to improve molybdenum adsorption kinetics.

The objective of IX adsorption stage is to recover the molybdenum from the PLS by means of the selective adsorption onto an ion exchange resin in a CIX ion exchange system. The Clean-IX® continuous ion exchange circuit uses a selection of Moving Packed Bed Columns and a Fluidised Column.

In the adsorption columns, molybdenum is extracted from the clarified PLS, with minor co-extraction of uranium and iron.

Two adsorption columns operate in parallel; both being moving packed-bed columns which operate in an up-flow arrangement and counter-currently to the flow of the resin. Molybdenum-bearing PLS is pumped into the bottom of the column and exits as barren solution from the top of the column. Barren resin enters the top of the column and loaded resin, carrying the extracted molybdenum, is removed from the bottom of the column. The adsorption column contains ion exchange resin. As the liquor contacts the ion exchange resin, molybdenum oxycations are adsorbed (i.e. loaded) onto the resin. Barren solution gravity flows out of the top of the adsorption column to a barren solution holding tank from where it can be exported downstream to uranium SX.

A portion of the barren solution is also used to wash the loaded resin. Each hour (approximately), the lower portion of resin in the adsorption column is automatically transferred, via air-lift, to the loaded resin wash column. The adsorption stage of the IX system produces the molybdenum free solution, as barren liquor, which is collected in a tank before being pumped to the SX plant.

IX Elution

During adsorption, small amounts of uranium and iron will co-load onto the resin along with the molybdenum. The elution process thus comprises two steps, the first being to elute the uranium and iron using sulfuric acid which is returned to the leach circuit, and the second using a sodium hydroxide solution to elute molybdenum, which is pumped to the molybdenum precipitation circuit.

In the uranium elution column, uranium and iron are desorbed (i.e. eluted, or “unloaded”) from the washed loaded resin, generating an eluate containing uranyl sulfate and iron sulfate. The uranium elution column is a moving packed-bed column which operates in an up-flow arrangement and counter-currently to the flow of the resin. Eluant – a sulfuric acid solution containing a nominal 100 g/L H_2SO_4 – is pumped into the bottom of the column and exits as eluate containing uranyl sulfate and iron sulfate from the top of the column. Washed, loaded resin enters the top of the column and eluted resin, depleted of uranium and iron, is removed from the bottom of the column. Eluate gravity flows out of the top of the uranium elution column to a local uranium eluate holding tank, from where it can be exported back to the leach circuit.

In the molybdenum elution column, molybdenum is desorbed (i.e. eluted, or “unloaded”) from the resin, generating an eluate containing molybdate (molybdenum oxyanion). The molybdenum elution column is a moving packed-bed column which operates in an up-flow arrangement and counter-currently to the flow of the resin. Eluant – a sodium hydroxide solution containing a nominal 40 g/L NaOH – is pumped into the bottom of the column and exits as eluate containing molybdate from the top of the column. Washed resin enters the top of the column and eluted resin, depleted of molybdenum, is removed from the bottom of the column. As the eluant contacts the resin, molybdenum ions are released from the resin, forming molybdenum oxyanions in solution. Eluate gravity flows out of the top of the molybdenum elution column to a local molybdenum eluate holding tank, from where it can be exported to a downstream molybdenum processing circuit.

Figure 17-3: Simplified schematic diagram of a typical CIX process

17.3.5 A4300 – Solvent Extraction (SX)

Extraction

The objective of the extraction stage is to recover uranium from the IX barren solution by selectively loading uranium onto an organic phase and recycling the raffinate solution to the leach circuit. The uranium SX process is best operated at temperatures of 35°C and above. While this isn't a problem in summer in Niger a steam heated feed heater is installed at the IX feed to ensure that the temperature is maintained at the optimal value through to SX.

IX barren solution in the feed tank is transferred via pumps to the mixer settlers in the extraction stage. It is pumped into the first mixer settler and from then on transfers through the next two mixer settlers. The fresh organic phase is introduced in the last mixer settler and moves in counter-current direction with the feed solution. The final loaded organic is recovered from the first mixer settler and transferred to the scrubbing stage. The raffinate is recovered from the last mixer settler and the majority is pumped to the process water reservoir. A bleed of raffinate is taken forward to neutralisation and is subsequently used for dust suppression on the mine roads for impurity bleed purposes.

A solvent that consists of Alamine 336 (extractant); Isodecanol (modifier); and an Aliphatic Kerosene (diluent) is used as an organic phase in the uranium extraction stage. Figure 17-4 below shows a schematic diagram of a counter-current solvent extraction process.

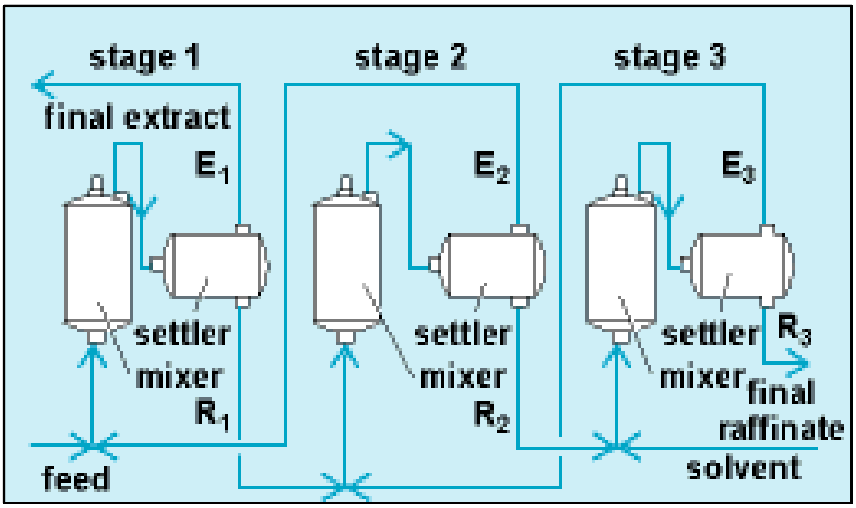


Figure 17-4: Schematic diagram of a counter-current process

Scrubbing/Washing

The objective of the scrubbing stage is to remove entrained impurities (e.g. chlorides) from the organic before the stripping stage. Scrubbing is performed by washing the organic phase with a solution of demineralised water, sulfuric acid (pH of 2) or sodium hydroxide in various combinations. The process is a similar counter-current setup with two mixer settlers.

The loaded organic is introduced into the first of the two mixer settlers and moves in counter-current direction to the scrubbing solution. The various scrubbing solutions are introduced into the two mixer settlers as the aqueous phase, selected as required for organic treatment.

The spent scrubbing solutions are recovered from the mixer settlers and transferred back to the leach circuit for recovery. The loaded organic phase is recovered from the first mixer settler and transferred directly to stripping.

Stripping

The objective of stripping stage is to recover uranium from the loaded organic phase by selectively stripping uranium into the aqueous solution before recycling the organic phase to the extraction section.

Stripping applies similar counter-current mixer settlers as extraction, with three stages. The loaded organic is introduced into the first of the three mixer settlers and moves in counter-current direction to the stripping solution. The stripping solution is introduced into the last of the three mixer settlers and moves in counter current direction to the organic phase.

The OK liquor is recovered from the first mixer settler and transferred to the ADU precipitation section via a holding tank. The stripped organic phase is recovered and transferred to the extraction section for use as an extractant.

Barren solution from the ADU precipitation section is used as uranium stripping solution.

Crud treatment

Crud is removed periodically from the settlers via a series of diaphragm pumps with a flexible hose and wand, which is then accumulated in the high shear crud holding tank. The crud is treated via centrifuge into its separate entrained solutions. The recovered aqueous phase is fed to the eluate feed tank whereas the recovered organic phase is fed to the barren organic tank.

17.3.6 A4500 - ADU Precipitation

OK liquor from the SX plant will be fed into the first of 4 precipitation tanks connected in series. Here the pH will be adjusted by sparging with gaseous ammonia diluted with air. The pH of the solution is raised stepwise; in the 1st tank the pH is raised to 5.4 and in the 2nd tank the pH is raised to 7.2. ADU will be precipitated, and the resulting slurry will be pumped to a thickener. The thickener overflow will be pumped back to the SX plant as strip liquor, via a polishing filter.

Thickener underflow will be pumped to the first of two wash centrifuges. A portion of the thickener underflow is recycled to the ADU precipitation tanks to provide seed for the precipitation process thereby improving the precipitate quality. The moisture content of the ADU slurry will be reduced to approximately 40 % and the resulting solids will be washed with clean demineralised water to remove any contaminants and residual sulfate in the mother liquor. ADU cake from the first centrifuge will be re-pulped with clean water and the process repeated in a second centrifuge. Clean ADU cake will be stored in the ADU storage tank ready for dispatch or transfer to the ADU calcination circuit. Wash solutions from the centrifuges will be recycled to the ADU precipitation vessels.

The final ADU concentrate will be pumped to the calcining and packing plant.

Product calcining and packing

The objective of this circuit is to dry and pack the uranium according to end user specifications. The yellowcake purification plant is a vendor package, and the following process description is taken from the vendor package document:

<u>Yellowcake Storage Tank</u>

The yellowcake storage tank will have the primary function of providing a small buffer storage capacity. The storage tank will need to be fed from the wash centrifuge discharge pump without impacting on the dewatering/drying plant production. The buffer capacity will be large enough to ensure that upstream processes can operate continuously during operations and during minor plant upsets. A secondary function is to allow the centrifuge discharge to be re-directed away from the dryer should there be a need to shut down the dryer or drum packing plant quickly. If required, water can be added to the storage tank to reduce the solids concentration and the storage tank will be fitted with an agitator to keep the solids in suspension. Water added to the storage tank will also help to reduce water soluble contaminant levels in the thickener underflow feed stream. To determine the extent of cake washing required, contaminant levels (sulfates, chlorides, etc) will need to be understood along with other characteristic of the feed such as the as the solids concentration (% w/w) of the thickener underflow.

Centrate Storage Tank

Solution discharged from the centrifuge is known as centrate. The centrate storage tank will have the primary function of collecting the centrate discharge, as well as all wash-down drainage from the other modules. The centrate storage tank will be fitted with a pump to transfer the contents back to the uranium precipitate wash thickener (or equivalent).

Dewatering Plant

The yellowcake is pumped from the storage tank to the centrifuge which will be located as a modular design in its own container. The centrifuge will have a liquid discharge (centrate) and a solids discharge (cake). The centrate will be pumped back to the uranium precipitate wash thickener (or equivalent). The solids discharge of the centrifuge will consist of yellowcake slurry with a paste like consistency and a solids content of approximately 65-70 % w/w (subject to quality of precipitate). The centrifuge will operate continuously.

Drying Plant

The yellowcake slurry will be discharged from the centrifuge via a hopper into a screw conveyor. The screw conveyor will transfer the yellowcake to an electrically heated, horizontal rotary dryer which will reduce the moisture content of the feed to ≤ 2 % w/w. Should there be a problem downstream with the dryer or drum packing plant, the screw conveyer will divert cake back to the yellowcake storage tank.

The dryer will normally operate at 650°C to produce U_3O_8.The dryer is housed as a modular component in its own container. The dryer includes an inlet feed screw which delivers wet cake to a retort tube, and a discharge hopper. The retort tube is fitted with flights to allow the cake to be transported along the length of the heated tube. The dryer has multiple heat zones, is heated electrically and is automated. The dryer is lined with high quality refractory materials to minimise heat loss. The product is discharged from the retort tube into a discharge hopper. The discharge hopper will have sufficient capacity to provide a small buffer should there be a problem downstream with the drum packing plant.

Off-Gas System

The off-gas system uses a liquid ring vacuum pump to draw evaporated steam and gas away from the dryer. The off-gas (steam, gas and entrained solids) passes through a spray condenser, and then through a venturi Scrubber and a cyclonic separator, condensing the steam and removing any entrained solids. The gas then passes through a mist filter before passing through the bag house. The solids phase will be pumped back to the thickener. The spray condenser water operates on a closed loop. Water from the seal tank is cooled by a heat exchanger. A Refrigerated chiller is used to remove the heat load. All of this equipment will be housed in the off-gas & bag house module.

Drum Packaging Plant

The yellowcake from the dryer will pass via a tube conveyor from the feed hopper located in the dryer module. The drag chain tube conveyor is a fully enclosed device with venting via the bag house where required and will have cooling jackets to assist in reducing the product temperature to acceptable levels prior to drum packing. The drum packing plant module will operate automatically, with drum weighing, filling, sampling and un-lidding/lidding performed as automatic operations.

Drums are also automatically washed and dried once they have been filled and lidded. The plant fills top loaded, centre fill 205 litre drums with each drum containing approximately 450 kg or 990 lb of yellowcake (approximately 84 % uranium).

17.3.7 A4100 – Molybdenum Precipitation, Drying and Packaging

Molybdenum eluate is received from the IX plant into the feed tank and pumped via a cartridge filter into the pre-acidification tank where the pH is lowered to between 5 and 6 by controlled addition of concentrated sulfuric acid. The solution is then pumped to the precipitation tank, which has a steam jacket to maintain the temperature at 80ºC, where molybdenum sulfide is precipitated by the addition of a sodium sulfate solution. Once the precipitation reaction is complete, the solution is pumped to the rapid acidification tank, where the pH is dropped to 2.5 before being pumped to the molybdenum product thickener. Off gas from the precipitation process flows to the molybdenum precipitation scrubber package.

The thickener overflow is collected in a tank before being pumped to the neutralisation circuit, while underflow is filtered in a horizontal filter press before being conveyed to the drying and packaging vendor package, which comprises of a single Holoflite dryer and ancillary equipment, a single off-gas treatment module, and a fully automatic drum packing module. These modules are fully automatic and are assumed to operate in a very similar manner to the uranium drying and packaging modules described above.

17.3.8 A4400 - Process Water Bleed and Neutralisation

The objective of the barren solution bleed, neutralisation and thickening is to control the ion concentrations in the process water by bleeding a portion of the barren solution that is recycled to the process water reservoir.

The bleed solution is mildly acidic and contains dissolved metals such as calcium, magnesium ferric iron and aluminium. It is neutralised using lime before the precipitated salts are separated from solution in a thickener. The thickener overflow gravitates to the transfer sump and is pumped away for possible use as dust suppression spray water or to the tailings stack, while thickener underflow is pumped to the belt filter section to join the solid leach tailings.

17.3.9 A3700 – Reagents

Caustic Make-Up

Caustic solution make-up plant consists of receiving, storage and distribution areas. The caustic solids are supplied in bulk bag and are added to a storage silo via hoist. Solids are transferred from the storage silo to the make-up tank via screw conveyor, where they are diluted with demineralised water in an agitated tank. The correct caustic solution in the storage tank is distributed via a transfer pump to the molybdenum off gas scrubbing and IX reagent make-up sections.

The caustic make-up area is installed with a spillage sump pump that collects the spillage and transfers to the process water circuit.

Flocculant Make-Up

The flocculant make up and dosing plant is provided as a vendor package and consists of reagent bag handling, reagent mixing, and flocculant holding and dosing units. The flocculant reagent is supplied in a powder form and contained in bags.

The bags are man handled with a hoist and emptied into a bin. The powder is extracted from the bin by a screw feeder that is attached to the bottom-end of the bin and transfers the powder to an educator, where it is mixed with water. The solution from the educator discharges into a mixing tank and more water is added to obtain a correct flocculant concentration.

The correct flocculant solution is transferred by a positive displacement pump to a holding and dosing tank. A flocculant dosing pumps are used to add flocculant to the respective thickener feed boxes. The flocculant preparation and dosing area is equipped with a spillage sump pump that collects the spillage and transfers to the process water reservoir.

Peroxide Storage and Supply

The hydrogen peroxide storage and dosing is achieved via re-usable Intermediate Bulk Container (IBC) supply. The peroxide substance is supplied in IBCs which are used to dose the reagent to leach using positive displacement pumps that connect to the IBC via reinforced flexible hose. One IBC is used for each leach stage.

A safety shower is installed in the peroxide area to cater for emergency conditions. The area is installed with a spillage sump pump that collects the spillage and transfers to the leach feed tank.

Milk of Lime Make-Up

The milk of lime make-up plant consists of vendor packages, the milk of lime preparation unit and the milk of lime storage and supply facility. The raw material is solid lime, which is supplied in a powder form via bulk bag to a storage bin. The burned lime powder is mixed with water and the correct solution transferred to a holding tank. A transfer pump feeds the solution/suspension to the dosing tank, where dosing via peristaltic pump is done to the neutralisation facility.

Milk of lime make-up area is installed with a spillage sump pump that collects the spillage and transfers back to the lime solution holding tank.

Sodium Carbonate Make-Up

The sodium carbonate make-up and supply plant consists of a powder handling and a mixing and supply area. The sodium carbonate is supplied in a powder form and contained in bags. The bags are man handled with a hoist and emptied into the sodium mixing tank, where water is added to obtain a correct aqueous concentration. The correct solution is transferred via pump to the SX plant. Sodium carbonate make-up area is equipped with a spillage sump pump that collects the spillage and transfers to the process water circuit.

Organic Phase Make-up Plant

The organic phase make-up plant consists of two areas, Alamine and Isodecanol drums storage area and diluent storage area. The Alamine (extractant) and Isodecanol (phase modifier) substances are combined with a diluent to make the organic phase for the SX plant.

The diluent is supplied by a tanker via an offloading pump to a storage tank. The diluent is transferred to the SX plant by a diluent feed pump. The diluent storage tank is fitted with a tank flame arrestor, to cater for emergency conditions associated with fire.

The Alamine and Isodecanol organic substances are supplied in different drums. The two are combined at a prescribed volume ratio with a diluent in the SX plant to make organic phase. The organic phase make-up plant is installed with a spillage sump pump that collects the spillage and transfers to the high shear tank located in the SX plant.

Acid Plant

The acid plant will produce sulfuric acid required for leaching the ore in the tank leaching process. The sulfuric acid plant is supplied as a vendor package and consists of the following unit systems:

- Sulfur storage
- Sulfur melting and filtration
- DCDA sulfuric acid plant
- Cooling water system
- Steam generation

<u>Sulfur Feedstock</u>

Practical operating range for an acid plant is between 50 % and 110 % of the nominal load and rated capacity. The plant uses solid sulfur as raw material feedstock which is supplied using tipper trucks to a covered 12 days live capacity stockpile.

<u>Acid Plant Description</u>

The sulfuric acid plant consists of the following key units:

- Sulfur Melting, Filtration and storage tanks
- Sulfur combustion furnace
- SO_2 Converter Tower

- Drying and Absorption Packed Towers
- Acid Cooling
- Cooling Water Towers
- Gas Stack
- Start-up burner
- Waste Heat Boiler

The sulfur raw material handling is done in sequence by loading from stockpile to a feed bin and conveying to the agitated brick-lined melting pits. The melting pits are equipped with steam coils and tanks to contain the molten product.

The molten product pumped through filters to remove impurities and the clean sulfur is stored in a tank. The clean sulfur is fed to a brick-lined furnace where it is combusted to produce SO_2 laden gas.

A start-up burner heats the furnace to a combustion temperature and motorised air blowers supply air to the drying tower through air filters, where the air is dried with sulfuric acid and blasted into the furnace. The operating temperature in the furnace is typically 1,100ºC and the SO_2 concentration in the gas ranges between 10 – 12 % by volume. The SO_2 laden gas is cooled and fed to a converter unit.

The converter is made of a steel tower that contain support trays for catalyst loading, super heater, waste heat boiler, gas heat exchangers and ducts with dampers. The converting process involves double catalysis with four passes for conversion to SO_3. The intermediate absorption of the SO_3 into solution takes place after 3rd pass of the converter, where after the gas is passed through heat exchangers before the 4th pass

The 4th pass converter gas product is fed to the absorption tower where is brought in contact with the circulating acid for absorption and drying towers separate acid mists. Packed towers conduct the final drying, intermediate absorption and final absorption of the acid. The acid recovery circuit consists of a tank with a submerged pump to circulate the acid in all three packed towers. Cooling of acid is performed by cooling towers (water) and reduces the circulating acid temperature to ~60 – 70 ºC, and the final product is transferred by pump to the acid storage tanks.

Acid Plant Utilities

The following utilities would be required at the battery limits:

- Plant and instrument air supply
- Process and potable water make-up.
- Power supply
- Start-up sulfuric acid
- Dosing chemicals and hydrated lime

Acid Plant Waste Heat Recovery

The acid plant design enables power generation by using the waste heat recovered from the process. The waste thermal energy is recovered in the form of super-heated steam (60 bar and 450 °C).

17.3.10 A6300 - Services and Utilities

Raw Water Storage and Distribution

Raw water is received into the respective storage tank. Two pump lines, distribute raw water to two main sections of the operation respectively, i.e.

- fire water sections
- Process water make-up reservoir and reagent make-up

Process Water Storage and Distribution

The process water reservoir is supplied from various sources that include:

- Raw water make-up
- ADU thickener overflow and excess barren liquor
- ROM stockpile spillage and flood pumps
- Spent scrubbing solution
- SX raffinate

Process water is distributed to various areas of the plant with process water transfer pumps. The water is distribution areas include:

- Belt Filtration plant
- VeRo section
- Vent scrubbers
- ROM stockpile wash points

Fire Protection Water Supply, Storage and Distribution

Fire protection water is supplied from the raw water tank and is stored in fire water storage tanks. A foam fire protection unit for the SX plant is supplied as vendor package and fire water is distributed to various areas of the operation that includes:

- Processing plant
- Acid plant
- Reagents make-up plant
- Laboratory
- Workshops
- Offices

- Central control room

Potable Water Distribution

A Potable water treatment plant is supplied directly with off-site Raw Water supply. The potable water product is distributed to via three pump lines to gland seal water, safety showers and other process areas that includes:

- Demineralised water plant
- Steam start-up boiler plant
- Ablutions
- Safety Showers network

Gland Seal Water Supply, Storage and Distribution

The gland seal water tank is supplied from the raw water tank. Gland seal water is distributed to various slurry pumps in the plant with gland seal water supply pumps that are fitted with cartridge filter on the pumps discharge.

Demineralised Water Supply, Storage and Distribution

The demineralised water plant is provided as a vendor package and is supplied with water from the potable water tank. The details of reagents required for water treatment will be confirmed by the vendor.

The demineralised water plant consists of water treatment unit, intermediate demineralised water storage tank and distribution pumps.

The demineralised water is distributed to:

- ADU purification, drying and packaging plant
- Scrub strip washing mixer and solution tanks
- Sodium carbonate make-up mixing tank
- Sodium hydroxide make-up mixing tank
- Sulfuric acid plant

Steam Boiler

The two steam boiler plants are both vendor packages and supply steam for leach heating, as a supplement to the acid plant steam generation, and other applications. One boiler will supplement the acid plant LP steam product to heat leach and the other will supply steam to the IX feed heat exchanger and the Molybdenum precipitation circuit.

Diesel Storage and Supply

The diesel facility is provided to carry three functions, i.e.

- Receive diesel supply from road tankers
- Diesel storage and distribution

- Oil spill handling

The oil spill separation unit is supplied as a vendor package and handles collected spill from spillage sump pump. The separated mediums are handled further in the respective diesel spillage holding areas.

Process Plant Air supply

Process plant air supply facilities comprise of compressed air supply units for plant and instrument air. The compressed air supply units consist of two inline compressors, air filters, air dryers and air receivers for instrument and plant air distribution.

17.3.11 Future Additions

The following sections can be added when ore from the underground mining operations is treated in future years.

De-sliming and Flotation

Milled ore is fed to a de-sliming cyclone cluster from the VeRo circuit discharge. The de-sliming cyclone overflow gravitates to the leach feed slurry thickener. The underflow gravitates to the flotation conditioning tank and undergoes reverse flotation to reduce the carbonate content of the feed prior to leaching. Carbonate reduction of the feed would minimize the acid consumption in the tank leach. Flotation of the cyclone underflow is carried out in a cascading float plant consisting of six rougher cells after conditioning in an agitated tank. The flotation circuit would target a mass pull to concentrate of around 4 %. The calcite-rich carbonate concentrate is collected in a launder and pumped to the neutralisation tanks as a process effluent.

The rougher tail is collected in the flotation tails sump and pumped to the leach feed thickener feed box. Aeration of the rougher cells is achieved by a blower.

Flotation reagents would be pumped into the conditioning tank in controlled amounts to aid the flotation process.

Flotation Reagents Make-up

The flotation reagent make-up and supply consists of handling areas and make-up tank areas for sodium silicate, flotation collector (FS2) and frother. The bags will be lifted with a hoist and the contents poured into a receiving funnel above the respective agitated solution make-up tanks. Raw water will be pumped to the make-up tanks to achieve the required concentration.

The flotation reagents area will be supplied with a spillage sump pump that collects spillage and transfers it back to the dosing tanks.

Radiometric ore sorting (ROS)

This section will be located at the underground mines, outside of the processing plant. However, since it will involve ore processing, it is included here for completeness.

Prior to sorting, of the run of mine ore will be screened into three fractions coarse, medium and fine using a double deck screen. Ore concentration will be performed using individual radiometric ore sorter (ROS) modules for the coarse and medium material, while the fines will bypass the sorters. The coarse module will consist of one ROS unit that processes feed from double deck screen oversize material (-250+90 mm) and the medium module will consist of two ROS units that process feed from double deck screen midsize material (-90+20 mm). Screen undersize (-20 mm), estimated at approximately 25 % of the run of mine ore, is not sorted. The ROS units are supplied as vendor packages.

ROS rejects from all modules are combined on the ROS discard conveyor and transferred to the rejects stockpile. Concentrate from all ROS modules is collected and transferred on the concentrate conveyor to combine with screen undersize material and transferred to the ROM stockpile in the processing plant by truck.

17.4 Process Plant Capital Costs

17.4.1 Capital Cost Estimate

The summary of the capital cost estimate, quoted in USD is provided in Table 17-4 below.

Table 17-4: Base Case Capital Cost Summary (USD)

Description	Supply Cost	Erection Cost	Total Cost
Direct Field Costs			
Bulk Earthworks & Infrastructure	-	6,988,944	6,988,944
Civil Works	-	19,858,083	19,858,083
Process Plant Buildings	-	5,361,415	5,361,415
Structural Steelwork	8,219,470	890,887	9,110,357
Platework & Liners	7,069,543	1,232,175	8,301,718
Mechanical Equipment	76,620,420	2,503,916	79,124,336
Piping & Valves	6,263,815	6,048,644	12,312,459
Electrical	12,467,085	2,450,115	14,917,199
Instrumentation	11,882,787	585,510	12,468,296
Civils P&G's		4,866,173	4,866,173
SMPP P&G's		8,774,721	8,774,721
E&I P&G's		3,303,083	3,303,083
Transportation of Equipment to Site (Excl Import Duties)	6,570,172		6,570,172
Commissioning Spares	3,650,531		3,650,531
First fill of Reagents	2,804,028		2,804,028
Vendor assist during Constr & Comm	2,787,389		2,787,389
6 Months Operating Spares	525,895		525,895
TOTAL DIRECT FIELD COSTS	138,861,134	62,863,666	201,724,800
Home Office & Indirect Field Costs			
EPCM		23,733,507	23,733,507
TOTAL H.O. & INDIRECT FIELD COSTS		23,733,507	23,733,507
TOTAL NET COST	138,861,134	86,597,173	225,458,307
Other Costs			
Bonds Guarantees etc	1,240,021		1,240,021
Insurance	3,989,891		3,989,891
Contingency	14,613,704		14,613,704
TOTAL OTHER COSTS	19,843,615		19,843,615
Owner's Costs - Excluded			
TOTAL OWNER'S COST			
OVERALL PROJECT COST	158,704,749	86,597,173	245,301,922

17.4.2 Basis of Estimate

The guidelines and procedures for preparing the project cost estimate are in accordance with both the SGS Bateman Estimator's Best Practice Guide PCNG-0920-002 Rev 0 definition for a Class 2 estimate classification and the Association for the Advancement of Cost Engineering International (AACEI) Class 2 estimate classification guidelines.

The capital cost estimate is structured in line with the project work breakdown structure (WBS).

All tenders from the market were commercially and technically adjudicated and recommendations were prepared. These recommendations formed the basis of pricing.

17.5 Battery Limits

Reference must be made to the Execution Scope of Work that clearly define the Incoming and Outgoing Battery Limits of the scope of work for the project.

17.6 Estimating Criteria

The capital cost estimate has been compiled based on a full engineering, procurement, and construction management (EPCM) execution strategy. The capital costs have been developed from a range of sources, including finalised PFD's, defined piping and instrument diagrams (P&ID's), defined mechanical layouts, finalised major mechanical equipment list, detailed minor mechanical equipment list, preliminary structural steel/civil layout drawings, preliminary electrical and instrumentation bills of quantities and multiple source formal pricing enquiries from designated vendors and contractors to obtain the required class of estimate.

17.6.1 Estimating Accuracy

The capital cost estimate has been prepared in accordance with the SGS Bateman Estimator's Best Practice Guide PCNG-0920-002 Rev 0 definition for a Class 2 estimate classification and the Association for the Advancement of Cost Engineering International (AACEI) Class 2 estimate classification guidelines.

17.6.2 Base Date

The base date of the estimate is April 2022. Forward escalation is excluded.

17.6.3 Base Currency/ Exchange Rate

The capital estimate has been compiled in US Dollar (USD).

No foreign currency or rate of exchange variations was allowed in this estimate. It will fall within the Client's scope of work to make adequate provision and risk allowance for rate of exchange variations.

17.6.4 Scope Definition

The estimate is based on the scope as defined within this document and by the engineering documentation such as:

- Completed PFDs
- Defined P&IDs

- Preliminary Civil/Structural Layouts
- Preliminary Civil/Structural bill of quantities (BOQ)
- Defined Plot plan
- Defined Mechanical layouts
- Finalised major equipment list
- Detailed minor equipment list
- Develop the main cable routing on plant layout drawings
- Preliminary load list
- Preliminary substation layouts and design
- Preliminary electrical bills of material
- Control system topology
- Instrument list
- Preliminary Control and Instrumentation (C&I) BOQ
- Preliminary line and valve list
- Major pipe routes identified with preliminary red-line layouts produced
- Preliminary piping BOQ.

17.6.5 Pricing Basis

Pricing for the direct works is based on a variety of sources as follows:

- Single and/or Multiple source fixed and firm quotations
- Single and/or Multiple budgetary quotations
- Provisional sum allowances
- Factored or estimating allowances

17.6.6 Presentation of Capital Cost

The overall capital cost estimate is compiled using a spreadsheet format.

17.6.7 Capital Estimate Structure

The cost estimate is compiled in line with the Work Breakdown Structure (WBS) and project Cost Breakdown Structure (CBS).

17.7 Direct Costs

Material and labour quantities were obtained as described below and converted to capital cost estimates by the application of unit cost and unit rates or formal budgetary/fixed and firm quotations for the supply, fabrication, construction and installation of the various materials and equipment.

17.7.1 Earthworks

The earthworks bill of quantities has been priced using current market related rates competitively tendered by earthworks / civil contractor. Preliminary and general costs is included in the contractor's tendered price.

Contractor's indirect costs (P&G's) caters for the contractor's mobilisation and demobilisation including establishment and later removal of construction plant and equipment, contractor's manual indirect and non-productive labour, scaffolding, safety equipment, personal protective equipment, transport and travelling, on-boarding cost for permanent site access for all site contractors as per the client's site requirements, meals, accommodation and supervision including contractual requirements relating to finance costs, insurance, bonds and work permits. P&Gs have taken into account practicalities of establishing site and construction activities.

17.7.2 Civil Works

Civil works quantities for the project have been developed from preliminary site layout drawings. The civil BoQ's have been priced using current market related fixed and firm rates competitively tendered by civil contractor. Preliminary and general costs is included in the contractor's tendered price.

17.7.3 Architectural/Building

All bill of quantities for infrastructure and building has been priced using market related fixed and firm rates competitively tendered by earthworks and civil contractor. Preliminary and general cost has been included in the contractors tendered price.

17.7.4 Structural Steel

Structural quantities were developed from the preliminary structural steel and mechanical layouts. The structural BoQ's have been priced using current market related fixed and firm rates competitively tendered by Structural, Mechanical, Piping, Platework (SMPP) contractor. Preliminary and general costs will be included in the SMPP contractor's tendered price.

The structural steelwork cost includes for supply, fabrication, surface protection, delivery to site and shop detail drawing and final painting. The preliminary steelwork model includes conservative estimates of equipment weights, self-weights.

17.7.5 Plateworks & Liners

Platework items were derived from the preliminary 3D model and mechanical layout drawings. Platework and liners quantities have been priced using SMPP contractor's unit rates derived from the SMPP contractor's competitively tendered price for works. Preliminary and general costs are included in the contractor's tendered price

The platework and associated linings cost include supply, shop detailing, fabrication, surface protection (where applicable), freight and installation of all shop and site-fabricated platework and associated linings. Rubber lining, epoxy internal surface treatment and liner plate costs will be included where required.

17.7.6 Mechanical Equipment

Pricing of mechanical equipment was based on market related quotations for the items identified from the mechanical equipment list developed from the PFD's, P&ID's and plot plan and mechanical layouts drawings.

Enquiries were issued to multiple vendors which are considered to be specialist equipment suppliers per respective process mechanical equipment as per the project procurement strategy and procurement operating plan.

BoQ's were developed for equipment installation and using current market related rates competitively tendered by SMPP contractor. Preliminary and general costs are included in the capital estimate based on SMPP contractor's tendered price.

17.7.7 Piping & Valves

The piping quantities were prepared by the engineer based on the P&ID's; preliminary 3D modelling for major pipe routes and pipe rack layout drawings. The piping quantities have been priced for supply and installation using the SMPP contractor's tendered price. The pricing of valves, special piping items and pipe supports was included in the tendered price. All overland piping has been excluded in this phase.

The installation pricing for the valves and special piping items and pipe supports have been priced using current market related rates competitively tendered by SMPP contractor. Preliminary and general costs are included in the SMPP contractor's tendered price.

17.7.8 Electrical

Electrical equipment was developed based on preliminary cable routings reflected in the P&IDs and issued to multiple vendors for market related pricing. Electrical bulk material supplies (cables, cable trays, etc.) have been priced by the Electrical & Instrumentation (E&I) contractor. Preliminary and general costs are included in the contractor's tendered price.

17.7.9 Control and Instrumentation

Instrument equipment (e.g. Systems Integrator, Field Instruments and control valves) were developed based on the topology diagrams and P&IDs and issued to multiple vendors for market related pricing. Control and instrumentation bulk material supplies have been prepared based on P&ID's and preliminary plant layout drawings and priced using the E&I contractor's tendered pricing. Preliminary and general costs are included in the contractor's tendered price.

17.8 Allowances

Growth allowance is normally applied to estimates where material take-offs are performed. Where part of the conceptual cost estimate is done in more detail, then the allowance for growth will be agreed in consultation with the discipline engineers for only those specific portions of the estimate.

Quantity and price growth allowance have been applied to the estimate based on the degree of engineering completed and quality of pricing information that supports the estimate.

Allowance for design growth and wastage have been allocated per discipline and agreed in consultation with the discipline engineers taking into account the growth allowances recommended by SGS Bateman Estimator's Best Practice Guide PCNG-0920-002 Rev 0 guideline for a class 2 estimate classification.

17.9 Transport

The costs for sea freight and inland transportation costs are included in the estimate for delivery of equipment from the country of origin to site based on the market quotations. Import duties are included. Transport cost have been allocated at package level. Where no pricing was included, an allowance has been made.

17.10 Spares

The estimate provides for commissioning, 6 months operating and critical spares. The spares cost has been allocated to each discipline at package level using market related pricing.

The following spares and consumables will be included in the capital cost estimate:

- Commissioning or Initial Spares (included in the capital estimate)
- Operational Spares (excluded in the capital estimate – Included in Operating Costs)
- Critical spares (included in the capital estimate)

Discipline engineers have verified if the spares cost provision is technical compliant with the project requirements.

17.11 First Fills (Oils, Lubricants)

Cost for first fills of lubricants are included in the vendor's quotations. Discipline engineers have verified if the first fills provided by the vendors are technically compliant with the project requirements.

17.12 Vendor Assistance

Cost for vendors assistance during construction and commissioning is included in the vendor's quotations.

17.13 Indirect Field Costs (IFC)

Indirect costs are generally time or duration based and include items that are necessary for the completion of the project but are not related to the direct construction costs.

The project indirect field costs are totally dependent on the project duration.

17.13.1 Engineering, Design and Project Management

These costs cover the project management, engineering and procurement, construction management and commissioning assistance up to C2 (EPCM) costs directly associated with the implementation of the project. The manhour loading have been developed based on SGS Bateman's experience and in accordance to the project execution schedule. No allowances were made for training of local personnel in the capital cost. However, the training cost allowances are made in the project economic assessment.

17.13.2 Bonds, Guarantees etc

An allowance for bonds and guarantees based on a factored percentage is included in the estimate.

17.13.3 Project Insurance

Insurance included in the estimate is an allowance for project related risks which are insurable. It is dependent on project variables and project specific circumstances. It typically includes for the following:

- Contractors All Risk on construction and site activities typical cover – this depends on the extent of cover required.
- Third Party Liability insurance typical cover.
- Medical Evacuation and casavac typical cover. This depends on the area, location and the detailed circumstances.
- Marine Cargo and difference in excess typical cover.

The following risks have not been allowed for in the estimate and thus excluded due to the specific requirements the owner may have. These should be strongly considered in addition to those listed above:

- Delay in Start-up insurance (DSU)
- Project Specific required professional indemnity
- Advance Loss of Profits (ALOP)

The insurance estimate allowance should be finalized by performance of an insurance review by specialized parties, once the exact requirements of the owner and the project are available in more detail. An allowance based on a factored percentage of the total net cost will be included in the estimate as a guide. However, it is advisable that formal quotations for project insurance is sourced and issued by the Client.

17.14 Project Contingency

Contingency is a sum of money included in an estimate to allow for uncertainty. Project contingency is not intended to cover scope changes or project exclusions. Scope changes are covered by the owner's contingency.

The QRA is done by an independent consulting firm, to ensure that the outcome is independent. SGS Bateman to include the contingency in the capital estimate.

17.15 Owner's Cost

The estimate excludes Owner's costs. These costs fall under the client scope of work:

- Owner's Team
- Owner's contingency for changes in scope or additional work
- Pre-development costs (cost of study, etc)
- Land acquisition

- Insurance, client to provide and SGS Bateman to allow in the estimate
- Resettlement or relocation costs
- Community relations
- Business systems
- Loss of production and efficiency resulting from implementation
- Owner's start-up and commissioning crew
- Project taxes, fees, duties, customs, permitting and approvals
- Development fees and approval costs of statutory authorities
- Finance fees or cost of capital
- Pre-production costs (operator training)
- Workplace health and safety fees
- Operational readiness
- Site survey and soils testing
- Environmental considerations (EIA)
- Additional study fees

17.16 Exclusions

The following items will be excluded from the scope of the estimate:

- Any costs associated with statutory requirements, local permits, licensing, royalties and approvals, social, community or environmental requirements
- Owner's costs not included in the estimate.
- Owner's contingency allowance
- Value Added Tax (VAT) and Goods & Services Tax (GST)
- Financing costs
- Marketing costs
- Business system costs
- Operational costs (included in the Operating Costs Estimate)
- External auditing costs
- Permit applications
- Foreign currency exchange rates variations from the estimate base date
- Schedule acceleration costs
- Schedule delays and associated costs, such as those caused by:
    - Unexpected site conditions
    - Weather conditions other than fair

  - Unidentified ground conditions
  - Labour disputes
- Force Majeure
- Facilities for disposal of hazardous products generated by operations
- Provision of landscaping and nursery services
- Mine closure/rehabilitation costs
- Higher level management system (MIS, MES or ERP)

17.17 Cash Flow, Forward Escalation and Financial Modelling

17.17.1 Cash flow

Detailed cashflow is included in the capital estimate workbook. It was based on execution schedule and vendors payment milestones.

17.17.2 Forward Escalation

An allowance for Indicative forward escalation from estimate base date to project completion is excluded.

17.17.3 Financial Modelling

Financial modelling has been done by Cresco.

17.18 Process Plant Operating Costs

17.18.1 Operating Cost Summary

The operating cost estimate for the Miriam ore at 200 ppm molybdenum is summarised in Table 17-5 and shown in Figure 17-5. The estimate includes reagents and consumables, fuel, labour, maintenance materials and power consumption.

Table 17-5: Operating cost estimate

Cost Component	Total ($/a)	Total %
Labour - Production/SHEQ[1]	2,408,272	7.4
Maintenance	4,803,695	14.8
Power	8,560,875	26.4
Fuel (Mobile Equipment Only)	770,146	2.4
Reagents and Consumables	15,752,398	48.6
Waste Disposal	148,766	0.5
TOTAL	**$32,444,151**	100

1. SHEQ = Safety, Health, Environment and Quality

USD/t of Total Feed to Process Plant	32.4
USD/lb eU	18.3
USD/lb eU_3O_8	15.5

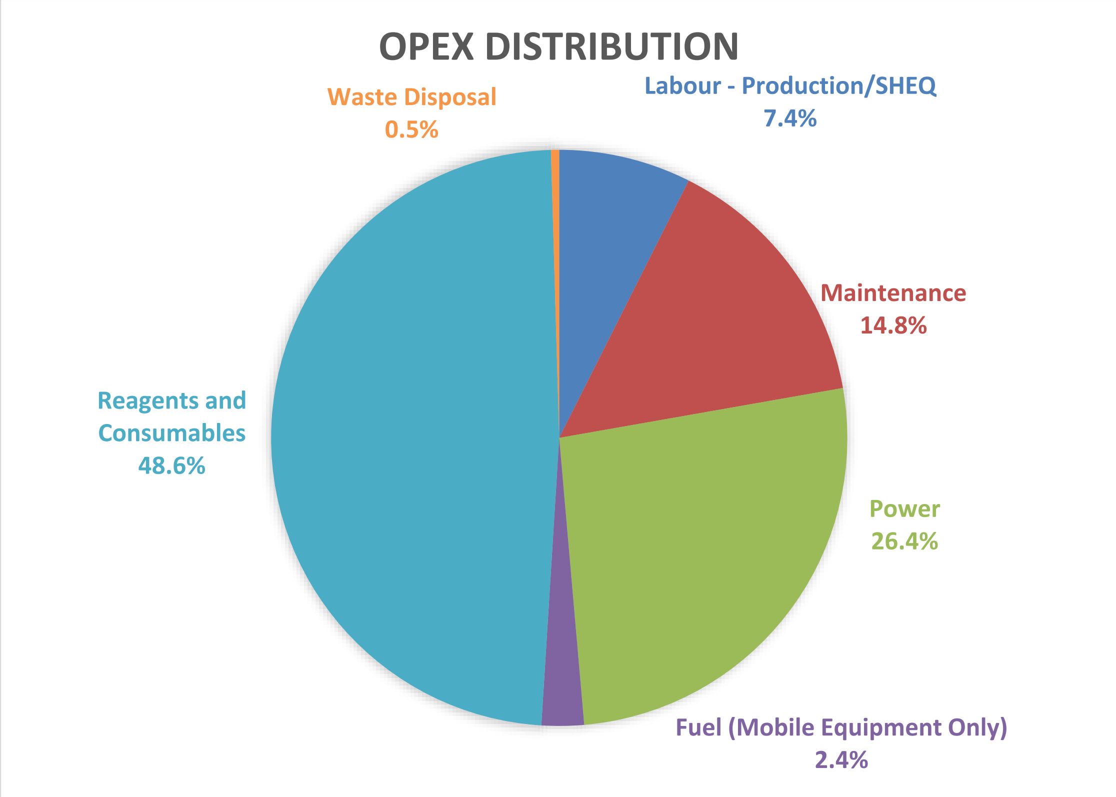


Figure 17-5: Operating Cost Distribution – Miriam Ore 200 ppm Molybdenum

17.18.2 Basis of Estimate

Scope

Table 17-6 indicates the agreed responsibilities within SGS Bateman's scope.

Table 17-6: Operating Cost scope

Activity	Responsibility
Operating Costs	SGS Bateman
Overall compilation of total project operating costs	SRK
Mining costs (up to the stockpile) including all equipment	SRK
Overall compilation of operating costs for the process plant within the agreed battery limits.	SGS Bateman
All infrastructure outside process plant battery limits	SRK
All infrastructure inside process plant battery limits, including roads, buildings, stormwater	SGS Bateman
Tailings Stacking	SRK

The operating costs can be categorised as fixed or variable costs.

Fixed costs include:

- Manpower (Labour for plant operation and maintenance only)
- Maintenance and operating supplies

Variable costs include:

- Power
- Reagents, fuel and consumables
- Waste Handling

Accuracy

The accuracy for the operating cost estimate is as for the capital cost estimate. The methodology used in preparing the operating costs in this report was based on the scope, pricing and information available at the time but should be revised as the industry fluctuates, especially in terms of reagent pricing. A forecast of reagent pricing was used for key reagents as based on It must be noted that these costs apply only to the operation of the plant at full capacity, under name-plate design conditions. During commissioning, start-up and ramp-up the unit costs will vary in comparison to when the plant is operating at full capacity.

Exchange Rate

Operating costs are base dated August 2022. The estimates are presented in US dollars and the exchange rate used is ZAR 16.0 / USD.

Exclusions

The following are excluded from this estimate:

- Mining Costs (Outside of project scope)
- Tailings Handling Costs (Outside of project scope)
- General, Medical and Administration Costs, other than plant and technical/engineering services
- Security costs
- Duties and taxes on exports of products
- Marketing costs
- Depreciation and replacement capital
- Insurance
- In-country corporation tax
- First fill reagents costs (included in capital estimate for Owners Costs)
- No provision for annual increases in salary, services and supplies growth has been allowed

- Product dispatch including handling and cost of transport for products from site to destination. (Outside of project scope)
- Contingency

17.18.3 Fixed Costs

Labour

The salary grades of plant personnel used to derive the overall plant labour contingent is shown in Table 17-7.

Table 17-7: Personnel Grades (Supplied by GoviEx)

Personnel Supplied by GoviEx	***Grade***	***Monthly Salary (USD)***
Unskilled Labour	**1**	$622.27
Skilled Labour	**2**	$852.47
Technical	**3**	$1,120.77
Engineers/Technical	**5**	$1,606.92
Senior Engineers	**9**	$3,502.31

Labour contingents have been derived for the selected flowsheet and are inclusive of production, SHEQ, laboratory, product dispatch and maintenance staff to meet typical South African regulations in terms of health and safety standards. It excludes non-technical staffing like administration, finance, human resource, medical and procurement. The production labour force is based on operating the process plant for three 8-hour shifts per day, seven days a week. Shift rotations will comprise a total of three operating crews with allowance made for a standby crew.

The manning structure for production was derived by SGS Bateman for each area, based on previous studies on uranium processing plants, together with input from GoviEx. Allowance has been made for shared resources across areas. The compliment allows for leave to relieve personnel in critical production areas. Maintenance staff is also accounted for in the process plant technical and management contingent. Salaries have been calculated based on a basic wage plus additional allowances applied for the labour contingent to establish the total cost to company. A total of 228 operating personnel are estimated to be required as shown in Table 17-8. The labour requirement for the flotation circuit have not been included.

Table 17-8: Total processing plant complement

	Staff number
Management / Admin	68
Supervisors	24
Operators	64
Labour	72
TOTAL	**228**

Maintenance

In all cases, the cost of maintenance supplies is calculated as a factor of the mechanical equipment supply costs excluding piping and valves, electrical and instrumentation based on previous studies for typical uranium hydrometallurgical plants but excludes the maintenance associated with the acid plant. Generally, maintenance materials are considered to be (7 – 13 %) of the mechanical equipment supply cost. An estimate of 7 % has been applied. The maintenance labour component has been allowed for in the annual labour estimate.

17.18.4 Variable Costs

Power

The overall operating power consumption is estimated at 7.56 MW. The power requirements for each process area were estimated from tenders available, database information and reduction factors applied to the loads per area as required.

A unit energy supply rate of USD 0.152/kWh was supplied by SRK. An overall annual plant availability of 85 % has been used. It is based on all normally operating equipment (i.e., ignoring stand-by units). Allowance has been made for absorbed power by the use of load factors (0.85x) applied to the actual motor kilowatts for drives installed for operational use.

No reclaim of power from the acid plant has been included in estimating the overall plant power consumption.

Reagents and Consumables

Prices for major reagents and consumables for this estimate were based on information supplied from SRK/GoviEx and budget level quotations obtained from chemical suppliers.

Reagent Pricing

Recent global markets have shown a strong upturn in global reagent pricing in the last year. This is due to a few contributing factors. One factor has been high freight costs due to high global fuel prices, compounding the global supply price increase for certain reagents. Global political instability and the effects of the global COVID pandemic were contributing factors to the substantial market upturn in the last year. A forecast of reagent pricing was thus used for key reagents in order to account for the large global market disturbance and to relate reagent pricing to expected future figures to better represent plant reagent costing in a time period relative to actual plant operation. Thus, for ammonia and hydrogen peroxide supply pricing, these future projected price points were used in the model.

No cost has been allocated for raw water supply based on recommendations by GoviEx. This is due to the raw water being supplied internally to the project with the operating costs for the supply being included in the mining scope.

Reagent Consumptions

The sulfur, lime, sodium carbonate, sodium hydroxide, ammonia, sodium sulfide and hydrogen peroxide requirements are calculated from the chemical reactions used in the Metsim mass balance.

General Consumables

General plant consumables such as anti-scalent filter cloths, plant safety equipment and gear, minor chemicals, laboratory chemicals, office items, packaging and waste bags have been allowed for as 5 % of the overall reagent cost.

Details of the delivered prices used, and sources are shown in Table 17-9.

Table 17-9: Reagent and consumable cost summary

Reagents and Consumables	Annual Rate Metric t/a	Unit Delivered Cost (DAP) $/t	Supplier	% of Cost	Total Cost $
Sulfur - Sulfuric acid Production	17619.8	375	STORM	42%	6,601,875
Caustic flakes (98%)	1390.9	942	Axis House	8%	1,310,492
Lime (100%)	858.9	433	STORM	2.4%	371,818
Ammonia (100%)	474.6	580	Protea Chemicals	1.7%	275,251
Sodium carbonate (100%)	537.3	599	Axis House	2.0%	321,966
Hydrogen peroxide (50%)	4913.0	748	Axis House	23%	3,674,894
Sodium sulfide (100%)	631.1	905	Axis House	3.6%	571,258
Flocculant - Kemira N100 (100% solids)	66.3	3,577	STORM	1.51%	237,262
Alamine 336 (100%)	1.5	16,910	BASF	0.16%	24,949
Isodecanol (100%)	0.74	2,371	Axis House	0.01%	1,749
Shellsol D70 (100%)	34.7	2,406	Axis House	0.53%	83,437
S970 Resin	9.6	15,777	Purolite	1.0%	150,749
VeRo tools and maintenance consumables				8%	1,264,500
Crusher liner and wear replacement				0.7%	112,084
Other consumables				5%	750,114
TOTAL REAGENTS COST				100%	**15,752,398**

Fuel

The annual fuel costs were estimated for mobile plant equipment used within the plant boundaries and required for daily operations. The fuel cost is based on an estimated fuel consumption rate of 25 litre/h for loaders, 3 litre/h for forklifts and 35 litre/h for cranes. A diesel cost of XOF 540/L is used in the model.

Waste Services

An estimated annual allowance made for waste management services based on USD 156/t of uranium product derived from a typical South African uranium plant case.

17.19 Mechanical Engineering

This section serves to describe the methodology upon which Mechanical Engineering discipline used to develop the design and the associated cost estimate for Mechanical Equipment associated with the Madaouela Uranium Project Feasibility Study.

17.19.1 Mechanical Basis of Design

The plant design and equipment selections were in accordance with the process flow sheets, the mass and energy balances and the process design criteria.

The Mechanical Design Criteria established the minimum engineering specifications, standards and practices for the design, manufacture, supply including inspection and testing, installation, and commissioning requirements of mechanical equipment.

Drawings were generated for FS level requirements. The activities detailed below were carried out during the design phase of the FS:

- Development of design criteria.
- Production of equipment specifications.
- Input to P & IDs for mechanical items.
- Briefing of draughtsmen and engineering input into drawing office.
- Calculation and checking of pump heads, conveyors etc.
- Development of design concepts. Design of special chutes, plate-work details and Tanks including calculation of fabrication masses based on preliminary design estimates.
- Selection of equipment to meet duty and other requirements.
- Co-ordination of equipment into cohesive, effective systems.
- Line sizing checking for equipment package interfaces.
- Maintenance of equipment lists.
- Technical input to enquiry and purchase requisitions.
- Technical evaluation of tenders.
- Technical clarification with suppliers for significant discrepancies.
- Review of supplier information for compliance with design requirements.
- Co-ordination of other disciplines in package unit designs.
- Drawing review and approval internally and with Client. Review, approval of Mechanical Layouts for other disciplines to proceed with design and detailing, client interface.
- Input to flowsheet reviews and HAZOP studies.

17.19.2 Mechanical Basis of Estimate

The Indirect Field Costs including man-hour estimate is based on the following documents

- M7534-P120-001 to PFD Process Flow Diagrams
- M7534-P130-00x to P&ID, Piping and Instrumentation Diagrams
- M7534-2030-001 Project Area Breakdown Structure (WBS)
- M7534-M670-001 Mechanical Design Criteria
- M7534-5610-001 POP Procurement Operating Plan
- M7534-5610-001 COP Sub-Contractor Operating Plan
- M7534-M810-001 Mechanical Equipment List
- M7534-M210-00x(various) Mechanical Layouts

- M7534-4800-001 Project Schedule

The mechanical equipment list with revisions was issued at various project stages as source information was developed. Procurement Operation Plan (POP) with initial packages was based on Mechanical Equipment List (MEL) RevG) in line with PDFs Rev E. Initial Electrical load list was a based-on MEL Rev H in line with P&IDs. Initial SMPP equipment and platework construction masses and sized was based on MEL Rev i in line with P&IDs. Supplier information and further major changes like the milling and leaching changes were implemented to MEL(J).

17.19.3 Mechanical Package Summary

Pricing of mechanical equipment was based on the requisitions for the items identified from the mechanical equipment list developed from the initial PFDs, subsequent P&IDs, plant layouts and general plant arrangement drawings. Some packages were feasibility study budgetary quotations without comprehensive requested detail design information for this phase.

Enquiries were generally issued to multiple vendors or by exception to prequalified single source specific technology suppliers (i.e. VeRo – Dry Milling).

Equipment supply enquiries were issued through Procurement and Contracts with SGS Standard Procurement Terms as basis for the Madaouela Uranium's terms and conditions. Construction contracts were prepared based on FIDIC red book terms and conditions (for building and engineering works designed by the employer) and the VeRo was based on yellow book.

The following Mechanical Equipment Packages were issued to the market for the Feasibility Study either as:

{formal} comprehensive technical enquiries with all specification and schedules

{short} compact form with scope specification and associated data sheets package;

{estimator} small value packages based on similar recent database prices or off the shelf item prices.

Table 17-10: Mechanical Equipment Packages issued to market

Number	Description	Type
M001	Plant, IX	Formal
M003	Thickener & Clarifier	Formal
M004	Feeder Apron	Formal
M005	Crusher, Jaw	Formal
M007	Mill (Wet Milling Not selected)	Formal
M009	SX Package	Formal
M011	Dust Extraction (Baghouse, Ducting Fans)	Short
M012	Crane & Hoist	Short
M013	Belt Magnet & Metal Detectors	Short
M015	Pump, Slurry & Water	Formal
M016	Pump Solution	Formal
M017	Tank Modular Water (Process, Fire, Potable)	Short
M018	Compressed Air	Short
M020	Agitator & Mixer	Formal
M021	Plant, Flocculant	Short
M023	Plant, Vacuum Belt Filter	Formal
M025	Plant, Lime Slaking	Short
M027	Plant, Sulfuric Acid	Formal
M028	Plant, Ammonia	Short
M029	Filter Press	Short
M030	Boiler, Diesel	Short
M032	Plant, ADU & Molybdenum	Formal
M033	Centrifuges	Formal
M035	Heat Exchanger	Short
M036	Pump, Organic	Short
M038	FLAME ARRESTOR (DILUENT TANK)	Estimator
M042	Plant, Demin Water (+ POTABLE WATER)	Short
M043	Separator, Oil	Short
M044	Plant, Diesel (Tanks, Pumps and dispensing)	Short
M046	Conveyor	Formal
M048	Feeder, Belt Weigh	Short
M052	SAFETY SHOWERS (Included as SMPP supply)	Estimator
M053	Pumps, Peristaltic	Short
M056	Mixers, Ammonia/Air Sparges	Short
M057	Filter, Polishing	Formal
M059	Cyclones	Short
M063	Plant, Flotation	Short
M064	Plant, Sodium Hydroxide Makeup	Short
M065	Plant, Sewage	Short
M066	Lube	Short
X-M001	SMPP	Formal Contract
X-M002	VeRo (Dry Milling)	Formal Contract
X-M037	Fire Protection (Pump Station for Hydrants & Foam System)	Short Contract

Mechanical Equipment Packages Approach

The general approach for mechanical packages was to:

- Prepare detailed packages with tender Scope of Work, technical specifications, data sheets, drawings, pricing schedules as identified on the MEL based on the PFDs.
- After approval issued to Procurement to add standard procurement commercial conditions and approach pre-qualified suppliers that signed non-disclosure agreements (NDA) by issuing complete enquiry packages with all specifications via shared link on SharePoint.
- Following the tender period suppliers submitted tenders on the requested closing dates driven by the FS phase planning schedule.
- Separate evaluations were done technically and commercially with a final selection of the most suitable supplier. Tender information was shared distributed to other disciplines and drafting office for comments and identifying major concerns.
- Clarifications were only requested on major critical issues that would have significant cost impacts, while procurement reviewed on commented on the tender commercial qualification.
- Data Base Estimates were submitted for only minor items not included in the procurement packages issued or supplier omissions based on estimated & Escalated budget cost of previous experiences.

Estimate Exclusions and Qualifications

<u>Exclusions</u>

- Detail plate work design (only mechanical layout drawings developed).
- Stockpile withdrawal chutes detailed designs.
- Provision for a fire consultant or detailed fire risk assessment.

<u>Qualifications</u>

- All mobile equipment were costed separately from the mechanical packages.
- All general tools and lifting equipment for maintenance are excluded except for the special tools offered by the suppliers.
- General test work will be part of the specialized equipment supplier’s due diligence.
- The Client’s risk-insurer to provide guidance on the fire requirements for the fire protection package.
- Training is included on some packages as a take-out price.

17.20 Piping Engineering

This section describes the methodology used by the Piping Engineering Discipline (Engineers and Drawing Office) to develop the design and the associated cost estimate for electrical infrastructure, and systems.

The following documents were developed and forms part of the piping cost estimate development.

Table 17-11: Piping Cost Estimate documents

Item	Activity Description	Developed Y/N	Deliverable Y/N
1.1	Project set up – Codes, standards, procedures, filing system etc.	Y	N
1.2	Project set up – PUMA (Piping Software)	Y	N
1.3	Discipline strategy document	N	N
1.4	Piping design criteria	Y	Y
1.5	Fluid code list	Y	Y
1.6	Preliminary piping material line classes	Y	N
1.7	Input into P&ID's	Y	Y
1.8	General piping supply specifications	Y	N
1.9	Overland Piping Layout Input	N	N
1.10	In-Plant piping layout input	Y	N
1.11	Piping general arrangements input and review	N	N
1.12	Isometric drawing review and input	N	N
1.13	Piping tie-in / Battery limit schedule	Y	Y
1.14	Piping line list	Y	Y
1.15	Piping valve list/BOQ	Y	Y
1.16	Special piping item list/BOQ	Y	N
1.17	Pipe support schedule	N	N
1.18	Bolt and gasket schedule	N	N
1.19	Preliminary valve data sheets	Y	N
1.20	Preliminary SPI data sheets	Y	N
1.21	Prepare piping bulk BOQ	Y	Y
1.22	SMPP technical adjudication	Y	Y
1.23	Manual valve technical adjudication	Y	Y
1.24	SPI technical adjudication	Y	N

17.20.1 In-plant Piping BOQ Development

The in-plant piping design was based on the project P&ID's and preliminary plant layout at FS level. The quantities were developed from a preliminary 3D piping model. Fittings were estimated based on typical design norms. All BOQ's were generated per line and materials based on the preliminary piping line class specifications selected as per the FS fluid List. Small bore utility piping was not modelled and estimated on the BOQ.

All manual and automated valves shown on the P&ID's were captured in the valve list and formed part of the valve enquiry. The design of the valves was based on the preliminary valve data sheets selected from standard SGS Bateman valve data sheets and needs to be finalized during the next phase of the project.

Major Special Piping Items (SPI) were allowed for such as bellows and hoses as per the preliminary SPI schedule. Standard materials were used based on the commodity conditions listed in the fluid list. Other SPI items were allowed for as part of SPI, Site Run & Infrastructure allowance. The materials of all special piping items must be confirmed during the next phase of the project.

The secondary pipe supports were quantified by using the pipe length x allowable pipe span per size as per the standards SGS Bateman norms. The quantity of required supports was then converted into kilograms steel and formed part of the SMPP tender BOQ.

Pipe Insulation for lines requiring insulation as per the P&ID's were determined by the preliminary pipe length and quantity of fittings and valves. The Insulation type and thickness as per standard industry norms. The costing for the supply and install thereof formed part of the SMPP tender.

The VeRo change to the P&ID's were finalized after the project piping design were completed and costed. The Line and Valve list were updated with these changes and the piping costing adjusted accordingly.

Overland Piping BOQ Development

No overland piping was allowed for during this phase.

Infrastructure Piping BOQ Development

Infrastructure design required piping for potable water, fire water and air forms part of the additional allowance noted as "SPI, Site Run & Infrastructure allowance".

17.20.2 Battery Limits

Reference must be made to the battery limit schedule and be read in conjunction with the project P&ID's that indicates the battery limits between the Client and SGS Bateman design. All physical limits are within the plant perimeters and no overland piping were allowed for outside the Ring main road running around the plant.

17.20.3 Piping Procurement Packages

Manual and Automated Valve Supply Package

The Valve enquiry went to out to three valve vendors. AR Controls were selected to be technically the preferred supplier for the Feasibility Study.

SPI Supply Package

The SPI enquiry went out to two vendors with the selected supplier to be Jachris Hose and Coupling PTY LTD. The supplier is well known in the industry and supplied SGS Bateman successfully on previous projects. The enquiry consisted of bellows and hoses only.

Piping Supply and Installation

The in-plant piping supply and installation costs formed part of the project SMPP package. The technical evaluation for the piping portion indicated the acceptance of 3 vendors technically with qualification, recommendations, and adjustments as noted therein. For Feasibility Study purposes the submitted price for piping were based on the adjusted rates supplied from Global Construction Africa (GCA).

17.21 Civil Engineering

This section serves to describe the methodology upon which Civil Engineering discipline used to develop the design and the associated cost estimate for civil, bulk earthworks and infrastructure, associated with the Madaouela Uranium Project Feasibility Study.

17.21.1 Civil Basis of Design

The Basis of estimate for civil, bulk earthworks and infrastructure explains the scope of works and how the quantities were derived and estimated. The preliminary civil, bulk earthworks and infrastructure design, MTO's (Material Take-Offs) and BOQ's (Bill of Quantities) were prepared for each area based on the following below:

- FS plant layout prepared
- Developed project design criteria
- Design specifications and standards prepared
- FS preliminary designs prepared

17.21.2 Civil Engineering Scope of works

The scope of work for the civil, bulk earthworks and infrastructure includes all the plant areas, as per plant layout developed. Preliminary design were developed for each plant area, where MTO's (Material Take-Offs) and BOQ's (Bill of Quantities) were developed, and issued for enquiries. From the tenders that were received, a preliminary cost estimate was developed. The cost estimate developed include all labour, material, transport to site, bulk excavation, restricted excavation, all concrete works, fencing, infrastructure buildings, including all roads, stormwater, sewer and dams.

The material selection was based on suitability of materials, durability, maintenance, constructability, costs, industry practices and nature of interface environment.

17.21.3 Quantity and Cost Development

The quantities developed were based on the Feasibility Study mechanical model layout and drawings produced for each plant area, and preliminary designs that were prepared, as well as the procurement packages and the engineering analysis that were performed.

Procurement packages

The civil, bulk earthworks and infrastructure was executed as a package.

Enquiry documents were issued to the market, tenders were received and adjudicated technically and commercially to select the most suitable contractor's price for the costing of this Feasibility Study.

Pricing of the bulk earthworks for the process plant and infrastructure terrace is based on utilising the owner's fleet of earthmoving equipment whose primary function is earthmoving around the open pit mine and the dry stack tailings dam.

Material Selection

The material selection was based on suitability of materials, durability, maintenance, constructability, costs and the industry practice.

Design Approach

The following design approach was used:

- Preliminary design was done based on the mechanical model layout and drawings provided.
- Where feasible, the following general principles have been adopted:
    - Use of standard designs from the SGS Bateman data base.
    - Use of previous similar designs.

Material Take-offs build-up

All civil, bulk earthworks and infrastructure were taken from the preliminary design prepared, as well as the mechanical model and drawings provided.

All bulk earthworks were measured from the balancing of the cut and fill, as well as the recommendation of the Geotech report.

All concrete works such as foundations, were based on preliminary foundation sizes required.

All roads, stormwater, dams and sewer were based on the plant layout developed.

17.21.4 Assumptions and Risks

Assumptions

The preliminary designs prepared, and consequent material take-off are a fair representation of quantities required at this phase of the project.

- The execution of project shall be based on South African National Standards (SANS).
- Adequate laydown area will be provided by the employer to suit contractor's requirements.
- The Geotech report provided is a fair representation of the soil conditions on site.
- Quality soil construction materials, as well as quality aggregate for concrete will be available.

Risks

The quantities may change during execution phase when the certified drawings and loads are available.

Interfaces with existing facilities are not checked.

Engineering documents

Where reference is made to a document, specification, code or standard, the reference will be taken to mean the latest edition of the document, specification, code or standard, including latest addenda, supplements and revisions thereto, as at the base date for the Project.

The works shall conform to the documents prepared during the Feasibility Study such as the design criteria, concrete specifications, bulk earthworks specifications, SANS code of practice, as well as the civil, bulk earthworks and infrastructure bill of quantities prepared.

17.22 Structural Engineering

This section describes the methodology used by the Structural Engineering Discipline (Engineers and Drawing Office) to develop the design and the associated cost structural steelwork.

17.22.1 Structural Scope of works

The scope of work for the structural steelwork includes all the plant areas, as per plant layout developed. Preliminary designs were developed for each plant area, where MTO's and BOQ's were developed, and issued for enquiries. From the tenders that were received, a preliminary cost estimate was developed. The cost estimate developed for structural steel includes all the shop drawings, corrosion protection, fabrication, transport to site, supply, storage on site, and site installation.

The BOQ's included the supplying of labour, material, fabrication, corrosion protection, transporting to site, site installation, and final touch ups where required.

The material selection was based on suitability of materials, durability, maintenance, constructability, costs, industry practices and nature of interface environment.

17.22.2 Structural Basis of Estimate

The basis of estimate for structural steelwork explains the scope of works and how the quantities were derived and estimated. The preliminary structural steelwork design, MTO's and BOQ's were prepared for each area based on the following information below:

- Feasibility study plant layout prepared
- Developed project design criteria
- Design specifications and standards prepared
- Preliminary designs prepared

17.22.3 Quantity and cost development

The quantities developed for structural steel were based on the Feasibility Study mechanical model and drawings produced for each plant area, and preliminary designs that were prepared, as well as the procurement packages and the engineering analysis that were performed as indicated below:

Procurement packages

The structural steel works was executed as part of the SMPP package.

Enquiry documents were issued to the market, tenders were received and adjudicated technically and commercially to select the most suitable contractor's price for the costing of structural steelwork for this Feasibility Study.

Engineering analysis

<u>Material Selection</u>

The material selection was based on suitability of materials, durability, maintenance, constructability, costs and industry practice.

<u>Design Approach</u>

The following design approach was used:

- Preliminary design of structural steelwork was done based on the mechanical model and layout drawings provided.
- Where feasible, the following general strategic principles have been adopted:
  - Use of standard designs from the SGS Bateman data base.
  - Use of previous similar designs.

Material Take-offs build-up.

All structural steelwork materials take-offs were taken from the preliminary design prepared, as well as the mechanical model and drawings provided.

Open grid flooring was measured in square meters from the mechanical model and drawings provided.

Standardised hand-railing were measured in linear meters from the mechanical model and drawings provided.

17.22.4 Assumptions and Risks

<u>Assumptions</u>

The preliminary designs prepared, estimated sizes of structural elements and consequent material take-off were taken as a fair representation of quantities required at this phase of the project.

The execution of project shall be based on SANS standards.

Adequate laydown areas will be provided by the employer to suit contractor's requirements.

Risks

The quantities may change during execution phase when the certified drawings are available.

Interfaces with existing facilities are not checked.

Engineering Documents

Where reference is made to a document, specification, code or standard, the reference will be taken to mean the latest edition of the document, specification, code or standard, including latest addenda, supplements and revisions thereto, as at the base date for the Project.

The works shall conform to the documents prepared during the Feasibility Study such as the design criteria, structural steel specifications, SANS code of practice, as well as the structural steel bill of quantities prepared.

17.23 Electrical Engineering

This section describes the methodology used by the Electrical Engineering Discipline (Engineers and Drawing Office) to develop the design and the associated cost estimate for electrical infrastructure, and systems.

17.23.1 Electrical Basis of Design

This phase of the Project was based on SGS Bateman latest specifications and best practices with the SANS replaced with International (IEC) standards where possible. Standard SGS Bateman specifications and standards were utilised to provide a sound, workable and cost-effective design base for this estimate.

17.23.2 Electrical Basis of Estimate

The cost estimate was developed based the below basis of design:

- Preliminary and historical information
- SGS Bateman electrical specifications and standards
- Developed electrical design criteria
- Mechanical equipment list from which electrical load list was developed.

17.23.3 Electrical Discipline Feasibility Study Activities (Scope of Works)

The electrical engineering scope of work was to quantify the electrical requirements for the design of electrical distribution system architecture, inclusive of equipment and contracts.

The electrical engineering scope is inclusive of MV cabling, Grinding Plant MV Container Substations, all plant LV Container Substations, Miniature/Kiosk Substations, LV cabling, Motor Field Stop Start Stations, Lighting and Small Power, Electrical Installation and Erection Contract. The contents of the container substations included Switchgear, UPS, Fire Protection, HVAC, Lighting & Small Power and space provision for free issued C&I equipment. The C&I control Room was included in the MV & LV Container Substation Package.

Bulk quantities such as cable racking is based on cable routing following pipe racks wherever possible. Area and street lighting and small power was estimated using the plant layout and assuming coverage requirements. Substation Placement detail design and quantities will require updating in the detailed design phase.

17.23.4 Electrical Package Summary

Pricing of electrical equipment and contract was based on the requisitions for the items identified.

Equipment supply enquiries were done through Procurement and Contracts with SGS Standard Procurement Terms as the basis for the Madaouela Uranium's terms and conditions. Construction contract was prepared based on FIDIC red book terms and conditions (for building and engineering works designed by the employer).

Table 17-12: Construction Contracts

Number	Description	Type
E001	MV Switchgear	Formal
E002	LV Substation	Formal
E003	Transformers	Formal
S-E001	Consultant Electrical Protection	Formal
X-E001	MV Switchgear and MV VSD's (Cancelled)	Formal
X-E002	LV MCC's, VSD's and UPS's	Formal
X-E003	Earthing and Lightning Protection	Formal
X-E004	Electrical and Instrumentation Installation	Formal

This information was used to estimate the costs, engineering and design office man-hours required for the project to be implemented.

17.23.5 Electrical Discipline Feasibility Study Pricing Considerations

General

The following requirements were considered for electrical engineering equipment pricing:

- Equipment to be suitable selected for energy efficiency i.e. motors and lighting
- Equipment to be suitable specified for the corrosive and acid areas
- Equipment to be suitable IP rated for indoor or outdoor installation
- Equipment to be suitable rated for short circuit rating
- Shop assembly, Packaging and Delivery to site to be suitable for land transport
- Supplier drawing and data requirements to be provided as per SD&DR
- Name and rating plates to be as per site data and project requirements
- Special tools and maintenance equipment
- Training of maintenance and operating personnel

- Electrical procurement and contract packages were grouped into similar types to minimise the number of packages
- Electrical vendors and contractors that are agreed upon in a joint Project vendor list.

Price Bases

The costs for the following contracts were obtained through the following process:

- The cost for the LV Container Substations including specified container equipment was through quotations from LV Container Substation Package tenderers
- The cost for the MV Container Substation including specified container equipment was through quotations from MV Container Substation Package tenderers
- The cost for the Transformers, Ring Main Units and Miniature/Kiosk Substations was through quotations from Transformer Package tenderers
- The cost for the Protection Specialist Services Contract was through quotations from Protection Specialist Services Contract Package tenderers
- The Earthing and Lightning Protection Contract including equipment & bulks supply and installation costs was through quotations from Earthing and Lightning Protection Contract Package tenderers
- Electrical and Instrumentation Contract including equipment & bulks supply and installation costs was through quotations from I&E Package tenderers.

17.23.6 Electrical Discipline Feasibility Study Assumptions

The following electrical distribution assumptions have been made:

- The power supply has sufficient electrical capacity and physical space for supplying the Project electrical loads
- Average Low Voltage cable lengths were assumed to be 30 m from transformer to MCC Incomers and 150 m from MCCs to plant loads. The volt drop considerations were according to the design criteria specification
- The fault levels were assumed to be 25 kA @ 6.6 kV for cable calculations.

17.23.7 Electrical Discipline Feasibility Study Battery Limits, and Qualifications

Battery Limits

The following electrical battery limits apply:

- Outgoing Terminals of the 6.6 kV Switchgear, feeder breakers (6.6kV MV Switchgear supplied by others)
- Containerized Substations top of the civil plinths
- The field connections as stated in the cable schedules
- The structural steel to which supports the containerized substations and electrical equipment
- Tailings Storage Facility - Minisub outgoing feeders

- Off-site accommodation - Municipality DB outgoing feeder.

Qualifications

The following qualifications apply:

- No electrical engineering consultant design inputs considered during this phase of the project
- Pricing for Protection Settings and Earthing and Lightning Protection services have been included and, for the execution phase of the project
- Containerized and prefabricated buildings internal lighting and small power – i.e. admin buildings, substations, medical facilities, crib rooms, change houses, stores, workshops, gate house, etc. were priced as part of the buildings
- Electrical power and control cables, cable racking, earthing and lightning protection system, motor field stop start stations, welding socket outlet, junction boxes, lighting and small power is costed on the installation contract costing
- Preliminary overall layout plan of the equipment and main rack routing were used to prepare cable runs.

17.24 Control and Instrumentation Engineering

17.24.1 Introduction

This Discipline Strategy sets out the methodology and strategies employed to ensure that the C&I Design, Procurement, Construction, Management, Risk Assessment and Quality Assurance is executed by using the latest, most cost-effective equipment, latest specifications and best practices most suited to the Madaouela Uranium Feasibility Study, thereby ensuring that the project is completed on time, within budget, is operable, and to the required quality standards.

17.24.2 Control and Instrumentation Basis of Design

The discipline strategy was a high-level plan of execution, and it did not address the detailed specifications for these processes and document content. The documents were updated as and when required to align with the overall project strategy.

The cost estimate was developed based the below basis of design:

- Preliminary and historical information
- SGS Bateman C&I specifications and standards
- Developed C&I design criteria
- Mechanical equipment list from which electrical load list was developed and plant layout drawings.

Standard SGS Bateman specifications and standards were utilised to provide a sound, workable and cost-effective design base for this estimate.

17.24.3 Control and Instrumentation Activities (Scope of Works)

The C&I Engineering scope of work was to quantify the Control system, Instrumentation and Network infrastructure including comprising of the following:

- IT networks, Security and Communications requirements for the design of Control and Instrumentation systems, inclusive of equipment and contracts.

The following documents were developed for and form the technical basis of the estimate:

- M7534-I130-001 Rev B – Develop the Control System Topology - Preliminary
- M7534-I810-001 Rev C – Instrument list - Developed from P&IDs
- M7534-I880-001 Rev D – Instrumentation BOQ
- M7534-I880-002 Rev C – Equipment Installation and supply BOQ (Networks, Security and Telephones)
- M7534-I880-004 Rev B – PCS SOW and BOQ

17.24.4 Pricing Considerations

The costing of the C&I works, as a minimum, is based on the following fundamental documents:

- Plant Layout Drawings
- P&ID's
- Project Specifications and Scope of Work documents
- C&I Design Criteria
- C&I drawings and schedules

17.24.5 Equipment Quantities

Instrumentation

The post Hazop P&ID's, and corresponding layouts, were used for all indexes and reports.

An Instrument index was compiled from the P&IDs with the VeRo changes included. All other schedules, drawings and BOQ's have been based on post Hazop P&ID's.

Process Control System

The instrument index and electrical drive index were used to create the I/O and electrical interface counts. Possible vendor package interface I/O has not been allowed for. The big vendor packages, i.e., Mill/VeRo, has not been accounted for. These quantities, together with the plant layout were used to develop a basic (preliminary) PCS and Network Topology drawing to quantify the PCS effort. Spare I/O of 25 % of the design quantity was allowed for.

Site Installation and Construction

Equipment installation quantities were derived from the instrument index, BOQ, layout drawings and PCS topology drawing.

A Cable schedule was compiled, thus cable and termination MTOs were verified per instrument / installation point for the BOQ. Cable lengths however were estimated.

Cable racking MTOs were estimated per plant area. Detailed racking drawings were not done.

Valve air manifolds, tubing and fittings were also estimated.

Equipment Cost

The C&I packages are categorised into two groups as follows:

- Group 1: Equipment Supply.
- Group 2: Supply and Install Contracts

There were packages created and priced via formal enquiries (3 vendor tenders where possible) for the following C&I items.

Group 1: Equipment supply

- M7534-I-001 Field Instruments (Analyser, Density, Flow, Level, Pressure and Temperature)
- M7534-I-003 Gas analysers.

Group 2: Supply and Install Contracts

- M7534-X-I001 Process Control System
- M7534-X-E004 Electrical and Instrumentation Construction/Installation package submitted by Electrical
- M7534-X-I002 Security, Access Control, IT & Communications (Telephones)

Quotes

Quotes were received for the following C&I items.

- Field Instruments. Single tenderer priced on Field instruments, was found to be technically compliant
- Gas analysers. Three tenders were sent out, however only one tenderer returned a quote
- Process Control System. Full tenders were sent to 3 suppliers of which only two returned quotes
- Electrical and Instrumentation Construction/Installation package submitted by Electrical. Full tenders were sent to 3 suppliers of which only two returned quotes
- Security, Access Control, IT & Communications (Telephones). Full tenders were sent to 5 suppliers of which only one returned a quote.

Previous Quotes / Database Pricing

Database pricing were not utilised since budget prices were obtained via enquiry tenders for pricing.

Estimates

There was no need for estimates, as all proposal requirements were met with tender budget pricing that were sent out as formal enquiries.

17.24.6 Battery Limits, Qualifications, and exclusions

Battery limits

The following C&I battery limits apply:

- Flanges on tanks, top of concrete plinths, foundations, supporting structures, etc.

Exclusions

The following items are excluded from the C&I estimate:

- The supply of conveyor pull-key switches, drift switches, belt rip switches and speed switches. The conveyor supplier allowed for the supply of these conveyor switches
- The supply of on/off control valves. The piping department allowed for the supply of the on/off control valves
- The supply of the belt weightometers. The mechanical department allowed for the supply of the weightometers
- Manual valve supply, including the manual valves used for pressure transmitter, pressure gauge and other instrument process connections
- On/Off and modulating control valve installation – Installed by SMPP Contractor
- Flow meter tube installation - Installed by SMPP Contractor
- MIS and MES systems that hook up to the PCS system and interface to these systems.
- LIMS systems
- Reporting systems
- ERP systems and interface to these systems.

17.25 Drawing Office Engineering

An overall 3D model was generated, and was built up from individual 3D models from each process area of the plant.

3D Models were generated for all process areas and infrastructure areas of the plant.

2D Mechanical Layouts were generated from the 3D models for MTO purposes.

3D Piping models were generated after completion of the mechanical models for MTO purposes.

The Plant originally had a SAG Mill for Grinding Purposes and has been replaced with VeRo Crushers which is the base case for the FS.

18 PROJECT INFRASTRUCTURE

This section presents the surface infrastructure assets proposed for the Miriam open pit operation (Miriam), the power supply strategy, and a summary of the transport options to site for consumables and equipment. Further other underground operational areas are planned and are reported in separate subsections.

This section describes and presents the basis of costs estimation for the following:

- Access road(s).
- Mine Support Facilities (the “MFA”).
- Mine Maintenance Area (the “MMA”).
- Off-site accommodation.
- Utilities (electricity, communication, water, fire and dust suppression).
- Transport and logistics.
- Explosives Storage Facility (ESF).
- Wellfield infrastructure.
- M&M and MSNE Surface Infrastructure.
- Bulk power supply to the Project.

18.1 Regional Infrastructure

18.1.1 Site Location

The Madaouela Uranium Project site is a greenfield project located within one of the most significant sandstone-hosted uranium deposits in the world - Madaouela in Niger, West Africa.

The Madaouela Uranium Project site closest town is Arlit, Niger. The project site is referenced to this town.

Arlit is approximately 1,200 km (driving distance) from Niamey, Niger’s capital city.

The project site is situated approximately 10 km south of Arlit in Niger at approximately 18° 33' 18.2902" N and 7° 29' 49.3202" E.

The project site topography is semi-desert and relatively flat at altitude approximately 430m above mean sea level.

Niger, officially Republic of Niger (République du Niger) is a landlocked western African country. It is bounded on the northwest by Algeria, on the northeast by Libya, on the east by Chad, on the south by Nigeria and Benin, and on the west by Burkina Faso and Mali.

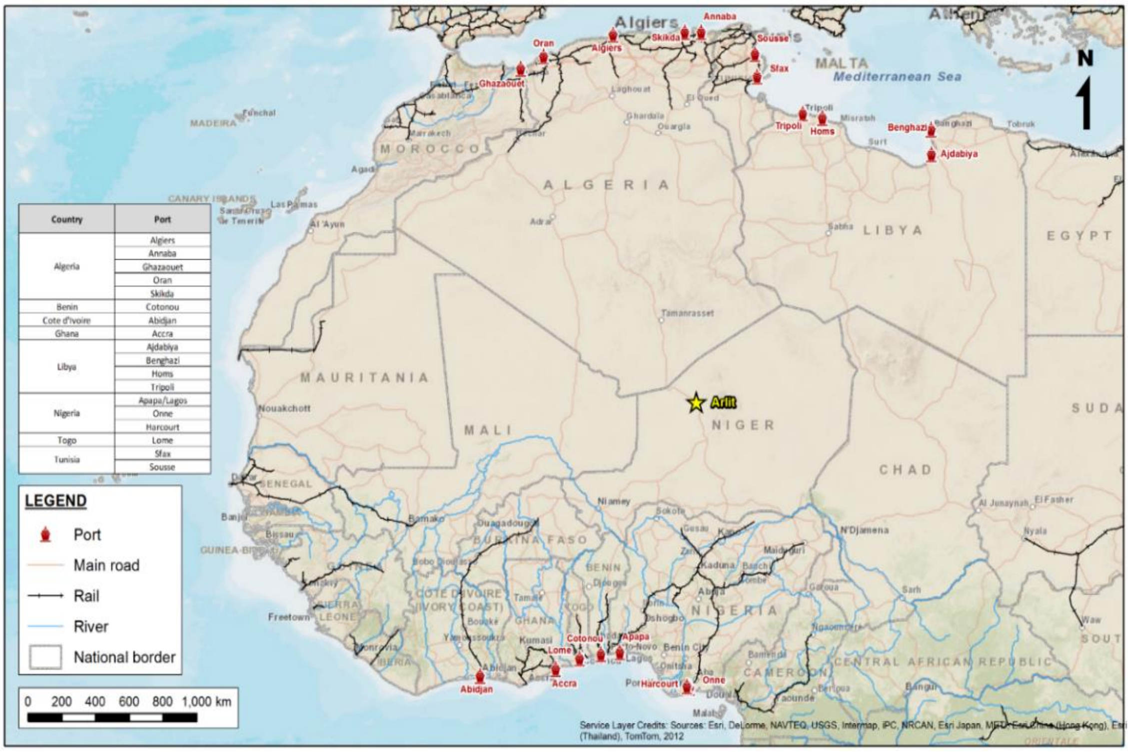


Figure 18-1: Site Access

18.1.2 Site Access

Niamey has an international airport. Niamey Airport provides both International and Domestic air services linking the country’s airports.

The nearest major airport to site is Agadez, which is 750 km northeast of Niamey and approximately 250 km south of Arlit. Arlit has a regional airstrip and there are other airstrips such as Maradi, Zinder and Dirkou.

For sea freight Niger uses the three closest ports: Port of Cotonou in Benin, Lomé’ Port in Togo and Harcourt in Nigeria, each are more than 956 km away from Niamey.

Madaouela project site is accessible through roads all year around. Transportation from the ports is approximately 1,750 km through national road including N25. Niger railroad construction is in the pipeline. The new plant entrance is roughly 3 km from the N25 national road.

18.1.3 Power

SONICHAR (Nigerien Anou-Aren coal company) own and operate a coal fired power station at Tchirozérine and supplies power to the Akokan-Arlit area and associated mining operations via a 132 kV transmission line to a substation at Akokan, termed “Poste 132”. The transmission infrastructure is owned and maintained by NIGELEC (Société Nigérienne d'Electricité).

Electrical power supply for the Madaouela Uranium Project site will be provided through the overland transmission line. This is discussed further in Section 18.7 of this report.

18.2 Site Layout

18.2.1 Layouts

The Surface infrastructure layout is presented in Figure 18-2. The drawing presents the infrastructure compound located to the northeast of the open pit and includes the processing plant, tailings storage facilities and infrastructure. Note the process plant, bulk power supply connection, tailings storage facilities and open pit are shown yet reported on other sections of this report.

18.2.2 Development of the Layout

The general principles in the determination of the layout are as follows:

- Ensure ease of access but assist in the managing of ingress / egress to different compounds and areas.
- Optimise capital cost where possible (orientation, layout, positioning).
- Optimise operating costs (materials handling lifts / lengths).
- Reduce environmental or social impacts.
- Optimise the placement of the SX Plant and Ammonia Plant with respect to material handling, health, safety and environment.
- Optimise the flow of people, machinery, and reagents (Figure 18-3).

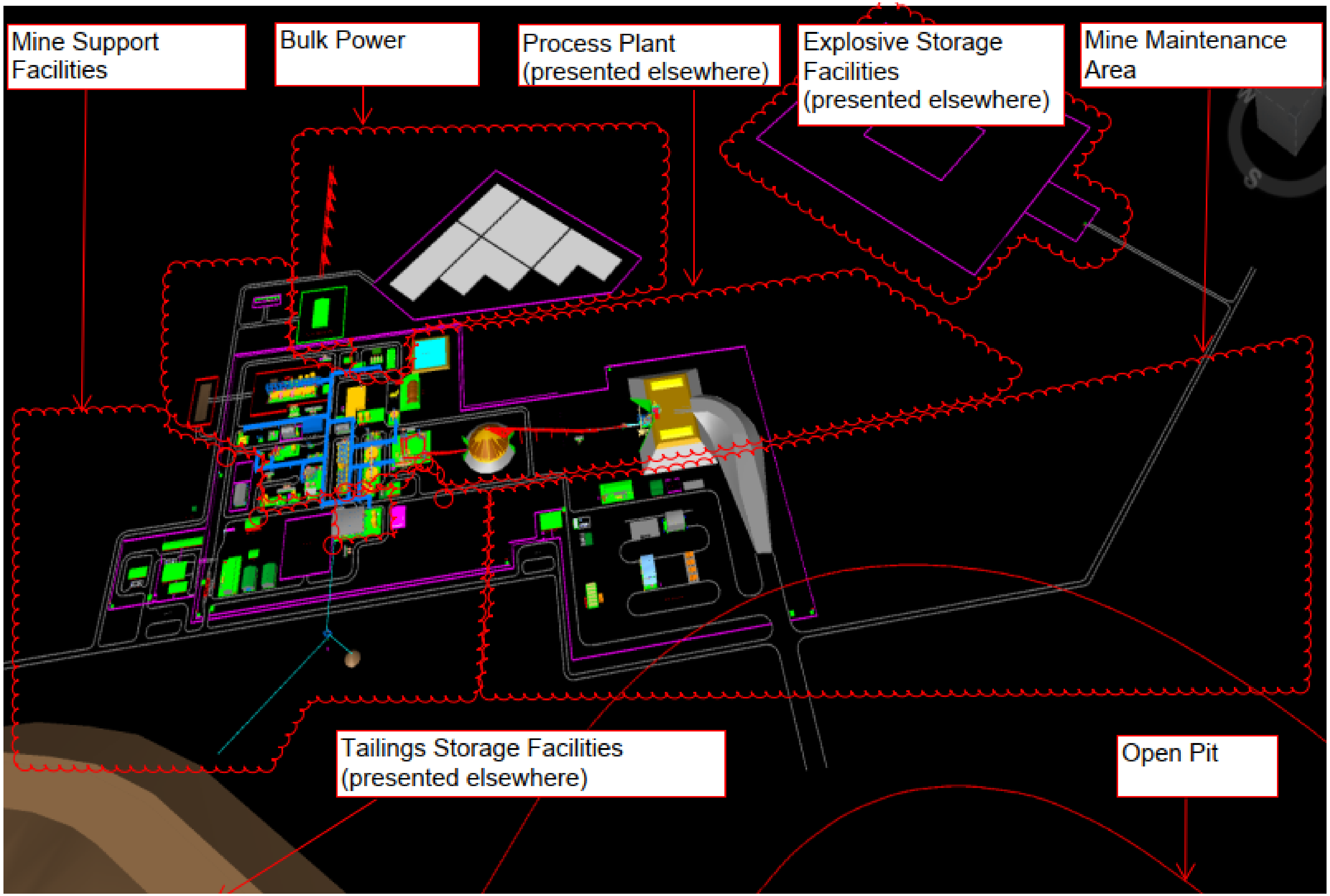


Figure 18-2: Madaouela Project Surface Infrastructure Main Areas Identified

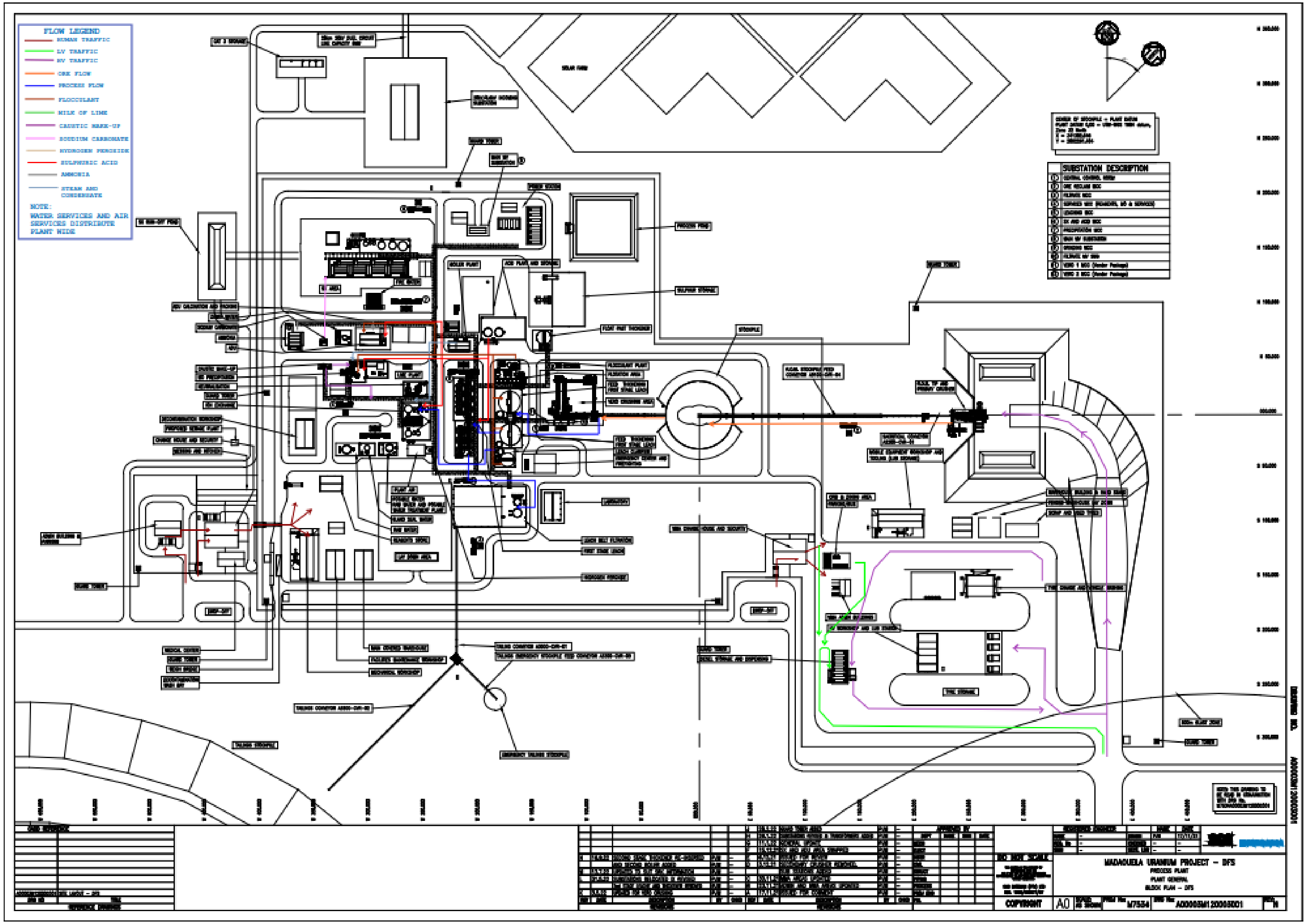


Figure 18-3: Optimised flow of People, Machinery and Reagents

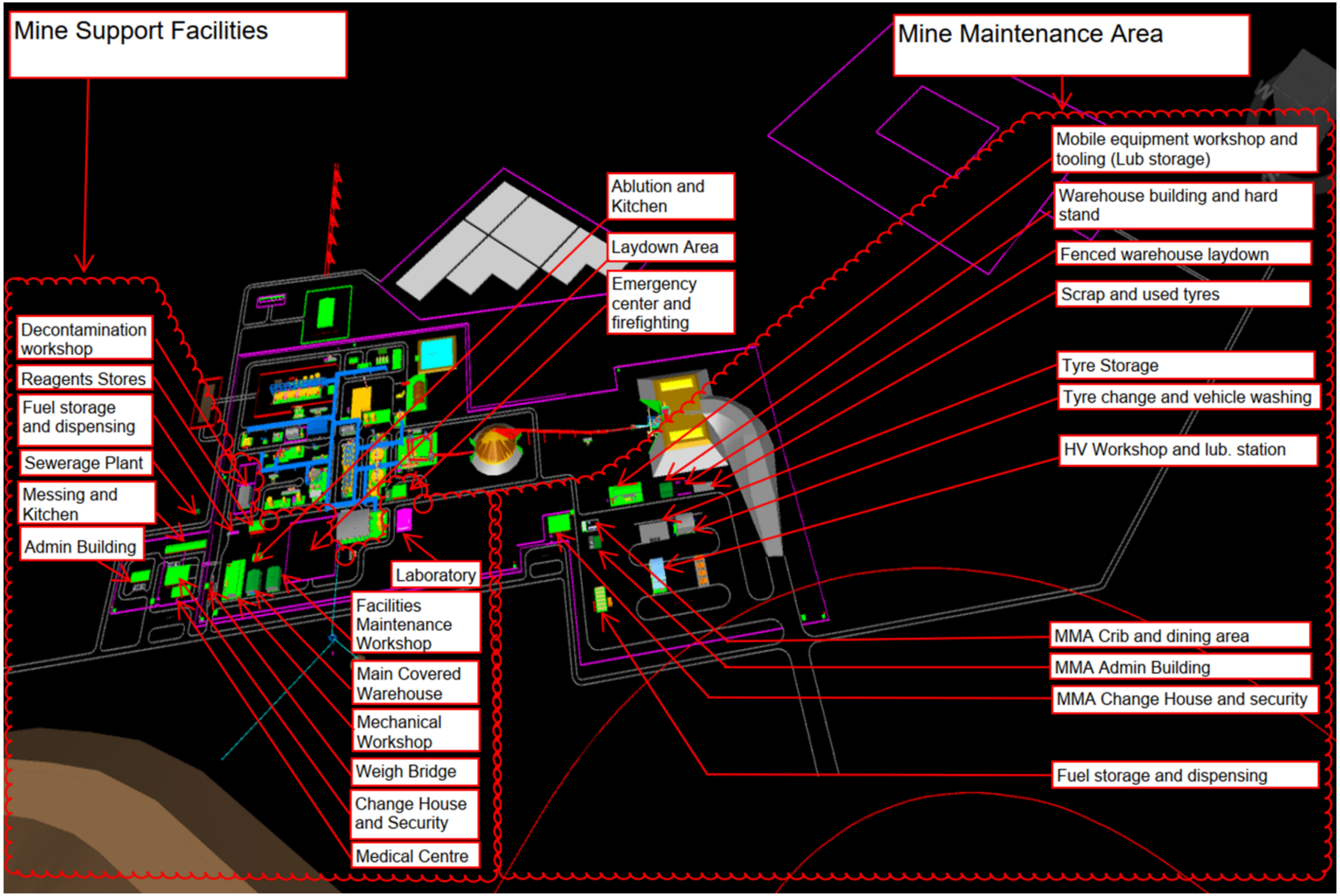


Figure 18-4: Madaouela Project Mine Support and Mine Maintenance Area Buildings Identified

18.3 Basis of Design

18.3.1 Introduction

The Basis of Design (BoD) enables the definition of infrastructure assets and is based on specific operations, maintenance, security and logistics criteria whilst maintaining the environment and the health, safety and welfare of personnel.

The following sections present the BoD used to define the surface infrastructure assets at the Miriam operational area.

18.3.2 Topography

The general area is relatively level. The minimum and maximum elevation within the area of the open pit and supply water wells is approximately 450 meters above sea level (mASL) and 465 mASL respectively (over a circa 2,500 m distance).

18.3.3 Climate Conditions

The Project concession is characterised by a hot arid desert climate. Further details are provided in Section 5.2.

18.3.4 Ground Conditions

In general, the ground conditions encountered across the project site were Aeolian blow sands underlain by weathered Guezouman (sedimentary rock) grading into competent Guezouman.

The moisture content, specific gravity, sieve analysis, particle analysis distribution etc., details are document on the factual ground investigation report for plant, TSF and infrastructure (see Section 24.1).

The above summary is based on the Miriam exploration, resource drilling and associated reports which is further detailed on another document.

18.4 Surface Infrastructure

18.4.1 Introduction

The surface infrastructure layout is presented in Figure 18-2. The drawing presents the main components of the Project which are:

- Roads.
- Earthworks and surface water management.
- Mine Facilities Area (MFA).
- Mine Maintenance Area (MMA).
- Security infrastructure.
- Support vehicles.
- Off-site accommodation units.
- Utilities (electricity and water distribution).
- Explosives storage

18.4.2 Roads

Introduction

They were two road types that were allowed for in this FS study as shown below:

- Type A – Main access road
- Type B – Plant access roads.

The total lengths are presented in Table 18-1:

Table 18-1: Summary of roads

Category	Type	Pavement (mm)	Total Length (m)
Type A	Gravel road	150/150/200	2,740
Type B	Gravel roads	150/150/150	5,740
Total roads distance			**8,480**

Main Access Road

The main access road is 2,740 m long and links the site to the national road “N25”.

Design Vehicles

Primary usage (>90 %) will be for 4-axle rigid highway construction trucks with a 20-t payload or 5 / 6 axle articulated delivery lorries. Other vehicles will be delivery trucks (similar loading) and light vehicles. Maximum truck width will be around 2.6 m.

Road Geometry

Road geometry will be a 2-way, single lane road incorporating 3.5 m wide lanes on either side.

- Total running lane width 7 m
- Total width including v-drains 9 m.

Vertical / Horizontal Alignment

The terrain is relatively level and therefore the straight grid horizontal alignments are proposed. The following general geometric design parameters was used for the main access road as shown in Table 18-2 below.

Table 18-2: General geometric design parameters for main access road

Gradients for Unsurfaced / Gravel Roads:	
Minimum longitudinal gradient	1:200 (0.5%)
Maximum longitudinal gradient	1:20 (5%) [1:16.67 (6%) may be used in extreme case / very short distances]
Minimum cross fall	1:33.33 (3%) or ≥ longitudinal gradient of road
Road Widths:	
One-way Main access road	3.5 m wide
Two-way Main access road	7m wide
Speed Restrictions:	
Main access roads	40 km/h unsurfaced
Mine plant and internal roads	30 km/h
Horizontal and vertical curvature	Guideline recommendations
Parking Areas:	
Minimum gradient of block paving	1:50 (2%)
Cross fall on parking areas	1:50 (2%) surfaced 1:33.33 (3%) unsurfaced

Pavement

Ground conditions are estimated to be sand, gravel or weathered rock. Table 18-3 shows the pavement layers adopted for the main access road.

Table 18-3: Pavement design (Type A)

Layer	Details
Gravel wearing course	150 mm thick
Base layer	150 mm thick
Sub-base layer	200 mm thick

Earthworks

Due to terrain, minimal earthworks are envisaged. An allowance is made for clearance, grubbing and removal of 100 mm of topsoil across the width of the road.

All earthworks' platforms and terracing were designed in accordance with the latest overall layout and the recommendations of the geotechnical engineering report especially with regard to allowable bearing pressures, grades and safe slope stability.

The following specifications and guidelines (Table 18-4) as recommended by SANS 1200, section C and D, for site clearance and earthworks was used. TRH 14, specifications guidelines for construction materials was also used.

Borrow Pits

In the event that material will be imported, borrow pits will be established. Requirements will be determined at detailed design stage.

Culverts / Drainage

The route for the section of the main access road does not intersect major natural water courses. No culverts are envisaged.

An open V-drain will be excavated on one side of the road to assist in management of surface water run-off during precipitation events.

Signage / Safety

Road marking and signage design will be included in the detailed design phase.

Table 18-4: Parameter for earthworks

Gradients for Terrace	Slopes (V : H)
Minimum gradient	1:150 (0.67%)
Maximum gradient	1:25 (4%)
Maximum gradient on access ramps	1:10 (10%)
Slopes in Cut & Fill	
During Construction	
Cut	2 : 1 in hard material; 1 : 1 in intermediate material; 1 : 2 in soft material & vert. in rock;
Fill	1 : 1.5
Permanent	
Cut	1 : 2 in intermediate material; 3 : 1 in rock; 1 : 3 in soft material
Fill	1 : 2 max with acceptable granular material

National Road Intersection

Modification and signage will be required at the intersection with the national road. Exact requirements to be finalised at detailed design stage and to be developed in accordance with standards for local and national specifications. In the interim, an allowance has been made for widening of the national road to establish the following:

- Central reservation and turning lane with left turn to allow empty haul trucks to safely turn from the southbound running lane onto the access road.
- A merge-in turning to allow loaded haul trucks to gather speed before merging into the northbound running lane.
- Warning and information signage on approaches.

Plant Roads (Type B)

The total estimated distance of the Plant roads is 5,740 m. The design parameters, geometry and material specifications are similar to the main access road. The following geometric design parameters (Table 18-5) was used for the Plant roads as shown on the table below:

Table 18-5: Geometric design parameters was used for the Plant roads

Gradients for Unsurfaced / Gravel Roads:	
Minimum longitudinal gradient	1:200 (0.5%)
Maximum longitudinal gradient	1:20 (5%) [1:16.67 (6%) may be used in extreme case / very short distances]
Minimum cross fall	1:33.33 (3%) or ≥ longitudinal gradient of road
Road Widths:	
One-way plant roads	3 m wide
Two-way plant & public roads	6 m wide
Speed Restrictions:	
Plant Roads and internal roads	30 km/h
Horizontal and vertical curvature	Guideline recommendations
Parking Areas:	
Minimum gradient of block paving	1:50 (2%)
Cross fall on parking areas	1:50 (2%) surfaced 1:33.33 (3%) unsurfaced

Pavement

Ground conditions for the Plant roads are estimated to be sand, gravel or weathered rock. Below (Table 18-6) were the pavement layers adopted for the Plant roads.

Table 18-6: Pavement design (Type B)

Layer	Details
Gravel wearing course	150 mm thick
Base layer	150 mm thick
Sub-base layer	150 mm thick

18.4.3 Earthworks & Surface Water Management

Earthworks (Plant area)

Considering the relatively level terrain and anticipate ground conditions, minimal bulk earthworks are envisaged to achieve the development platforms for construction. Earthwork volumes are based on platform areas as measured from the drawing and considering an average cut to fill thickness of 0.5 m following the removal and storage of 100 mm of topsoil.

All earthworks' platforms and terracing for different process plant areas were designed in accordance with the latest overall layout and the recommendations of the geotechnical engineering report especially with regard to allowable bearing pressures, grades and safe slope stability.

The following specifications and guidelines as recommended by SANS 1200, section C and D, for site clearance and earthworks was used. TRH 14, specifications guidelines for construction materials was also used.

Plant and Infrastructure Site

The Plant and infrastructure area is located on a very shallow incline sloping to the southeast. The average annual rainfall for the site is considered low. Side drains were allowed for on all the roads to drain the surface run-off to the natural water course.

18.4.4 Support Infrastructure (MFA)

A mine support area (MFA) will be constructed to support the mining operation which will include the following buildings and infrastructure:

- Earthworks and Roads:
  - Bulk earthworks (under assets)
    - Main access road
  - Main intersite roads
    - Secondary intersite roads
  - Service/ maintenance tracks.
- Site Area Security Infrastructure:
  - Project main gate (main access road)
    - Project rear gate (from mining area)
  - External security posts/ watch towers
    - Internal compound security posts
  - Perimeter fencing.
- Project Facilities Compound:
  - Administration building
    - Medical Centre
  - Messing and kitchen
    - Crib and ablution
  - Change house and security
    - Laboratory
  - Raw water and potable treatment
    - Weigh bridge.
- Storage and warehousing compound:
  - Main covered warehouse
    - Secured outdoor laydown area
  - Sulfur storage
    - Facilities maintenance
  - Covered open sided canopy structure for mobile equipment parking
    - Facilities fuel storage and dispensing (LV vehicles).
- Security and emergency services compound:
  - Security centre and main office

  - Emergency centre and firefighting.

These are located adjacent to one another with internal access once through the security gates. Within the fenced compounds are internal gravel roads, parking areas, and designated walkways.

The MFA also has:

- Water supply (potable) and dispensing, wastewater collection points
- Drainage/ surface water management
- Mini-substations, power distribution to distribution boards at each building or installation
- Area lighting
- Communications links
- Security fencing, gates, and guard tower.

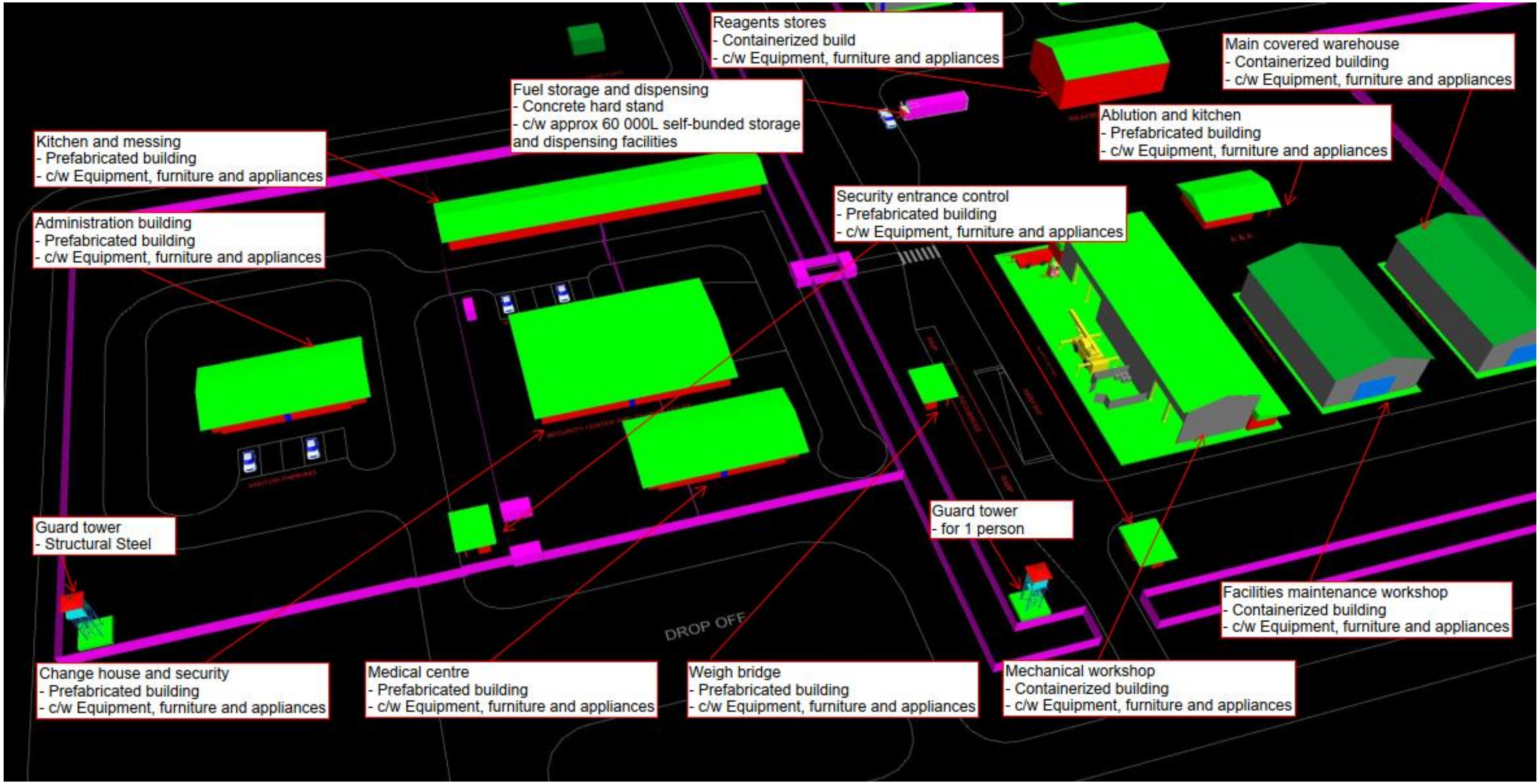


Figure 18-5: The general layout of the Madaouela MFA (buildings identified)

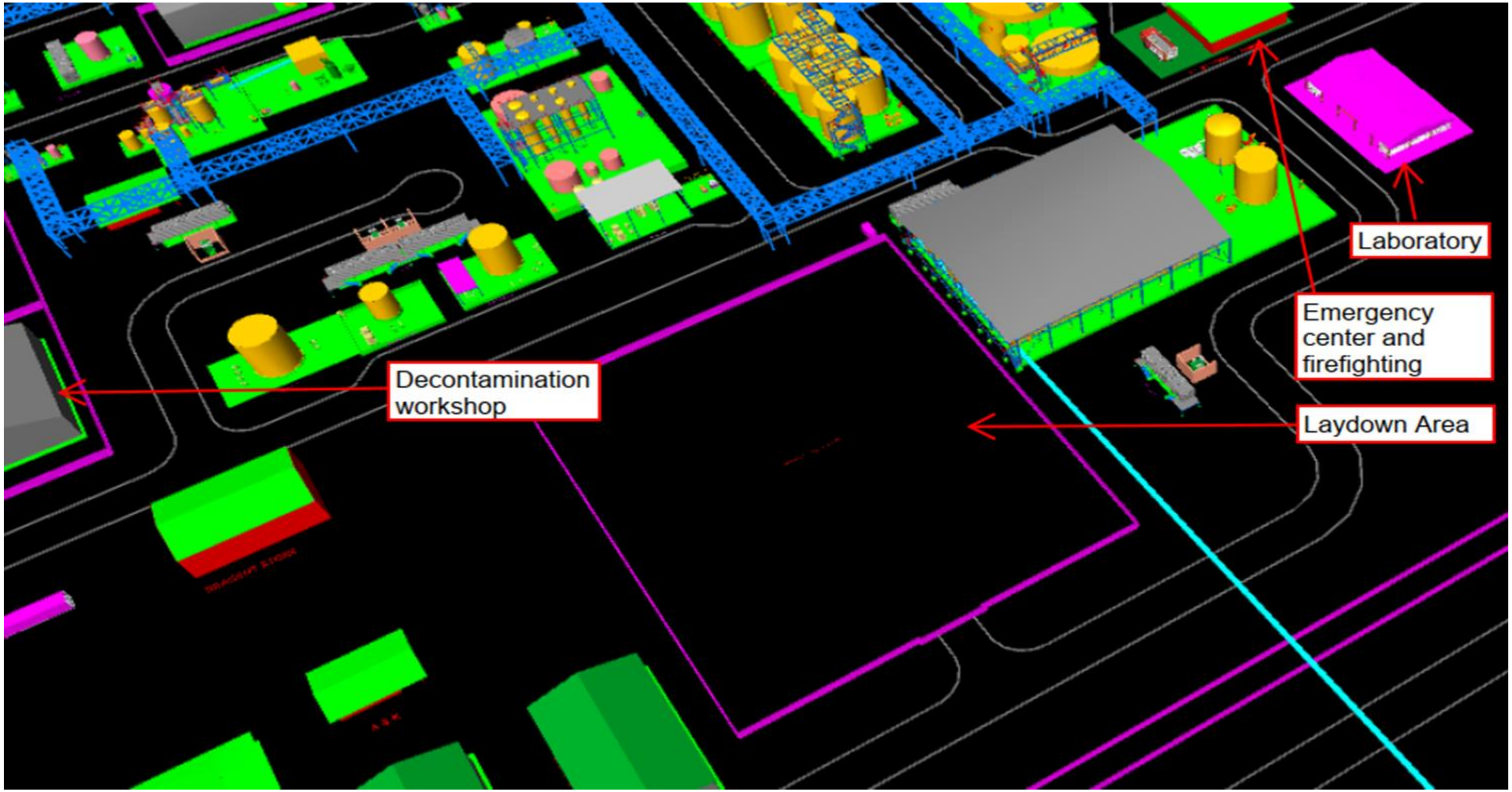


Figure 18-6: The general layout of the Madaouela MFA (buildings identified)

Administration Building

The prefabricated administration building will house the G&A workforce to support mining, mine manager, human resources, procurement, finance, technical services, maintenance, logistics and operations services. M&M administration building shall house some of the G&A workforce.

The building shall comprise offices, workstations, reception area, IT rooms, training rooms, ablutions, and a storeroom. The building shall be equipped with furniture and appliance such as desks, chairs, telephones, microwaves, etc.

The building shall be equipped with user requirement such as pumped fire water, air conditioners as stipulated on the user requirement. A perimeter road, common parking areas and walkways between the buildings will be provided.

Medical Centre

A prefabricated medical building to support basic triage will be provided in the compound. The supplier will equip, staff and manage the medical centre for a set period.

The following is expected to be located at the medical centre:

- Modular / multi-containerized Clinic facility
- Comprehensive Clinic suite of equipment including Advanced Life Support clinic equipment, supplies, and pharmaceuticals plus digital x-ray capability
- 4x4 Ambulance and 4x4 Support vehicle.

The supplier will staff the clinic with:

- Niger Doctor
- Niger Nurse.

Messing and Kitchen

The messing and kitchen area will comprise prefabricated buildings and also be provided by a third-party supplier.

The building shall comprise offices, fully equipped kitchen, restaurant, laundry, stores, refrigeration and ablutions. The building shall be equipped with furniture and appliance such as tables, chairs, telephones, stoves, microwaves, etc.

The building shall be equipped with user requirement such as pumped fire water, air conditioners as stipulated on the user requirement. A perimeter road, common parking areas and walkways between the buildings will be provided.

The messing and kitchen will be equipped to prepare and distribute meals to the crib at the MMA.

Crib and Ablution

The crib and ablution are prefabrication building, with appropriate dining tables, chairs and washing facilities provided for process plant and mine maintenance area workforce.

The crib and ablution shall be equipped with electrical reticulation up to the connecting point, wastewater/sewer reticulation up to the connecting point, clean water reticulation up to the connecting point, including all required excavations, backfilling, and required furniture, appliances and equipment, i.e. air conditioning, chairs, tables etc.

Laboratory

The laboratory building comprises a modular prefabricated building with laboratory equipment specified and obtained from a laboratory services provider and capable of testing samples from the following departments: exploration, mining, and environmental. The supplier will equip, staff and manage the laboratory for a set period.

The laboratory building shall include full plumbing, electrical, piping, HVAC, air extraction and detailed sections, as well as potable water and sewer infrastructure. The building shall be provided with all laboratory equipment and below:

- The methods and procedures appropriate for the sample types and elements analysed
- All laboratory consumables and reagents required to analyse the projected sample volumes and analytical procedures
- SLIM laboratory Management System
- Laboratory staff and training
- Building cleaning, upkeep, and minor maintenance.

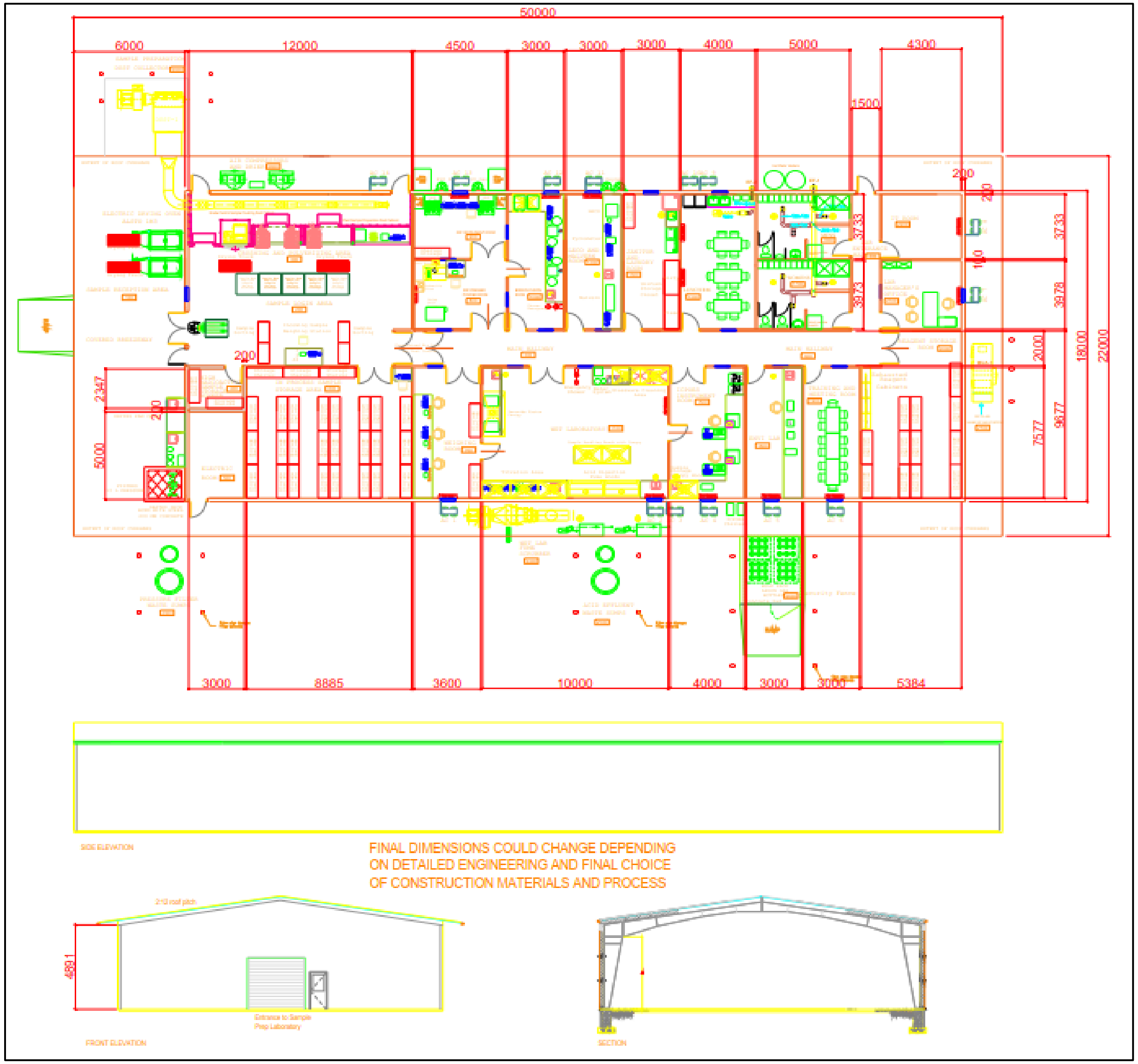


Figure 18-7: The general layout of the Madaouela laboratory

Main Covered Warehouse

The main covered warehouse and storage area has been designed to provide adequate covered and open storage for goods and supplies, as well as loading and off-loading areas, prior to redistribution around the site, if required. It is located near to the main site entrance limiting but prior to plant limiting the risk of errant drivers entering secure and high-risk areas. Security and access controls will monitor the movement of goods through the facility.

It is assumed that all consumables will be palletised and transported to site by 40 tonne articulated vehicles. Any larger item will be delivered by low-loader direct to the appropriate store. Given the mode of delivery, it is considered appropriate to utilise the site crane to offload containers with a warehouse dedicated forklift trucks to offload and stacking pallets and transferring to their appropriate storage area within the warehouse.

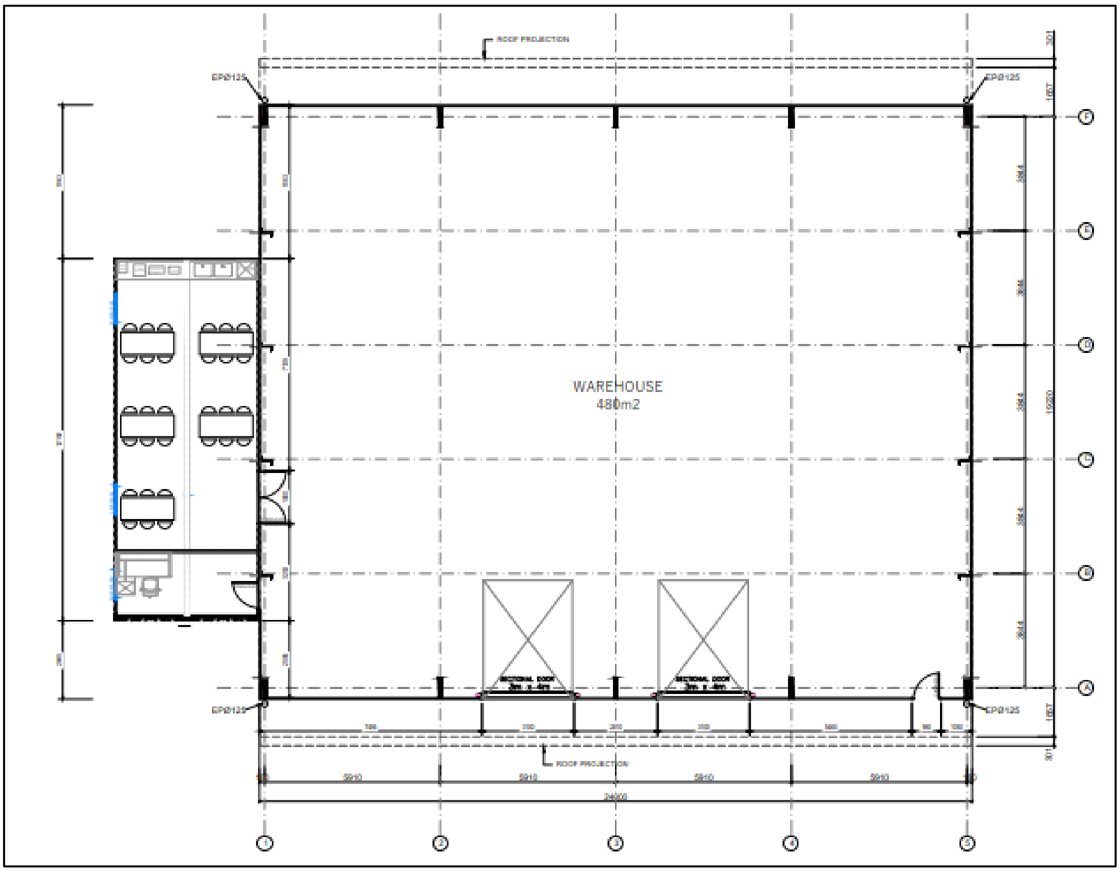


Figure 18-8: The general layout of the Madaouela main covered warehouse

The workshop shall be equipped with electrical reticulation up to the connecting point, wastewater/sewer reticulation up to the connecting point, clean water reticulation up to the connecting point, including required excavations, backfilling, and required furniture, appliances and equipment, i.e. air conditioning, chairs, tables etc.

A secured open storage area has been provided at close proximity to the main covered warehouse.

Facilities Maintenance Workshop

The facilities maintenance building is where the infrastructure maintenance team is based and has offices, stores and shares the outdoor laydown area in front of the Warehouse and within the same fenced compound area. It has a covered parking area for mobile support vehicles.

The workshop shall be equipped with electrical reticulation up to the connecting point, wastewater/sewer reticulation up to the connecting point, clean water reticulation up to the connecting point, including required excavations, backfilling, and required furniture, appliances and equipment, i.e. air conditioning, chairs, tables etc.

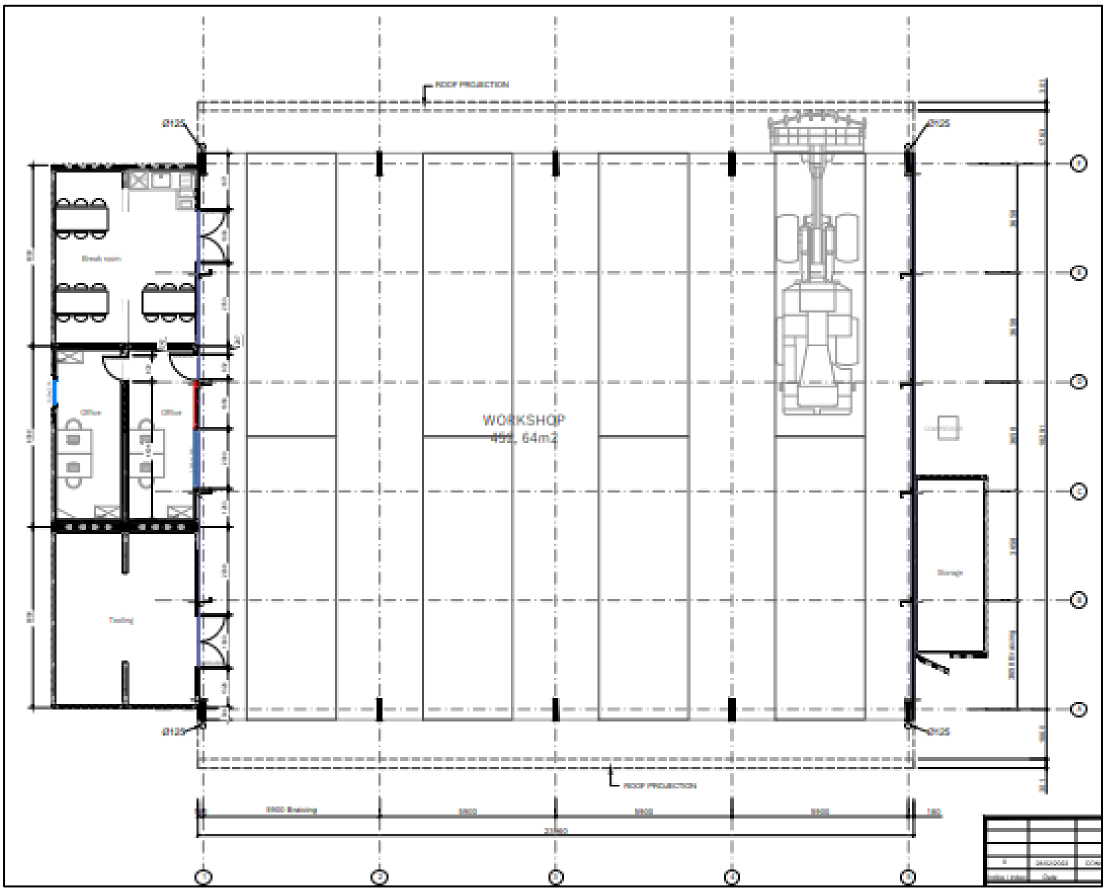


Figure 18-9: The general layout of the Madaouela facilities maintenance workshop

Facilities Fuel Storage and Dispensing (LV Vehicles)

The facilities a concrete hard stand, to be completely provided with the fuel storage and dispensing facilities for light support vehicles. The facilities is located adjacent to the logistics warehouse and comprises of a 60,000 L self-bunded fuel tank with appropriate dispensing equipment to feed the refuelling point for light vehicles contained within a secured area.

The self-bunded tanks shall be equipped complete with dispensing pumps, automatic shut nozzles and a within a IP66 enclosure main electrical control panel.

Security Centre and Main Office

The security centre is located adjacent to the front gate. The prefabricated has offices, stores, and shares the same fenced compound area as the emergency response centre. Internal and external security operations are managed from this building. It has a covered parking area for mobile support vehicles.

The security centre and main office shall be equipped with electrical reticulation up to the connecting point, pumped fire water, wastewater/sewer reticulation up to the connecting point, clean water reticulation up to the connecting point, including required excavations, backfilling, and required furniture, appliances, and equipment, i.e. air conditioning, chairs, tables. IT equipment, etc.

Emergency Response and Firefighting.

The emergency response centre is located adjacent to the leaching and has offices, stores, and it is at the heart of the plant, at close proximity to the plant control room. The centre shall have a fire control panel that is interfaced with all the plant wide fire protection system control panels. It has a parking area for the firefighting equipment.

The emergency response and firefighting building shall be equipped with below;

- Aerial Ladder Equipped Fire Vehicle/ Truck (reinforced structured off-road capable, fully equipped with optimum efficiency for Mining Fire brigades, Automatic foam proportioning systems, high pressure water pump, telescopic lighting system, rescue equipment, electric and hydraulic winch, and all deemed necessary for mining industry.
- Rapid Intervention Vehicle (4x4 off-road capable, fully equipped with double engine 500 L Tank Capacity, CO_2 extinguishing system, Dry chemical powder units, water handling capability while vehicle is moving, high pressure water pump, automatic foam proportioning systems, telescopic lighting system and all deemed necessary for mining industry).
- Mobile Wheeled Foam Trolley (to be equipped with 120 L (min) tank capacity, AFFF or equivalent foam in the trolley, Variable foam inductor (225 l/min) with an induction rate of 3 %, low expansion foam branch pipe, 2 off 15 m long x 65 mm diameter viking (or equivalent) fire house with installation connectors and all deemed necessary for mining industry.
- Fire Fighting Suits and Consumables (New, Resupply of used and expired firefighting suits, consumable supplies and all deemed necessary for mining industry).

18.4.5 Mine Maintenance Area (MMA)

A maintenance area (MMA) will be constructed to support the mining operation which will include the following buildings and infrastructure:

- MMA change house and security.
- MMA admin building.
- Parking.
- Crib and ablutions areas.

- Diesel storage and dispensing for heavy vehicles and light vehicles.
- HV workshop and lube station.
- Mobile equipment workshop and tooling (lube storage).
- Warehouse building and hard stand.
- Fenced warehouse laydown area.
- Scrap and used tyres laydown.
- Tyre storage.
- Tyre change and vehicle washing.

The MMA also has:

- Water supply (potable) and dispensing, wastewater collection points.
- Drainage/ surface water management.
- Mini-substations, power distribution to distribution boards at each building or installation.
- Area lighting.
- Communications links.
- Security fencing, gates, and guard tower.

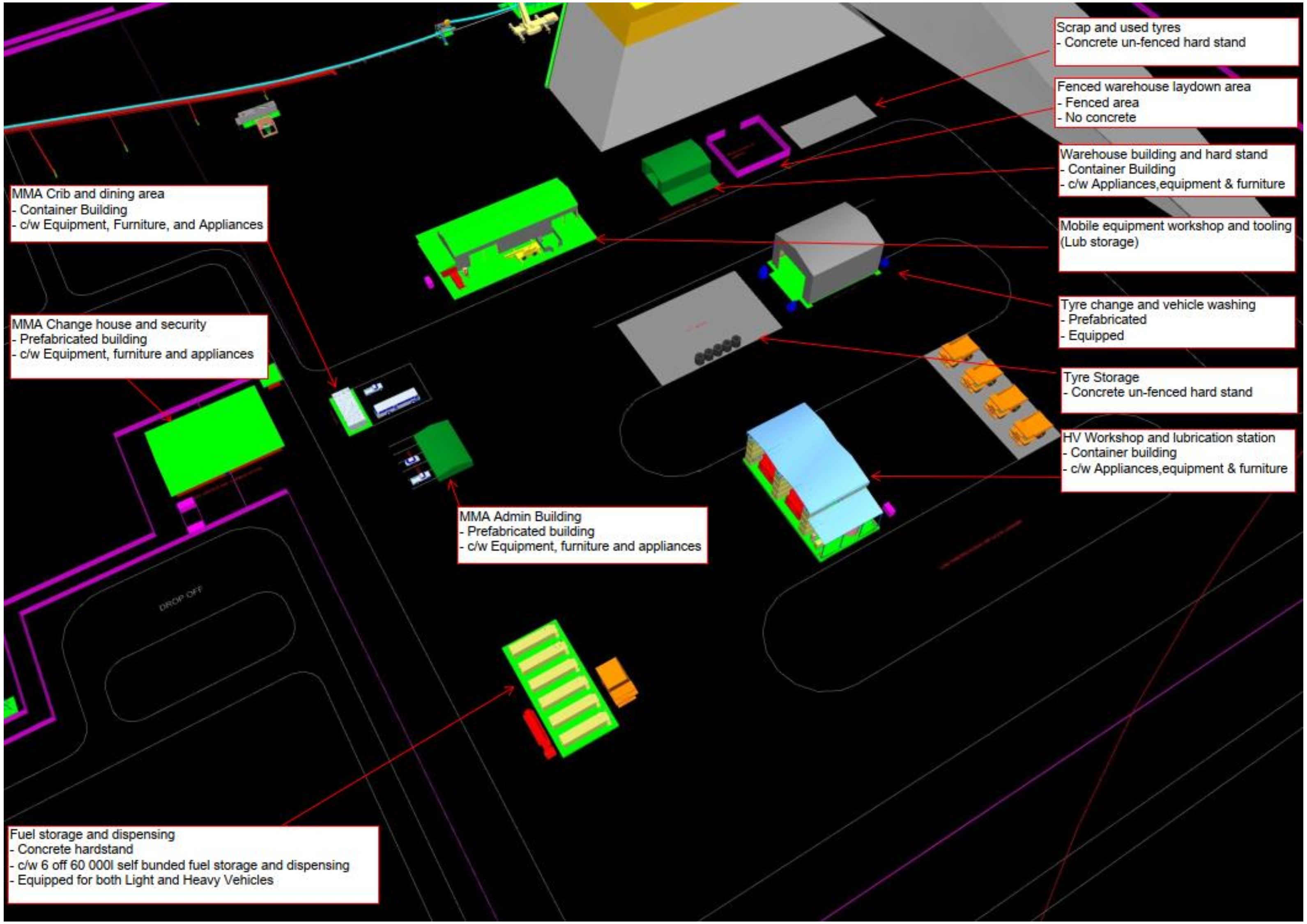


Figure 18-10: The general layout of the Madaouela Mine Maintenance Workshop

Light and Heavy Vehicle Maintenance Workshop

The vehicle maintenance workshop has four workshop bays. The workshop is a pre-engineered structure with roller doors at one end. The bays within the workshop are sized to accommodate the largest vehicle within the fleet. The workshop sized to ensure maintenance access all around the vehicle and storage space and sufficient room for the overhead gantry crane assembly or other lifting equipment.

The workshop shall be equipped with electrical reticulation up to the connecting point, wastewater/sewer reticulation up to the connecting point, clean water reticulation up to the connecting point, including required excavations, backfilling, and required furniture, appliances and equipment, i.e. air conditioning, chairs, tables etc.

Fuel Storage and Dispensing (HV/LV)

The fuel storage and dispensing unit comprises a series of 60,000 L self bunded fuel tanks with appropriate dispensing equipment to feed the refuelling point for off-highway trucks and light vehicles contained within a secured area.

The self-bunded tanks shall be equipped complete with dispensing pumps, automatic shut nozzles and a within a IP66 enclosure main electrical control panel.

Vehicle Wash Bay

A vehicle wash bay has been provided near the workshops the Miriam compounds. The wash bay consists of a reinforced concrete slab, drainage sump, blockwork walls and a pressure wash system. Return water within the drainage sump is pumped through a pollution control unit and into the water recirculation system.

18.4.6 Utilities (Electricity, Communication, Water, Fire and Dust Suppression)

Power

The infrastructure electrical equipment system frequency will be 50 Hz, the equipment voltage will be 6.6 kV for Medium Voltage, 380 V for Low Voltage and 230 V for the Lighting and Small Power voltage. The electrical power strategy is discussed further in Section 18.7.

Infrastructure Electrical Power Distribution

The MV power will be distributed from the Mine Main MV (6.6 kV) Substation to the MFA and MMA (6.6 / 0.4kV) Mini substations as per the Electrical Overall Single Line Diagram, Figure 18-11.

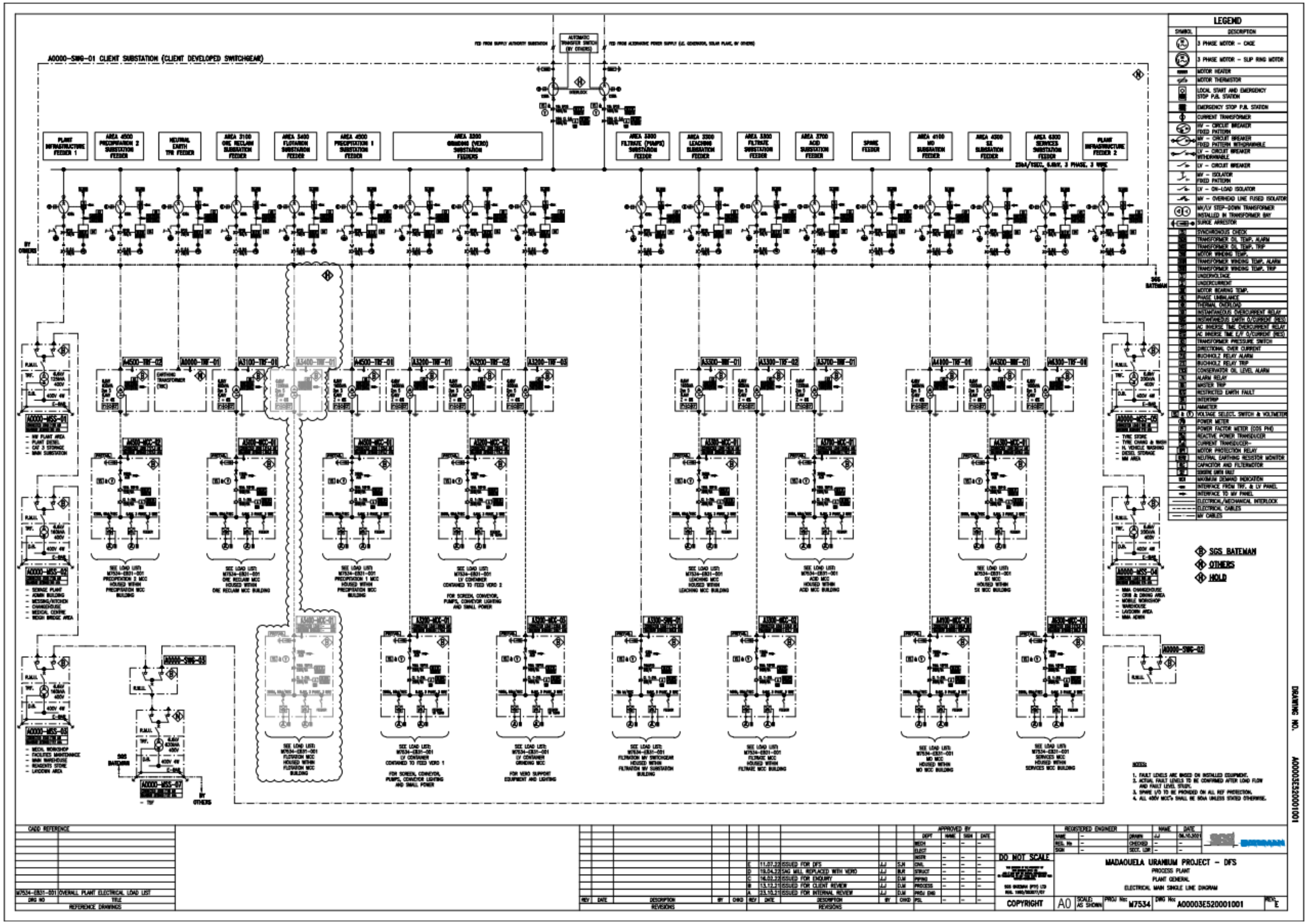


Figure 18-11: Madaouela Project Electrical Single Line Diagram

The main cables will be routed underground (or within cable racking) for safety reasons.

The Explosives Storage Facilities power locally through dedicated power source (i.e. diesel generator, with solar and battery

The Wellfield has a dedicated off-grid solar only option with back-up diesel generator for emergency loads.

Lighting

External LED lighting has been allowed at the following main areas:

- Flood lighting to critical areas.
- Road and access lighting at junctions.
- Critical and high security facilities.

Floodlighting would be achieved via 10 m masts to provide a low but even distribution.

Roads will only be illuminated at junctions and security check points by traditional road lighting columns fed via feeder pillars.

The lighting would be supplied from a series of dedicated or feeder pillars independent from other service supplies. The feeder pillars would be supplied from the mini substations.

Communications

An allowance has been made for the following site and project wide communications infrastructure:

- Business data network and server/computer systems.
- Voice over IP (VoIP) data telecommunications system within the process plant.
- Access control system to establish access permissions and a live record of personnel in restricted areas.
- Security and surveillance system to provide area surveillance, detection and assessment (camera for detection and surveillance).
- SCADA field units, central control.
- Control room requirements and systems.

Raw Water Storage & Distribution

Bulk water supply from the Madaouela wellfield (pumps and pipeline) are discussed in the water management section. Raw water will be pumped to central raw water storage tank for subsequent distribution (Figure 18-12).

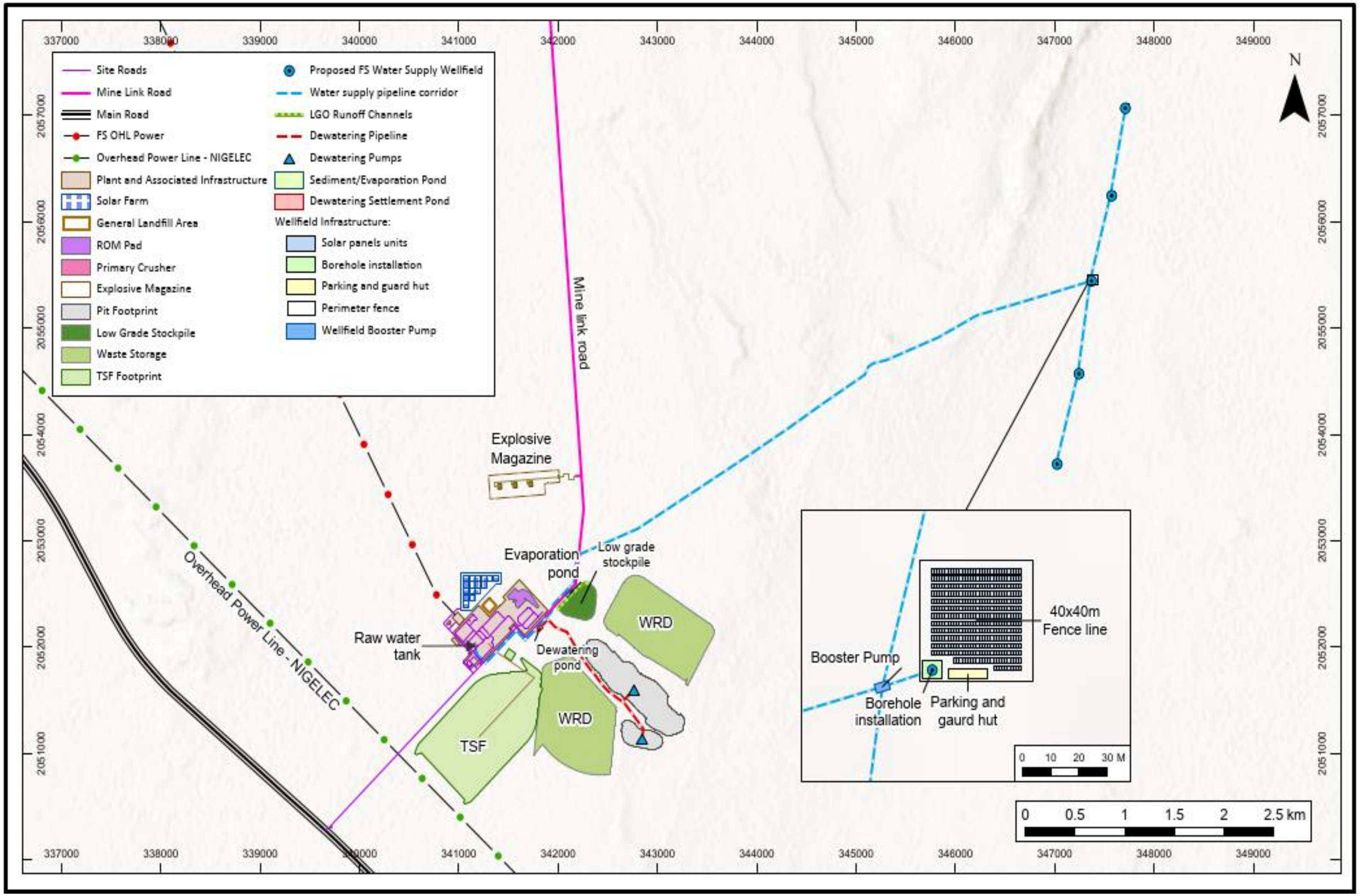


Figure 18-12: Madaouela Project Proposed water supply wellfield

Potable Water

Potable water shall be received from the potable water treatment plant. A storage tank is provided for storing 1 day of domestic consumption of potable water. A ring main system with all the pumping station for pressure maintenance and distribution pipelines shall be provided for ablution facilities. The system is designed for 228 people per 24 hr cycle.

Sewerage and Wastewater

The foul water network collects the foul water from the various installations: ablutions, change house, central feed from the plant. The sewage and wastewater will be conveyed via a gravity feed pipeline and manholes to a common sewage treatment plant. A 150 mm diameter pipe is considered appropriate to convey the wastewater to a package sewerage treatment plant. The tank will discharge treated water to the ground via a reversed land drain arrangement. The sludge within tank will periodically require emptying and disposal at an appropriate waste location. The system is designed for 228 people per 24 hr cycle.

Sewage treatment (modular) will for treating 70 m^3/24 hr cycle and will be undertaken in a vendor package. The plant shall be hybrid consisting of Anaerobic Digester, Recycle Sump and Return Sump, Pumps, Settler, Trickling Filter, Sodium Hypochlorite Dosing System, Ferric Chloride Dosing System.

Fire and Dust Suppression

The infrastructure major buildings will be provided with fire suppression system including fire hoses, fire hydrants, hose reels, fire extinguishers, sprinklers system, fire control panels, detectors (heat, smoke and flame), complete with signage. The fire suppression system shall be designed/ approved by a fire consultant. Each buildings fire control panel shall be integrated with the fire protection pump station and their alarms shall be wired to the emergency and firefighting building alarm system.

The dust suppression will be undertaken by a water bowser which will be filled at the compounds. It shall take bleed water from the process to wet the roads.

18.4.7 Security

Strategy

The mine intends to contract the Niger military to provide a security detail to the Project but will be coordinated by the GoviEx security manager. During capital construction, GoviEx will construct security infrastructure. The security operation is managed from the security centre.

Security Infrastructure

Security Infrastructure will comprise:

- Project main gate (main access road).
- Project rear gate (from the mining area).
- External security posts / watchtowers (e.g. off-set from N-9 and explosives storage area).
- Internal compound security posts.

- Perimeter fencing and ditch infrastructure.
- Access control system to establish access permissions and a live record of personnel in restricted areas.
- Security and surveillance system to provide area surveillance, detection alarms for key locations.

Security Team

GoviEx has discussed requirements with military and obtained a budget quotation for the cost of the following being provided under a monthly fee:

- External security team:
  - A total of 60 military personnel for the security at the three processing plant gates, product storage, explosive storage, perimeter patrol, and the expatriates living quarters
    - 4x4 vehicles for each security post.
- Internal security team:
  - 10 internal security within infrastructure compounds.

18.4.8 Support Vehicles

The following vehicles are allowed for:

- Bus 50-Seater school bus type (2 off).
- Bus 30-seater school bus type.
- Flat bed truck and hoist (hi-up) 6 ton.
- Truck low loader.
- Trailer 70t trailer.
- Mobi lift 9-ton.
- Cherry picker (20 m reach) Gennie Z 34/22/C 4WD.
- Mobile Scissor Lift 32 ft, Electric, Self-driven.
- Front End loader 938H/IT38H – 3 m^3.
- Grader 140K or equivalent.
- Bobcat Skidstear loader 0.5 m^3 bucket.
- TLB JCB or CAT 428F or equivalent.
- Forklift 3-ton.
- Forklift 5-ton.
- Mobile crane 40 ton all terrain.
- Mobile Genset 60 kVA CAT DE65E0 or equivalent.
- Toyota Light Vehicle, 4x4, Double-Cab (6 off)

- Toyota Light Vehicle, 4x4, Single-Cab (6 off).

The below vehicles are supplied under separate contracts:

- The security and medical teams' vehicles.
- The emergency and firefighting teams' vehicles.

All cranage, required for lifting TEUs / FEUs etc, is assumed to be shared with that allowed for under the processing plant support fleet.

18.4.9 Off-site Accommodation Units

GoviEx currently operates an accommodation unit in the nearby town of Akokan. For the Project, GoviEx intends to build the accommodation facilities in Arlit, the facility to include ten (10) Senior staff lodges (fully furnished containerised units) and for management.

The site would be fenced and secured and have potable water, sewerage system, and electrical supply and communication. The earthworks, concrete, formwork, reinforcement & holding bolts etc. are included. Electricity, water and sewerage are assumed to be available from the Arlit town infrastructure.

The containerized buildings shall be fully furnished, equipped, with appliances and including the operation personal for 5 years, main kitchen, dining area, laundry room, security control, admin office and accommodation units. The accommodation facilities shall be equipped with cooking equipment, refrigeration, storage, sinks, beds, sofa's, TV's, beds, bedding etc.

The below show typical buildings but not limited, parking lots, perimeter fence is not shown.

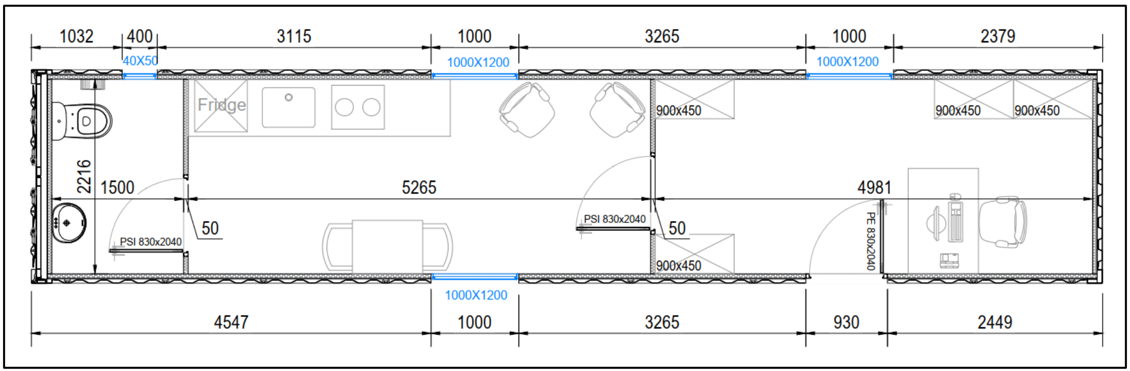


Figure 18-13: Security Control (for Off-site Accommodation)

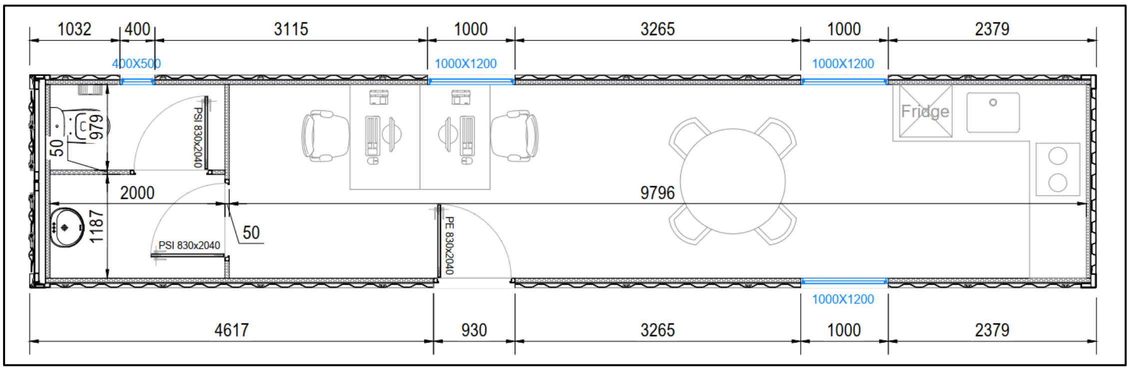


Figure 18-14: Administration Office (for Off-site Accommodation)

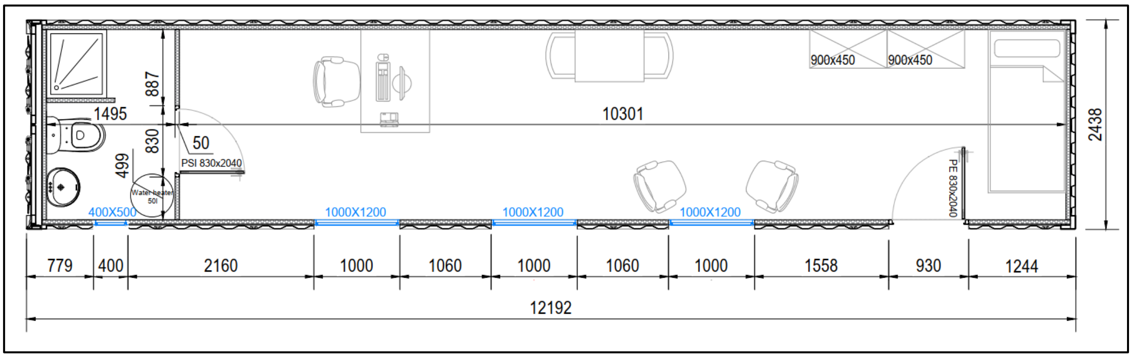


Figure 18-15: Accommodation Units (10 off for Off-site Accommodation)

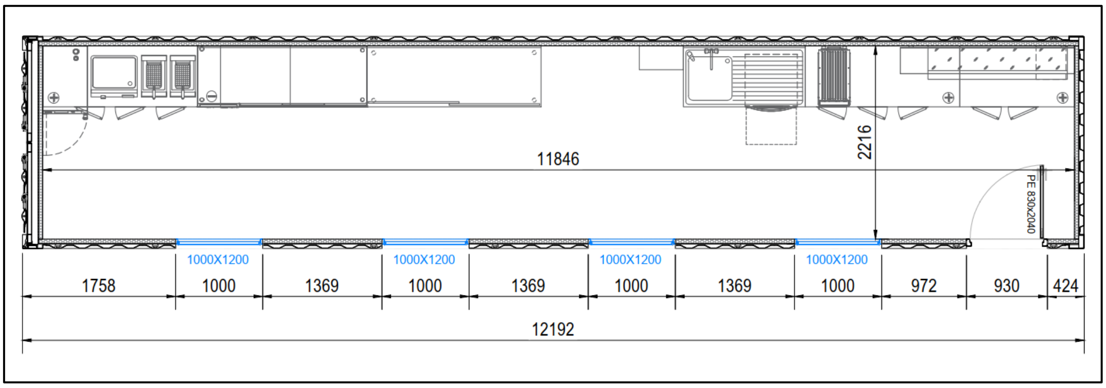


Figure 18-16: Kitchen (for Off-site Accommodation)

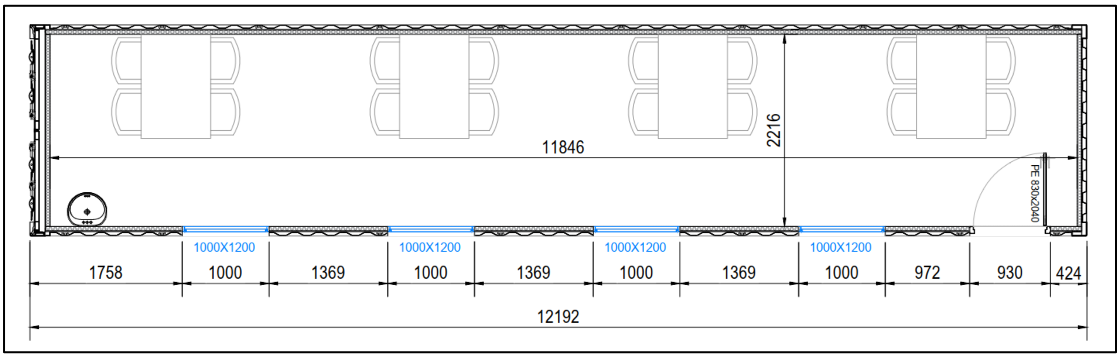


Figure 18-17: Dinning Area (for Off-site Accommodation)

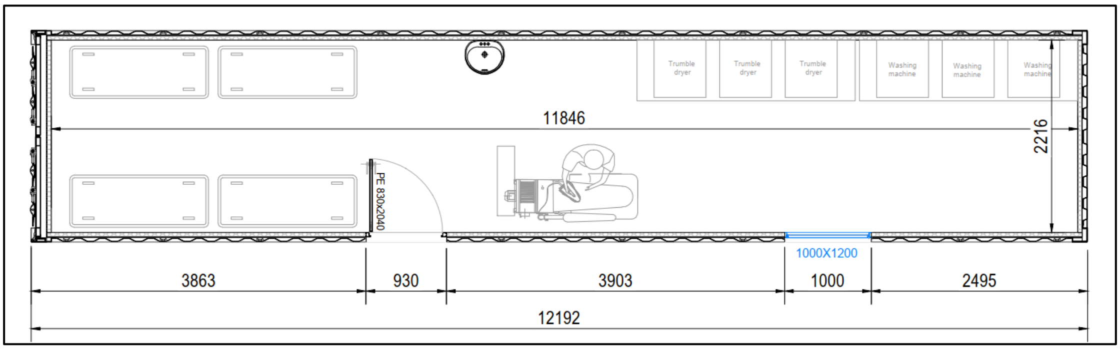


Figure 18-18: Laundry (for Off-site Accommodation)

18.5 Supply Logistics

Introduction

This section presents the logistics scenario to transport the anticipated quantities of reagents and consumables required to support the proposed Madaouela Project.

The landlocked Niger relies heavily on road and air transportation. As of 2002 there were 10,100 km (6,276 mi) of roads, of which 798 km (496 mi) were paved. The principal road runs from west to east, beginning at Ayorou, going through Niamey, Dosso, Maradi, and Zinder, and ending at Nguigmi. A 902-km (560-mi) all-weather stretch between Niamey and Zinder was opened in 1980. Extending from the main route are roads from Niamey to Burkina Faso (not paved), from Zinder to Algeria through Agadez (with tough desert driving on dirt tracks), from Dosso to Benin, and from Birni Nkonni and Maradi to Nigeria. A 602 km (385 mi) highway between Tahoua and the uranium mines at Arlit was completed in 1981.

Niger's most important international transport route is by road to the rail terminus at Parakou, Benin. From there, OCBN, a joint Benin-Niger railway, operates service to the Benin port of Cotonou. The Niger River is navigable for 300 km (186 mi) from Niamey to Gaya on the Benin frontier from mid-December through March.

There were 26 airports and airfields in 2001, nine of which had permanent-surface runways. The international airport is at Niamey. There are domestic airports at Agadez, Maradi, Zinder, Arlit, and Tahoua. Niger is a participant in the transnational Air Afrique, which provides international service, along with several other airlines.

A logistic study was conducted thus the export guidelines for containerized and break-bulk shipments document number M7534-0760-002 provides further details such as road security, weighbridges an axle load limits, transport time frame, incoterm, export customs code, freight forwarders, clearing agent, insurance etc.

Sea Freight and Road Infrastructure

For Sea freight, currently three countries of export; South Africa, China and Europe has been identified. Cotonou Benin has been identified as a port of entry.

Rail Transport

Future rail projects are in preparation. Nigeria-Niger (Kano-Maradi) Railway line construction begins (constructionreviewonline.com). Contractors begin preliminary work on USD 1.9 billion Kano-Niger Republic rail line.

Figure 18-19: Existing regional infrastructure

Route Summary

The main road route through Benin to Niger is the RNIE2 which travels northward from Cotonou towards Niger. The road crosses the Benin-Niger border at Gaya after around 740 km. From Gaya, the road continues northeast too Agadez and then northward to Arlit passing the Project site for a total distance of circa 1,850 km. The total travel time to Arlit is estimated at 3-5 days for commercial traffic assuming envisaged travel speeds are maintained with no unforeseen hold-ups.

FS Logistics Solution

The proposed transport solution is for cargo arriving by sea freight to be imported via the Port of Cotonou, Benin and then transported by road to the Project site. This transport solution is the recommended solution from the conducted logistic study and is considered the primary logistics route. The strategy would be to outsource all off-site logistics to a service provider who would work with the Project's logistics office and be responsible for import and transport.

A multi-logistic split between departure and arrival (Benin) location should be considered on execution.

Although there would be out of gauge and break-bulk cargo during construction and some minor volumes during operation, in general cargo would be containerised where possible. Containers would be either TEU or FEU dependant on the stowage factor.

18.6 Explosives Storage Facility (ESF)

18.6.1 Overview

During the course of the life of mine, GoviEx will use explosives to fragment the rock in preparation for excavation, loading and hauling to the Run of Mine (RoM) ore pad or waste rock storage dumps. The components of the explosives are ammonium nitrate fuel oil (ANFO), boosters / primers, and detonators as well as various non-explosives such as cords. These materials will be stored at the explosive storage facility (ESF). Materials will be stored in separate buildings spaced apart in accordance with guidance for safe storage. Only technical grade ammonium nitrate (AN) will be stored in the facility with mixing operations to form ANFO or heavy ANFO (i.e. emulsion) occurring in a specialist mobile mixing unit (MMU), which is truck mounted.

18.6.2 Basis of Design

The required quantities of explosives are greatest during the development of Miriam, and these are presented in Table 18-7. The quantities reduce for M&M and MSNE. Discussions with Explosives Contractors and suppliers operating in the area indicate a realistic delivery schedule is monthly; however, to mitigate the risk of any delay, the ESG has the capacity for 3 months of Primers and Detonators, and 2 months of AN will be held on site.

Table 18-7: Explosives Quantities in Miriam (Max)

Item	Units	Quantity per year	Quantity per month
Ammonium Nitrate	tonnes	2,148	179
Emulsion	tonnes	137	11
Primer	#	100,891	8,408
Detonator	#	100,891	8,408

18.6.3 Guidance / Regulations

The following guidance has been referred to in the development of the Explosives Storage Facility:

- AS 2187.1—1998: explosives - storage, transport, and use - storage (FOREIGN STANDARD) specifies requirements for the storage of explosives including pyrotechnics as defined in AS 2187.0, and for the location, design, construction and maintenance of explosive storage facilities.
- NFPA 495 Explosive Materials Code, 2006 Edition.
- Government of South Australia. TECHNICAL NOTE 60. Safe storage and handling of ammonium nitrate.

18.6.4 Location and Layout

The layout observes the guidance AS 2187.1—1998 as to the quantity distances of storage of division of 1.1, 1.2 and 1.5 explosives for the quantities as stated in the basis of design and for bunded / mounded storage. Separation between storage buildings is ~120 m. The AN storage is circa 395 m to associated works. The AN storage is circa 730 m to nearest Class A protected works. See Figure 18-20.

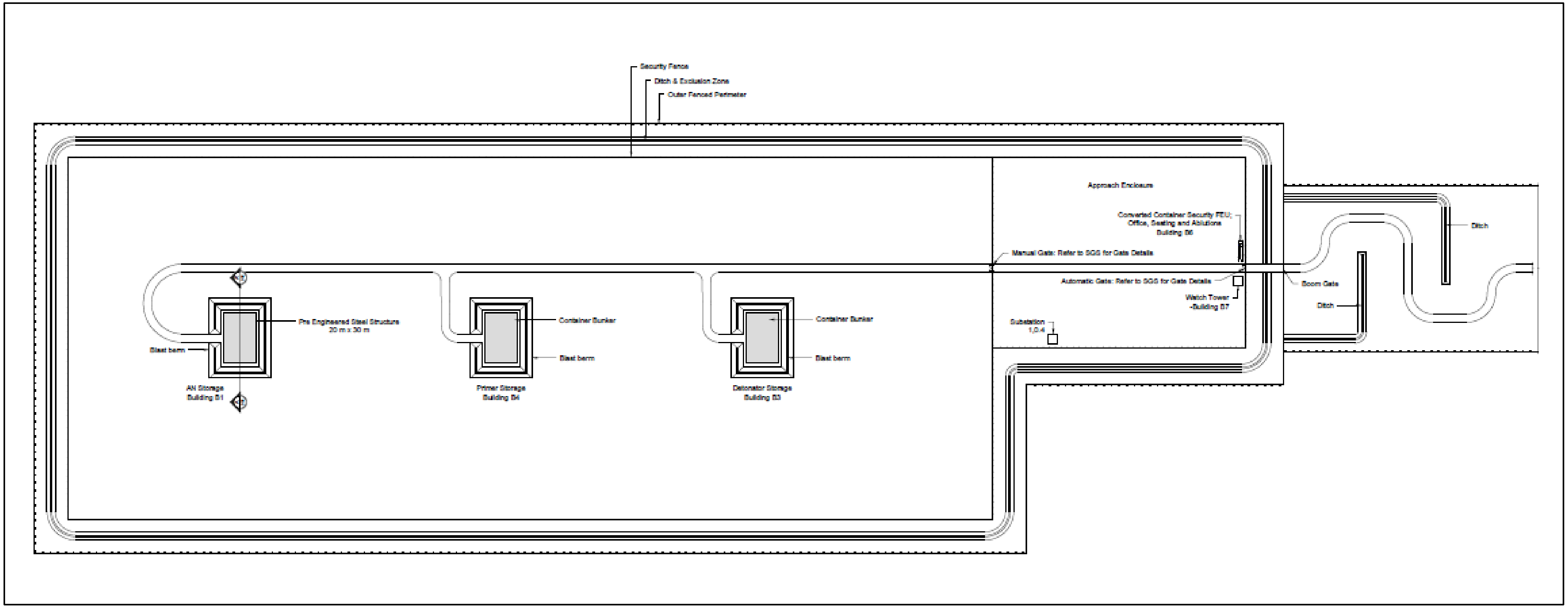


Figure 18-20: Layout of the ESF (see also Drawing 31342-1400-GA-001)

18.6.5 Earthworks / Roads / Drainage

Preliminary

It is intended to use the Miriam Mine waste rock stockpiles as the primary source of imported earthwork materials. It is understood that the waste rock is chemically inert. Samples of these stockpiles will be tested to determine what geotechnical quality of material can be produced once crushed, screened, and blended. This will inform the design of the engineered layers within the works and minimize the cost of procurement. Should the materials not be to the required standard a suitable substitute will be procured from off-site commercial sources.

Site Preparation and Earthworks

The natural vegetation is sparse and site preparation will be limited to the mechanical clearance and removal of vegetable matter to a depth of 150 mm. Only the footprints of the roads, buildings, and perimeter security fence will be cleared. Ground levels vary little within the ESF. Cut to fill in creating a level working surface under the footprints of the buildings in preparation for receiving further engineered layer works is expected to be minimal. Unlined earth drains will be constructed in strategic positions to direct stormwater away from the buildings and roads, terminating outside the ESF secure area.

Buildings

Blast berms will be constructed around the AN, detonator and primer stores. Berm material will be drawn from the Miriam Mine waste stockpile and constructed to a height of 3 m above floor level to a trapezoidal cross section with 1:1 side slope. Compaction will be nominal. Surface drains will convey stormwater to the site stormwater channels.

Roads

An unsealed service road approximately 575 m long will provide access for delivery and collection of ammonium nitrate, primers, and detonators. The road will terminate in a 30 m diameter turning circle adjacent to the AN store. Ground levels along the centreline of the road varies little. Cut to fill volumes in forming the longitudinal profile of the road are expected to be minimal.

18.6.6 Buildings

Five buildings will be constructed within the ESF facility.

- Ammonium Nitrate store
- Detonator store
- Primer store
- Site/Admin office
- Security office/ watchtower

A laydown area has been provided for a specialist service provider who shall provide and maintain a truck mounted mobile mixing unit (MMU). The providers are to make their own provisions for storage and maintenance.

Ammonium Nitrate (AN) Store

The AN storage building is a pre-engineered painted steel structure 20 m wide and 30 m long with a minimum eaves' height of 3 m. The structure will be supported on reinforced concrete pad footings. Refer to Figure 18-21 and Figure 18-22 below for side and front elevations.

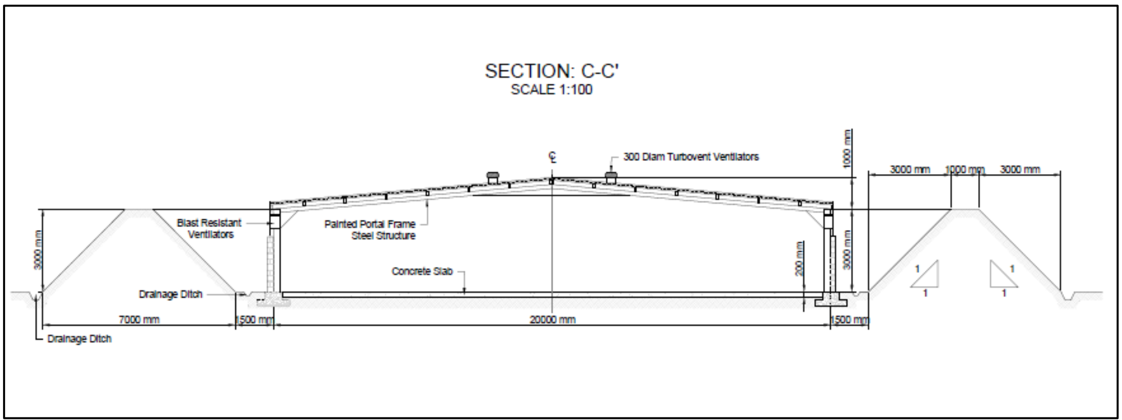


Figure 18-21: Side elevation of the AN storage building (31342-1400-GA-002)

Roof cladding shall be 0.8 mm colour one side (C1S) IBR profile sheet on a 5 % slope with 10 % of the roof area in 60 % translucent polycarbonate sheet to provide natural lighting. Sisalation under sheet insulation will reduce heat build-up in the building and six 300 mm diameter roof mounted turbovent ventilators will exhaust hot air.

Side cladding shall be 0.6 mm C1S IBR profile sheet on painted cold rolled sheeting rails, terminating at 2 m above floor level. Fourteen 1.2 m by 1.2 m blast resistant ventilators will be installed in the side cladding providing airflow through to the roof ventilators. Unpainted blockwork walls 2.2 m high on concrete strip footings will complete the closure of the perimeter.

The 200 mm thick mesh reinforced power-floated surface bed will be laid on damp proofing and appropriately jointed, saw cut and sealed to accommodate shrinkage and thermal expansion.

Access to the building will be via a 4 m wide by 3 m high roller shutter door fitted with a lockable wicket gate providing secure vehicular and personnel access. Emergency egress is provided by 4 escape doors with internally mounted push bars.

A 9 kg dry chemical powder fire extinguisher is mounted adjacent to each emergency exit door.

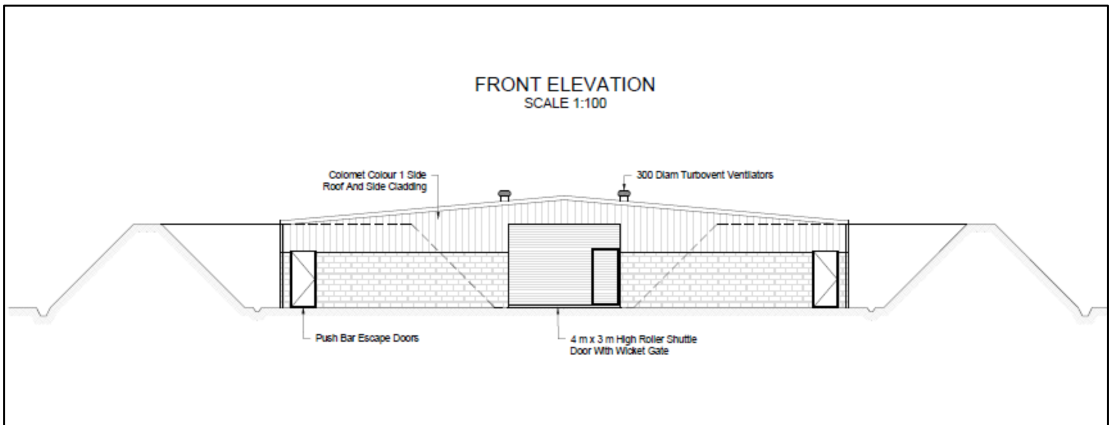


Figure 18-22: Elevation of the AN storage building (31342-1400-GA-002)

Detonator Store

Refer Figure 18-21 below for a typical side elevation of the Primer / Detonator Stores.

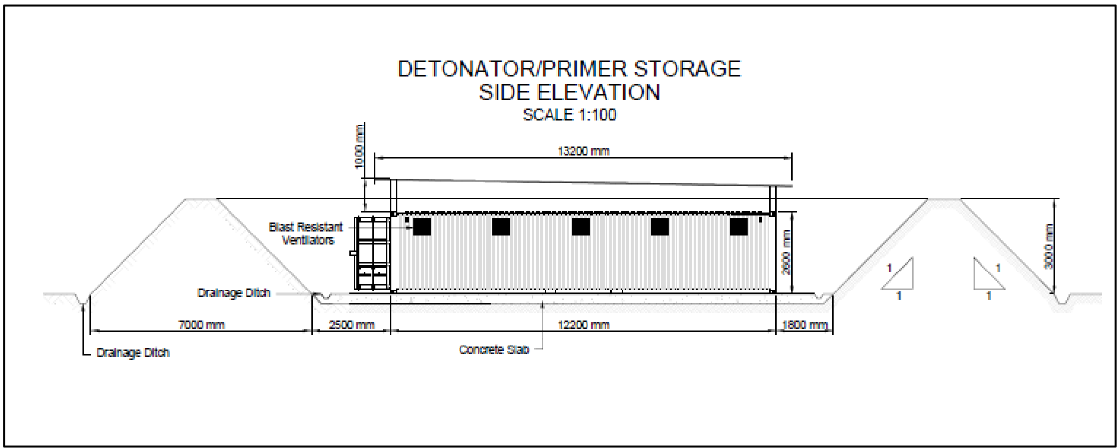


Figure 18-23: Elevation of the Primer / Detonator storage building (31342-1400-GA-002)

The Detonator Store will consist of 3 modified forty-foot (FEU) shipping containers spaced 2 m apart and housed within a 3 m high blast berm in which a 2.5 m wide access portal has been provided. Each FEU will be mounted on three reinforced concrete strip footings.

Blast berm material will be drawn from the Miriam Mine waste stockpile and constructed to a height of 3 m above floor level to a trapezoidal cross section with 1:1 side slope. Compaction will be nominal. A painted steel roof structure will be launched off the containers and clad with CIS IBR profile roof sheeting to provide shade.

Each FEU unit will be modified to the appropriate standard for storage of explosive materials Modifications will include and are guided by AS 2187.1—1998.

Primer Store

The Primer Store will consist of 3 modified forty-foot (FEU) shipping containers and in all respects other than signage be identical to the B2 Detonator Store installation.

Site/Admin Office

The office shall be a converted forty-foot (FEU) shipping container mounted on three reinforced concrete strip footings. The unit will be painted externally and internally partitioned into office, ablution, and storage areas. The ablution area will provide toilets, handbasins and urinals. The storage area will be accessed through the double doors at the end of the FEU. All wastewaters will connect to a buried conservancy tank which will be emptied as frequently as required.

Unit power will feed from an internally mounted distribution board and a suitably sized emergency lighting/battery backup system installed to ensure continuity of power supply. Artificial lighting shall be by fluorescent surface mounted lights with surface mounted conduiting and switches. A 3-tier power trunking duct at floor level will provide power and data links to workstations. A split unit air conditioner will control temperatures in the work environment.

One dry chemical powder fire extinguisher will be provided in the office and one in the storage area. Smoke detectors will be installed

18.6.7 Explosives Contractor Yard

Discussions with Maxam, an Explosives Supplier who has provided a quote, and confirm they require:

- Office;
- Maintenance facility for mobile equipment;
- Temporary stores for small quantities of AN; and
- Stores areas for non-explosives.

This yard is currently located within the out enclosure, but as more detailed discussions advance with regards to contract, then potentially the yard would be moved nearer to the MMA.

18.6.8 Utilities / Services

Electrical power is distributed at LV around the site to buildings, lighting, and security functions. Electrical loads are estimated to be <100 kW, with primary supply from the 6.6 kV switchboard at Miriam with a back-up diesel generator for when line maintenance is required. Bulk water will be delivered to site and stored in an above ground storage tank fitted with a pumping system sized to deliver water to the Site/Admin Office. Bottled potable water will be supplied for drinking and cooking purposes.

18.6.9 Security

Watch Tower / Security Office

A security office is mounted at approximately 5 m AGL and provided with an external covered walkway for all-weather all-round surveillance to provide early alert to the security force (Figure 18-24).

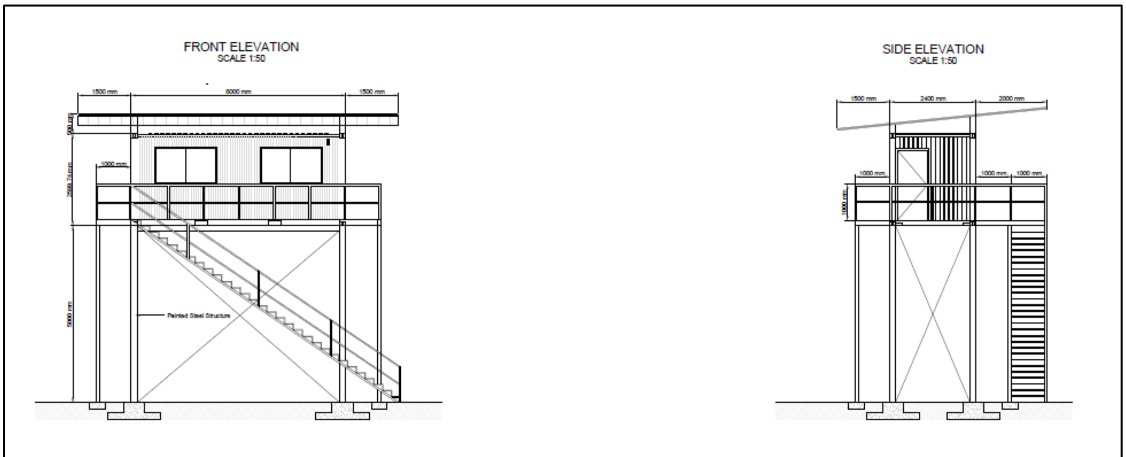


Figure 18-24: Front and side elevations of the watch tower

The office shall be a converted twenty-foot (TEU) shipping container mounted on a painted structural steel frame supported on reinforced concrete pad footings and accessed via staircase. The TEU will be painted externally, and a painted steel roof structure will be launched off the container and clad with CIS IBR profile roof sheeting to provide shade and weather protection. Artificial lighting shall be by fluorescent surface mounted lights with surface mounted conduiting and switches. A split unit air conditioner will control temperatures in the work environment. One dry chemical powder fire extinguisher will be provided in the office.

Fencing / Gates

The perimeter of the ESF is protected by a double fence system. The ESF itself has an inner and outer enclosure comprising the double fence system. The external and internal fences are separated by 5 m. The 1 m deep vehicle trap trench is centred within this gap. The inner fence is as per the plant high security fencing. The environment is not corrosive and standard galvanised mesh will be adequate. The purpose of the external fence is to create a buffer between the public and the primary security measures provided by the vehicle trap trench and the inner high security fence, support warning signage, and is typical post and rail.

Technology

All buildings have card reader access. Area lighting is provided by pole mounted LED lights as well as LED lighting affixed to the building eaves. A pole mounted CCTV covers the main gates and building entrances.

Fire Prevention

The design will eliminate and reduce the amount of potential fuel, combustible materials, and dangerous contaminants in and around the stores. The stores are equipped with portable fire extinguishers to allow operatives to tackle any small fires should they occur although if fire is noticed in

18.6.10 Operations

The ESF is permanently manned by unarmed watchpersons who would alert the army security units to respond in the event of an emergency.

18.6.11 Estimated Costs

Basis of Estimate

The following points should be noted:

- A bill of quantities was included in the Miriam enquiries for civil, structural, electrical and security and networks, and the completed documents and rates therein were used to inform construction capital cost;
- A cost was obtained for converted containers (e.g. Detonator stores, office, watchtower);
- The bunds are constructed from waste rock;
- The cost for the Maxam yard is an allowance only.

Summary Capital Cost

See Table 18-8 for the ESF Capital Cost

Table 18-8: ESF Capital Cost

Layer	USDM
Earthworks and Civils	0.2
Buildings, Structures & Converted Containers	1.0
Electrical, security, networks	0.5
Power supply	0.4
P&Gs (Total)	0.4
Total	**2.5**

Operating Cost

Explosives Contractor costs are considered within the mining operating cost. The watchman and army security are included in the Miriam G&A. Power is minimal and considered within the overall Miriam power cost.

18.6.12 Key Assumptions / Risk / Clarifications

- The security of the compound is a risk. The army will manage security under the contract with GoviEx.
- Security of supply. The design is based on 2 months' supply for AN (1 month live, 1 month security stock), and 3 months for primers and detonators.
- It is assumed that the Contractor provide their own facilities.

18.7 Bulk Power Supply – Miriam

18.7.1 Overview

Miriam will have an on-grid power supply strategy with a hybridised back-up diesel power plant with solar and battery energy storage system to provide stable and continuous power to the project. The renewables plant is estimated to provide 26 % renewables penetration. Grid power is to be provided by SONICHAR (Nigerien Anou-Aren coal company), which owns and operates a power station at Agadez with two coal fired steam turbines. The power is delivered from Agadez to substation "Poste 132" at Arlit via a 132 kV transmission line, owned and operated by "NIGELEC" (Société Nigérienne d'Electricité, Nigerien Electricity Society).

18.7.2 Bulk Power Supply Strategy

The bulk power supply strategy for the Miriam processing plant and infrastructure comprises:

- Construction of a ~28 km 20 kV dual circuit OHL and Miriam 20/0.6 kV substation connecting to the Akokan substation Poste 132 where 8 MW is supplied.
- Diesel Generators Plant (DG Plant): Addition of 9 x 2,000 kVA, 6.6 kV diesel generators and synchronising panel connected to the main mine 6.6 kV distribution board to secure the remaining 30 % load.

- Installation of an 8 MWp solar power station (Solar PV) to offset the cost of diesel, transportation, diesel consumption and CO_2 emissions at the site, generating 26 % of the processing plant energy demand. A further 0.5 MW will be added in response to the additional demand from the flotation plant.
- Installation of a 5 MWh battery energy storage system (BESS) to support the solar plant and provide continuous and guaranteed power supply to the processing plant in the event of grid failure and/ or changeover from the grid to the island power station allowing solar and battery to power the plant during the day.
- Construction of a 6.6 kV switchgear supplied by the grid, diesel generators, and renewables plant and feeding the site electrical distribution system.

The procurement strategy is as follows:

Table 18-9: Bulk Power Procurement Strategy

Package	Details	Units
1	Grid Connection & Miriam Substation	EPC(*1) / Transfer to NIGELEC
2	Diesel Generator Plant	EPS(*2) / Owner Operate
3	Solar PV and Battery Energy Storage System	EPC(*1) / Owner Operate
4	6.6kV Switchgear	EPS(*1) / Owner Operate

18.7.3 Studies and Trade-Off

The bulk power supply strategy was developed in two phases of study.

Phase 1 Power Study

Using the PFS load list a series of hybrid options (hybrid mix and capacity) were assessed with and without a grid connection. During Phase 1, a series of discussions took place with key stakeholders; SONICHAR, NIGELEC, Niger Ministry of Mines and Energy (MoE), and anecdotal evidence was gathered through discussions with operations at Arlit. The assessment demonstrated the on-grid option with a hybrid diesel – solar PV 8MWp – BESS 5MWh returned the lowest levelised running cost of both running / levelised cost of energy, and optimum Pay-back on Alternative Energy Investment. Note that heavy fuel oil (HFO) isn't available in this location.

Phase 2 Power Study

An updated FS electrical load list (ELL) was obtained for the Miriam Plant and Infrastructure. The on-grid option with a hybrid diesel – solar PV – BESS was optimised for the load list which involved the resizing and design of the diesel power plant to cope with power demand on plant start-up, and design of the MV Plant Substation.

The single line diagram for the tender design is presented in Figure 18-26.

On this basis the supply strategy was formed along with various procurement options. Options included construction under an "engineering, procurement, and construction" (EPC) contract followed by owner operation, "engineering, procurement, and supplier supervision" (EPS) with the existing site construction teams undertaken construction work and the same but with operations by the supplier under a power purchase agreement (PPA).

The solution was split out into four packages for pricing enquiries:

- Grid connection incl. substation;
- MV substation;
- Diesel Generator Plant (EPC, PPA); and
- Solar PV and Battery Energy Storage System (EPC, PPA).

The option was given to the suppliers to provide pricing for the combined Hybrid Diesel-Solar-BESS Plant.

The bids were technically and commercially evaluated to ensure any areas of non-compliance or gaps would be priced in the final cost estimate. Various other key input costs were received from GoviEx – diesel cost, confirmation of grid tariff (Table 18-11), and the various contract options were assessed and compared to identify for instance the following:

- Compliant solution providing the lowest levelised cost of energy (i.e. the cost per kWh as supplied to the project);
- Non-compliant solution providing the lowest levelised cost of energy
- Lowest capital cost option.

The results were subsequently updated for a revised ELL received from the processing engineers with the ball grinding circuit replaced with the VeRo mills. This had the effect of reducing continuous demand, maximum average demand, and start-up electrical demand by around 10 %. This did not fundamentally affect the sizing of the hybrid power plant but the intensity of operation of the diesel generators was reduced.

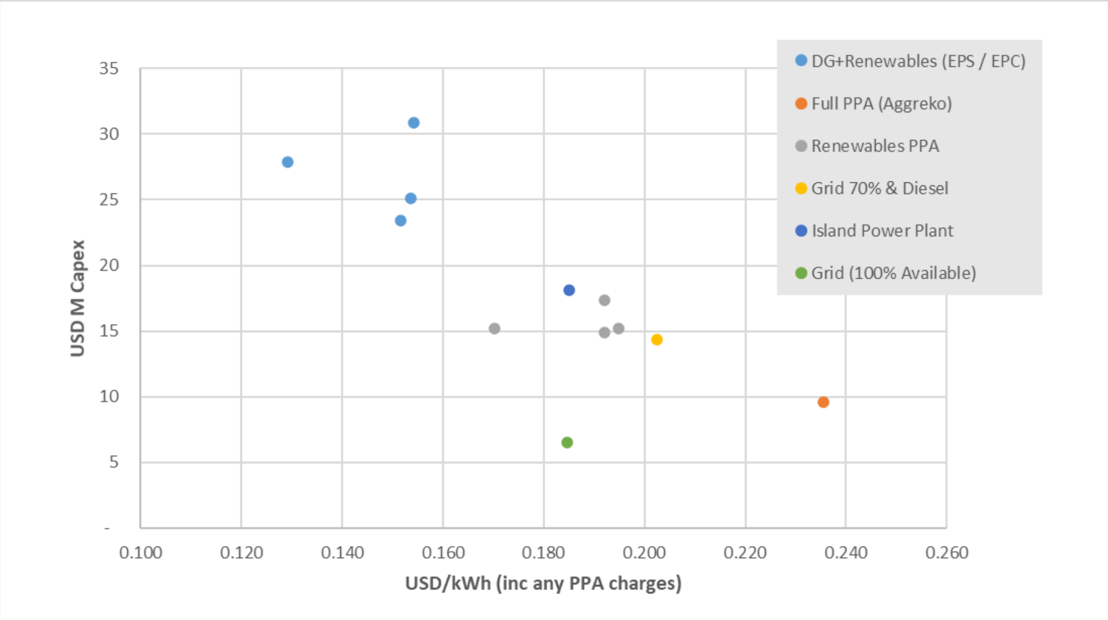


Figure 18-25: Phase 2 Power Study Cost Assessment – Capital Cost vs Running Cost

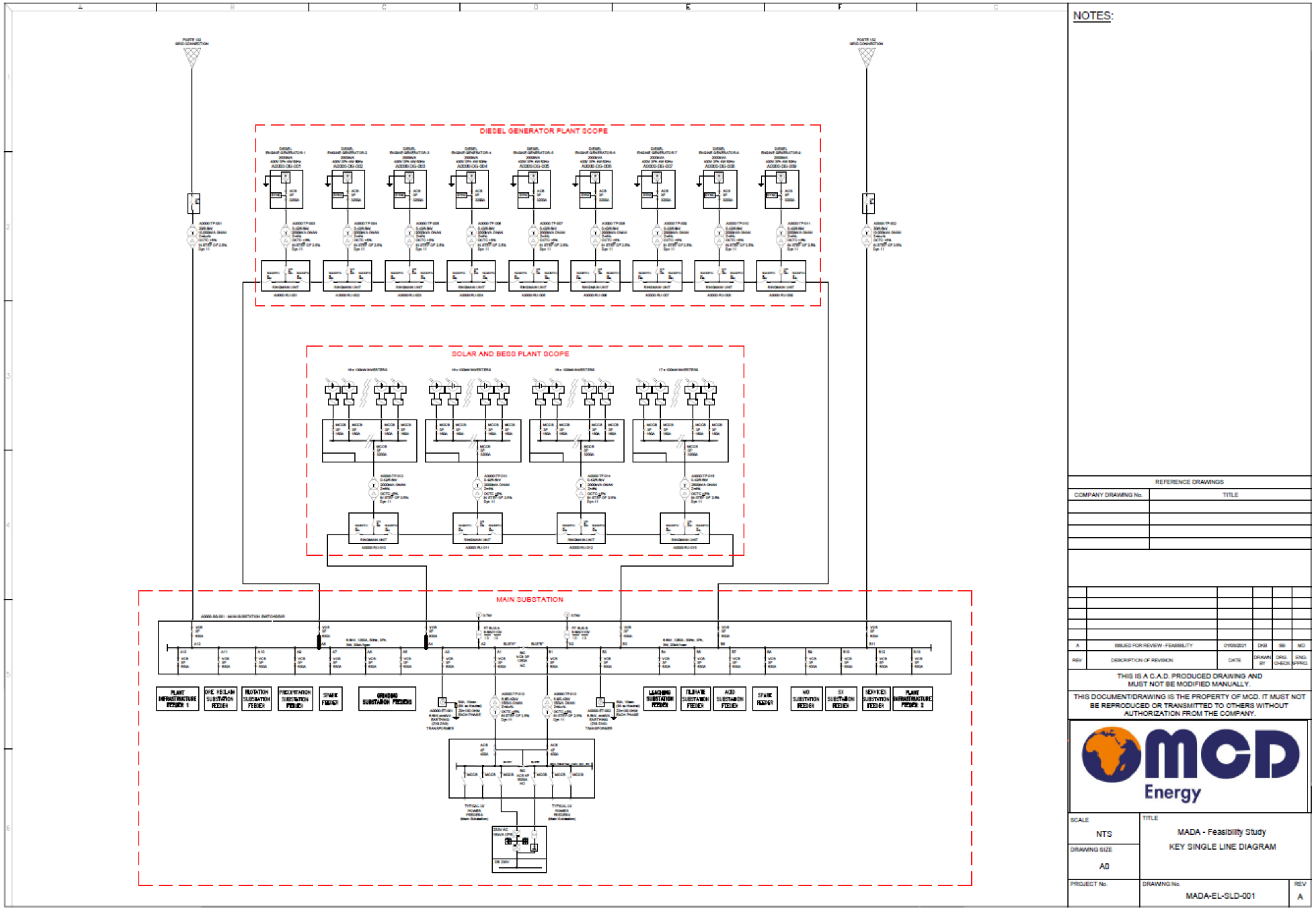


Figure 18-26: Power Plant Design

The results of the analysis show three groups of cost:

- Owner construction (via an EPC or EPS contract) and operation by GoviEx: - this showed the highest capital cost but corresponding lowest levelised cost of running (e.g. 16 USDc/KWh);
- Owner construction (via an EPC or EPS contract) and operation of the DG Plant only by GoviEx with the renewables plant being constructed by an independent power producer and contracted under a power purchase agreement (PPA): this showed reduced capital cost as the IPP bears the cost of construction but consequently, the levelised cost of running is higher;
- The full PPA for DG plant and renewables as priced at 24-25 USDc/KWh.

Within the analysis, various supplier options were compared.

A discounted cost analysis showed that option EPS1 was the pricing option that provided the lowest cost of energy for the FS plant design (DG Plant, 8MWp Solar, and 5MWh BESS) – see Figure 18-27.

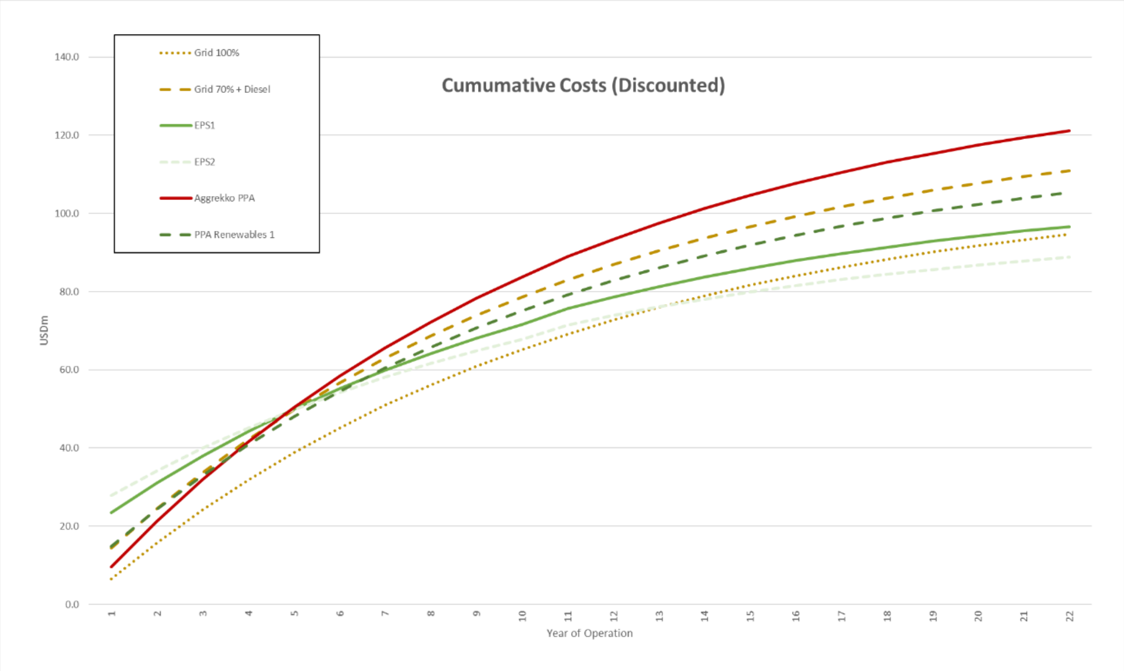


Figure 18-27: Phase 2 Power study cost assessment – Cost Analysis (Discounted)

On this basis, the option selected from the pricing enquiries was EPS1 as this provides the lowest supply cost at 15.9 USDc/kWh over the LOM, (at the selected fuel price, exchange rate and grid supply cost and availability).

The battery limit with the plant electrical distribution system is the outgoing feeders from the switches in the MV substation.

Table 18-10: Bulk Power Procurement Strategy

Package	Details	Procurement Basis
1	Grid Connection	EPC
2	DG Plant	EPS
3	MV Switchgear	EPS
4	Solar PV + BESS	EPC

18.7.4 Basis of Design

Design and cost inputs for the study are presented in Table 18-11.

Table 18-11: Inputs for Phase 2 Study

Item	Units	Value	Source / Notes
Electrical Load List	Name	M7534-E831-001 Rev D.2 - with VeRo Changes.xlsx	SGS / VeRo Mill
Maximum Current on Start-up	Amps	1020	SGS / VeRo Mill
Continuous Demand*	kW	5600-6012	SGS / VeRo Mill
Max. Average Demand	kW	7582	Increasing to 8000 when the flotation plant is commissioned.
Continuous demand (selected for running time)	kW	6012	Increasing to 6300 when the flotation plant is commissioned
Grid Availability	%	70	
Grid Cost (per kWh)	FCFA/kWh	120	SONICHAR letter June 2021 (confirmed as applicable as of FS date)
Grid capacity	MW	8	As per SONICHAR letter
Diesel (delivered to Site)	CFCA/L	540.00	GoviEx
Exchange Rate	XOF:USD	650.00	Exchange rate at the time
Litres per kWh for DG	L/KWh	0.27	Industry benchmark
Fuel Supply	#	Miriam Fuel Farm	SGS
Solar Irradiation (Peak)	kWh/kWp/yr	1,704	Solar PV Simulation Software

18.7.5 Local Grid Connection & Substations

Poste 132

Substation “Poste 132” at Akokan is served by the dedicated 132 kV transmission line from the Agadez power station. The substation has two 17 MVA, 132/20 kV, 50 Hz transformers. NIGELEC reports the current available energy capacity at the substation is between 12 and 20 MW, depending on load, season, and turbine maintenance status.

During the PFS it was established that with modifications at the substation, it would be possible to install a dual circuit line 3 phase, 20 kV line for the 28 km from Poste 132 to a Project substation at Miriam.

Overhead Line & 20/6.6 kV Miriam Substation

The OHL shall be either a double-circuit arrangement mounted on single lattice steel structures, (6-line conductors plus earth) or a 2-x single-circuits arrangement mounted on lattice steel structures/poles (3-line conductors plus earth). The OHL supplier shall include;

- Connection to the at Poste 132;
- OHL Structures and OHL Conductors (28 km);
- Insulators;
- Earthing & Lightning protection;
- Foundations;
- 20 kV Outdoor circuit protection at the end of the line;
- 20/6.6 kV Step down transformers;
- 6.6 kV Cable connection to the Madaouela facility Main Substation;
- Suitable means of mechanical and theft protection.

The supplier will be responsible for the development, construction, and supply periods of the project, i.e., funding, engineering, procurement, construction, testing, commissioning, and supply of the Works and shall deliver the 20 kV OHL such that it is fit for purpose and free of defects. The supplier shall supply as part of the Main Package Substation including but not limited to the following:

MV Substation

The supplier will supply a packaged substation with the following specifications:

- The Main Packaged Substation shall be the intake point for all power sources including:
  - 2nos. Grid incomers, 2nos. DG Plant incomers, 2nos. Solar Plant incomers.
- All incomers shall be capable of running in parallel and/or independently with the appropriate mechanical and electrical interlocks/ switchgear.
- Main Packaged Substation shall be the point of power distribution for the facility at 6.6kV.
- The 6.6 kV switchgear shall provide 630 A outgoing feeders as follows;
  - 2nos. Neutral earthing transformers feeders
  - 2nos. Main packaged substation transformers feeders
  - 2nos. Grinding substation feeders
  - 1no. Leaching substation feeder
  - 1no. Filtrate substation feeder
  - 1no. Acid substation feeder
  - 1no. molybdenum substation feeder
  - 1no. SX substation feeder
  - 1no. Services substation feeder
  - 2nos. Plant infrastructure feeders

  - 1no. Precipitation substation feeder
  - 1no. Flotation substation feeder
  - 1no. Ore reclaim substation feeder
  - 2nos. Spare feeders
- The supplier shall include for:
  - 6.6 kV switchgear
  - Main substation transformers (for LV power)
  - Neutral earthing transformers
  - Substation distribution panel(s)
  - Uninterruptable Power Supply (UPS) unit(s) complete with distribution panel
  - Containerised building and building services.

The MV substation will be supplied on an Engineer, procure and supply basis and the main construction Contractors will assemble the packages under supervision of the supplier's representative.

18.7.6 Hybrid Diesel-Solar PV-BESS Plant

Diesel Generator Plant

The DG Power Plant is intended to provide standby power in the event of loss of grid power and supplement power when grid supply is limited. Therefore, the DG power plant has been sized to operate in the most efficiently optimum manner.

The DG Power Plant comprises: Option 1: 8 nos. 2000 kVA (Prime Rated), 400 V, 50 Hz containerised diesel generators complete with a day fuel tank, which is connected to the main fuel farm.

Each DG shall be supplied complete with onboard synchronisation and load sharing facilities to operate in island mode and/or grid mode. Each DG is connected to a step-up transformer and ring-main unit to provide connection to the main 6.6 kV switchboard. All electrical cabling for generators and transformers up to the connection point on the 6.6 kV board is included in the DG Plant supply. All ancillary electrical equipment required i.e., NET's, aux generators etc. required for the day-to-day operation of the diesel power station are to be provided

The DG Power Plant will include the following key infrastructure:

- Containerised Diesel Generators
- Step up transformers
- Ring main units (RMUs)
- Interconnecting 6.6 kV cable i.e., transformers to RMUs and RMU to RMU)
- Interconnecting LV and control cables.
- Cable containment (conduit/ trenching, trays, ladders etc).
- Equipment for paralleling, synchronising and load sharing.
- Protection and isolation equipment.

- Earthing and lightning protection
- Day-fuel storage (to be refilled from the project fuel storage facility) and filling facilities.
- Fuel filling and distribution piping.

Solar PV Plant

Installing alternative technologies such as solar and energy storage not only reduces the cost for usage of the diesel generators and fuel, but it also reduces the associated CO_2 emissions from both transportation of the fuel and fuel consumption through power generation.

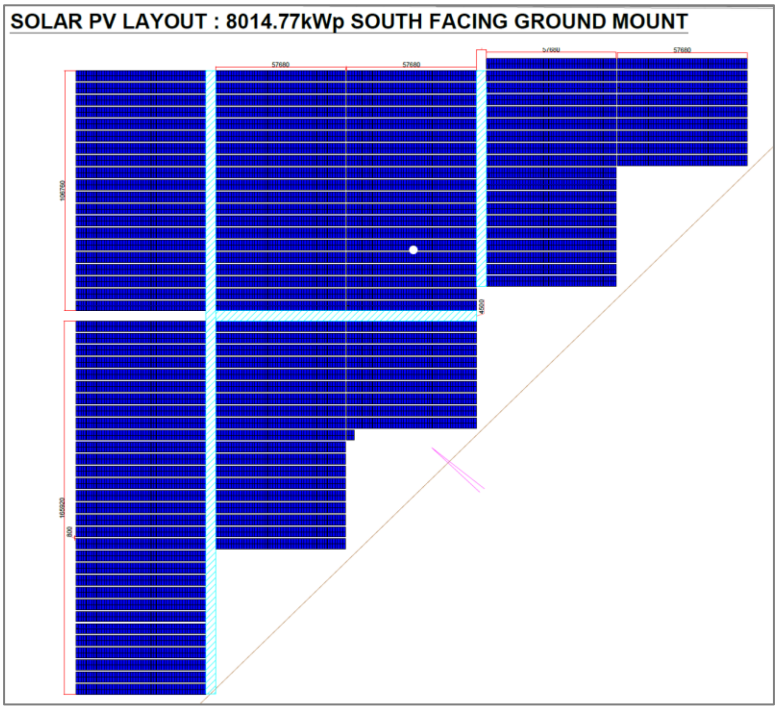


Figure 18-28: Proposed Solar PV layout for Madaouela

Solar-hybrid systems work on the basis of "fuel-saver technology"; i.e by adding photovoltaic energy to the grid-connected plant, during daylight hours the energy generated by a diesel generator, or the grid is scaled back and replaced with the solar generated energy. Given the estimated solar irradiation at Madaouela site of ~1,704 kWh/kWp/year for every MWh installed, the solar plant can be expected to produce around 1.704 m kWh/ per annum and provide potential CO_2 saving of 5 - 600 tonnes per MW per year. Preliminary design of South-facing solar layout for Madaouela site (Figure 18-28):

The tender design for the solar plant is based on Tier 1, 545 Wp mono crystalline panels with 100 kW string inverters. Solar PV can be installed in modular blocks. The minimum block size i.e., the most economical / easily transportable solution, is 250k Wp solar for each ISO 40' Container. Preliminary site layout for solar plant at Madaouela, to the Northwest of the processing plant and close to the incoming overhead lines.

The initial plant will be 8 MW; however, when the flotation plant is introduced, an additional 0.5 MW of solar will be added to maintain the renewables penetration level into the system.

Battery Energy Storage System

The battery is sized such that it supplies the required “spinning reserve” capacity to bridge a power gap. The battery will not be used for “time-shifting”. In the case of Miriam, the battery will be continuously charged. In order to do this a battery of 5 MWh would be required together with the solar PV power plant of 8 MWp. This solution assists in closing the gap between changeover from a grid outage to the island power station. In practice, when the grid fails the battery and solar are sized sufficiently to be able to take over the entire site load until the generators can auto-start. This normally takes around 5 - 10 minutes. In this time there would be no noticeable difference in the power supply to the processing plant and work would continue as normal with no production loss.

18.7.7 Operating Philosophy

The operating philosophy is presented in Table 18-12.

Table 18-12: Operating Philosophy

Agadez Plant	Item	Source / Notes
Full Power (8MW available to GoviEx)	Grid power available – Daylight (peak)	Solar plant fully utilised with any shortfall from the grid (or DG Plant) if required for maximum demand or start-up.
	Grid power available – Night	Grid provides sufficient power for continuous and max average demand, with assistance from DG Plant if start-up required.
	Grid Outage - Daylight (peak)	The solar farm will be supplying power predominantly. The BESS will allow uninterrupted transfer from grid to DG Plant if grid power is being used.
	Grid Outage - Night	The BESS will allow uninterrupted transfer from grid to DG Plant. DG plant and battery (if charged) will facilitate a “black-start-up” of the plant.
Generator Maintenance (4MW available to GoviEx, for approximately 2 months per annum)	Grid power available - Day	Solar plant fully utilised with any shortfall from the grid (or DG Plant) if required for maximum demand or start-up.
	Grid power available – Night	Grid provides partial power for continuous and max average demand, with the DG also running.
	Grid Outage - Day	The solar farm will be supplying power predominantly. The BESS will allow uninterrupted transfer from grid supplement to DG Plant.
	Grid Outage - Night	The BESS will allow the DG plant to ramp up to meet full demand as in this scenario around 2-3.5MW of DG power is required to meet the base load.

The estimated production of each power source is provided below assuming the 70 % grid availability (Table 18-13).

Table 18-13: Power plants production

Power Source	Consumption	Units
Power Consumption (Total)	52,665,120	kWh/year
Grid energy	27,323,184	kWh/year
DG Energy	11,709,936	kWh/year
Solar production	13,632,000	kWh/year

18.7.8 Estimated Costs

Cost of Energy

Based on the cost inputs, the levelised running cost for the selected option is 0.152 USD/kWh. The return on investment for renewables is 4.16 years and the levelised cost of energy (whole plant cost over total production; undiscounted) over 20 years is 0.175 USD/kWh (Table 18-14).

Table 18-14: Summary of Estimated Operating Cost– Miriam power supply

Item	Capital Cost per Annum (USDM)
Grid tariff	5,288,358
Fuel	2,753,724
DG maintenance cost	234,199
Solar maintenance cost	40,000
Battery maintenance cost	50,000
Total	8,366,281

Capital Cost

The following table (Table 18-15) summarises the capital cost for the selected power supply solution and achieves the levelised running cost.

Table 18-15: Summary of Estimated Capital Cost– Miriam power supply

Item	Capital Cost (USDM)
Overhead line	3.89
Incoming substation	1.49
Main 6.6kV Switchgear	1.65
DG Plant	4.78
Solar 8 MW & Battery 5 MWh	9.52
Construction, Installation, Civils	2.13
Total	23.46

Sustaining Cost

When the flotation plant is constructed, 0.5 MW of solar panels will be added to the solar plant for a capital cost of USD 0.38M based on the cost / MW from the enquiries made.

18.7.9 Conclusion

The Madaouela project benefits from the option to connect to the local grid operated by SONICHAR / NIGELEC and 8 MW is confirmed by SONICHAR as being available, and which sufficient to operate the plant.

However, the grid is known to periodically suffer from instability causing outages. In addition, each turbine at the SONICHAR power station at Agadez is on planned maintenance for 1 month per year, which halves the available power at Miriam site

Therefore, a hybrid plant will also be constructed to secure power supplies under all grid operating scenarios. The inclusion of a Solar PV plant both optimises the levelised running cost and reduces GoviEx's scope 2 emissions. The addition of the battery in this set-up is to provide grid support and a smooth transition when the grid drops out from grid to island power mode.

18.7.10 Key Assumption / Risks / Clarifications / Opportunities

The key assumptions in relation to inputs to cost and production hours for the different energy sources are clarified in the Bulk Power section. The bulk power solution is designed to provide continuous power under all operating scenarios. The key risks relate to the cost inputs:

- Grid outage information could not be obtained. The 70 % grid availability is a reasonable estimate based on experience in similar settings and cognisant of anecdotal information gathered from stakeholders. As the grid is continuously maintained and improved and if the various renewables projects proposed are developed, it is hoped that grid stability improves.
- Fuel price and exchange rates may change in the future. An increase in fuel price would have an impact on levelised running cost.
- The exact response of the generators under the anticipated ambient environmental and operating conditions will not be known until a reasonable amount of operating data has been collected in the first years.
- A number of suppliers suggest the Solar Irradiation (Peak) in reality may be marginally higher than the level assumed in the tender design by around 10-15 %. The tender design value which was obtained from a world database for the Arlit location. This would have a positive impact on solar penetration.
- Solar tracking could also improve solar irradiation but would also increase O&M costs and maintenance risks.
- Once the Solar plant is installed and operating data obtained, there may be an opportunity to increase the size of the solar plant to further reduce levelised running cost.
- The estimate of costs assume good quality recognised branded equipment is used which is operated and maintained in accordance with manufacturers guidelines and specification, and fuel and lubricant quality is within optimal operating parameters.

18.8 Water Supply Wellfield

18.8.1 Design Criteria

The Project's make-up water demand will be met by a wellfield located approximately 7.5km north-east of the process plant. The design approach is to provide sufficient wellfield capacity to deal with higher-than-average water demand within a "reasonably foreseeable" risk tolerance range. Uncertainty analysis and stochastic modelling has been used to generate a probability of certain estimated groundwater inflows into the mining operations (SRK, 2022e), groundwater inflow being the key variable affecting water demand.

Abstraction rates for the wellfield have been determined from the site-wide water balance which calculates the mine's make-up water demand (SRK, 2022c). The P10, P50 and P90 percentile make-up water demand is shown in Figure 18-29. This assumes underground dewatering water is not utilised by the plant, which would significantly reduce wellfield abstraction rates after year 8. The wellfield has been designed based on a conservative water demand, namely the P10 scenario.

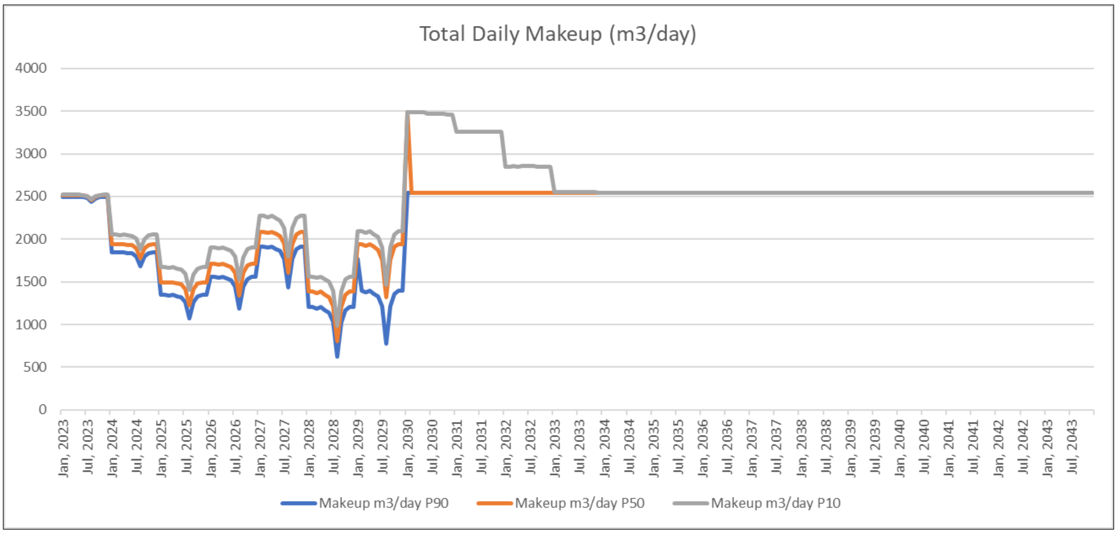


Figure 18-29: Water Demand required from the Wellfield assuming Underground Dewatering Water is not utilised by the Plant

18.8.2 Wellfield Design

The wellfield design comprises 5 production wells, with one of these utilising the existing MAD1_0103 which has been subject to pumping tests (SRK, 2022g). Four additional wells are proposed to be drilled at approximate 700m spacings. The layout of the wellfield is presented in Figure 18-30.

A range of power options were investigated as part of the Feasibility Study and, considering favourable climatic conditions, a solar powered solution was selected. More information on the wellfield power supply is available in Section 18.8.5.

Pumping will occur during daylight (8 hours per day) which increases the demand from the wellfield 3 times. The maximum daily volume required from each of the 5 wells to meet the demand over 8-hours of pumping is almost 2,100 m^3, meaning each well would need to pump at 90 m^3/hour for 8-hours. Assuming the well is switched off for 16-hours a day this results in an 'effective' daily pumping rate of 30 m^3/hour which is considered sustainable in terms of a long-term average (see numerical modelling for more details – SRK,2022e).

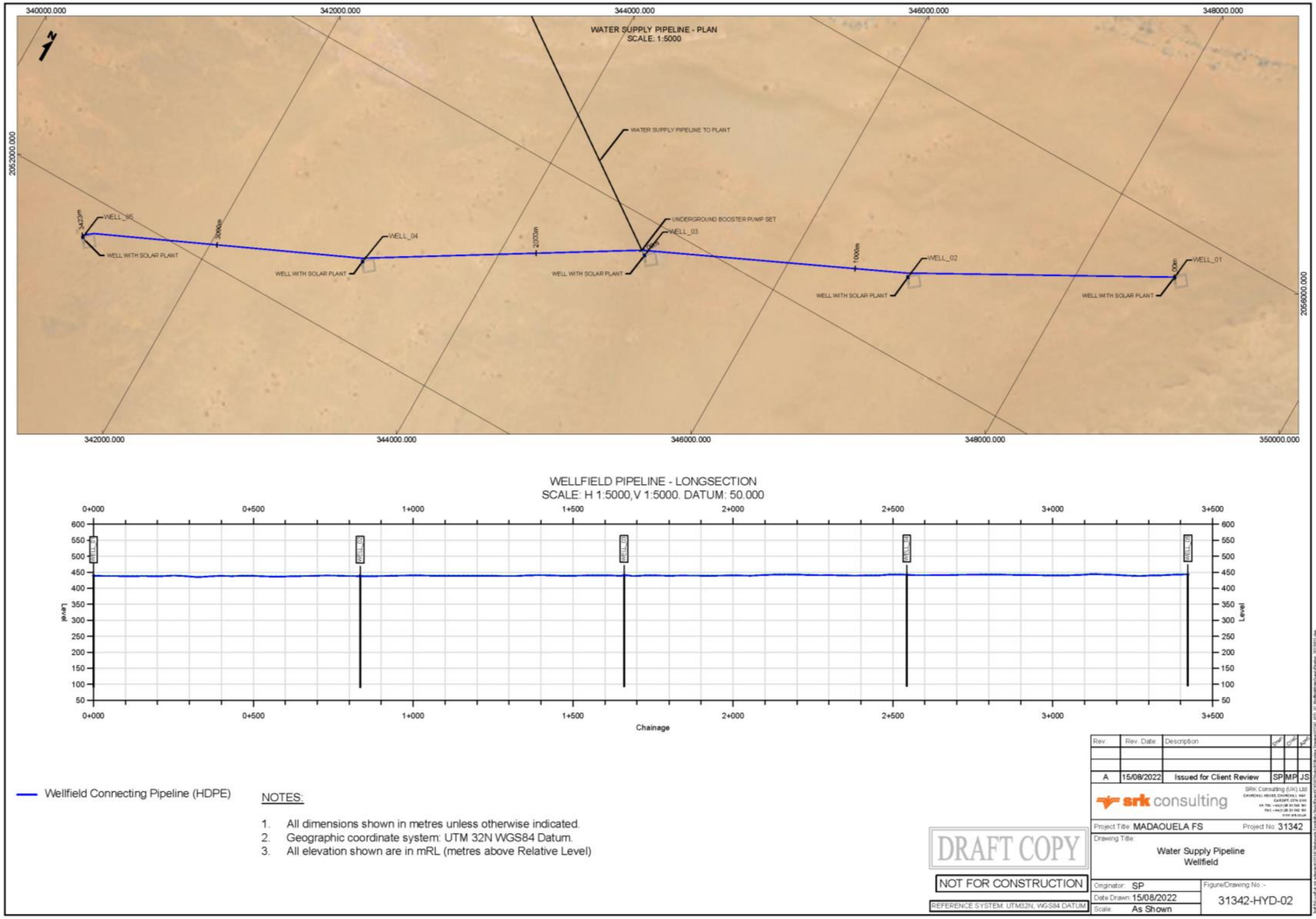


Figure 18-30: Wellfield Layout

Wells will be drilled to a depth of 400 m to the base of the Guezouman aquifer at a diameter of 12 inches. They will be completed with 8-inch well casing which will be screened across multiple aquifers to maximise yields from aquifers including the Izegouande, Guezouman and Tarat.

Boreholes are designed to accommodate a Grundfos SPE 95-9 submersible pump with a motor diameter of 6-inches. Boreholes will pump to a connecting pipeline at surface that runs along the length of the wellfield.

More details on the wellfield design can be found in SRK (2022h).

18.8.3 Pipeline Design (Wellfield to Plant)

The water supply main will be used for the transmission of water from the wellfield to the process plant. Pipeline routes have been assessed (SRK, 2022h) with the final proposed route shown in Figure 18-31.

The wellfield boreholes will pump water to an underground tank from where a separate booster pump will pump water to the process plant raw water tank. The proposed booster pumping system has been designed to pump up to a maximum of 430 m^3/hr. Maximum pressure developed in the system is 65 m.

A Grundfos centrifugal volute pump (Model NB 150-400/431) was recommended by the manufacturer as an appropriate solution that can also be solar powered.

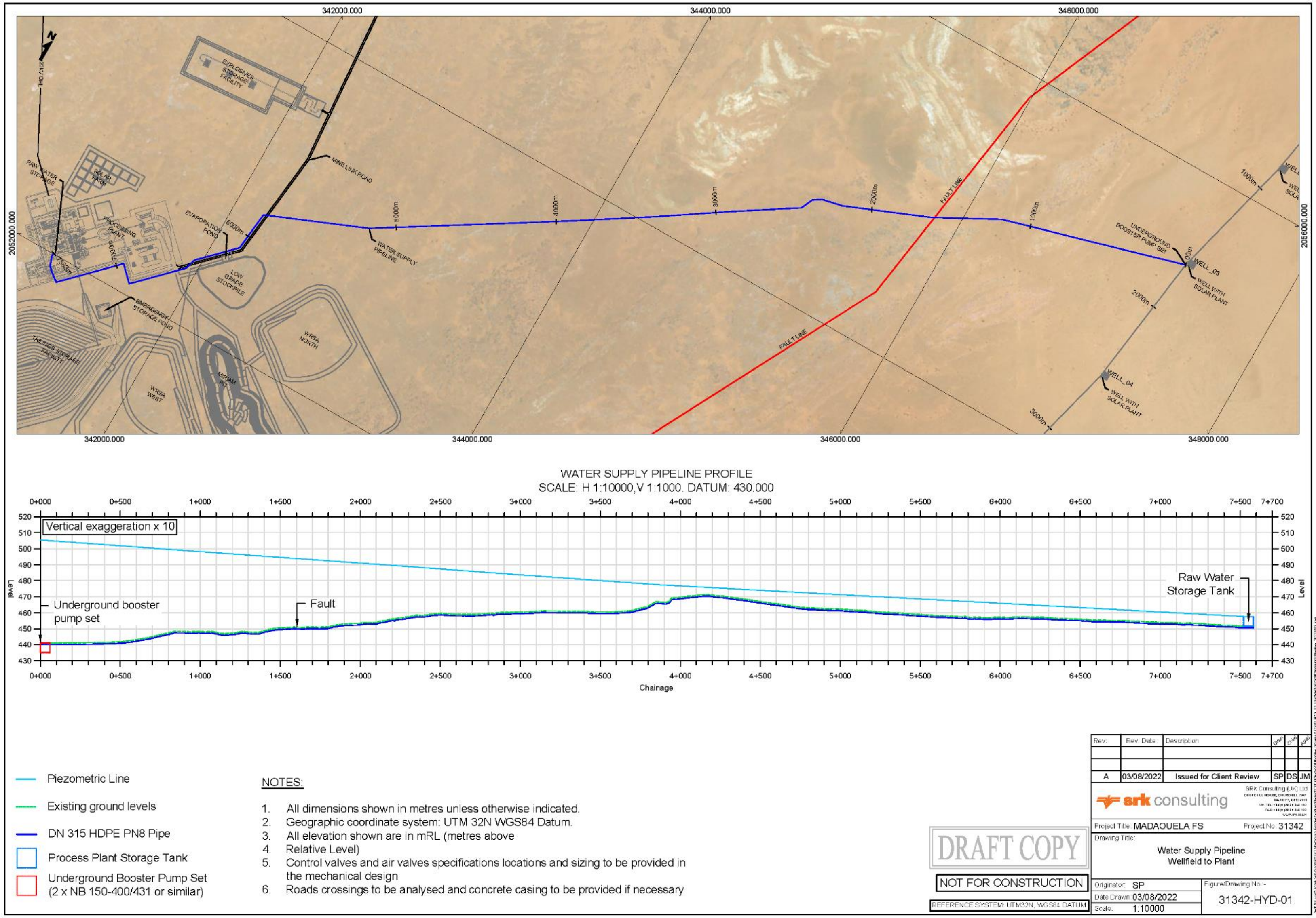


Figure 18-31: Proposed Water Supply Pipeline Route between Wellfield (right side of image) and Plant (left side)

The proposed pipeline comprises 355 DN, PN8, SDR 21 HDPE where water velocity is calculated to reach 1.7 m/s at 122 l/s (full pump capacity). For safety reasons, the entire system is planned to be underground.

The pumping system and reservoir will be placed in an underground concrete structure. Road crossings should be analysed in relation to compaction, and concrete encasing should be considered should it be necessary.

The pipeline crosses the Madaouela fault at approximately 1.7 kilometre of chainage. The best material choice for pipelines that cross faults is high-density polyethylene (HDPE), which can withstand severe deformations. Although employing HDPE increases the durability of these pipelines, it does not reveal how distorted they are in reality. The mitigation technique includes isolating and bypassing pipes damaged by fault rupture and replacing the damaged component when fault displacements are sufficient to rupture the pipe.

18.8.4 Cost Estimation

Assumptions

A wellfield cost model has been developed to assess the capital and operating expenditures expected based on an owner-operation. The cost estimate has been completed to a FS level and has an estimated level of confidence of ±15 %

The cost estimate is in USD and has been developed by SRK based on quotes and published price lists from manufacturers and suppliers and SRK's internal cost database.

The following assumptions and parameters have been used, changes of which will affect the level of accuracy:

- 17 % installation factor for all equipment.
- 17 % factor for Preliminary and Generals (P and G's).
- Cost of delivery based on cost per container of USD 9,000 with a capacity of 20 tonnes. Equipment weights have been estimated.
- Project power cost of 0.159 USD/kW where equipment is powered by mains (solar grid).
- Pump maintenance cost of 0.03 USD for every m^3 pumped.
- Wellfield infrastructure, such as electricity supply, fences, outbuildings, etc. are costed in detail under the infrastructure study, with total costs presented in this report.
- Access ladders, concrete tank and mechanical components along the pipeline were not costed.
- Based on manufacturer guidance proposed pumps are assumed to have a design life of approximately 20 years, which is equal to the current mine life.
- Excavation rate of 6 USD/m^3 in a 1.5m deep x 1.4m wide deep trench (main pipeline burial).
- Pipeline gravel bedding at the rate of 28 USD/m^3 for bedding depth of 300 mm.
- Costs are not adjusted for potential inflation.

Capital Expenditure

A summary of the captial costs for the wellfield and main pipeline to the process plant is presented in Table 18-16.

Table 18-16: Wellfield Capital Costs (USD)

Purchase Description	Unit	Rate	Rate Source*	QTY	Cost	Markups	Total (USD)
Wellfield							
Drilling and construction of an 8" water supply borehole and observation well	No.	163,082	Q	5	815,409	277,239	1,092,648
Grundfos SPE 95-9	No.	28,100	Q	6	200,000	68,270	268,270
Electric Cabling	m	64	Q	750	48,300	18,110	66,410
Vertical Flow sleeve	No.	831	E	5	4,154	1,417	5,571
VSD	No.	10,388	E	5	51,939	17,670	69,609
Rising main	m	26	E	750	19,500	10,005	29,505
Monitoring Equipment	No.	5,000	E	5	25,000	8,523	33,523
Surface pipelines to storage tank (DN225)	m	30	Q	2,000	60,000	24,900	84,900
Surface pipelines to storage tank (DN180)	m	25	Q	2,000	50,000	21,500	71,500
Main Pipeline to Plant and Booster Station							
Excavation	m^3	6	Q	16,000	96,000	32,640	128,640
Pipeline bedding	m^3	28	Q	2,280	63,840	21,706	85,546
Booster pump (Grundfos NB 150-40)	No.	17,800	Q	2	35,600	12,104	51,604
HDPE – DN 355, SDR21	m	30	Q	7,600	228,000	77,520	314,520
Infrastructure and Power Supply							
Wellfield infrastructure (office, ablutions, security)	No.	341,139	INF	1	-	-	341,139
Power supply	No.	2,002,942	INF	1	-	-	2,002,942
TOTAL CAPEX FOR WELLFIELD AND MAIN PIPELINE							**4,646,327**

Q = Quote obtained for this study.

E = Estimated based on similar projects/archived quotes/price lists.

INF = From infrastructure study (Section 18).

Operating Expenditure

Wellfield operating costs are based on the assumption that all pumps will be powered by the solar system. Wellfield capital and operating costs are summarised in Table 18-17. The operating costs include salaries for 1 x wellfield operator/manager (grade 4 labour) and 2 attendants/operators (grade 2 labour). The cumulative cost of capital + operating after 20 years is nearly USD 6.4 M.

Table 18-17: Wellfield Operating Costs and Life of Mine Summary (USD)

Year	CAPEX	OPEX (Wellfield)	OPEX (Pipeline & Booster Station)	Total Annual (USD)	Total Cumulative (USD)
-1	4,646,327		-	4,646,327	4,646,327
1		61,429	18,121	79550	4,725,877
2		58,279	16,501	74,780	4,800,657
3		60,012	18,157	78,169	4,878,826
4		62,805	21,214	84,019	4,962,845
5		57,042	15,391	72,433	5,035,278
6		61,190	18,539	79,729	5,115,007
7		72,955	27,883	100,838	5,215,845
8		71,239	27,497	98,736	5,314,581
9		67,995	25,458	93,453	5,408,034
10		65,595	27,143	92,738	5,500,772
11		65,546	20,465	86,011	5,586,783
12		65,546	20,465	86,011	5,672,794
13		65,546	20,465	86,011	5,758,805
14		65,546	20,624	86,170	5,844,975
15		65,546	21,483	87,029	5,932,004
16		65,546	23,669	89,215	6,021,219
17		65,546	23,669	89,215	6,110,434
18		65,546	20,620	86,166	6,196,600
19		65,546	20,345	85,891	6,282,491
20		65,546	20,225	85,771	6,368,262

18.8.5 Wellfield Power Supply

Supply Strategy (Wellfield)

The wellfield will operate for 8 hours per day and pump, pipelines, and tanks are sized accordingly. The submersible pumps and surface booster pump are powered by a dedicated series of solar panels.

Supply Trade-off (Wellfield)

To select the power supply solution, a trade-off was undertaken to compare solar pumping system, grid power, diesel generator power only, and island diesel generator-solar-battery. The “solar only” option was comparable in capital cost to selected alternatives and with zero associated operating cost.

Power supply

Each pump will have a series of GF 270 solar modules to meet the power demand. The GF 270 is a polycrystalline solar module mounted on a support structure comprising galvanised steel poles. Each panel has a peak output of 270 W requiring 418 no. panels for a total surface area of ~1,400 m^2 (or 40 m x 35 m) with 14 rows of 30 panels, with 1 m spacing between each row. The solar panel farm sits adjacent to the individual boreholes.

18.8.6 Support Infrastructure

Security

Each borehole and solar panel array will be enclosed within a fenced area (40 x 40 m). Fencing will be 2.5 m high with gates to allow vehicular access.

Buildings

A containerised office with ablutions will be located at the booster pump and adjacent well. A small stand-by generator to provide power to the offices is located here. A small shelter cabin will be located within the fenceline at each of the other four well sites for shelter and manning.

Communications

The mobile phone network is understood to extend into this area.

18.8.7 Assumptions / Clarifications

- The booster pump and tank is located adjacent to one of the supply wells and well are circa 1,000 m distance apart.
- Degradation in the solar panels will need to be monitored. For the study its presumed that no replacement is needed.
- GoviEx already notes standalone solar pumps are installed at water holes in the region which are manned by a watchman (unarmed).
- The army detail at the Madaouela project will can rotate past on security patrol and mine engineering services and project staff will regularly visit for review and maintenance.

18.8.8 Estimated Costs

The costs are summarised in Table 18-18.

Table 18-18: Wellfield Power Supply and Infrastructure Costs

Details	USDM	Source
Solar Plant Infrastructure	2,003,000	Grundfos Quotation
General Infrastructure	341,000	Civil infrastructure
Total	2,344,000	Total

18.8.9 Key Assumptions / Risks / Clarifications

There are two risks around the solar pump solution:

- That the envisaged kW-peak is Solar plant providing sufficient power over an 8-hour period, 365 days per year.
- An event occurs that reduces solar output for more an eight-hour period.

18.9 Stormwater Management

18.9.1 LGO Stockpile and Miriam Pit

Design Concept

Runoff and seepage from the LGO stockpile will report towards diversion channels proposed downstream of the stockpile which in turn will report into an evaporation pond. The foundation pad for the stockpile facility will be designed to facilitate runoff and seepage towards the diversion channels. The pond has been designed to received direct rainfall and groundwater inflows from Miriam Pit, although the final site layouts now include a separate dewatering pond (see Section 16.2.5). This results in an oversized evaporation pond for the purposes of the FS.

Detailed design reporting can be found in SRK (2022d), with a summary of the main design outcomes presented in the following sections.

Design Criteria

The design of the storm water system for the LGO stockpile was guided by the following principles:

- Maximize the surface area of the evaporation pond.
- Ensure that the capacity of the evaporation pond can contain the 1:50-year 24-hour storm runoff and the expected maximum groundwater inflow from the open pit.
- Ensure that the drying period is kept to a minimum (the pond was sized to dry within 14 days).
- Where practically reasonable, minimize the siltation risk of the evaporation pond.

Design Results

The conceptual stormwater management design for the LGO stockpile is illustrated in Figure 18-32 (diversion channels in red and evaporation pond labelled). A conceptual level water balance was developed to assist with sizing the evaporation pond. The results of the water balance are summarised in Table 18-19. The stormwater runoff and direct rainfall volumes were based on the 1 in 50-year 24-hour storm event.

Note: The final LGO stockpile outline has changed slightly since these figures were generated, however the design concepts remain consistent. In addition, the final pond design will no longer receive inflow from Miriam pit dewatering nor outflow to the process plant i.e. Since these two volumes in the water balance are identical (1,468 and 1,500 m^3/day) they essentially cancel out one another, resulting in an identical change in storage volume (approximately 1,200 m^3), hence the evaporation pond design remains unchanged.

Table 18-20 summarises the proposed dimensions of the evaporation pond.

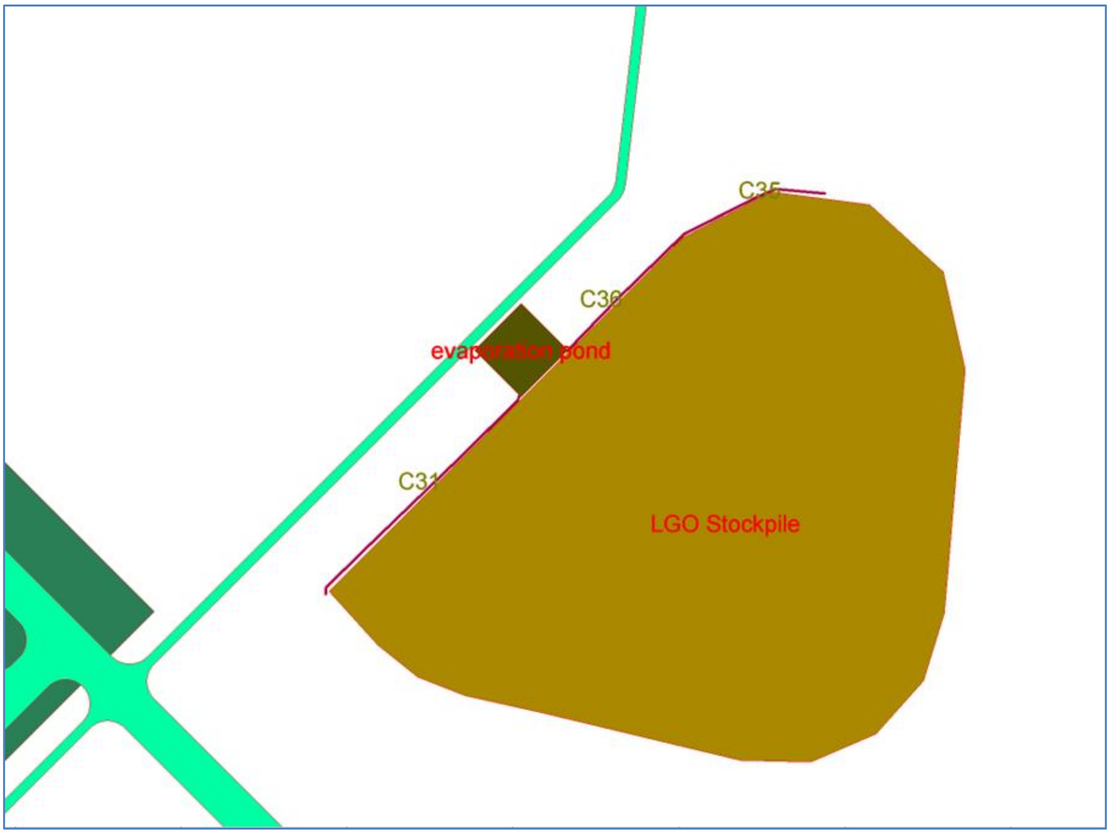


Figure 18-32: LGO Stockpile Stormwater Management Design

Table 18-19: Water Balance Summary Developed for the Evaporation Pond

Inflows (m^3/day)		Outflows (m^3/day)		Change in Storage Volume (m^3)	
Miriam pit inflow	1,468	Spill	0	Initial volume	0
1:50-Year Direct Rainfall	129	Evaporation *14 days	100	End volume	1,200
1:50-Year LGO Stockpile Runoff	1,430	Seepage *14 days	227		
		Plant demand	1,500		
Total inflow	3,028	**Total outflow**	1,827	Balance	0

Table 18-20: Proposed LGO Stockpile Evaporation Pond Dimensions

LGO Evaporation Pond Dimensions	
Length (m)	40
Width (m)	40
Height (m)	2
Freeboard (m)	0.8
Total Height (m)	2.8
Operating Volume (m^3)	3,200
Total capacity (m^3)	4,480

Currently the evaporation pond has been designed without lining to allow infiltration of the water in the pond into the ground, thus reducing the storage capacity required for evaporation. However, if it is found that the water quality of the LGO or open pit water is such that the environment will be negatively impacted then the pond can be lined with a 300 mm clay liner, sourced from the same source as the clay that will be used to line the TSF. It is recommended that the clay should have a permeability not less than 10^{-7} m/s (preliminary results indicate the clay material to be sourced to be in the order of 10^{-10} m/s to 10^{-11} m/s).

The proposed concept design details of the diversion channels are summarised in Table 18-21.

Table 18-21: Proposed Sizes for the Diversion Channels

Name	Length (m)	Roughness	Depth (m)	Bottom Width (m)	Side Slope (1:H)	Slope (m/m)	Max Flow (m³/s)	Max Velocity (m/s)
C31	180	0.03	1	1	1.5	0.00127	0.224	0.56
C35	91	0.03	1	1	1.5	0.00526	0.224	0.64
C36	121	0.03	1	1	1.5	0.00108	0.222	0.58

Cost Estimation

A conceptual level costing of USD 41,000 is estimated for the evaporation pond and USD 23,000 for the drainage channels. The level of design implemented is to a conceptual level with a cost accuracy of +- 40 % for feasibility planning purposes. The total costs for these works are estimated at USD 64,000.

18.9.2 Miriam Waste Rock Dumps

Design Concept

The management strategy for stormwater runoff from the West and North WRD facilities has been evaluated. Construction of evaporation paddocks around the toe line of the WRDs are proposed based on meteorological considerations (the site is characterised low rainfall, high evaporation and dust storms) and anticipated runoff water quality. The geochemical characterisation study has shown that the waste rock has a low potential for acid generation. Some metal leaching is possible, most notably for molybdenum, uranium and arsenic. However, given the hydrological and hydrogeological context there is low potential for released solutes to migrate. The arid climate means that that there is minimal opportunity for seepage generation.

Evaporation paddocks are designed to locally contain runoff water such that it does not pose a downstream risk to the operation. Specifically, paddocks have been designed to a 1:50 year storm event as well as annual average rainfall conditions. The design maximises the surface area of the paddocks to obtain high evaporation rates

Detailed design reporting can be found in SRK (2022d), with a summary of the main design outcomes presented in the following sections.

Design Results

Table 18-22 summarises an individual paddock required for the West and North WRDs based on a dump height of 50m. A paddock cross-section showing the key design elements is illustrated in Figure 18-33. A typical example of a paddock arrangement is shown in Figure 18-34.

Table 18-22: Required individual Paddock Size for West and North WRDs

Parameters	Minimum Dimensions
Minimum length per paddock (m)	10
Minimum width per paddock (m)	10
Minimum height per paddock (mm)	600

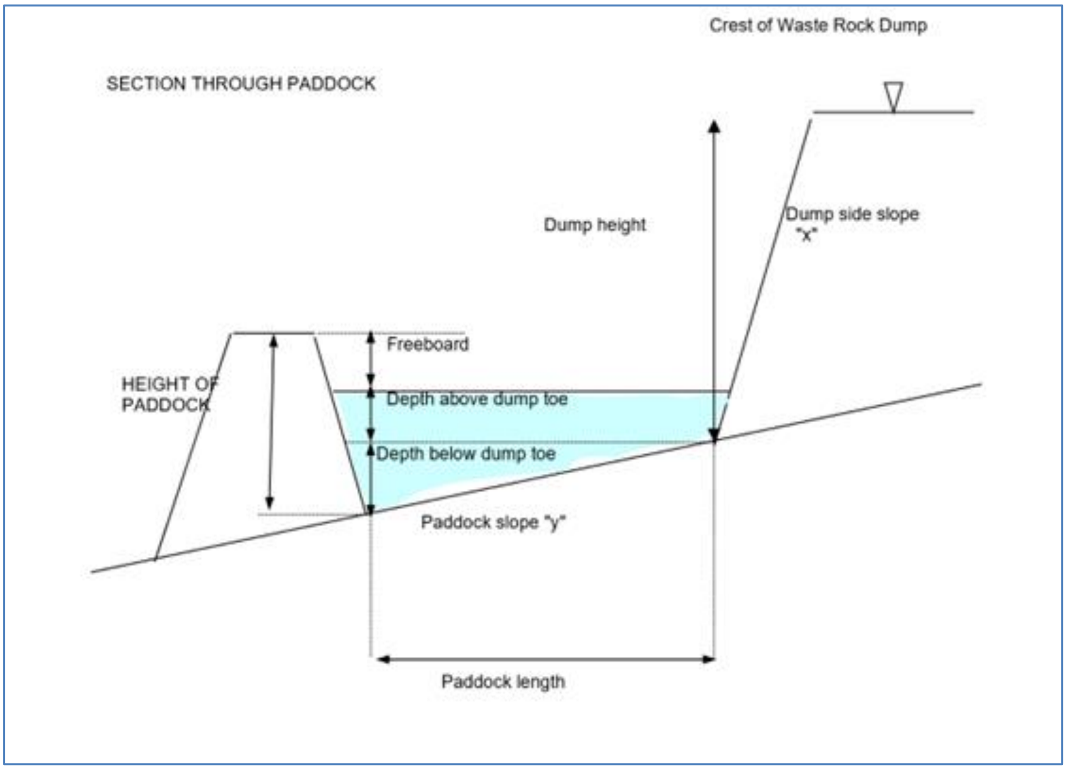


Figure 18-33: WRD Evaporation Paddock Cross-Section

Figure 18-34: Typical Example of Evaporation Paddocks (aerial view)

Construction Considerations for Paddocks

The mining plan will make provision for the paddocks to be incorporated into mine infrastructure such as the haul and access roads around the WRDs and associated berms. As a result, the calculations presented above are intended to provide a minimum berm height of 600 mm that it is recommended is used when designing WRD infrastructure.

Paddocks can also be excluded from areas where the runoff from the WRD will not affect downstream areas such as the north-eastern sections of the WRD's should the site conditions post construction of the WRD toe line dictate that the Paddocks are not required, and the runoff can be managed such that minimal impact downstream will be observed.

Maintenance Considerations for Paddocks

Paddocks will silt up over time due to dust storms. In order to maintain sufficient storage space for water in the Paddocks, periodic maintenance will need to be performed by excavating the silt (dust from sandstorms) from the Paddock basin. The excavated material can then be placed on the Paddock's berms and separation walls to increase the wall height with each cleaning cycle or placed on the WRD.

Cost Estimation

Costs associated with the WRD paddocks are included as part of the WRD development (no additional costs to the development of the WRD are allowed as material used in the construction of the paddocks are the same as the WRD material or the material cleared from the WRD footprint. Instead of spoiling the material, it can be used at the site for paddock wall construction).

Alternatively, the paddocks can be incorporated into the other local infrastructure such as the berm and embankments of the haul and access roads thus eliminating any additional costs associated with the construction of the paddocks. Also, phasing the paddock construction works over time by only constructing paddocks around the toe line of the WRD as the dump expands, and not all at the start of the project, will help defer capital cost expenditures.

18.10 M&M / MSNE Infrastructure

18.10.1 Overview

The underground mines at M&M and MSNE will go into production in project years 2028 and 2039 respectively.

Initially, the box cut, and mine link road (MLR) to M&M mine will be constructed to allow development of the underground mine infrastructure and construction of surface infrastructure, and the ore sorter facility. M&M will have dedicated power supply.

The concept for surface infrastructure is to relocate the prefabricated and modular buildings and installations from Miriam mine maintenance area (MMA) to M&M. Depending on timing some temporary facilities for construction will continue to be utilised until the relocation is complete.

The key capital costs elements for M&M are:

- Mine Link Road (MLR).

- Power supply (M&M and MSNE).
- Ore sorter facility.
- M&M Surface Infrastructure:
- Box-Cut M&M;
- M&M access road;
- Support Infrastructure (buildings and installations).
- Support utilities (e.g. site services).
- MSNE surface infrastructure.

Note that underground and surface water management is discussed in the Water Management Section 16.13, and the underground infrastructure (portal, ventilation) is presented in the Mining Section 16.11, which includes material handling equipment ahead of the secondary crusher within the ore sorting facility.

18.10.2 Mine Link Road (MLR)

Appendix (to be available on request, not appended to report section)

- BOQ & Preamble.
- Final Drawings.
- GT memorandum.

Purpose

The M&M mine is located approximately 14 km north of Miriam and it has been determined that hauling ROM on a mine link road (MLR) will be the most cost-efficient way of delivering ROM to the Miriam Mine plant for processing. Eventually the MSNE mine will go into production, replacing the M&M mine as the source of ROM. The MSNE mine is located approximately midway along the MLR to the M&M mine. The MLR will therefore serve both underground mines over the project life. The construction will be undertaken by a Civil Contractor under the supervision of the GoviEx site team.

Route

The route alignment is shown in Figure 18-35.

The Contractor shall be responsible for setting out the Works; the establishment of all lines and levels of all new construction from datum’s as listed below (see Table 18-23). The coordinate format is Universal Transverse Mercator.

Table 18-23: Location points (Please refer to Drawing 31342-1100-MLR-001 Rev A).

Reference UTM Zone 32Q			
Survey Points	**E**	**N**	**H**
MLR P1	342149	2052470	461
MLR P2	342794	2057466	457
MLR P3 (MSNE T junction)	341743	2060267	451
MLR P4 (M&M Termination)	340001	2063543	446
MLR P5 (MSNE spur)	341401	2060223	450
MLR P6 (MSNE Termination)	341377	2060196	450

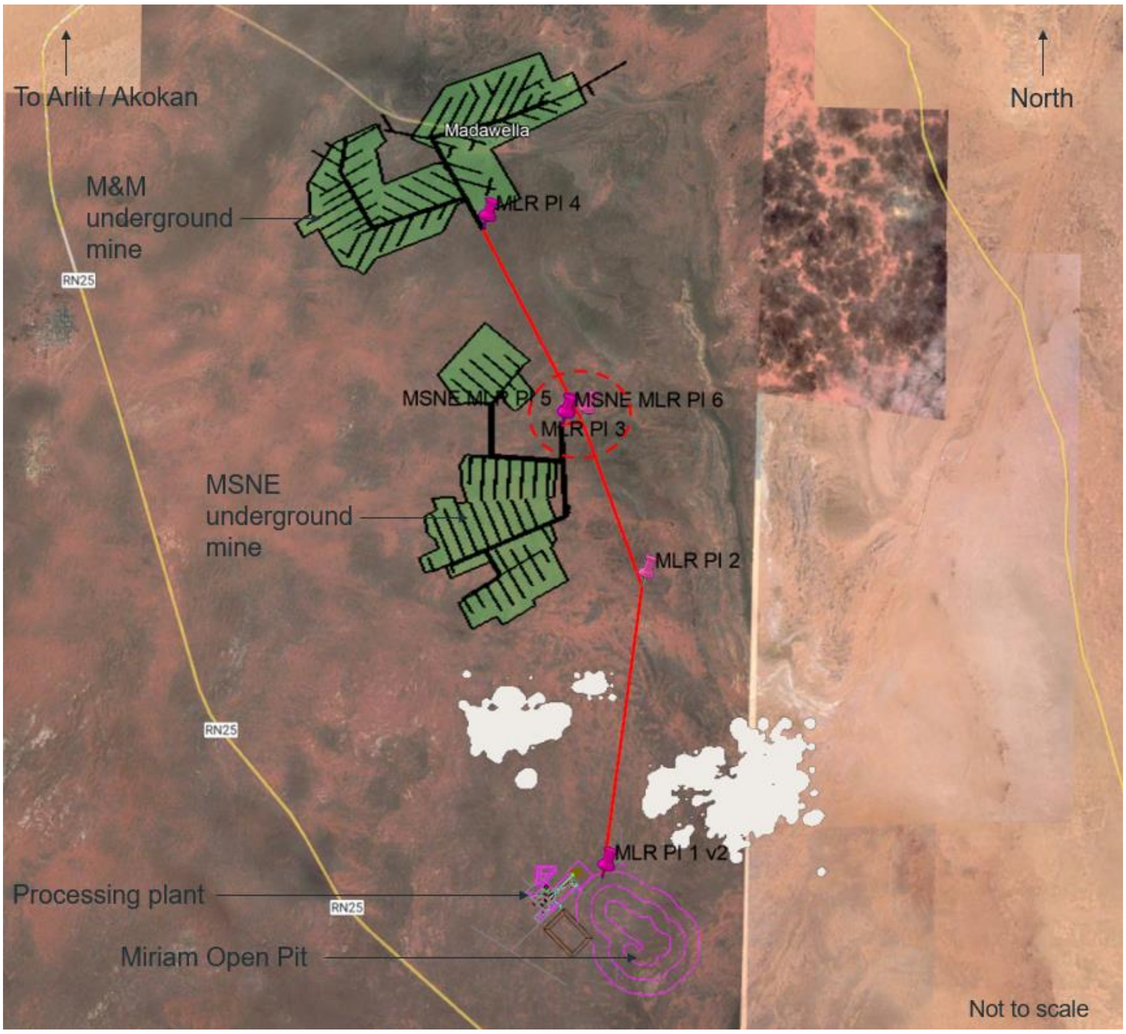


Figure 18-35: MLR Routing

Geotechnical

The available topographic and geological survey data was used in the determination of the route alignment. Limited test pits were carried out at the site suggested a CBR of 10-20 % is appropriate with Medium to fine grain Sand with gravels encountered at surface above siltstone / sandstone bedrock.

Route Constraints

Cultural heritage sites have been identified in the project area and the route has been aligned to avoid these. Road construction, maintenance and dust suppression will require significant volumes of water. The Miriam Mine pit de-watering water will be the primary source.

Design Vehicles and Traffic.

The MLR is designed to accommodate 4-axle rigid, or 5-axle articulated, highway construction trucks with a 30-t payload. A cycle time of one hour is expected.

Road Geometry

See Figure 18-36 below for the proposed road geometry. A running width of 3.5 m per lane is provided with a typical cross fall of 2 % for surface drainage.

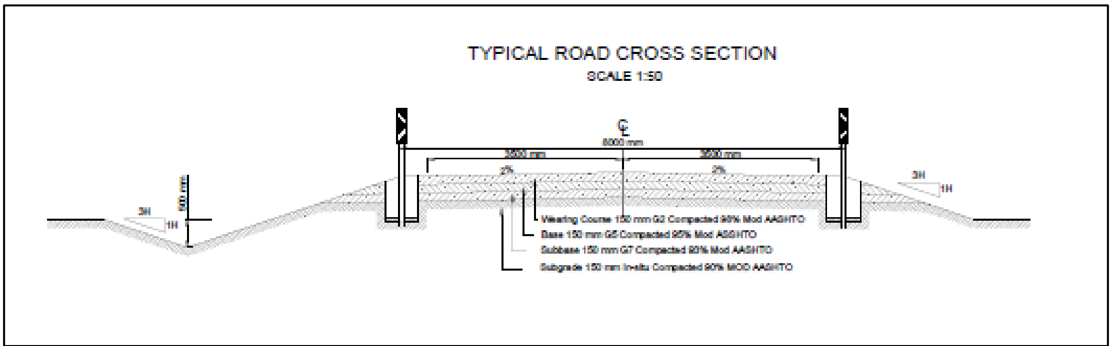


Figure 18-36: Road Geometry

Vertical /Horizontal Alignment

The total change in natural ground level over the length of the road is approximately 15 m with variations in elevation limited generally to less than 2 m although an area at approximate chainage 7.5 km will require greater attention but in general vertical alignment adjustments are minor. The proposed alignment parameters are presented in Table 18-24. While the road is designed for 60 km/hr speeds, actual speed will be restricted to lower than this to reduce dust emissions and for increase safety and fuel economy.

Table 18-24: Road Parameters

Parameter	Details
design speed	60 km/hr
maximum gradient	5%
minimum site distance	250 m
minimum horizontal radius	300m

Pavement Design

Pavement design parameters are presented in Table 18-25. These are subject to field and laboratory trials of waste rock for use as a pavement aggregate.

Table 18-25: Pavement Design

Layer	Details
Wearing course of compacted crushed and graded waste rock to 98% MOD.AASHTO equivalent to a G7	150 mm thick
Base course of compacted crushed and graded waste rock to 95% MOD.AASHTO equivalent to a G5	150 mm thick
Subbase course of compacted crushed and graded waste rock to 93% MOD.AASHTO equivalent to a G7	150 mm thick
In-situ subgrade compacted 90 % MOD.AASHTO	150mm thick

Borrow Pits

It is intended to use the Miriam Mine waste rock stockpiles as the primary source of imported earthwork materials. Samples of these stockpiles will be tested to determine the quality of material that can be produced once crushed, screened and blended. This will inform the final road pavement design which will be adjusted to maximise the use of waste rock and minimize the cost of procurement from commercial sources.

Earthworks

Native vegetation is limited and will be grubbed out and bladed to one side to a depth of 150 mm. In-situ material will be ripped, watered and compacted to form the sub-grade vertical profile to receive the engineered layers of the pavement. The sub-base, base course and wearing course materials will be drawn from stockpiles of G2, G5 and G7 material created from the waste rock.

Culverts / Drainage

A grader formed v drain will be constructed on the upslope side of the road to direct overland stormwater flows to pipe culverts that will be strategically positioned along the route. The vertical alignment of the road will be adjusted at these crossing points to accommodate the cover required to protect the pipes from vehicle loads. A typical pipe culvert arrangement is shown in Figure 18-37.

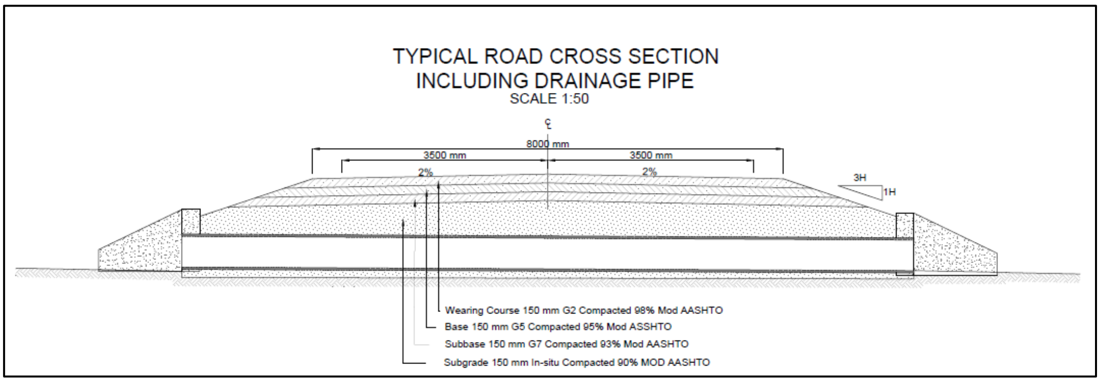


Figure 18-37: Cross section through a pipe culvert.

Fencing and Signage

Speed limit and traffic signage will be deployed as well appropriate signage to ensure the safe approach and entry into Miriam, M&M and MSNE Mines. Advisory signage will be installed at the intersection of the MSNE Mine link road and the MLR. Dust and weather conditions may limit visibility and road edge signs will be positioned to demarcate the running width limits. Warning signs will identify the positions of the stormwater drainage culverts.

Project Execution

The road design will be undertaken by a local civil engineering consultancy once suitably detailed topographic data is available and further test pits are undertaken using the operations team's equipment. A site trial of waste rock use in haul roads needs to be undertaken under supervision to develop a method compaction specification for waste rock. This will include suitable laboratory testwork. A tender design will be prepared, and a local civil engineering Contractor will complete the work. Waste rock will be free issued to the Contractor for crushing and screening.

18.10.3 Power Supply (M&M)

The main consumes of power at M&M and subsequently MSNE are:

- Ventilation
- Conveyors
- Ore sorter
- Mobile equipment
- Surface Infrastructure

The maximum power demand are as follows (Table 18-26):

Table 18-26: M&M and MSNE power demand

Parameter	Units	M&M	MSNE
Max. Average Demand	kW	5,800	6,300
Continuous Demand*	kW	4,200	5,700

The bulk power supply strategy for the M&M and MSNE follows that of Miriam to achieve the same energy mix and cost of energy to the project. The same assumptions around grid availability and input costs are assumed as per Table 18-11.

The bulk power supply consists of the following constructions for M&M:

- Construction of a 20 kV single circuit OHL and new 20/0.6 kV substation connecting M&M to the Akokan substation Poste 132 where sufficient capacity is considered to be available in the future.
- Diesel Generators Plant (DG Plant): Addition of 5 x 2,000 kVA, 6.6 kV diesel generators and synchronising panel connected to the main mine 6.6kV distribution board to secure the remaining 30 % load.

- Installation of a 5.5 MWp solar power station (Solar PV) to offset the cost of diesel, transportation, diesel consumption and CO_2 emissions at the site, generating 26 % of the processing plant energy demand.
- Installation of a 3.5 MWh battery energy storage system (BESS) to support the solar plant and provide continuous and guaranteed power supply to the processing plant in the event of grid failure and/ or changeover from the grid to the island power station allowing solar and battery to power the plant during the day.
- Construction of a 6.6 kV switchgear supplied by the grid, diesel generators, and renewables plant and feeding the site electrical distribution system.

To facilitate MSNE production a 20 kV single circuit OHL connecting a new MSNE new 20/0.6 kV substation to the M&M substation, where sufficient capacity is considered to be available in the future. No additional renewables plant will be added at this stage.

18.10.4 Ore Sorting Facility

Overview

Radiometric ore sorter units (supplied as vendor packages) and associated screens will be located adjacent to the underground mines. Concentration will be performed using individual radiometric ore sorter (ROS) modules. The ore will be sorted with the reject (waste) being produced.

Concentrate from all ROS modules is collected and transferred on the concentrate conveyor and combined with screen undersize material and transferred to the ROM stockpile in the processing plant by truck. ROS rejects from all modules are combined on the ROS discard conveyor and transferred to the rejects stockpile.

In the PFS, it was decided to use Ore Sorters from the Steinert range with the ore being crushed to suit the sorters as follows and a quotation was sought from a distributor of Steinert equipment in South Africa.

Design Development

The ore will be brought up to surface on a belt conveyor. The assumed feed profile for ore will be sized underground to -300 mm with minimal fines generation (P80-250 mm). The original work selecting the ore sorting machinery had been undertaken by the RADOS company at Mintek in South Africa.

Further to the work carried out in the previous study, it was decided to use Ore Sorters from the Steinert range and an initial design requiring three ore sorter machines to sort the following size fractions received from the screens:

- Two 2-meter-wide sorters set to receive the size range -75 mm to 25 mm at a rate of 117 tph (64 % of feed).
- One 2-meter-wide sorter set to receive the size range -25 mm to 8 mm at a rate of 38 tph (21 % of feed).
- -8 mm at a rate of 29 tph (16 % of feed), which will not successfully be sorted on the machines and would be transferred to the ore bin.

After further consultation with the preferred vendor of the sorters it was concluded that the savings could be achieved by changes to the screening of the ore as follows to achieve a 2-ore sorter design:

- One 2-meter-wide sorter set to receive the size range -75 mm to 47 mm at a rate of 64 tph (35 % of feed).
- One 2-meter-wide sorters set to receive the size range -47 mm to 19 mm 65 tph (35 % of feed).
- -19 mm 56 tph (30 % of feed), which will not successfully be sorted on the machines and would be transferred to the ore bin.

The two ore sorter design was selected for this study. The above sizes are based on experience and should be verified by further test work to obtain throughput and recovery guarantees from the manufacturer.

Ore Sorter Facility

The following is an overview of the facility with diagrams presented in Figure 18-38 and Figure 18-39 (below):

Crusher 110-CR-01

The Crusher will accept the -300 mm feed from the conveyor from underground and the recycled Ore from the conveyor 100-CV-007.

Primary Screen 100-SC-001

1,800 mm x 4,800 mm inclined at 20°, with:

- Top Deck Woven Wire Mesh with 75 mm opening
- Middle Deck Woven Wire Mesh with 48 mm opening
- Bottom Deck Woven Wire Mesh with 20 mm opening

The screen will be provided with chutes as follows:

- Oversize Chute 100-CH-004 to feed the +75 mm ore to Recycle conveyor 100-CV-007
- 46.7 to 75 mm Chute 100-CH-005 to feed Sorters 100-SO-001.
- 46.7 mm to 18.9 mm Chute 100-CH-006 to feed Sorter 100-SO-002
- Screen Underpan 100-CH-003 to feed the -18.9 mm to Conveyor 100-CV-006

Two Steinert KSS-520-200 Ore Sorters 100-SO-001 & 100-SO-002

The Sorters will have a compressor to actuate the diverting mechanism to “Accept” or “Reject” the ore. The Sorters will be housed within the Screen/Sorter house in a closed of area to avoid the dust created by material transfer. Each Sorter will be provided with the following Chutes:

- “Accept” Chutes 100-CH-007 & 008 to feed the “Accept “Ore to Conveyor 100-CV-002
- “Reject” Chutes 100-CH-009 & 010 to feed the “Reject “Ore to Conveyor 100-CV-003

The "Accepts" Conveyor 100-CV-002

The conveyor (600 mm wide, 100.9 m long) will be supported by a doghouse style gantry with a 600 mm wide walkway to one side the gantry will be supplied in 12 metre sections. Each section will be supported from the ground by a lattice braced trestle. The Conveyor will accept and discharge the -75 mm Accepted Ore into the "Accepts" Bunker.

The "Rejects" Conveyor 100-CV-003

The conveyor will be supported by a doghouse style gantry with a 600mm wide walkway to one side the gantry will be supplied in 12 metre sections. Each section will be supported from the Ore Sorter Facility ground by a lattice braced trestle. The Conveyor will accept and discharge the -75 mm "Rejected Ore into the "Rejects" Bunker.

The -18 mm Conveyor 100-CV-004

The Conveyor will accept and discharge the -18 mm from the Primary Screen Underpan 100-CH-003 onto the "Accepts" feed conveyor 100-CV-005.

The "Accepts/Rejects" Bunkers 100-BU-001 & 100-BU-002

Bunkers will be provided to store the "Accepts/Rejects" ore suitably equipped for truck loading. The bunkers will comprise of two sets of two bunkers, each bunker will hold approximately 116m^3 of ore fed by either the "Accepts" conveyor 100-CV-002 or the "Rejects" conveyor 100-CV-003. The bunkers are 5 m square x 8.5 m high with 1 m square outlet. The sloping sides of the bunkers will be provided with 8mm thick UHDPE (Tivar 80 or equal) liners. The outlet is provided with a 1,200 mm wide pivoting chute set at 35 degrees downslope and provided with an electrohydraulic actuator (Elram or equal) to adjust the downslope and promote flow. The chute is lined with UHDPE.

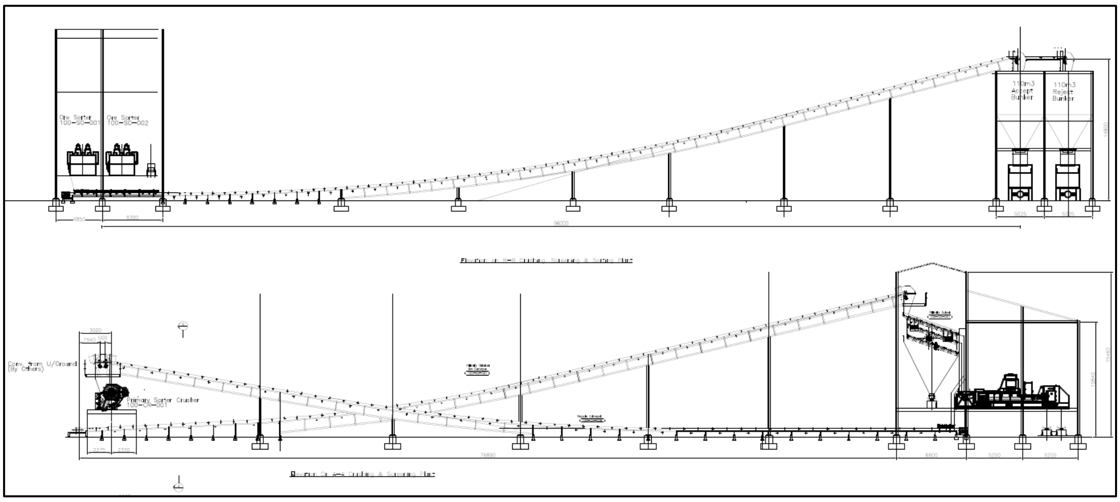


Figure 18-38: 2-ore sorter design – Elevation

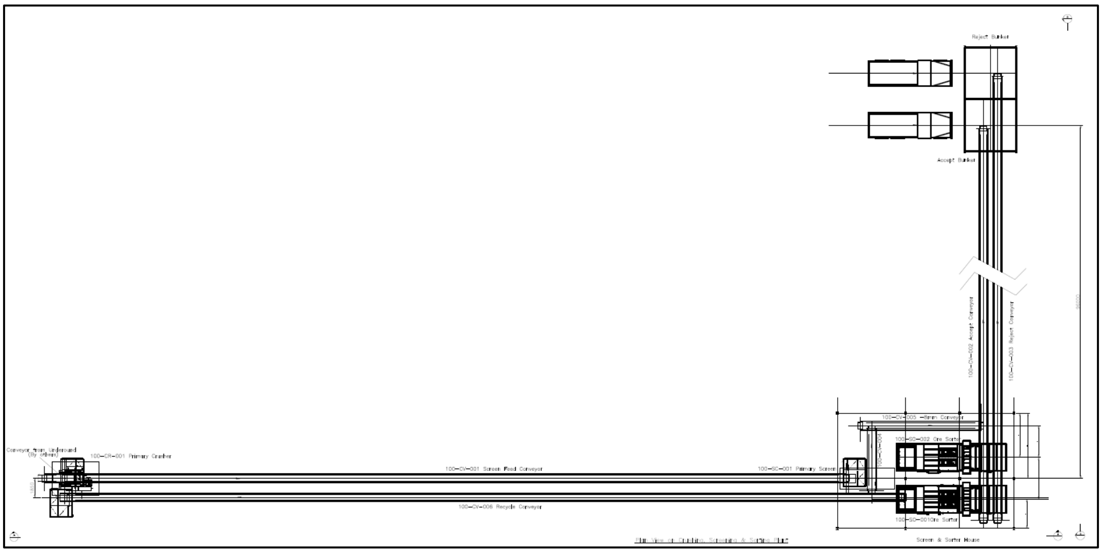


Figure 18-39: 2-ore sorter design – Plan

18.10.5 M&M Surface Infrastructure

Introduction

The surface infrastructure layout is presented in Figure 18-40. The drawing presents the main components of the Project which are:

- Box cut.
- Roads and platforms for infrastructure compounds.
- Mine Facilities Area (MFA).
- Mine maintenance area (MMA).
- Utilities (site wide).
- Ore sorter facility.
- Bulk power infrastructure.

Layout

The layout is shown in Figure 18-40 below.

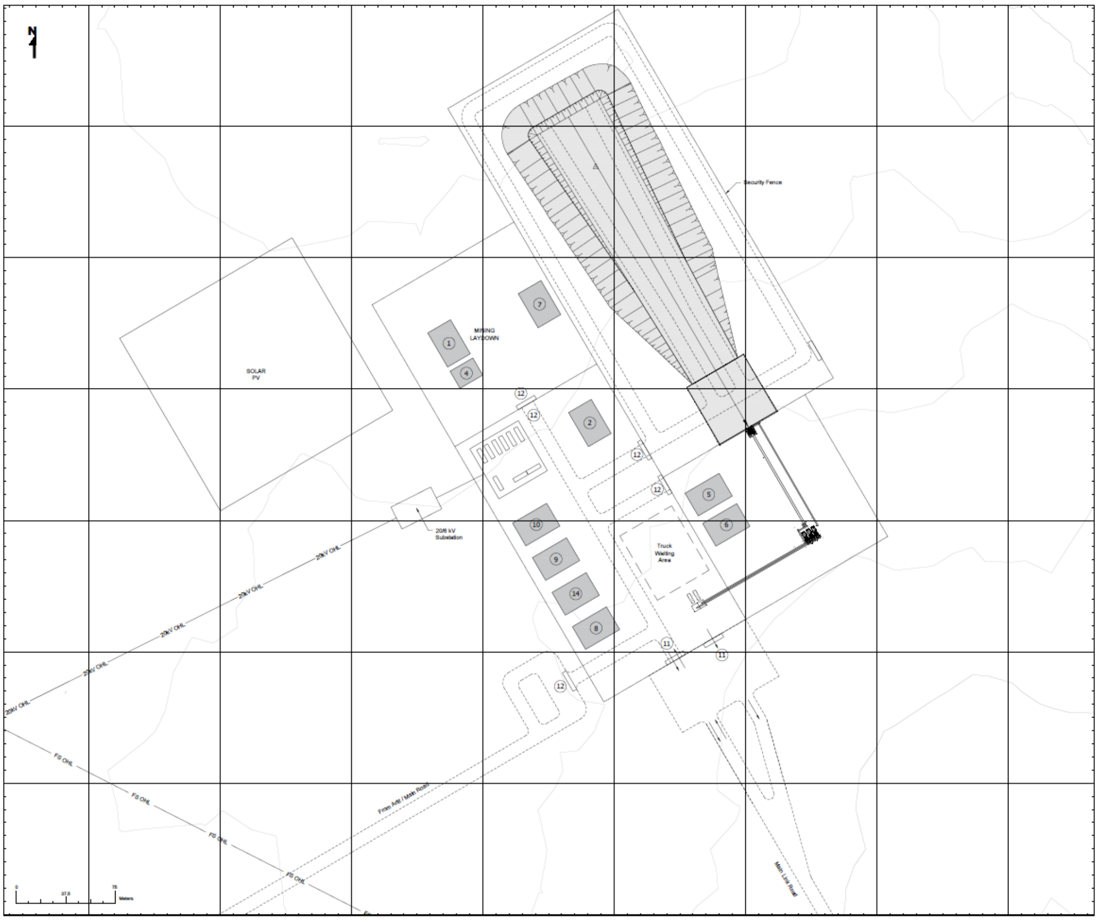


Figure 18-40: M&M surface lay-out (31342-1400-GA-009)

Development Strategy

GoviEx's strategy is to relocate infrastructure and installations from the mine maintenance area at Miriam to M&M infrastructure area and as such, these Miriam buildings and installations are understood to be supplied as prefabricated, modular, and relocatable.

Box Cut

The box cut will be excavated using GoviEx's civil construction equipment and team who are primarily engaged in TSF construction and management. GoviEx intends to divert this team to the box cut area for the 3-month period (as dictated by TSF construction) to excavate 230,000 m^3 of which 80,000 m^3 also requires input from the Explosives Contractor. Once the bulk excavation is completed, the site will be handed to the underground development team for installation of slope support.

Roads & Earthworks

There will be two road types:

- Type A – Main access road
- Type B – Intersite Roads
- Type D - Service / maintenance tracks.

M&M Main Access Road

The main access road is 1,750 m long and links the site to the national road "N25". This will be constructed in year 2 of operations as all construction traffic will be routed via Miriam for control purposes. As per the MLR, it is intended that waste rock will be free issued, crushed, and screened and used as road aggregate. Modification and signage will be required at the intersection with the national road. Exact requirements to be finalised at detailed design stage and to be developed in accordance with standards for highway design.

M&M Intersite & Service Roads

Intersite roads will comprise an unbound gravel pavement.

Service / maintenance tracks will be single lane improved dirt roads. These roads will support the perimeter security systems and maintenance tracks.

Earthworks

Due to terrain, minimal earthworks are envisaged. Given the accuracy of the available topographic survey data (SRTM) and the relatively flat terrain, a 3D estimate has not been attempted. An allowance is made for earthworks cut to fill, clearance, grubbing and removal of any topsoil.

Culverts / Drainage

Drainage around the site will be a network of open v-drains and graded site platforms.

M&M Surface Infrastructure (Mining and General Facilities)

Relocation of Infrastructure

The following infrastructure is intended to be relocated from Miriam once the open pit operations have ceased:

- Workshop (repurposed to u/g equipment);
- MMA Warehousing Building;
- Vehicle Wash (u/g equipment);
- Mechanical Workshop (to service conveyors, crushers, ore sorter)
- Fuel Storage
- MMA Administration (M&M Mining office)
- MMA Crib/Dining Area
- MMA Security entrance control (Main)

Assuming the inspections at the time confirm suitability for relocation, the buildings and installations will dismantled / disassembled, transported, and re-erected at M&M. New civil works will be required. Given the climate and location, some refurbishments are acknowledged as being necessary. These assets are as described for Miriam.

New Infrastructure

The following buildings and areas will be required as new construction:

- MMA Security centre and change house;
- Lamp room;
- Single fuel storage tank to support this work;
- Ore sorter plant warehouse;
- Security checkpoints;
- Fencing and gates;
- Parking area;
- Weighbridge;
- All utilities / services.

Transition (Temporary Infrastructure)

Construction and capital development phase will be supported by a series of prefabricated cabins modular buildings shipped to site from an international vendor to supplement the new infrastructure prior to the Miriam buildings being relocated. The temporary infrastructure will include:

- Temporary workshop and warehousing (shipping containers and fabricated metal roof);
- Temporary Vehicle Wash (tank, concrete pad, collection, and handheld jet wash);
- Temporary offices;
- Temporary Crib/Dining area, welfare, and ablutions; and
- Temporary security entrance controls.

Underground Infrastructure

Maintenance and refuelling bays as well as explosives stores are located underground.

Explosives Storage

The ESF at Miriam will be used for storage. An underground ESF will store minimal amounts of all components of the explosives.

Utilities

Electrical Distribution

MV power will be distributed from the substation at MV and LV distribution voltages to local substations:

- Portal;
- Ore Sorter
- MMA

- MFA
- Installations

It is proposed that the main cable installations would be underground (or within cable racking). The MV distribution in general would be supplied from a series open rings supplying 6.6/0.4 kV prefabricated dry type transformer sub stations and radial feeders for larger loads.

Backup Power Generation

The bulk power supply solution has sufficient generation capacity to ensure 24/7 operations.

Lighting

External LED lighting has been proposed at the following main areas:

- flood lighting to critical areas;
- road and access lighting at junctions; and
- critical and high security facilities.

Floodlighting would be achieved via 10 m masts to provide a low but even distribution.

Roads will only be illuminated at junctions and security check points by traditional road lighting columns fed via feeder pillars.

The lighting would be supplied from a series of dedicated feeder pillars independent from other service supplies. The feeder pillars would be supplied from the service sub stations.

Communications

An allowance has been made for the following site and project wide communications infrastructure:

- Business data network and server/computer systems;
- Voice over IP (VoIP) data telecommunications system within the site;
- Radio over IP (RoIP) for 2-way UHF radio services within the site;
- WIFI throughout mine site primarily for data network access for mobile plant;
- Satellite voice and data communications links;
- Access control system to establish access permissions and a live record of personnel in restricted areas;
- Security and surveillance system to provide area surveillance, detection, and assessment;
- Intrusion and detection alarms for key locations.
- SCADA field units, central control, masts, tower and RoIP system; and
- Control room requirements and systems.

Water Storage & Distribution

Discussed in the water management section (Section 16.13).

Potable / Drinking Water

An above ground potable water tank is proposed to store five (1) days domestic consumption of potable water. Drinking water will be bottled.

Sewerage and Wastewater

The foul water network collects the foul water from the various installations: ablutions, change house, central feed from the plant. The sewage and wastewater will be conveyed via a gravity feed pipeline and manholes to a common sewage treatment plant or sceptic tank system. The sludge within tank will periodically require emptying and disposal at an appropriate waste location.

Fire and Dust Suppression

It is assumed that fire and dust suppression will be undertaken by a water bowser which will be filled at the compounds. Building fire suppression sprinkler systems are proposed within each surface infrastructure building.

Security Strategy

Armed security will be provided by the Niger military to provide a security detail to the Project but will be coordinated by the GoviEx security manager. During capital construction, GoviEx will construct security infrastructure.

Security Infrastructure

Security Infrastructure will comprise:

- Project main gate (main access road);
- Project rear gate (from the mining area);
- Internal compound security posts;
- Perimeter fencing;
- Access control system to establish access permissions and a live record of personnel in restricted areas;
- Security and surveillance system to provide area surveillance, detection alarms for key locations.

18.10.6 MSNE Surface Infrastructure

Strategy

MSNE will go into production in 2037. The infrastructure and facilities required at MSNE will minimum required to facilitate safe operations given the M&M infrastructure and facilities will still operate..

Infrastructure & Utilities

The infrastructure and utilities to remain at M&M will be:

- Ore sorting facility and associated infrastructure;

- Security infrastructure and installations;
- Main administration and welfare, canteen
- Mine maintenance workshops and warehouses.
- Utilities and services.

The infrastructure and utilities to be developed at MSNE will be:

- Security infrastructure and installations;
- Localised administration and welfare
- Utilities and services.

18.10.7 Capital Cost Estimate

Summary & Basis of Estimate

A summary of the costs is presented below (Table 18-27 and Table 18-28):

Table 18-27: M&M Infrastructure Capital Costs

Item	USDM
Mine Link Road	2.6
Bulk Power Supply (OHL, DG, Solar/PV)	13.6
Portal M&M	1.8
Ore Sorter Station	9.0
Support Infrastructure (buildings and installations)	4.1
Surface Utilities	1.1
Access Road (operations)	1.4
Total	**33.7**

Table 18-28: MSNE Infrastructure Capital Costs

Item	USDM
Bulk Power Supply (OHL, DG, Solar/PV)	3.1
Portal M&M	1.8
Support Infrastructure (localised installations only)	1.5
Surface Utilities	0.5
Total	**6.9**

The following is a summary of the basis of estimates:

MLR

Undertaken by a Civil Contractor. Waste rock is free issued to the Contractor for crushing and screening to an aggregate for pavement construction.

Buildings and Installations

Costing used the Miriam FS estimate as a basis.

Ore Sorting Facility

Updated equipment supply costs were sought from Steinert for the ore sorting machines. Other suppliers were contacted for other equipment costs. The 2-ore sorter capital cost is ~USD 9M.

Box Cut Excavation

Civil rates derived for earthmoving at the TSF have been utilised in box cut excavation. The Civil Contractor rates acquired for Miriam plant construction were considered to be more applicable to detailed excavations. The drill and blast cost from the Miriam open pit operations were used.

Power Supply

The cost for M&M power supply infrastructure has used the Miriam FS costs developed from a formal preliminary enquiry process as a basis. E.g. cost / m for overhead line, similar substation, Cost per MW for Diesel Generator plant, Solar and Battery plant. The levelised running cost is considered to be the same.

Excluded

Indirect costs such as Owner's costs and Contingency are included at a project level.

18.10.8 Key Assumptions / Risks / Clarifications

The following are the key assumptions underpinning the design and costs:

- Site trials are undertaken in the in the first 3 years to develop a method specification for placement and compaction of waste rock and to assess deterioration with trafficking. The geotechnical data collected to date suggests waste rock is likely to be broadly suitable as an aggregate but confirmatory work needs to be undertaken.
- Further ore sorter testwork is required to verify throughput and recovery guarantees from the manufacturer for the range of split sizes. Identifying an ore sorter test facility in a country that accepts suitable samples from Niger is currently challenging and is a risk. An alternative option would be to negotiate with a preferred supplier for build a testing unit at the Project. At the time of writing, only Steinert were available for consultation. Chinese suppliers (e.g. HPY Technology, which is understood to now supply outside China) could also be contacted as part of the next study stage.
- A key objective of additional ore sorting testwork would be to extend the ore sorting testwork to material sizes above 50 mm (the current testwork is between -50 mm/+30 mm) but also to confirm the capacity for treating the material less than 30 mm (bottom size and specific machine throughput) and more generally ore sorter capacity outside the size ranges tested.
- The 2-ore sorter design also relies on overall operating hours exceeding 6,500 hours per year for the overall system. The implications being the introduction of parallel ore sorters to treat one of the size fractions at a cost +10 % on the existing capital cost. More testwork is needed.
- The existing testwork reports on the friable nature of the ore which will require a design with minimum transfer points which could cause generation of fines and i.e. increasing the percentage undersize bypassing the ore sorters.

- The box-cut cost included under surface infrastructure is for bulk earthworks excavation only using a GoviEx site civil team mainly employed on sustaining capital development on the DSF. This reduces costs significantly when compared to the civil engineering rate obtained as part of the Miriam construction enquiries. Portal construction works are covered in the mining cost model.
- The Miriam buildings and structures are circa 5-6 years old when M&M begins development. The plan to relocate assumes the Miriam buildings are of sufficient build quality, and suitably maintained, such that relocation with minimal reestablishment is possible. Cost for relocation includes 10 % original cost, for maintenance / refurbishment of structure.
- Temporary Contractor's / Construction infrastructure is sufficient for M&M operations until the relocation is complete.
- That grid power is available as envisaged by GoviEx in the future to meet the needs of M&M / MSNE is an assumption, which is reasonable assuming nearby operations close as planned and within the envisaged timescales but also that the apportionment of capacity at Poste 132 is as envisaged based on information from stakeholder engagement. The implication being that a requirement to rely on a standalone diesel-solar-BESS plant will increase levelised running costs.
- Achieving the proposed power supply cost in USD/kWh is dependent on the fuel price and exchange rate confirmed for the FS study.
- MLR: Waste rock will be free issued to the Contractor for crushing and screening. The waste rock is understood to be geochemically inert and is assumed to be broadly suitable for road construction although more intense maintenance may be required during operations.
- MLR: Only SRTM topography was available because detailed topographic data commissioned for the FS was not available. As such, and given the relatively benign terrain, a nominal cut and fill per metre has been estimated.
- The MLR will operate from sunrise to sunset and is required to support 14 truck passes per hour plus general light vehicle traffic.

19 MARKET STUDIES AND CONTRACTS

This section has been authored by GoviEx personnel and aims to provide an overview of the fundamental principles of the uranium market and how the derived U_3O_8 is sold into the market; transported; and transformed for use in nuclear reactors. As such the following elements will be described in order to:

- Understand the position and role of uranium within the nuclear fuel cycle;
- Analyse U_3O_8 demand with particular reference to the U_3O_8 requirements of the world's Reactors;
- Explain the transformation of U_3O_8 into UF_6 and the role of the Conversion Facilities who provide such a service;
- Summarise the requirements for transportation of U_3O_8 from GoviEx's Madaouela Uranium Project to the Conversion Facilities;
- Examine the contractual relationship between GoviEx as the Uranium Producer and the Conversion Facilities;
- Analyse the uranium market prices and pricing mechanisms.

19.1 Nuclear Fuel Cycle

The "nuclear fuel cycle" includes all nuclear operations ranging from the mining of uranium ore to the reprocessing of spent fuel and the ultimate radioactive waste disposal.

The fuel cycle is made up of a series of processes that manufacture reactor fuel, burn the fuel in a reactor to generate electricity, and manage the spent reactor fuel (Figure 19-1). These processes are grouped into three components, the front end, which includes all activities prior to placement of the fuel in the reactor, the service period, when the fuel is converted into energy in the reactor, and the back end, which covers all activities dealing with spent fuel from the reactor. If the spent fuel is sent to storage, the cycle is referred to as open. If it is reprocessed to recover useful components, it is known as closed. The United States employs an open fuel cycle, while France, Russia, China, and Japan reprocess their spent fuel.

The components of the cycle are organised as follows within this case study.

The Front End

- Uranium Metallurgy, Conversion to Uranium Hexafluoride, and Fabrication of Fuel Rods
- Uranium Enrichment

The Service Period

- Nuclear Reactors

The Back End

- Reprocessing Spent Fuel
- Nuclear Waste

Figure 19-1 below, identifies the key process steps required for both the Front End and Back End activities within the nuclear fuel cycle. (European Nuclear Society, 2003).

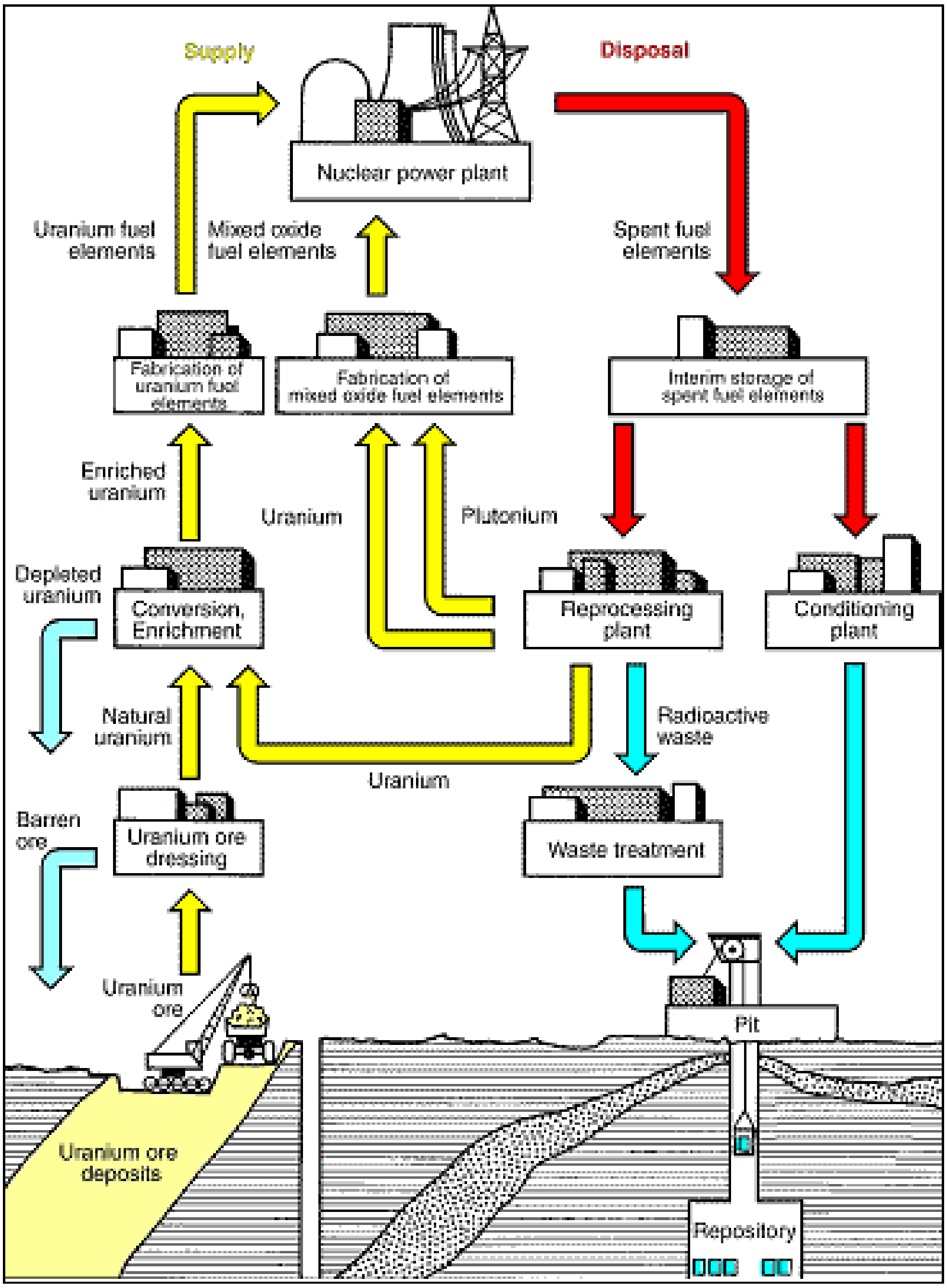


Figure 19-1: Key process steps required for front end and back end activities within the nuclear fuel cycle

The ' front-end' of the cycle begins with the extraction of the uranium ore by mining, and then,

- It is milled to refine the material to U_3O_8. The U_3O_8 is packed in a 55 US gallon drum (UN 1A2W) which are then transported from the mill to a UF_6 Conversion facility.
- Once the U_3O_8 has been converted to UF_6 at the Conversion Facility it this then transported to an Enrichment facility.

- At the Enrichment facility the U-235 isotope is concentrated from 0.711 % up to a maximum of 5 %.
- Following Enrichment, the EUP (Enriched Uranium Product) is produced which is transported to a Fuel Fabrication facility where the fuel that powers the Reactor is manufactured
- The nuclear fuel is transported from the Fuel Fabrication facility to the utility site where it is loaded into the Reactor to generate electricity

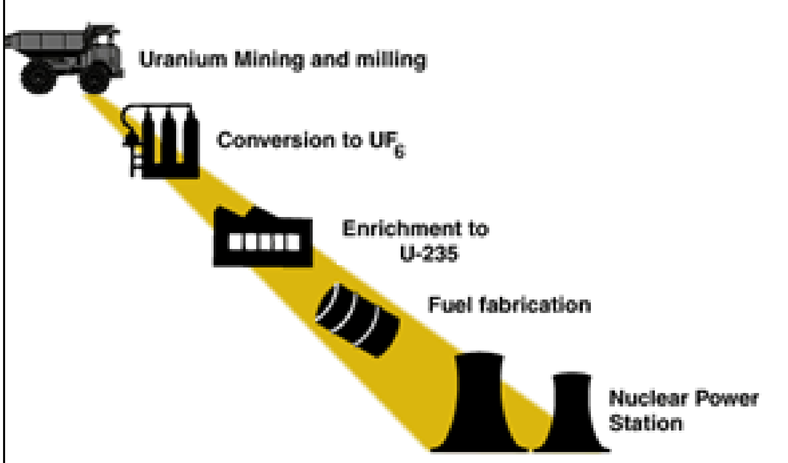


Figure 19-2: Front end fuel cycle

After three years of electricity production, nuclear fuel is removed from the Reactor and undergoes further steps including temporary storage, reprocessing, recycling and eventually disposal. This is commonly known as the Back End of the nuclear fuel cycle.

19.2 Uranium Market

19.2.1 Demand

According to the World Nuclear Association updated September 2021:

- The world will need significantly increased energy supply in the future, especially cleanly-generated electricity.
- Electricity demand is increasing about twice as fast as overall energy use and is likely to rise by more than half to 2040.
- Nuclear power provides about 10 % of the world's electricity, and 18 % of electricity in OECD countries.
- Almost all reports on future energy supply from major organisations suggest an increasing role for nuclear power as an environmentally friendly way of producing reliable electricity on a large scale.

A key advantage of nuclear is its ability to provide reliable and economic base-load power on a near zero-carbon full life-cycle basis. For example, it is worth mentioning that in the US alone, nuclear energy currently provides around 55 % of the country's carbon-free electricity, and in the European Union it accounts for 53 % of the region's carbon-free electricity.

In 2018 the world's nuclear power plants supplied 2,563 TWh of electricity through 396 GWe of operable capacity. This avoided the emission of 2.2 billion tonnes of carbon dioxide compared to the equivalent amount of coal power generation. Nuclear power also avoids the emission of pollutants including oxides of sulfur and nitrogen and is therefore favoured by some countries as a solution to combat air pollution.

In the future, nuclear energy could contribute substantially more given the expectation of rapidly rising electricity demand and the changes in energy consumption. The transport sector offers great potential with electric vehicles, and programmes to implement higher use of passenger electric vehicles are under way in numerous countries worldwide. Apart from electricity generation, nuclear represents a credible low-carbon source of process heat for various applications, such as district heating, water desalination, oil and chemical refining, and hydrogen production.

Table 19-1: World Nuclear Association nuclear capacity scenarios for 2040, GWe (WNA 2021)

Mid 2021 (GWe)	Case	Forecast (GWe)	Variance
	Lower	449	+14%
394	Reference	615	+56%
	Higher	839	+113%

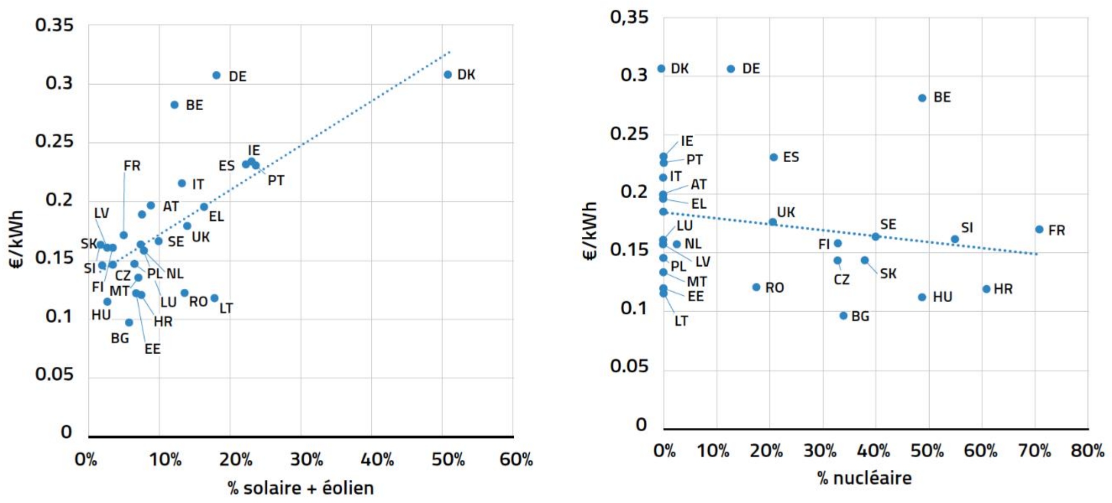
The drivers for the World Nuclear Association scenarios embrace broader changes than climate change policy alone. The Reference Scenario is largely a reflection of current government policies and plans announced by utilities for nuclear in the next 10-15 years, which (with a few significant exceptions) are generally rather modest.

In the IEA's World Energy Outlook 2020 it is noted that achieving the pace of CO_2 emissions reductions in line with the Paris Agreement is already a huge challenge, as shown by their Sustainable Development Scenario. The IEA noted that it requires large increases in efficiency and renewables investment, as well as an increase in nuclear power. This report identifies the even greater challenges of attempting to follow this path with much less nuclear power. It recommends several possible government actions that aim to ensure existing nuclear power plants can operate as long as they are safe, support new nuclear construction and encourage new nuclear technologies to be developed.

Countries envisaging a future role for nuclear account for the bulk of global energy demand and CO_2 emissions. Nonetheless in many jurisdictions nuclear power has trouble competing against other, more economic alternatives, such as natural gas or modern renewables. Concerns over safety and broader public acceptance remain obstacles to development. With nuclear power facing an uncertain future in many countries, the world risks a steep decline in its use in advanced economies that could result in billions of tonnes of additional carbon emissions.

Nuclear power plants contribute to electricity security in multiple ways. Nuclear plants help to keep power grids stable and can be a good complement in decarbonisation strategies since, to a certain extent, they can adjust their operations to follow demand and supply shifts. As the share of variable renewables like wind and solar photovoltaics (PV) rises, the need for such services will increase.

In a recent report “Road to EU Climate Neutrality by 2050”, authored by the ECR Group and Renew Europe in January 2021, it was reported under their key takeaways that with respect to both spatial requirements (area of land required) and costs of electricity, nuclear power provides further advantages over renewable energy. The cost advantage of nuclear energy increases once system costs are added and power increases further with higher penetration rates of renewable energy as highlighted by the figures below for Europe.



Price of electricity (household)

From: Prof. Samuel Furfari, Uinversite Libre de Bruxelles, 2019. *Source: Eurostat (Dec 2018)*

Figure 19-3: Europe cost of power based on percentage solar and wind, and nuclear energy

Table 19-2: Average power generation by area by energy source for Europe

	Average GWh / km²		Indexed to Nuclear (i.e. nuclear produces x times more electricity per km²)	
	NL	CZ	NL	CZ
Onshore Wind Land	13	13	534	534
Onshore Wind Water	14	n/a	506	n/a
Offshore Wind	26	n/a	266	n/a
Solar Roof	136	163	51	43
Solar Land	47	65	148	108
Nuclear	6,982	6,982	1	1

Beyond the historical large-scale reactors that have been under construction since the early nuclear renaissance that began from the 1950s, where reactors sizes grew from 60 MWe to more than 1,600 MWe, focusing on economies of scale, there has been an increasing focus on the development on Small Modular Reactors (SMRs).

SMRs are defined as nuclear reactors generally 300 MWe equivalent or less, designed with modular technology using module factory fabrication, pursuing economies of series production and short construction times.

Today, due partly to the high capital cost of large power reactors generating electricity via the steam cycle and partly for the need to service small electricity grids under about 4 GWe, there is a move to develop smaller units. These may be built independently or as modules in a larger complex, with capacity added incrementally as required.

Economies of scale are envisaged due to the numbers produced. There are also moves to develop independent small units for remote sites. Small units are seen as a much more manageable investment than big ones whose cost often rivals the capitalization of the utilities concerned.

An additional reason for interest in SMRs is that they can more readily slot into brownfield sites in place of decommissioned coal-fired plants, the units of which are seldom very large – more than 90 % are under 500 MWe, and some are under 50 MWe. In the USA coal-fired units retired over 2010-12 averaged 97 MWe, and those expected to retire over 2015-25 average 145 MWe.

Generally, modern small reactors for power generation, and especially SMRs, are expected to have greater simplicity of design, economy of series production largely in factories, short construction times, and reduced siting costs. Most are also designed for a high level of passive or inherent safety in the event of malfunction. Also, many are designed to be emplaced below ground level, giving a high resistance to terrorist threats.

19.2.2 Primary Supply

The supply of uranium is provided from two sources, the first and primary source is mined production and the second is from secondary sources such as inventory and enrichment tailings upgrading.

For 2022 the WNA is reporting that annual uranium demand is forecast to be 172 Mlb U_3O_8. In 2021, the WNA cites annual primary production as 125.6 Mlb U_3O_8 and in addition secondary supplies of 27.3 Mlb U_3O_8 for a total of 152.9 Mlb U_3O_8. Primary production was at approximately 73 % of annual demand down from 94 % in 2012.

In November 2017 Cameco Corporation announced the closure of its McArthur River/Key Lake uranium mine in Canada, with regulated annual production rate of approximately 18 Mlb U_3O_8, until such time as uranium spot and term prices recovered to a level appropriate with their corporate strategy. This is assumed to be a price of USD45 to USD50/lb U_3O_8. While McArthur River/Key Lake was on care and maintenance Cameco would meet its long term contractual commitments through uranium purchases on the spot market, thereby potentially drawing down on global inventory.

In December 2017, the largest global uranium producer Kazatomprom, accounting for about 40 % of annual global production, announced that it would reduce annual production by 20 %, compared to planned levels under Subsoil Use Contracts, over three years from January 2018, and in August 2021 extended the "flex down" of production by 20 % through 2022

During 2020, the uranium mining industry was impacted by Covid with Cameco closing the Cigar Lake mine for some months, restarting in 2021. Kazatomprom halted all ISR wellfield development for a period of six months. The production halts focused the major producers to purchase production shortfalls from the spot market.

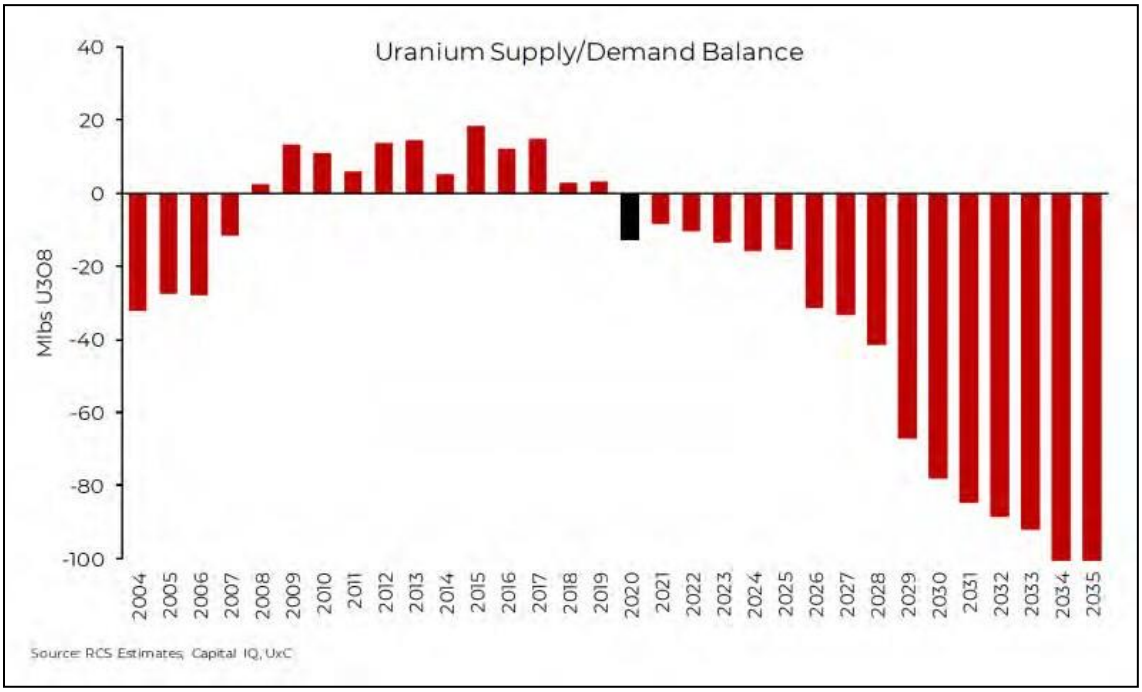


Figure 19-4: Supply/demand deficit forecast increase without new production

At the beginning of 2021 the Ranger mine in Australia closed due to resource depletion, and at the end of March 2021 the COMINAK mine in Niger was finally closed down. These two mines will account for the loss of 6 Mlb U_3O_8 from primary supply.

In February 2022, Cameco announced that McArthur River would gradually re-start late in the year, ramping up to 15 Mlbs per year in 2024. But a number of other uranium mines, at time of authoring, remain on standby/ care and maintenance including Langer Heinrich in Namibia, Honeymoon in Australia, and Alta Mesa, White Mesa, Willow Creek and Cameco's projects in the USA.

Ux Consulting Company LLC (UxC) estimates that approximately 70 % of global production has a cost in excess of USD 30 per pound U_3O_8 and 20 % with costs over USD 40, and with an increasing supply deficit higher cost production must be brought online to offset declining inventories and reserve depletion. Producers and developers will not risk capital to bring on idle capacity or construct new projects until uranium prices recover. In recent months, however, the spectre of high inflation threatens to increase costs of mining materials and inputs, and thus will inflate the cost of production in the uranium sector.

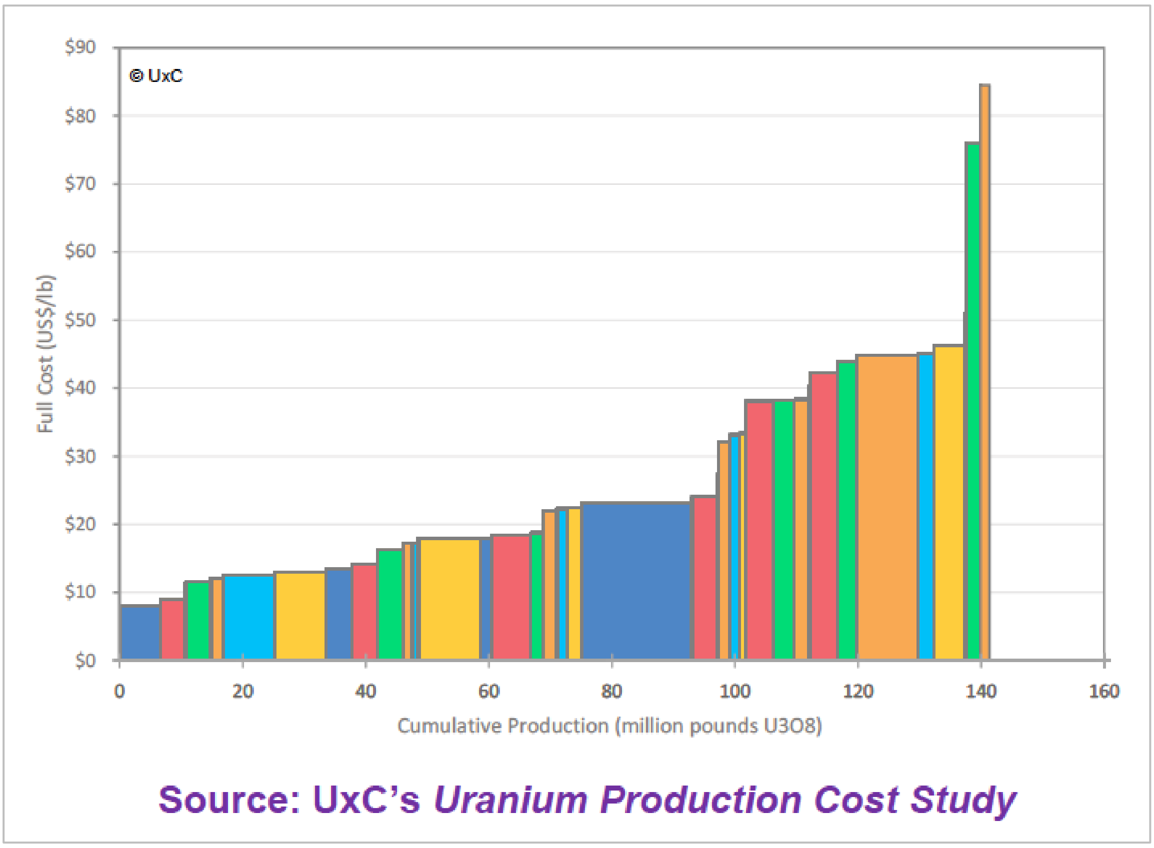


Figure 19-5: Production costs

19.2.3 Secondary Supplies

There are several sellers in the uranium market that are supplied by various sources of inventory. This inventory is in the form of U_3O_8, UF_6, and EUP. Secondary sales are forecast to decline through declining inventories and reducing enrichment capacity.

Table 19-3: WNA Reference Scenario Secondary Supplies (tU equivalent)

	2021e	2025e	2030e	2035e	2040e
US DOE	320				
Global ERU/MOX	2,250	2,810	3,850	4,660	4,660
Global underfeeding and tails re-enricher	7,930	6,080	2,240	2,460	1,920
Additional Russian secondaries					
Total	10,500	8,890	6,090	7,120	6,580
% Global Reactor Demand	17%	13%	8%	8%	6%

Source: WNA

The secondary sources are varied and comprise the following:

- MOX and RepU – Mixed oxide fuel (MOX) is a combination of plutonium oxide recovered from spent fuel and new uranium oxide from DU (a “waste” product of the fuel enrichment), while reprocessed uranium (RepU) involves the removal of uranium and plutonium from spent fuel to fabricate new fuel. Although these two fuel sources have been used for many years, the contribution has been quite low (approximately 5 % of total uranium supply).

- US/USEC Government Stockpile Sales – Government strategic stocks that have been deemed surplus. Some of this material is sold through the United States Enrichment Corporation (USEC), a public company that was previously a government organisation. In 2008, the US Department of Energy (DOE) released its Excess Uranium Inventory Management Plan that provided details regarding the US government's plans to dispose of its excess uranium inventories. These inventories, totalling 153 million pounds, were built up over decades primarily through enrichment activities, weapons programs, and the US-Russian HEU (highly enriched uranium) program. The uranium is in various forms, some of which are readily saleable, whereas others require substantial processing to bring to commercial reactor standards. The DOE sales were halted in 2019.

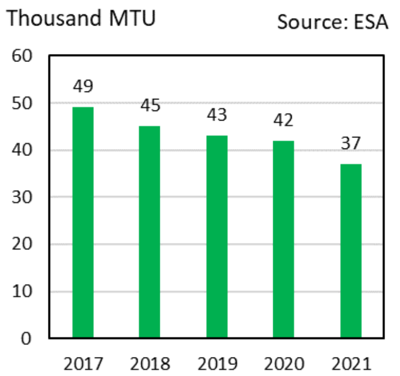
19.2.4 Outlook 2022 Onwards

Since 2011 the key impact on primary uranium demand was excess inventories throughout the supply pipeline. Increasing nuclear energy production and primary uranium supply constraint has resulted in declining inventories. The uranium miners have reduced their inventories to just in time levels through supply reductions, sell down of surplus inventories, on-market purchases and in the case of Kazatomprom sale of its surplus inventory to financially fund Yellow Cake.

Utility inventories have been declining as long term contracts have unwound, and utilities have undertaken active inventory control. This has been compounded by uncertainty associated with geo-political factors, especially affecting the USA, including the Iran Sanctions, Russia Suspension Agreement, and Section 232/Nuclear Fuel Working Group. During 2020 and into the start of 2021, the utilities were affected by Covid, which while it reduced nuclear energy generation by approximately 4 % in 2020, resulted in suspended mine production, a uranium price uptick and a decline of between 20-30 % of annual purchases.

In 2022, the uranium spot price has risen significantly owing to the geopolitical instability prevailing in the RSOI, and the purchasing activities of SPUT. On top of this, the longer term outlook for nuclear has been boosted by multinational policy moves to decarbonize the world's electricity generation, and to bolster energy security in uncertain times. Such nations as France and South Korea have held presidential elections in 2022, and the winning candidates have declared their intention to support significant nuclear energy build in the future. Furthermore, USA, UK, Japan and Netherlands have all pivoted towards providing financial and legislative support for future nuclear growth, while Belgium is in the process of negotiating lifetime extensions of two nuclear units. In addition, China plans to expand nuclear generation capacity threefold in the next twenty years, in order to promote clean electricity and provide energy security, which means that the outlook for world nuclear energy growth is very bright.

European Uranium Inventories



US Uranium Inventories

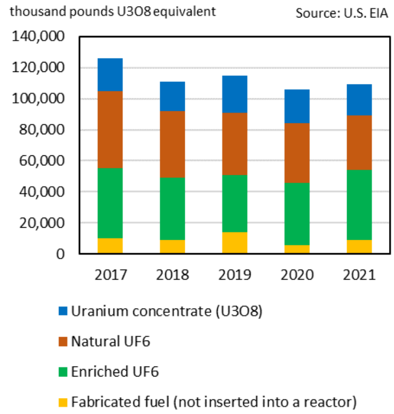
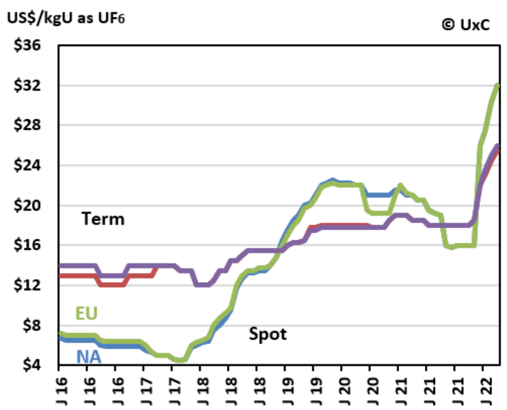


Figure 19-6: European and US inventories have declined over recent years

Conversion and enrichment markets have also been impacted by the rising price and increasing concerns on conversion and enrichment capacity medium to long term.

Conversion Prices



SWU prices improving

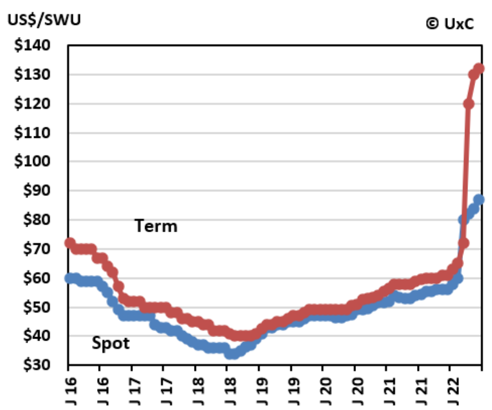


Figure 19-7: Conversion costs and SWU prices have been increasing since 2018

The increasing supply constraints, geopolitical disruptions, significant fund purchasing and declining inventories have been reflected in the improving uranium price. Based on history alone, uranium prices can make huge swings when future production levels are uncertain due to the long lead times required to bring new projects online. Since the actions taken by Cameco and Kazatomprom to constrain supply, plus the events this year in the RSOI, the uranium price has responded positively.

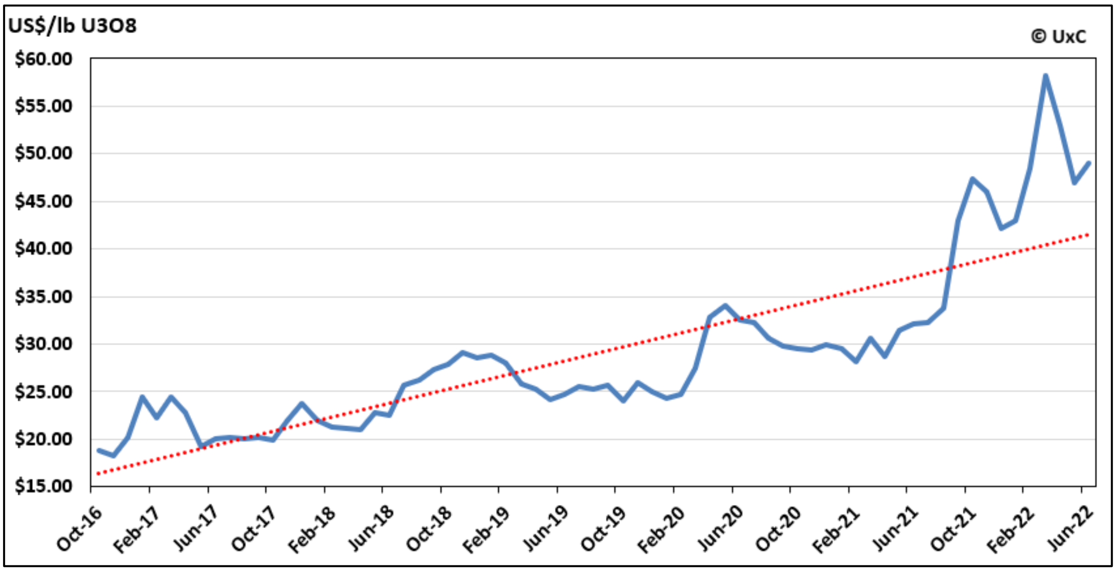


Figure 19-8: Uranium spot price quoted by UxC

Ux in its 2nd quarter 2022 Uranium Market Outlook forecast is also expecting the uranium long term contract price to remain well above the lower levels experienced in in 2020/ 2021.

UxC Annual Long-Term Base Price Projections, 2025-2035 (Then-Current US$/lb U3O8)											
Scenario	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
High Long-Term Base	$65.89	$69.58	$74.85	$81.05	$85.27	$90.65	$93.12	$95.47	$98.10	$99.75	$101.12
Mid Long-Term Base	$59.42	$63.10	$67.21	$68.99	$72.58	$76.49	$80.41	$82.75	$84.57	$87.56	$88.30
Low Long-Term Base	$54.18	$56.68	$59.53	$62.77	$64.24	$66.72	$67.27	$68.15	$69.84	$71.18	$73.03
Composite LT Base	$60.04	$63.44	$67.59	$70.99	$74.26	$78.26	$80.94	$82.93	$84.96	$87.17	$88.35

Figure 19-9: UxC forecast uranium price (Q2 2022)

19.3 Conversion Facilities

Globally there are seven Conversion Facilities that have the capability to convert U_3O_8 into UF_6. Table 19-4 below, shows the capacity and estimated annual production of each of the Conversion Facilities.

Table 19-4: Conversion Facilities

Conversion Facility	Nameplate Capacity tU as UF6
Cameco, Port Hope, Canada	12,500
Rosatom, Seversk, Russia	12,500
Orano, Comurhex, France	7,000
ConverDyn, USA (Honeywell)	15,000
CNNC China	15,000
Total	**62,000**

Source Data: WNA – The Global Nuclear Fuel Market – Supply and Demand 2019 - 2040

Cameco (Canada): Cameco's Conversion method is split between two processing plants. U_3O_8 is delivered to Cameco's Blind River facility in Ontario, Canada where it is refined to UO_3. The UO_3 is then transported to Cameco's Port Hope facility, where it is converted to UF_6.

Rosatom: Currently conversion in Russia is consolidated at the Siberian Group of Chemicals Enterprises at Seversk, in the Tomsk region. The site also has enrichment facilities. Rosatom supplies a full range of nuclear fuel cycle products to the global market. Conversion is exported mainly in the form of bundled products, in the form of fuel assemblies sold by TVEL and enriched uranium product (EUP) sold by TENEX.

Orano (France): Orano conducts conversion via a two-stage process at its Comurhex industrial plants at Malvesi and Tricastin sites in France. U_3O_8 is converted to UF_4 at Malvesi, and the UF_4 is then transported to Tricastin for final conversion to UF_6.

ConverDyn (Honeywell Metropolis Works, USA): The Honeywell Metropolis works is situated in Metropolis, Illinois, USA. The Conversion Facility is owned by Honeywell but it is operated by ConverDyn and is the only U_3O_8 to UF_6 Conversion Facility in the USA. This facility and has been operating since 1958. ConverDyn's ownership structure is 50 % Honeywell and 50 % General Atomics based in Denver, Colorado, USA. ConverDyn manage all aspects of the Conversion process including U_3O_8 deliveries, sampling and storage.

CNNC: CNNC has its own conversion facilities at Lanzhou and Hengyang sites, which not only aim to meet UF_6 requirements for domestic usage, but also for the supply of Chinese reactors built abroad.

19.3.1 Contracts with the Conversion Facilities

Deliveries to a Conversion Facility can be made by physical delivery or by Book Transfer. In order to maximise the sales opportunities relating to the U_3O_8 mined from the Madaouela Uranium Project, it will be essential for GoviEx to have the ability to physically deliver its U_3O_8 to the Conversion Facilities of ConverDyn, Cameco and Comurhex.

As such, GoviEx will need to enter into a weighing, sampling, analysis and storage contract, in order for a U_3O_8 holding account to be established in the name of GoviEx (U_3O_8 Holding Account) with each of the aforementioned Conversion Facilities.

The Conversion Facility is responsible for the management of its customers U_3O_8 Holding Accounts, which includes the administration process for crediting and debiting U_3O_8 transactions. Typically, U_3O_8 Holding Account statements are issued by the Conversion Facility on a quarterly basis.

In general, the Conversion Facilities do not offer their customers the ability to physically withdraw U_3O_8 and UF_6 from their U_3O_8 Holding Accounts; it can only be Book Transferred between customers who have U_3O_8 Holding Accounts at the same Conversion Facility.

19.3.2 Weighing, Sampling, Analysis and Storage of U_3O_8

Prior to any physical delivery of U_3O_8, a Producer will be required to enter into a contract with a Conversion Facility for the weighing, sampling, analysis and storage of U_3O_8. Dependant on the particular Conversion Facility, the terms and conditions within such contract will include but not be limited to:

- The Producers obligation to provide a U_3O_8 delivery schedule each year;
- The conditions of delivery for example, packaging, loading, marking, labelling, emergency response, shipping documentation;

- The Conversion Facilities weighing and sampling process;
- The specification of the U_3O_8 that will be accepted at the Conversion Facility for Conversion without surcharges. The specification for each Conversion Facility may vary slightly but will broadly be in line with ASTM specification C967-13 Standard Specification for Uranium Ore Concentrates;

19.4 Physical Delivery of U_3O_8

It is the responsibility of the party physically delivering the U_3O_8 (usually the Producer) to pay for the transportation to the Conversion Facility.

A percentage of the total U_3O_8 delivery quantity will be credited to the U_3O_8 Holding Account on the date of delivery. The U_3O_8 is then weighed and analysed by the Conversion Facility to confirm its acceptance. This analysis can take up to one hundred days. Once completed the balance of U_3O_8 will be credited to the U_3O_8 Holding Account. A fee may be charged for this service, particularly if there are any surcharges imposed by the Conversion Facility relating to impurity concentration levels. These charges vary depending upon the terms and conditions negotiated in the contract.

Title to the U_3O_8 will remain with the U_3O_8 owner (usually the Producer) until it is sold. Risk of loss and damage will transfer to the Conversion Facility upon physical delivery of the U_3O_8 at the Conversion Facility.

19.5 Book Transfer Delivery

When a customer agrees to purchase U_3O_8 from a Producer (or other supplier), the customer will expect to receive delivery by means of Book Transfer. This transaction will appear as a credit in the customers U_3O_8 Holding Account and a debit in the Producers account at the Conversion Facility.

Title passes from the seller to the buyer on the date the U_3O_8 is Book Transferred. Risk of loss and damage remains with the Conversion Facility.

It is standard practice for a Conversion Facility to impose a charge for Book Transferring U_3O_8. The only exception is if the buyer is a Conversion customer of the Conversion Facility.

Normally the seller will provide a Book Transfer notice document around ten working days prior to the required delivery date to instruct the Conversion Facility to effect the Book Transfer from one U_3O_8 Holding Account to another.

19.6 Transport to Market

It is proposed that deliveries will be made by road from the operating facilities south through Niger and across the border into Benin, and shipped out of the Port of Cotonou using a container shipping line.

A Nigerien trucking company familiar with the regulations for radioactive transport will be used for the road transportation through Niger into Benin to the Port of Cotonou.

The current proposed transport scheme is one that has been established for several years and improved upon year on year. When GoviEx's shipments commence, it will be prudent to ensure the route is well managed to maintain the ability to transport the U_3O_8 to Conversion Facilities in order to support sales to customer.

Great emphasis is placed on security to ensure the requirements of the Nigerien Government are met. Military escorts will be present with every convoy. Typically there will be two different escorts present with each convoy.

Presently, U_3O_8 transports in Niger are carried out in convoys of less than fifteen trucks for security purposes. If there is a requirement to transport a larger number of trucks, different security provisions will apply.

There are three escort trucks per consignment of ten twenty foot (20ft) isofreight containers (ISO's). The road transport from the Arlit area to the Port of Cotonou takes between five to six days. The road transport will only take place during daylight hours, therefore trucks will stay overnight at five specific and pre- agreed secure locations enroute to Cotonou.

The roads in pats of this region are in poor condition therefore specialist equipment will be made available such as cranes and tow trucks to get the trucks back on the road if they experience problems enroute.

19.6.1 Sea Freight from Cotonou to Europe and USA

The sea freight of the ISO's from Cotonou and Europe or the USA will be carried out by a scheduled liner service. The shipping of radioactive material by sea must be carried out in accordance with the rules and regulations of the International Maritime Dangerous Goods Code 2012 edition or latest version thereof.

The shipping line currently used for sea freight of U_3O_8 from Cotonou is CMA CGM. This company operates two routes into European ports including Le Havre in France. From Le Havre, the ISO's can be discharged for onward delivery to the Comurhex Conversion Facility or alternatively the ISO's could be routed from Le Havre to Antwerp when they can be shipped to North America for delivery to the Conversion Facilities of ConverDyn and Cameco.

Quotations were provided that covered transportation costs from the Madaouela Project in Arlit to Comurhex in France and ConverDyn in the USA. The costs were quoted at USD 30,000 and USD 34,000 per 20 ft ISO container. There is assumed to be 15 tU in U_3O_8 (approx. 40,000 lbs U_3O_8) in each 20 ft ISO container. This results in an average transport cost of USD 0.80 per pound U_3O_8 from Arlit to final conversion destination.

19.6.2 Radiation Protection

It is a requirement of the Transport Safety Regulation TD-R-1, 2005 Edition that a Radiation Protection Programme is put in place for all transport of radioactive material. The final company chosen for uranium transportation will have to follow the regulations set out by the World Nuclear Transport Institute (WNTI) who publish documents that detail best practice in the nuclear transport industry. Transportation companies will be required to use these WNTI publish documents in conjunction with their own procedures to ensure that all regulatory requirements are met or exceeded with regard to radiation protection.

19.7 Spot and Term Markets

When selling a commodity dependent upon strategy and available inventory, a supplier may look to sell into the spot market or the long term market. Spot sales are those where terms and conditions are agreed for a delivery in less than three months (Spot). A long term sale (Term) is one where the terms and conditions are agreed for a delivery in greater than twenty four months and a mid-term (Mid) sale is between the three months and two years.

19.8 Market Publications

In the Uranium market there are two trade publications that are commonly used as price reference points in U_3O_8 sales contracts: Ux Weekly published by the Ux Consulting Company LLC (UxC); and the Nuclear Market review published by TradeTech LLC. Both issue a weekly U_3O_8 Spot price and a Term month end price.

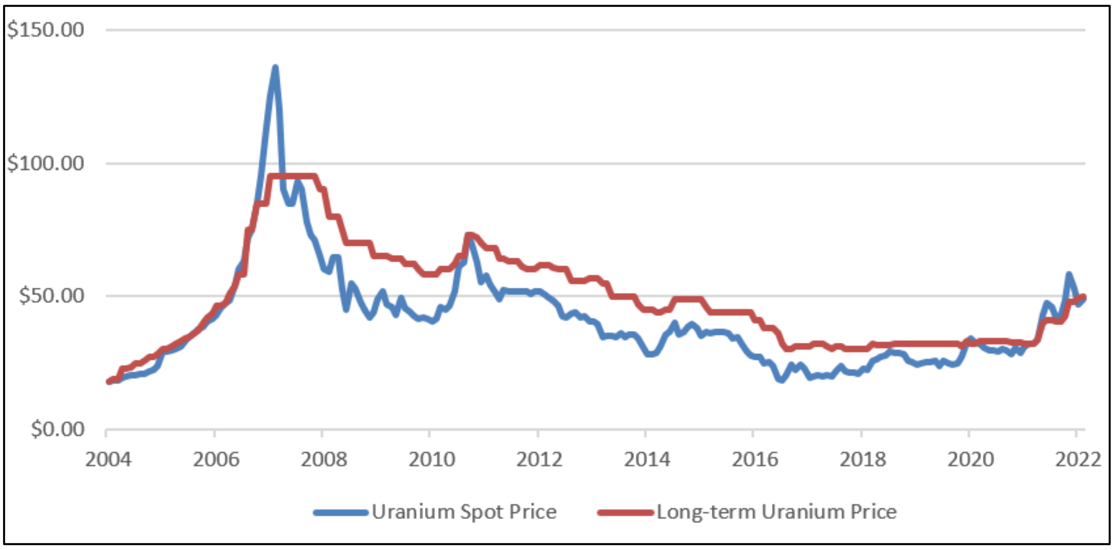


Figure 19-10: Spot versus Term price (2004 – 2022)

19.9 Pricing Mechanisms

There are a variety of pricing mechanisms that can be used when negotiating and concluding a contract for the sale of U_3O_8, in general there are three mechanisms that are favoured by the industry;

1) Fixed Price;

2) Market Related Price; and

3) Hybrid Price.

19.9.1 Fixed Price

Fixed pricing can also be divided into two categories:

1) Fixed price which is not subject to escalation; and

2) Based price escalated.

A fixed price contract is where the buyer and the seller agree to a specific price, which is not escalated by inflation indices. This type of pricing has been typically used for Spot or Mid sales, however more recently, buyers are now requesting fixed prices for longer term contracts.

Fixed pricing can be advantageous to the buyer and seller as both can easily forecast and measure cash flows, budgets and material inventory prices.

A base price escalated mechanism is traditionally used for longer term contracts. The base price is agreed and fixed in a contract between the buyer and seller and is escalated in line with an agreed escalation factor, the starting date of which is also agreed. A commonly used escalation factor is the US Gross Domestic Product Implicit Price Deflator (GPDIPD). The GPDIPD is one measure for the US annual inflation rate and is typically used in the nuclear industry.

Base price escalated approach has an element of unpredictability, but since the commonly used escalation factor or GPDIPD is used, it is unlikely that a huge variance will be seen year on year.

19.9.2 Market Related Price

Market related pricing is usually based on the Spot or Term price (as published by UxC and TradeTech or an average of both) near or at the time the delivery of U_3O_8 takes place. For Term contracts, it is not unusual for a seller to offer a buyer an agreed percentage discount against the Term price.

Market related pricing ensures that the purchase price will be more in line with the market conditions at the time of the purchase, but overall it gives a greater level of uncertainty for the buyer and the seller. This uncertainty can be mitigated somewhat by the use of price floors and ceilings, whereby the floor price protects the seller and the ceiling price protects the buyer. The level of at which the floor and ceiling prices are fixed will depend on the market conditions at the time of contract negotiations.

19.9.3 Hybrid Price

In recent years buyers have looked at ways to optimise pricing mechanisms especially for Term contracts. As a result, hybrid prices have been agreed which is a combination of both the fixed price and market price mechanisms. The percentage split between the two varies and is negotiated between buyer and seller. For example a Term sales contract could have 60 % of the annual quantity delivered using a fixed price mechanism and 40 % delivered using a market related price mechanism.

19.10 Yellow Cake Sales and Marketing

GoviEx is predominantly an exploration and mine development company and will contract out the logistics of its uranium deliveries to specialist nuclear transport companies. However, the marketing and sales of its U_3O_8 will be performed in-house.

The GoviEx Marketing Team will undertake a number of activities on behalf of Madaouela Uranium Project, with an overall approach of structuring GoviEx's sales and delivery to maximise return o However, n uranium sales through a blend of Spot and Term contract, based on appropriate pricing structures.

The marketing team will develop a marketing and sales strategy for presentation to GoviEx. The intent of the marketing and sales strategy will be to establish:

1) when and how much U_3O_8 will be available for sale;
2) the terms and conditions for such sale;
3) the market conditions, to leverage contract size to obtain prices favourable with respect to the market;
4) the appropriate length of supply contracts to balance customers' security of supply requirements with optimal timing of GoviEx production; and
5) a list of potential customers ranging from utility end users to traders and intermediaries.

The marketing and sales strategy will be continually reviewed to anticipate and accommodate any change in market dynamics. The Marketing Team will work closely with GoviEx to understand the U_3O_8 production forecasts for future sales activities based upon planning information received from GoviEx. Based on market demand for U_3O_8 requirements, the marketing team will approach potential customers and negotiate U_3O_8 sales on behalf of GoviEx.

Where volume, duration or price mechanism options exist within the portfolio of U_3O_8 supply contracts, the Marketing Team will analyse market conditions and provide a summary of such analysis in order to operate the contracts optimally to meet GoviEx needs.

Marketing Team will provide GoviEx with a summary of all negotiations and provide analysis and evaluation of the proposed sales. GoviEx will review with a view to providing approval for Marketing Team to proceed. Based on the approval by GoviEx, Marketing Team will enter into further negotiations with the customers to agree the final terms and conditions of supply through to contract drafting, conclusion and signature.

Prior to signature of any supply contract, Marketing Team shall arrange for each contract to undergo a full legal review by a recognised lawyer specialising in the applicable international law pertaining to each supply contract as negotiated by Marketing Team and the individual customers. Where applicable, Marketing Team will obtain Euratom Supply Agency (ESA) concurrence or notification as appropriate for all U_3O_8 supply contracts.

Marketing Team on behalf of GoviEx will draft and negotiate a weighing, sampling, analysis and storage contract with each of the Conversion Facilities, and Marketing Team will manage the U_3O_8 deliveries for receipt into U_3O_8 Holding Accounts at the Conversion Facilities to ensure that contractual obligations relating to the sales of U_3O_8 are met from both a quantity and lead-time perspective. In addition to the aforementioned, Marketing Team will also take responsibility for reconciling inventory movements in and out of the U_3O_8 Holding Accounts and verify the account balances against account statements issued by the operators of the Conversion Facilities.

20 ENVIRONMENT, SOCIAL AND PERMITTING

This section summarises the environmental and social work completed to date, identifies risks and opportunities associated with environmental, social and governance (ESG) factors and explains how these have been addressed over the course of the project development and updated as part of the current Feasibility Study. The company has integrated environmental and social considerations into project planning and made commitments to implementing robust ESG management as the project moves into development. The project's environmental and social setting is presented in Section 4.

This section outlines:

- The ESIA process and the subsequent change in project design;
- The regulatory framework pertinent to project permitting and standards applied in the ESIA and project planning.
- The stakeholder engagement activities undertaken both by the ESIA team and by GoviEx's Community Liaison Team.
- Impacts identified during the ESIA or as part of the 2022 updated baseline study.
- Material ESG risks and opportunities pertinent to the declaration of reserves.
- Environmental and social issues that have influenced the design of the project.
- Commitments to manage impacts during the design, construction, operation and closure of the mine.

20.1 Environmental and Social Studies and Approvals

20.1.1 Approvals, Tenure Rights and Relevant Legislation

The Mining Code, amended by Law No. 2006-26 of August 9, 2006, provides the framework legislation for the Niger mining sector, mineral rights, exploration and operation of mines. This Mining Code has recently been revised but any changes will only apply on renewal of the mining permit and conventions due in 2026 and 2027 respectively. For the Madaouela Project, the most important mine titles are the exploration license and the exploitation (mining) permit.

Exploration and exploitation permits are accompanied by a mining convention negotiated and signed between the company and the Ministry of Mines. This convention specifies the contractual relations between the State and the proponent. The convention is signed for a term of not more than 20 years and covers the exploration period and the first period of validity of the mining (exploitation) permit. The convention is then renegotiated upon each renewal of the mining permit. Further details on GoviEx's mining conventions can be found in Section 4.1.2.

The main permits/approvals and tenure rights required for operation of the project are presented in Section 4 and summarised below:

- Exploitation permit obtained from the Ministry of Mines – application for an exploitation permit must include a Feasibility Study, an environmental impact study (or environmental and social impact study (ESIA)), an environmental protection programme, a site rehabilitation plan and an environmental compliance certificate.

- Environmental compliance certificate from the Ministry of Environment – granted following submission of an ESIA report and supported by the ESIA Ordinance (No. 97-001 of January 10, 1997) and implemented by the associated decrees (ESIA Decree No. 2000-397/PRN/ME/LCD of October 20, 2000 and the BEEEI (Decree No. 2010-540/PCSRD/MEE/LCD of July 08, 2010).
- Surface rights - land access for the exploration programmes completed to date has typically been negotiated without problems. Land use related to any future exploration or/and mine development scheme is facilitated by provisions within the mining convention, so long as there is consent from the head of the relevant administrative region. In this case, GoviEx will require approval from the Prefet of Arlit who will apply to the Minister of Mines and Minister of Town Planning and Urbanism for an agreement for the right to occupy the required land (see also Section 4.2 and Table 4-3).
- Water usage approvals - obtained following exploitation permit approval and before infrastructure construction commences. The project will be applying for a water abstraction and water use permit. The current authorisation from the MH is for a limited number of water holes and a limited quantity (Section 4.6).
- Radioactive materials usage authorisation - obtained before operation. This requires submission and approval of a safety assessment, an ESIA report, evidence of a qualified team and evidence of measures in place necessary for the protection of worker and public health. This will be applied for immediately prior to the start of construction.
- Waste management – it is not clear if a specific permit is required, however, a radioactive solid waste management plan must be developed in the early stages of project planning.
- Cultural heritage - there may be no prospecting, exploration or mining activities within a radius of 100 meters of burial sites and sites considered as sacred, without the approval of their owners. Burial sites are located within and near the Madaouela project infrastructure footprint. GoviEx is preparing a cultural heritage management plan (Section 20.4.7) to provide a process and mechanism for agreement should any sites need to be moved.

20.1.2 The ESIA Process

An ESIA was prepared in 2014 on the basis of the project description included in the Integrated Development Plan (IDP) (SRK, 2015a). The ESIA was prepared in accordance with Environmental Management Code (Law No. 98- 56 of December 29, 1998) and its associated ESIA Decree (No. 2000-397/PRN/ME/LCD of October 20, 2000). In line with these requirements a terms of reference (ToR) for the ESIA was prepared in collaboration with the BEEEI.

The ESIA comprised the integrated assessment of physical, biological and social environments potentially affected by the project and included an environmental and social management plan (ESMP).

As part of the ESIA, the following baseline studies were undertaken:

- Biodiversity;
- Water resources;
- Soil and geomorphology;

- Air quality;
- Ionizing radiation;
- Socio-economic;
- Health;
- Traffic; and
- Heritage and archaeology

The study areas for individual baseline studies varied depending on the nature of the study, for example the water resource study looked at potentially affected catchments and aquifers as its study area, whilst the biodiversity study focussed on the directly affected footprint area within the wider Project area. Legini S.A was largely responsible for the coordination of the studies and collection of baseline information in the field. SRK provided technical support and expertise and also carried out the water quality sampling programme. SRK reviewed the baseline studies and also prepared the impact assessment report and management plan.

The ESIA report was submitted to the BEEEI on the March 10, 2015. On July 28, 2015 the ESIA was approved by the Minister in charge of the environment and an environmental compliance certificate was granted.

Several impacts have been mitigated and minimised as part of the project design. Examples include:

- minimisation of water abstraction by use of mine dewatering and poor quality bleed water for dust suppression on the DSF and haul road;
- rationalisation of water storage to reduce surface area for evaporation and treatment and reinjection of excess underground water;
- incorporation of progressive closure of the DSF with a permanent cap to prevent dispersal of radioactive material;
- extensive use of solar power and battery power storage to reduce diesel consumption as well as reduce reliance on the Sonichar coal fired power generation.

In 2022, as part of the Feasibility Study, Labogec updated aspects of the environmental and social baseline data. This was based on a request by SRK to review and update specific elements of the original study given the amount of time that has lapsed since the original baseline was conducted. The update was also done in light of the evolution of the project design since the compilation of the ESIA report. This is discussed further in Section 20.4.8 below.

The update targeted aspects of the baseline that may have altered over the course of the last 8 - 10 years. The update focused on the physical environment, social-economic characteristics, natural resources and land use, avifauna, traffic and water supply. GoviEx plans to conduct additional air quality, dust and water sampling before construction work starts. This will ensure a current baseline immediately prior to the start of the project construction and will provide the basis of evaluating any changes as a result of the project development. The intention will be to validate the baseline immediately prior to construction and to use this as the starting point for a regular programme of monitoring as outlined in the project ESMP.

20.1.3 Good International Industry Practice

In addition to meeting Nigerien legal requirements, the ESIA was undertaken to align with the GIIP standards and in particular the Equator Principles adhered to by many of the potential lenders. This requires consideration of the International Finance Corporation Performance Standards (IFC PS) and World Bank Group's Environmental, Health, and Safety (EHS) Guidelines. Given GoviEx is already in receipt of a valid Environmental Permit, the company does not intend to update the original ESIA report. However, in keeping with GIIP, the company will continuously review all the mitigation and management measures as they implement their overall environmental and social management plan.

To this end an Environmental and Social Design Criteria and Guidance (ESDCG) document was prepared by SRK to facilitate integration of environmental and social factors into the design process alongside engineering and financial considerations with the aim of:

- Reinforcing compliance with Nigerien environmental laws and regulations and internationally accepted standards and guidelines; and
- Preventing, minimising and mitigating potential environmental and social impacts during the construction and operational phases by modification of the project design and development of appropriate management measures in accordance with the management hierarchy.

Implementation of the ESDCG during project design assisted GoviEx in complying with GIIP.

The increased global focus on climate change, climate adaptation and pressure to reduce the carbon footprint of projects by consumers, insurers and the financial markets has resulted in additional scopes and options being incorporated into this Feasibility Study. These include a climate change assessment for the project area and incorporation of solar and battery storage into the power supply design.

20.2 Stakeholder Engagement

A Stakeholder Engagement Plan (SEP) was prepared in 2014 as part of the ESIA, to guide and document engagement undertaken as part of the ESIA. Stakeholders engaged with during this process included the BEEEI, traditional leaders, mayors and members of the community, allowing them to provide the study team with comments and suggestions on the ESIA process.

As part of this engagement, a number of issues and concerns were raised. These included:

- the existing negative legacy of mining activities in the area;
- the potential loss of local livelihoods due to competition for land and water resources, which could be exacerbated by population influx;
- possible pollution of the environment;
- potential infrastructure improvement and job creation; and
- the necessity for proper stakeholder consultation.

During the baseline update in 2022, focus group discussions (FGD) were held in the communes of Arlit, Gougaram and Dannet by Labogec. The FGDs were conducted in village assemblies, with groups of women, men and young people and individually for resource persons (person in a position of authority i.e., Mayor, Chief, head of civil society organisation etc). Concerns and interests remain largely similar to those articulated in 2014. The issues raised are dominated by the legacy of other mining companies and the reduction of grazing areas, radiation and other pollution. There are also expectations regarding the positive benefits, in particular job creation, the potential market for agro-pastoral products, the investment in social infrastructure and other community initiatives and the strengthening of the financial capacities of the municipalities.

Discussions with the GoviEx team in Niger and available stakeholder engagement meeting minutes indicate that regular project related engagement takes place at a national government level with authorities and regulators. Local community level meetings currently take place on a more ad hoc basis, using various methods including phone calls, for example with the Mayor of the village of Gougaram, to discuss community development priorities and progress. There have also been meetings with various Non-governmental Organisations (NGOs) to discuss collaborative working and partnership in the delivery of community development projects.

An updated SEP and grievance procedure is currently being developed by GoviEx staff. This will align with the IFC Performance Standards and the UN Guiding Principles. The SEP will allow GoviEx to take a comprehensive, consistent and coordinated approach to stakeholder engagement and disclosure throughout the project's development. GoviEx is planning to record future stakeholder engagement using an online database.

The main stakeholder groups identified in the draft SEP include:

- Niamey-based government authorities, in particular the various ministries responsible for environmental protection and the regulation of industrial development.
- Regional and local government.
- Military
- Local communities, pastoralists and artisanal miners.
- Local associations (religious, women and youth).
- Suppliers, employees and contractors.
- NGOs based in Niamey and those active in the project area.
- Media.
- Shareholders.

An Arlit based community liaison officer joined the GoviEx team in Niger in early 2022 to lead on engagement activities, management of grievances and potentially establish a community engagement forum (CEF). Through such a forum GoviEx aims to work towards informed consultation and participation of stakeholders including those who are recognised or self-identify as indigenous or are considered vulnerable or belong to a disadvantaged group. This includes the Tuaregs who have historically claimed to have been marginalised and lacked participation in decision making regarding extractive industry project.

20.3 Summary of Impacts

The impacts of the Project were presented in the ESIA in order of importance. The residual impact significance rating provided in the table assumes the management measures described within the ESIA report have been successfully implemented.

The first group of impacts in Table 20-1 represent the most important impacts for decision makers. Positive impacts are denoted with a "+ive" after them and represent the main benefits created by the Project from an environmental and social perspective and may be considered to balance some or all of the negative impacts. These include increasing government revenue during construction and operation, and the provision of employment and income for Nigerien people leading to reduced poverty. The only negative impact with a high significance before implementation of management measures is related to the proposed wellfield, however by maximising use of water from mine dewatering and implementation of other proposed mitigation measures the significance of this can be reduced to medium.

Table 20-1: Summary of impact significance ratings

Grouping	Identified impacts	Residual impact rating
Most important positive and negative impacts needing to be taken into account during decision making.	Water supply wellfield impacting on local aquifers and groundwater users	Medium
	Increased government revenue from fiscal and foreign exchange income	High +ive
	Direct and Indirect employment of Nigeriens residing in the Arlit Department	Medium +ive
Negative impacts having a high or medium significance without management and that require careful monitoring to ensure management measures are effective. If monitoring reveals additional management/remedial measures required, these must be implemented without delay.	Mine dewatering impacting on local aquifers and groundwater users	Medium
	Potential post-closure leaching of deleterious constituents from flooded underground mine workings to groundwater impacting on local aquifers and groundwater users	Medium
	Particulate matter from operations exacerbating health issues associated with the naturally high dust levels in the region	Low
	Land clearance for surface infrastructure causing loss, degradation and/or fragmentation of natural habitat and potential loss or disturbance of species of conservation value	Low
	Direct exposure to radiation through proximity to TSF and inhalation or ingestion of tailings material or process water	Low
	Increased demand on infrastructure and for services and goods	Low
	Change in community dynamics and social relationships	Medium
	Reduced access to the Project area for water and pasture	Low
	Increased infectious disease transmission between workers and the host community	Low
Impacts that can be managed readily through measures that are not difficult to implement and are known to be reliable.	Impacts of site infrastructure on storm water runoff patterns	Low
	Potential leaching of deleterious constituents from the waste facilities to groundwater impacting local aquifers and groundwater users	Low
	Seepage and discharge from waste water systems	Low
	Potential post-closure impacts of Miriam open pit on water users	Low
	Degradation and/or alteration of landscape resulting in loss of a soil resource and reduced land capability	Low
	Contamination of soils from solid or liquid waste or from aerial deposition	Low
	Gaseous emissions from operations exacerbating health issues in the region	Low
	Tailings dam forming pool during the rainy season and acting as an attractive nuisance to birds in the region	Low
	Direct inhalation of radon and radionuclides from the ventilation systems of the underground mines	Low
	Accidental spills of uranium concentrate during packaging and transport	Low
	Increased incidences of avoidable accidents and injuries	Low
	Accidental damage or loss of archaeological sites resulting from land clearance for construction of Project infrastructure and looting	Medium

Green shading indicates potential positive impacts, orange and yellow shading represents potential medium and low negative impacts, respectively.

20.4 Key Environmental and Social Issues, Risks and Opportunities

This section highlights the salient issues that pose a potentially significant risk to the project, have material cost implications or are a major concern or interest to local communities and other stakeholders.

20.4.1 Wellfield - Water and Security of Supply

Water use and water supply are critical issues for the project given the location and water stressed nature of the area. As noted in Section 24.4.4, the Orano mines to the north-west of the project area have had a demonstrable impact on the groundwater levels in the wider area. These are considered fossil aquifers with little or no active recharge under current climatic conditions. Similarly the Madaouela Project will result in local draw down of the water tables in the Guezouman and Tarat aquifers. This modelled area of impact extends several kilometres from the areas of mining and water abstraction.

The FS design has incorporated a number of design features to minimise the impact on the underlying aquifers

- The water storage pond at process plant has been optimised to reduce the surface area and associated water loss to evaporation
- The M&M and MSNE mines incorporate water treatment and reinjection of excess water to promote aquifer recharge
- The Miriam open pit will be back filled to the predicted groundwater rebound level to prevent the creation of a pit lake post closure that would result in water loss to evaporation and hyper saline conditions.
- Dust suppression for the dry stack and haul roads will make use of bleed water from the process plant.

Given the scarcity of water in the area, the security of the project water supply is a risk as the water will be pumped approximately 8 km from the wellfield to the process plant. The wellfield and the pipeline will be subject to routine security and regular inspection to ensure the integrity of the solar power supply and pumping infrastructure. To mitigate this risk GoviEx has already worked with the local communities to help with the provision of community water supplies. This programme will continue through the construction and operation stages to ensure local communities have access to adequate water supplies and ensure the project is not seen as a threat to community water supplies. This is just one element of a wider community development and community infrastructure programme planned by GoviEx. Water supply, ground water levels and groundwater quality will be systematically monitored as part of the ESMP.

20.4.2 Radiation

Radiation exposure is a common risk at all uranium mines and is highly regulated. GoviEx will have to demonstrate adherence to Niger and international standards for employee, community and environmental exposure to radioactive materials. The following issues will be key:

- Potential for unacceptable exposure to ionising radiation either via the inhalation of radioactive gas radon, the ingestion or inhalation of radioactive dust particles and/or direct exposure to radiation or directly through ingestion of radionuclides via surface or ground water or through the food web via bioaccumulation into edible plants that are either eaten or fed to animals;

- Regardless of the efforts by GoviEx, NGO's have historically leveraged community concerns to accuse uranium miners of community health impacts and undermine the reputation of the operating company. GoviEx will need to combine radiation control programmes, medical surveillance and environmental monitoring with a structured stakeholder engagement programme to try and manage the narrative around radiation exposure and community and employee health. This risk will continue post closure with the necessary disposal of project components.

20.4.3 Reduced Access to Land for Pasture and Water

According to community mapping carried out with pastoralist communities during the ESIA, the Project footprint is situated in an area traditionally used by the Tuareg and Fulani pastoralists. The area produces seasonal plants and grasses with a high mineral ('salt') content that is nourishing for livestock.

Traditionally it has been the practice of pastoralist groups from the department of Arlit Department and the Agadez region to move their herds to this area between October and March to take advantage of the seasonal availability of this vegetation for their livestock. As recorded in the ESIA, approximately a third of the Project area is grazed and browsed during the wet season and two thirds of the area is grazed and browsed during the cold dry season. During the hot dry season, April to July, the main source of water for people and animals are the village and community wells and livestock are fed from feed banks storing dried pasture.

Using satellite imagery from 2016, 2019 and 2021, Figure 20-1 shows a consistent seasonal vegetation pattern in the project area. This suggests nomadic and semi-nomadic herders in the project area are likely to have maintained the grazing habits described in the 2015 ESIA, with the movements of herders dictated by the availability of natural pastures. This was also confirmed by the 2022 baseline update which reported no significant change in land use and routes to access subsistence resources.

Data from the commune of Dannet indicates the free movement of livestock is threatened by demographic pressure and the overgrazing of certain areas. Furthermore, the groups of people engaged with as part of the focus group discussions conducted by Labogec during the baseline update reports that men, women and resource groups are concerned about reduced access to and availability of grazing areas and pasture areas as a result of the project.

Figure 20-1 highlights the relatively modest infrastructure footprint relative to the overall distribution of pastoral land in the wider region. Notwithstanding the relatively small footprint, the legacy of uranium mining in the area has resulted in concerns for pastoral groups being disadvantaged through their transient presence and roads constructed for transport that transect traditional pastoral land. The Project will result in some restrictions on land use and will potentially have some adverse impacts on the communities and people that traditionally use this land. The loss of access to this natural resource is an important consideration for the Project because the majority of the users may have little to no access to secure land rights as seasonal resource users, despite the passing of the Pastoral Code in 2010. Issues of concern historically for the pastoralists, the Tuaregs in particular, relate to marginalisation as well as the appropriation of land (including pastoral territories) and resources often without compensation.

The rights of pastoralists will be taken into consideration by the Project. A key mitigation measure will be to ensure the infrastructure does not act as a barrier to pastoralist movement.

The ESIA identifies the need to engage rural project affected people in economic displacement discussions to devise an Economic Displacement and Livelihoods Restoration Plan that enables herd mobility, both seasonal and as a response to drought, while securing rights to critical resources (dry-season pastures and water). Support to pastoral livelihoods through better water access and tailored service provision and supporting livelihood diversification will be planned and implemented through informed consultation and participation with the affected communities. This process will start early enough to avoid any potential delays to obtaining the required surface rights and should be in accordance with national laws and international standards to avoid legal, social and reputational risks. A clear community engagement strategy and recognition of traditional practices as well as rights under the Pastoral Code will help deflect potential criticism by advocacy NGOs.

An initial cost of CFA 11,760,000 (USD 19,000) has been estimated to prepare the Economic Displacement and Livelihoods Restoration Plan.

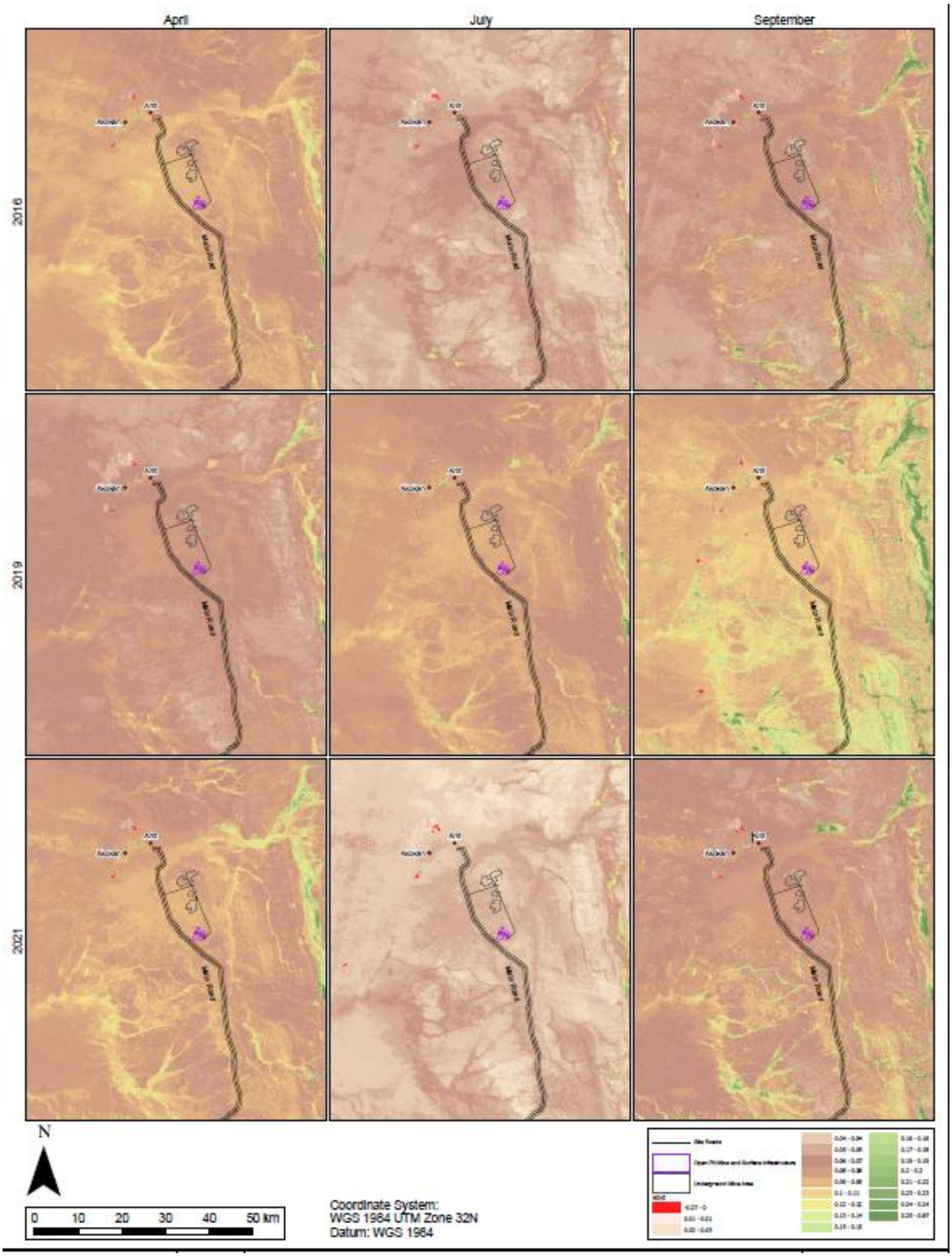


Figure 20-1: Change in growth of vegetation over the seasons in 2016, 2019 and 2021

20.4.4 Positive economic benefits

There are economic expectations from stakeholders ranging from jobs for local community members to address the high levels of unemployment and youth unemployment and the lack of opportunity to gain skills in the local area, through to the investment in social infrastructure and the strengthening of the financial capacities of the municipalities. The project has the potential to effect positive change through economic contribution and increased GDP, at a national, regional and local level. Positive impacts identified in the ESIA include:

- Increased government revenues from fiscal and foreign exchange income due to direct and indirect investment to the Nigerien economy.
- Direct and indirect employment of Nigeriens residing in the Arlit Department. GoviEx has a policy to employ 100 % Nigeriens where practicable and is committed to sourcing labour as close to the Project as possible. GoviEx's policy is assisted by the following
  - The closure of Orano's COMINAK mine resulting in the loss of jobs for skilled and semi-skilled mine workers in the project vicinity.
  - Arlit Department through its long association with the mining industry has a skilled and semi-skilled work force with mining related skills.
  - There is the EMAÏR (École des mines de l'Aïr), a training school for mining technicians and supervisors in Agadez, established by Orano.
  - The Government has opened a training institute in Agadez, supported by the School of Mining and Geology in Niamey. This institute provides technical and vocational education and training for the mining sector in the region by providing training in electromechanical engineering and renewable and fossil energy generation.

The creation of jobs as well as the generation of indirect employment through stimulation of demand for goods and services, the improved regional and local infrastructure and the potential increase in regional economic activity are positive economic impacts. These highlight the potential for the project to contribute positively to the UN's Sustainable Development Goals (SDG) and to bring benefits to the Government of Niger and the affected communities.

In efforts to maximise the economic benefits of the project, GoviEx has already been actively contributing to social investment by implementing programmes to improve the welfare of the community surrounding the project area. The programmes supported by GoviEx are focused around broad thematic areas of water, livelihoods, education and health with an aim to improving the overall standard of living of the community. GoviEx is also in the process of developing a skills training programme and career plan for employees and a local employment and procurement plan (LELP) which, if well executed, can enhance social benefits, stimulate business development opportunities across the region and bring a long-term benefit to the region.

GoviEx recognises the need to manage the high levels of expectations. The project also has the potential to have adverse impacts on the local communities (particularly vulnerable households) if not appropriately managed. The planned LELP and socio-economic development plan (SEDP) will include specific measures aimed at ensuring vulnerable households are not adversely affected.

20.4.5 Guidan Daka - artisanal gold mining village

A new community was established in March 2017 called Guidan Daka, located 12 km South from Arlit town (Figure 5-12) and on the border of the Aokare exploration license area (under application).

Guidan Daka was reportedly established by the Arlit regional office of mines and is effectively a gold processing site. With an estimated population of 10,000 relatively young people (5 % are women providing auxiliary services), this community has grown significantly over recent years and largely comprises artisanal gold miners who bring rock samples from gold sites in the North and near the border with Algeria and subsequently trade the gold. Figure 20-2 shows how

Guidan Daka has grown in size between 2016 and 2021. It is understood the community was created to avoid the growth of Arlit's population and to prevent potential groundwater contamination (specifically the Tarat aquifer) that may result from the use of acid and other chemical products used in the extraction of the gold. Housing is largely informal shacks and the community lacks basic social services. Drinking water is transported in from Arlit.

Information gathered as part of the 2022 baseline update notes that, according to Arlit's Mayor, the revenue for Arlit from the processing of gold at Guidan Daka is greater than that generated by the COMINAK mine. It is likely the population of this community will continue to grow in the future as a result of in-migration by youth from the three neighbouring communes who are increasingly involved in informal activities including gold panning, as well as by people from elsewhere in Niger and ECOWAS countries.

The baseline update indicates the community is organised under a community 'head' who ensures collaboration with law enforcement, including the defence and security forces. However, there are reports, although not linked to this community specifically, that informal networks are involved in the artisanal mining and transport of gold, which finances armed groups, including jihadists. According to Crisis Group[18], these networks reportedly operate through tacit understandings with the government which create informal systems for managing violence related to the illicit drug trade, gold mining and people-trafficking in the north of the country (Crisis Group, 2019 & 2020a).

Potential links to illicit trade, increase in population and changes to the social dynamics are possible risks for the project due to the relative proximity of Guidan Daka to the project infrastructure and the Aokare license area, once granted. Linked to this, insecurity might be an increased risk for the project linked to local outbreaks of violence and petty crime of an opportunistic nature, compounded by general instability in the region.

To manage these potential risks, GoviEx has a human rights policy and a security management plan and intends to establish an active engagement programme with various stakeholder groups and community engagement forums to facilitate and maintain dialogue with local decision makers and those with local knowledge. These plans and programme will be reviewed and strengthened in the lead up to the start of construction.

[18] https://www.crisisgroup.org/africa/sahel/niger

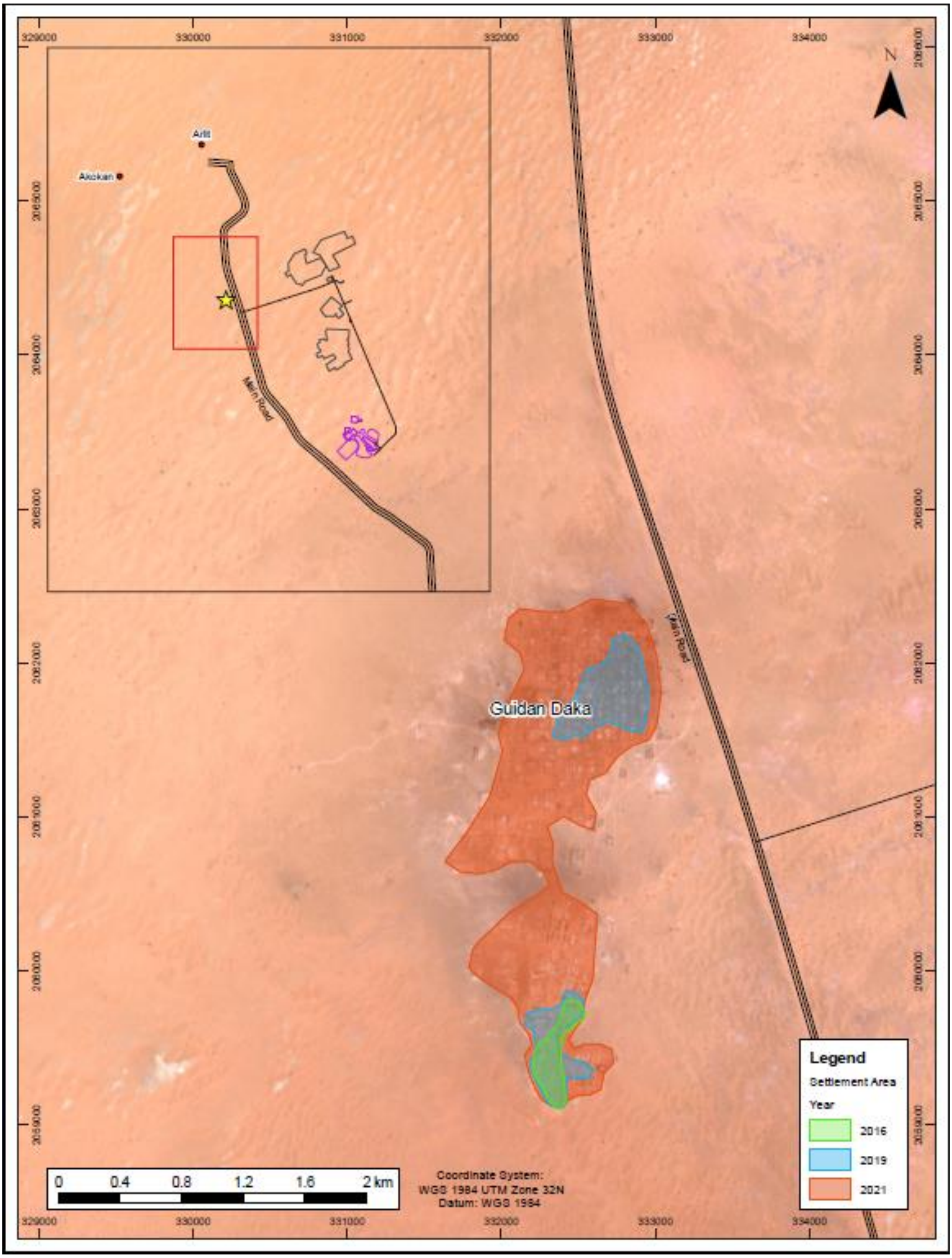


Figure 20-2: Growth of Guidan Daka between 2016 and 2021

20.4.6 Arlit as a migrant transit hub

Niger is a transit country for migrants (including asylum seekers and refugees) from West and Central Africa. In 2015, Niger passed a law on “illegal trafficking of migrants” (Law 2015-36) that criminalised the activities of people involved in the transportation of migrants. This had economic consequences and contributed to a loss of livelihoods in migration hubs as many actors involved stopped transporting migrants. Nonetheless, the town of Arlit is a hub and transit town for those (adults and children) migrating through Algeria, Libya and Morocco to southern Europe. Movement is usually done by bus and often takes several days, aided by smugglers and traffickers. Furthermore, traffickers predominantly exploit Nigerien children and women, as well as West and Central African victims, in sex and labour trafficking.

According to the 2022 baseline update, a number of youth from the commune of Dannet have attempted the journey to the north to cross the border to look for better opportunities. The baseline update does not report the same for the commune of Gougaram but there are similar underlying challenges for this community especially youth unemployment. The 2022 baseline update further reports that those who return to Dannet, unable to cross the border, have trouble reintegrating back into the communities and the rural pastoral lifestyle.

The Agadez region and the town of Arlit is increasingly turning into an alternative space for protection for those who fail to reach their final destination of Europe including unaccompanied children and victims of human trafficking. They generally lack access to livelihoods, support networks and the justice system, which increase their vulnerability to exploitation. This can negatively affect migrants’ ability to cope with or avoid situations of harm and the Project may exacerbate the levels of vulnerability that exists. The potential for further increases in population through influx by employment seekers and changes to the social dynamics linked to the project could exacerbate the vulnerability of these communities. As part of GoviEx’s ongoing stakeholder mapping process, the company will need to consider the complex and intersecting identities of vulnerable groups i.e., migrants, refugees, trafficked survivors, women, youth, Tuareg, etc and determine those who may have the lowest levels of public representation and therefore are most at risk of marginalisation. Through this process GoviEx will be able to implement differentiated measures, through its various social management plans, to ensure those who are disadvantaged or have vulnerable status are not disproportionally impacted or disadvantaged in terms of benefits and opportunities associated with the project.

Local opinion and perceptions of the migrants from other parts of Africa tends to be that they put additional pressure on social services, particularly water provisions, reducing the ability to meet local challenges. Potential influx of people as a result of the project or gold mining opportunities linked to Guidan Daka (see above) may further strengthen this opinion and perception, increasing pressure on GoviEx to provide these local services. GoviEx will need to manage these expectations through an active engagement programme.

20.4.7 Cultural heritage

The area has a number of archaeological and pre-historic sites with rock engravings indicative of ancient human settlement. 147 heritage sites were visually identified within the Project area. The sites have been classified into three main groups, namely: funeral (tombs), settlement (remains of habitations such as ruins and various fragments of tools and potteries) and natural (fossils and ostrich eggs) sites.

Maps showing the cultural heritage in the project area were provided to the project engineers and the location of project infrastructure was optimised during the FS to avoid known sites. Currently none of the identified sites fall within the proposed infrastructure footprint (Figure 20-3) but some may be impacted by the ore sorter reject facilities associated with the M&M and MSNE underground mines.

GoviEx is preparing a Cultural Heritage Management Plan (CHMP) for the management of heritage sites disturbed by the project footprint in accordance with national regulations, international standards and stakeholder input. Through effective implementation of the CHMP GoviEx will meet regulatory protocols, avoid fines and project delays and further build and maintain good community relations by respecting the cultural heritage.

There may be additional sites buried in the sand which would only be identified when earth works commence and this could cause delays to the commencement of project construction as the required permits and permissions are granted.

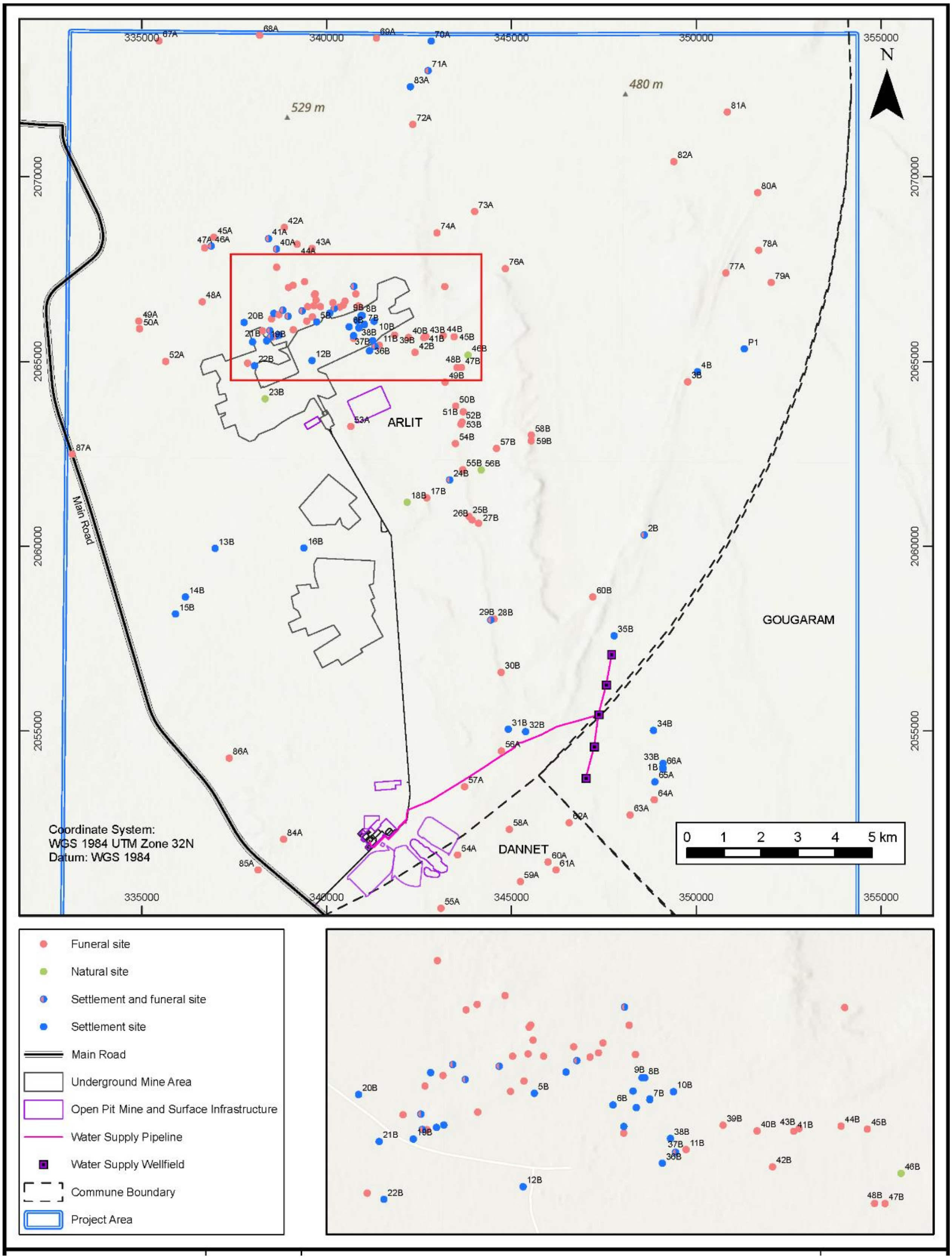


Figure 20-3: Locations of cultural heritage in the Project area

20.4.8 Project Design Changes Post ESIA

The project design has undergone several changes since the original ESIA was conducted. The key changes are:

- The location of the process plant and tailings storage facility have been relocated from the vicinity of the underground mine to a site immediately north of the Miriam open pit.
- Linked to the above, the explosives storage area and vehicle maintenance facilities are now also located adjacent to the Miriam open pit.
- The TSF will be lined with a combined clay and single textured HDPE liner rather than a simple clay liner. The capacity of the TSF has increased from 15 to 19.5 million tonnes.
- The location of the site access road has moved south and is considerably shorter thereby reducing the area of disturbance.
- The 2014 design included covered conveyors from the underground mines to the process plant (located adjacent to the portals). Ore will now be trucked from the ore sorters to the process plant now located adjacent to the open pit.
- Ore crushing will be done by vertical rotary crushers (VeRo) rather than using a SAG mill. The VeRo system uses a dry milling process and consumes less power.
- The ESIA design assumed all power would be provided via a connection to the national electricity grid supplied from the Sonichar coal fired power station. The FS design incorporates a hybrid national grid and solar power supply with battery storage. Additional capacity and redundancy is provided by diesel generators.
- Power demand has reduced from an average maximum of 17MW to ~14MW
- Key changes in the process plant include:
  - Recovery improved to 94.8 %.
  - Molybdenum product changed to MoS_3 with recovery of ~89 %.
  - No ablation in process plant flow sheet with a resultant reduction in water and power requirements.
  - Process bleed water to haul road dust suppression introduced with resulting minimal fresh water demand for dust suppression.
  - Single stage crushing upfront of VeRo Liberator milling opposed to dual crushing and SAG milling leading to further reductions in water and power requirements.
  - Process water demand reduced from 320 m^3/hr to 106 m^3/hr
  - Introduction of Molybdenum Ion Exchange upfront of SX to recover Molybdenum from SX feed stream.
  - Uranium SDU precipitation changed to ADU precipitation and hence introduction of the use of ammonia gas.
  - Sulfuric Acid consumption reduced 65 kg/t ore to 50 kg/t ore.
  - Steam from the acid plant used as heating in leach circuit.
- The ESIA had assumed there would be suitably managed off-site waste disposal facilities. The FS has assumed the in-house management of all waste. Any change in this situation would be an opportunity for the project.

SRK have reviewed the changes in relation to the project description and reassessed the impacts predicted in the 2014-15 ESIA process. This also takes into account the revised baseline information. The design changes are largely beneficial from an environmental perspective. The relocation of project infrastructure results in the main noise, dust and air emission sources being located further from the towns of Arlit and Akokan. The impact to air, noise and soil remain similar and the change in location does not impact the nature or scale of the impacts, particularly given lack of local community receptors. Air quality parameters will be reviewed against the final process flow sheet and the air quality monitoring programme adapted as required. Handling and storage of ammonia will require specific operating procedures to protect project staff from potential exposure to harmful gas emissions.

The optimisation of the uranium and molybdenum recovery processes has led to reductions in water and power requirements for the project. This has reduced the potential impacts on groundwater aquifers and reduced the carbon footprint for the project. The incorporation of solar and battery storage as a key feature of the overall power design has further improved the quantity of carbon associated with each tonne of uranium produced.

SRK considers that the proposed mitigation measures in the ESMP remain appropriate and applicable, and their effectiveness will continue to be measured through the implementation of the social and environmental management system.

20.4.9 Waste management

The earlier project designs had assumed that a suitable licenced off-site waste facility would be available for management and disposal of all waste. This is not a practical solution given the lack of waste management facilities within the Arlit region. As a result the FS has now incorporated the construction and operation of a Category 3 waste facility as well as a general, clay lined waste management facility. This includes a waste incinerator for medical and other easily combustible waste.

The administration offices and associated facilities include a dedicated sewage treatment plant incorporating new generation trickling filter technology. The design has been specified such that treated effluent meets IFC effluent standards. The effluent will be used to assist with revegetation projects in the vicinity of the project infrastructure using native tree species.

20.5 Approach to Environmental and Social Management

GoviEx is committed to the application of policies, strategies and practices that treat people and the environment with respect while pursuing the underlying business objective of creating value. GoviEx's commitment to sustainable development is captured in its Statement of Values and Responsibilities, from which its policies, strategies, and management system frameworks originate. These documents and commitments are available on the GoviEx corporate website[19].

GoviEx has developed the following corporate policies:

- Environmental policy;
- Socio-economic development policy;

[19] https://goviex.com/

- Stakeholder engagement policy; and
- Human rights policy.

GoviEx has recently started using the ONYEN ESG reporting software to record and track its ESG performance at a corporate and site level to ensure transparency, improve alignment with the IFC PS and report against the Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) reporting requirements.

20.5.1 Environmental and social management system

A management system framework was prepared by GoviEx in 2021 to support the development of its internal governance structures for the management of environmental, social, health and safety matters and facilitate the achievement of its stated corporate values and responsibilities.

The framework describes the expected structure and content of an environmental and social management system (ESMS) and an occupational health and safety management system (OHSMS) that meet the requirements of the following standards:

- International Standards Organisation (ISO) 14001 Standard (ISO 14001:2015) and 45001 Standard (45001:2018);
- International Finance Corporation (IFC) Performance Standard 1; and
- Towards Sustainable Mining (TSM).

GoviEx intends to develop the management systems steadily over time, in parallel with project and exploration development timelines and preparation of the supporting management plans as identified in the ESIA and ESMP.

The impacts identified in the 2015 ESIA report can be managed through the implementation of appropriate management measures captured in the ESIA report and the ESMP. GoviEx recognises the management measures will need to be implemented such that they reach and benefit all levels of society so existing inequalities are not exacerbated, community dependency on the project is minimised and support is given to social transitioning at closure.

In addition to the SEP, the CHMP currently being prepared and the rehabilitation and closure and costing plan (summarised in Section 20.9), additional plans to be prepared during detailed design and construction phase include (note these may be individual or combined plans):

- Construction Management Plan (addressing land clearance, water / waste management, air quality, noise, vibrations and other environmental impacts associated with construction)
- Community Development Plan/ Socio-economic Development Plan
- Economic Displacement and Livelihoods Restoration Plan
- Community Health and Safety Plan
- Water and Waste Management Plans
- Land and Wildlife Management Plan
- Air Quality Management Plan
- Emergency Preparedness and Response Plan

- Hazardous Materials Management Plan
- Closure and Rehabilitation Plan based on the closure strategy
- Human Resources Management Plan/ Local Employment and Local Procurement Plan
- Security Management Plan

The robustness of the supporting management plans, along with implementation, assurance and continual improvement functions of the ESMS, are fundamental to enabling the successful implementation of management measures by the GoviEx, its contractors and sub-contractors. A key part of the ESMS is the ongoing monitoring to confirm whether the impacts identified in the ESIA materialise and evaluate the effectiveness of control measures and determine if any additional measures are required to ensure continuous improvement.

Following approval of the EISA in 2015 an Environmental and Social specifications and an Environmental Convention was prepared by the BEEEI to document the ESMP commitments and the associated costs of implementing the ESMP. Once signed by GNH Ltd and the BEEEI, implementation of both the specification and convention and the obligations and commitments specified will become legally binding in accordance with the regulatory provisions specified in the documents.

The FS financial model has included budget for the recruitment and functioning of an in-country ESG team that will be responsible for the implementation of the ESMP and related management plans listed above. The model also includes a budget for the implementation of the various commitments and proposed management plans.

20.6 ARDML/Geochemistry

20.6.1 Methodology

A Geochemical characterisation study was undertaken to quantify the acid generating and metal leaching (ARDML) potential of materials likely to be exposed during the mining process. 50 waste rock core samples from exploration holes, 15 rock samples collected from the surface and 4 samples collected of stockpiled ore grade materials were assessed by SRK (in 2013) and a further 3 waste rock samples, 1 low grade ore (LGO) sample, 1 potential analogue for ore sorter reject and 1 tailings sample were analysed as part of this FS study (SRK 2022i).

The 2013 characterisation program involved short-term static testwork methods (SRK 2013b). Kinetic humidity cell testwork (HCT) was also undertaken during the FS study (SRK 2022i).

ABA methods provide an industry-recognised screening-level assessment of the potential for acid generation or acid neutralisation from a material. The approach is based on the balance and comparison between the potential to generate acid quantified by analysis of sulfide content and the potential to neutralize acid either from back titration method or by measuring carbonate content. It does not specifically consider mineralogy, kinetics or other influencing factors controlling sulfide oxidation but can be considered as characterising the ‘total potential reservoir of acidity or alkalinity in a given material’.

ABA was carried out in accordance with EPA 600 Modified Sobek Method (Sobek et al., 1978). The test method reports paste pH, total sulfur by combustion and IR detection (Leco), and neutralisation potential (NP) by reacting a sample with hydrochloric acid (HCl) and titrating with sodium hydroxide (NaOH). Organic and inorganic carbon were determined by Leco, sulfate was determined by dissolution with dilute HCl, addition of BaCl and spectrophotometric finish of $BaSO_4$, sulfide was determined by difference.

Acid Potential (AP) is expressed as kg $CaCO_3$ equivalents per tonne and calculated as:

AP (kg CaCO3/t) = sulfide sulfur (%) x 31.25

Neutralisation Potential (NP) is expressed as ka $CaCO_3$ equivalents per tonne. NP was determined by Wetlab through titration as described above, and a comparative NP was calculated from carbonate as:

NP (kg CaCO3/t) = inorganic carbon (%) x (100.09/12.01) x 10

From the values of AP and NP it is possible to determine the difference in these factors expressed as Net Neutralisation Potential (NNP) and the ratio as Neutralisation Potential Ratio (NPR) of each sample as follows:

Net Neutralising Potential (NNP) (kg $CaCO_3$ equivalents per tonne) = NP – AP

Neutralisation Potential Ratio (NPR) = NP/AP

The NNP and NPR allow classification of the samples as potentially acid forming (PAF) or non-acid forming (NAF). The results of ABA testwork can be used to determine the potential for acid generation from each lithology using the criteria outlined in Table 20-2.

Table 20-2: Interpretation of ABA data

Classification	NNP (kg $CaCO_3$ eq/t)	NPR
Potentially acid forming (PAF)	NNP < -20	NPR < 1
Non-acid forming (NAF)	NNP > +20	NPR > 3
Uncertain acid forming Characteristics (Uncertain)	-20≥ NNP ≤+20	1≥ NPR ≤3

Samples are classed as PAF if they have an NNP less than -20 kg $CaCO_3$ eq/t and an NPR less than 1. Conversely, samples are classed as NAF if they have an NNP greater than 20 kg $CaCO_3$ eq/t and an NPR greater than 3. Samples that have an NNP between -20 and 20 kg $CaCO_3$ eq/t and/or an NPR between 1 and 3 are classified as having uncertain acid generating characteristics. If the classification of a sample according to the NNP result differs from the classification according to the NPR result, then overall the acid generating potential is interpreted as being uncertain. For example, an ‘uncertain’ NNP and ‘NAF’ NPR would result in an overall uncertain classification.

Kinetic humidity cell tests were undertaken on the waste rock and tailings materials to provide a measure of the rate of reactivity and solute release for the waste rock dump and DSF. The test is designed to simulate the long-term weathering of material under accelerated laboratory conditions. The data allows the prediction of sulfide mineral oxidation rates, acid generation and metal mobility in comparison to the snapshot provided by the static tests. HCT testing was not undertaken on the Miriam Waste Sample (VeRo Crushed).

Humidity cell testwork (HCT) was undertaken in accordance with the standard ASTM D5744 – 13e1 test method (ASTM, 2013). Leachates were analysed weekly for pH, electrical conductivity (EC), total alkalinity as $CaCO_3$, total dissolved solids (TDS), major anions, major cations and dissolved metals. The humidity cells were operated for 20 weeks.

20.6.2 Results

The previous studies showed that acid generating potential is generally low (SRK, 2013b). All of the sampled drillcore materials reported low sulfide concentrations. Higher sulfide was reported in surface samples of Talak and Guezouman indicating potentially acid forming (PAF) characteristics, however, other indicators (NAG pH and paste pH) did not support this. The core materials were all either classified as non-acid forming (NAF) or as having an uncertain acid generating potential. The uncertain classification is conservative and based upon there being limited neutralising potential in some samples. However, based upon the low sulfide sulfur concentrations it is unlikely there is substantial potential for acid generation. The ABA results for the FS update are presented in Table 20-3 and show the waste rock and LGO Stockpile have an extremely low potential for acid generation. Only the acid leached tailings residue showed evidence of potential acid generation and this material will be placed in the line DSF and progressively capped.

SRK (2013b) reported elevated concentrations of arsenic, antimony, manganese, molybdenum, uranium and zinc in the solid phase relative to average crustal abundance. However, leach testing reported limited concentrations of dissolved constituents in solution, indicating that mobility into contact waters is generally likely to be low. The exception was the surface samples that showed a higher solute release relative to the drillcore materials due to the more porous finer grained secondary minerals present in these samples have a higher reactivity. Highest metal release rates were observed in the ore samples for uranium, manganese and molybdenum.

Leachates from the net acid generation (NAG) testing were analysed during the FS update and showed that some metal leaching is possible, most notably for molybdenum, uranium and arsenic in highly oxidizing conditions (Table 20-4). However, significantly lower potential is observed in kinetic testing indicating considerable lag time in any metal leaching.

Table 20-3: Summary of acid base accounting assessment

Sample Description	Paste pH	Total S	Sulfate S	Sulfide S	Total C	TIC	$AP^{Sulfide\ S}$	$NP^{Titration}$	NP^{TIC}	NNP ($NP^{Titration}$ - $AP^{Sulfide}$)	NP^{TIC}/ $AP^{Sulfide\ S}$	$NP^{Titration}$ / $AP^{Sulfide\ S}$
	pH	%	%	%	%	%	kg $CaCO_3$/t					
WR Drillcores	8.4	0.03	0.02	*0.001*	0.25	0.16	*0.03*	19.0	13.7	19.0	437	608
M&M	8.4	0.02	0.02	*0.001*	0.34	0.27	*0.03*	27.0	22.3	27.0	715	864
Miriam	8.2	0.02	0.02	*0.001*	1.70	1.62	*0.03*	119	135	119	4312	3808
Miriam Waste Sample (Ore Sorter Reject Proxy)	9.1	0.04	0.02	*0.005*	0.24	0.22	*0.16*	22.0	18.3	21.8	117	141
Mineral TAS (LGO Stockpile)	8.0	0.06	0.03	*0.001*	0.80	0.73	*0.03*	60.0	60.7	60.0	1941	1920
GoviEx residue HMC222005 (Tailings)	4.7	0.33	0.02	0.16	0.02	0.02	5.13	2.69	1.50	-2.44	0.29	0.52

NOTES:

0.005 Blue italics indicates result less than detection limit

Indicates sample is classified as NAF

Indicates sample has an uncertain acid generating potential

Indicates sample is classified as PAF

Table 20-4: Summary of NAG Leachate Analysis Results

Sample Description	pH	EC	Total Alkalinity as $CaCO_3$	Sulfate as SO_4	Ag	Al*	As	B	Bi	Ca*	Cd	Co	Cr	Cu	Fe*	Hg
	pH	mS/m	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Drillcores	7.6	17	32	10	*0.001*	*0.100*	0.022	*0.001*	*0.001*	11	*0.001*	*0.001*	0.031	*0.001*	0.049	*0.001*
M&M	7.8	14	36	3.0	*0.001*	0.33	0.002	*0.001*	*0.001*	7.0	*0.001*	*0.001*	0.017	*0.001*	0.17	*0.001*
Miriam	8.0	15	28	3.0	*0.001*	0.15	*0.001*	0.009	*0.001*	9.0	*0.001*	*0.001*	0.014	*0.001*	0.19	*0.001*
Mineral TAS	7.5	15	16	13	*0.001*	*0.100*	0.002	*0.001*	*0.001*	9.0	*0.001*	*0.001*	0.035	*0.001*	0.25	*0.001*
GoviEx residue HMC222005 (Tailings)	3.3	37	*5.0*	85	*0.001*	*0.100*	*0.001*	*0.001*	*0.001*	13	*0.001*	0.009	*0.001*	0.048	0.10	*0.001*
Miriam Waste Sample (Ore Sorter Reject Proxy)	4.8	64	36	12	*0.001*	*0.100*	0.031	0.049	*0.001*	17	*0.001*	0.007	0.002	*0.001*	*0.025*	*0.001*

Sample Description	Mg*	Mn*	Mo	Na*	Ni	P	Pb	Sb	Se	Sn	Sr	Te	U	Zn
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Drillcores	1	0.027	0.13	4.0	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.020	*0.001*	0.047	*0.001*
M&M	*1.0*	*0.025*	0.064	2.0	*0.001*	*0.001*	*0.001*	*0.001*	0.002	*0.001*	0.027	*0.001*	0.001	*0.001*
Miriam	*1.0*	0.028	0.032	2.0	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.025	*0.001*	*0.001*	*0.001*
Mineral TAS	*1.0*	0.051	0.32	1.0	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.012	*0.001*	0.010	*0.001*
GoviEx residue HMC222005 (Tailings)	*1.0*	0.033	0.030	*1.0*	0.009	*0.001*	0.19	*0.001*	*0.001*	*0.001*	0.031	*0.001*	0.20	0.97
Miriam Waste Sample (Ore Sorter Reject Proxy)	*1.0*	0.32	0.19	*1.0*	0.008	*0.001*	*0.001*	*0.001*	0.001	*0.001*	0.035	*0.001*	0.26	0.17

[*] = Element analysed on ICP-OES instrument

0.01 *Blue italics* Indicates less than analytical limit of detection

The HCT results for key parameters are presented in Figure 20-4 to Figure 20-13 below. The testwork results support the static testwork predictions; with generally lower metalloid release for in the waste rock and LGO Stockpile sample and higher levels of release apparent within the tailings leachate samples, except for arsenic, molybdenum and uranium.

pH was circum-neutral in all waste rock and LGO Stockpile leachates, ranging between pH 7.1 and 8.6 (Figure 20-4). pH was consistently acidic in the tailings leachate and showed an overall decreasing trend, ranging between a maximum pH 4.9 and minimum pH 3.4.

All samples reported an initial flush of electrical conductivity (EC) which was highest in the tailings (maximum 260 mS/m) (Figure 20-5). Waste rock and LGO Stockpile EC was lower and more stable from week 8, between 8 and 12 mS/m. EC in the tailings was lower from week 8 but showed a very gradual increasing trend, ranging between 14 and 33 mS/m.

A similar initial flush was reported for sulfate release (Figure 20-6) but all samples reported relatively consistent trends from week 12. As expected, sulfate release was highest in the tailings leachate, ranging between 48 and 84 mg/L from week 12 onwards.

Figure 20-8 and Figure 20-9 show estimated sulfide and NP remaining in the cells. The ABA testwork results reported sulfide at detection limit in all waste rock samples and the LGO Stockpile sample so these are not shown on Figure 20-8. The ABA sulfide content of the tailings sample was used together with sulfate release in the HCT leachates to estimate sulfide depletion. Figure 20-8 shows estimated sulfide depletion occurring around week 17. Figure 20-9 shows that NP within the tailings sample was rapidly consumed however all of the waste rock samples and the LGO Stockpile sample have greater than 90 % NP remaining.

Ficklin metal concentrations within the HCT leachates are shown versus pH in Figure 20-10. All waste rock leachates and the LGO Stockpile leachates are “near-neutral low metal” and the tailings leachates range between “acid low metal” and “acid high metal”. The tailings sample also reported increasing concentrations of cadmium to a maximum of 0.003 mg/L, lead to a maximum of 0.65 mg/L, copper to a maximum of 1.5 mg/L), nickel to a maximum of 1.2 mg/L) and zinc to a maximum of 2.6 mg/L over the testing program.

The HCT leachates are not directly comparable to Project Design Criteria (PDC) effluent guidelines but the data can be reviewed in conjunction with the guidelines just for initial screening purposes only. At week 20 the maximum cadmium concentration in the tailings leachate was below the effluent PDC of 0.005 mg/L (dissolved) but lead, copper, nickel and zinc concentrations were all above the effluent PDCs (0.01 mg/L [dissolved], 0.01 mg/L [dissolved], 0.2 mg/L [total] and 0.1 mg/L [total], respectively). There is no effluent PDC for tin.

Uranium concentrations in the HCT leachates were variable (Figure 20-11). The tailings sample reported an overall increasing trend to a maximum concentration of 0.97 mg/L at week 20 but the trend levels off around week 16. The WR Drillcores and LGO Stockpile leachates reported decreasing uranium concentrations, consistently below 1 mg/L from week 10 onwards. There is no effluent PDC for uranium but for comparison purposes only, the uranium drinking water PDC is 0.03 mg/L (total). The M&M and Miriam waste rock samples typically reported concentrations around 0.01 mg/L or lower from week 10 onwards.

The M&M leachates and WR Drillcore leachates showed an initial flush of molybdenum but all samples except for the LGO Stockpile reported a decreasing trend and concentrations less than 0.5 mg/L from week 6 onwards (Figure 20-12). Molybdenum concentrations in the LGO Stockpile leachates were relatively consistent around 1 mg/L.

Arsenic concentrations were highest in the WR Drillcores but reported a decreasing trend (Figure 20-13); the concentration at week 20 was 0.04 mg/L. The LGO Stockpile sample reported lowest arsenic concentrations (maximum 0.005 mg/L at week 17). Arsenic concentrations in all other samples were typically around 0.01 mg/L and showing relatively stable trends from around week 10, except for the Miriam sample which decreased to a minimum of 0.002 mg/L at week 15 then increased again thereafter. For comparison purposes only, the arsenic effluent PDC is 0.02 mg/L (dissolved) so all samples were below this from week 10 onwards except for the WR Drillcore leachates.

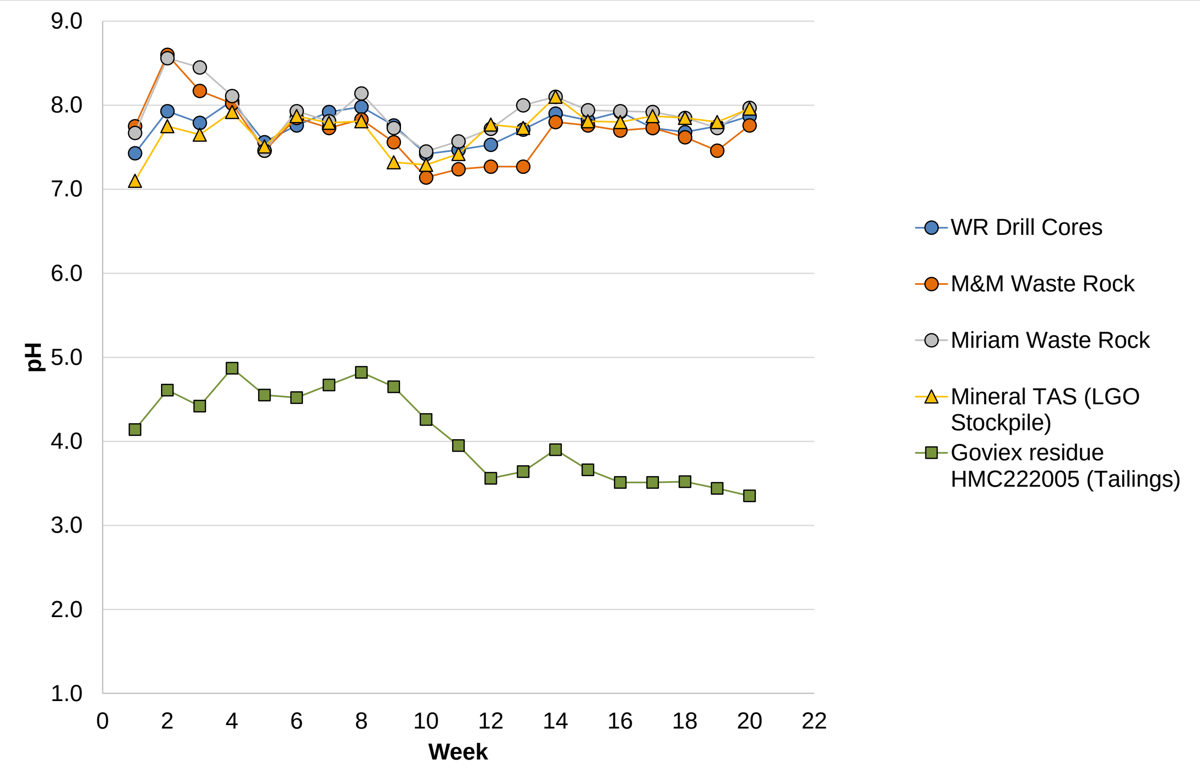


Figure 20-4: pH in HCT Leachate

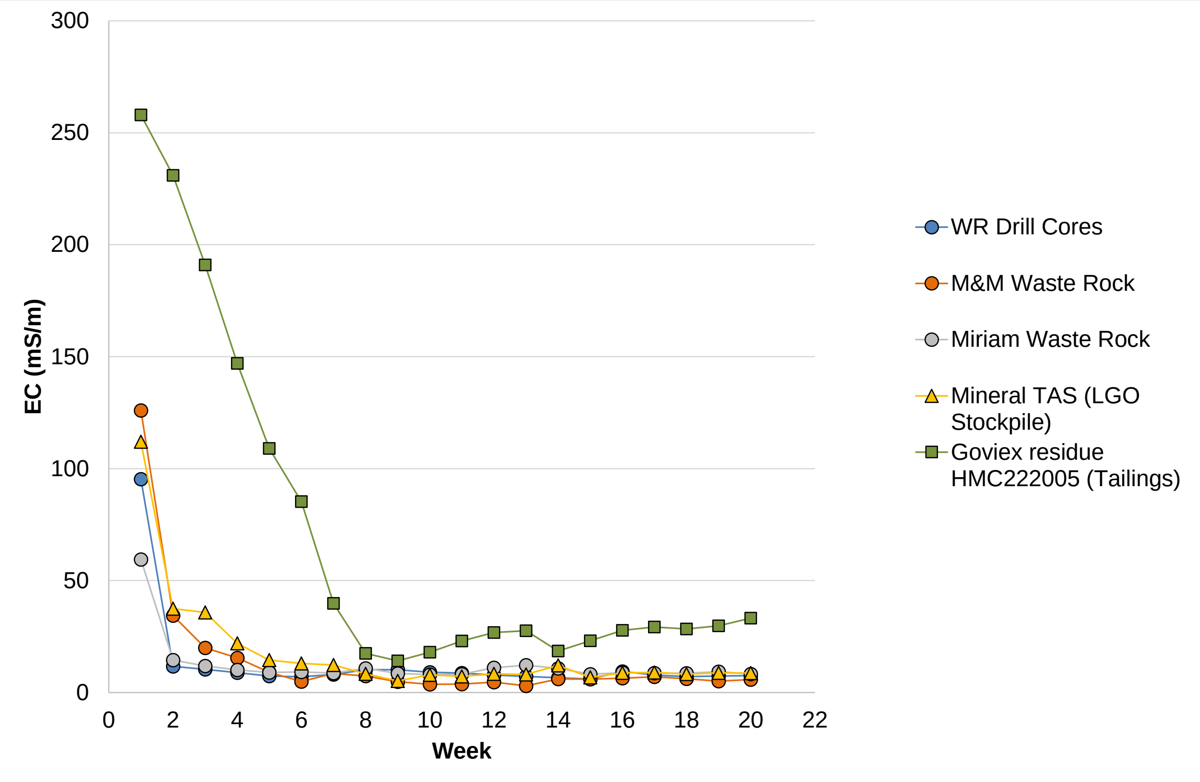


Figure 20-5: EC in HCT Leachate

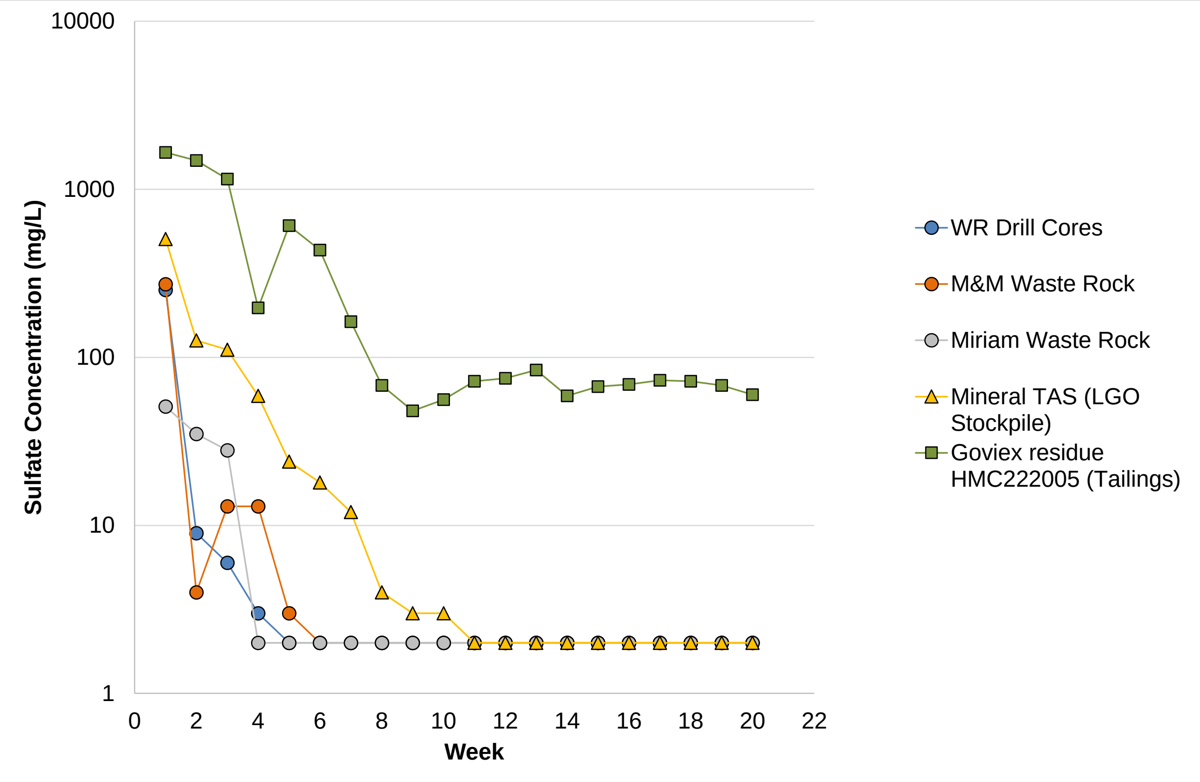


Figure 20-6: Sulfate Concentrations in HCT Leachate

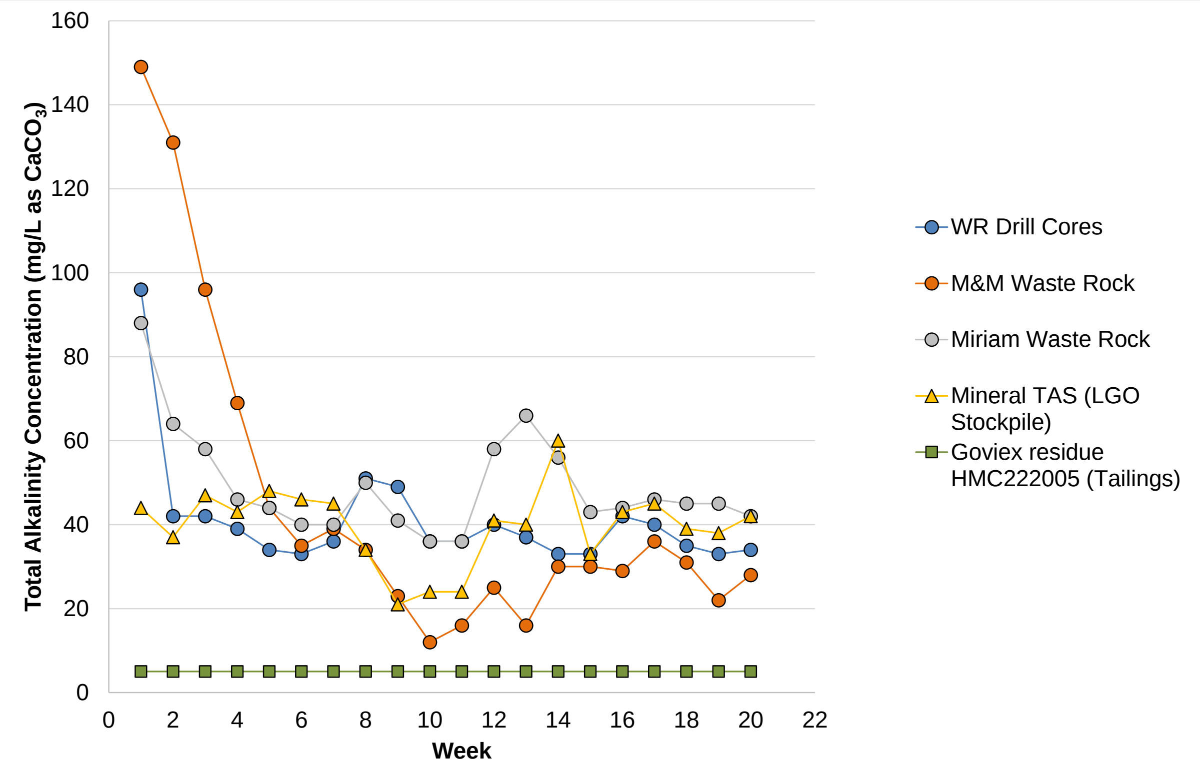


Figure 20-7: Total Alkalinity in HCT Leachate

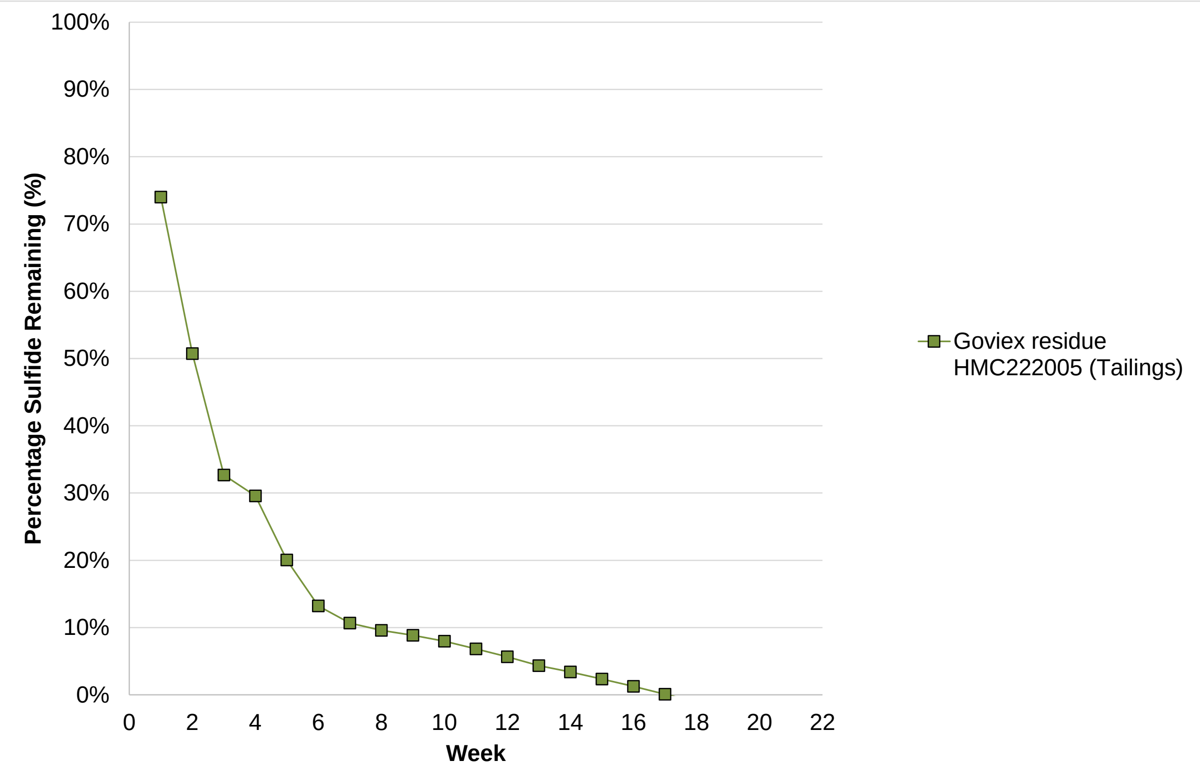


Figure 20-8: HCT Sulfide Remaining

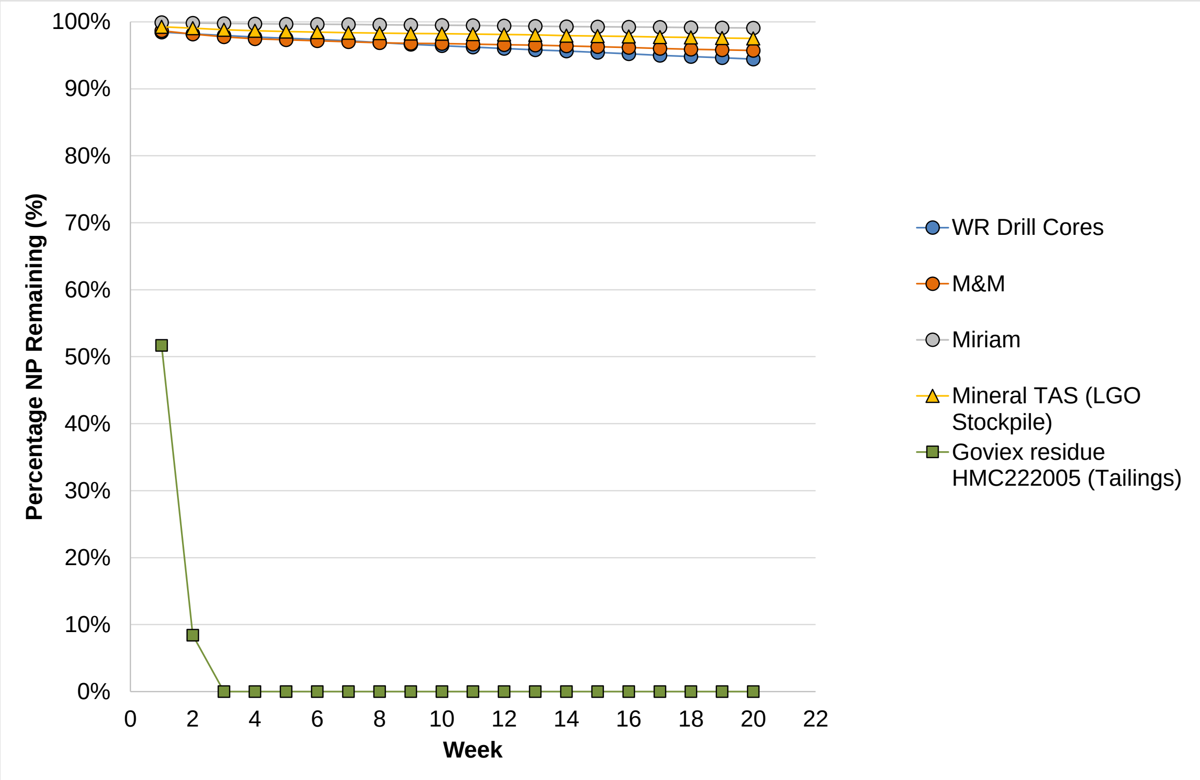


Figure 20-9: HCT NP Remaining

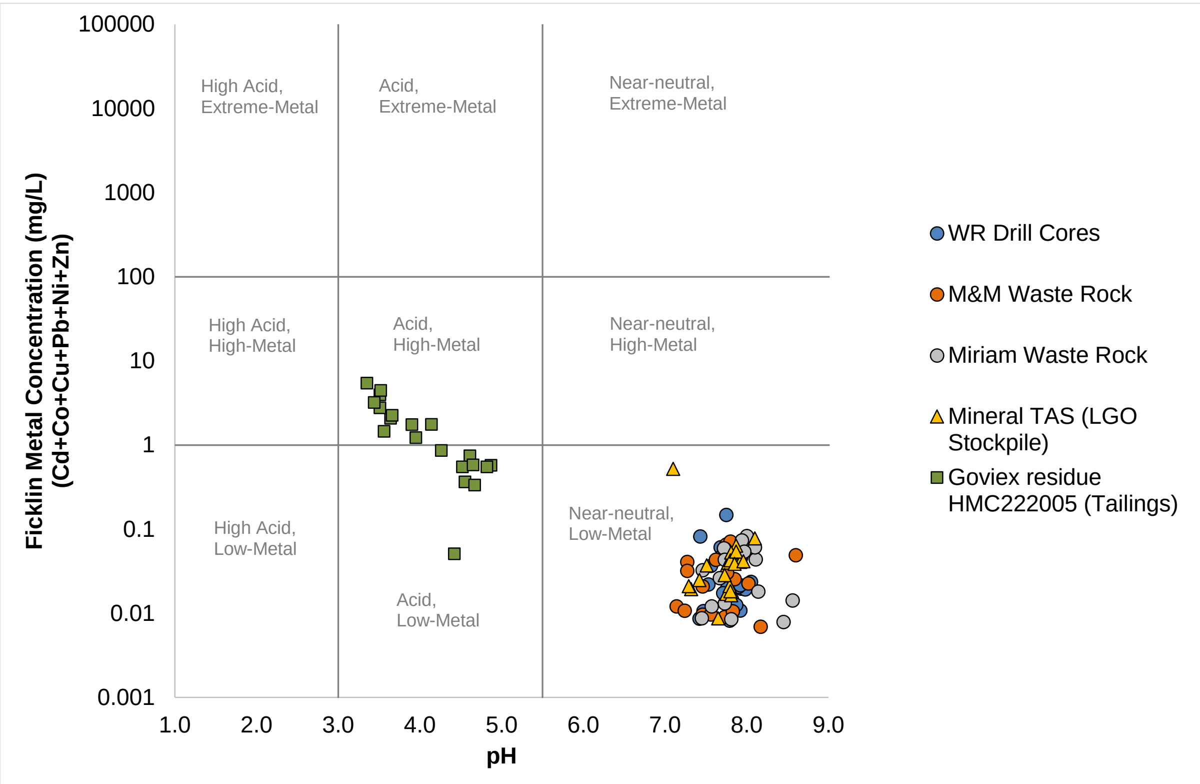


Figure 20-10: Ficklin Metal Concentrations in HCT Leachates

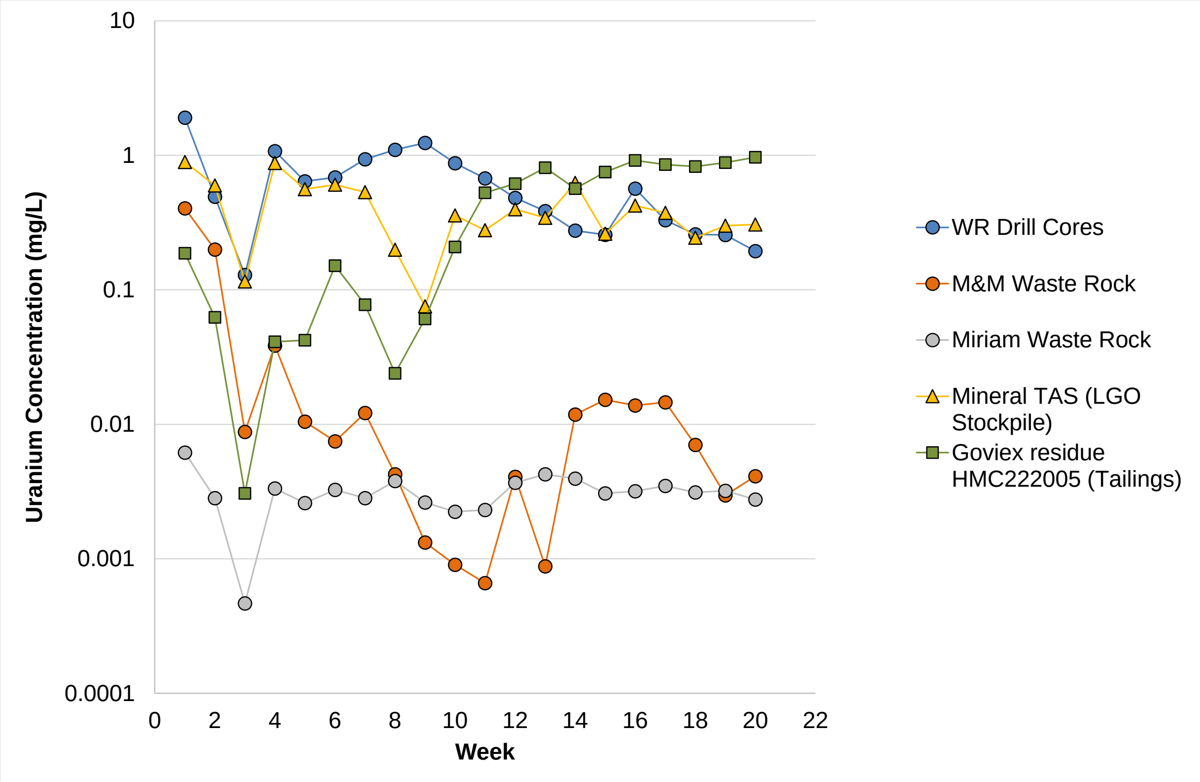


Figure 20-11: Uranium Concentrations in HCT Leachates

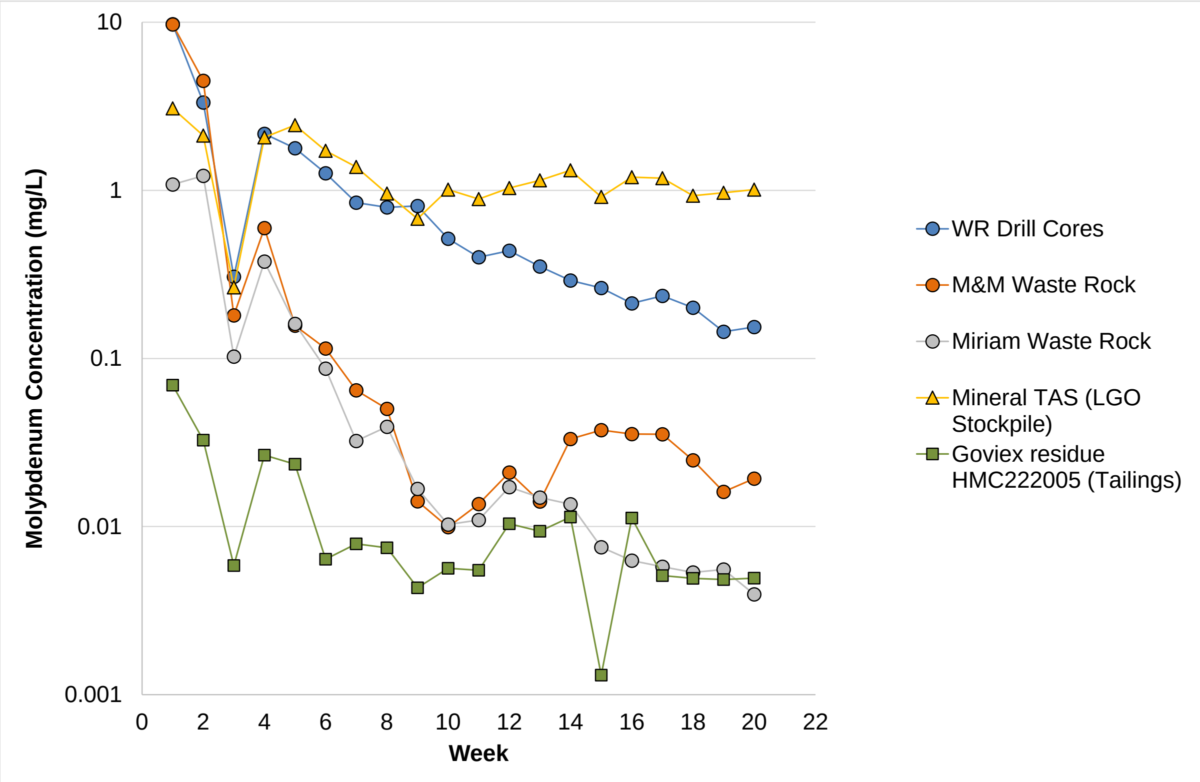


Figure 20-12: Molybdenum Concentrations in HCT Leachates

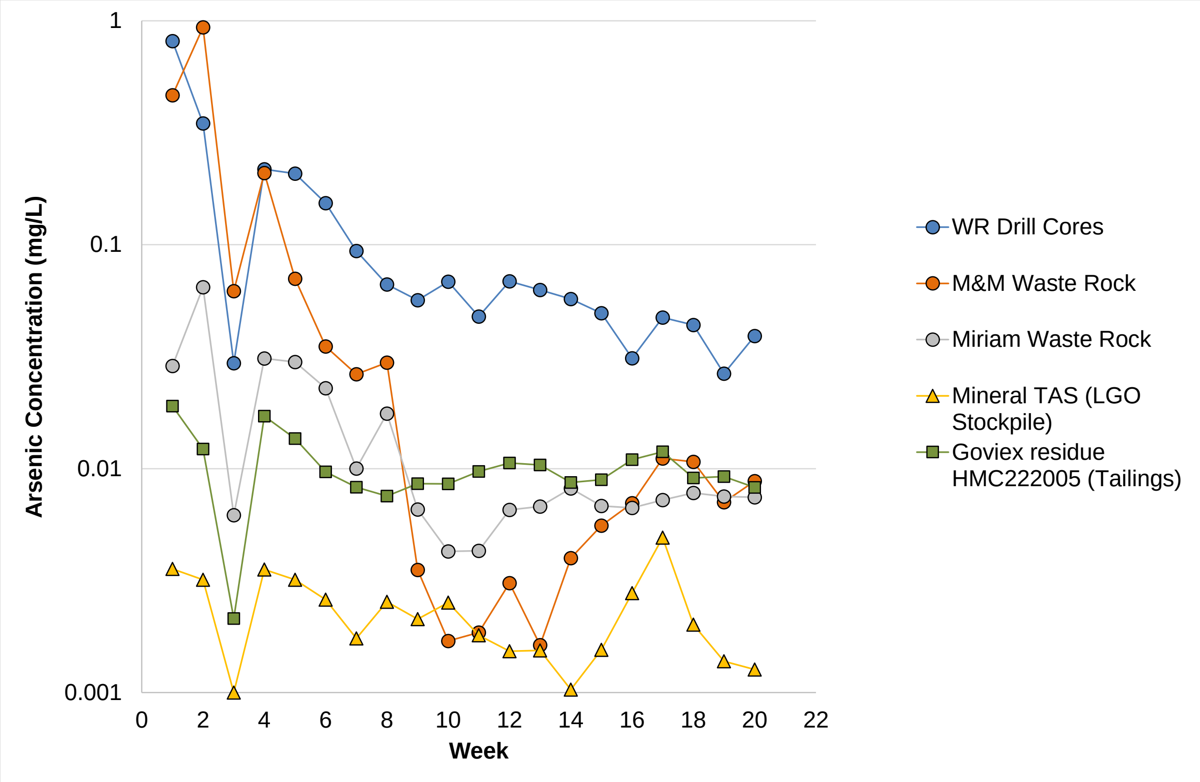


Figure 20-13: Arsenic Concentrations in HCT Leachates

20.6.3 Conclusions

The kinetic HCT results support the static testwork predictions with all waste rock samples remaining circum-neutral and displaying NAF conditions and the tailings sample generating an acidic leachate and displaying PAF conditions. There is a potential for metal mobility from the tailings that reported increasing concentrations of cadmium, lead, copper, nickel, tin and zinc throughout the 20 weeks of testing. The sulfide content in the tailings was estimated to be fully depleted around week 17 so it is possible the increasing metal trends within the tailing's leachates can be expected to stabilise or potentially decrease with time.

Uranium concentrations were also highest in the tailings residue and showed an overall increase but with more stable release (around 1 mg/L) from week 16 onwards. It should be noted the tailings sample available initially showed poor leaching and high residue uranium concentrations. Samples from later optimised metallurgical testing had much lower uranium concentrations and presumably leached at lower levels.

Metalloid mobilisation was low in the waste rock and LGO Stockpile samples but there is a potential for arsenic, uranium and molybdenum leaching at low levels reported for the WR Drillcore and LGO Stockpile samples.

Given the hydrological and hydrogeological context there is low potential for released solutes to migrate. The arid climate means there is minimal opportunity for seepage generation.

The waste rock dumps will feature evaporation paddocks around the toe line of the dumps that are constructed as part of the foundation preparations or during road construction. The paddocks are further discussed in the Stormwater Management Report (SRK 2022d). They will be excluded from areas such as the north-eastern sections of the WRD's where the runoff will not affect downstream areas. Site conditions post construction of the WRD toe line will dictate where paddocks are not required, and runoff can be managed in such a way as to cause minimal impact downstream. Based on the results of the geochemistry studies and the site water balance it has been deemed that the waste rock dump and ore sorter rejects do not require a cover for closure.

Runoff and seepage from the LGO stockpile will report towards diversion channels proposed downstream of the stockpile which in turn will report into an evaporation pond. The foundation pad for the stockpile facility will be designed to facilitate runoff and seepage towards the diversion channels (SRK 2022d). The LGO Stockpile should be processed during LoM operations and not remain post-closure.

The geochemical characterisation results for the ore sorter reject sample are likely to be over-conservative. SRK recommends this work is refined as the ore sorter testwork is further progressed to confirm if further control measures are required.

The tailings characterisation is currently preliminary given the nature of the initial metallurgical testwork samples and during operations additional characterization will be undertaken to confirm the current evaluation. The tailings are predicted to be PAF and have the potential to leach elevated concentrations of key parameters notably, uranium, molybdenum, cadmium, lead, copper, nickel, tin and zinc. To mitigate potential impacts associated with the geochemical characteristics of the tailings, the DSF has been designed with a basal clay and HDPE liner. During operations, seepage water will be captured and evaporated. The DSF will be progressively closed with a permanent cap during the life of mine. The cap will consist of two layers (clay / low permeability material and coarse waste rock). The low permeability layer us designed to prevent oxygen ingress, minimise radon emissions, and act as a general barrier to radiation; the coarse waste rock layer is designed to prevent wind and water erosion of the underlying finer material. Further information is provided in the Closure Management Report (SRK, 2022j).

20.7 Baseline Water Chemistry

A groundwater baseline study was undertaken as part of the ESIA reported in 2015. The full study is reported within ESIA Volume 4: Appendix F Water Resources Study (SRK, 2015b). The programme involved six water quality sampling rounds at 27 monitoring locations undertaken in the Project area and in community drinking water sources adjacent to the Project area. A total of 71 samples were collected during July and November 2012, February and July 2013 and July and October 2014. During the FS, one further round of water quality sampling was undertaken for comparison purposes and three opportunistic water quality samples were collected from new pumping test boreholes drilled in the vicinity of the Miriam open pit. Full details of the FS water quality baseline update are presented in SRK 2022i.

Baseline water quality was compared to the PDC for drinking water (SRK2022k). Baseline water quality data shows that concentrations of molybdenum, uranium, arsenic, gross alpha and gross beta are generally naturally more elevated in groundwaters close to the mineralisation in comparison with the surrounding community wells.

The Piper Plot presented in Figure 20-14 shows that groundwaters are dominated by sodium and bicarbonate ions. The community wells trend towards calcium-bicarbonate water types and moderate sulfate levels are apparent in the monitoring locations close to the mineralised zones (M&M, Miriam and MSNE).

Figure 20-15 to Figure 20-18 show pH versus arsenic, sodium, molybdenum and uranium for all monitoring locations. The monitoring wells in the vicinity of M&M and MSNE report elevated pH exceeding the drinking water PDC in the majority of samples. Sodium and arsenic are marginally elevated relative to the drinking water PDC in a number of samples in this area and uranium is slightly elevated in the Army Camp borehole. Elevated gross alpha and gross beta results coincide with the mineralisation in monitoring wells around M&M and MSNE. The water quality results for monitoring wells around Miriam are similar to M&M, with pH exceeding drinking water PDC in all samples. Sodium and arsenic concentrations are marginally elevated relative to the drinking water PDC in one or more samples. Elevated uranium is reported in one of the wells, gross alpha was elevated in the majority of locations and gross beta was elevated in two samples.

Water from the open pit will be used in the process plant where treatment will be undertaken, including for potable water. Dewatering and discharge requirements for the underground mine is discussed further in SRK 2022f.

The water quality at the community wells is generally good except for slightly elevated pH above the drinking water PDC and an unusually high nitrate result reported at one monitoring location (Madaouela well) during the FS baseline update. The groundwater quality in the vicinity of the proposed wellfield is also good with only pH exceeding the drinking water PDC (8.6 relative to PDC of pH 8.0). The elevated pH does not necessarily make the water unsafe to drink, however alkaline water can have an unpleasant smell or taste, and it can also damage pipes and water-carrying appliances.

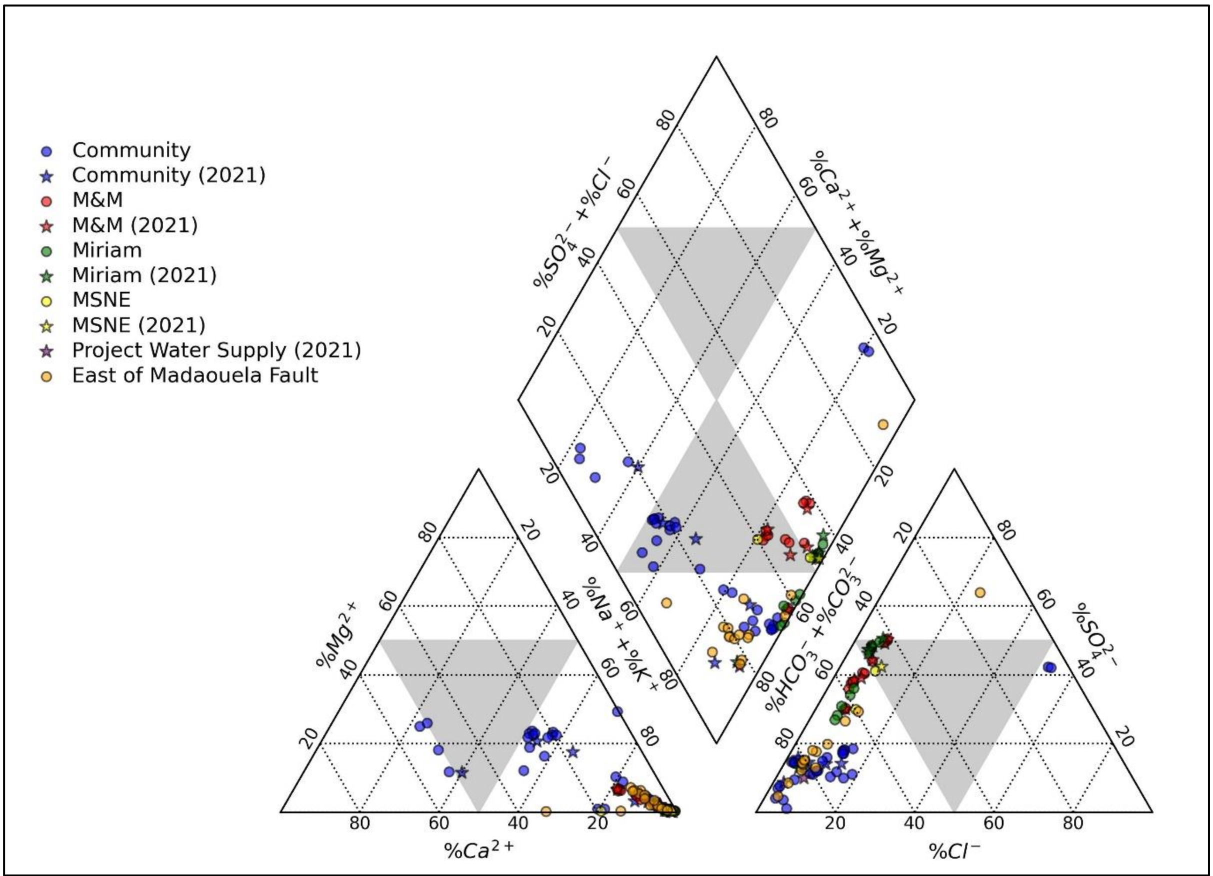


Figure 20-14: Piper Plot

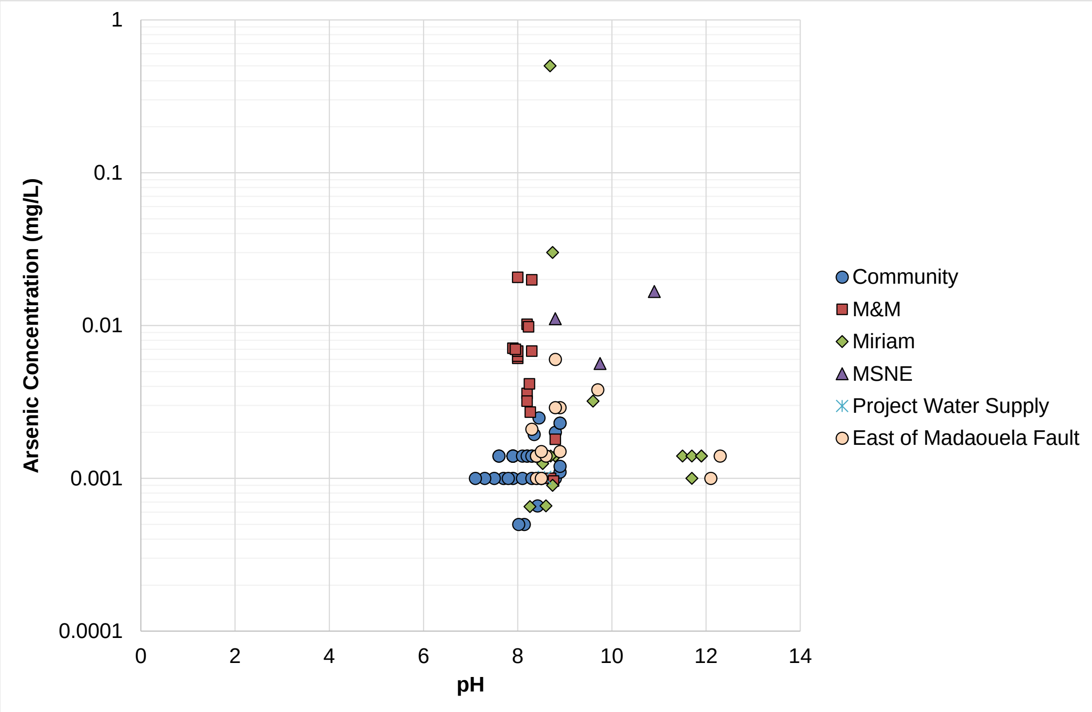


Figure 20-15: pH versus arsenic for previous baseline and 2021 water quality samples

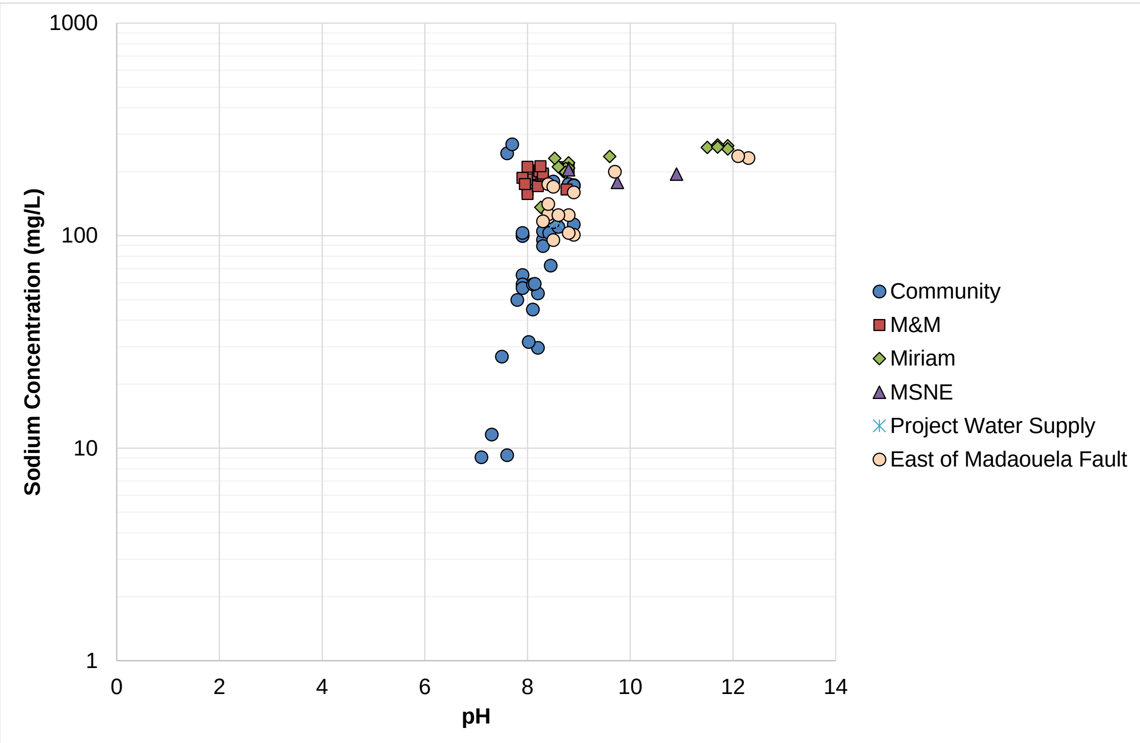


Figure 20-16: pH versus sodium for previous baseline and 2021 water quality samples

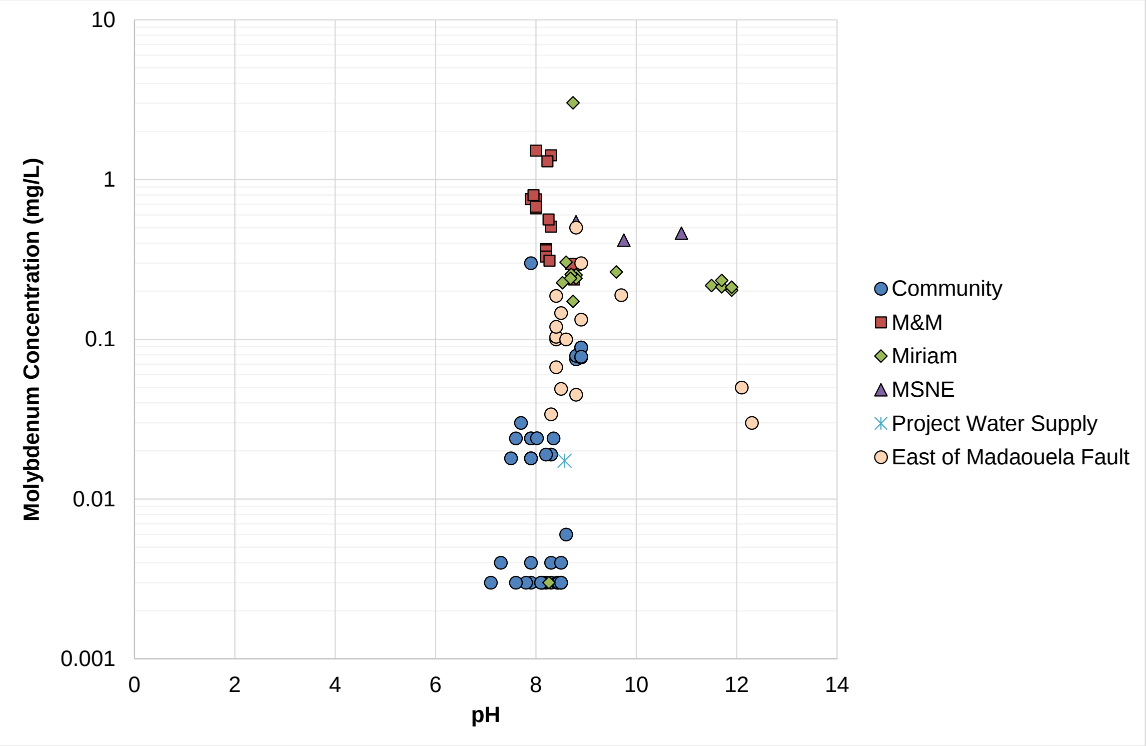


Figure 20-17: pH versus molybdenum for previous baseline and 2021 water quality samples

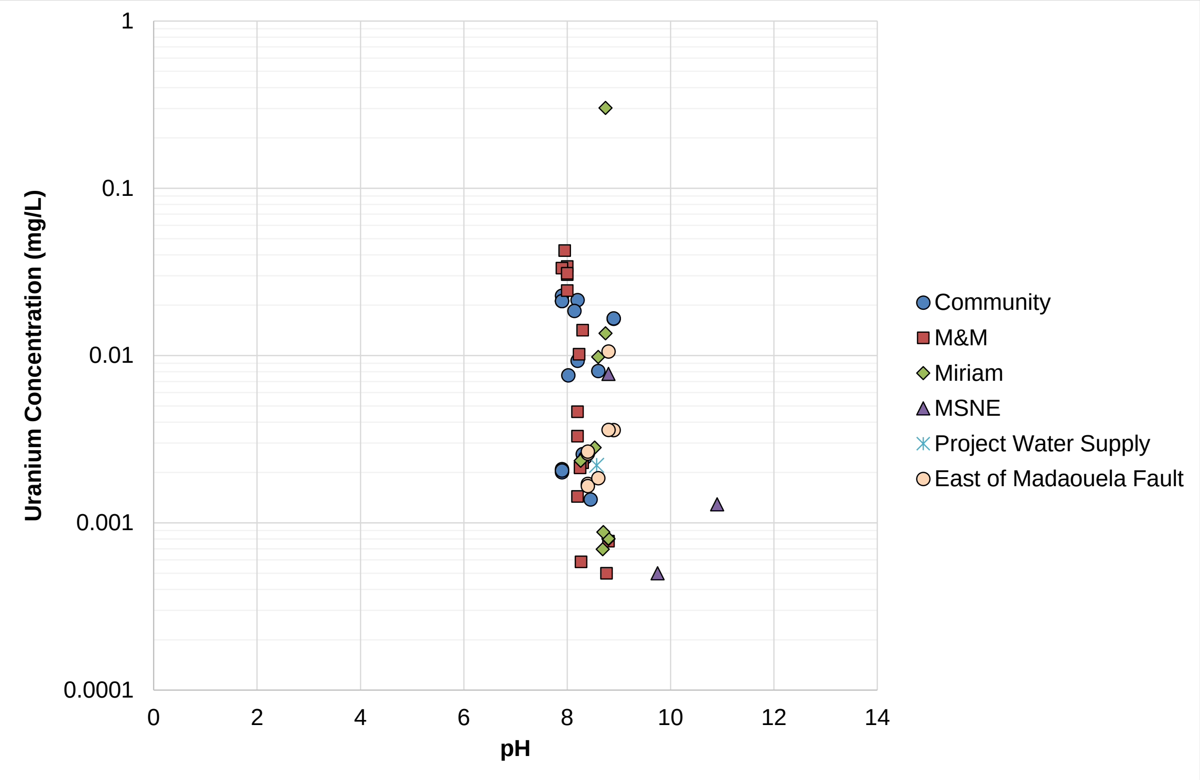


Figure 20-18: pH versus uranium for previous baseline and 2021 water quality samples

20.8 Water and Mineral Waste Monitoring

20.8.1 Groundwater and Surface Water Quality

GoviEx are planning on establishing a Water Quality Management Plan that details operational monitoring commitments.

A network of groundwater monitoring locations will be established around the site for future routine monitoring. Immediately prior to the start of construction, a round of water sampling will be conducted to confirm baseline conditions. The monitoring locations will be based on pre-existing wells that will be maintained to provide an early warning of any potential changes to groundwater quality. These locations will be selected and located around the site based on the hydrogeological understanding of potential flow pathways.

Surface water quality sampling will also be undertaken where present, for example at the dewatering ponds and evaporation ponds to better understand the potential risk to any animal that may drink the water e.g. birds or livestock.

Water quality samples will be collected on a quarterly basis and analysed within the onsite laboratory for a full suite of physiochemical parameters and metalloids. A sub-set of water quality samples will be submitted annually to an external laboratory to provide quality assurance for the on-site laboratory data, and provide supporting data for additional analytes.

20.8.2 Waste Rock, Tailings and Ore Sorter Rejects

GoviEx intends to establish an ARDML Management Plan that details operational monitoring commitments for mine residues. In the active dumps, waste rock and ore sorter reject samples will be collected after deposition to confirm the geochemical characteristics remain as predicted. Composite grab samples will be collected at a minimum frequency of one sample for every 300,000 tonnes. One tailings solids sample will be collected on a quarterly basis. The samples will be analysed for acid base accounting including sulfur and carbon speciation and elemental analysis by inductively coupled plasma (ICP) method after a multi-acid digestion. The results should be reviewed to ensure that they support the current findings regarding the geochemical characterisation predictions.

20.9 Rehabilitation and Closure Strategy and Closure Costs

A stand-alone conceptual Rehabilitation and Closure Plan has been produced that provides a framework to enable GoviEx to continually review and update the project closure strategy and planning as the project progresses into operation and moves towards eventual closure. The conceptual plan covers rehabilitation of the various projects areas and provides the basis for a closure cost estimate.

Closure related impacts, risk and benefits from the Project identified during the ESIA process will be re-assessed continually throughout the life of the Project, as part of the ESMS, with the aim of progressing the plan from conceptual in nature to a detailed implementation plan as the operation progresses. The objective of this review process is to use the outcome of ongoing operational monitoring and mine planning to refine the closure and rehabilitation measures so that at least two years prior to actual planned closure the actions required are thoroughly identified and relevant costs allocated.

The mine closure planning for the Project follows Niger legal requirements and good international industry practice and aims to:

- present a vision for closure, with clearly defined closure outcomes and completion criteria;
- incorporate physical and socio-economic considerations and will become an integral part of a project life cycle;
- include financial provisions to ensure that there are sufficient funds available to complete the prescribed closure activities;
- be regularly updated and refined to reflect changes in mine development and operational planning, as well as the environmental and social conditions and circumstances;
- include appropriate aftercare and continued monitoring of the site pollutant emissions and related potential impacts;
- include adjustments to closure funding arrangements to reflect any changes in mine closure requirements.
- design tailings structures should be decommissioned so that water accumulation on the surface is minimised and that any water from the surface of the structure can flow away via drains or spillways and these can accommodate the maximum probable flood event;
- ensure surface water and groundwater should be protected against adverse environmental impacts and leaching of chemical should be prevented to protect human health and ensure compliance with water quality objectives.
- Incorporate climate change predictions from the dedicated climate change study for the project. In reality the predicted changes to climate are relatively modest given the very arid nature of the project area.

Where possible disturbed areas will be shaped so the land has a similar type of landform as before the Project. Some disturbed areas will not look the same as before mining commenced, such as the open pit, the waste rock dumps and the tailings storage facility. These disturbed areas will be managed to ensure they are safe and the landforms are sustainable into the future.

The FS financial model includes a provision of ~USD 8.5m. It should be noted that this figure does not include the majority of the DSF capping costs which are scheduled to be done progressively over the LOM to minimise dust and radiation exposure. These progressive rehabilitation costs are captured under the operating costs in the financial model.

21 CAPITAL AND OPERATING COSTS

The tables below summarise the capital and operating costs for the Madaouela Uranium Project. The detailed development of these individual costs is provided in the relevant sections.

21.1 Capital Expenditure

The process plant is designed around two stage acid leaching to maximise uranium and molybdenum recovery whilst reducing overall acid consumption. Plant feed is designed at 1 Mtpa, with ore initially crushed before milling. The Feasibility Study has been moved away from SAG milling in the comminution circuit due to the introduction of the two VeRo Liberator mills as a replacement to reduce operating and capital costs associated with the comminution process as well as reducing total power required.

Total capital expenditure for the life of the operation is presented in Table 21-1. Capital costs include a 10 % contingency.

Processing capital costs include a USD 11 million allowance for administration buildings, process plant stores, medical centre and laboratory and Miriam open pit infrastructure. The process plant costs amount to USD 231 million.

Infrastructure initial capital costs include USD 26 million for power supply for project, of which USD 14 million is associated with the inclusion of a solar hybrid power plant.

Table 21-1: Capital expenditure

Parameter	Units	Total amount
Initial Capital		
Open Pit Mining	(USDm)	46.1
Processing	(USDm)	242.4
Tailings	(USDm)	14.8
Infrastructure	(USDm)	28.6
Water	(USDm)	6.0
Owners Costs	(USDm)	4.8
Total	**(USDm)**	**342.7**
Sustaining Capital		
Open Pit Mining	(USDm)	2.7
Underground Mining	(USDm)	218.6
Tailings	(USDm)	7.8
Power	(USDm)	2.5
Infrastructure	(USDm)	34.2
Water	(USDm)	7.6
Processing	(USDm)	3,1
Total	**(USDm)**	**276.6**
Total Capital Expenditure	**(USDm)**	**619.3**

A number of potential optimisations are not included in the current study which will be assessed in the next stage, namely:

- Use of a Power Purchase Agreement (PPA) for the supply of renewable energy for the project. The FS assumes a USD 14.3 million capital investment at the start of the project to provide a solar hybrid power plant to ensure power stability. Now that the power load is finalised, the next stage can include negotiations for PPA contracts whilst ensuring the Levelised Cost of Electricity (LOCE) is improved.
- The FS assumes that the Miriam mining fleet would be purchased new as the conservative option, however given the relatively short life of the Miriam deposit, an assessment of second hand/refurbished open pit mining equipment was undertaken. This study indicated that savings of between 30 and 60 % could be achievable by using second hand or

refurbished open pit mining equipment. The initial mining equipment capital cost is currently planned at USD 26.4 million.

21.2 Operating Costs

A detailed reassessment of the operating costs has been fully updated and based on recent quotations and tenders.

Table 21-2: Project Unit Operating Costs

	USD /t Process	USD /lb U_3O_8	LoM USDm
Open Pit Mining	*20.8*	*9.1*	102.6
Underground Mining	*44.0*	*16.0*	633.7
Total Mining*	38.1	14.5	736.3
Processing	35.8	13.6	691.5
SG&A	9.3	3.5	179.0
Sub Total Operating Costs	83.1	31.7	1,607.0
Mine Closure	0.4	0.2	8.5
Total Operating Costs	**83.5**	**31.8**	**1,615.4**

**Weighted average between open pit and underground mining costs*

The Madaouela Project contains molybdenum mineralisation in both the open pit and the underground mines, and this saleable by-product results in additional revenue to support the development of the project and its cashflows.

The process plant has been designed and costed for the recovery of molybdenum for the life of the mine. While molybdenum reserves are defined for the Miriam open pit and the initial mining period in the M&M the molybdenum resources have not been classified for the majority of M&M and not at all for MSNE. The financial model incurs the costs associated with molybdenum recovery throughout the life of mine immaterial of the molybdenum grade from ore resources. This provides a conservative cashflow approach, hence an approach is provided that provides a sensitivity including molybdenum grades in the underground mining operations not included in the measured and indicated resource categories.

Royalties apply to both uranium and molybdenum revenue. The tables below provide analysis of the impact of inclusion of the molybdenum to total operating costs dependant on the inclusion of molybdenum reserves or the upside of molybdenum outside of these categories but based on drilling results.

Table 21-3: Total Operating Costs Net of Molybdenum Credits (Reserves Case)

	USD /t Process	USD /lb U_3O_8	LoM USDm
Sub-Total Operating Costs (Table 21-2)	83.5	31.8	1,615.4
Royalty Tax	12.1	4.6	233.2
Molybdenum Revenue	1.6	0.7	30.6
Total Operating Costs	**94.0**	**35.8**	**1818.0**

Table 21-4: Total Operating Costs Net of Molybdenum Credits (Upside Case)

	USD /t Process	USD /lb U_3O_8	LoM USDm
Sub-Total Operating Costs (Table 21-2)	83.5	31.8	1,615.4
Royalty Tax	12.1	4.6	241.3
Molybdenum Revenue	7.6	2.9	146.3
Total Operating Costs	**89.5**	**34.1**	**1,730.5**

22 ECONOMIC ANALYSIS

An economic analysis on the Mineral Reserves of the Project together with an assessment of a production case that includes value obtained from a molybdenum product has been undertaken.

The key assumptions, inputs and outputs are described in this section. A financial model has been created in Microsoft Excel, in US Dollars and in real money terms valid at Q3 2022. The LoM plan is based on:

- The Miriam open pit is mined first, processing the ore above a [0.4kg/t eU] grade first and stockpiling low grade ore for potential processing at the end of the Life of Mine.
- The Marianne-Marilyn and MSNE-Maryvonne underground mines come into production one after the other once the open pit has been mined out.
- There is one-year overlap between open pit and underground mining as the underground production at Marianne-Marilyn ramps up; and
- The process plant is designed around two stage acid leaching to maximise uranium recovery whilst reducing overall acid consumption. Ore is crushed before milling and two VeRo Liberator mills have been used. The milled ore is planned to be leached using sulfuric acid to extract the uranium and molybdenum into solution, with the molybdenum to be removed by continuous flow Ion Exchange, with precipitation of the Molybdenum to produce molybdenum trisulfide (MoS_3). The project is designed to produce triuranium octoxide (U_3O_8) through industry standard ammonium diuranate (ADU) and calcination (see Section 13 for additional details).

22.1 Inputs and Case

Molybdenum production (MoS_3) is an independent by-product of the processing plant based on metallurgical test work results that demonstrates recovery to produce a clean U_3O_8 product. Therefore, associated operating and capital costs to recover MoS_3 are included in the model in all cases no matter the molybdenum resource status.

The project contains molybdenum mineralisation in both the Miriam open pit and underground mines at the following average levels:

Table 22-1: Average Molybdenum Content (ppm) for Indicated, Inferred and Unclassified Resource

	Indicated	Inferred	Unclassified
Miriam	130	-	-
MM	474	335	388
MSNE	-	-	568

As a result of the confirmation of appreciable molybdenum in metallurgical tests conducted, it is considered relevant to present the potential positive impact that recovery of MoS_3 product from processing uranium ore life of mine would have on project economics.

22.1.1 Inputs

The assumptions applied and the inputs to the financial model include:

- The ore tonnages and uranium grades in the LoM plan, constitute the Mineral Reserves, prepared in line with the CIM definition standards.
- A plant capacity of 1 Mtpa.
- On average a 76.7 % mass yield is achieved via the ore sorter stage, this includes a portion of screened fine material that does not pass through the ore sorter.
- Overall uranium recovery of 94.8 % for open pit plant feed, 91.5 % for underground plant feed.
- The molybdenum resource is split between indicated (73 ppm), indicated and inferred (127 ppm) and indicated, inferred and unclassified (360 ppm). Recovery of molybdenum metal is 88.9 % for the open pit and 79.9 % for the underground. The base case considers only indicated molybdenum and Section 22.2 explores the results should inferred and unclassified molybdenum be included.
- Plant operating costs include an allowance for molybdenum recovery based a 50 ppm Molybdenum grade even if no molybdenum resource is present.
- A LoM of 19.5 years based on plant production, excluding construction.
- An assumed U_3O_8 price of USD 65 /lb and a molybdenum price of USD 5.9 /lb MoS_3. This is based on the Q3 2022 long term price sourced by the Company
- Operating and capital costs are defined in Section 21 . These include a 10 % contingency on all upfront capital costs.

- A 30 % income tax rate after a three-year tax holiday.
- Royalty rate based on the 2022 Niger Mining Code which stipulates a flat rate of 7 %.
- A base case 8 % discount rate; and
- No provision for salvage value at closure has been assumed.

LoM ore tonnages and uranium grades for the three different deposits are presented in Table 22-2. Figure 22-1 and Figure 22-2 present the mining production schedule and the mill feed schedule, respectively, per source of material.

Table 22-2: Technical Mining Inputs

Parameter	Units	
Ore production period	(years)	19.7
Plant operating period	(years)	**19.5**
Miriam	(years)	Year 0 to 5
Marianne-Marilyn	(years)	Year 5 to 16
MSNE-Maryvonne	(years)	Year 15 to 19.5
RoM Ore to Plant	(kt)	**19,341**
Miriam	(kt)	4,940
Marianne-Marilyn	(kt)	9,945
MSNE-Maryvonne	(kt)	4,457
RoM U Grade	(kg/t eU)	**1.08**
Miriam	(kg/t eU)	0.87
Marianne-Marilyn	(kg/t eU)	1.16
MSNE-Maryvonne	(kg/t eU)	1.14
U Content	(kt)	**21.18**
Miriam	(kt)	4.58
Marianne-Marilyn	(kt)	11.53
MSNE-Maryvonne	(kt)	5.08

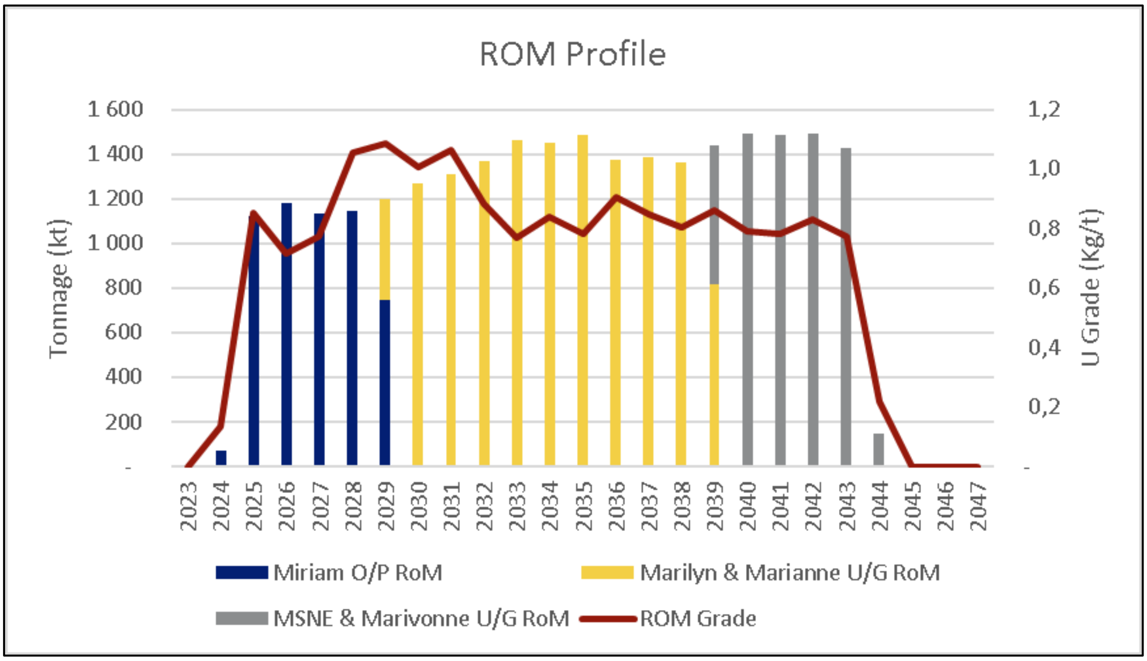


Figure 22-1: Run of mine profile

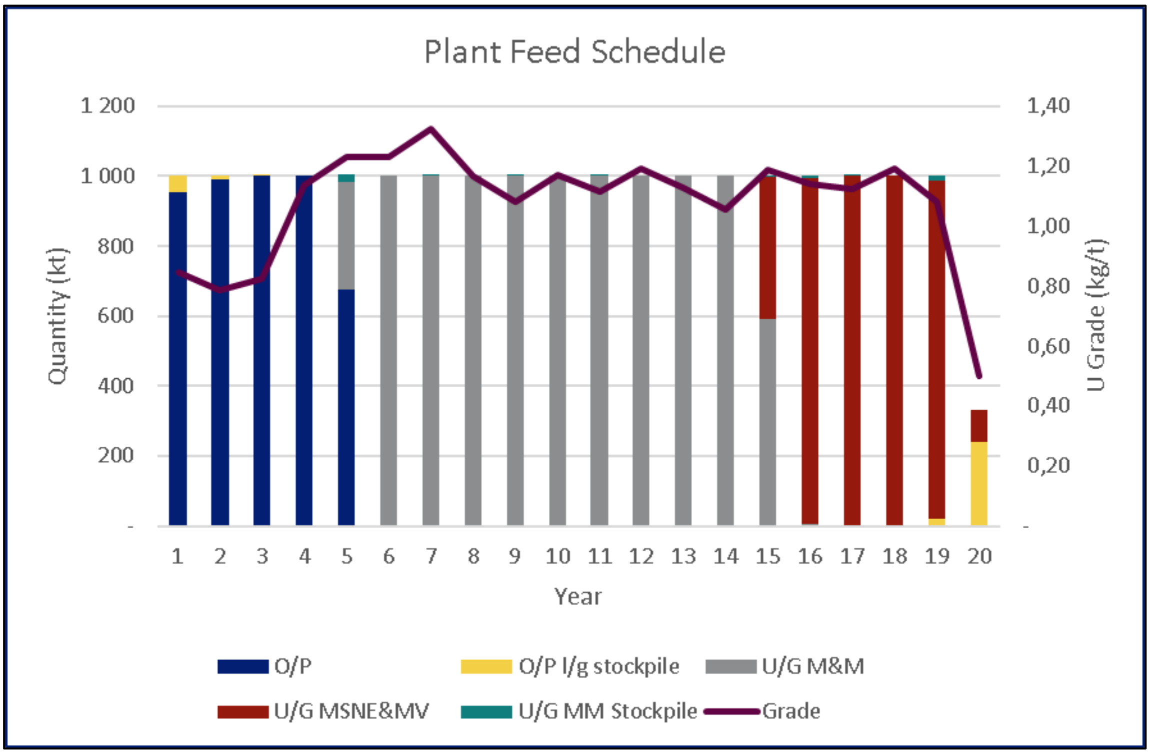


Figure 22-2: Mill Feed profile (post ore sorter)

22.1.2 Result

The economic analysis of the production case including the Mineral Reserve and recovery of a molybdenum by-product is presented in Table 22-3. Revenue generated by MoS_3 sales refers only to the indicated case with the inferred and classified cases shown separately.

Table 22-3: Uranium + Molybdenum Mineral Reserve economic summary

Parameter	Units	Value
Mining		
RoM Ore	(kt)	19,341
U Grade	(kg/t eU)	1.10
U Content	(Kt eU)	21.33
Processing		
Average U Recovery	(%)	92.20%
U Recovered	(M lb)	43.06
Revenue		
U_3O_8 Sales	(Mlb U_3O_8)	50.78
U_3O_8 Price	(USD/lb U_3O_8)	65.00
U_3O_8 Revenue	(USDm)	3,301
MoS_3 sales	(USDm)	31
Operating Expenditure		
Direct Operating Costs	(USDm)	1,615
Royalty (U + Mo)	(USDm)	233
Total Operating Costs	(USDm)	1,848
Unit Operating Costs		
Subtotal Operating Costs	(USD/t ore)	83.51
	(USD/lb U)	37.51
	(USD/lb U_3O_8)	31.81
Royalty	(USD/t ore)	12.06
Total Operating Costs	(USD/t ore)	95.57
	(USD/lb U)	42.93
	(USD/lb U_3O_8)	36.40
Operating Profit – EBITDA	(USDm)	1,483
Corporate Profit Tax	(USDm)	252
Net Free Cash	(USDm)	611
NPV @ 8.00%	(USDm)	120
IRR	(%)	12.71%
Breakeven Price (NPV=0 @ 8%)	(USD/lb U_3O_8)	57.38

Table 22-6, at the end of this section, provides the first 10-year outputs from the Financial Model.

22.1.3 Sensitivity

Table 22-4 and Table 22-5 presents NPV and IRR sensitivity results for changes in uranium prices and molybdenum prices, at the base U_3O_8 price of USD 65 /lb and 8 % discount rate.

Table 22-4: NPV and IRR sensitivity to uranium price

Price (USD/lb U_3O_8)	NPV (USDm)	IRR (%)
70	199	15.5%
65	120	12.7%
60	41	9.7%

A sensitivity to the molybdenum grade is presented in Table 22-5 at the base U_3O_8 price of USD 65 /lb and 8 % discount rate.

Table 22-5: NPV and IRR sensitivity to molybdenum price[1]

Price (USD/lb MoS_3)	NPV (USDm)	IRR (%)
6.49	121	12.8%
5.90	120	12.7%
5.36	119	12.7%

[1] based on a USD 65/lb U_3O_8 price

Table 22-6: Summary of the Economics Assessment (LoM and first 10 years)

Calendar Year			**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Production Year			**-2**	**-1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Total Mining Waste														
Waste	(Mt)	50	-	7.58	9.75	10.23	10.34	8.90	3.15	-	-	-	-	-
RoM Ore	(Mt)	26	-	0.07	1.12	1.18	1.13	1.15	1.20	1.27	1.31	1.37	1.46	1.45
Grade	(Kg U/t)	0,85	-	0.13	0.85	0.72	0.77	1.05	1.08	1.01	1.06	0.88	0.77	0.84
Content	(Kt eU)	21,972	-	0.04	0.87	0.84	0.87	1.18	1.29	1.28	1.38	1.21	1.12	1.21
Total Processing														
RoM Ore	(Mt)	19,341	-	0	1 000	1 000	1 003	1 000	1 005	1 000	1 000	1 000	1 000	1 000
Grade	(Kg U/t)	1.09	-	0.06	0.85	0.79	0.83	1.14	1.23	1.23	1.32	1.17	1.08	1.17
Content	(Kt eU)	21,184	-	0.00	847.48	786.70	828.49	1,134.94	1,238.76	1,228.69	1,324.25	1,165.36	1,079.68	1,169.01
Sales														
U_3O_8 Tonnage	(Mlb U_3O_8)	50.78	-	-	2.09	1.94	2.04	2.80	3.02	2.92	3.15	2.77	2.57	2.78
Product Price	(USD/lb)	65.00	-	-	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00
U_3O_8 Sales Revenue	(USDm)	3, 300.5	-	-	135.8	126.0	132.7	181.8	196.5	190.0	204.8	180.2	166.9	180.8
MoS_3 Tonnage	(Mlb MoS3)	5.19	-	-	0.16	0.28	0.52	0.71	0.79	1.03	1.03	0.56	-	-
Product Price	(USD/lb)	5.90	-	-	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
MoS_3 Sales Revenue	(USDm)	30.6	-	-	0.9	1.6	3.0	4.2	4.7	6.1	6.1	3.3	-	-
Operating Costs														
Mining: Miriam	(USDm)	102.6	-	-	22.1	22.6	23.8	22.5	10.9	-	-	-	-	-
Underground Mining	(USDm)	633.7	-	-	-	-	-	6.2	22.4	41.8	44.8	45.0	47.0	44.6
Mining: Other	(USDm)	-	-	-	-	-	-	-	-	-	-	-	-	-
Processing	(USDm)	691.4	-	-	33.4	33.4	33.7	33.9	33.6	36.2	35.7	36.9	36.5	36.6
SG&A	(USDm)	179.0	-	-	8.7	8.6	8.7	9.4	9.5	9.5	9.4	9.1	10.9	9.1
Mine Closure	(USDm)	8.5	-	-	-	-	-	-	-	-	-	-	-	-
Royalty Tax	(USDm)	233.2	-	-	9.6	8.9	9.5	13.0	14.1	13.7	14.8	12.8	11.7	12.7
Corporate Income Tax														
Profit Tax	(USDm)	252.,3	-	-	-	-	-	19.7	21.3	15.4	18.4	10.2	4.2	9.1
Net Profit	(USDm)	661.7	-	-	30.2	20.6	26.4	45.9	49.6	35.8	42.9	23.8	9.8	21.1
Capital Expenditure														
Mining	(USDm)	267.4	-	46.1	1.4	1.2	2.0	30.4	42.5	12.4	4.6	10.8	5.9	4.2
Processing	(USDm)	245.5	190,5	51.9	-	-	-	3.1	-	-	-	-	-	-
Tailings	(USDm)	22.6	-	14.8	1.3	0.5	0.0	0.0	0.0	1.4	0.5	0.0	0.0	0.0
Infrastructure	(USDm)	65.,3	3,7	24.9	-	-	8.9	17.6	7.2	0.8	-	-	-	-
Water management	(USDm)	13.6	-	6.0	0.1	-	-	-	0.4	-	1.0	-	4.7	0.4
Owner costs	(USDm)	4.8	1,7	3.2	-	-	-	-	-	-	-	-	-	-
Total	(USDm)	619.3	195,8	146.9	2.8	1.7	10.8	51.2	50.2	14.6	6.1	10.8	10.5	4.6
Economic Assessment														
EBITDA	(USDm)	1,482.7	-	-	62.9	54.1	60.0	101.0	110.8	94.8	106.2	79.6	60.9	77.9
Free Cash Flow (post-tax, pre-finance)	(USDm)	611.1	(195.8)	(146.9)	59.4	53.1	49.6	28.9	40.4	64.8	81.4	58.8	45.9	64.0
Cumulative FC	(USDm)		(195.8)	(342.7)	(283.3)	(230.2)	(180.6)	(151.7)	(111.3)	(46.5)	34.9	93.7	139.6	203.6

22.2 Molybdenum Upside Cases

The inputs are the same as those previously presented in the "Uranium and Molybdenum Mineral Reserves", however include upside from the inferred and unclassified molybdenum grades.

Figure 22-3 below shows the difference in kg of molybdenum recovered per year for each of the three modelled cases.

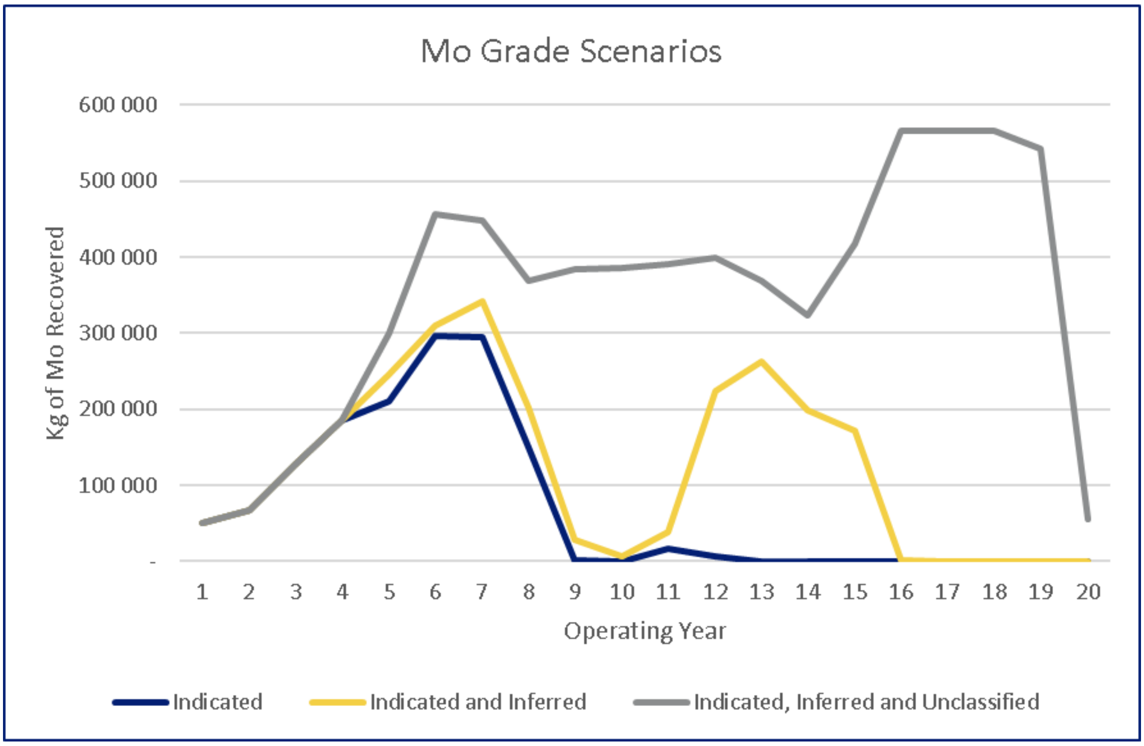


Figure 22-3: Recovery of Molybdenum for three cases

22.2.1 Results

The economic analysis for the indicated; indicated and inferred; indicated, inferred and unclassified molybdenum cases for the LoM are shown in Table 22-7.

Table 22-7: Molybdenum Grade Cases: Economic Summary

Parameter	Units	Indicated Mo Only (as above)	Indicated and Inferred Mo	Indicated, Inferred and Unclassified Mo
Revenue				
U_3O_8 Sales	(M lb eU_3O_8)	50.78	50.78	50.78
U_3O_8 Price	(USD/lb U_3O_8)	65.00	65.00	65.00
U_3O_8 Revenue	(USDm)	3,301	3,301	3,301
Molybdenum Sales	(USDm)	31	53	146
Operating Expenditure				
Direct Operating Costs	(USDm)	1,615	1,618	1,635
Royalty (U + Mo)	(USDm)	233	235	241
Total Operating Costs	(USDm)	1,848	1,852	1,877
Unit Operating Costs				
Operating Costs (Excl. Royalty)	(USD/t ore)	83.51	83.63	84.55
	(USD/lb eU)	37.51	37.56	37.98
	(USD/lb eU_3O_8)	31.81	31.85	32.21
Royalty	(USD/t ore)	12.06	12.14	12.48
Total Operating Costs	(USD/t ore)	95.57	95.77	97.03
	(USD/lb eU)	42.93	43.02	43.58
	(USD/lb eU_3O_8)	36.40	36.48	36.96
Operating Profit – EBITDA	(USDm)	1,483	1,501	1.570
Corporate Profit Tax	(USDm)	252	258	278
Net Free Cash (EBITDA - Tax - CAPEX)	(USDm)	611	624	673
NPV @ 8%	(USDm)	120	125	140
IRR	(%)	12.71%	12.85%	13.27%
Breakeven Price (NPV=0 @ 8%)	(USD/lb U_3O_8)	57.38	57.09	56.12

22.2.2 Sensitivity

Table 22-8 presents NPV and IRR sensitivity results for changes in price based on the range of long-term forecasts sourced by the Company.

Table 22-8: NPV sensitivity to changes in Uranium price

Price (USD/lb U_3O_8)	Indicated Mo Only - NPV at 8% (USDm)	Indicated and Inferred Mo - NPV at 8% (USDm)	Indicated, Inferred and Unclassified Mo-NPV at 8% (USDm)
70	199	203	219
65	120	125	140
60	41	46	61

Table 22-9: NPV sensitivity to changes in MoS3 price

Price (USD/lb MoS_3)	Indicated Mo Only - NPV at 8% (USDm)	Indicated and Inferred Mo - NPV at 8% (USDm)	Indicated, Inferred and Unclassified Mo- NPV at 8% (USDm)
6,49	121	126	144
5,90	**120**	**125**	**140**
5,36	119	23	136
[2] based on a USD 65 /lb U_3O_8 price			

22.3 Processing Low Grade Ore

The current economic assessment excludes the processing of the residual 458 Kt of low-grade ore (0.31 kg/t U) that would remain in the open-pit stockpile. The reason for stockpiling this ore is that there is that there is higher economic benefit in processing the higher grade ore first and marginal economic benefit when processing this ore at the end of life of mine due to decreases in operating expenses. The following changes in end of project life operating costs have been considered:

- Rehandling Costs: Low Grade Stockpile rehandling is undertaken without any margin and at a rate of $2.15 / tonne
- Training Costs: No further training costs have been considered in the last 6 months of mine operations
- G&A costs: These have been halved in the last 6 months as operations wind-up.
- Processing Costs: Reagent costs have been proportionally decreased based on the low grade ore's reagent requirements.

Including this low-grade ore in the project economics results in a breakeven operational cash flow at the end of life of mine. A decision to process this stockpile will be dependent on the project economics (including uranium and reagent prices) at that point in time.

22.4 Conclusion

Cresco has undertaken an economic assessment to verify and demonstrate the economic viability of the Mineral Reserves. Mineral Reserves declared at a price of USD 65/lb U_3O_8 and USD 5.90 /lb MoS_3 (indicated Molybdenum only) return a positive NPV of USD 120 million at a discount rate of 8 %, with an IRR of 12.71 %.

As a result of recoverable molybdenum being present in assay and metallurgical test work, two additional cases are considered which are the indicated and inferred Molybdenum with a positive NPV of USD 125 million at a discount rate of 8 %, with an IRR of 12.85 %, and an indicated, inferred, and unclassified Molybdenum case with a positive NPV of USD 140 million at a discount rate of 8 %, with an IRR of 13.27 %.

23 ADJACENT PROPERTIES

There are currently two producing mines in the Arlit region that are on property positions immediately adjacent to the Madaouela Uranium Project:

23.1 SOMAÏR

Société des mines de l'Aïr (SOMAÏR) was established in 1968. The company is operated by Orano, which owns 63.4 % of the share capital; the remaining 36.6 % is held by Société du Patrimoine des mines du Niger (SOPAMIN, the Nigerien national mining company). SOMAÏR has operated several uranium deposits near the town of Arlit since 1971. The ore is extracted from open pit mines and processed in heap leaches or processed mechanically at the Arlit mill. In both cases, the resultant uranium solutions are processed achieving rates of 2,000 metric tons of uranium per year (2020 production: 1,879 metric tons).

23.2 COMINAK

COMINAK (Compagnie Minière d'Akouta) is operated by Orano (34 %). The other shareholders are SOPAMIN of Niger (31 %), OURD (Overseas Uranium Resources Development, Japan) (25 %), and Enusa Industrias Avanzadas SA of Spain (ENUSA, 10 %). Ore is extracted underground and processed in the site's mill, producing approximately 1,000 metric tons of uranium per year (2020 production: 1,112 metric tonnes). The COMINAK mine was closed on March 31, 2021 and is currently under site remediation.

23.3 Imouraren Project

Located 80 kilometers south of Arlit, the Imouraren deposit was discovered in 1966 and constitutes one of the largest deposits in the world today. The feasibility study was completed in December 2007 and submitted in April 2008. AREVA received the mining permit for the deposit in early January 2009. The Imouraren SA mining company was established, with Orano Mining (95.3 % AREVA and 4.7 % KIUI) holding a 66.65 % interest, 10 % by Niger and 23.35 % SOPAMIN. In view of market conditions construction work was suspended. The site, equipment and facilities are currently under care and maintenance.

23.4 SOMINA: Azelik

The Société des Mines d'Azelik SA (SOMINA) is a joint venture established in 2007 to mine Azelik/Teguidda, 160 km southwest of Arlit and 150 km northwest of Agadez, in the Agadez region. Its equity is 37.2 % China's CNNC International, 33 % Niger government, 24.8 % ZXJOY Invest (Chinese) and 5 % Korea Resources Corp (KORES). SOMINA came into production at the end of 2010 but was put on care and maintenance in 2015.

23.5 Dasa

Global Atomic Corporation, a public company listed on the Toronto Stock Exchange, is developing the Dasa project, about halfway between Arlit and Agadez. In December 2020 the government granted a mining permit for the project.

Table 23-1: Niger Mine Production (tonnes U)

	2011	2012	2013	2014	2015	2016	2017	2018
SOMAÏR	2,726	3,065	2,730	2,331	2,509	2,164	2,116	1,738
COMINAK	1,075	1,506	1,508	1,501	1,607	1,313	1,332	1,112
SOMIMA	64 est	96 est	290 est	225 est				
Total	**3,865**	**4,667**	**4,528**	**4,057**	**4,116**	**3,477**	**3,449**	**2,911**

Source: World Nuclear Association

The above stated production figures have not been reviewed by a Qualified Person, are unknown as to compliance with or correlation to CIM definitions for mineral resources, and therefore should not be relied upon.

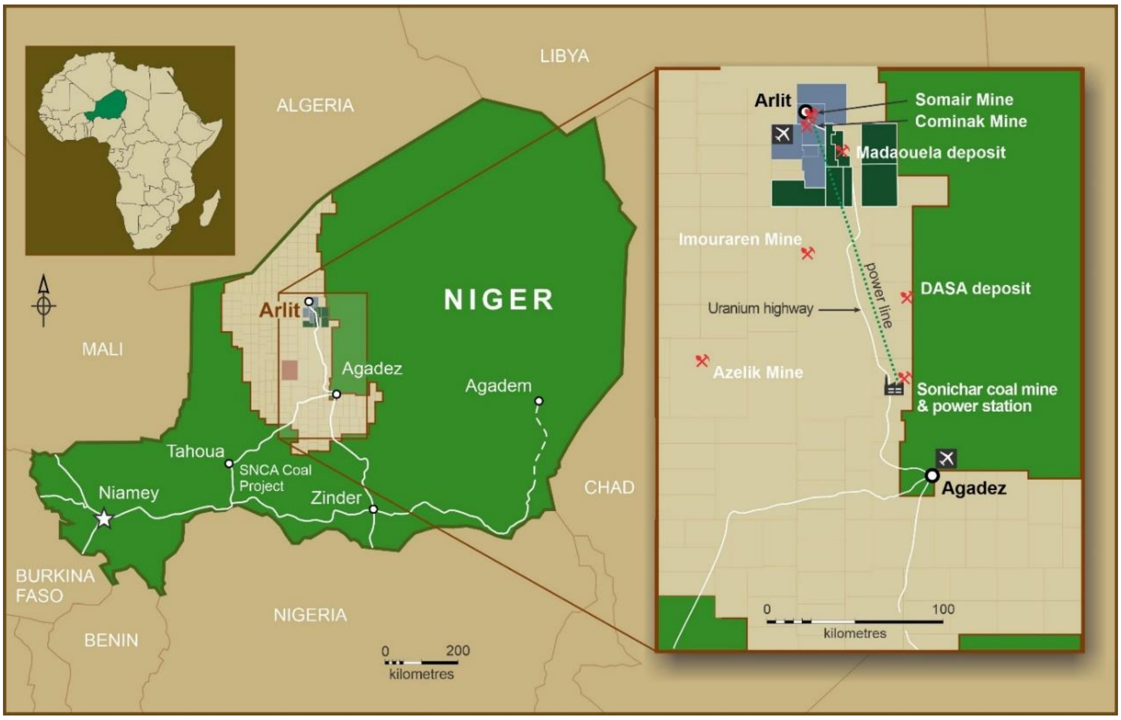


Figure 23-1: Location of uranium projects in Niger

23.6 Statement (SRK)

The above stated public information demonstrates that the Madaouela Uranium Project is located in an active uranium mining district that has been established and continually in production since 1970. There are other uranium deposits in the Arlit region of north central Niger that are currently in development; however they are not immediately adjacent to the Madaouela Uranium Project.

24 OTHER RELEVANT DATA AND INFORMATION

24.1 Geotechnical Studies Infrastructure

24.1.1 Background

SRK were appointed to develop plans for the mining aspects of the Project. SGS Bateman were appointed by GoviEx to undertake a Feasibility Study (FS) for the processing of the ore. SRK, in conjunction with SGS, designed, specified, and supervised the GI focussing on the following assets:

- Waste dumps;
- Tailings Storage Facility (TSF);
- Miriam Overhead Line (OHL);
- Mine Link Road;
- MSNE / M&M portals; and
- Borrow pit areas.
- Process plant and infrastructure

The key aims of the investigation were to:

- Characterise the geotechnical properties of the near surface soils;
- Understand the potential geohazards and foundation conditions of the infrastructure and waste areas;
- Characterise the distribution of clay and sandy soils; and
- Identify areas for borrow pit material.

A full factual ground investigation report including the site records, drawings, exploratory hole records and laboratory tests was prepared by SRK in 2022 and summarises the site work and laboratory test work conducted fully and is heavily referenced in this section.

24.1.2 Field Work

The GI was completed between August 13, 2021 and September 10, 2021 by an experienced SRK associate engineer from the Ghana office, Bright Mpere. Mr Mpere provided a memo and daily site reports for the duration of the investigation. The GI comprised of 14 No. rotary bored boreholes and 47 No. trial pits. The locations of the exploratory holes are provided in Table 24-1 and Table 24-2. All coordinates were determined using a hand-held GPS with a +/-5 m accuracy. The soil and rocks were logged and sampled in accordance with BS5930:1999+A2:2010 and BS EN ISO 14688-1&2: 2002. Full details of the work are included in the 2022 Factual Report.

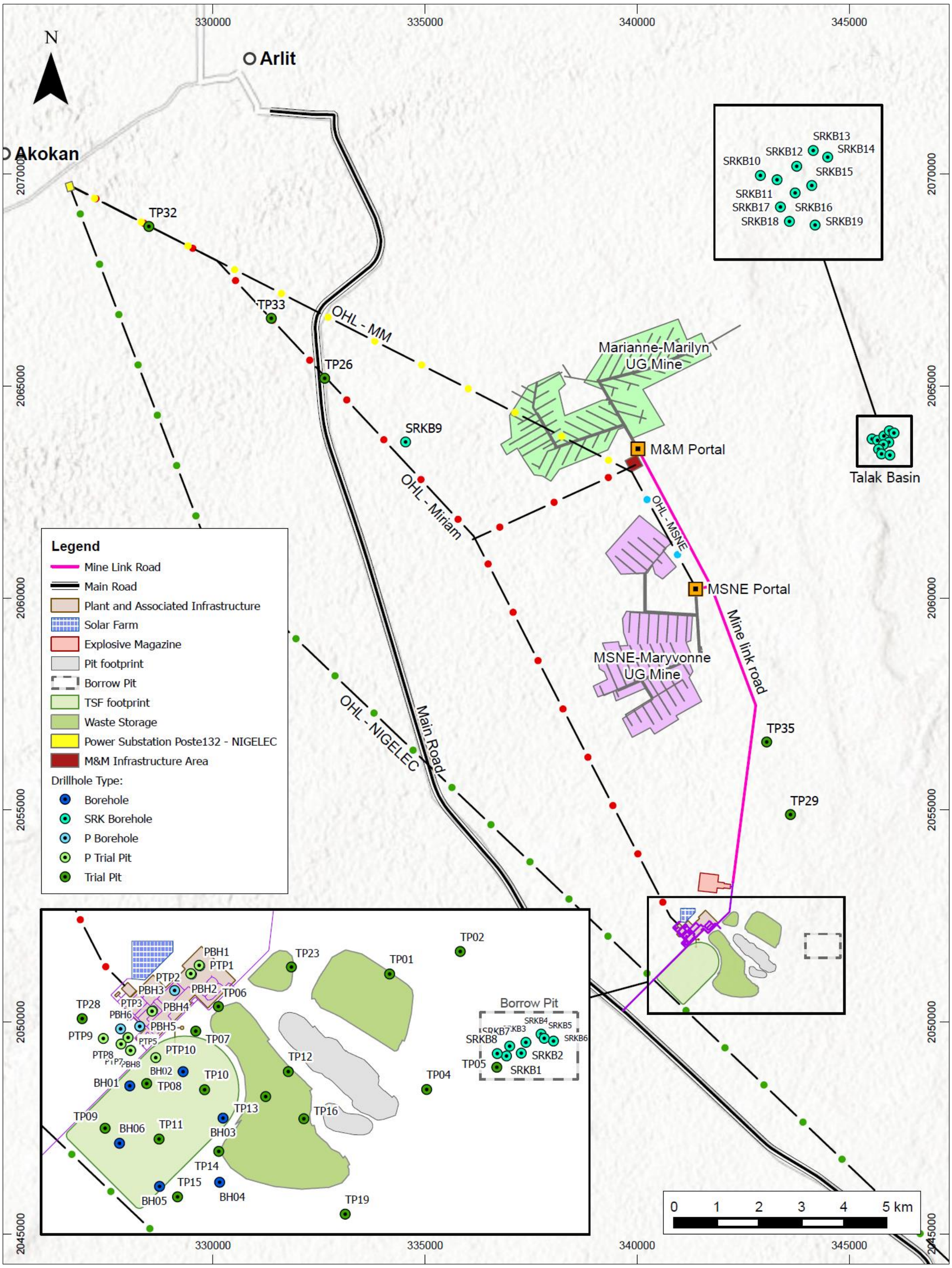


Figure 24-1: Exploratory holes

Boreholes

A total of 6 No. boreholes were completed around the perimeter of the TSF. The remaining 8 No. boreholes were completed across the plant site. No boreholes were completed along the haul road or overhead electrical cable alignments or in the borrow pit area. A summary is provided below in Table 24-1.

No Standard Penetration Tests (SPTs) were performed during the investigation as the costs and logistics associated with mobilising a SPT hammer to site were prohibitive. Assessment of rock strength was conducted based on in-situ observations. SRK note that the site appears to have limited geotechnical risks due relatively flat and level topography combined with shallow bedrock resulting in shallow refusal during trial pits. The absence of SPT testing is not thought to significantly impact the findings of the ground investigation.

Table 24-1: Exploratory borehole locations

Trial pit ID	Eastings	Northings	Final depth	Target Asset
BH01	340998.569	2051449.1	29.32	TSF
BH02	341450.593	2051574.22	29.91	
BH03	341789.704	2051180.4	30.00	
BH04	341760.407	2050639.14	29.63	
BH05	341254.111	2050606.88	26.00	
BH06	340914.003	2050967.95	30.00	
PBH1	341592.674	2052467.87	30.00	Processing Plant
PBH2	341521.44	2052396.99	29.20	
PBH3	341381.334	2052259.85	30.00	
PBH4	341197.255	2052090.95	30.00	
PBH5	341092.089	2051959.25	30.00	
PBH6	340924.03	2051934.62	30.00	
PBH7	340987.659	2051859.52	30.00	
PBH8	341014.706	2051759.9	30.00	
*Coordinates in UTM32 North				

Trial Pits

All the 47 trial pits were excavated using a mechanical excavator to a target depth of 3 m. They were completed in the TSF, waste rock dumps, plant, overhead cable alignment, haul road alignment and borrow pit areas. A summary is provided below in Table 24-2.

The following trial pits were scheduled but not executed during the GI due to logistical constraints: TP03, TP17, TP18, TP20, TP21, TP22, TP24, TP25, TP27, TP30, TP31, PTP4 and PTP6. The number and distribution of trial pits excavated across the site are considered appropriate to correctly characterise the ground conditions. Furthermore, it was important understand the occurrence and nature of the borrow pit outcrop.

Table 24-2: Exploratory trial pit locations

Trial pit ID	Eastings	Northings	Final depth (m)	Target Asset
TP01	343198	2052401	2.9	Waste Dump
TP02	343795	2052591	1.2	
TP04	343511	2051425	0.3	
TP05	344104	2051613	3.5	
TP06	341752	2052126	0.9	
TP07	341561	2051918	0.8	TSF
TP08	341146	2051475	3.0	TSF
TP09	340795	2051097	2.9	
TP10	341635	2051423	0.3	
TP11	341251	2051006	0.5	
TP12	342342	2051576	1.0	Waste Dumps
TP13	342151	2051365	0.8	
TP14	341755	2050902	3.0	TSF
TP15	341407	2050518	0.6	TSF
TP16	342474	2051177	0.45	Waste Dumps
TP19	342823	2050371	2.9	
TP23	342369	2052460	0.8	
TP26	332632	2065181	3.5	OHL
TP28	340601	2052023	0.6	Processing Plant
TP29	343613	2054891	0.8	Mine Link Road
TP32	328488	2068761	3.2	OHL
TP33	331374	2066595	3.5	
TP35	343052	2056604	2.3	Mine Link Road
PTP1	341589	2052474	0.5	Processing Plant
PTP2	341519	2052403	0.8	
PTP3	341191	2052086	0.4	
PTP5	340990	2051863	0.6	
PTP7	341010	2051754	0.4	
PTP8	340930	2051808	1.5	
PTP9	340780	2051855	0.5	
PTP10	341223	2051693	0.5	TSF
SRKB1	344186	2051708	3.2	Borrow Pit
SRKB2	344311	2051732	4.0	
SRKB3	344350	2051823	3.8	
SRKB4	344478	2051893	1.1	
SRKB5	344505	2051857	3.2	
SRKB6	344583	2051834	3.0	
SRKB7	344213	2051791	3.5	
SRKB8	344108	2051728	2.5	
SRKB9	334540	2063679	1.7	
SRKB10	345537	2063750	3.5	
SRKB11	345665	2063717	3.4	
SRKB12	345816	2063821	3.0	
SRKB13	345943	2063942	3.4	
SRKB14	346054	2063891	3.0	
SRKB15	345932	2063673	3.5	
SRKB16	345804	2063616	3.2	
SRKB17	345691	2063508	3.0	
SRKB18	345760	2063397	2.5	
SRKB19	345957	2063369	2.5	
*Coordinates in UTM32 North				

Monitoring

No water was noted in any of the exploratory hole records provided. None of the boreholes were installed with monitoring wells as part of this investigation. Information on groundwater at depth is provided in the Integrated Development Plan IDP, (SRK, 2015a). Further groundwater assessment is being carried out as part of the Feasibility Study.

24.1.3 Laboratory Testing

Selected samples from the trial pits and boreholes were transported to Rocklab, Pretoria, South Africa for geotechnical laboratory testing, with some tests conducted by SGS Laboratory. The following tests were conducted:

- Natural moisture content;
- Specific gravity;
- Sieve analysis;
- Particle size distribution;
- Plasticity indices;
- Proctor Test (Optimum Moisture Content and Maximum Dry Density);
- Uniaxial compressive strength;
- Flexible wall permeability test; and
- Consolidated undrained triaxial tests on reconstituted samples.

The tests conducted are summarised in Table 24-3. The full results are presented in the SRK Ground Investigation Report (SRK 2022l).

Table 24-3: Summary of geotechnical tests

Test type	Test Method	Number of tests (No.)	Geology Code
Natural Moisture Content	SANS3001:GR20	4	AEO
		4	TARAW
		7	TARA
		14	UTTW
Specific Gravity	ASTM D854-02	2	AEO
		4	UTTW
Sieve Analysis	SANS3001:GR1	1	AEO
		4	TARA
		3	TARAW
		4	UTTW
Particle Size Distribution	ASTM D422 BS ISO 11277:2009 Jennings, 1988	2	AEO
		2	TARAW
		9	UTTW
Plasticity Indices	ASTM D422	2	AEO
		2	TARAW
		9	UTTW
Proctor Test	ASTM D698	2	AEO
		1	TARAW
		2	TARA
		5	UTTW
Uniaxial Compressive Strength	ISRM	4	TARA
Flexible wall permeability test	BS 1377 Part 6	1	TARAW
Consolidated undrained triaxial tests on reconstituted samples	BS 1377 Part 7	3	TARAW

It is noted that the particle size distribution test conducted by SGS laboratory quotes the values of each fraction using three different methods, ASTM D433, British Standards BS ISO 11277:2009 and Jennings, 1988. The difference being the sieve size defining the boundaries between the soil fractions as shown in Figure 24-2 below in log-scale. SRK note there is limited difference between the results of the test methods in practical terms.

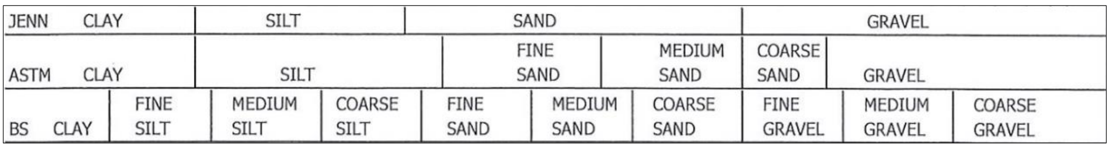


Figure 24-2: PSD Chart for each methodology

24.1.4 Summary of Ground Conditions

The investigation focussed on two main areas with distinct ground conditions, the main mine infrastructure area and the borrow pit area.

In general, the ground conditions encountered across the project site were Aeolian blow sands underlain by weathered Guezouman (sedimentary rock) grading into competent Guezouman. Localized zones of borrow pit are also present throughout the site. A summary of geologic units is presented in Table 24-4 below. Full tests results can be found in the SRK Ground Investigation Report (SRK 2022l).

Table 24-4: Summary of ground conditions encountered

Geology	Depth from (m bgl)	Depth to (m bgl)	Average Thickness (m)	Description	Locations encountered
Aeolian blown Sands	0	0.07 - 1.70	0.47	Brown topsoil / Medium grained orange SAND / No recovery.	39 out of 69
Weathered Tarat	0.0 - 1.20	0.20 - 21.0	3.43	Moderately to highly weathered medium grained SANSTONE. Bands of very weak SILTSTONE at some locations.	23 out of 69
Izegouande	0.0 - 21.0	0.40 - >30.00	>10.07	Pink, moderately weathered, medium grained SANDSTONE. Bands of weak grey SILTSTONE at some locations.	35 out of 69
Weathered Tarat	0.0 - 1.80	0.50 - 4.0	1.86	Dense medium to fine grained orange SAND with gravels / Hard to stiff, low to high plasticity CLAY	24 out of 69
Unité Terminal du Tchinezogue (UTT)	0.07 - 1.50	0.50 - >3.50	>1.36	Weak highly weathered green SILTSTONE / Medium to strong medium grained orange SANDSTONE.	13 out of 69

Aeolian Blown Sand (AEO)

In summary the Aeolian blown sand was encountered in the majority of exploratory hole locations from surface to depths ranging between 0.07 and 1.71 metres below ground level (m bgl) and is described as either a loose or medium dense sand.

In the borrow pit area it was encountered in 8 of the 10 locations and described as high plasticity sandy clay in seven locations and loose medium grained sand in one location. Within the footprint of the TSF the Aeolian sand has varying descriptions of brown topsoil, medium grained orange sand and brown sandy clay. Within the borrow pit close to the plant the material was described as loose medium to fine grained sand in eight locations and stiff sandy clay in one location.

The sand was not as frequently present across the WRD and OHL. Of the two trial pits along the mine link road, aeolian sand was noted in one of them.

Weathered Tarat (TARAW)

The weathered Tarat was mainly encountered underlying the processing plant, TSF and WRDs. It is generally described as a dense medium to fine grained sand at shallow depth grading into a highly weathered medium grained sandstone at depth. At two locations along the route of the OHL (TP32 and TP33) the material is described as a hard/stiff, low to medium plasticity clay/sandy clay. In BH06 within the footprint of the TSF the material is described as a low to medium plasticity clay.

Tarat (TARA)

Tarat was encountered in 35 out of 69 locations and is generally described as medium strong to strong, moderately weathered, pink, medium grained sandstone with carbonate and hematite alteration. At two locations (BH04 and TP29) the material is described as a weak highly weathered grey siltstone.

Tarat was not noted on the logs for PTP01, TP01, TP10, TP11, TP16 and TP04 however, it is noted that these trial pits refused on sandstone.

Weathered "Unité Terminale du Tchinezogue" (UTTW)

The exploratory holes in the borrow pit are (SRKB10-SRKB16) record this material as a dense medium to fine grained clayey sand with gravels. Within SRKB17 and SRKB18 the material is described as a hard high plasticity green clay. Within SRKB19 the material is described as a hard clay overlain by a dense sand with gravels.

The exploratory holes within the borrow pit (SRKB1-SRKB9) record this material as a stiff to hard, low to high plasticity, red, clay/sandy clay and in some locations with highly weathered siltstone relics.

Weathered Tchinezogue is also recorded in TP19 (WRD) and TP26 (OHL) and described as a loose/medium dense, medium to fine grained yellow sand.

Tchinezogue

Tchinezogue material was recorded in 13 of the 69 exploratory hole locations at depths ranging from 0.07 m to 1.2 m bgl. At 11 of the locations the material is described as a weak highly weathered green siltstone. At two locations (TP05 and TP19) the material is described as a medium/strong medium grained orange sandstone. No laboratory testing was conducted on this unit.

24.1.5 Engineering Considerations

General

- The entire area has a covering of loose to medium dense aeolian sand, as is to be expected for a desert environment. It has found to generally be <1 m in thickness and laboratory testing indicates it's a fine-grained sand so can be used as construction material.
- The aeolian sand is not a suitable material beneath a foundation without appropriate conditioning, and requires removal during the preparation for any plant, infrastructure, or waste structures.
- The weathered zone of the bedrock is either dense sand with gravel or medium strong sandstone. This material is suitable for foundations of medium loaded plant and haul roads. Where found, it is relatively thin and is immediately underlain by the unweathered bedrock.
- The unweathered bedrock is strong sandstone which can used to form foundations for heavily loaded plant, associated infrastructure and waste structures including the waste rock dumps and TSF.

- Conventional mechanical excavation using a bucket of an excavator on the sandstone may be problematic due to its density and strength. Where excavation is required, tougher measures such as the use of breakers or blasting may need to be considered.

Borrow Pit

- Samples were tested for the relevant parameters required for liner and capping systems.
- Generally, the material falls within the required parameters for plasticity and particle size, however not all samples meet the requirements.
- Some of the sample descriptions and photos indicate areas of more sandy clays in areas and the inclusion of siltstone and sandstone gravels.
- For use as a borrow pit, the material may require treatment such as screening to remove larger size particles, which is not uncommon for borrow materials.
- Permeability and shear strength require further investigation as follows:
    - Ensure the soil used in the liner system has a high enough shear strength when remoulded to ensure stability of the TSF and waste dump structures.
    - Ensure the soil provides an adequate hydraulic barrier to protect the underlying strata from infiltration.
    - Samples have been saved if further testing is required to conduct shear strength and hydraulic conductivity testing.

24.2 Geotechnical Open Pit

This section contains the results of the Geotechnical Feasibility Study carried out on the Miriam deposit within the Madaouela Project. Focus has been to update the geotechnical model, undertake slope stability analyses and update the pit slope geotechnical design criteria.

24.2.1 Geotechnical Data

The geotechnical database consists of 12 non-oriented boreholes totalling 1,500 m of geotechnically logged core as part of the 2013 pre-feasibility dataset, plus 6 non-oriented boreholes totalling 620 m of geotechnically logged core as part of the 2021 FS data collection. Both sets of drillholes were surveyed with downhole televiewers, yielding ~11,500 structural features picked up. In addition, 108 laboratory tests were carried out on rock samples, of which 65 were UCS tests and 33 triaxial tests.

Figure 24-3 shows a plan view of the Madaouela Miriam projected open pits and geotechnical drillholes: blue (2013) and red (2021).

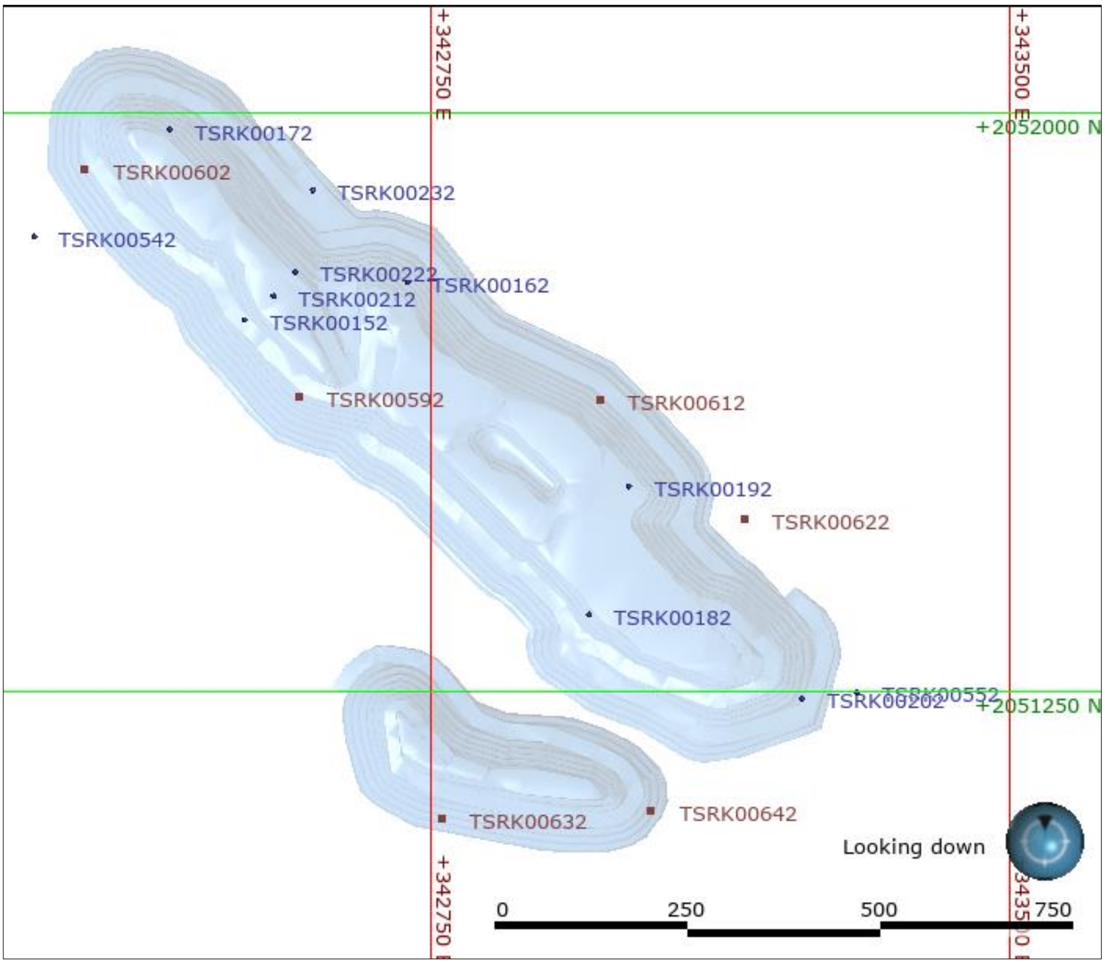


Figure 24-3: Plan view of Miriam projected open pits and geotechnical drillholes

24.2.2 Rock Mass Characterisation

The Madaouela Uranium Project sits within the Tim Mersoi Sedimentary Basin and contains sandstone-hosted uranium deposits. Topographic relief at the site is minimal, a few tens of meters from high to low. The Miriam deposit is a tabular body extending approximately 1.4 km from northwest to southeast and 0.7 km from northeast to southwest. Geology within the Miriam deposit consists of three main sub-horizontal sedimentary units, which are (from shallowest to deepest): Tchinezogue —a fluvio-deltaic sedimentary unit— Guezouman —a coarse-grained sandstone— and Talak —a grey-black fine-grained shale/argillite.

The geotechnical domains in the Miriam deposit match said sedimentary units, save Tchinezogue, where the upper 30 – 40 m are separated into "Weathered Tchinezogue" because it is weathered and oxidised and represents slightly lower rock mass conditions.

Figure 24-4 shows the northeast and southwest walls of the main projected pit (longitudinal cross-section). The Weathered Tchinezogue unit thickens northwards from 21 m to 54 m, consistent with the overall stratigraphic dip of 1.5° to the northwest.

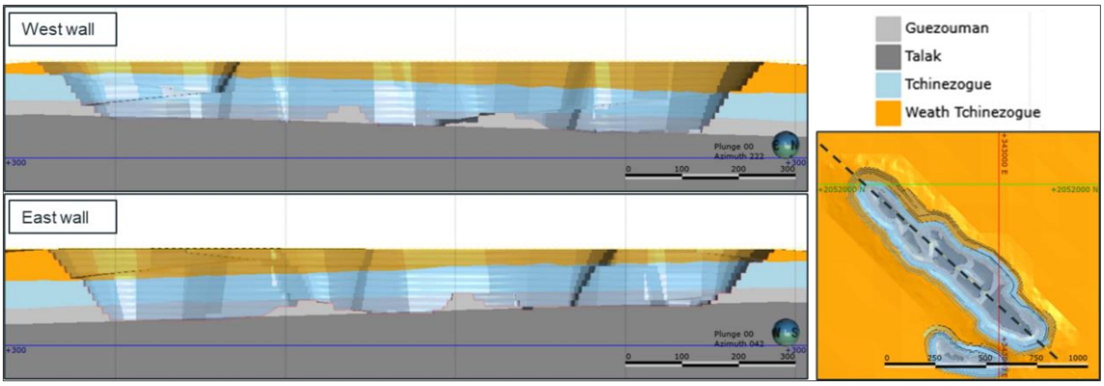


Figure 24-4: West and East wall (longitudinal cross section through main pit)

The geotechnical parameters used within the PFS report "Madaouela Integrated Development Plan Mine Geotechnical Report" (SRK, 2013a) were updated in this report (see Table 24-5) according to the following criteria:

- UCS, γ, m_i and E_{rm} were updated based on laboratory tests (except for Talak, for which no tests were undertaken).
- GSI was updated via the 2021 drillhole data.

The parameters in Table 24-5 are:

- UCS: Uniaxial Compressive Strength of the intact rock.
- GSI: Geological Strength Index
- γ: Unit Weight
- D: Damage Factor
- m_i: Intact Rock strength parameter
- E_{rm}: Young's Modulus of the rock mass

Table 24-5: Updated material parameters

Domain	UCS [MPa]	GSI [—]	γ [kN/m^3]	D [—]	m_i [—]	E_{rm} [GPa]
Weathered Tchinezogue	65	57	22	0.7	10	2.5
Tchinezogue	60	71	22	0.7	10	5.3
Guezouman	55	75	22	0.7	10	10
Talak	25	45	22	0.7	10	2.3

24.2.3 Structural Setting

Miriam lies west of the regional NNE-SSW-striking Madaouela Fault. Fault MI-NEFt-1, which intersects the SE end of the projected pits, a change in the structural conditions is interpreted to be associated with this fault zone which defines two separate structural domains (Figure 24-5):

- Domain 1: north of Fault MINE-Ft-1, with two main sets (sub-vertical joints and bedding).

- Domain 2: small area around the sub-vertical Fault MI-NEFt-1 in the south-east of the pit,

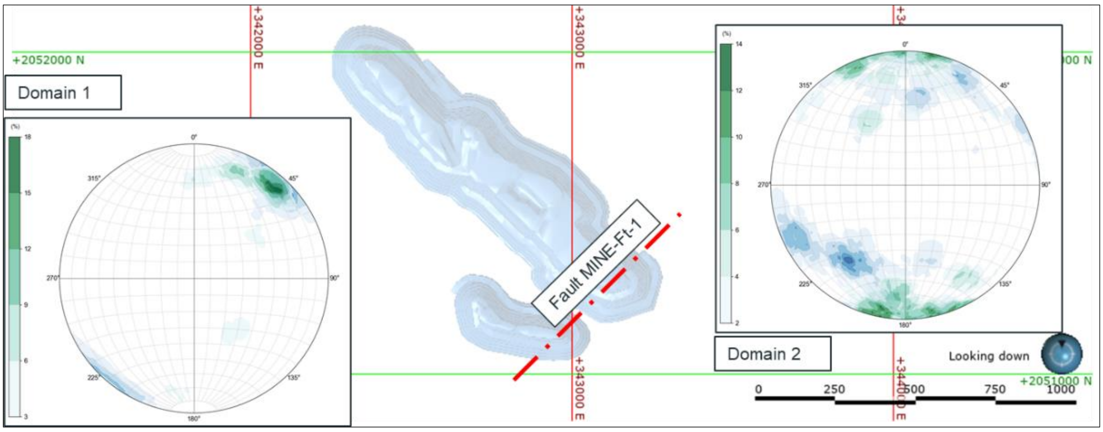


Figure 24-5: Structural domains

Table 24-6 lists the dip and dip direction for each set within Domain 1. Figure 24-6 shows the stereonet for Domain 1 (with bedding joints removed to view the sub-vertical sets).

Table 24-6: Sets in Domain 1

Set	Type	Dip	Dip Direction
1	Bedding	01	315
2	Joint	84	221
3	Joint	54	225

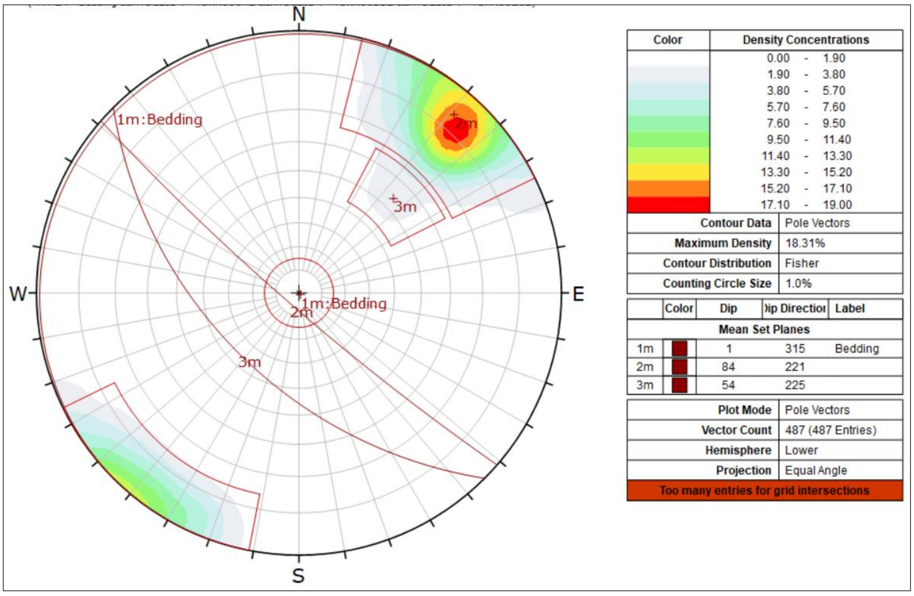


Figure 24-6: Domain 1 stereonet (excluding bedding)

24.2.4 Groundwater

Table 24-7 describes the various lithological units from a hydrogeological standpoint, with respect to their permeability and estimated hydraulic conductivity. Four pumping tests and one packer test were carried out on the Guezouman domain; no tests were done on the other units.

Table 24-7: Hydrogeological description of lithological units

Domain	k_h * [10^8 m/s]	k_v/k_h * [—]	Hydrogeological Description	Source
Weathered Tchinezogue	5	0.2	There may be some permeability parallel to bedding but vertical permeability is negligible	Estimation
Tchinezogue				
Guezouman	50	0.1	Considered a relatively poor aquifer on a regional basis, although localized pockets of high permeability do exist	Four pumping tests and one packer test.
Talak	1	0.05	Comprises an argillic rich sequence and forms the basal aquitard to the local aquifer system.	Estimation

** k_h: horizontal hydraulic conductivity; k_v: vertical hydraulic conductivity.*

Figure 24-7 and Figure 24-8 show the groundwater contours near Miriam. For the stability analyses described below, the water table boundary conditions are set at the contact between the Weathered Tchinezogue and Tchinezogue units, i.e., at approximately +420.00 m elevation.

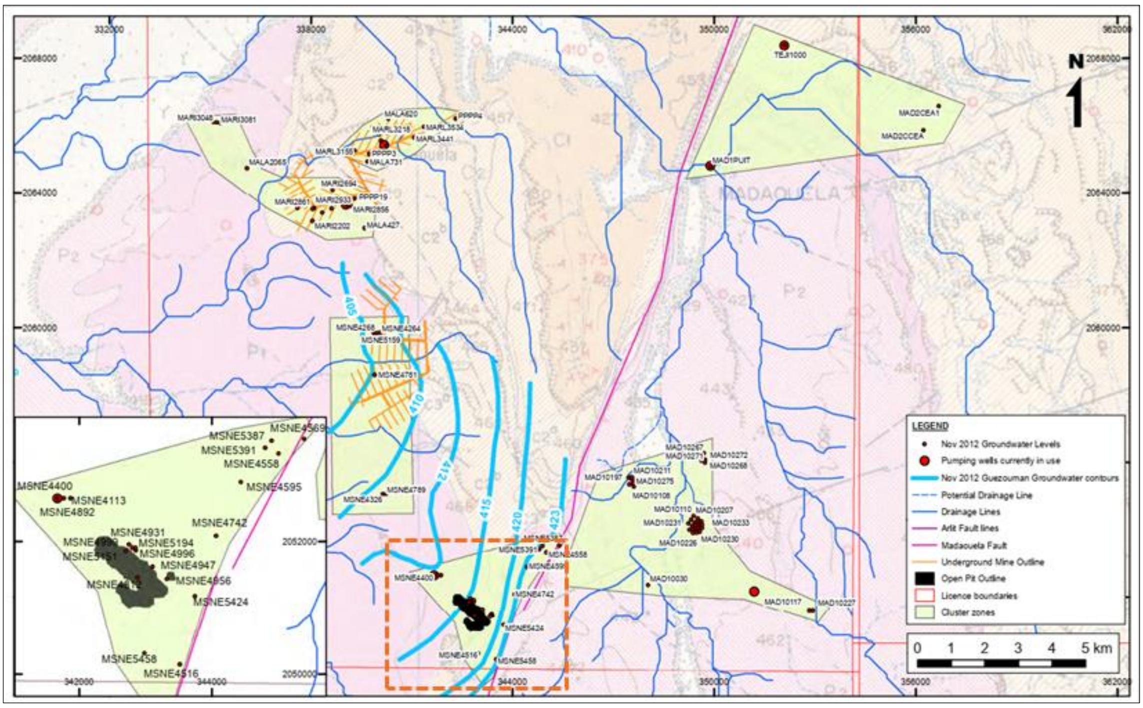


Figure 24-7: Regional map with November 2012 groundwater contours

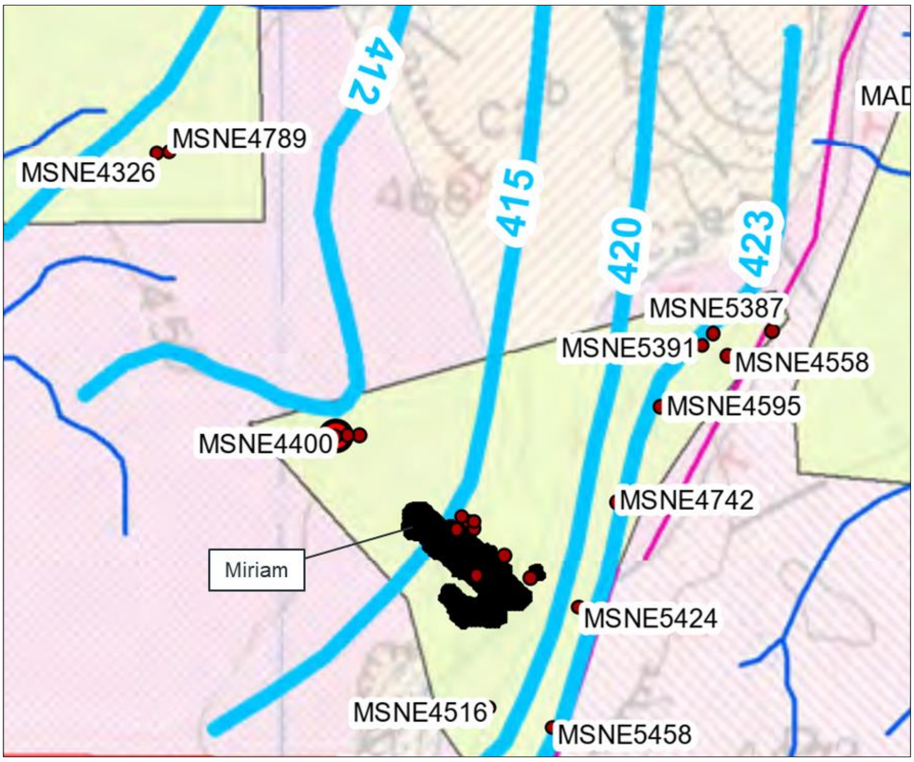


Figure 24-8: Detail of November 2012 groundwater contours near Miriam

24.2.5 Slope Analyses

Bench Analyses

A kinematic analysis was carried out in Dips version 8.0 (Rocscience, 2022). The main areas of interest are (Figure 24-9):

- The NE wall, where flexural toppling and possibly wedge failures are the main concern; and
- The SW wall: where flexural toppling is the main concern.

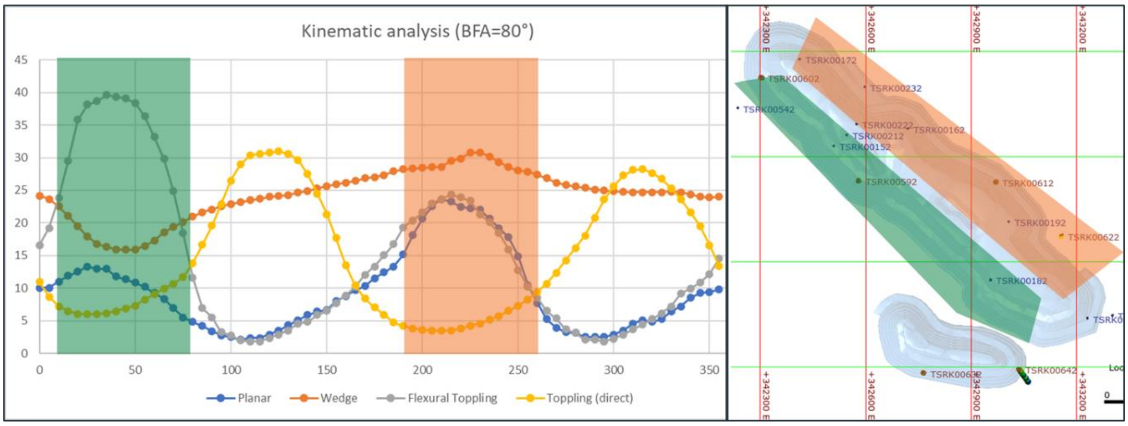


Figure 24-9: Kinematic analysis. The NE wall (orange) and SW wall (green) are highlighted

As the main joint set (Set No. 2) is sub-vertical and sub-parallel to the prevailing bench face orientation (striking NW-SE), both wedge and toppling analyses have predicted very little backbreak and low probabilities of failure. The bench design adopted is detailed in Table 24-8.

Table 24-8: Adopted bench and inter-ramp geometry

Parameter	Abbreviation	Unit	Weathered Tchinezogue	Other Units
Bench width	BW	m	6.6	6.6
Bench face angle	BFA	°	75	85
Bench height	BH	m	12	12
Inter-ramp angle	IRA	°	51	57

Overall Slope Analysis

Overall and inter-ramp geotechnical stability analyses have been carried out mostly with Slide version 9 (Rocscience, 2022), with an additional analysis undertaken using RS² version 11 (Rocscience, 2022), aimed at assessing heave failure. Slide analyses comprised two water table scenarios —dry, and with a water table calculated via finite element analysis (FEA)— and four rock mass strength scenarios:

- isotropic,
- with bedding,
- with Joint Set J2,
- with Joint Sets J2 and J3.

In the anisotropic scenarios, strength sub-parallel to the joints was estimated with Jennings' criterion and the joint strength itself was based on laboratory tests data on natural discontinuities.

Table 24-9 shows the results for the eight scenarios analysed, with the lowest factor of safety being FoS = 2.06 for the FEA-calculated water table (Figure 24-10). Figure 24-11 shows the lowest FoS for the dry case (FoS = 2.58, Joint Sets 2 and 3). The RS² analysis (Figure 24-12) was aimed at assessing the FoS for heave failure and so did not include strength anisotropy but it did include a conservative water table coincident with the pit slope.

Overall, the failure surfaces output by Slide are consistent with the floor heave failure shown by RS². For comparison purposes, a simplified circular failure surface was also calculated with the limit equilibrium method, yielding FoS = 2.30 (Figure 24-13), which is close to FoS = 2.26 obtained with Slide for the isotropic scenario with water table.

Table 24-9: Slope stability analysis results

Scenario	FoS (dry)	FoS (water table)
Isotropic	2.88	2.26
Bedding	2.78	**2.06**
Joint set J2 (subvertical)	2.75	2.15
J2 + J3 (50° dipping)	**2.58**	2.07
RS² (isotropic)	—	**1.46**

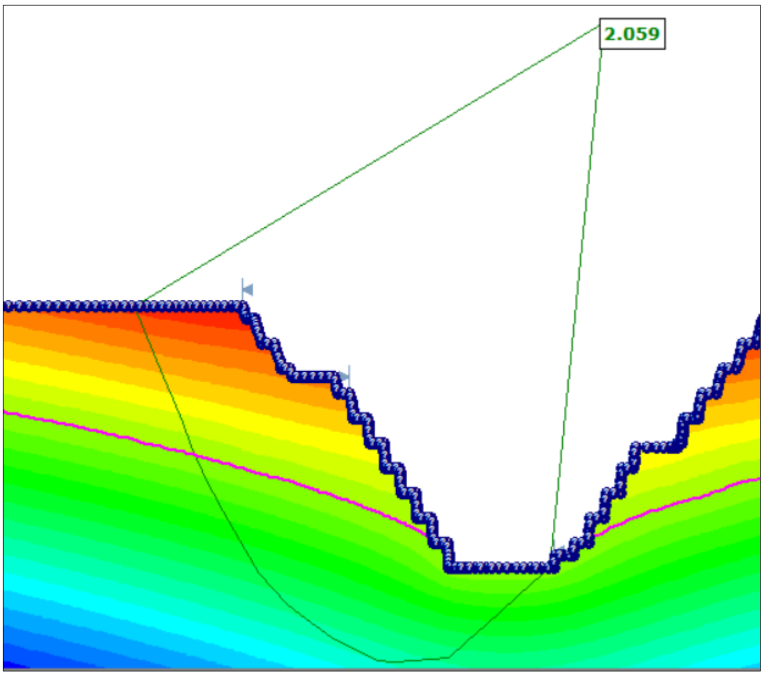


Figure 24-10: Slide analysis with FEA water table and bedding planes

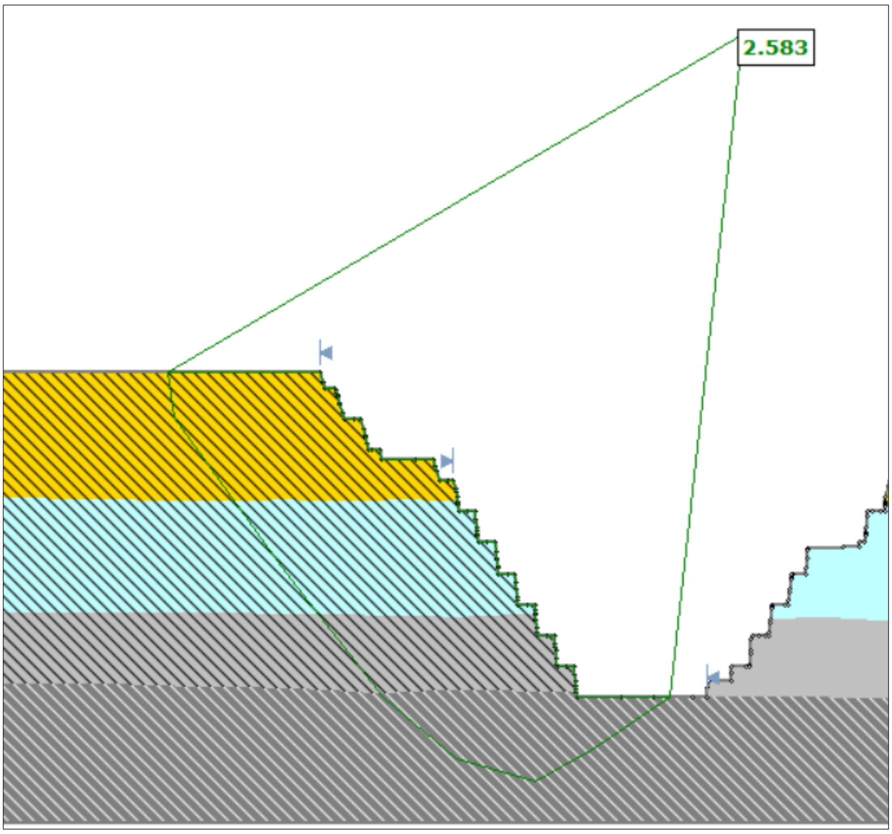


Figure 24-11: Slide analysis with dry slope and Joint Sets 2 and 3

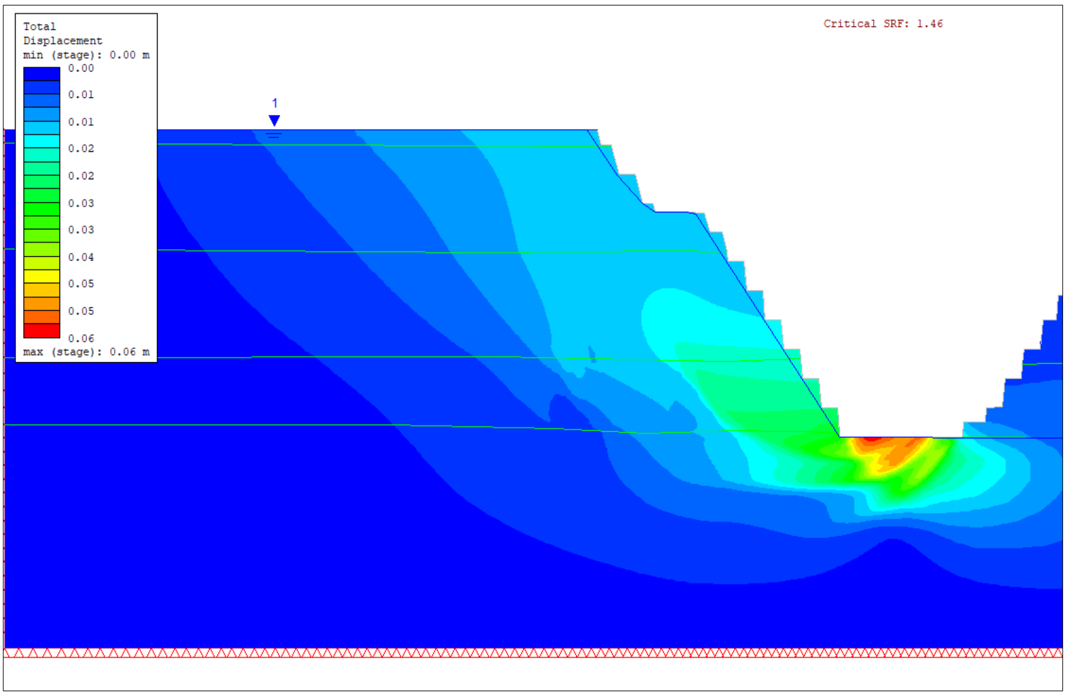


Figure 24-12: RS² stability analysis output for heave analyses

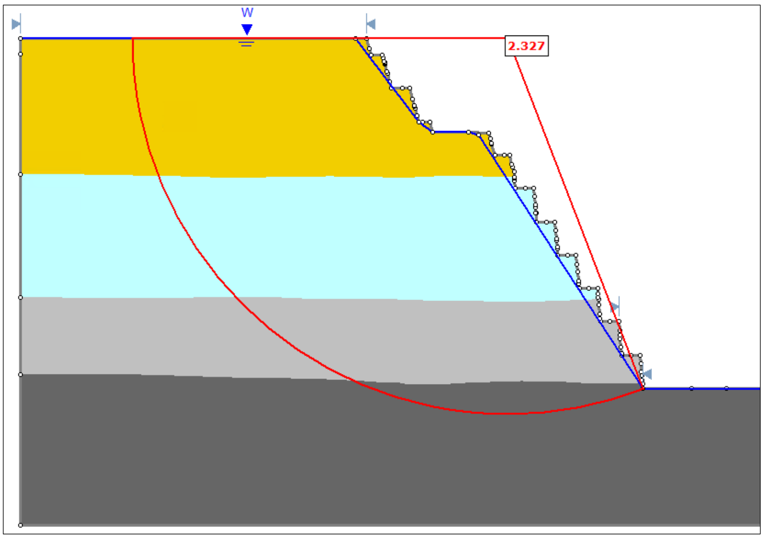


Figure 24-13: Slide circular stability analysis (isotropic, with water table)

24.3 Geotechnical Underground Mining

Section 24.3 describing the geotechnical investigation and analysis associated with underground mining methods has been taken from the 2021 Pre-Feasibility study report. No addition geotechnical data collection or analyses has been undertaken as part of the updated Feasibility study. As part of the final FS for the underground operation, additional geotech information will be collected and the mine design reviewed against any updated parameters.

24.3.1 Marianne-Marilyn (M&M)

Field Program

Thirty geotechnical holes were drilled to understand rock mass and structural conditions across the deposit. All holes were drilled a minimum of 10 m into the Talak to ensure sufficient distance into the footwall.

Hole locations were chosen based on:

- 3D geological wireframes provided by GoviEx;
- Preliminary structural interpretation from Quickbird imagery;
- Leapfrog 250 ppm uranium grade shell; and
- Preliminary mine layout.

Percussion (air rotary) drilling was done from surface down to a minimum of 30 m above the ore zone. Drilling method then changed to triple tube, oriented core drilling through the hanging wall and 15 m into the footwall. This improved drilling rates. Locations of the geotechnical holes are shown in Figure 24-14.

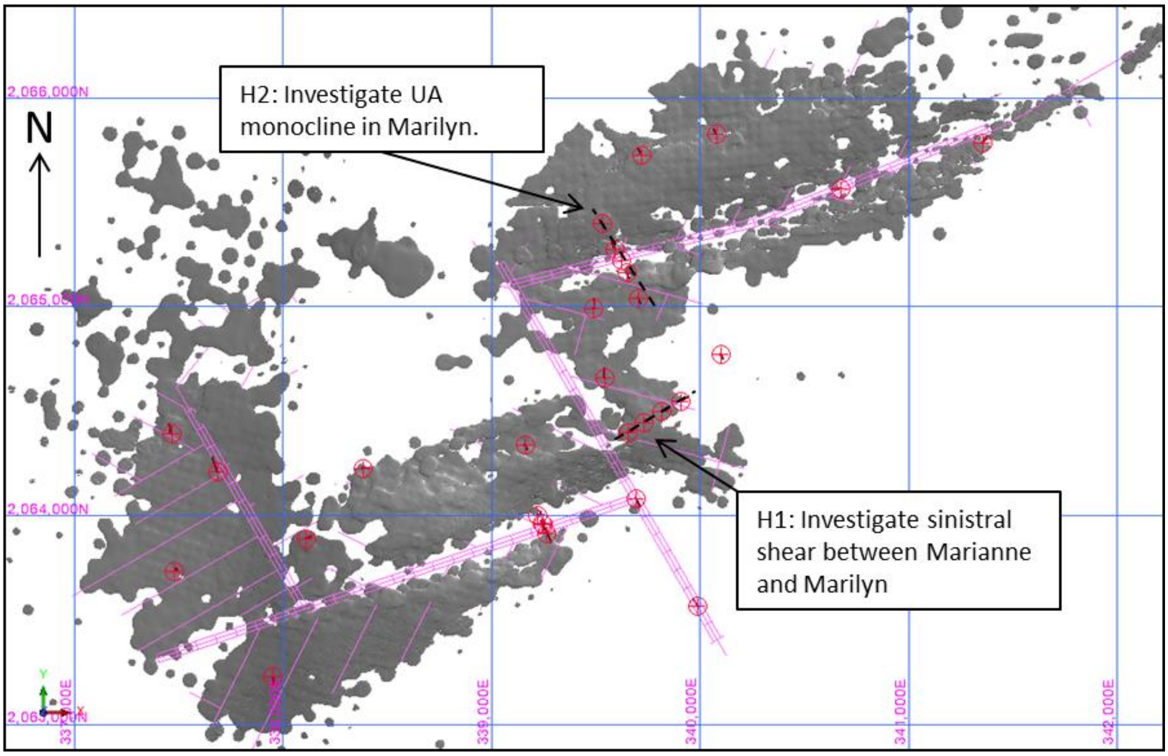


Figure 24-14: Plan view of the geotechnical holes (red) relative to the proposed mine layout at Marianne-Marilyn, and the 250 ppm uranium Leapfrog Grade Shell.

Structural Geology (Marianne-Marilyn)

Structural Setting

The Marianne-Marilyn deposits are the northernmost mineralised zones within the Madaouela Project. The mineralisation is elongate along a WSW-ENE trending structural axis which comprises a series of domes, faults and monoclines (Figure 24-15).

The major structures affecting the deposit and their potential implications for the geotechnical evaluation are outlined below.

Major Structures

<u>Monoclines</u>

The M&M deposits are affected by two well-defined monoclinal structures that control the location of elongate *barres* of UA sediments (Figure 24-15; Yahaya & Lang, 2000). Based on subtle gradient changes in the base of the Guezouman/Top Talak horizon a further, smaller, monoclinal-type structure has been interpreted to the north of the large southwestern UA-bearing structure (Figure 24-16).

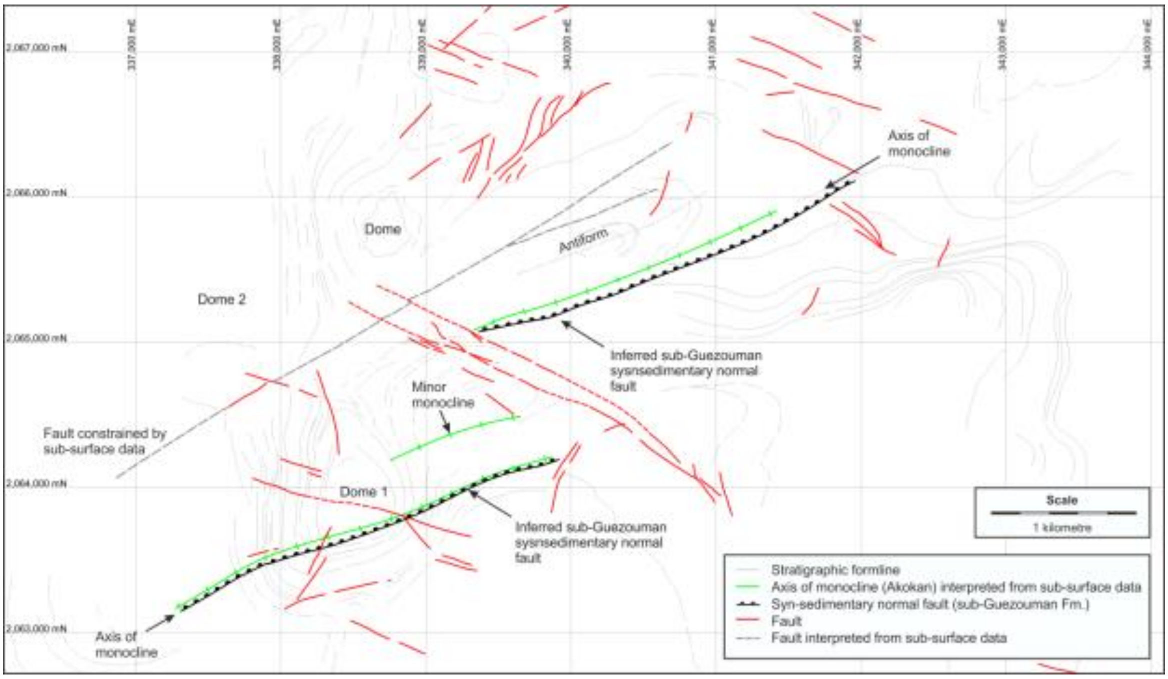


Figure 24-15: Plan view of stratigraphic formlines and structures interpreted at Marianne-Marilyn

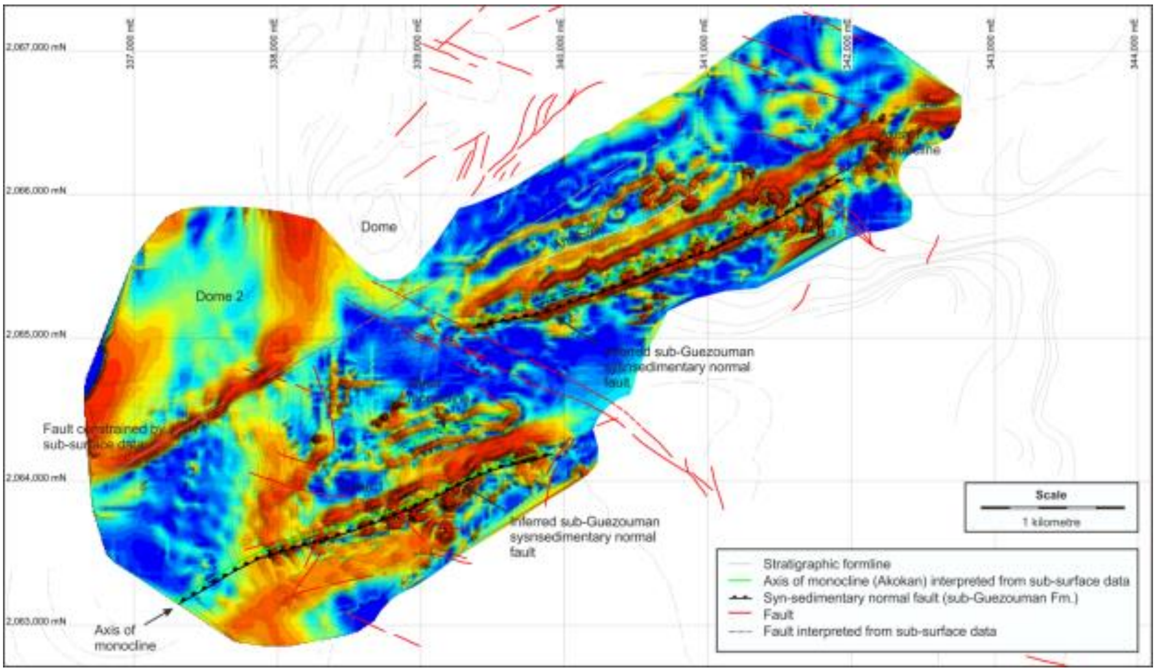


Figure 24-16: Plan view of stratigraphic formlines and structures interpreted at Marianne-Marilyn relative to a dip map of the top Talak/base Guezouman.

Domes

The west of the M&M deposit is dominated by a dome, where the stratigraphy defines a radially gently-dipping zone of uplift (Figure 24-15). Stratigraphic dips are accentuated on the flanks of this structure but near-horizontal at the apex (Figure 24-16). In general the stratigraphic dips on the flanks are approximately 5° or less, with the exception of the southern flank of the dome which reaches up to approximately 8°.

Faults

In total eight faults have been interpreted to be through-going structures at M&M, the details of which are shown in Figure 24-17. All of these structures have been interpreted primarily on the basis of linear traces on the Quickbird image. The majority of these traces are associated with small displacements of the stratigraphic traces on the surface.

Fault Rock Characteristics

Fault rock characteristics are known for a number of faults from diamond core drilling in the Marianne-Marilyn deposits. The principal characteristics of these are described below.

Akokan Faults

The Akokan Faults have a syn-sedimentary origin and are likely to have originally consisted of a localised zone of soft-sediment shear. Evidence for small-scale sedimentary faults and convolute slump structures are evident throughout the UA and Guezouman drill core intervals.

Steep Faults

The nature of the steep faults affecting Marianne-Marilyn is less constrained than the Akokan faults due to the uncertainty in dip of these structures. The nature of the faults vary markedly, with some uncorrelated faults comprising zones of clean slip surfaces with negligible fault rock to zones of variable recovery and broken rock.

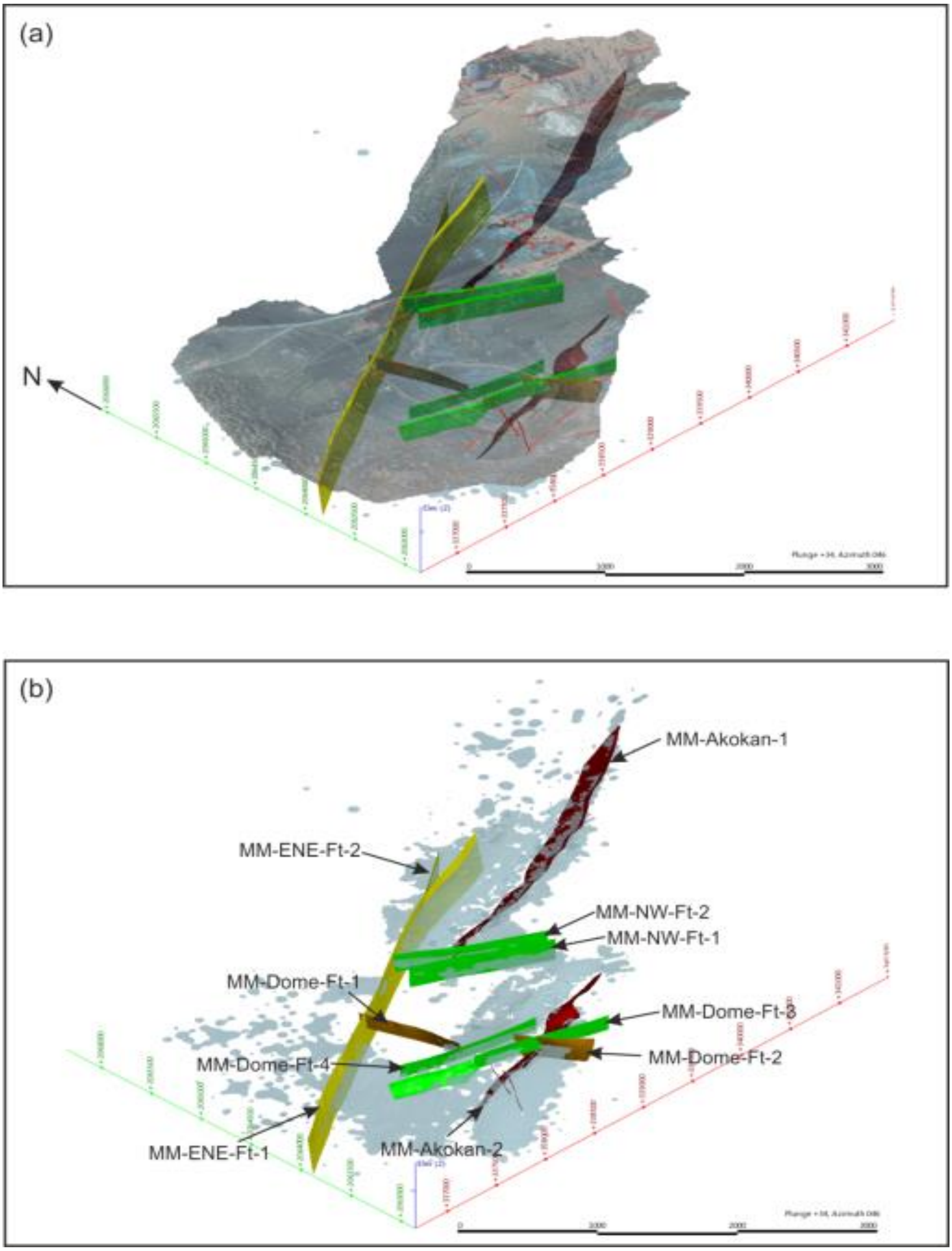


Figure 24-17: 3D view of interpreted faults at Marianne-Marilyn: (a) relative to topography with interpreted Quickbird image drape; (b) relative to Leapfrog 400 ppm uranium grade shell.

Rock Fabric

Oriented core drilling and ATV surveys give good information regarding the orientation and properties of discontinuity sets in the rock mass. The main discontinuity sets identified in both the hanging wall and footwall are:

- **Closed Bedding planes**; sub-horizontal; generally smooth and likely to persist for approximately 3-10 m (considered to be dominant discontinuity set). These are considered closed features (i.e. would not affect fracture frequency) and therefore their strength component has a “bond strength” (cohesion) as well as a friction angle.
- **Open Bedding Planes (bedding parallel joints)**; sub-horizontal; similar to bedding planes but are open, i.e. have aperture typically ranging from 0.1-1.0 mm. Some surface staining is present, but generally there is no infill and joint wall strength is equal to the intact rock strength.
- Sub-vertical joints; secondary joints, likely cut by bedding, aperture typically ranging from 0.1-1.0 mm

Rock Mass Model

A rock mass assessment has been undertaken to review the variability of rock mass characteristics of the geological units that form the hangingwall, orebody and the footwall of the Marianne-Marilyn deposit. Guezouman sandstone will form the pillars and the immediate roof, UA and Talak units will form the floor and lower portion of the pillars depending on the presence of UA channel. Data from the geotechnical site investigation program has been used to determine the rock mass design parameters.

Four geotechnical domains have been defined at Marianne-Marilyn. Analysis shows that these domains are primarily governed by lithology.

Means and ranges of rock mass properties per geotechnical domains, including intact UCS, rock mass unconfined compressive strength (RMS), Laubscher RMR_{90}, and estimated Geological Strength Index (Hoek et al. 2005) (GSI) from observations of core photographs are listed in Table 24-10.

Table 24-10: Rock mass properties per geotechnical domain.

Geotechnical Domain	Rock Type	Density (kg/m^3)	Design Intact UCS (MPa)	RMS (MPa)	RMR_{90}	GSI
Guezouman (Hangingwall)	Sandstone	2,200	40	13.9	71	65 - 75
Guezouman (Orebody)	Sandstone	2,200	40	13.9	63	60 - 70
UA (Footwall)	Silt/Mudstone	2,250	50	9.4	60	55 - 65
Talak (Footwall)	Clay/Mudstone	2,450	30	3.9	56	50 - 60

Geotechnical Design

A two-staged approach involving the use of both empirical design methods and numerical modelling has been used for underground geotechnical design at Marianne-Marilyn. Empirical analysis was conducted in the first stage, to determine acceptable range of span, bedded roof bolting system design, and pillar design. These results were then complimented by numerical modelling, where 3D and 2D conceptual models were developed to confirm the expected stress state, and rock mass behaviour of the roof, floor and the pillars.

Empirical Analysis

<u>Span Design</u>

Empirical method for assessing the stability of excavation proposed by Ouchi (2004) was used to examine the allowable span for man-entry openings at Marianne-Marilyn.

Ouchi's updated span design curve (Figure 24-18) for weak rock masses (Ouchi et al. 2004) compares the RMR_{76} (Bieniawski 1976) and critical span to categorize the design into stable, potentially unstable and unstable. The RMR_{76} rating for the Guezouman domain was derived using 'GSI $\cong$ RMR_{76}' correlation. A correction factor of minus 10 was then applied to the RMR_{76} to account for shallow dipping bed planes in the immediate roof. This results in a stable design span of 10 m, which is equivalent to 7 m opening width in room and pillar layout.

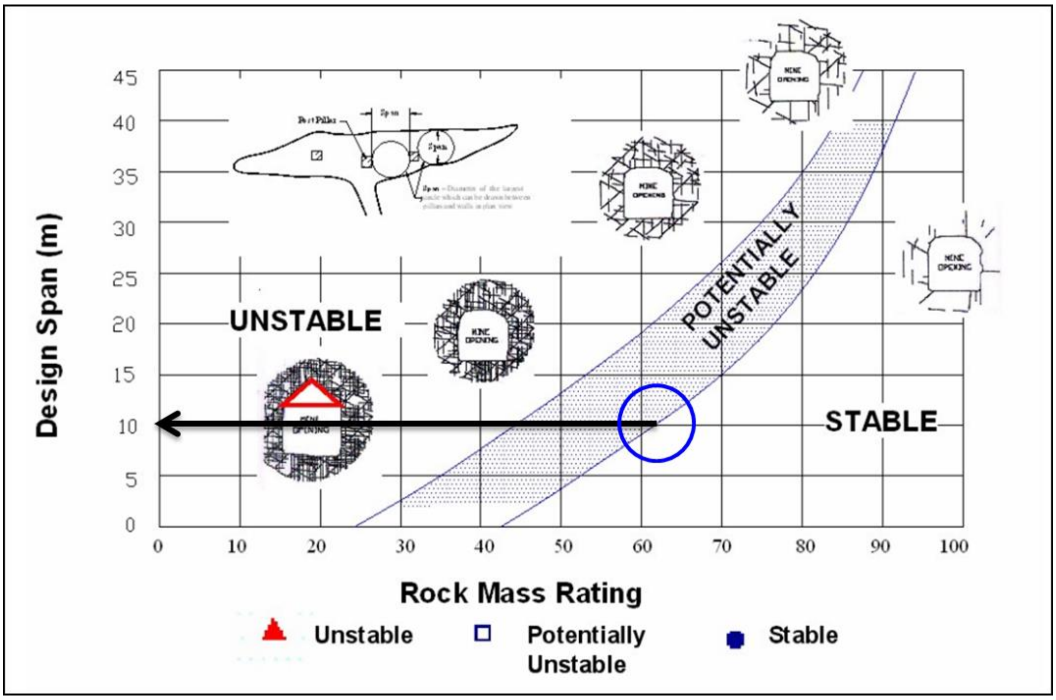


Figure 24-18: Underground span design guideline curve (Ouchi et al. 2004)

<u>Roof Stability Analysis</u>

The results of empirical assessment on design span indicate that 7 m opening width is a suitable design for Marianne-Marilyn Project area. SRK have examined the stereonets obtained from oriented core logs and acoustic televiewer logs and identified two main joint sets in majority of the deposit.

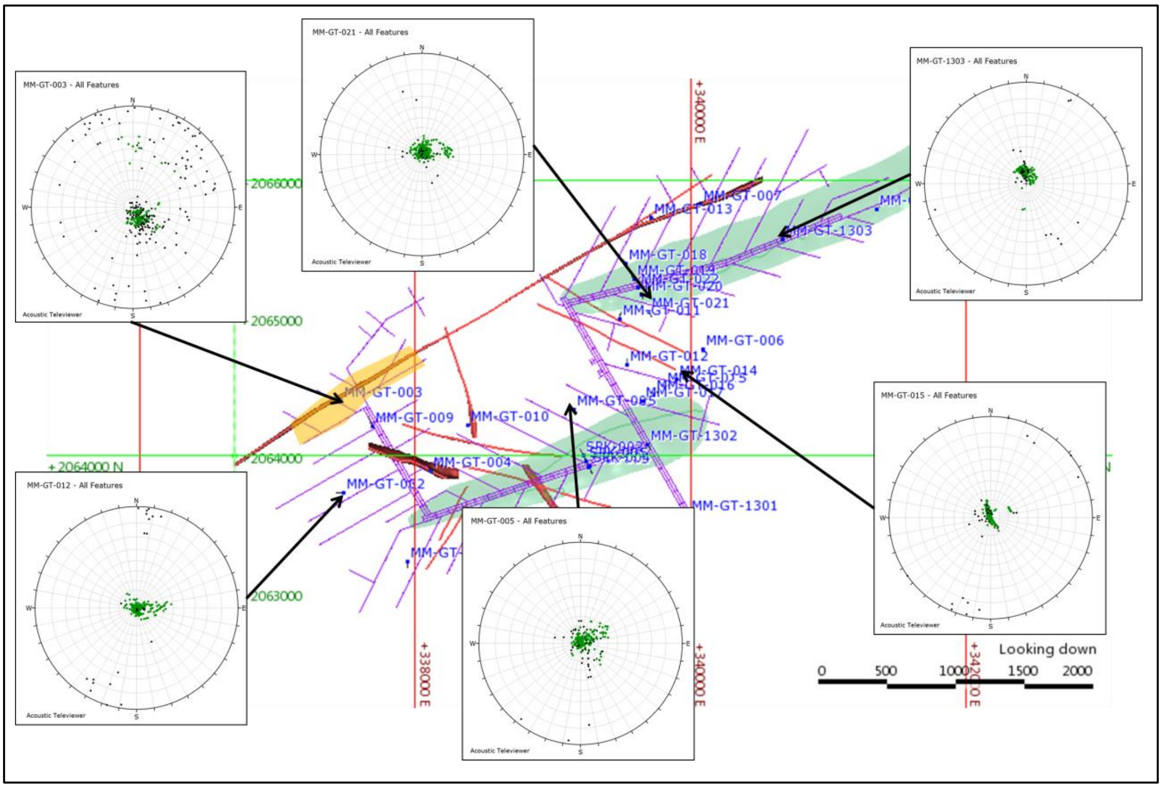


Figure 24-19: Stereonet plots representing discontinuities across Marianne-Marilyn deposit. An increased bedding dip and additional intermediate dipping joint set is seen in Hole MM-GT-003 due to intersection with a fault structure.

The combinations of the joint sets do not form wedges. The flat lying bedding planes and sub-parallel joints in the immediate roof could form layers of rock that act as "beams" and deflect into the excavation under loading. Pattern roof bolting is recommended to increase the stiffness of the immediate roof.

<u>Ground Support Design</u>

It is important to distinguish between the safety and stability of an excavation. The stability of an underground opening is concerned with the design of the excavation and ground support that is installed to prevent falls of ground. The potential for instability of the rock around development and stopes has been identified. These instabilities can, in general, be managed using levels of ground support typical for a Poor to Fair rock mass.

In the case of excavations that need to be accessed by personnel, it is essential that not only is it stable, but also that other factors, such as the development of 'loose' rock, which affects the safety of the workplace, be addressed. It is quite possible for an excavation to be stable such that no major ground falls will occur, and yet the development of small blocks and 'loose' rock presents a considerable hazard.

For liability reasons, most mines are moving towards the installation of mesh and rock bolts throughout all parts of the mine in which personnel access is required. Without the use of mesh, a formal documented scaling process is required and must be incorporated into the support standards for the mine. Welded wire mesh, with a maximum mesh size of 100 mm (4") square, constructed from #8 gauge wire or thicker, is preferred to chain link or "chicken wire" type mesh.

If mesh is not used on a mine wide basis, then, as a minimum, it should be used in areas that are accessed on a proportionately higher basis, such as meeting stations, explosive magazines, and workshops.

The roof support design is based upon accepted bolting design criteria tempered by SRK's recent experience in design and review of bolting systems in similar ground conditions and rock types. SRK recommends full column resin grouted 1.5 m long #6 (20 mm nominal diameter) rebar bolted on a 1.2 m by 1.2 m square pattern for excavations with spans up to 7 m. Rockbolts should be forged head and be installed with a minimum 150 mm by 150 mm domed washer plate and appropriate spherical washer to provide adequate surface support of the excavation and transfer load into the back.

Pillar Design

Pillar design at the Marianne-Marilyn is based on the empirical design methodology described by Lunder and Pakalnis (1997).

The empirical formulae requires input parameters of unconfined compressive strength of the intact rock, average unit weight of the overburden rock, the depth from surface, room width, and the dimensions of the pillar. The values used in the analysis were:

- Unconfined Compressive Strength: 40 MPa
- Overburden Rock Unit Weight: 24 kN/m^3 (estimated from density)

Depth of overburden at Marianne-Marilyn varies from 50 m in the northeast area to 160 m in the southwest area. This depth was categorized into three ranges that best describes the boundaries of the proposed mining panels; under 75 m, 75-120 m, and 120-160 m. The 7 m width and 2 m height of the rooms in production panels were kept constant at all depths.

The design criteria for the pillars at Marianne-Marilyn were:

- Minimum factor of safety of 1.5; and
- Minimum width-to-height ratio of 2

The width-to-height ratio limits the potential for pillar foundation failure (pillars punching into the soft roof or floor), and shear failure along weak joint or bedding plane. The designs are considered to be relatively conservative, and further investigation of ground behaviour may allow for an increase in extraction ratio. Table 24-11 shows the current design configuration based on empirical analysis.

Table 24-11: Production panel pillar designs from empirical analysis.

Depth Range (m)	< 75		75 to 120		120 to 160	
Pillar Type	**Initial**	**Final**	**Initial**	**Final**	**Initial**	**Final**
Pillar Dimension (m)	15 x 15	4 x 4	17 x 17	5 x 5	19 x 19	6 x 6
Pillar Height (m)	2	2	2	2	2	2
Room Width (m)	7	7	7	7	7	7
Depth from surface (m)	50	50	100	100	140	140
Pillar Width-Height Ratio	7.5	2	8.5	2.5	9.5	3
In-Panel Extraction Ratio	54%	87%	50%	83%	47%	79%
Factor of Safety	13.6	2.2	7.4	1.6	5.7	1.5

Numerical Modelling

Numerical modelling assessment consisting of mine scale 3D stress analysis and detailed 2D pillar stability analysis was conducted to confirm and optimise the design obtained from empirical study. Numerical modelling complements the empirical design by simulating complex excavation shapes, material heterogeneity, and plastic deformation of rock mass.

3D Boundary Element Stress Analysis

A conceptual 3-dimensional mine scale elastic model of room and pillar layout, using the Map3D boundary element code, was built to examine the mining-induced stresses around the excavation. Of particular interest was the stress state in various types of pillars considered in the mine plan. The pillar types include the square in panel pillars, barrier pillars that separate the adjacent mining panels and central drift, and secondary barrier rectangular pillars.

The conceptual model consists of 8 mining panels and is 900 m long by 650 m wide. The entire model dips by 7° allowing the depth to range by 50-160 m. The excavation phase was constructed using 7 m room width, 2 m mining height, and 5 m square pillars. 15 m barrier pillars divide the mining panels, and 10 by 15 m secondary barrier pillars were positioned every 100 m of development to ensure stability for ventilation infrastructure. Three parallel central drifts connect the mining panels with 25 m spacing in between. Figure 24-20 shows isometric view and plan view of the 3D conceptual model.

A simplified model of two geotechnical domains was considered. The geotechnical parameters (rock mass Young's modulus and Poisson's ratio) of the ore bearing Guezouman domain were assigned to all of the model space, while characteristics of Talak were assigned to the green blocks representing the floor of the excavation. The blue blocks are the excavated void space. The input parameters are:

- Guezouman: E = 15.6 GPa, v = 0.40
- Talak: E = 2.3 GPa, v = 0.21

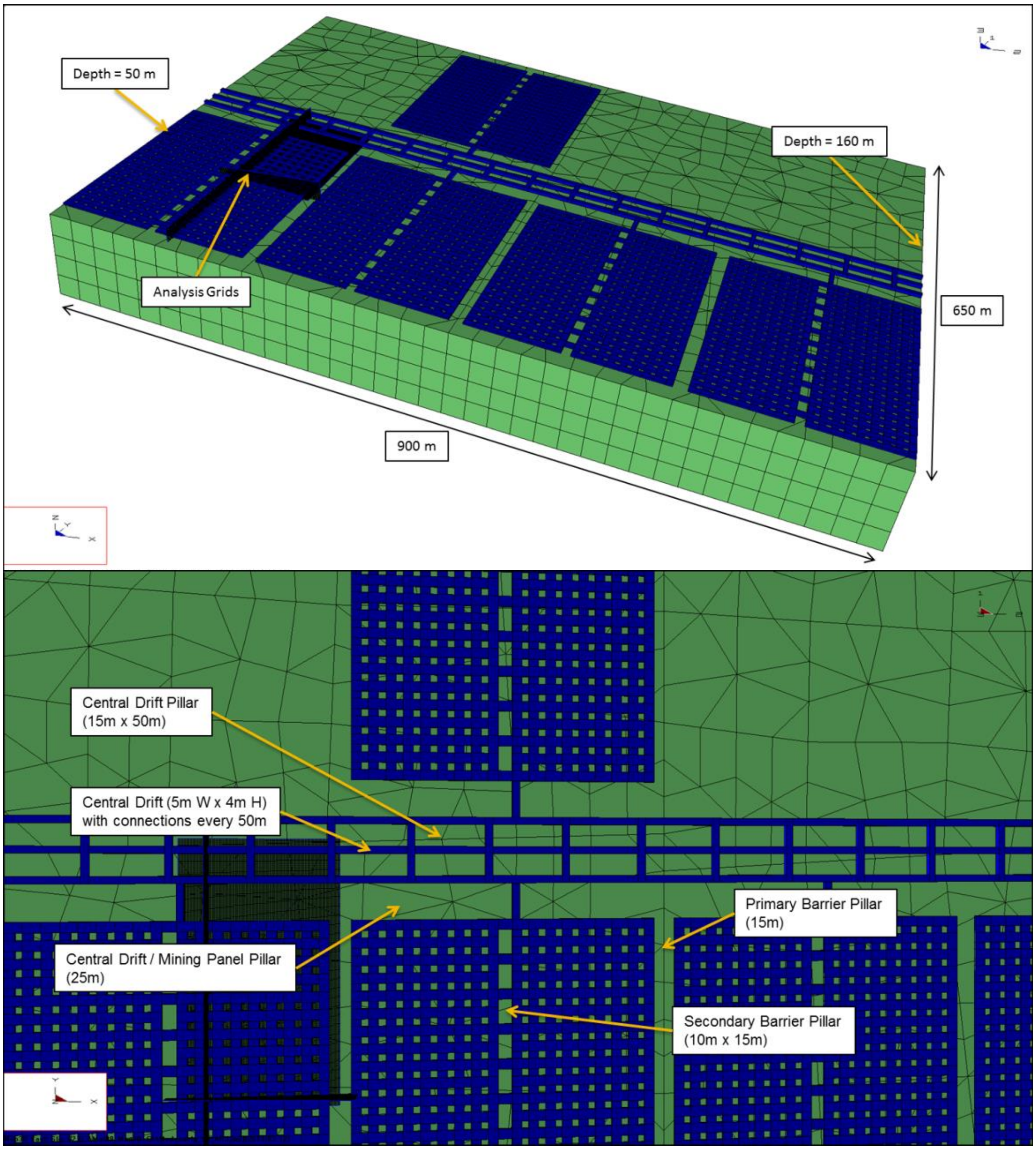


Figure 24-20: 3D Conceptual model and plan view of mining layout.

Results indicate higher stress conditions at the outer edges of the pillars, and lower stress in the core area. It is expected that some fracturing would occur at the outer wall of the various pillar types, but would not influence the load on pillar core significantly. This fracturing would be controlled by localised bolting.

Table 24-12 summarises the 3D boundary element stress analysis results. The results are given in terms of the maximum stress at the pillar core.

Table 24-12: Summary of 3D stress modelling results.

Pillar Type	Depth (m)			
	75	100	125	160
	Maximum Stress (MPa)			
Final pillars (5 x 5m)	7	11	13.5	16
Primary barrier pillars	3	4	5	7
Secondary barrier pillars	3.5	7	8	10
Central drift / Mining panel pillar	2	3.5	4	4.5

<u>2D Finite Element Pillar Modelling</u>

Pillar stability numerical modelling was conducted using Phase2 two dimensional finite element code by Rocscience.

Three base case geometries of square pillars were modelled comprising of a single pillar with half a room width on both sides. The pillar sizes were 4 x 4 m, 5 x 5 m and 6 x 6 m with a constant room width of 7 m, as determined in the empirical analysis. Displacement of the lower boundary was fixed, and the side boundaries were fixed in horizontal direction. Displacement in the upper boundary was allowed and a distributed load was applied gradually in multiple stages. The distributed load was adjusted to account for change in overburden depth.

Figure 24-21 shows the modelling results of a 5 x 5 m pillar at an overburden depth of 125 m.

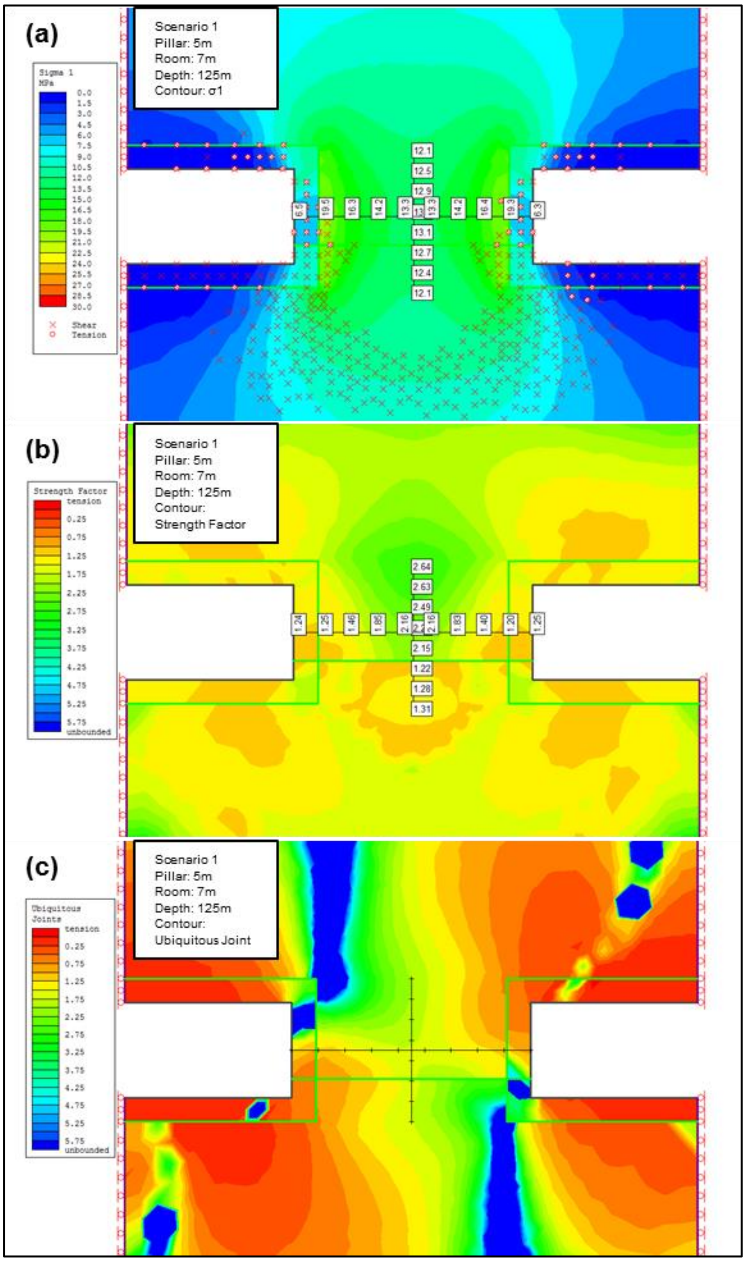


Figure 24-21: 2D Finite element pillar analysis results of 5 x 5 m pillar at 125 m depth. Contours of sigma1 (a), strength factor (b), and ubiquitous joint strength factor (c)

Table 24-13 summarises the results in terms of average strength factor at the pillar core. It is noticeable that 4 x 4 m pillars provide acceptable strength factor at depth. However, weak foundation material, possibility of further blast damage and variability of Guezouman sandstone intact rock strength limits our confidence to design pillars solely based on the numerical modelling. The results reinforce the opportunity for design optimisation.

Table 24-13: Summary of 2D pillar numerical modelling.

Pillar Type	Depth (m)			
	75	100	125	160
	Strength Factor at Pillar Core			
Final pillars (4 x 4m)	1.6	1.5	1.5	1.4
Final pillars (5 x 5m)	2.2	2.1	2.0	1.9
Final pillars (6 x 6m)	2.4	2.4	2.3	2.2
Primary barrier pillars	10.6	9.9	8.9	7.8
Secondary barrier pillars	5.3	4.8	4.7	4.3
Central drift / Mining panel pillar	6.9	6.5	6.1	5.2

Geotechnical Design Sectors

The Marianne-Marilyn geotechnical design sectors are presented in Figure 24-22. The production mining panels were grouped in terms of the depth of overburden and anticipated dip of the mineralisation. The subsection of each sectors (labelled with an ‘a’) indicate unfavourable dip and/or depth. Each design sectors are assigned with suggested pillar dimensions considering the results from empirical and numerical modelling analyses, as well as practical issues associated with the mining process. Barrier pillars are also recommended to limit the propagation of potential unstable zone. The recommendations are summarised in Table 24-14.

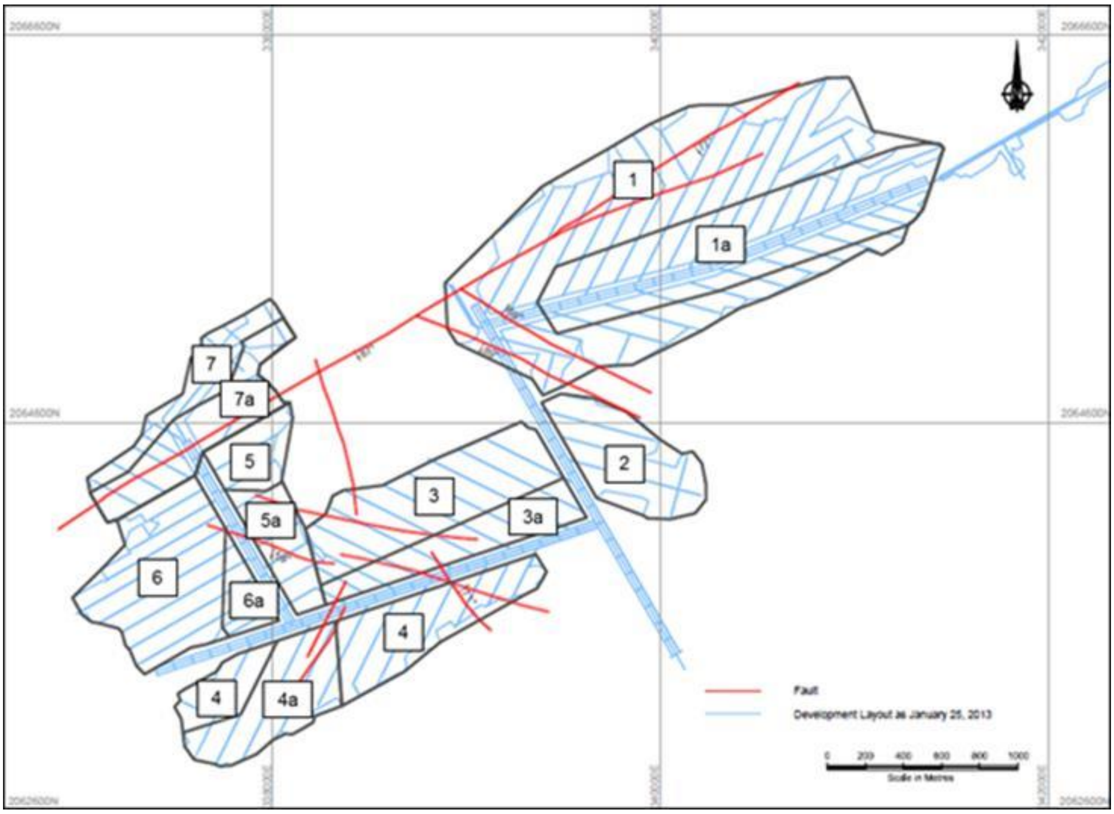


Figure 24-22: Marianne-Marilyn geotechnical design sectors.

Table 24-14: Geotechnical design summary.

Design Sector	Depth	Dip	Pillar Dimension			Panel Width	Extraction Ratio	Comments
	m	°	Width (m)	Length (m)	Height (m)	m	%	
1	50-75	0-7	4	4	2	7	87	Shallow and minor dipping ore; conventional R&P with 4 m square pillars
1a	50-75	7-10	4	4	2	7	87	Shallow and moderate dipping ore; apparent dip R&P with 4 m square pillars
2	50-75	0-7	4	4	2	7	87	Shallow and minor dipping ore; conventional R&P with 4 m square pillars
3	50-75	0-7	4	4	2	7	87	Shallow and minor dipping ore; conventional R&P with 4 m square pillars
3a	50-75	7-10	4	4	2	7	87	Shallow and moderate dipping ore; apparent dip R&P with 4 m square pillars
4	75-120	0-10	5	5	2	7	83	Moderate depth and dip; apparent dip R&P with 5 m square pillars
4a	120-160	10-16	6	6	2	7	79	Deep and moderate-to-steeply dipping; 6 m square pillars; some areas require stepped R&P
5	75-120	0-7	5	5	2	7	83	Moderate depth and minor dip; conventional R&P with 5 m square pillars
5a	75-120	7-10	5	5	2	7	83	Moderate depth and dip; conventional R&P with 5 m square pillars
6	100-120	0-7	5	5	2	7	83	Moderate depth and minor dip; conventional R&P with 5 m square pillars
6a	100-120	7-10	5	5	2	7	83	Moderate depth and dip; conventional R&P with 5 m square pillars
7	75-120	0-6	5	5	2	7	83	Moderate depth and dip; conventional R&P with 5 m square pillars
7a	75-120	7-16	6	6	2	7	79	Moderate depth and moderate-steeply dipping; 6 m square pillars; apparent dip R&P and some areas require stepped R&P

The following excavation criteria apply to the production panel designs:

- Production panels are developed with initial pillar dimension, which is equivalent to two times the length of final pillar plus an opening width e.g. Sector 1 would be (2 x 4m) + 7m = 15m;
- Final pillars are formed on retreat by splitting the initial pillars through the centre of the pillar length;
- Mining height at production panels is kept at 2 m with the use of low profile mining equipment;
- Pattern roof bolting is to be applied in the production area with 1.2 m by 1.2 m spacing using 1.5 m long #6 (20 mm nominal diameter) full column resin grouted rebar;
- 15 m barrier pillars are to be left between adjacent mining panels, and secondary barrier pillars with a minimum 10 x 15 m dimension should be left every 100 m span within the panel;
- Minimum of 20 m spacing (25 m if depth > 100 m) should exist between the central access drift and production panels; and

- 20 m rib pillars should be designed around identified fault structures.
- Appropriate offset of the central drives from the Akokan faults may be required if these faults propagate above the UA channels.

Decline

Access to Marianne-Marilyn will be through a surface portal into a central drive in the south-centre of the deposit. The decline is approximately 700 m in length and plunges at 8° to reach the mineralised depth. Two geotechnical holes (MM-GT-1301, MM-GT-1302) were drilled to characterise the likely encountered ground conditions. Figure 24-23 shows the location of mine access decline respective to the mine plan.

As the decline excavations are a life of mine critical infrastructure excavations it is considered prudent to increase the level of ground support above that recommended for the rest of the mine. Addressing ground control issues resulting from potential deterioration of these excavations throughout the mine life and the impact that this would likely have on production the following ground support is recommended; 2.4 m long #8 (25 mm) resin grouted rebar on 1.4 m centres through welded wire mesh in the back. Ribs to be supported with 1.5 m long #6 (20 mm) resin grouted rebar installed on 1.5 m centres through welded wire mesh that has been extended to within 1 m of the floor. The maximum mesh size of the welded wire mesh should be 100 mm (4”) square, constructed from #8 gauge wire or thicker. Smooth wall blasting techniques are strongly recommended in permanent infrastructure excavations

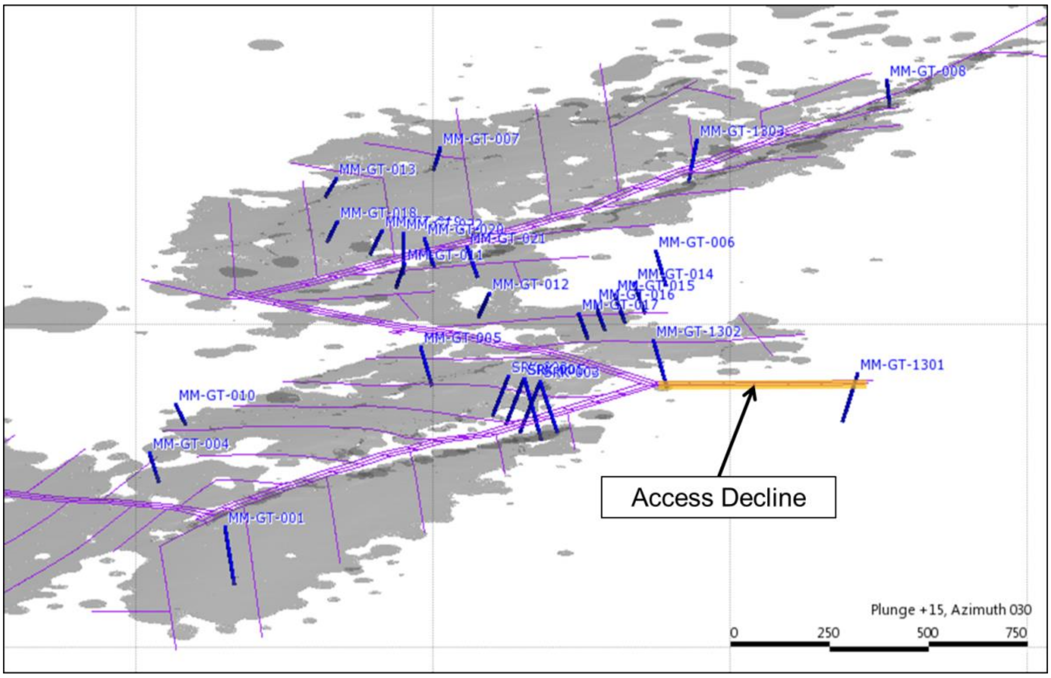


Figure 24-23: Marianne-Marilyn deposit access decline.

From surface the access decline passes through the Tchinezogue formation, which is a sub-horizontal bedded fluvio-deltaic sedimentary unit. The thickness of this unit is approximately 80 m, and the top 20 m is weathered and oxidised due to fluctuation of the groundwater table. The expected ground conditions and the geotechnical parameters along the length of the decline are given in Table 24-15.

Table 24-15: Expected lithologies and geotechnical parameters along the decline.

Decline length	Formation	RQD Design Value (%)	RMR_{90} Design Value
0 m - 0+150 m	Weathered Tchinezogue	79	59
0+150 m - 0+360 m	Fresh Tchinezogue	96	65
0+360 m – 0+700 m	Guezouman SST	96	80

24.3.2 MSNE

Field Program

Twelve holes were drilled in MSNE to understand the general geotechnical conditions. Holes were drilled a minimum of 10 m into Talak (footwall) to ensure sufficient depth past the ore zone. Hole locations were based on the structural interpretation done from Quickbird Imagery, the proposed mine layout and the Leapfrog 250 ppm uranium grade shell.

Hole locations relative to the Leapfrog 250 ppm uranium grade shell are shown in Figure 24-24.

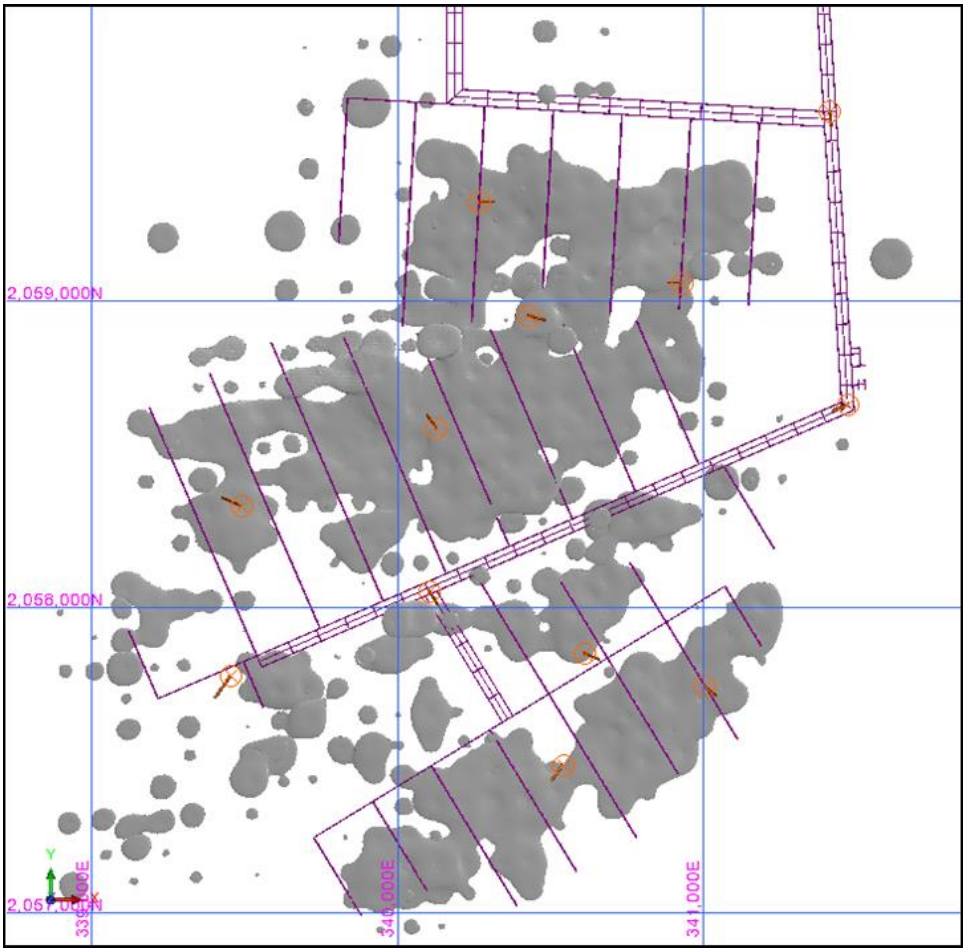


Figure 24-24: Plan view of geotechnical hole locations, proposed mine layout and the Leapfrog 250 ppm uranium grade shell at MSNE. Access to Maryvonne will be from the north central drive.

Geology

Exploration and geotechnical drilling suggests that the geology at MSNE comprises Guezouman sandstone overlying UA channels overlying Talak mudstone formation. The Guezouman dips sub-horizontally across the whole deposit and forms the hanging wall and host rock. The UA formation exists in the southern area of the deposit and will form the footwall. To the north, where UA is absent, the Talak unit will form the footwall. Figure 24-25 shows isometric view of MSNE Project area and an N-S cross section through MSNE Project area with the geology wireframes provided by GoviEx.

Characteristics of each formation are considered to be similar to those described in Section 7.3.2 (Geology of M&M).

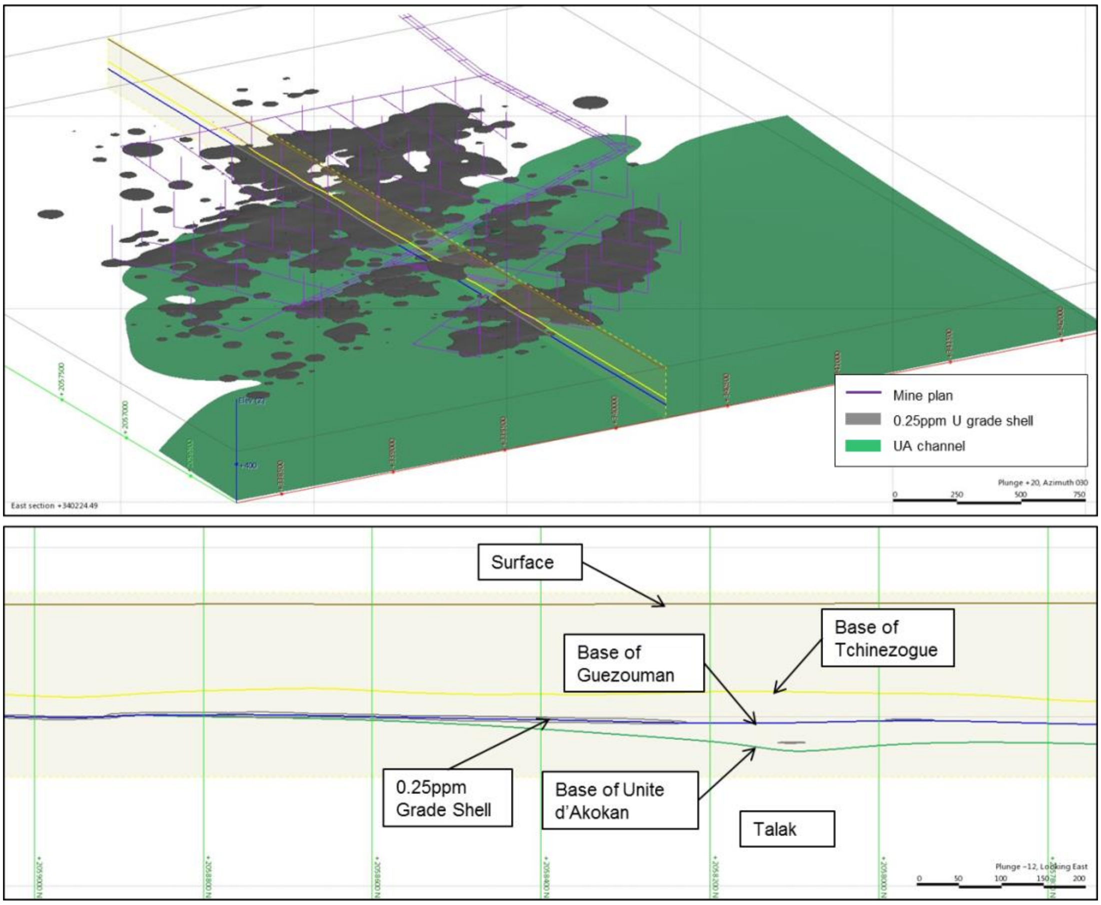


Figure 24-25: Isometric view and cross section view of MSNE geology.

Structural Geology

Structural Setting

<u>Faults</u>

In total six faults have been modelled to be through-going structures at MSNE. MSNE-NE-Ft-1 appears to belong to a relatively significant NE-SW fault trend. This fault trace appears to bound the deposit area to the west and accommodates a significant west-side-down dip-slip displacement that juxtaposes Tchinezogue Formation on the west against Tarat Formation on the east. Fault displacement is interpreted to be transferred to an adjacent segment to its south over a broad zone of fault overlap, which may constitute a relay zone.

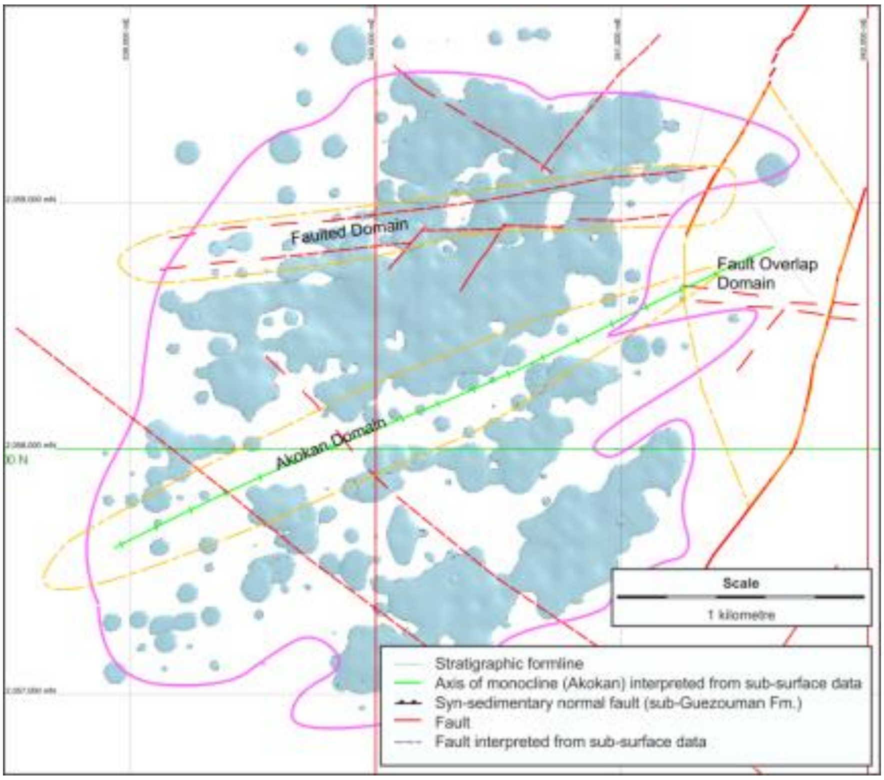


Figure 24-26: Plan view of structural domains relative to the Leapfrog 250 ppm uranium grade shell for MSNE.

Stratigraphic Dip

The stratigraphic dips in the MSNE deposit area are relatively subdued away from significant structures. Dips calculated on the basis of horizon intercepts are commonly 0-3° and rarely exceed 5°.

Rock Fabric

ATV and oriented core data identify discontinuities present within the rock fabric. Comparisons of all data across the deposit (Figure 24-27) have identified the following main discontinuity sets within the hanging wall, footwall and orebody:

- **Closed Bedding planes**; sub-horizontal; generally smooth and likely to persist for approximately 3-10 m (considered to be dominant discontinuity set). These are considered closed features (i.e. would not affect fracture frequency) and therefore their strength component has a “bond strength” (cohesion) as well as a friction angle.
- **Open Bedding Planes (bedding parallel joints)**; sub-horizontal; similar to bedding planes but are open, i.e. have aperture typically ranging from 0.1-1.0 mm. Occasionally some surface staining is present, but generally there is no infill and joint wall strength is equal to the intact rock strength.
- **NW-SE striking sub-vertical joints.** These are likely secondary joints which are cut by bedding in all lithologies. Aperture typically ranges from 0.1-1.0 mm.

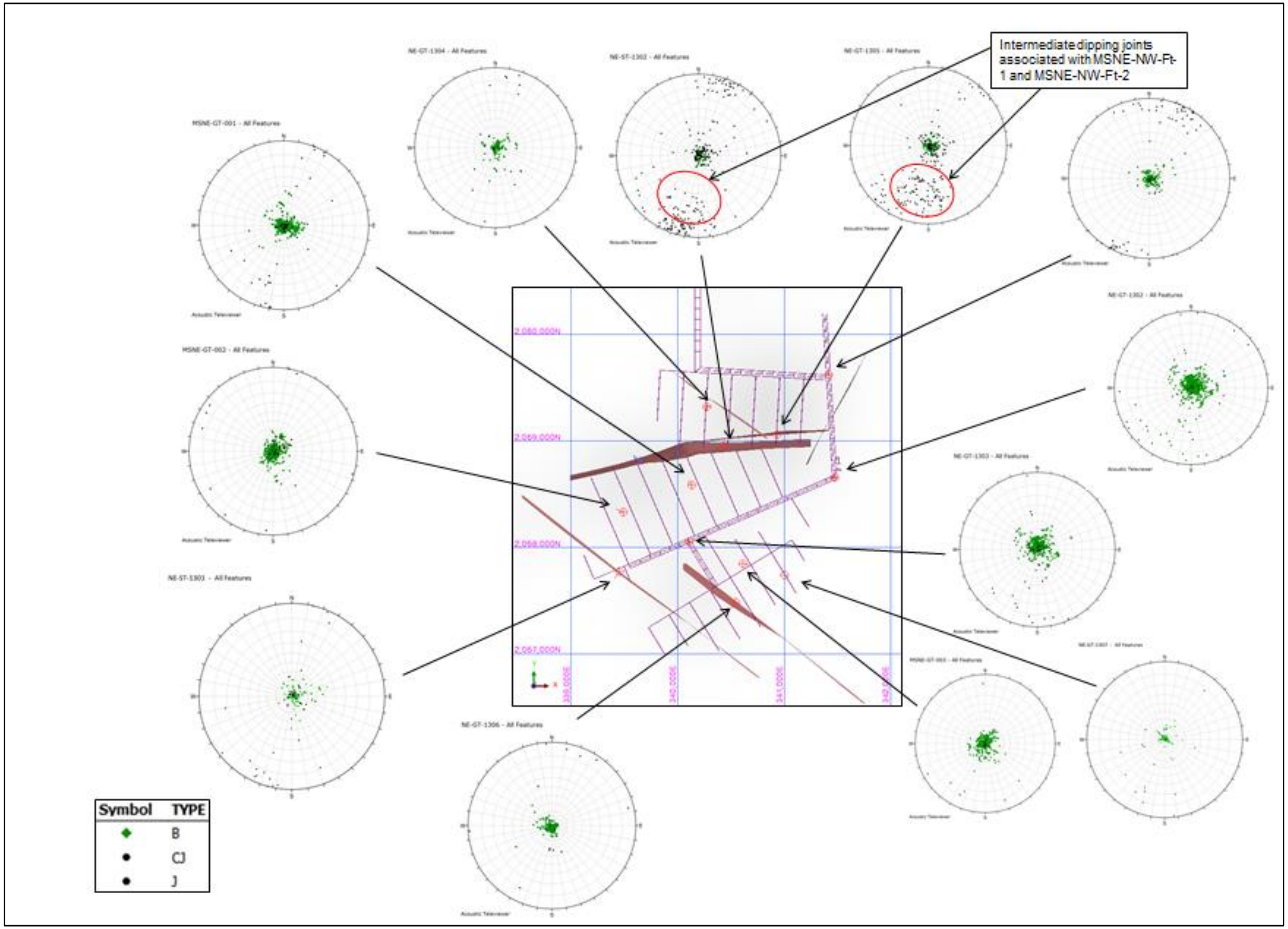


Figure 24-27: Stereonet plots of ATV data showing variation in rock fabric across the MSNE deposit.

Rock Mass Model

Rock mass assessment has been conducted to review variability of rock mass characteristics of the three lithology units that form the orebody and immediate hangingwall (Guezouman), and footwall (UA or Talak) of the MSNE deposit.

Guezouman Unit – Hangingwall and Orebody

The Guezouman sandstone unit is relatively massive with an average fracture frequency per meter of 0.16 and RQD of 99 %. The intact UCS from Point Load Testing ranges from 15-70 MPa, and the laboratory UCS test results average at 35 MPa. A relatively low average unit weight of 21 kN/m^3 is likely the reason for the spread in intact rocks strength. 40 MPa was selected as design intact UCS. The average RMR value is 75 and GSI observed in the core box photographs range between 65-75, indicating a good quality rock mass. Very little variation of rock mass parameters is observed at the hangingwall and mineralised depths.

UA Unit - Footwall

A single UA channel exists between the Guezouman and Talak in the southern area of MSNE deposit with thickness reaching up to 40 m.

Although thinly bedded mudstones are frequently visible, very few discontinuities exist as indicated by average fracture frequency of 0.11 per meter and RQD of 100 %. In terms of intact rock strength, six PLT results exist within the UA unit that ranges from 10-25 MPa. This result fits in the lower range of the intact UCS observed in UA channels in the MM Project area. A lower design intact UCS of 30 MPa has been chosen. The average RMR is 63 and estimated GSI is in the range of 55-65.

Talak Unit - Footwall

The Talak unit, which forms the footwall for the northern section of the MSNE Project area, is relatively isotropic rock mass with an average fracture frequency of 0.09 per meter. The intact rock strength is considered extremely weak. The PLT and laboratory UCS testing suggests a typical UCS value of 30 MPa. The average RMR obtained from geotechnical logging is 63. The estimated GSI varies between 50-60.

Geotechnical Domains

Geotechnical domains at MSNE are governed by lithology. Therefore geotechnical design parameters have been chosen for each formation and are given in Table 24-16.

Means and ranges of rock mass properties per geotechnical domains, including intact UCS, rock mass compressive strength (RMS), Laubscher RMR, and estimated GSI from core photograph observations are listed in Table 24-16.

Table 24-16: Geotechnical design parameters for MSNE

Geotechnical Domain	Rock Type	Density (kg/m^3)	Design Intact UCS (MPa)	RMS (MPa)	RMR_{90}	GSI
Guezouman (Hangingwall/Orebody)	Sandstone	2200	40	13.9	75	65 - 75
UA (Footwall)	Silt/Mudstone	2200	30	5.6	63	55 - 65
Talak (Footwall)	Clay/Mudstone	2450	30	3.9	63	50 - 60

24.3.3 Geotechnical Design

Empirical Analysis

The first stage of design involved the use of empirical methods to determine the roof span, roof support system, and the pillar dimensions. Below are the methodologies:

- Span design: The empirical span design curve by Ouchi (2004) was used to determine a stable roof span in the Guezouman domain;
- Roof stability analysis: Structural sets identified from oriented core logging and acoustic televiewer surveys were assessed for potential wedges forming in the roof. Sub-horizontal discontinuity features within the immediate 10 m of the roof were also observed for potential for slip or separation under load;
- Ground support design: The results of roof stability analysis were considered to determine a suitable ground support design. The design is based on SRK’s recent experience in design and review of bolting systems in similar ground conditions; and
- Pillar design: The pillar load, estimated using Tributary area method, was compared to pillar strengths calculated using empirical formulae by Lunder and Pakalnis (1997). The design criteria considered are for factor of safety ≥ 1.5, and width to height ratio ≥ 2.

Results from the empirical analyses are as follows:

- Maximum span remains at 10 m (7 m room and pillar openings) as per Marianne-Marilyn;
- Two main joint sets were identified across the MSNE deposit; sub-horizontal open bedding planes and NW-SE striking sub-vertical joints. Additional north, northeast intermediate dipping joint sets are encountered in holes NE-ST-1302 and NE-GT-1305 that are associated with the NW fault system. Thin wedge will forms in north area (trending 020°) of the faulted zone;
- Full column resin grouted 1.5 m long #6 (20 mm nominal diameter) rebar bolted on a 1.2 m by 1.2 m square pattern is recommended to support the bedded hangingwall and potential wedges; and
- Empirical analysis indicates that 4 x 4 m square pillars are inadequate at mining depths of MSNE. Instead, 5 x 5 m or 6 x 6 m pillars are stable for cover depths of 120 m and 160 m respectively.

Numerical Modelling

The second stage of geotechnical design involved the use of numerical model analysis to confirm and optimise the design obtained from empirical study. Below are the methodologies:

- Map3D was used to build a mine scale 3D conceptual model for examining the mining induced stresses around excavations. Since geotechnical design parameters of Guezouman and Talak are equal to that of Marianne-Marilyn, the same computer model was used.
- Phase 2 (Rocscience) was utilized to determine the factor of safety of different types of pillars at varying depth and dip of mineralisation. The behaviour or roof and floor are also observed for potential punching of pillar. The design input parameters are shown in Table 24-17.

Table 24-17: Rock mass properties used in Phase2 numerical modelling.

Geotechnical Domain	GSI	m_i	Intact Rock UCS (MPa)	Young's Modulus (GPa)	Poisson's Ratio	Generalized Hoek-Brown Constants		
						m_b	s	a
Guezouman	70	17	40	15.6	0.40	5.823	0.0357	0.501
UA	60	7	30	7.0	0.26	1.678	0.0117	0.503
Talak	55	4	30	2.3	0.21	0.802	0.0067	0.504

The results are as follows:

- Table 24-18 summarises the mine scale 3D stress analysis in terms of maximum stress at the pillar core.

Table 24-18: Summary of 3D stress modelling results.

Pillar Type	Depth (m)		
	100	125	160
	Maximum Stress (MPa)		
Final pillars (5 x 5m)	11	13.5	16
Primary barrier pillars	4	5	7
Secondary barrier pillars	7	8	10
Central drift / Mining panel pillar	3.5	4	4.5

The results of 2D pillar modelling are summarised in terms of strength factor at pillar core in Table 24-19. Taking into consideration roof and floor behaviour, stable ground conditions can be achieved by using 5 x 5 m or 6 x 6 m pillars at all depths.

Table 24-19: Summary of 2D pillar modelling results.

Pillar Type	Depth (m)		
	100	125	160
	Strength Factor at Pillar Core		
Final pillars (4 x 4 m)	1.5	1.5	1.4
Final pillars (5 x 5 m)	2.1	2	1.9
Final pillars (6 x 6 m)	2.4	2.3	2.2
Primary barrier pillars	9.9	8.9	7.8
Secondary barrier pillars	4.8	4.7	4.3
Central drift / Mining panel pillar	6.5	6.1	5.2

Room and Pillar Design Sectors

Room-and-pillar design sectors (Figure 24-28) have been developed based on depth of cover and dip of the orebody. Pillar dimensions, panel widths and extraction ratios for each design sector are given in Table 24-20.

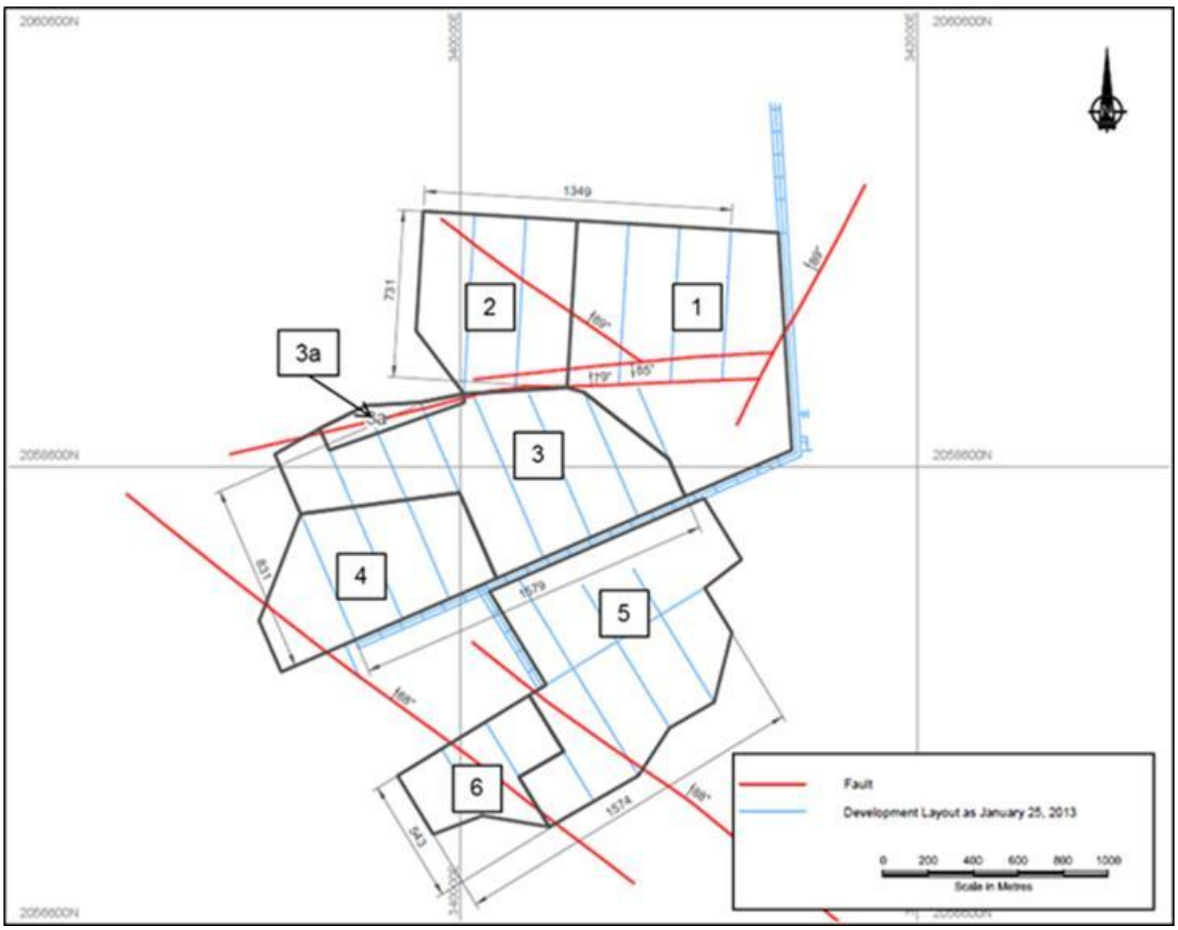


Figure 24-28: MSNE geotechnical design sectors.

Table 24-20: Geotechnical design summary.

Design Sector	Depth	Dip	Pillar Dimension			Panel Width	Extraction Ratio	Comments
	m	°	Width (m)	Length (m)	Height (m)	m	%	
1	100-120	0-7	5	5	2	7	83	Moderate depth and minor dipping ore; conventional R&P with 5 m square pillars
2	120-140	0-7	5	5	2	7	83	
3	120-140	0-7	5	5	2	7	83	
3a	120-160	7-16	6	6	2	7	79	Deep and moderate-to-steeply dipping; apparent dip R&P or stepped R&P with 6 m square pillars
4	140-160	0-7	5	5	2	7	83	Deep and minor dipping ore; conventional R&P with 5 m square pillars
5	120-140	0-7	5	5	2	7	83	Moderate depth and minor dipping ore; conventional R&P with 5 m square pillars
6	140-160	0-7	5	5	2	7	83	Deep and minor dipping ore; conventional R&P with 5 m square pillars

The following excavation criteria apply to the production panel designs:

- Production panels are developed with initial pillar dimension, which is equivalent to two times the length of final pillar plus an opening width e.g. Sector 1 would be (2 x 5m) + 7m = 17m;
- Final pillars are formed on retreat by splitting the initial pillars through the center of the pillar length;
- Pattern roof bolting is to be applied in the production area with 1.2 m by 1.2 m spacing using 1.5 m long #6 (20 mm nominal diameter) full column resin grouted rebar;
- 15 m barrier pillars are to be left between adjacent mining panels, and secondary barrier pillars with a minimum of 10 x 15 m dimension should be left every 100 m span;
- Minimum of 25 m spacing should exist between the central access drift and production panels; and
- 20 m rib pillars should exist around identified fault structures.

Decline

Access to MSNE and Maryvonne deposits will be through a surface portal into a central drive in the northeast area of the MSNE deposit. The decline is approximately 700 m in length, and plunges at 8° to reach the mineralised depth. Geotechnical hole NE-GT-1301 was drilled to characterise the likely encountered ground conditions. Figure 24-29 shows the location of mine access decline respective to the mine plan.

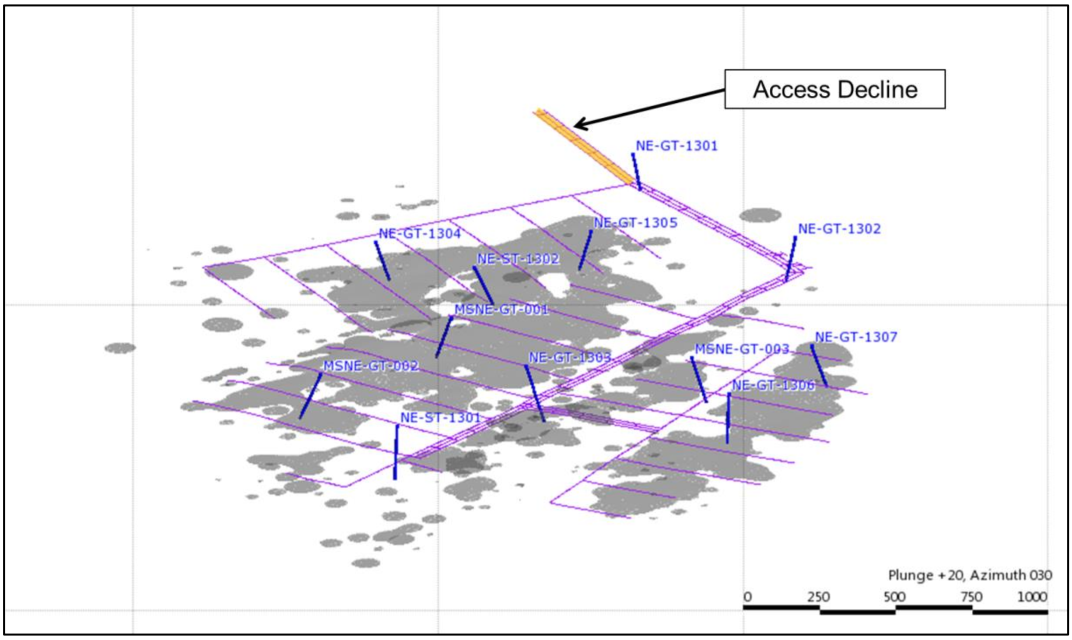


Figure 24-29: MSNE deposit access decline.

From surface the access decline passes through the Tchinezogue, formation which is approximately 70 m thick in this area. The upper 40 m is weathered and oxidised due to fluctuation of the groundwater table. Underlying the Tchinezogue is the Guezouman sandstone formation. The expected ground conditions and the geotechnical parameters for the length of the decline are given in Table 24-21.

Table 24-21: Lithologies and geotechnical parameters along the length of the MSNE decline.

Decline length	Formation	RQD Design Value (%)	RMR_{90} Design Value
0 m - 0+290 m	Weathered Tchinezogue	97	62
0+290 m - 0+500 m	Fresh Tchinezogue	99	67
0+500 m – 0+700 m	Guezouman SST	100	77

The following ground support is recommended for the decline; 2.4 m long #8 (25 mm) resin grouted rebar on 1.4 m centres through welded wire mesh in the back. Ribs to be supported with 1.5m long #6 (20 mm) resin grouted rebar installed on 1.5 m centres through welded wire mesh that has been extended to within 1 m of the floor. The maximum mesh size of the welded wire mesh should be 100 mm (4”) square, constructed from #8 gauge wire or thicker.

24.3.4 Maryvonne Geotechnical Design

Maryvonne deposit will be mined by conventional room and pillar method with access from the south via MSNE. No geotechnical data exists for this deposit. Data currently available for analysis is:

- GoviEx exploration database;
- Wireframes of geology contacts generated by SRK from exploration drilling;
- Leapfrog mineralisation grade shells; and
- Quickbird Imagery.

Structural Geology

At surface, Maryvonne is located in a relatively sandy area with interrupted exposure of the Izegouande Formation, similar to MSNE.

Structurally the deposit is located 6 km west of the regional NNE-SSW striking Madaouela Fault. Unlike Marianne-Marilyn, to the north, domes do not affect the Maryvonne deposit area.

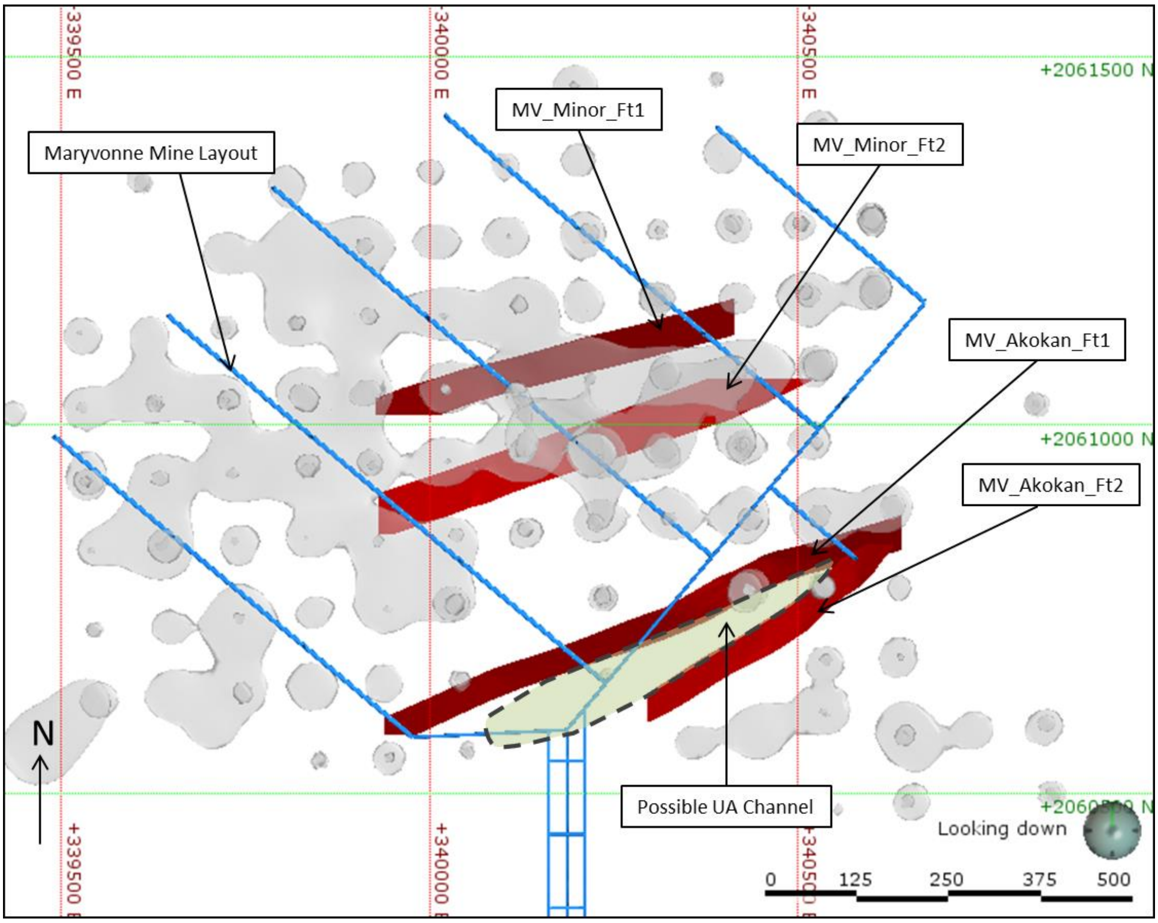


Figure 24-30: Positions of the interpreted faults and mine layout of Maryvonne. The inferred UA channel is shown.

Rock Mass Conditions

In the absence of geotechnical data, rock mass conditions have been extrapolated from the MSNE deposit since the lithological conditions are similar. Rock mass properties for each lithology are assumed to be the same as those at MSNE given in Table 24-16.

Design Sectors

Geotechnical design of Maryvonne is based on analysis done at Marianne-Marilyn and MSNE, and applying the existing design sectors generated.

Maryvonne is expected to be similar to Design Sector 2 at MSNE. However, a reduced extraction ratio and stope size is incorporated into this design due to the absence of geotechnical data. Recommended pillar dimensions, panel widths and extraction ratios are given in Table 24-22.

Table 24-22: Recommended pillar dimensions, panel widths and extraction ratios

Depth	Dip	Pillar Dimension			Panel Width	Extraction Ratio	Comments
m	°	Width (m)	Length (m)	Height (m)	Opening Width (m)	%	
120-140	0-10	6	6	2	7	79	Limited geotechnical data within Maryvonne means a conservative design approach is taken.

The following excavation criteria apply to the production panel designs:

- Production panels are developed with initial pillar dimension, which is equivalent to two times the length of final pillar plus an opening width e.g. Sector 1 would be (2 x 5m) + 7m = 17m;
- Final pillars are formed on retreat by splitting the initial pillars through the center of the pillar length;
- Pattern roof bolting is to be applied in the production area with 1.2 m by 1.2 m spacing using 1.5 m long #6 (20 mm nominal diameter) full column resin grouted rebar;
- 15 m barrier pillars are to be left between adjacent mining panels, and secondary barrier pillars with a minimum of 10 x 15 m dimension should be left every 100 m span;
- Minimum of 25 m spacing should exist between the central access drift and production panels; and
- 20 m rib pillars should exist around identified fault structures.

24.4 Hydrogeological Characterisation and Updated Conceptual Hydrogeological Model

24.4.1 Introduction

This section summarises an update to the hydrogeological conceptual understanding of the Project based on updated hydrogeological data. The hydrogeological understanding was initially developed in 2013 during the Integrated Development Plan (IDP). The Pre-Feasibility Study (PFS) drew hydrogeological conclusions from the IDP and did not include any additional fieldwork. New information available for the FS includes:

- A dedicated FS hydrogeological drilling and pumping test programme focussing on the Miriam deposit, the purpose of which was to better define potential pit inflows;
- Updated groundwater levels; and
- Additional groundwater quality samples, including from boreholes pumping tests at Miriam.

A further pumping test completed during the 2013 field program (MAD1_0003) has also been analysed due to its proximity to the proposed Miriam pit. This was not originally analysed as it was completed after the IDP reporting cut-off.

Full details of the FS hydrogeological investigation and updated conceptual hydrogeological model are presented in SRK (2022g). The following sections present a summary from SRK (2022g).

24.4.2 Approach

The Miriam deposit area has been the focus of the FS investigations since Miriam is the only deposit being developed to an FS level. Remaining Madaouela deposits, namely M&M and MSNE, remain at PFS level.

Figure 24-31 shows the locations of historic hydrogeological test work. One pumping test has been completed in the immediate vicinity of Miriam in borehole MSNE_4931, completed during the IDP studies in 2013 which comprised a step test and 7-day constant rate test. Seven nearby observation wells were monitored during the constant rate test.

For the FS, additional confidence was required for Miriam dewatering predictions to determine whether dewatering volumes could meet the make-up water demand during the early mine life when only Miriam is operational. Therefore, three additional pumping test locations were selected from the exploration and geotechnical programme to enable a satisfactory spatial coverage of the Miriam deposit. Monitoring wells were placed close enough to the pumping well to be confident of observing a pumping response. Figure 24-32 shows pumping wells (in purple) and associated monitoring boreholes (in yellow).

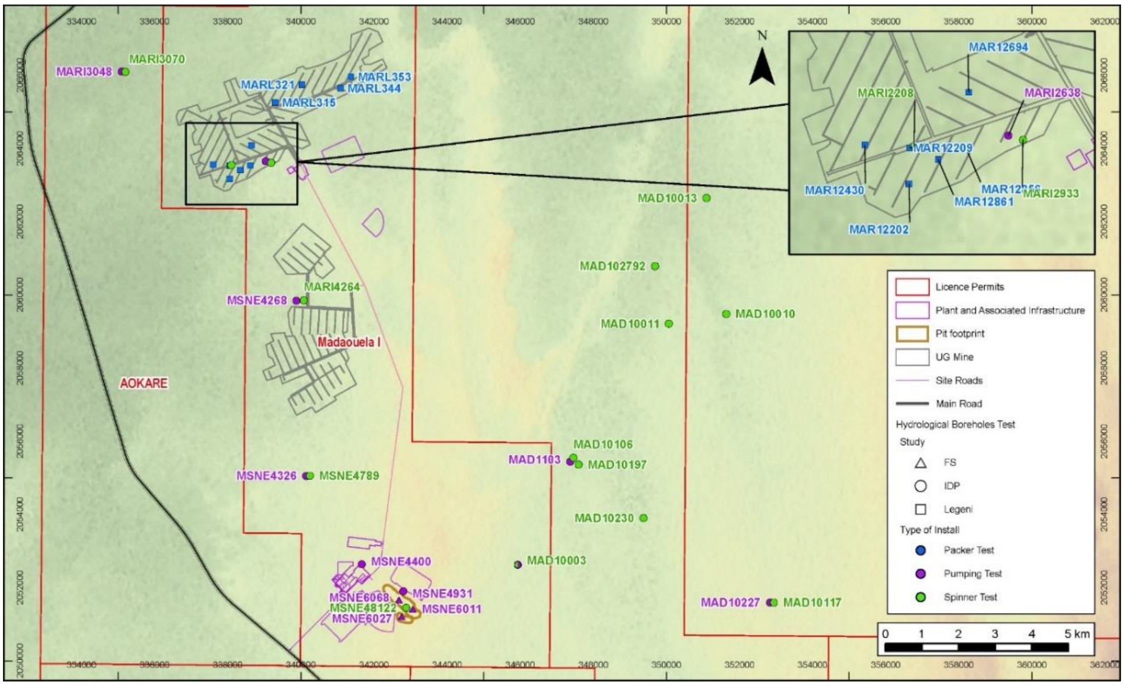


Figure 24-31: Location of all Hydrogeological Tests Conducted Historically and for the FS

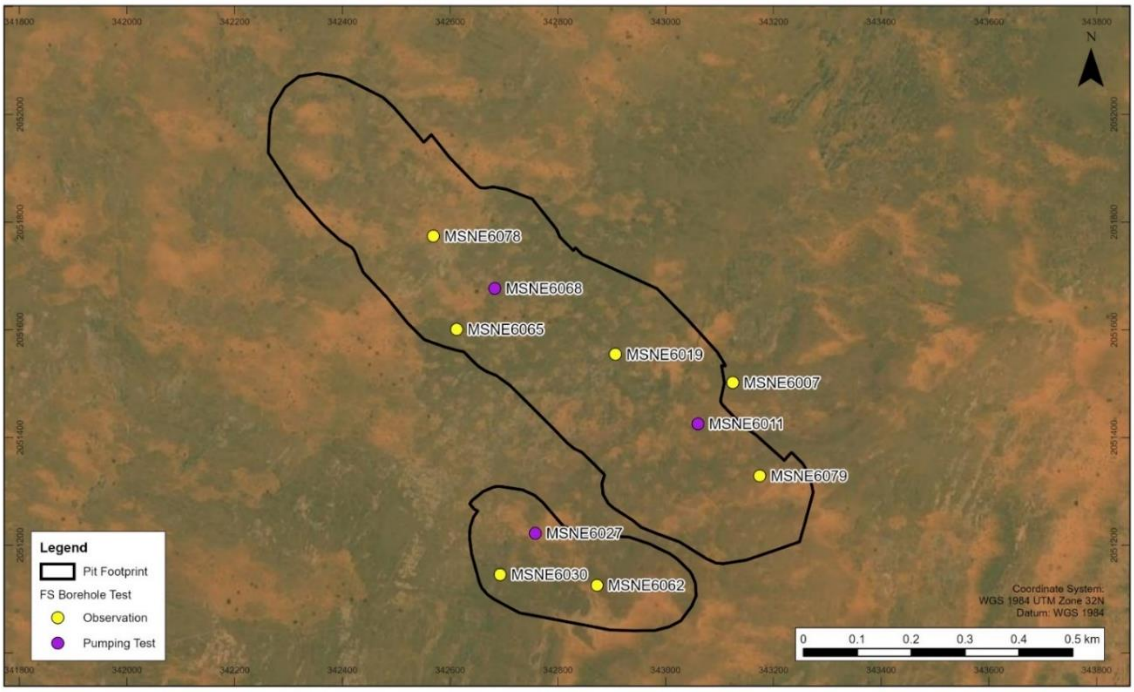


Figure 24-32: Location of FS Pumping Tests in relation to Miriam Footprint

Drilling of FS pumping wells took place between May and July 2021 and comprised reaming of existing exploration/geotechnical holes by the drilling company, ESAFOR. The drilling and subsequent pumping tests were supervised by a GoviEx hydrogeologist with remote guidance provided by SRK.

Both step tests and constant rate tests (CRTs) were completed on wells MSNE_6011, MSNE_ 6027 and MSNE_6068. Each step of the step tests ran for 120 minutes until an approximate stabilisation in the pumping well before the next rate was applied. At the end of the final step the recovery was measured with the pumping well water level allowed to recover to within a minimum of 5 % of the pre-pumping water level. CRTs were run for 5 days to assess long term well performance, boundary conditions and to accurately estimate aquifer properties.

During each test, water level transducers were installed in the pumping well and a selection of monitoring wells to automatically record groundwater levels every 30 seconds. These were complemented with manual water level measurements collected at intervals.

24.4.3 Pumping Test Analysis

The calculated borehole efficiency of MSNE_6011 and MSNE_6027 from the step tests is approximately 96-97 % which indicates that these boreholes are not being excessively impacted by near-borehole linear and non-linear head losses. The calculated efficiency of MSNE_6068 is lower at 76-80 %. Although not excessively low, the efficiency could indicate positive linear well losses suggesting that this borehole may be experiencing some permeability reduction at the wellbore, most likely caused by insufficient development. These influences were taken into consideration when analysing the constant rate test for this borehole.

The average transmissivity and hydraulic conductivity from the 5-day constant rate tests are 6.3 m^2/d and 2.7 x 10^{-6} m/s, respectively. Average storativity is approximately 4 x 10-5. These results closely align to results from historical testwork.

In 2013, as part of the IDP, a step test was completed on borehole MAD1_0103. At the time of the IDP this test was not analysed or reported on due to it being conducted after the IDP reporting had been prepared. The test has been analysed as part of the current study given its proximity to the proposed water supply wellfield. The analysis showed a very efficient borehole (100 % at all tested rates) with an average transmissivity and hydraulic conductivity of 51 m^2/d and 5.8 x 10^{-6} m/s. The maximum sustainable yield of this hole is estimated to be 60 m^3/hr. A further 7-day pumping test is recommended for this hole.

24.4.4 Groundwater Levels

Groundwater level monitoring shows that a steadily declining water level is exhibited at many piezometers across the Project site, with the rate of decline increasing during 2021. The steady decline is likely due to regional groundwater exploitation from aquifers that rarely receive any recharge except in response to extreme rainfall events. Historically, groundwater contours have been heavily influenced by the COMINAK and SOMAÏR operations, as well as localised groundwater abstractions for community water supply and GoviEx drilling programmes. Figure 24-33 illustrates the variation of water elevation across the site area.

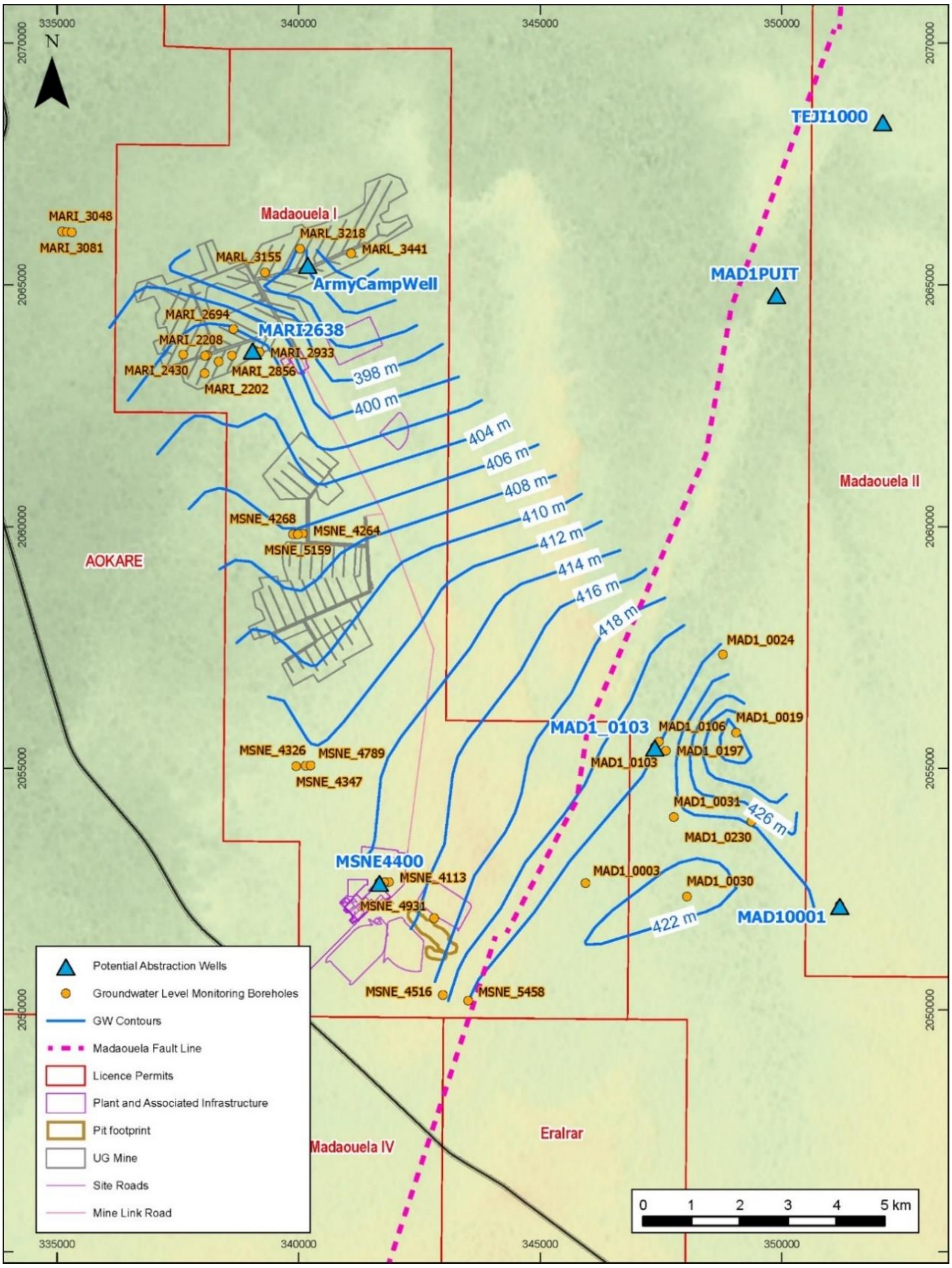


Figure 24-33: Groundwater contours from March 2019

24.4.5 Groundwater Quality

Groundwater quality sampling was completed in September 2021. Samples from boreholes in the vicinity of Miriam exceed drinking water PSGs (Project Specific Guidelines) for pH, fluoride, sodium, uranium and gross alpha/beta. Samples from boreholes in the vicinity of M&M are shown to exceed drinking water PSG for pH, sodium, uranium and gross alpha/beta.

The water quality at community wells is generally good except for slightly elevated pH above the drinking water PSG. Elevated pH is consistent with the Project baseline and there does not appear to be a clear spatial pattern across the Project area. A sample collected in the vicinity of the proposed wellfield showed generally good water quality with the majority of parameters below their respective drinking water PSG. The only exception is pH which exceeds the PSG value of 8.00 (8.53).

24.4.6 Conceptual Groundwater Model

A conceptual groundwater flow model is an idealised picture of a groundwater system, which is developed from interpretation of available groundwater data (including water quality), and is typically based on a simplification of the true groundwater system. At a given scale, the hydrogeological system can be broken down into four fundamental components that governs the behaviour of the groundwater system:

- The hydraulic properties of the geological units, which governs their ability to transmit and store groundwater
- Interactions with the adjacent groundwater systems (i.e. boundary conditions)
- The recharge to the groundwater system governing the amount of water entering the groundwater system
- The discharge mechanisms, which includes both natural discharge and groundwater abstraction

Conceptual models are typically developed as a precursor to numerical flow modelling. The conceptual model is used to provide a summary of the current interpretation of the groundwater flow systems in the area. The numerical groundwater model is constructed based upon this conceptual model and then used as a tool to prove or disprove the concepts outlined. The process is somewhat iterative in the fact the conceptual model should be continuously revisited and revised to reflect the findings of the numerical model.

Geological Interpretation

The stratigraphy in the Project area is very consistent, although can be locally deformed adjacent to fault structures. The drilling grids on the deposits comprising the Mineral Reserve are at a density of at least 100 x 100 m spacings which is adequate to accurately map the key stratigraphic units.

Although SRK has updated the stratigraphic model at both Miriam and M&M deposits as part of the Feasibility Study (summarised in Section 7) based on drillholes completed in 2021, the differences in these models and those used for the IDP are insignificant. This was anticipated by SRK, as the areas of drilling focus in 2021 were already defined to a drilling density of 30 to 40 m grids in both Miriam and M&M deposits. SRK therefore used the IDP stratigraphic models for the groundwater modelling in the Feasibility Study so that completion of the 2021 drilling program and updating of the stratigraphic models would not delay the start these studies.

Hydrostratigraphy and Updated Hydraulic Properties

Groundwater flow is primarily controlled by both lithology and structure, as is typical for sedimentary groundwater systems. The majority of groundwater flow occurs within the coarse sedimentary sandstones. The major faults, including the Arlit and Madaouela Faults, result in discontinuity within the high permeability sandstone beds and form low permeability barriers within the regional groundwater system. However, locally to the proposed Miriam pit site, there is little evidence that similar barriers to flow are exhibited by the local modelled fault structures, therefore groundwater flow is thought to locally be primarily controlled by lithology.

The absence of vertical connectivity also results in strong vertical water quality gradients with depth. There is limited throughput in the deeper groundwater units which subsequently show increased dissolved solids content due the longer groundwater residency times.

The low permeability nature of the major regional structures (i.e. the Arlit and Madaouela faults) is confirmed by available field data. It is conceptualised that vertical hydraulic conductivity is enhanced, and horizontal conductivity is reduced, around the smaller post-sedimentary structures although this is yet to be confirmed by field data. Syn-sedimentary structures can lead to zones of higher hydraulic conductivity where they result in a comparatively high energy depositional environment and hence zones of coarser-grained sediments. It is possible that this situation arises towards the base of the Guezouman in close proximity to the UA channels at a Marianne, Marilyn and MSNE although this is yet to be confirmed.

The impact of exploration and mining activities on hydraulic properties can also be significant. Old exploration boreholes that are not suitably backfilled can result in significant increases in vertical hydraulic conductivity, and the mine workings themselves will also alter aquifer hydraulic properties locally.

The available field data has been used to characterise the hydraulic properties of the major lithological units in the Project area, and this information is summarised in Table 24-23.

Table 24-23: Summary of updated hydraulic properties by stratigraphic unit

Unit	Description	Hydraulic Conductivity Range (m/s)	Storage Properties
Moradi, Tamamalt and Tejia	These units have not been considered in any detail as they are typically absent across the project area or within the unsaturated zone. They do not constitute viable aquifer, and where they are present they are assumed to have the same properties as the underlying Izegouande.	N/A	N/A
Izegouande	Generally considered to be a poor aquifer comprising interbedded sandstones and shales. It is described as series of perched aquifers and "water pockets" in the Akouta EIA. Sandstone units becoming more abundant towards the base (SOMAÏR EIA). The GoviEx spinner testing programme has indicated that there is significant permeability with this unit, although the tests are not of sufficient duration to confirm whether the permeability is extensive or localized.	1.22×10^{-08} to 1.65×10^{-06} (Akouta EIA, pumping tests) 7.5×10^{-07} to $1.2E \times 10^{-06}$ (SOMAÏR EIA, pumping tests)	Specific Storage of 8.6×10^{-6} m^{-1} calculated from pumping test result in SOMAÏR EIA
Madaouela	Considered a poor aquifer of interbedded sandstones and shale, similar to the Izegouande in terms of hydraulic properties, although spinner testing completed to date by GoviEx suggests it may be slightly less permeable.	3.5×10^{-6} (GoviEx IDP pumping test)	Specific Storage of 3.7×10^{-6} m^{-1} calculated from GoviEx IDP pumping test.
Tarat	The principal sandstone aquifer in the area. The SOMAÏR and Akouta EIA's describe it as the only exploitable aquifer to meet the water supply requirement for those operations. A decreasing permeability from the north to the south east is noted in the Akouta EIA. Pumping test and spinner test results from the GoviEx water supply investigations also suggest it is likely to be the most productive aquifer to the east of the Madaouela fault.	1.00×10^{-06} to 8.00×10^{-04} (Akouta EIA, pumping test) 1.95×10^{-07} to 4.5×10^{-04} with most values ranging from 5.0×10^{-06} to 5.0×10^{-05} (SOMAÏR EIA, pumping tests) 2×10^{-6} (GoviEx IDP pumping test, single test close to Madaouela fault; higher permeability encountered in	Specific Storage of 7.5×10^{-6} m^{-1} calculated from GoviEx IDP pumping test. Specific Yield of 15% inferred from Akouta EIA

Unit	Description	Hydraulic Conductivity Range (m/s)	Storage Properties
		subsequent holes - analysis pending)	
Tchinezogue	Comprises silts, fine sandstones and clays, and is an aquitard. It is considered that there may be some permeability parallel to bedding but vertical permeability is negligible.	No data	
Guezouman	Comprises a fining upward sequence of conglomerate, sandstones and some shales. Zones of elevated permeability at the base of the unit were encountered during exploration mining at Marilyn. Considered a relatively poor aquifer on a regional basis but localized pockets of high permeability do exist.	2×10^{-5} – 3.6×10^{-5} (AEC pumping tests; Marilyn area) 1.7×10^{-9} – 3.2×10^{-7} (Legeni packer testing report; Marilyn area) 4.9×10^{-06} to 1.7×10^{-05} (Akouta EIA, pumping tests) 1.3×10^{-07} to 3.0×10^{-05} (SOMAÏR EIA, pumping tests) 4.4×10^{-7} to 8.4×10^{-6} (GoviEx IDP pumping test) 8.2×10^{-7} to 7.31×10^{-5} (GoviEx FS pumping tests)	Specific Storage ranges from 4.2×10^{-7} to 3.2×10^{-6} m^{-1} calculated from GoviEx IDP pumping tests. Specific Yield of 7% inferred from Akouta EIA Specific storage ranges from 2.91×10^{-7} to 6.09×10^{-6}
Unite Akokan	The Unite Akokan (UA) is conformably deposited on the Talak argillites. It is composed of medium-grained feldspathic sandstone, developed to the north of the basin, and grading toward sandstone and clay to the south. The UA channel in the Marianne-Marilyn area is described as thinly-bedded mudstones and siltstones, suggesting comparatively low permeability.	No data	No data
Talak	Comprises an argillic-rich sequence and forms the basal aquitard to the local aquifer system.	No data	No data

Boundary Conditions

For the purposes of this study the Talak is assumed to form an impermeable basal unit to the regional groundwater system. This assumption is reasonable as the deeper Farazekat aquifer, which sits below the Talak, is not exploited in the area and is largely disconnected from the overlying aquifer systems due to the very low hydraulic conductivity of the Talak. The Talak outcrops to the north and east of the project area, and is also outcropping between M&M and the Madaouela fault. The Arlit fault is taken as the western limit of the model area as it is known to form a barrier to groundwater flow based on the experiences of the COMINAK operation. The southern extent of the groundwater system in the Madaouela is not well constrained as the principal aquifers continue to plunge to the south.

Locally in the Miriam area, although there are several modelled small scale fault structures, none were observed to act as barriers or conduits for flow during the FS hydrogeology pumping tests.

Groundwater Recharge and Discharge

Groundwater recharge and discharge mechanisms in the Sahara region are complex due the fact that present day recharge rates are negligible, but discharge of fossil groundwater continues to occur. This results in the absence of a natural equilibrium between groundwater recharge and discharge. It is therefore necessary to consider how the groundwater systems may have evolved since the onset of desertification during the mid-Holocene (around 5,500 years ago).

Previous studies have indicated that groundwater within the Tarat aquifer around Arlit can be attributed to humid periods around 10,000, 25,000 and 30,000 years ago (Dodo & Maria Zuppi, 1999). The most recent recharge event corresponds with the African Humid Period which continued from around 14,500 to 5,500 years before present. During these humid periods groundwater recharge rates would have been high. Groundwater elevations would also have been higher and would likely have resulted in the discharge of groundwater to perennial river systems during that period.

With the onset of desertification the groundwater recharge rates have reduced to negligibly low levels across the majority of the project area. The natural groundwater gradients that were observed before the major abstractions were likely to be partially driven by historical groundwater recharge. Prior to the initiation of dewatering and water supply abstraction in the 1960’s evaporation of groundwater was the primary groundwater discharge mechanism. This evaporation from groundwater gives rise to upwards hydraulic gradients from the deeper groundwater units to the shallow units, and lateral groundwater flow towards areas of outcrop.

The only potential source of groundwater recharge at present is considered to be from infiltration through dry stream beds following intense storm events. There is greatest potential for this to occur to the east of the project area where the runoff from the Air Mountains collects in the dry river channels. There is no available data on the magnitude or frequency of these recharge events, and for the purposes of groundwater resource evaluations recharge is conservatively assumed to be zero.

Direct recharge from infiltration of precipitation is unlikely to occur as soil moisture deficits are so high that infiltrating water is retained as soil moisture and then evaporated back to the atmosphere. The proliferation of vegetation that is observed along stream channels during the wetter months would also suggest that much of the infiltration through dry stream channels is also lost to evaporation. There is no evidence of hydraulic gradients away from stream channels in any of the available data which supports the assumption of negligible or zero recharge.

Groundwater Abstraction

SRK were unable to obtain updated dewatering information for the neighbouring operations for this FS study.

As of 2013, groundwater discharge in the Project area is dominated by the activities of the SOMAÏR and COMINAK operations and the associated water supplies to the towns of Arlit and Akokan. The majority of the abstraction is from the Tarat aquifer. This has led to a reversal in vertical groundwater gradients with downward vertical gradients now being observed from the Izegouande to the Tarat around the SOMAÏR mine.

Drawdown within the Tarat has also extended to the south and east of Arlit, extending into the Mad1 concession area. Drawdown in the Tarat is estimated at 40 m immediately to the west of Miriam (compared to over 100 m in the vicinity of the COMINAK mine). The extent of drawdown further south is yet to be confirmed.

Drawdown within the Tarat will have led to increases in the rate of discharge from Guezouman into the overlying Tarat, and may be responsible for depletion of groundwater within the Guezouman. SRK are yet to obtain accurate baseline (i.e. 1960's) groundwater elevations for the Guezouman but current estimates suggest the Guezouman has experienced about 10 m of drawdown on average, and possibly around 20 m in the Marilyn area. Local abstractions (historical dewatering at Marilyn and the army camp water supply well) are also responsible for the observed drawdown but increased rates of leakage from the Guezouman into the overlying Tarat is also likely to have an influence.

The principal objective of the conceptual and numerical modelling is to determine the impact that GoviEx will have on the regional groundwater system, and what would the implications be for the GoviEx operations and other groundwater users in the area.

Dewatering of the Guezouman has the potential to reverse groundwater flow directions between the Guezouman and the Tarat. The extent hydraulic connection between the Guezouman and the Tarat is thought to be limited but this is the subject of on-going evaluation.

Water supply abstractions to the east of the Madaouela fault will results in drawdown in the aquifer systems in that area. The low permeability nature of the Madaouela fault means it is extremely unlikely that any impacts will be felt on the western side of the fault.

24.5 Groundwater Modelling

24.5.1 Introduction

Groundwater modelling was completed as part of the Integrated Development Plan (IDP) in 2013 (SRK, 2013a). A 3D numerical model was constructed to estimate dewatering rates, cone of depression and wellfield sustainability. The model constructed as part of the IDP study was constructed in MODFLOW 2005. This model was updated for the FS modelling using the MODFLOW Python package, FloPy. FloPy includes pre-processing and post-processing functionality as well as the capacity to run MODFLOW simulations. The increased functionality allowed for the construction of stochastic simulations with customised sequential alterations to the numerical groundwater model, and the subsequent post-processing of a large amount of data.

The following section provides a summary of the FS groundwater modelling; full detailed reporting can be found in SRK (2022e).

The objectives for the FS groundwater modelling study are as follows:

- Confirm the validity of the existing conceptual hydrogeological model and parameter values based on the data collated during the FS field programme;
- Refine the groundwater model in the vicinity of the Miriam pit to incorporate latest hydraulic property values from FS pumping tests;
- Incorporate the latest mine designs for Miriam, MSNE and M&M deposits;
- Assess potential water supply wellfield performance; *and*
- Estimate dewatering rates for all deposits for use in the life of mine water balance update.

24.5.2 Groundwater Model Domain and Grid Discretization

The groundwater model domain was unchanged from the IDP model configuration. The model domain reflects the original leapfrog model with model layer thicknesses manipulated to represent the dip of geological units. The boundaries of the model domain are summarised as follows:

- The western boundary of the model corresponds with the Arlit fault, which is assumed to be an impermeable no-flow boundary in all model simulations;
- The northern and eastern boundaries are defined by the Talak-Farazekat contact at the outcrop, and are also assumed to be impermeable no-flow boundaries;
- The southern boundary is less well constrained as the strata continue down dip. Sensitivity analysis described in Section 8.8 of the IDP report (SRK, 2013a) was used to confirm that the model boundaries are sufficient distances from the wellfield and mine workings not to influence the results.

The finite-difference grid has been modified during FS modelling with increased refinement in the vicinity of the Miriam, M&M and MSNE deposits as well as the Madaouela Fault.

Figure 24-34 shows the configuration and mesh refinement of the numerical groundwater model. Figure 24-35 shows representative model cross-sections.

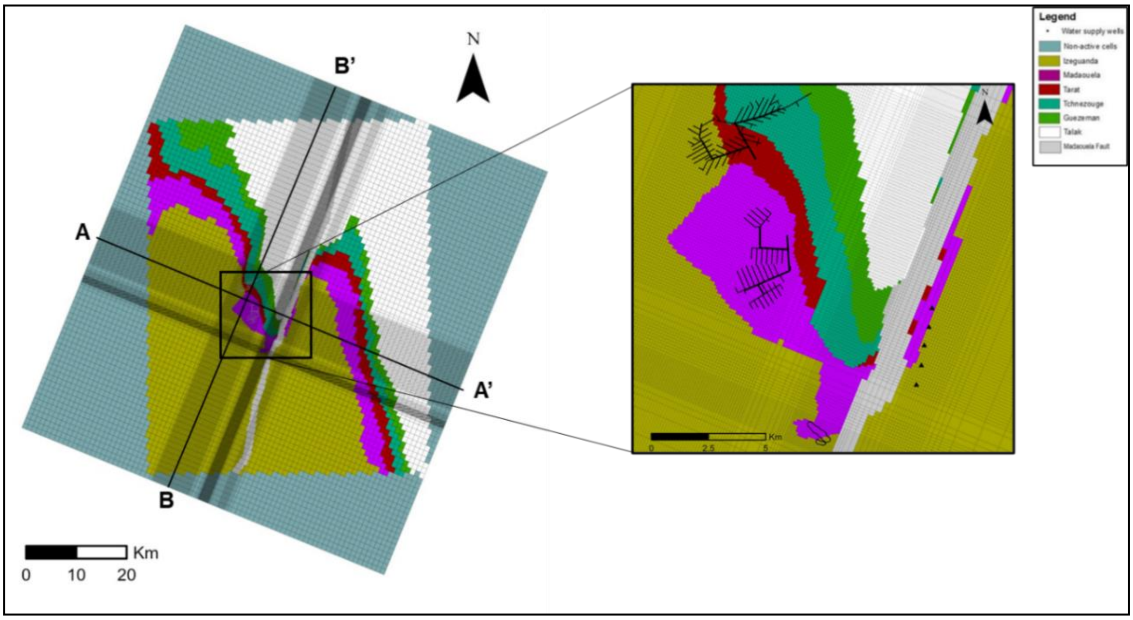


Figure 24-34: Numerical Groundwater Model Configuration and Mesh Refinement

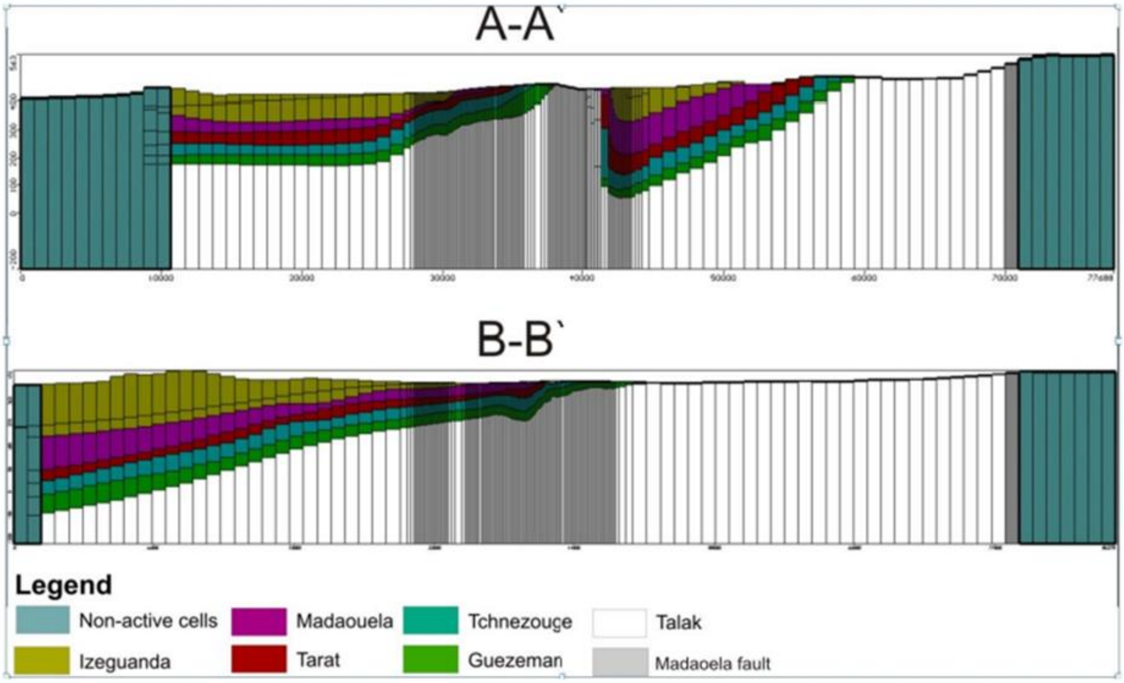


Figure 24-35: Model Cross-Sections as per the IDP Report (SRK, 2013a)

24.5.3 Hydrogeological Zones and Hydraulic Properties

Hydrogeological zones were defined based on the principal stratigraphic units. The Madaouela fault zone was incorporated as a separate hydrogeological unit due to the uncertainties surrounding the continuity and connectivity of the units across the fault zone. Incorporating the fault zone as a distinct hydrogeological unit ensures that efficient sensitivity analysis can be completed on the fault zone.

The FS pumping tests in the Miriam area provide a higher level of confidence in the hydraulic property values at this location. The representation of the Guezouman in the model has been modified accordingly. Based on the new field data the Guezouman global hydraulic conductivity is determined to be an order of magnitude greater than previously reported. This has implications for the inflow predictions for the three deposits.

The hydrogeological zones and their hydraulic parameter characteristics are summarised in Table 24-24 below.

Table 24-24: Hydrogeological Zones and Parameter Values

Hydrogeological Zone	Model Layer ID	Horizontal Hydraulic Conductivity [m/s]	Vertical Hydraulic Conductivity [m/s]	Specific Yield [%]	Specific Storage [1/m]
Izegouande	1 – 2	5E-07	5E-08	5	1E-06
Madaouela	3	5E-07	5E-08	5	1E-06
Tarat	4	1E-05	1E-06	10	1E-05
Tchinezogue	5	1E-09	1E-09	1	1E-06
Guezouman (Global)	6	2E-06	2E-07	5	8E-07
Guezouman (Miriam)	6	3E-06	3E-07	5	8E-07
Talak	7	1E-09	1E-09	1	1E-06
Madaouela Fault	1 - 7	1E-09	1E-09	1	1E-06

24.5.4 Groundwater Recharge

The only potential source of groundwater recharge at present is considered to be from infiltration through dry stream beds following intense storm events. There is greatest potential for this to occur to the east of the project area where the runoff from the Air Mountains collects in the dry river channels. Direct recharge from infiltration of precipitation is unlikely to occur as soil moisture deficits are so high that infiltrating water is retained as soil moisture and then evaporated back to the atmosphere. For the purposes of modelling recharge is assumed to be zero for all numerical model simulations which represents a conservative scenario for groundwater resource evaluations.

24.5.5 Initial Conditions and Calibration

The initial heads for the FS Initial Conditions run were first set using a linear interpolation across the model domain, with higher heads from the southeast and lower heads in the northwest to reflect the observed groundwater level dataset from 2022. The numerical groundwater model was run with the various water supply wells at the SOMAÏR and COMINAK operations active, with a 30-year simulation during which all these discharges were active throughout.

The output heads were compared to the contour plot for the Tarat (Bottero, 2004 from SRK, 2013a) and the 2022 groundwater level dataset. The calibration to the Tarat contours in the vicinity of the SOMAÏR and COMINAK operations was poor (as was the case with the IDP modelling), with limited drawdown observed throughout the model domain. An improved, but still poor, fit was achieved by reducing the Madaouela and Izegounde hydraulic conductivity by an order of magnitude. However, the initial condition hydraulic heads in the MSNE and M&M area show a good correlation between observed and initial heads in the project area.

24.5.6 Discussion of Initial Conditions Model Results

The lack of drawdown in the vicinity of the SOMAÏR and COMINAK area is unlikely to influence model results, particularly with the COMINAK operations ceasing in 2021. However, in scenarios where the cone of depression extends across to and intercepts that from the COMINAK and SOMAÏR abstractions, resulting inflows will be conservative estimations.

The model uncertainty that results from the poor regional calibration supported the importance of using stochastic model runs, with variation in the property values for the Tarat, Madaouela and Izegouande units. These units will influence the wellfield performance but are expected to have little control on the inflow predictions.

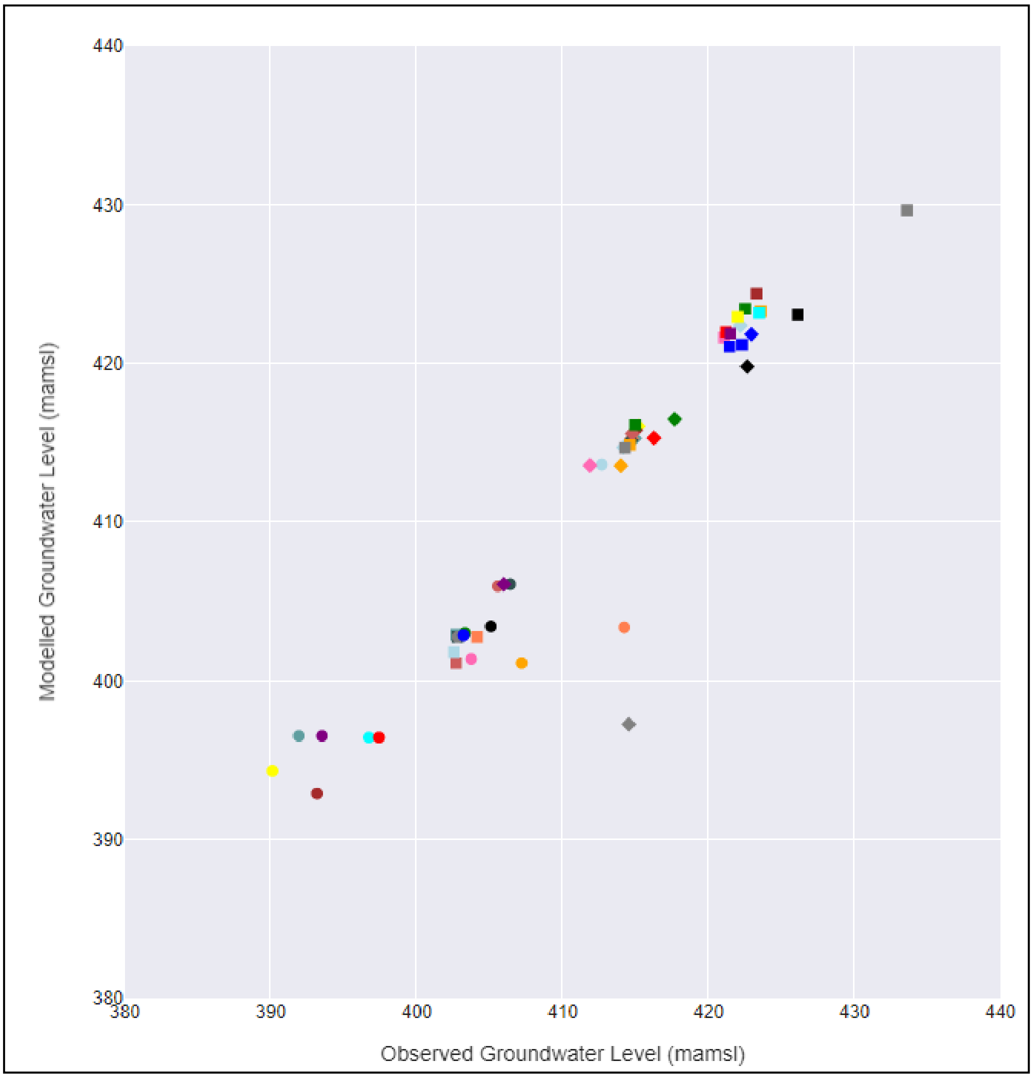


Figure 24-36: Observed vs Modelled Groundwater Levels from the Initial Heads Run

24.5.7 Predictive Modelling

Probabilistic Approach

A probabilistic approach to numerical groundwater modelling was taken accordingly to provide insight into the potential range of inflows to the deposits under various hydrogeological conditions.

As recharge is assumed to be zero, the principal controls on groundwater inflow are the hydraulic properties of the various hydrogeological zones, with all inflow conceptualised to be released from storage. Similarly, the impact of the project wellfield to the east of the Madaouela Fault is principally controlled by hydraulic properties.

The hydraulic property ranges for each modelled unit were established with a triangular-shaped probability distribution, whereby the “minimum”, “maximum” and “mode” property values were assigned based on the available information. As the drain conductance for the underground workings is calculated using the Guezouman hydraulic conductivity (K), the drain conductance was varied in line with the changes in the Guezouman K.

A total of 300 runs were completed using random sampling from the probability distributions summarised in Table 24-25. Of these 300 runs, 15 did not converge and are excluded from further reporting.

Table 24-25: Hydraulic Property Ranges for Stochastic Analysis

Hydrogeological Zone	Horizontal Hydraulic Conductivity [m/s]			Vertical Hydraulic Conductivity [m/s]	Specific Storage [1/m]			Specific Yield [%]		
	Min	Mode	Max		Min	Mode	Max	Min	Mode	Max
Izegouande	3E-07	5E-07	1E-06	0.1 x Horizontal Hydraulic Conductivity	5E-07	1E-06	2E-06	2%	5%	8%
Madaouela	3E-07	5E-07	1E-06		5E-07	1E-06	2E-06	2%	5%	8%
Tarat	4E-06	1E-05	6E-05		1E-06	1E-05	5E-05	5%	10%	15%
Guezouman (Miriam)	1E-06	3E-06	4E-06		3E-07	1E-06	2E-06	2%	5%	8%
Guezouman (Global)	5E-07	2E-06	6E-06		4E-07	8E-07	3E-06	2%	5%	8%

The predictive model scenarios are run at monthly stress periods with 100 timesteps in the first stress period and 10 timesteps in the subsequent stress periods to improve model convergence. The duration of the model simulation is 25 years.

Representation of Mine Dewatering

To run predictive scenarios the FS designs for the Miriam open-pit, and M&M and MSNE underground mines were represented using drain boundary conditions. These drains were configured to have a transient time-series to represent progressive mine development.

The Miriam open pit is incorporated in the model with monthly timesteps, with a modified pit at each stress period. As the pit progresses through model layers, those overlying model layers are converted into drains. The Miriam pit is introduced to the model in the first stress period, Year 0, with operations ceasing in Year 7[20]. The M&M and MSNE underground workings are introduced with annual underground plans used to represent the gradual progression of underground workings. In the groundwater model, M&M advances from Year 6 to Year 17 and MSNE advances from Year 11 to Year 20[21]. The interpolation on a stress period basis for the underground operations is more complex than for the Miriam open pit and annual progression was accepted on the basis that annual inflows provided sufficient resolution for the model objectives.

MODFLOW uses a conductance parameter for drain cells to constrain the flow through the drain cell for a given head gradient. For those drain cells representing the Miriam open pit, the conductance can be set to an artificially high value, under the pretence that the model cell volume reflects the scale of the pit void space. For those drain cells representing underground workings, the void volume is small in comparison to the model cell volume, and the assumption that the entire model cell will drain is invalid. In order to constrain a representative conductance value for the underground workings, the available observed inflow data for the historical Marilyn workings were used to calibrate inflows. The Guezouman aquifer is the principal unit controlling inflows, so the base-case hydraulic properties were used for calibration. Analytical calculations were used to estimate inflow rates for M&M and Marilyn at end of mine-life. The analytical inflow rates were then used to constrain conductance values for the groundwater model. In the monte-carlo model runs, the conductance term changes proportionally to the changes in the Guezouman K.

The mine plans contained ventilation shafts that were excluded from the numerical model. It is assumed that these shafts will be sufficiently lined to be essentially impermeable and have limited influence on mine inflows. The model grid was concluded to be of too coarse a resolution to provide genuine insight into the impact of these ventilation shafts on inflow rates should they not be engineered to prevent inflows.

Project Wellfield Supply

The planned wellfield supply was included in the predictive model runs. The pumping rate is split equally between the five wells in the wellfield, with a continuous rate of 508.8 m^3/d per well, or 106 m^3/hr. This represents the average make-up water demand required from the wells across the 20-year mine life as predicted by the Project water balance (SRK, 2022c).

The individual wellfield pumping wells are modelled within the Tarat aquifer at depths of 350 m, with water being drawn principally from the Tarat, but with contributions from the Guezouman with leakage through the Tchinezogue. The pumping wells also draw water from the Izegouande and Madaouela minor aquifers which overlay the Tarat.

The Madaouela Fault is modelled as a low permeability barrier to flow based on pumping tests and hydrogeological conceptualisation. The wellfield pumping therefore has no influence on groundwater inflows at the planned mines.

[20] The pit-shells utilised were *Rev03_NoDumps_Y1.dxf* to *Rev03_NoDumps_Y7.dxf* received February 2022
[21] The mine design files used are *MAD_hydro_YR2028.dxf* to *MAD_hydro_YR2041.dxf* received February 2022

24.5.8 Groundwater Modelling Results

Dewatering Rates (Mine Inflows)

Table 24-26 presents the predicted annual average inflows into the various deposits based on the results of the Monte-Carlo simulations. Four average annual flow rates are presented for each mine and the total:

- Base case: with the base case hydraulic properties prior to Monte Carlo simulations.
- P10: the 10th centile flow i.e. there is a 10 % chance of non-exceedance.
- P50: the 50 % i.e. average flow
- P90: the 90th centile flow i.e. there is a 90 % chance of non-exceedance.

Figure 24-37 illustrates a time-series showing all 285 model scenarios and the resulting inflows for each deposit.

Table 24-26: Annual average inflows for Miriam, M&M and MSNE deposits; Base Case, P10, P50 and P90 inflows

Year	Miriam Inflows (m^3/d)				M&M Inflows (m^3/d)				MSNE Inflows (m^3/d)				All Deposits Inflows (m^3/d)				
	Base-case	P10	P50	P90	Base-case	P10	P50	P90	Base-case	P10	P50	P90	Base-case	P10	P50	P90	Design
0	36	21	27	48	0	0	0	0	0	0	0	0	36	21	27	48	**48**
1	689	493	601	696	0	0	0	0	0	0	0	0	689	493	601	696	**696**
2	1,050	881	1,056	1,207	0	0	0	0	0	0	0	0	1,050	881	1,056	1,207	**1,207**
3	1,143	972	1,161	1,321	0	0	0	0	0	0	0	0	1,143	972	1,161	1,321	**1,321**
4	1,194	1,043	1,229	1,403	0	0	0	0	0	0	0	0	1,194	1,043	1,229	1,403	**1,403**
5	1,076	1,000	1,180	1,361	0	0	0	0	0	0	0	0	1,076	1,000	1,180	1,361	**1,361**
6	914	825	975	1,147	4	2	5	8	0	0	0	0	918	828	980	1,154	**1,155**
7	0	0	0	0	1,026	695	1,353	2,045	0	0	0	0	1,026	695	1,353	2,045	**2,045**
8	0	0	0	0	2,104	1,438	2,545	3,763	0	0	0	0	2,104	1,438	2,545	3,763	**3,763**
9	0	0	0	0	2,276	1,642	2,555	3,634	0	0	0	0	2,276	1,642	2,555	3,634	**3,634**
10	0	0	0	0	2,722	2,050	3,094	4,283	0	0	0	0	2,722	2,050	3,094	4,283	**4,283**
11	0	0	0	0	3,118	2,352	3,552	4,930	13	8	17	27	3,131	2,361	3,569	4,957	**4,947**
12	0	0	0	0	3,671	2,719	4,146	5,844	210	81	168	270	3,881	2,800	4,314	6,114	**6,012**
13	0	0	0	0	4,574	3,391	5,254	7,367	1,572	842	1,654	2,561	6,146	4,233	6,907	9,928	**9,021**
14	0	0	0	0	5,628	4,327	6,665	9,153	5,131	3,577	6,749	10,074	10,759	7,903	13,413	19,227	**15,902**
15	0	0	0	0	6,798	5,269	7,981	10,836	7,950	5,614	10,227	14,734	14,748	10,883	18,208	25,570	**21,063**
16	0	0	0	0	5,510	4,868	7,003	9,213	10,190	7,361	12,241	16,803	15,700	12,229	19,244	26,016	**21,454**
17	0	0	0	0	0	0	0	0	11,286	8,679	13,111	17,023	11,286	8,679	13,111	17,023	**13,111**
18	0	0	0	0	0	0	0	0	11,753	9,814	13,282	16,449	11,753	9,814	13,282	16,449	**13,282**
19	0	0	0	0	0	0	0	0	11,096	9,856	12,334	15,345	11,096	9,856	12,334	15,345	**12,334**

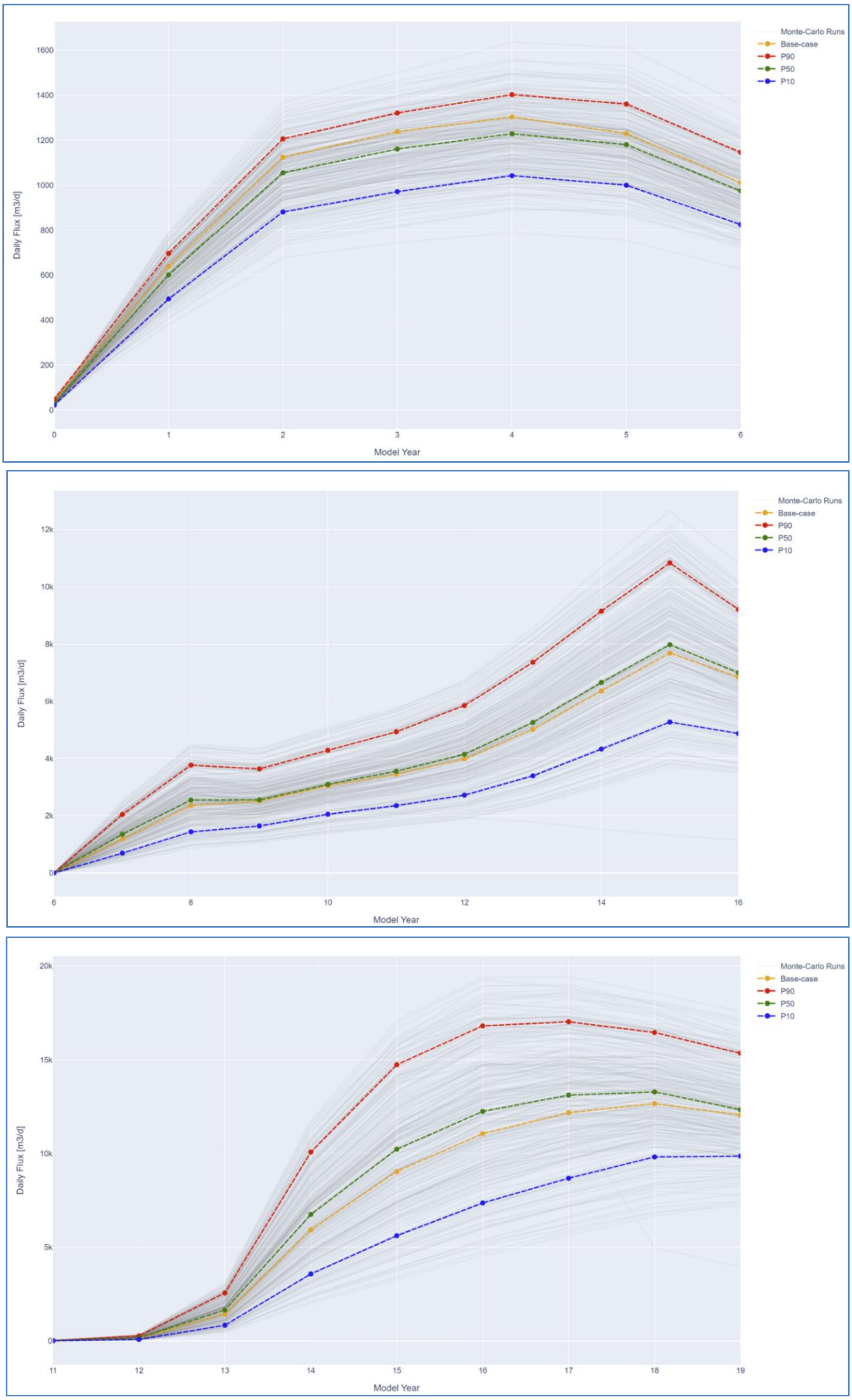


Figure 24-37: Predicted Inflows for Miriam (top), M&M (middle) and MSNE (bottom) from Base Case and all Monte-Carlo runs

Table 24-27 summarises the predicted inflows from the numerical groundwater modelling exercise.

Table 24-27: Summary of Predicted Inflows

Mine	Year with Maximum Inflow	P10 – P90 inflow range (m^3/d)	Base case Inflow (m^3/d)
Miriam	4	1,000 – 1,400	1,200
M&M	15	5,300 – 10,800	6,800
MSNE	17	9,800 – 16,400	11,300
TOTAL ACROSS ALL MINES	**16**	**12,200 – 26,000**	**15,700**

The total mine inflow water produced between Year 0 and Year 7 of mining when only Miriam is in operation is therefore limited to a maximum of around 1,400 m^3/d. The total mine inflow water produced increases significantly between Year 14 and Year 19 when both M&M and MSNE see peak inflows

The FS model update projects increased inflows to the IDP report (SRK, 2013a) for all deposits. This is reflective of the lower Guezouman hydraulic conductivity value used in the IDP model (5E-7 m/s) which is the minimum value used for the FS modelling exercise. Furthermore, the FS model update incorporates updated mine plans for all deposits. Inflow rates are controlled almost exclusively by the hydraulic conductivity of the Guezouman.

Due to the lower hydraulic conductivity values observed at MSNE the P50 time-series is deemed sufficiently conservative to use for inflows to this deposit. M&M and Miriam show evidence of higher K ranges and therefore the P90 time-series is seen as an acceptably conservative estimate of inflows.

Mining Impact on Groundwater Levels

To assess the impact of mine dewatering on groundwater levels, the Guezouman heads were reviewed for the base-case and P90 runs for end of mine-life for Miriam (year 7), MSNE (year 17) and M&M (year 19). The base-case and P90 drawdowns for these three years are shown in Figure 24-38.

The drawdown patterns in the Guezouman at the end of Year 7 show the following:

- The base-case run shows an extending cone of depression from the Miriam pit on closure, with drawdown extending ~3 km from the pit and truncated to the east by the Madaouela Fault which acts as a barrier to flow. Maximum drawdown of 30-40 m is shown in the immediate area of the Miriam pit.
- The P90 drawdown at Miriam shows a greater areal extent with a shallower gradient. This distribution is not reflective of the true P90 drawdown at Miriam, which intersects other units.
- Drawdown at M&M mine of 5 to 9 m as mining commences here. Similar drawdown at the wellfield.

And at the end of Year 17:

- The base-case run shows the end-of-mine-life for M&M with the previous year (Year 16) featuring maximum total inflows for MSNE and M&M combined. The cone of depressions from mining at M&M, MSNE and Miriam are all interconnected. Miriam drawdown shows around ten metres of recovery. At MSNE there is a predicted drawdown of 60 m compared with 45 m at M&M.
- The P90 drawdown shows a far more extensive cone of depression around M&M and MSNE, measuring 10 km from east to west and extending south of Miriam. Drawdown of up to 45 m is predicted at M&M and 70 m at MSNE. The drawdown between M&M and MSNE is ~15 m.
- And at end of Year 19:
- The end-of-mine-life predicted drawdown for MSNE under the base-case scenario is ~75 m at MSNE, with the cone of depression extending ~5 km tin an east-west direction and continuous with the Miriam and M&M cones of depression. Recovery at M&M is limited, with 40 m of residual drawdown. At Miriam the residual drawdown is ~10 m.
- The P90 scenario predicts a drawdown of ~90 m at MSNE, with the cone of depression extending 11 km in an east-west orientation. The drawdown extends between Miriam and M&M. M&M shows ~35 m of residual drawdown while Miriam shows recovery to ~7 m drawdown.

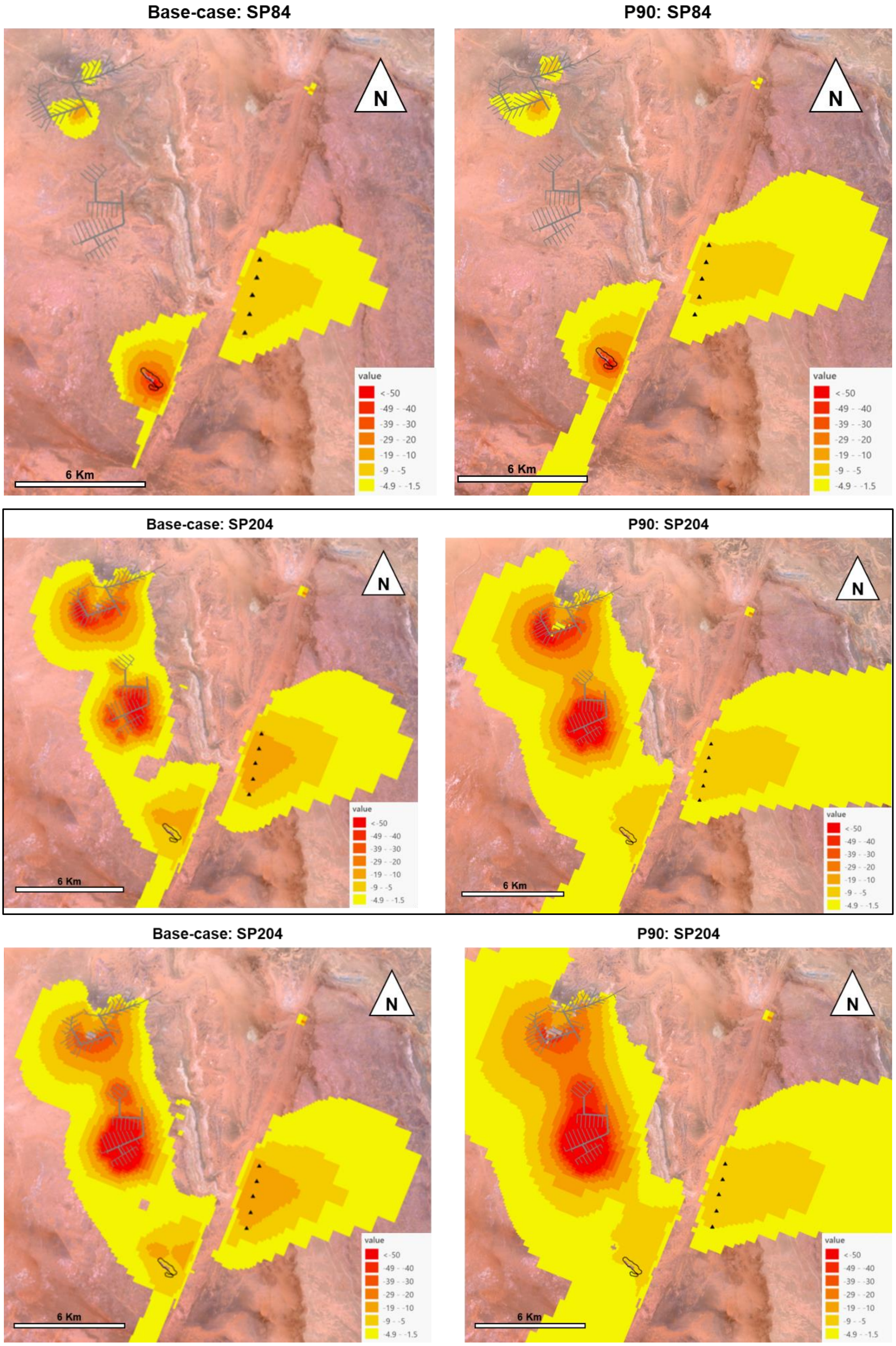


Figure 24-38: Guezouman Base-case (left) and P90 (right) Drawdown: Year 7 (top), 17 (middle) and 19 (bottom)

Wellfield Performance

In the groundwater model, the wellfield target average yield of 508.8 m^3/day per well is met across all the stochastic model runs. The Tarat base-case drawdown at the end-of-mine-life is shown in Figure 24-39. The maximum drawdown at the wellfield itself is, at a maximum, 15 m with the cone-of-depression extending approximately 13.5 km to the east.

The water levels rebound with 6 - 7 m of residual drawdown after 5 years of closure. To further constrain the recovery of water levels post-closure, the model runs were extended to 100 years post-closure. The groundwater levels in the observation wells show almost complete recovery of storage 60 years post-closure. The almost negligible impact on groundwater levels is due to the relatively low volume of water extracted (18,583,920 m^3) over the life of mine which is estimated to account for a small fraction of available Tarat storage to the east of the Madaouela fault; between 0.5 and 1.4 %.

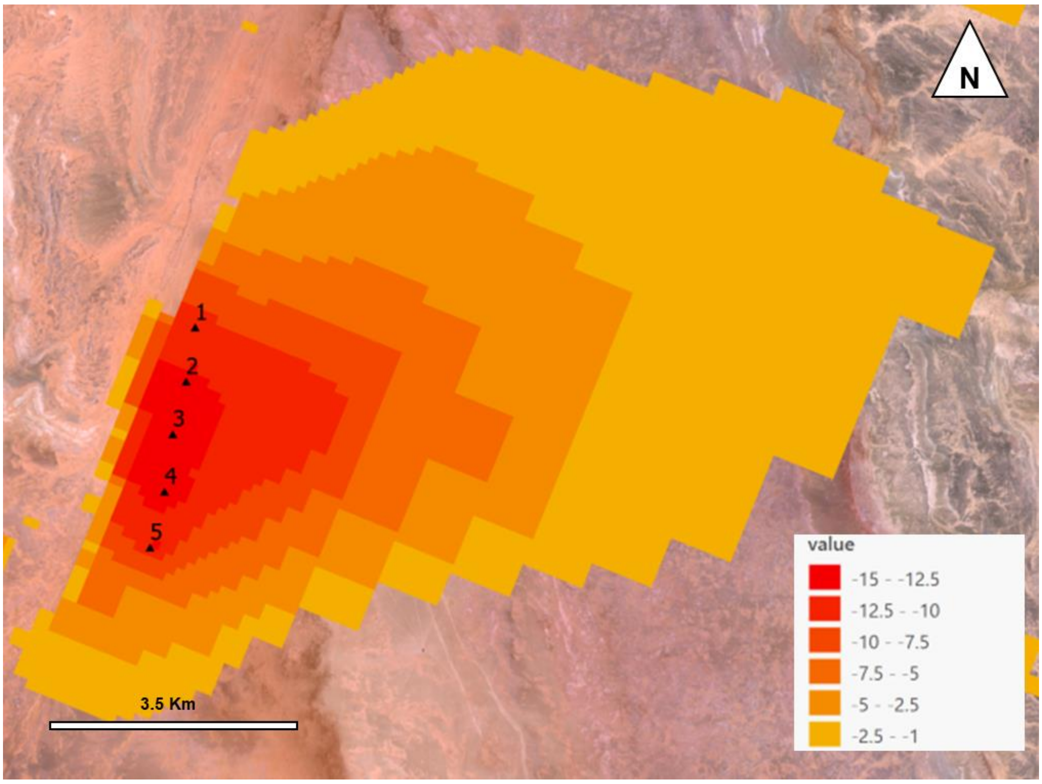


Figure 24-39: Tarat Base-case Drawdown at the Wellfield (Year 19)

24.5.9 Groundwater Modelling: Summary

The numerical groundwater modelling exercise has improved the understanding of the potential rates of inflow to the three mines. The model has been updated with the latest dataset based on the results of the FS field programme, increasing confidence in the model outputs, particularly at the Miriam deposit. The latest mine designs have been implemented in a realistic time-staggered approach, providing insight into the time-series of potential inflows.

Due to the lower hydraulic conductivity values observed at MSNE, the P50 time-series is deemed sufficiently conservative to use for inflows to this deposit. M&M and Miriam show evidence of higher hydraulic conductivity ranges and therefore the P90 time-series is considered an acceptably conservative estimate of inflows.

As the key sensitivity to modelled inflows, it is recommended that further field investigations focus on the hydraulic properties of the Guezouman aquifer, particularly in the vicinity of M&M and MSNE when these projects move into a FS level of confidence. The observed inflows in the early years of mine-life will provide valuable insight and allow the refinement of the projected inflows prior to the peak inflows later in the mine life of the underground operations.

24.6 Water Balance

A water balance model for the Project was developed and is reported in detail in SRK (2022c). The following sections provide a summary.

24.6.1 Concept

The water balance was modelled using GoldSim software with the following facilities represented:

- Miriam open pit
- M&M underground mine
- MSNE underground mine
- Sedimentation ponds at underground mines
- Processing plant
- Wellfield
- Seepage trench

TSF and WRD elements were not considered in the site water balance as they are not considered to supply water during mine operations and therefore not important for the overall objectives of the water balance model. However, the water balance does simulate discharge of a proportion of process bleed water from the plant to the TSF for dust suppression purposes. Figure 24-40 schematically presents the conceptual water balance.

24.6.2 Inputs

Table 24-28 provides a summary of the input parameters used in the water balance model.

Table 24-28: Inputs for the Water Balance Model

Water Balance Component	Input
Climatic Variables	• Monthly precipitation distribution • Monthly evaporation
Hydrologic Variables	• Pit wall runoff coefficient
Open Pit and Underground Mines	• Groundwater inflows • Underground service water demand
Process Plant	• Process water demand • Bleed water discharge
Dust Suppression	• TSF dust suppression • Haul road dust suppression • Link road dust suppression
Freshwater Demand	• Freshwater demand – potable water requirements
M&M Sedimentation Pond	• Detail Design (SRK, 2022g)
MSNE Sedimentation Pond	• Detail Design (SRK, 2022g)

24.6.3 Outputs

The water balance has been developed by running the model for different groundwater inflow scenarios i.e. for the P10, P50 and P90 percentiles of estimated groundwater inputs, as estimated from numerical groundwater modelling (SRK, 2022e). The key outputs from the water balance from a water management perspective are:

- project wellfield abstraction volumes required to meet the process plant make-up water demand; and,
- excess water volumes that require discharge to an infiltration trench.

Make-Up Water Demand

The Project wellfield comprises five abstraction wells located approximately 8km to the north-east of the Process plant. The wellfield is required to provide the make-up water requirements for the process plant, dust suppression and potable water. Figure 24-41 presents the estimated demand for each of these elements for the P50 model scenario, and Figure 24-42 summarises the total demand for all model scenarios (i.e., P10, P50 and P90). For the purposes of water supply the P10 is considered the most conservative scenario i.e. there is a 10 % probability that more water than this will be required.

Make-up demand for the first 2 - 3 years is approximately 105 m^3/hr which then reduces through to 2030 where the additional influx from Miriam pit dewatering is provided to the plant. Water demand peaks between c.2030 - 2031 at approximately 140 m^3/hr whereas Miriam dewatering ceases and M&M dewatering ramps up. From c.2032 the demand stabilises at around 105 m^3/hr.

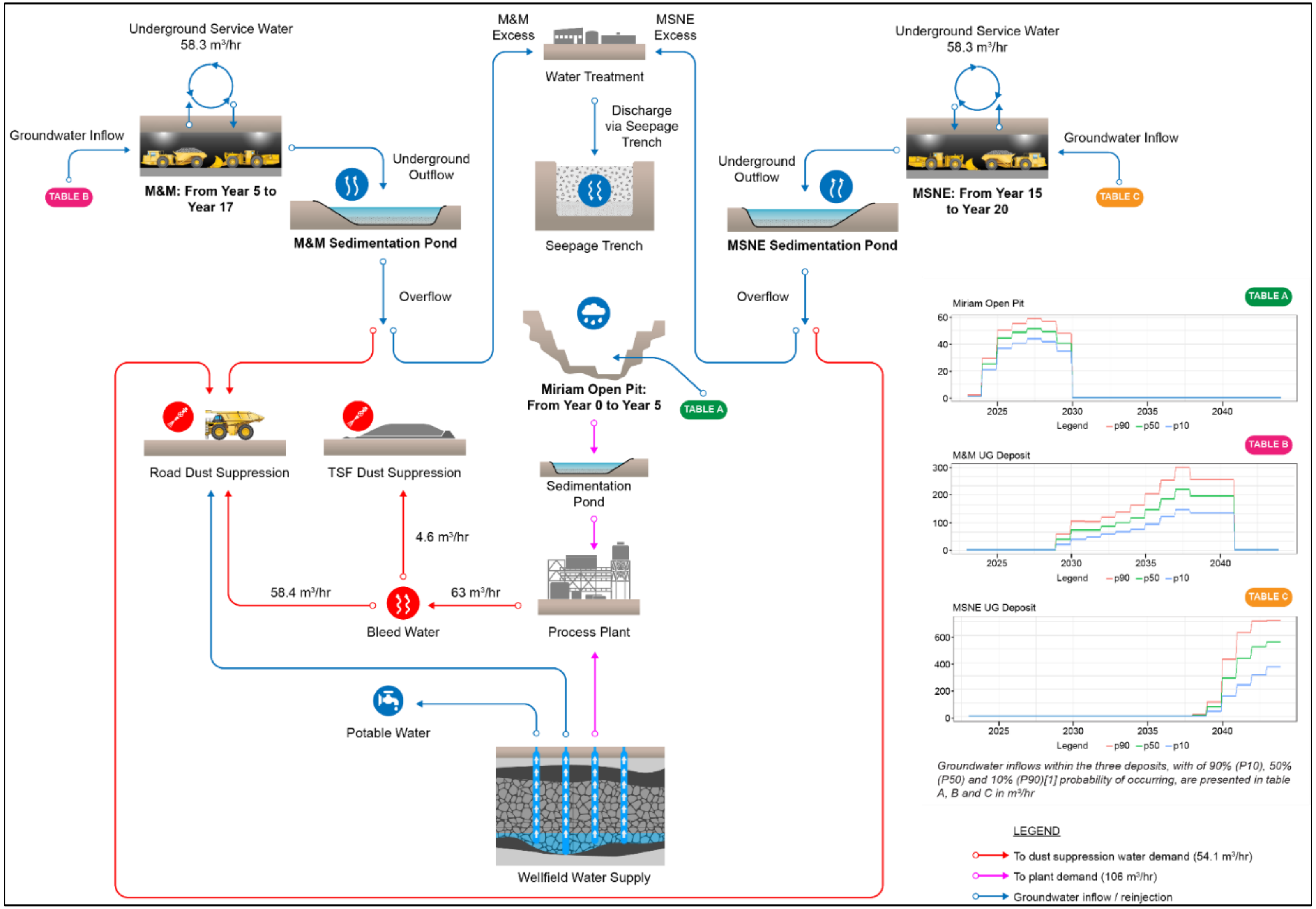


Figure 24-40: Water Balance Flow Diagram

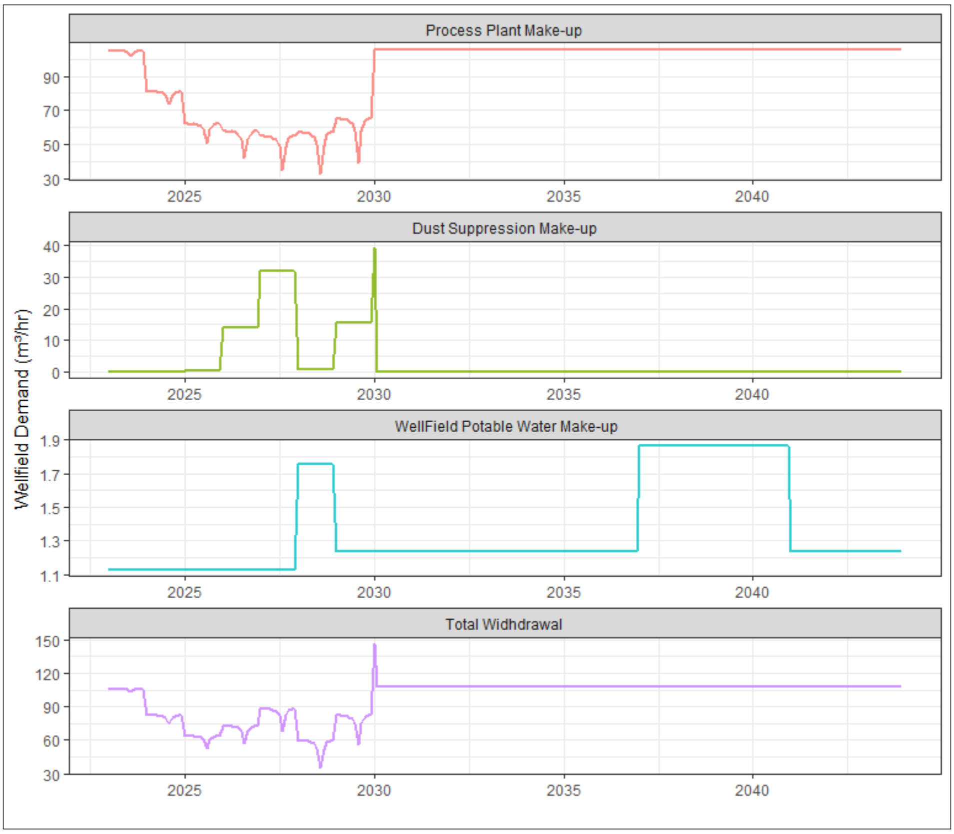


Figure 24-41: Wellfield Abstraction as Estimated from the Project Water Balance

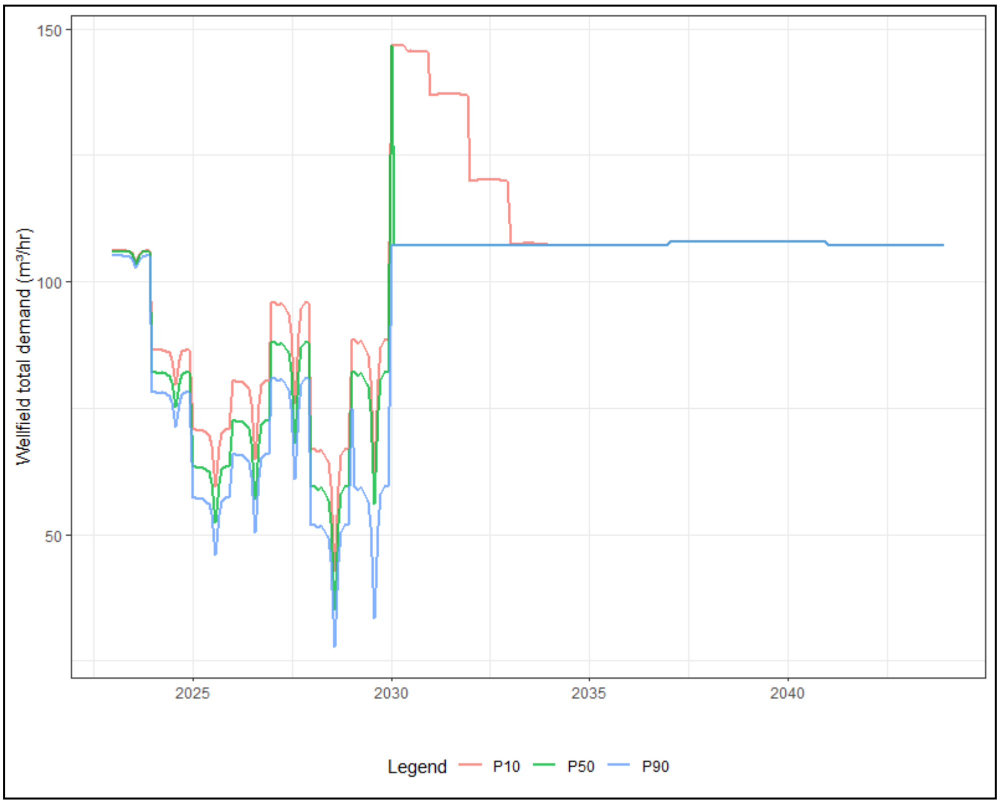


Figure 24-42: Wellfield Total Demand (results are provided in terms of average conditions for the P10, P50 and P90 percentile groundwater inflow conditions)

Excess Water

Excess water from the operation will develop as underground mining commences and dewatering volumes exceed predicted water demand. The excess water considers groundwater inflows into the operations along with reductions associated with underground service water demand, dust suppression and evaporation losses from sediment ponds.

Figure 24-43 presents the total combined excess water from M&M and MSNE for the P10, P50 and P90 groundwater inflow scenarios. The P90 is considered the most conservative scenario i.e. there is a 90 % probability that this excess water volume will not be exceeded. Excess water is predicted to start manifesting between 2029 (P90) and 2034 (P10) at the onset of dewatering from M&M. For the P90 scenario, excess water volumes rise gradually to approximately 350 m^3/hr to 2040 and peak in 2041 to over 600 m^3/hr where both M&M and MSNE are dewatering.

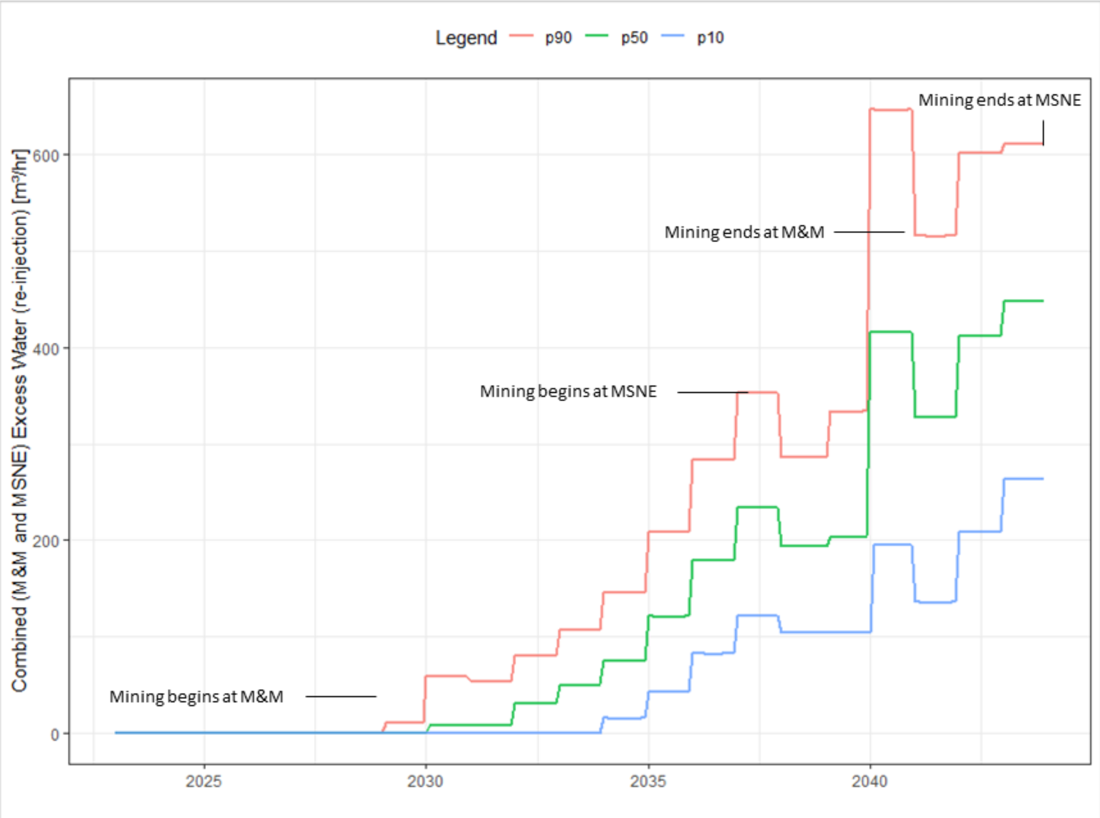


Figure 24-43: Combined Excess Water from Underground Dewatering for P10, P50 and P90 Water Balance scenarios

24.7 Water Related Risks and Opportunities

Underground water management components are currently designed to a PFS level of confidence. The following should be considered as this aspect of the Project moves towards FS:

- Detailed assessment of underground dewatering requirements to an FS level of confidence.
- Detailed assessment of treatment requirements, including for excess water discharge and underground clean/dirty water separation.

- Vent raise assessment associated with the risk of intercepting saturated horizons within the Tarat aquifer during underground mining.
- Further assessment, including field investigations, to confirm the performance of an infiltration trench for disposal of treated water along with proximity of the trench to the existing mine infrastructure (including underlying mine workings with regard to water recirculation risk). A trade-off with other disposal methods, such as reinjection via boreholes, should also be completed.

As FS elements of the project move towards detailed design stage, the following recommendations are provided:

- Detailed technical review of the solar system proposed to power the wellfield and associated infrastructure to confirm system suitability and constraints.
- Long-duration pumping tests and additional field trials along the proposed wellfield.
- In the current study the process plant does not utilise dewatering water from the underground operations. The Project should consider this as an opportunity to reduce wellfield reliance.
- Storm water management of the LG stockpile and WRD currently assume runoff water quality does not pose an environmental risk. This requires further confirmation based on geochemical material characterisation to confirm whether additional infrastructure (e.g. lined channels/ponds and treatment) are necessary.
- Continual update of the Project water balance as the Project evolves to confirm make-up demand and excess water volumes.

24.8 Tailings Storage Facility

24.8.1 Overview

The Madaouela tailings storage facility has been designed by SRK (UK) as a filtered tailings stack. This method of tailings storage was selected to maximize the return of water to the process plant and minimize the potential for release of tailings or seepage to the environment. This strategy also offers the potential for progressive reclamation, which will greatly reduce potential for dust generated from the tailings surface.

Tailings produced from processing the ore are thickened to remove excess water before entering the filter circuit. Once tailings have been thickened, they are deposited on a vacuum belt. The vacuum belt removes additional water from the tailings to form a filter cake that falls onto an overland conveyor. Tailings are transported by conveyor to the Dewatered Stack Facility (DSF), where they are deposited off a spreader-stacker. The disposal methodology is very similar to the method used at other nearby uranium mine sites (SOMAÏR and COMINAK).

The facility has been designed to store 19.5 Million tonnes (Mt), or 12.5 Million cubic metres (Mm^3) of tailings over 20 years at an average production rate of 1 Million tonnes per annum (Mtpa).

The DSF site has been selected based on proximity to the processing plant and orientated to take advantage of the natural topography to promote seepage toward the southwest of the facility where an evaporation pond will be constructed. The DSF will have a basal lining system to contain tailings and water. The tailings surface will be progressively covered throughout the project in accordance with best practice for tailings management.

A set of drawings have been produced to accompany the descriptions within the text and are presented in section 24.8.17 and summarised in Table 24-29.

Table 24-29: List of DSF Drawings

Drawing Number	Drawing Name
31342-TLS-001	Site Layout
31342-TLS-002	Base Preparation of Tailings Waste Facility
31342-TLS-003	Start of Stage 1 Design
31342-TLS-004	End of Stage 1 Design
31342-TLS-005	Stage 2 Design
31342-TLS-006	Stage 3 Design
31342-TLS-007	Stage 4 Design
31342-TLS-008	Stage 5 Design
31342-TLS-009	Typical Design Details
31342-TLS-010	Typical Design Details
31342-TLS-010	Typical Design Details

24.8.2 Site Setting

The Project site is located in the northern central part of Niger. The location is extremely dry with high temperatures, limited rainfall, and high evaporation year-round. A detailed climate review is presented in Section 5.2.

Precipitation

The records studied indicate that precipitation can be categorised into a “wet season” (June – October) and a dry season (November – May). The average annual precipitation is 69 mm, and the wettest month is August, with an average rainfall of 37mm.

Evaporation

As detailed in Section 5.2 there are several methodologies to estimate evaporative losses. The Penman Open Water method predicts (2,867 mm/yr) or the Morton Shallow Lake method predicts (2,178 mm/yr). A range of 69 mm to 229 mm in December and 152 mm and 446 mm in May is expected however local instrumentations are recommended in future to confirm this value.

Storm Data

Intensity Duration Frequency (IDF) curves have been developed for the site and are summarised in Table 24-30.

Table 24-30: IDF adjusted for the site based on daily site information [mm/hour]

Prob	RP (years)	24-hr	48-hr	72-hr
0.5	2	0.88	0.46	0.33
0.8	5	1.50	0.79	0.60
0.9	10	2.00	1.02	0.76
0.95	20	2.58	1.27	0.94
0.98	50	3.38	1.58	1.18
0.99	100	4.04	1.85	1.38

Seismicity

The Global Earthquake Model (GEM) Global Seismic Hazard Map (version 2018.1) was reviewed which shows the Peak Ground Acceleration (PGA) with a 10 % probability of being exceeded in 50 years. As shown in Figure 24-44, the site is located in an area of low seismic hazard. Seismicity is therefore unlikely to play a significant role in stability of the DSF.

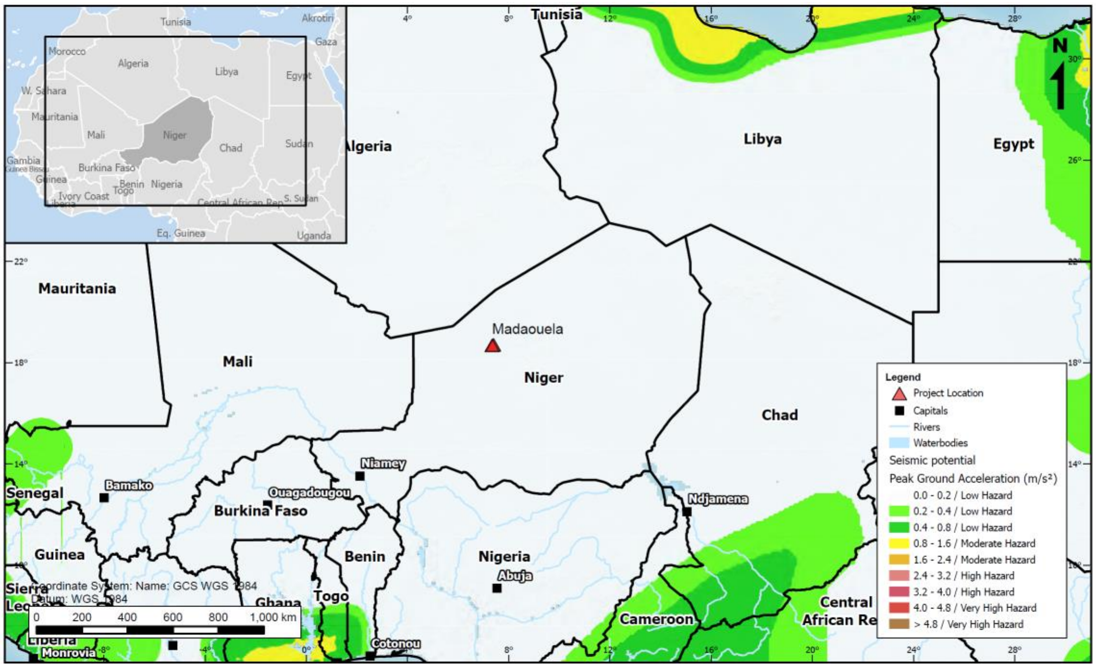


Figure 24-44: Peak Ground Acceleration with 10 % probability of exceedance in 50 years (Pagani., *et al*. 2018.1).

24.8.3 Ground Investigation

A Ground Investigation (GI) was completed by the Client under the guidance of SRK (UK) during 2021. The GI covering the DSF area included six rotary cored boreholes and eight trial pits. In general, the ground conditions encountered were aeolian blown sands underlain by shallow weathered Tarat formation (sedimentary rock) with competent rock below.

Representative samples were scheduled for laboratory analysis including moisture content; specific gravity; sieve analysis; particle size distribution; plasticity indices; proctor test and uniaxial compressive strength. A comprehensive Ground Investigation Report was produced outlining the findings of the work (SRK, 2022l) which has been summarised in Section 24.1.

24.8.4 Tailings Test Work

Vietti Slurrytec (Pty) Ltd produced a report (Vietti Slurrytec, 2021) in November 2021 presenting the laboratory scale thickening and filtration test work conducted on uranium tailings slurry material prepared by Mintek. The report provided indicative data for the filtered tailings that would be received in the DSF. A summary of indicative tailings properties is provided in the list below.

- Particle specific gravity was 2.63 g/cm^3
- Particle size distribution was 8.3 micron (d20), 55.1 micron (d50) and 162.2 micron (d80).
- Particle size distribution test with 64 % sand, 30 % silt and 6 % clay.
- Solids concentration of 65 %.
- Cake moisture content of 21 % using vacuum filtration tests (mass_$_{water}$ / mass_$_{total}$)
- Cake moisture content of 19 % using pressure filtration tests (mass_$_{water}$ / mass_$_{total}$)

Specialised Testing Laboratory (Pty) Ltd (Specialised Testing Laboratory (Pty) Ltd, 2022a & b) and WSP Golder (WSP Golder, 2022) produced laboratory results on samples of tailings in May 2022. The updated testing was completed on an updated tailings product and included the test work summarised below.

- Two Particle Size Distribution tests, with 68 % sand, 26-27 % silt and 3-5 % clay.
- Two Atterberg tests reporting both samples to be non-plastic.
- One property of aggregate and sand test, 220 mm of slump at 25 % moisture content (mass_$_{water}$ / mass_$_{total}$).
- One slurry consolidometer test reporting:
  - Void ratio ranging between 0.69 and 0.78 for effective stresses ranging between 10 kPa and 1000 kPa.
  - Permeability ranging between 4.0×10^{-7} m/s and 9.3×10^{-8} m/s.

24.8.5 Design Criteria

The DSF criteria are summarised in Table 24-31.

Table 24-31: DSF Design Criteria

Parameter	Unit	Value
Target Production Rate	Mtpa	1
Life of Mine (LOM)	Years	20
LOM Storage	Mt Mm^3	19.5 12.5
Final Moisture Content (geotechnical)	**%**	25
Tailings Beach Slope	%	10
Tailings Deposited Dry Density	t/m^3	1.55
Tailings Specific Gravity	-	2.65
Minimum freeboard (all berms)	m	0.5
Minimum external berm crest width	m	20
Peak Ground Acceleration	m/s^2	< 0.2
SG of Bleed Stream	-	1.15

24.8.6 DSF Design

The facility has been designed based on the design criteria outlined in Table 24-31 and SRK's experience. Reference to national and international standards has been made where applicable when compiling the design criteria; however, the design of the DSF was selected to align with previous work in the region and the current industry shift towards Best Available Technology (BAT). It is well established that the use of dry stacking for filtered tailings falls within the definition of BAT. Three key principles of BAT for tailings are summarised below and have been considered in the design process:

- "Eliminate surface water from the impoundment". Addressed by creating positive drainage throughout the footprint of the tailings stack.
- "Promote unsaturated conditions in the tailings with drainage provisions". High evaporation rates and installation drainage features below the stack promote development of unsaturated conditions.
- "Achieve dilatant conditions throughout the tailings deposit by compaction". The design does not explicitly promote dilatant conditions, but instead incorporates sufficiently low slope angles such that liquefaction is not a realistic failure mechanism. The slope of the tailings surface will be controlled by the wetted tailings angle of repose.

Previous work on the Madaouela project also identified the DSF as the preferred tailings strategy for the site, so there is no significant change in strategy since the previous studies were undertaken.

The filtered tailings strategy will help maximize the return of water to the process plant and minimize the potential for release of tailings or seepage to the environment. The disposal method is very similar to the method used at other nearby uranium mine sites (SOMAÏR and

COMINAK). No alternative tailings strategies were considered during this study, as this had been covered in previous studies.

The DSF has been designed to store 19.5 Mt of filtered tailings deposited over a period of 20 years. SRK has further developed the DSF design including facility sizing, construction methodology, water balance, evaporation pond design and a closure plan.

The design will commence with the construction of berms, followed by the base pad surface and liner system in stages. The conveyor system will then be installed followed by dust suppression methods/equipment, followed by the closure capping system.

The software package Muk3D version 2020.1.1 (Minebridge, 2022) has been used to model the storage capacity of the facility. The facility was then staged to reduce capital costs, limit the length of time the geomembrane is left exposed, and reduce the costs of mobilisation of specialist crews to site to install the membrane. A total of five stages have been selected.

24.8.7 Filtered Tailings Conveyance System

Filtered tailings will be received at 20 % moisture content (mass water / total mass), which is equivalent to approximately 25 % geotechnical moisture content (mass water / mass solids). Tailings will be transported from the processing plant to the apex of the DSF using an overland conveyor system (Drawing 31246-TLS-010). A 900-CV-002 tailings conveyor will run at ground level from the process plant toward the DSF before elevating up the western side of the DSF as shown in Figure 24-45.

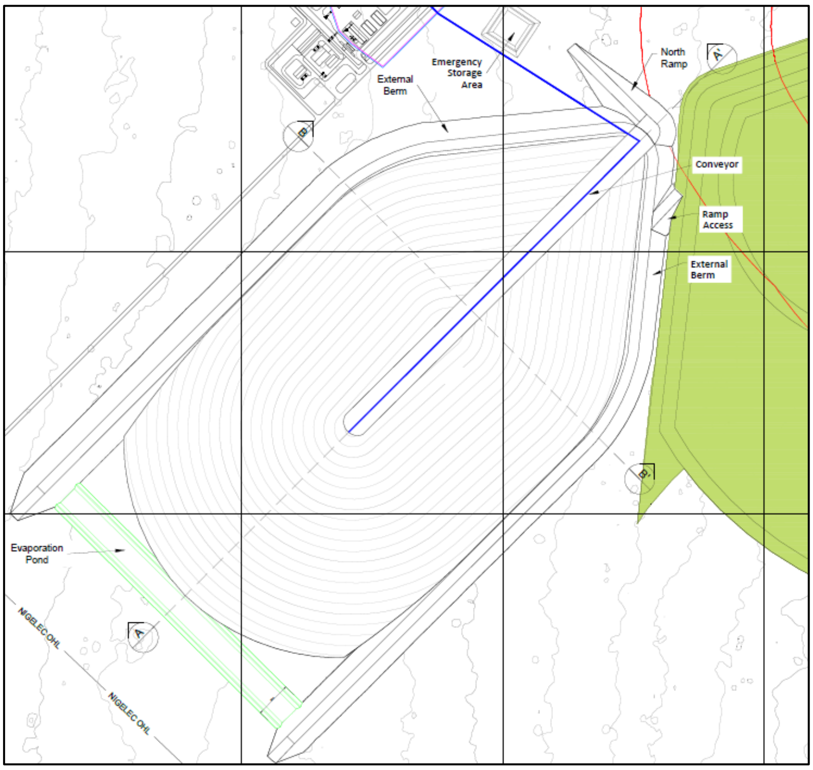


Figure 24-45: Plan view of conveyor system

Figure 24-46 outlines the layout of the conveyance infrastructure down the centreline of the DSF (Drawing 31246-TLS-010). The conveyance system will be placed on suitably compacted waste rock material and not directly on placed tailings.

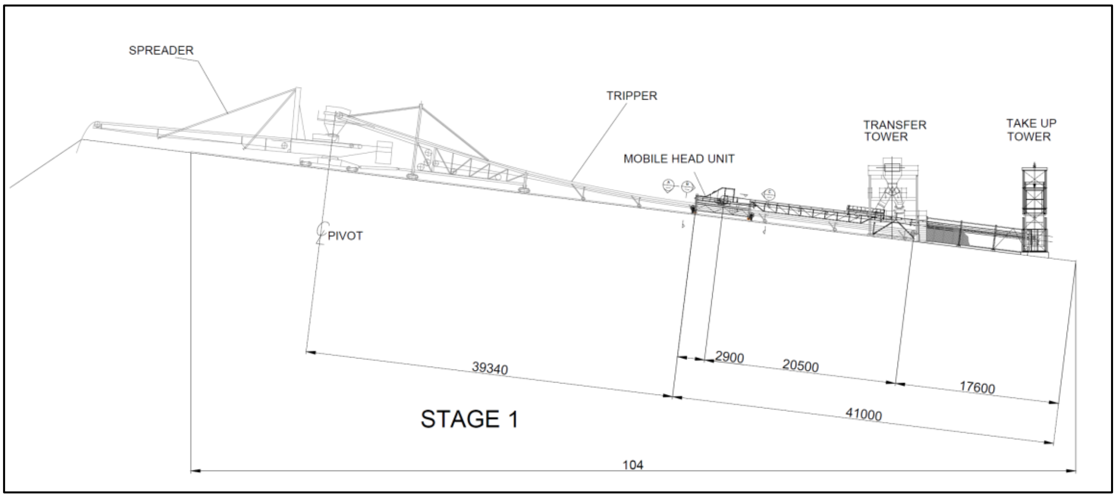


Figure 24-46: Tailings Conveyance System

The tailings will then be dropped through the transfer station onto the central spine conveyor and transported to the stacker. A 900-CV-003 stacker machine will include a 70 m ramp which can extend to approximately 104 m in length.

The tailings stacker will start discharging from the perimeter embankment at the apex of the DSF and will gradually advance to the centre of the initial footprint. The stacker will also rise as it advances from 10 m above the base surface (berm crest) at the start to 41 m above the base surface. The tailings from the tripper conveyor falls onto the conveyor of the slewing stacker that allows approximately 120 degrees deposition radius.

The stacker is supplied with a transfer tower, extendable spine conveyor, tripper and spreader boom that will all be assembled onto the ramp. The machine will self-advance using hydraulic actuation until it has advanced to a distance of 20 m. A rigging crew will then be required to install additional lengths of the spine conveyor, pull the tripper back, and install additional rail pads. The cycle will then re-start for a further 20 m of advancement. A 900-CV-004 extendable spine conveyor will be stored within the magazine of the mobile head unit, equivalent to approximately 120 m of conveyor belt of 60 m of stacker advancement.

During normal operations the material will exit the transfer tower and move up to the tripper and then to the slewing spreader. The tailings will fall off the spreader conveyor and run down the active face of the tailings facility. It is anticipated that the tailings will form a 10 % slope down the active face. The anticipated slope has been estimated based on experience with similar belt filtered tailings and is consistent with observations of the adjacent sites (SOMAÏR and COMINAK). No formal compaction of tailings will take place, but some minor grading may be required to level the tailings surface prior to installation of the permanent cover system.

During shutdown periods for repair/maintenance/extension, material will be diverted into an emergency storage area (Drawing 31342-TLS-001). This has been sized to store a minimum of two days of tailings production. Material from the emergency storage area will be transported using conventional equipment (loader/excavator) to the take up tower, where it will be re-integrated to the main tailings feed. Full details of the system proposed are presented in a report produced by RMS, 2022.

24.8.8 Construction

An excavator, dozer, compactor and truck will be purchased at Year -1 (2023) to facilitate the construction of the DSF. A loader and dozer from the mining fleet will also be available for use on the DSF construction.

A material specification table is presented in Drawing 31246-TLS-009 (Design Details) specifying the different material types and properties required to construct the DSF.

Containment embankments (10 m high, 20 m crest width and 3V:1H side slopes) will be constructed using suitable waste rock material to constrain tailings placement within the facility (Drawing 31246-TLS-009). The berms will be constructed to the final design geometry before the tailings facility is developed to minimize material re-handling. The embankments help reduce the overall footprint of the DSF by constraining the flanks and this will reduce the amount of liner quantities required.

With the exception of the containment embankments, the facility will be constructed in five phases to reduce the initial capital costs and reduce the length of time the basal liner will be left exposed to the environment. An overview of each stage is presented in Table 24-32.

Table 24-32: DSF Staging Summary

Stage Number	Period (years)	Cumulative Storage Capacity (Mt)	Cumulative Basal Area (m^2)
1	2025 – 2026	2	293,764
2	2027 – 2031	7	431,387
3	2032 - 2036	12	584,428
4	2037 - 2041	17	747,720
5	2042 - 2044	19.5	866,177

The base will be prepared in stages with the removal of aeolian sand and a cut and fill operation to provide a graded base surface (0.5 % overall and 0.25 % into the centre). The total base surface will cover an area of 866,177 m^2 (Drawing 31246-TLS-002).

A 500 mm thick geological barrier will be placed and compacted in 150 mm layers across the DSF footprint and up the upstream side of the containment berms. The geological barrier will be comprised of local borrow materials with sufficient clay content to limit seepage below the stack. A 1.5 mm thick, single textured white High-Density Polyethylene (HDPE) geomembrane will be placed above the geological barrier (Drawing 31246-TLS-009).

A series of drains will be placed on top of the HDPE geomembrane in a herringbone pattern, spaced at 50 m intervals, connected to a central drain that will run along the base of the spine of the DSF. The drains will be constructed from suitable gravel material prepared on site using a mobile crusher and will be 0.3 m thick and 6 m wide. The drains will be wrapped in a geotextile (Tencate S51 Geotextile Bidim S51 UV Reinforced 200 Gr/m^2) to prevent the drains from clogging. The drains will promote depressurization of the pore water within the stack and allow seepage flows to report to the evaporation pond (Drawing 31246-TLS-009).

Internal berms will be constructed across the width of the DSF base, ahead of the projected tailings footprint for each construction stage, using suitable waste rock material. This will provide containment for a pond that will promote evaporation of seepage flows and bleed water.

24.8.9 Operations

Dust Suppression

The facility is in an arid dry climate where the tailings are predicted to dry out quickly. Dust suppression is required to prevent tailings material from being blown to surrounding areas. A series of sprinklers will be placed on the tailings surface to help maintain a wetted surface during deposition. A simple cover system, consisting of 0.3 m suitable waste rock material, will be placed behind the working face to minimize the amount of tailings exposed to the atmosphere. An allowance has been made for two 0.3 m layers of waste rock across the entire facility to provide flexibility for use of waste rock as a method of dust suppression.

Temporary Cover System

Throughout operation of the DSF, a cover system will be progressively constructed. Tailings that are deposited to the final design elevation will be allowed to desiccate for a short duration before the temporary cover is placed. Construction of the temporary cover system will be undertaken continuously to minimize the area of the exposed tailings to the working face of the DSF. The material used will comprise of suitable waste rock material.

A permanent cover system will be constructed in campaigns following placement of the temporary cover system. The permanent cover system is described in more detail in Section 24.8.10.

Evaporation Ponds

Temporary berms will be created across the width of the DSF base to create an evaporation pond for each stage, using suitable waste rock material. At the end of each stage, the central portion of the lower containment berm will be excavated and the central drain will be extended down the centreline of the DSF into the next evaporation pond. (Drawing 31246-TLS-004/5/6/7/8).

Monitoring

As part of the Operation, Maintenance, and Surveillance (OMS) Manual, a monitoring programme will be required and geotechnical instrumentation will be installed on the DSF.

Suitable levels of monitoring will be required as part of the operational phase with Trigger Action Response Plans (TARPs) prepared and periodically updated as the facility progresses. The proposed design has a relatively low risk profile and uses a simple deposition strategy; therefore, extensive investigation and monitoring is not warranted. The following condition and performance monitoring activities are required:

- In-situ tailings properties:
    - Cone Penetration Testing with measurement of pore pressure (CPTu) will provide geotechnical information for tailings within the DSF and allow instrumentation to be installed. CPTu surveys will be undertaken every year.

- Pore pressures:
  - Vibrating Wire Piezometers (VWP) will measure pore pressures within the DSF. These would either be installed within the tailings during construction or installed during CPTu campaigns. The number of VWP sensors installed will depend upon findings from CPTu campaigns, and upon monitoring results from previously installed instrumentation. A minimum of 10 VWP's will be installed in each of the five development stages with position and depth determined by qualified experts.
- Deformation:
  - Topographic surveys would be undertaken every 3 months to track deposition, deformation, and consolidation of the tailings surface throughout operations.

24.8.10 DSF Closure

A technical review of the radiological exposure from uranium tailings was completed by Intelliscience Ltd (May 2022). This work was based on one tailings sample and four waste rock samples. Based on this technical analysis completed, it was found that the capping system did not require a synthetic liner and a geological barrier was sufficient to reduce the radiological exposure to acceptable levels.

SRK's conceptual closure plan proposes that the DSF is permanently closed as the DSF progresses. The cover system will consist of two layers (Drawing 31246-TLS-009):

- Placement of 500 mm of suitable impermeable material, sourced from the same borrow pit as the lining system, to prevent oxygen ingress, radon emissions and to act as a general barrier to radiation. The material will be in accordance with the material specification and placed and compacted to 95 % Standard Proctor Maximum Dry Density (SPMDD); and
- Placement of 1 m of suitable waste rock material, to prevent wind and water erosion of the underlying finer material.

The permanent closure capping system will be installed in distinct campaigns throughout the DSF lifespan. The external containment berms that provide containment for tailings will be graded away from the tailings such that the closed facility sheds all precipitation away from the facility.

The evaporation ponds, and their precipitates, will be covered with tailings as the tailings stack advances. The final evaporation pond will be removed, and the liner will be folded back at closure prior to placement of the final cover system after any excess solution has evaporated. Exposed precipitates will be transported and placed on the DSF stack and buried by a layer of suitable waste rock. The excess liner around the pond will be folded back on top of the tailings in advance of the final cover system placement. This will ensure the landform does not impound water in the long term.

As part of the closure works, the spreader and conveyor system will be removed from the top of the DSF, and any defects in the capping system will be repaired.

24.8.11 Slope Stability Assessment

Slide2D version 9.023 (Rocscience, 2022) was used to conduct a series of slope stability analyses. The following cases were analysed:

1. Two strength cases for the tailings material were analysed; 1) The Mohr-Coulomb constitutive soil model was used with zero effective cohesion and varying effective friction angles of 24º, 28º and 32º. The Vertical Stress Ratio (VSR) constitutive soil model was used with varying VSRs of 0.4, 0.2 and 0.1 analysed.

2. Two tailings pore pressure cases were analysed with an Ru of 0.05 and 0.1 analysed.

This resulted in a total of twelve static slope stability analysis outputs. Two representative cases are presented in Figure 24-47 and Figure 24-48.

Dynamic loading slope stability assessments were conducted using the same parameters as shown in Figure 24-47 and Figure 24-48, with a target Factor of Safety (FOS) of 1. A horizontal pseudo-static seismic coefficient (Ky) of 0.327 g and 0.088 g respectively were calculated.

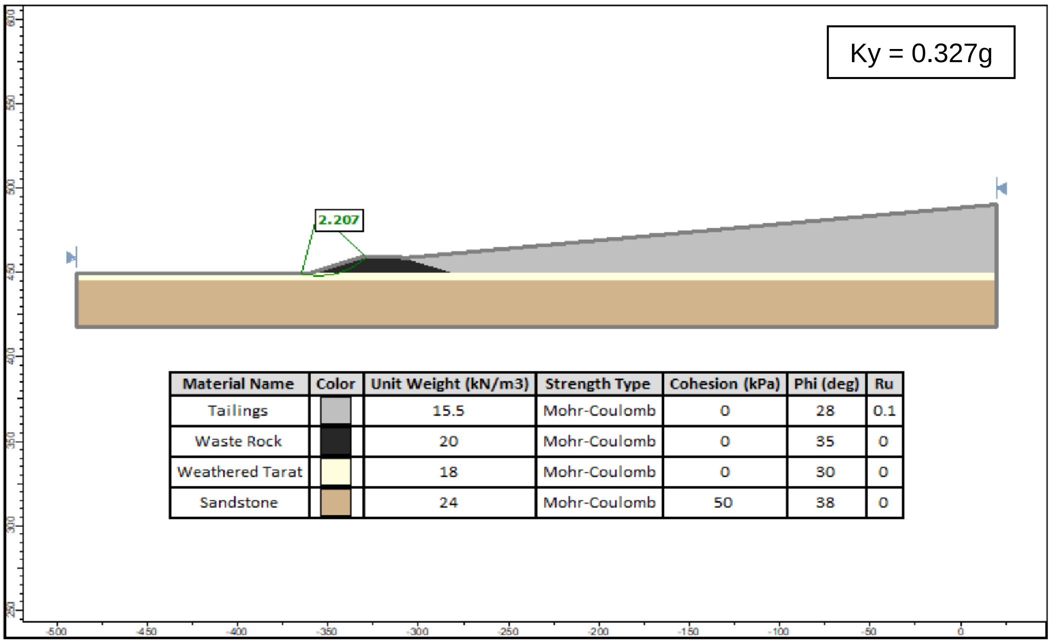


Figure 24-47: Slope stability analysis output, Mohr-Coulomb tailings strength model

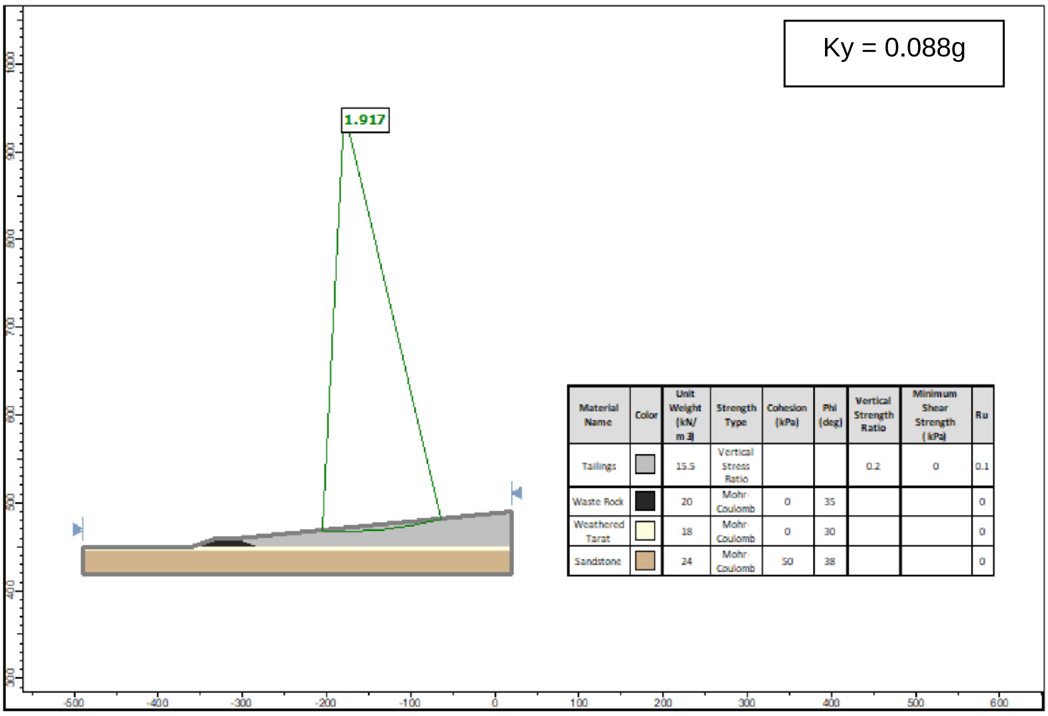


Figure 24-48: Slope stability analysis output, VSR tailings strength model

Static loading slope stability FOS all exceed 1.5 with the exception of the VSR case of 0.1 which is representative of a post-liquefied strength case. However, this case still demonstrated a FOS>1 if Ru is kept below 0.1. If failure was to occur (FOS<1) it is unlikely to result in a breach of containment, slight sloughing of the tailings is considered more credible.

For all cases where peak strengths are considered the derived horizontal yield coefficients (Ky) far exceed the magnitudes of seismic load that are applicable for the location. For example, the VSR of 0.2 and Ru of 0.1 case has a Ky of 0.4 m/s^2 (0.04 g) which is double the 0.2 m/s^2 (0.02 g) predicted by the hazard map for the site location (Figure 24-44).

The above analysis is sufficient to demonstrate applicable FOS for all static and dynamic loading cases considered, and that tailings strength, pore pressure and seismic loads are not critical concerns for this slope design.

24.8.12 Tailings Water Balance

The tailings facility will receive water from three sources: 1) water delivered within the filtered tailings, 2) stormwater flows, and 3) excess bleed water from the process plant that will be used to assist with dust suppression. All water reporting to the tailings will be collected in a downstream evaporation pond to the southwest of the DSF. The design of the evaporation pond will incorporate sufficient capacity for temporary storage of water. The tailings facility is considered a “dead end” in terms of the site wide water balance under the assumption that all water reporting to the tailings facility will evaporate once reaching the pond. The tailings water balance was completed to ensure that the pond has sufficient temporary capacity to contain water prior to evaporation occurring. It is important to remark that the top boundary condition was constant flux = 0, that does not consider evaporation.

The rate of seepage water exiting the tailings stack has been estimated by developing a series of 1-dimensional seepage analyses using the computer program HYDRUS. The tailings facility was discretised into 618 columns of tailings that overly a free flow boundary condition at the base. The height of each column is developed through time to simulate the growth of the tailings facility and total seepage will be calculated as the sum of seepage from each column. The seepage calculations are based on an unsaturated flow using van Genuchten method to estimate permeability. The permeability equations used for seepage calculations are presented below, and parameters selected for the Madaouela tailings are presented in Table 24-33.

$$\theta(\Psi) = \theta_r + \frac{\theta_s - \theta_r}{[(1 + \alpha\Psi^n)]^m}$$

$$\theta(\Psi) = \theta_r + \frac{\theta_s - \theta_r}{[(1 + |\boldsymbol{\alpha\Psi}|^n)]^m}$$

Table 24-33: Tailings Properties for Seepage Assessment

Parameter	Value
θ_r	0.03 m³/m³
θ_s	0.42 m³/m³
α	4.71 1/m
n	1.473
m	$1 - 1/n$
K_s	8.64E-3 (m/day)
l	0.5
S_e	$\frac{\theta-\theta_r}{\theta_s-\theta_r}$ (effective saturation)

The seepage analyses undertaken indicates that seepage flows increase throughout the life of mine with a maximum flow rate occurring towards the end of the mine life (at 20 years), then decreases through time thereafter. The maximum steady state flow of water from the tailings is 36,000 m^3/year (~100m^3/day). This prediction represents the estimate for seepage flows considering tailings placed with a saturation of 80 % of the conveyor (corresponding to volumetric water content of 0.342).

Excess bleed water from the plant used for dust suppression has been estimated at 6m^3/hour and will be used through a sprinkler system. It is assumed that 1/3 of the dust suppression water will evaporate on the tailings surface leaving approximately 4 m^3/hour (~100 m^3/day) that will report to the evaporation pond. The total steady state water received in the evaporation pond is 200 m^3/day including both the seepage water and runoff from dust suppression.

The predicted evaporation on the project site is estimated at nearly 6 mm/day according to the climate review. This suggests that the pond must have a surface area of at least 35,000 m^2 to maintain a negative water balance. Since the width of the proposed facility is 600 m, the evaporation pond would need to extend roughly 60 m beyond the toe of the tailings. The design currently has an allowance of 70 m of lined area beyond the toe of the projected tailings for use as an evaporation pond, more than is required from the estimated inflows. Based on the design geometry of the pond, the pond will have a maximum depth ranging between 0.6 m and 1.0 m, depending on the position of tailings within the impoundment.

The storm water flows have been estimated by calculating the total storm water for the design event and multiplied by the lined surface area of the tailings facility. The predicted precipitation from the 24-hour storm with 100-year return period is 4 mm/hour. The maximum footprint area of the tailings facility is 866,000 m^2 once the final stage on construction is complete. Assuming a 24-hour period with 1.0 runoff coefficient, this amounts to around 80,000 m^3 of storm water. The pond has been designed with a minimum height of 2.0 m, which allows more than 100,000 m^3 capacity beyond the normal operating depth at which negative water balance is achieved. This ensures adequate storage of temporary storm water. The storm water will be left within the tailings facility to evaporate. In most instances, the tailings facility will be able to accommodate much more water that required since the tailings only approach the evaporation pond towards the end of each stage.

24.8.13 Design Contingency

As part of the storage capacity modelling exercise, a tailings slope of 5 % and 15 % was modelled to ascertain the impact of varying deposition slope angles on design strategy. With a tailings slope of 5 % the DSF using the same base surface area would only store 12.7 Mt of tailings at a height of 24.5 m. The facility is constrained to the south-west by a third party powerline, to the north-west by an access road, and to the north by the conveyor system delivery point. However, there is capacity within the design to use additional waste rock to increase the berm height if required, which would accommodate additional tailings storage. There is also the potential to adjust the external berms to expand the facility towards the east, which would also increase the tailings capacity.

With a tailings slope of 15 %, and the same base surface, 22.9 Mt of tailings could be stored at a height of 40 m, but two conveyor runs would be required and some regrading of the material. If one conveyor was used the stack would not use the full capacity of the base and materials would require significant rehandling.

Note that the DSF is supported by a dedicated mobile fleet of equipment which can be used to re-handle dried/consolidated tailings from the as-deposited inclinations to the as-designed final slopes. Consequently, the design includes sufficient/appropriate contingency to appropriately manage material and slope inclination variability.

24.8.14 Cost Estimate

Rates

The rates used within the cost estimated are summarised in Table 24-34 and discussed further below.

A quote was obtained from RMS for the tailings conveyance system. This included a fixed length of conveyor from the process plant to the apex of the DSF, a transfer tower, tripper, spreader, and extendable conveyor to reach the final deposition point. The quote includes for a take up tower to allow for tailings in the emergency storage area to be placed back onto the conveyor system and deposited within the DSF. The quote includes spares, insurance, shipping, transport, Engineering Procurement Contracting and Management (EPCM) and a contingency allowance.

A scaled estimate of $100,000 has been included for a dust suppression system to be installed on the berms of the DSF.

Five pieces of construction fleet equipment are required to operate the DSF which includes an excavator, dozer, compactor and two 40 T trucks. A loader is required for some jobs on the DSF but will be borrowed from the mining fleet as required. Unit rates for specific tasks has been calculated from first principles using the assumed equipment fleet. The rate includes labour, maintenance, spares, insurance and the shipping of the equipment to site. The equipment is also anticipated to be used for alternative works on site, such as pre-strip earthworks, foundation preparation, and ancillary infrastructure works.

A direct quote was obtained from Solmax © to supply a white 1.5 mm HDPE geomembrane for the basal lining system. The quote included the cost of mobilising a specialist crew to site, the transportation of the materials from France to the Port of Lagos and the installation of the liner. Solmax © also provided a direct quote for supplying a geotextile for the basal finger drains and the installation of the geotextile.

Table 24-34: Summary of rates used within the cost estimate

Item	Rate	Units	Rate Notes
Tailings Conveyance System			
Tailing Conveyor & stacker	4,533,323	LS	RMS Quote
Spares & Insurance	116,313	LS	RMS Quote
Shipping and transport	186,400	LS	RMS Quote
EPCM	483,604	LS	RMS Quote
Contingency	543,250	LS	RMS Quote
Dust Suppression			
Sprinkler System	100,000	LS	Scaled estimate
Construction Fleet Equipment			
Loader	275,000	No.	Included in alternative scope
Excavator	890,000	No.	CAT Quote
Dozer	415,000	No.	CAT Quote
Compactor	236,000	No.	CAT Quote
Truck (40T)	515,000	No.	CAT Quote
General Earthwork and Grading			
Clear, grub, move surficial material	1.13	per m^3	SGS Earthworks cost
Foundation preparation - shallow excavation	2.68	per m^3	First principles (from mining cost sheet)
Foundation preparation - short haul fill placement	2.07	per m^3	First principles (from mining cost sheet)
Waste rock fill for external berms (extra over from mine haul to place in compacted 1.5 m lifts)	1.00	per m^3	Estimate from first principles
Impermeable material for 0.5 m basal liner system load-haul-place-compact (Assumed from borrow pit at 2 km distance)	5.61	per m^3	First principles (from mining cost sheet)
Select waste rock load-haul-place-compact (berms for evaporation ponds)	2.18	per m^3	First principles (from mining cost sheet)
Basal Liner Supply and Installation			
Mobilisation of crew to site	10,000	No.	Solmax Quote

Item	Rate	Units	Rate Notes
Transportation of liner to site (No. of 40' sea containers from France to Port of Lagos)	5,692	No.	Solmax Quote
Supply of white 1.5 mm HDPE geomembrane for basal liner	3.81	per m^2	Solmax Quote
Installation of geomembrane	0.55	per m^2	Solmax Quote
Drainage			
Supply and place gravel aggregate for finger drain (prepared on site using a mobile crusher/ 0.3 m thick & 6m wide)	30.00	per m^3	Scaled estimate for on-site crushing and screening
Supply of geotextile for finger drain (0.5 mx0.3 m drain with allowance for overlap)	0.72	per m^2	Solmax Quote
Installation of geotextile for finger drain	0.25	per m^2	Solmax Quote
Permanent Cover System			
Impermeable material for cover liner system load-haul-place-compact to 0.5 m thickness (Assumed from borrow pit at 2 km distance)	5.61	per m^3	First principles (from mining cost sheet)
Waste rock load-haul-place (1 m thick)	2.18	per m^3	First principles (from mining cost sheet)
Operating			
Tailings Conveyance	1.56	per tonne	RMS Quote
Placement of temporary waste rock cover; load/haul/place (2 x 0.3 m thick layer)	2.18	per m^3	First principles (from mining cost sheet)
Pipes, pumping, and sprinklers	0.02	per tonne	Scaled estimate

Capital Expenditure & Closure

A summary of the DSF initial capital costs, sustaining capital costs and closure capital costs are presented in Table 24-35. The following assumptions apply to the cost estimate provided below:

- Capital costs have been staged to align with five stages of DSF construction.
- Initial capital costs include costs for the tailing conveyance system, dust suppression system, construction fleet equipment, earthworks and grading for the Stage 1 area, installation of the stage 1 basal lining system and stage 1 drainage system. These costs are all accrued in Stage 0, i.e. the time needed to prepare the base surface ready to receive tailings during Stage 1 of deposition.
- Sustaining capital costs include costs for the earthworks and grading, installation of basal lining system, drainage system and permanent cover system for Stage 2 to 5, and the permanent cover system for Stage 1.
- Costs related to the filter plant are included in processing plant.

Table 24-35: Summary of Initial, Sustaining and Closure Capital Costs

Item	Description	Initial CAPEX	Sustaining CAPEX				Closure CAPEX
		Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
1	Tailings Conveyance System	5,862,890	-	-	-	-	-
2	Dust Suppression	100,000	-	-	-	-	-
3	Construction Fleet Equipment	2,571,000	-	-	-	-	-
4	General Earthwork and Grading	4,359,525	633,793	674,153	570,430	573,088	0
5	Basal Liner Supply and Installation	1,375,897	722,642	773,018	646,800	649,743	0
6	Drainage	144,549	77,980	79,043	77,141	60,415	0
7	Permanent Cover System	-	-	616,291	653,728	714,610	1,199,266
Total Initial CAPEX		14,413,861		Cost per tonne of tailings			0.74
Total Sustaining CAPEX		5,538,246.00		Cost per tonne of tailings			0.28
Total Closure CAPEX		3,183,895		Cost per tonne of tailings			0.16

Operating Expenditure

The operating costs include a cost for tailings conveying, the placement of the temporary waste rock cover and the operation of the pipes, pumps and sprinklers used for dust suppression of the tailings. The results of the operating cost estimate are presented in Table 24-36.

Table 24-36: Summary of DSF Operating Costs

Item	Description	Total (USD)
1	Tailings Conveyance	30,557,069
2	Placement of temporary waste rock cover	697,455
3	Pipes, pumping and sprinklers	134,904
Total		31,389,428
Cost per tonne of tailings		1.61

DSF Cost estimate

A summary of the DSF cost estimate is presented in Table 24-37. The DSF does not include any costs for the processing plant, or processing costs.

Table 24-37: Summary of overall DSF costs

Initial CAPEX	Sustaining CAPEX	Closure	OPEX	Total LOM	Cost per Tonne (USD)	Cost per Tonne ex. Closure
14,413,862	5,538,247	3,183,895	31,389,428	54,525,432	2.80	2.64

24.8.15 Risks and Opportunities

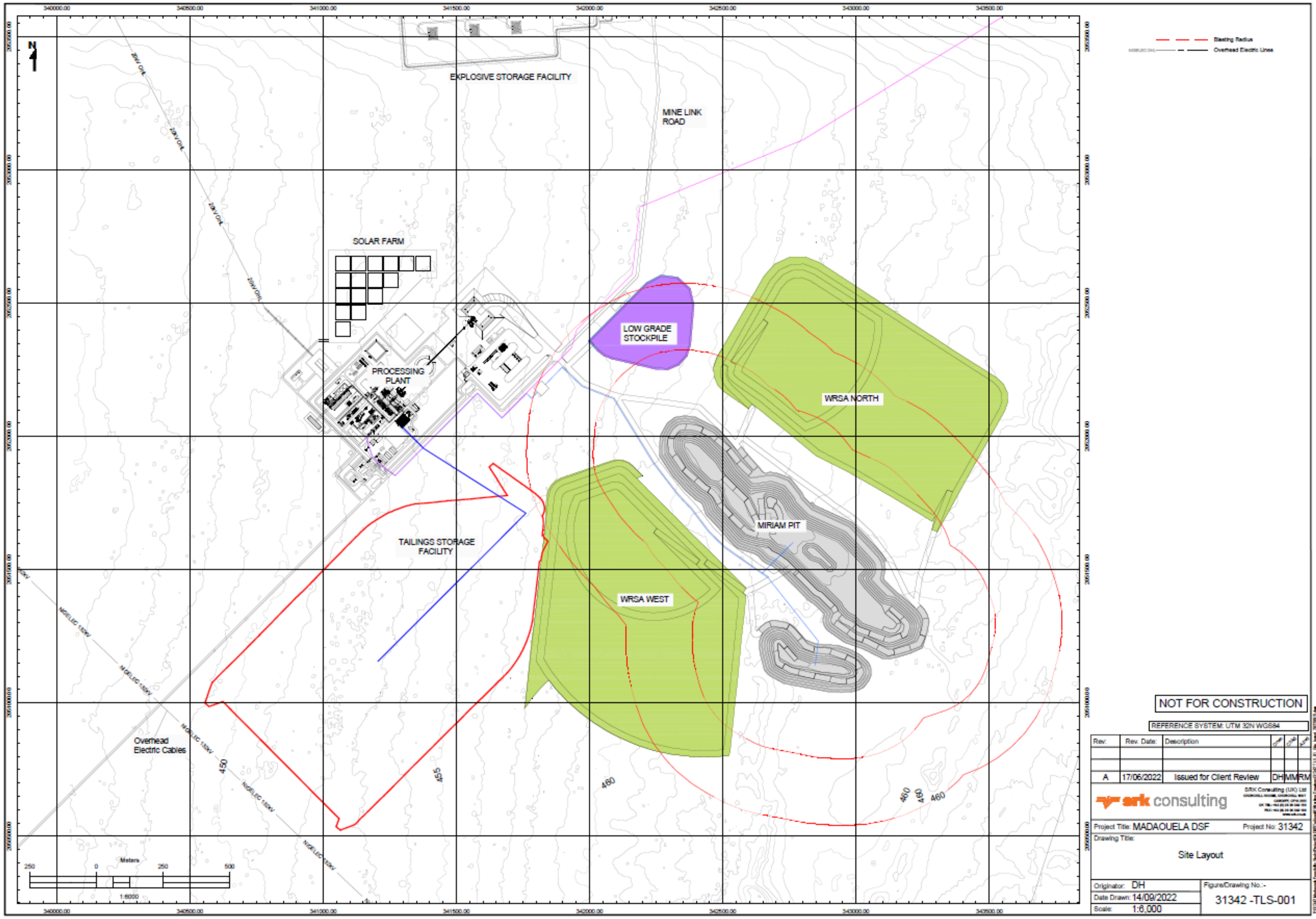
- Tailings dewatering – SRK has assumed that tailings can be produced at an 80 % soils content (w/w) and achieve a slope of 10 %. Should a different solids content or slope be realised, the volumetric calculations for the TSF will have to be reviewed.
- Tailings water content – SRK have assumed a final 25 % geotechnical moisture content for the tailings, and thus this material is able to be conveyed at a gradient up-hill to the apex of the facility. If the water content increases, there is the risk of difficulty in transporting the material (i.e the tailings could potentially liquefy on the conveyor belt and result in backflow and spilling).
- Plant bleed water – SRK has assumed constant plant bleed water of 35,560 kg/h with a specific gravity (SG) of 1.15. Should the plant bleed water vary significantly, the evaporation ponds will need to be re-sized.
- Tailings Density – SRK has estimated the density of the tailings (1.55 t/m^3) from relatively few samples (two). If the density is lower a greater area will be required to store the tailings and the volumetric calculations for the TSF will have to be reviewed.
- Earthworks quantities – cut and fill quantities have been based on the ALSO_30m topographical survey provided by the client. The quantities could vary if the on-site topography is less/more suitable to the required pad grade.
- External and internal berms – waste rock material with no processing requirements has been assumed as suitable material for the construction of the external and internal berms. If this material is unsuitable additional costs may be incurred in processing the material into a product that can be used.

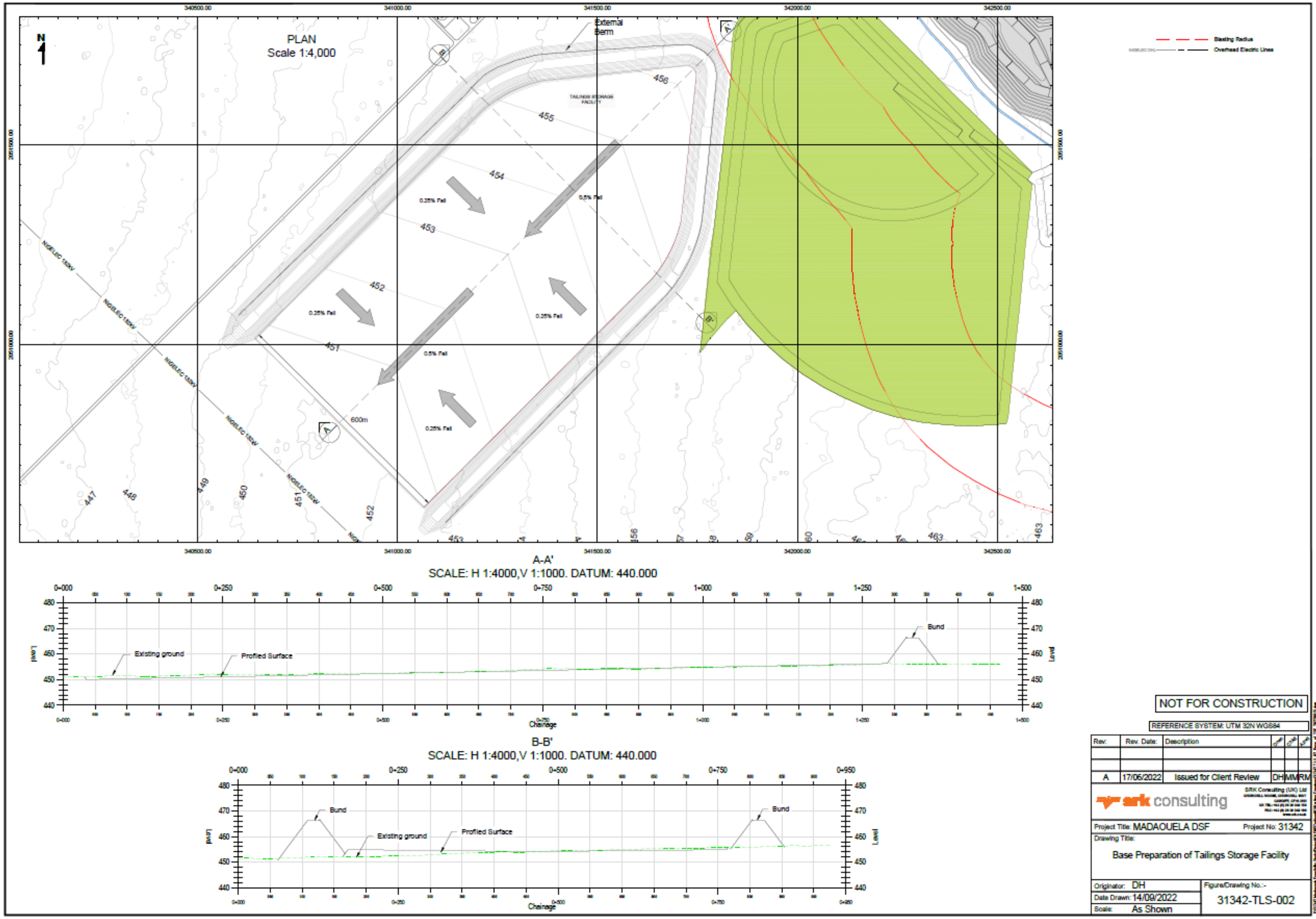
24.8.16 Conclusions

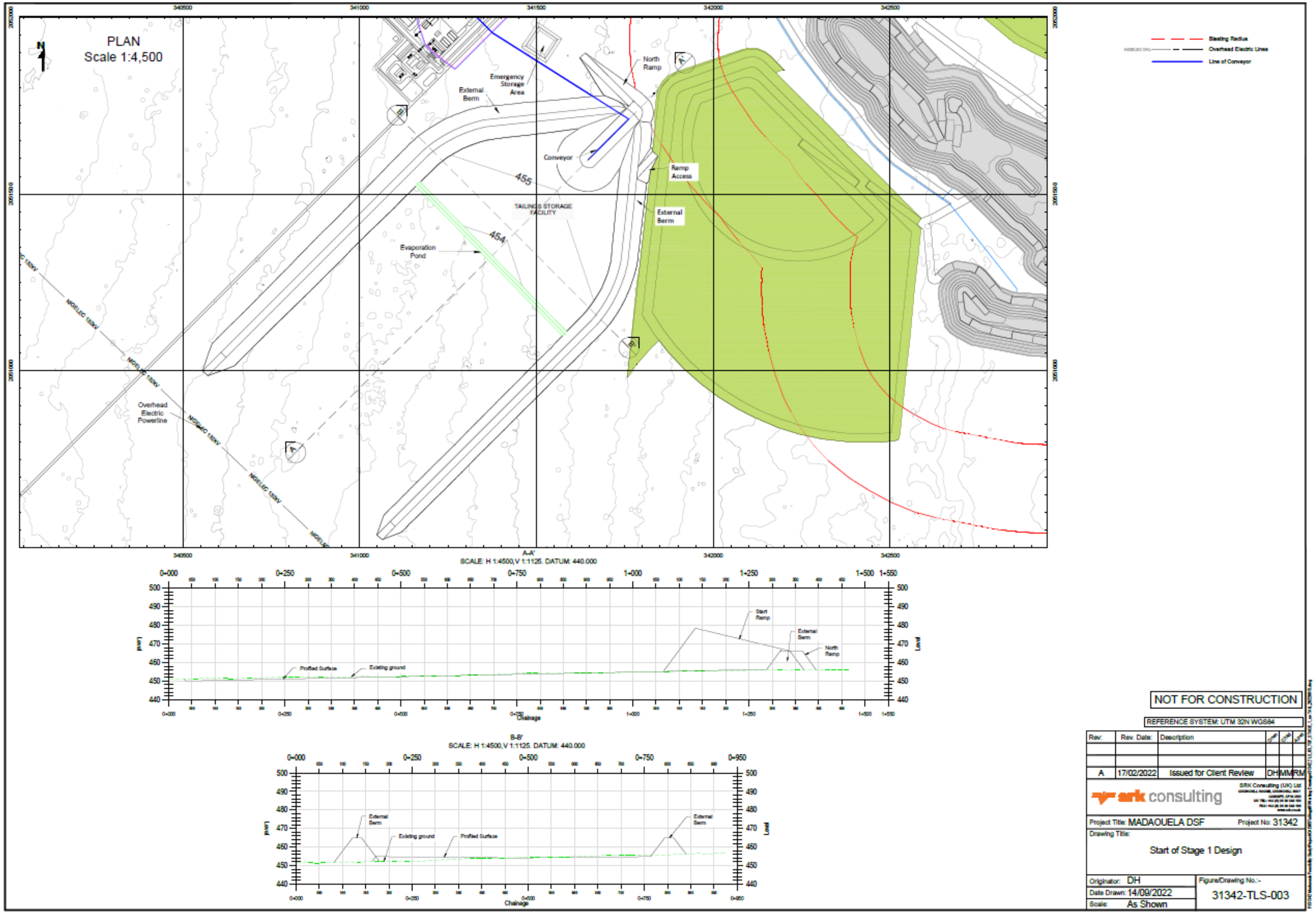
SRK has developed a design for a DSF with associated cost estimates in line with a detailed feasibility study. Based on the design criteria, the design presented is technically feasible and will provide tailored solutions to the project requirements. Cost estimates have been provided and are intended to be used as an input into the Madaouela Project cost model.

- Use of belt conveyors and extendible spreader/stacker systems to handle tailings filter cake from the processing plant to the tailings storage area minimizes tailings material handling costs, reduces fuel consumption and minimizes dust generation during tailings transportation.
- The dewatered stack tailings storage facility (DSF) has a composite lined base to minimize seepage losses and will be progressively constructed in a series of stages which minimizes capital costs.
- Staged development of the DSF allows for progressive cover and closure which minimizes the size of exposed active areas of tailings deposition and thus minimizes potential dust generation.
- The development of the DSF will be supported by provision of a dedicated mobile equipment fleet which will primarily be used for shaping the final tailings surface and placement of temporary and permanent tailings cover material.
- The selected DSF design is well aligned with recognized international 'best-practice' and 'best-available-techniques' for safe tailings storage. It will allow for construction, operation, monitoring and closure in full accordance with the Global Industry Standard on Tailings Management (GISTM, 2020).
- Use of waste rock and soil from the open pit to construct the DSF base platform and perimeter berms allows for optimisation of tailings footprint creating an efficient ratio of lined basal area to stored tailings tonnes.

24.8.17 DSF Drawings




PLAN
Scale 1:4,000
External Berm
TAILINGS STORAGE FACILITY
0.25% Fall
0.5% Fall
600m
NIGELEC 132kV
Blasting Radius
Overhead Electric Lines
A-A'
SCALE: H 1:4000,V 1:1000. DATUM: 440.000
Existing ground
Profiled Surface
Bund
Chainage
Level
B-B'
SCALE: H 1:4000,V 1:1000. DATUM: 440.000
NOT FOR CONSTRUCTION
REFERENCE SYSTEM: UTM 32N WGS84
Rev. Rev. Date: Description
A 17/06/2022 Issued for Client Review DH MM RM
srk consulting
SRK Consulting (UK) Ltd
Project Title: MADAOUELA DSF
Project No: 31342
Drawing Title:
Base Preparation of Tailings Storage Facility
Originator: DH
Date Drawn: 14/09/2022
Scale: As Shown
Figure/Drawing No.:-
31342-TLS-002


PLAN
Scale 1:4,500
North Ramp
Emergency Storage Area
External Berm
Conveyor
Ramp Access
TAILINGS STORAGE FACILITY
External Berm
Evaporation Pond
Overhead Electric Powerline
Blasting Radius
Overhead Electric Lines
Line of Conveyor
A-A'
SCALE: H 1:4500, V 1:1125. DATUM: 440.000
Start Ramp
External Berm
North Ramp
Profiled Surface
Existing ground
Chainage
B-B'
SCALE: H 1:4500, V 1:1125. DATUM: 440.000
External Berm
Existing ground
Profiled Surface
External Berm
Chainage
NOT FOR CONSTRUCTION
REFERENCE SYSTEM: UTM 32N WGS84
Rev. Rev. Date: Description
A 17/02/2022 Issued for Client Review DH MM RM
srk consulting
Project Title: MADAOUELA DSF
Project No: 31342
Drawing Title:
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Originator: DH
Date Drawn: 14/09/2022
Scale: As Shown
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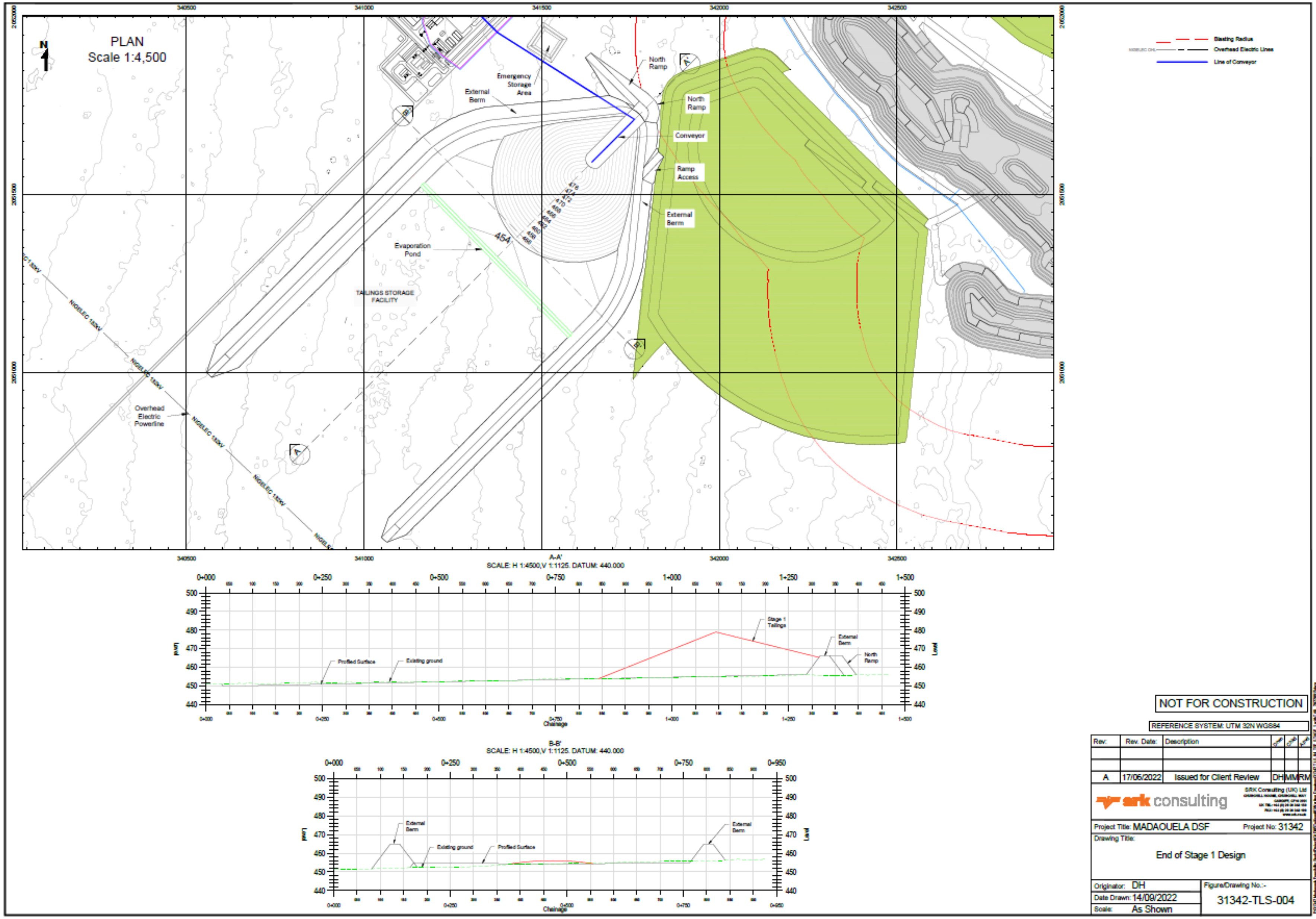
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N
Emergency Storage Area
External Berm
North Ramp
North Ramp
Conveyor
Ramp Access
External Berm
Evaporation Pond
TAILINGS STORAGE FACILITY
Overhead Electric Powerline
Blasting Radius
Overhead Electric Lines
Line of Conveyor
A-A'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
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Existing ground
Stage 1 Tailings
External Berm
North Ramp
Chainage
B-B'
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Chainage
NOT FOR CONSTRUCTION
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SRK Consulting (UK) Ltd
Project Title: MADAOUELA DSF
Project No: 31342
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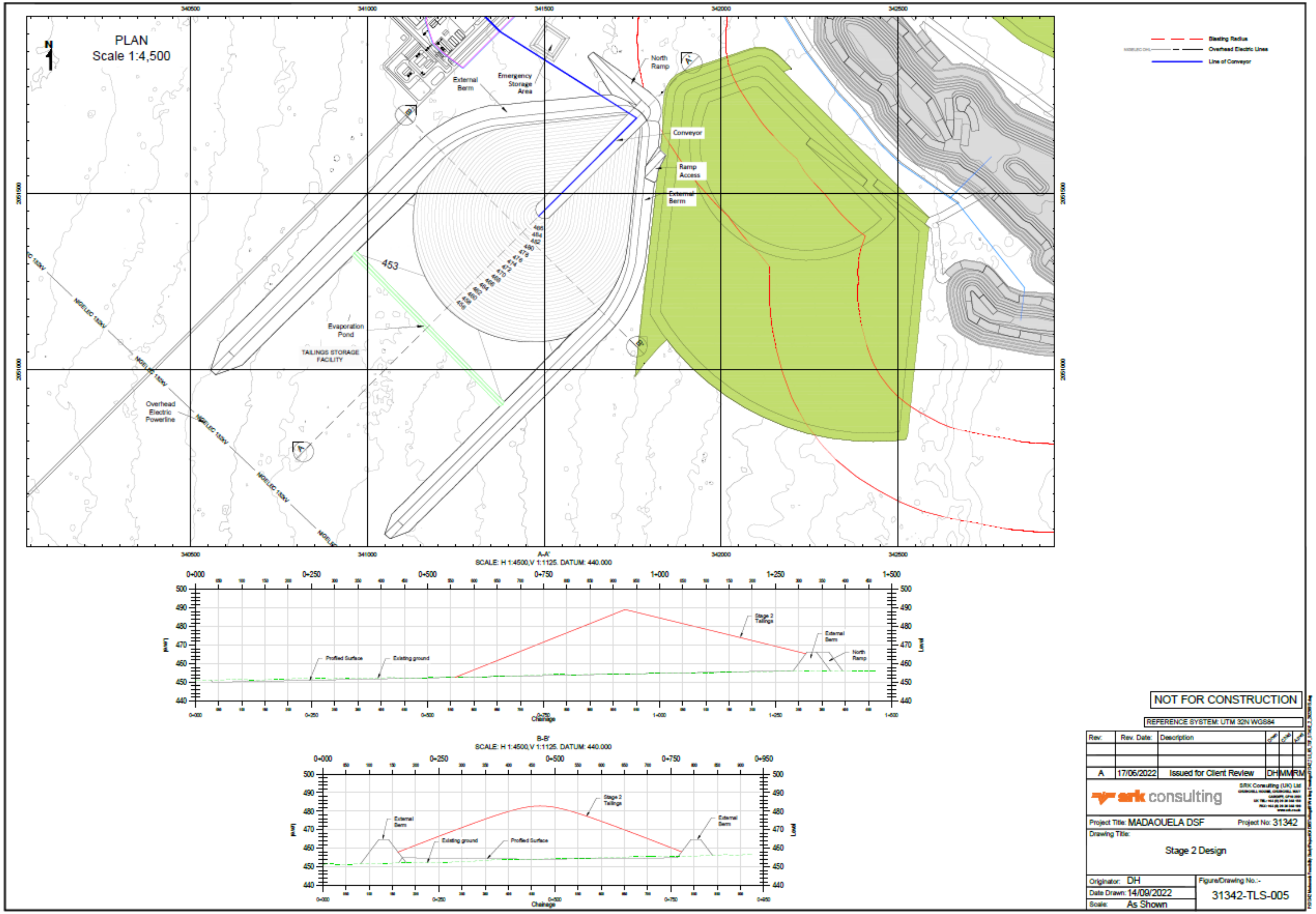
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External Berm
Emergency Storage Area
North Ramp
Conveyor
Ramp Access
External Berm
453
Evaporation Pond
TAILINGS STORAGE FACILITY
Overhead Electric Powerline
Blasting Radius
Overhead Electric Lines
Line of Conveyor
A-A'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
Profiled Surface
Existing ground
Stage 2 Tailings
External Berm
North Ramp
Chainage
B-B'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
NOT FOR CONSTRUCTION
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Rev. Rev. Date: Description
A 17/06/2022 Issued for Client Review DH MM RM
srk consulting
SRK Consulting (UK) Ltd
Project Title: MADAOUELA DSF
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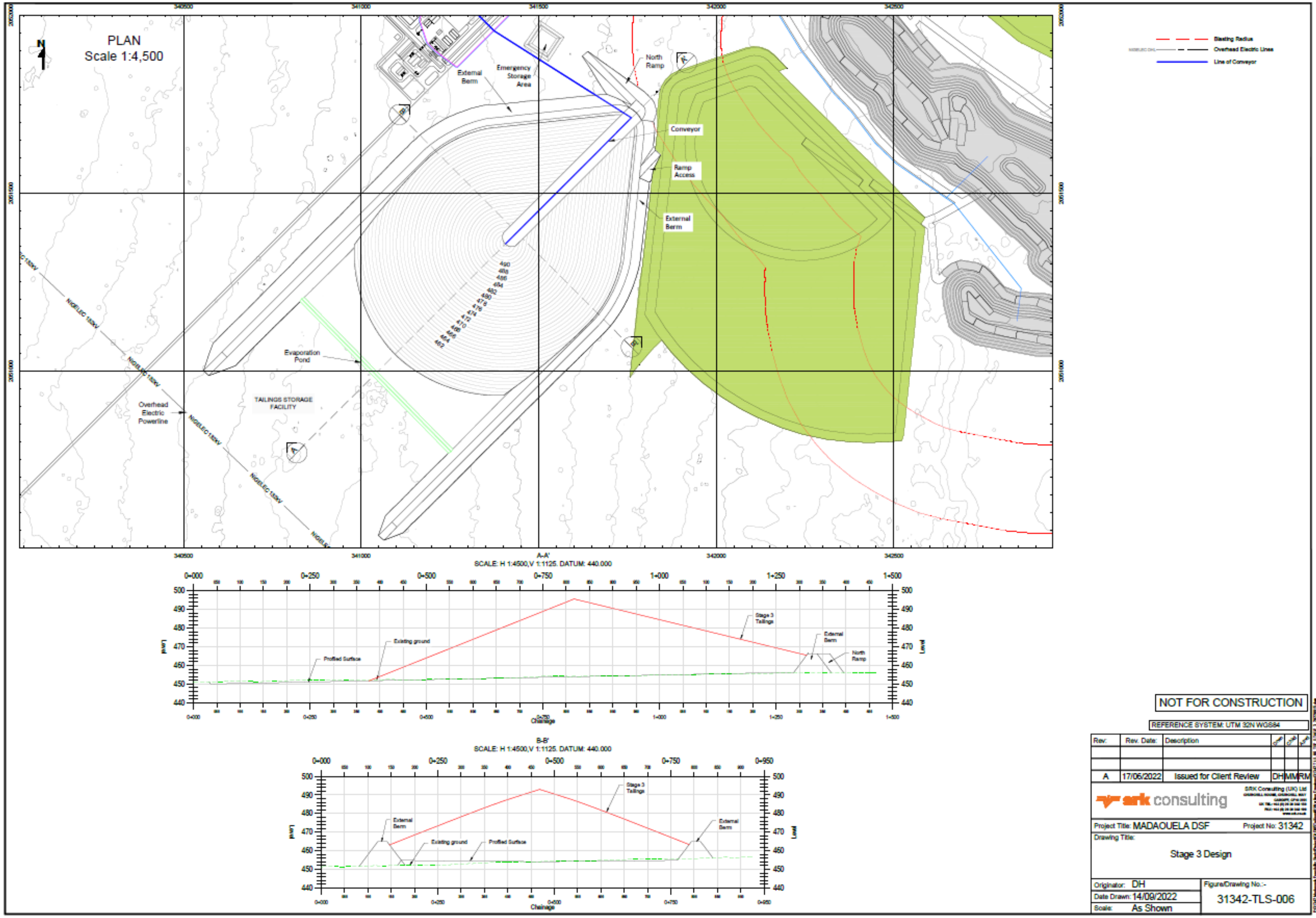
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External Berm
Emergency Storage Area
North Ramp
Conveyor
Ramp Access
External Berm
Evaporation Pond
TAILINGS STORAGE FACILITY
Overhead Electric Powerline
Blasting Radius
Overhead Electric Lines
Line of Conveyor
A-A'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
Stage 3 Tailings
External Berm
North Ramp
Existing ground
Profiled Surface
Chainage
B-B'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
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Project Title: MADAOUELA DSF
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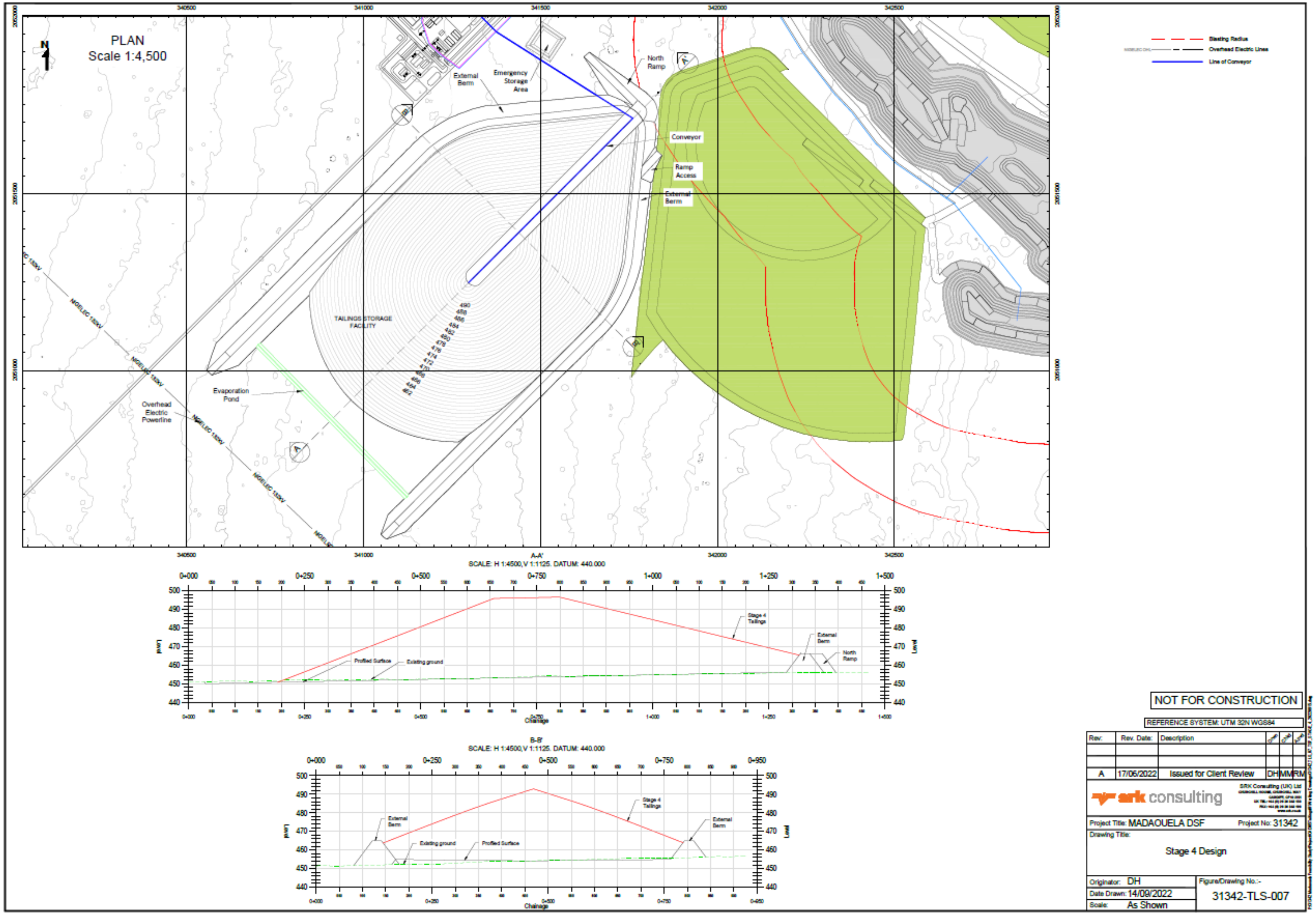
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External Berm
Emergency Storage Area
North Ramp
Conveyor
Ramp Access
External Berm
TAILINGS STORAGE FACILITY
Evaporation Pond
Overhead Electric Powerline
Blasting Radius
Overhead Electric Lines
Line of Conveyor
A-A'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
Stage 4 Tailings
External Berm
North Ramp
Profiled Surface
Existing ground
Chainage
B-B'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
NOT FOR CONSTRUCTION
REFERENCE SYSTEM: UTM 32N WGS84
A 17/06/2022 Issued for Client Review DH MM RM
srk consulting
Project Title: MADAOUELA DSF
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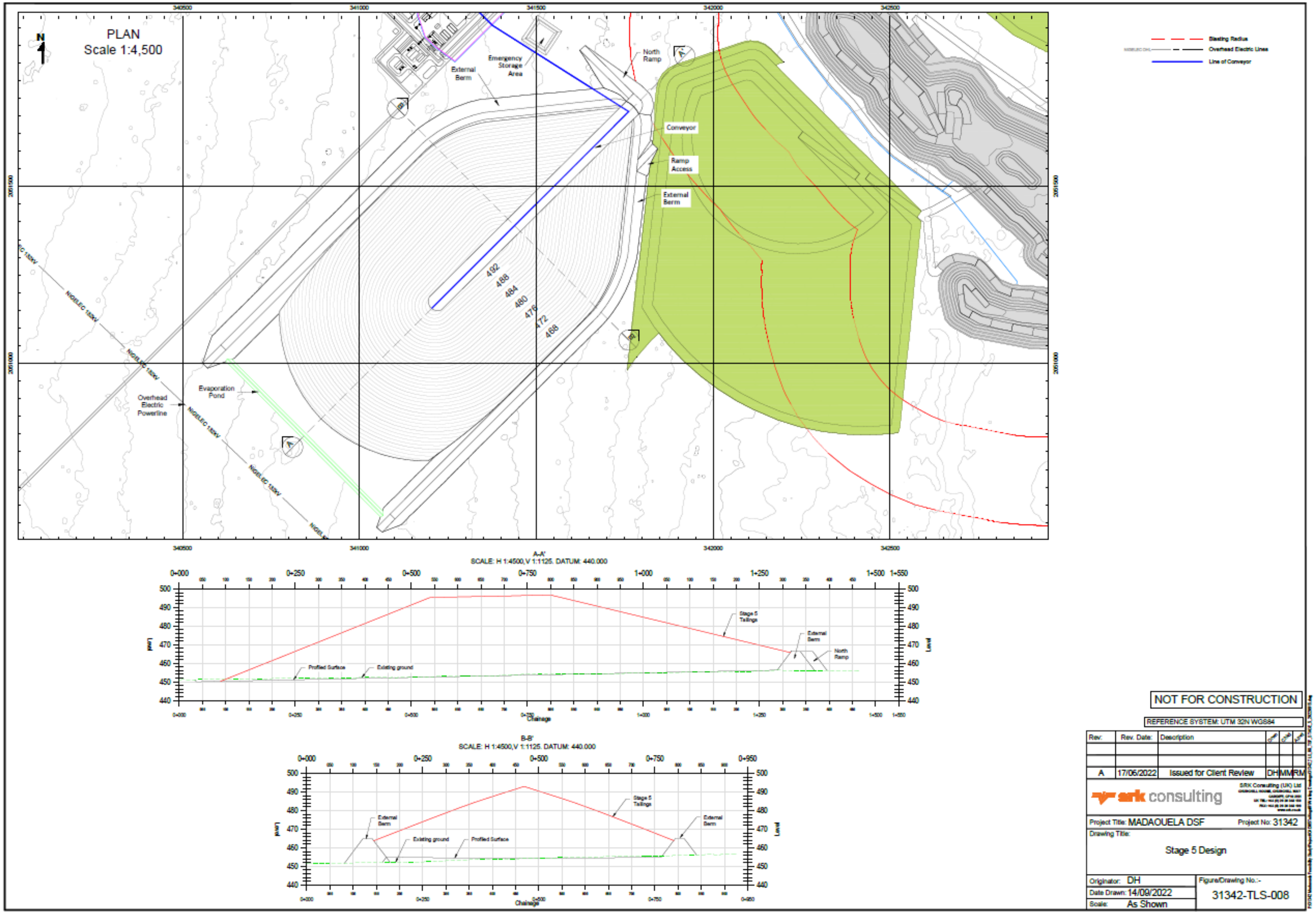
PLAN
Scale 1:4,500
N
Emergency Storage Area
External Berm
North Ramp
Conveyor
Ramp Access
External Berm
Evaporation Pond
Overhead Electric Powerline
492
488
484
480
476
472
468
Blasting Radius
Overhead Electric Lines
Line of Conveyor
A-A'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
Stage 5 Tailings
External Berm
North Ramp
Profiled Surface
Existing ground
Chainage
B-B'
SCALE: H 1:4500,V 1:1125. DATUM: 440.000
Stage 5 Tailings
External Berm
Existing ground
Profiled Surface
NOT FOR CONSTRUCTION
REFERENCE SYSTEM: UTM 32N WGS84
Rev: Rev. Date: Description
A 17/06/2022 Issued for Client Review DH MM RM
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SRK Consulting (UK) Ltd
Project Title: MADAOUELA DSF
Project No: 31342
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Originator: DH
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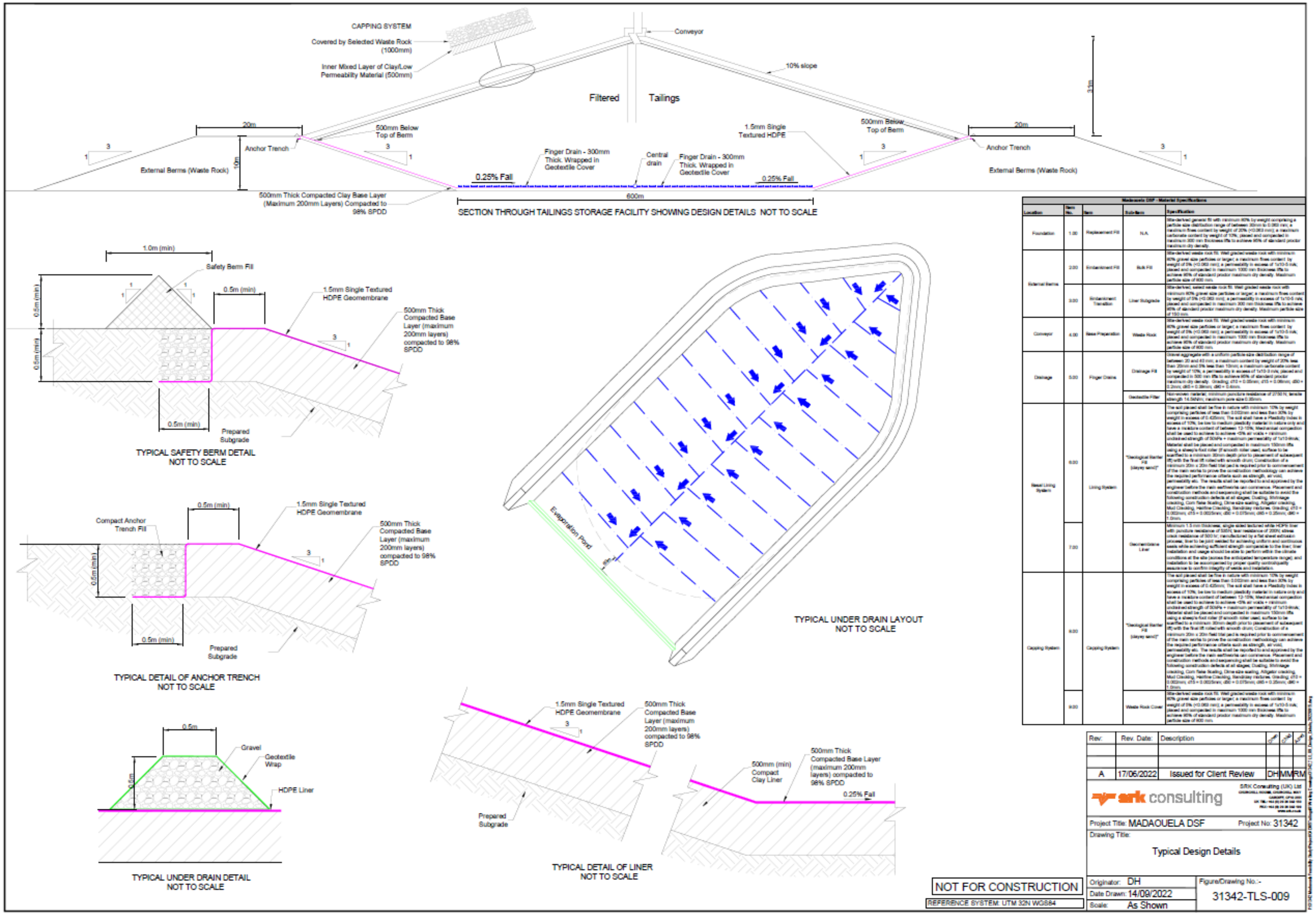
CAPPING SYSTEM
Covered by Selected Waste Rock (1000mm)
Inner Mixed Layer of Clay/Low Permeability Material (500mm)
Conveyor
10% slope
Filtered Tailings
20m
500mm Below Top of Berm
Anchor Trench
External Berms (Waste Rock)
10m
Finger Drain - 300mm Thick, Wrapped in Geotextile Cover
Central drain
1.5mm Single Textured HDPE
0.25% Fall
500mm Thick Compacted Clay Base Layer (Maximum 200mm Layers) Compacted to 98% SPDD
600m
SECTION THROUGH TAILINGS STORAGE FACILITY SHOWING DESIGN DETAILS NOT TO SCALE
1.0m (min)
Safety Berm Fill
0.5m (min)
1.5mm Single Textured HDPE Geomembrane
500mm Thick Compacted Base Layer (maximum 200mm layers) compacted to 98% SPDD
Prepared Subgrade
TYPICAL SAFETY BERM DETAIL NOT TO SCALE
Compact Anchor Trench Fill
TYPICAL DETAIL OF ANCHOR TRENCH NOT TO SCALE
Evaporation Pond
TYPICAL UNDER DRAIN LAYOUT NOT TO SCALE
0.5m
Gravel
Geotextile Wrap
HDPE Liner
TYPICAL UNDER DRAIN DETAIL NOT TO SCALE
500mm (min) Compact Clay Liner
TYPICAL DETAIL OF LINER NOT TO SCALE
Madaouela DSF - Material Specifications
Location
Item No.
Item
Sub-Item
Specification
Foundation
Replacement Fill
External Berms
Embankment Fill
Bulk Fill
Conveyor
Base Preparation
Waste Rock
Drainage
Finger Drains
Drainage Fill
Geotextile Filter
Basal Lining System
Lining System
Geomembrane Liner
Capping System
Waste Rock Cover
Rev.
Rev. Date
Description
A
17/06/2022
Issued for Client Review
DH MM RM
srk consulting
SRK Consulting (UK) Ltd
Project Title: MADAOUELA DSF
Project No: 31342
Drawing Title:
Typical Design Details
NOT FOR CONSTRUCTION
REFERENCE SYSTEM: UTM 32N WGS84
Originator: DH
Date Drawn: 14/09/2022
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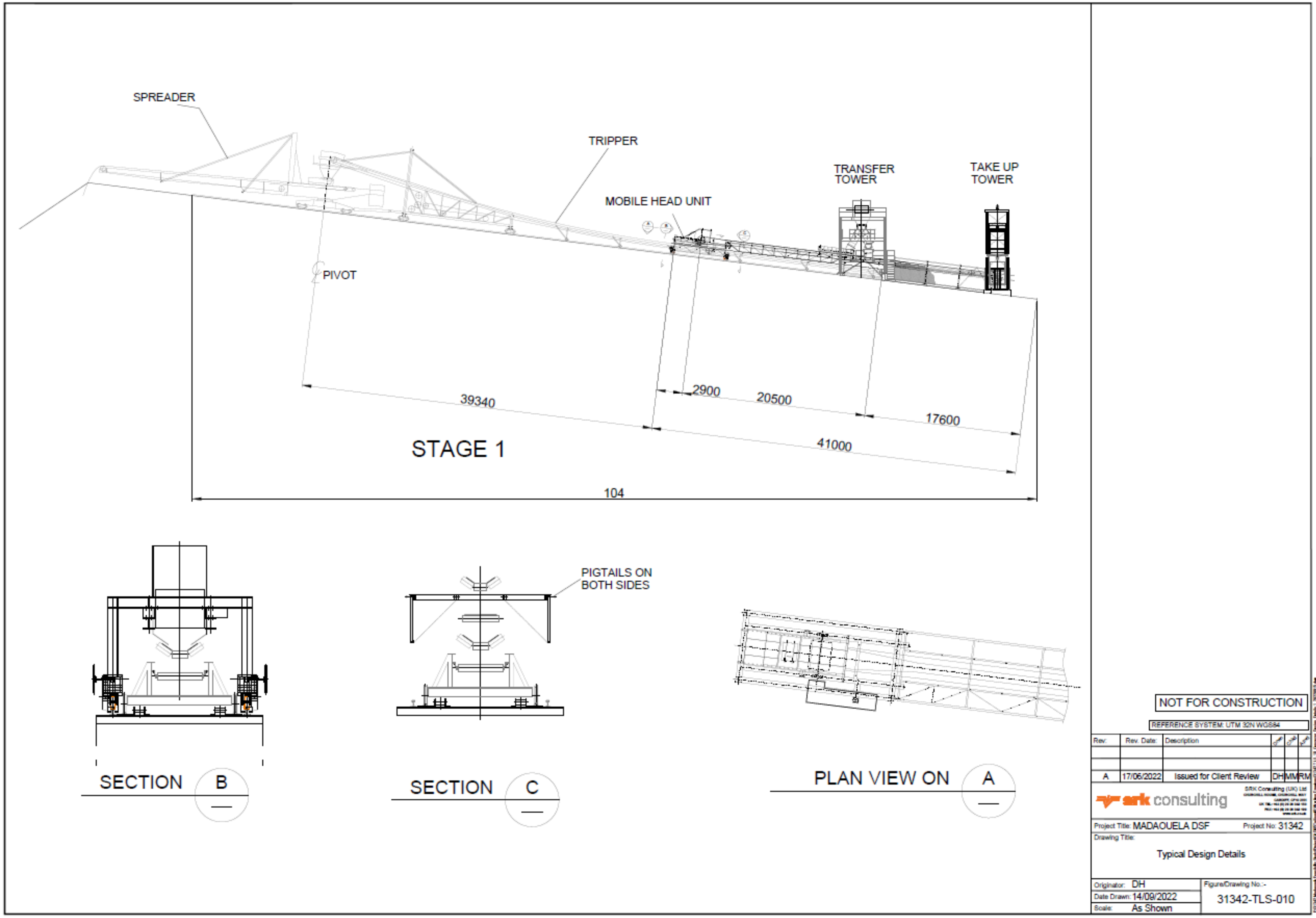
SPREADER
TRIPPER
TRANSFER TOWER
TAKE UP TOWER
MOBILE HEAD UNIT
PIVOT
39340
2900
20500
17600
41000
STAGE 1
104
PIGTAILS ON BOTH SIDES
SECTION B
SECTION C
PLAN VIEW ON A
NOT FOR CONSTRUCTION
REFERENCE SYSTEM: UTM 32N WGS84
Rev. Rev. Date Description
A 17/06/2022 Issued for Client Review DH MM RM
srk consulting
Project Title: MADAOUELA DSF Project No: 31342
Drawing Title:
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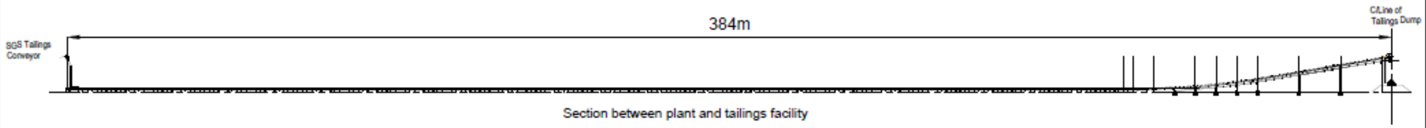


Section between plant and tailings facility

NOT FOR CONSTRUCTION

REFERENCE SYSTEM: UTM 32N WGS84

Rev:	Rev. Date:	Description			
A	17/06/2022	Issued for Client Review	DH	MM	RM

srk consulting

SRK Consulting (UK) Ltd

Project Title: MADAOUELA DSF Project No: 31342

Drawing Title:

Typical Design Details

Originator: DH

Date Drawn: 14/09/2022

Scale: As Shown

Figure/Drawing No.:-

31342-TLS-011

25 INTERPRETATION AND CONCLUSIONS

SRK's interpretations of the geology, mineral resources, and feasibility level studies of mining, infrastructure and processing options for the Madaouela Uranium Project are as follows.

SRK (UK) Limited and SGS-Bateman have completed technical studies to a feasibility level of confidence for the Miriam open pit project, process plant and associated infrastructure. Additional work and mine modelling has been carried out on the two underground mines updating previous pre-feasibility studies. The Project development plan envisions an average 2.60 Mlb per year eU_3O_8 yellowcake production rate over a nineteen and half year mine life, with uranium recovery of 94.8 % and 91.5 % respectively from the open pit and underground mines based on mineral reserves. Initial capital costs are estimated at USD 343 M, LoM capital costs at USD 619 M, and cash operating costs of USD 83.5 /t ROM excluding royalties and by-product credits. A long-term uranium price of USD 65 /lb U_3O_8 has been applied. During the uranium metallurgical recovery process, MoS_3 will be recovered at an average rate estimated at 577 t MoS_3 per annum. A production case has been presented in the FS, which includes the equivalent credits received for MoS_3, at a sales price of USD 5.9 /lb, to offset processing costs. Molybdenum reserves are not reported for the full underground mines due to a lack of data for the full underground mine. The production case economics at a long-term uranium price of USD 65/lb U_3O_8 indicate an after-tax NPV of USD 140 M (at 8 % discount rate) with an IRR of 13.3 % and a total life of mine net free cash of USD 673 M. Cresco has assessed the economic viability of the uranium Mineral Reserves, which return a positive NPV of USD 120 million at a discount rate of 8 %, with an IRR of 12.7 % at a price of USD 65/lb U_3O_8.

GoviEx geologists are confident that the exploration potential on all tenements has the possibility to increase the current resources of the Madaouela Uranium Project. GoviEx exploration drilling has identified additional targets that are currently excluded from the mineral resource statement. These include new targets at Marianne northwest, MSNE, Maryvonne and northwest Miriam and a number of additional drilling targets in the Mad I, Eralral and Mad IV exploration leases.

SRK concurs that the entire property position warrants the further exploration effort and has potential to significantly increase the current project's mineral resources, which if successful would potentially improve the Madaouela Uranium Project value and return; however, SRK cautions that an exploration potential cannot be relied upon until further drilling and sampling is done to properly assess that potential.

SRK concludes the Madaouela Uranium project is of merit that justifies continued development by GoviEx specifically towards further resource definition and steps to project development.

Risk is inherent in any development project. Feasibility studies are aimed at finding solutions that eliminate or minimize the identified risk associated with the project. SRK is of the opinion that these risks have been clearly identified, appropriate designs selected and mitigation measures have been proposed. Project risks have been recorded in a stand-alone project risk register. This register was populated at a multi-disciplinary risk workshop.

The more salient risks associated with the project include:

- **Grid Power** – The power provision for the project is based on a link to the national grid with supplementary and full back-up power provided through a combination of solar, battery and diesel generators. The design is based on discussions with NIGELEC and assumptions on the reliability of the grid supply which NIGELEC may not be able to deliver.
- **Legal and permitting** – GoviEx will need to renew its mining permit in 2027 and delays in financing and construction may place risk on this renewal.
- **Water supply** – The wellfield is 8 km from site with two days storage capacity at the process plant. The pipeline will be buried; however, the project is in a very arid area with nomadic herdsmen looking for access to water, there is the risk of disruption to the pipeline. GoviEx has already provided access to additional groundwater sources via a programme of rural borehole supplies, but this will require on-going consultation with the nomadic communities at specific times of the year.
- **Closure** – There is a risk to groundwater quality post closure. The current mitigation is to backfill the open pit to the modelled rebound level to prevent the formation of a pit lake. The geochemistry of the fill material and the groundwater quality will be monitored, and models updated during the life of mine and the closure programme adjusted as appropriate to mitigate any deterioration in groundwater quality. Lessons from the COMINAK closure will also be drawn on in this regard.
- **Security** – the north of Niger is relatively safe, however, there is a risk that instability linked with rebel insurgency in Mali could threaten the security of the project area and thereby limit project activity and endanger project staff. The project makes allowances for security in keeping with the nature of the risk and GoviEx will ensure adequate security intelligence and procedures are in place to protect staff.
- **Russia /Ukraine Conflict** – the current conflict poses a risk to global supply chains. GoviEx is looking to minimize this risk through the sourcing of alternative suppliers and logistics. This could also represent an economic opportunity.
- **Construction** – there is a risk that GoviEx owners' team does not have capacity to enable project ramp up on commencement of construction following securing of project finance. This could lead to construction delays. Mitigation includes early establishment of an appropriately resources owners team FEED and pre-construction enabling works.
- **Social –** traffic on the mine link road will inevitably lead to interactions with nomadic pastoralist and their animals who cross the area at various times of year in relation to seasonal changes in water and vegetation availability. There is a risk of accidents and community tension. Ongoing training and awareness both of GoviEx employees and contractor and engagement with the local communities will help mitigate this risk.
- **Social** – the influx of people and growth in the region in addition to closing of the mines of COMINAK and eventually SOMAÏR, will lead to increased numbers of job seekers and additional pressure on local social services (water, health, education). This may result in tension between migrants, local residents and GoviEx. This will be mitigated through the development and implementation of a Social Management Plan, Stakeholder Engagement Plan and a Community Development Plan.

The FS has highlighted several opportunities to increase mine profitability, project economics and further reduce risks. These will be assessed in the next stage and include:

- **Use of a Power Purchase Agreement** (PPA) for the supply of renewable energy for the project. The FS assumes a USD 14.3 million capital investment at the start of the project to provide a solar hybrid power plant to ensure power stability. Now that the power load is finalised, the next stage can include negotiations for PPA contracts whilst ensuring the levelised cost of electricity is improved.
- **New vs Reconditioned Mine Equipment** - the FS assumes that the Miriam mining fleet would be purchased new, however given the relatively short life of the Miriam deposit, an assessment of second hand/refurbished open pit mining equipment was undertaken. This study indicated that savings between 30 and 60 % could be achievable by using second hand or refurbished open pit mining equipment. The initial mining equipment capital cost is currently planned at USD 26.4 million.
- **Underground mineable ore** can be accessed from the base of the Miriam Pit which is currently not included in the mine plan. At Miriam, approximately 1.53 Mt of measured and indicated resource at 0.85 kg/t uranium and 0.40 Mt of inferred resource at 0.73 kg/t U, for a total of 1.8 Mlb U_3O_8, would be accessible from portals that could be developed from the base of the Miriam open pit.
- **Reagents –** The FS has assumed all reagents will be sourced internationally and imported to Niger. There is an opportunity for both financial benefits to the project as well as to the Niger economy from working with local reagent supplier.

26 RECOMMENDATIONS

Based on the positive project economics, it is recommended to advance the Madaouela Project to construction and development. The recommended development path is to advance key activities that will reduce project execution time. SRK believe identified project risks are manageable, and there are clear opportunities that can further improve the economic value.

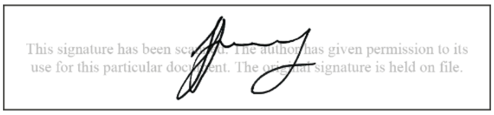
The project exhibits positive economics with the assumed uranium price, currency exchange rates, and consumables pricing. Value engineering should be advanced in anticipation of full project finance in order to de-risk the construction schedule and minimise costs.

From the identified project risks and opportunities, the following were noted as critical actions that have the potential to strengthen the project and further reduce risk and should be pursued as part of the project development plan.

- Use of a Power Purchase Agreement (PPA) for the supply of renewable energy for the project. The FS assumes a USD 14.3 million capital investment at the start of the project to provide a solar hybrid power plant to ensure power stability.
- Inferred Resources – continue with exploration drilling programmes designed to find additional Inferred Resources, and improve confidence in existing Inferred Resources, to convert into higher confidence Measured & Indicated Resources.
- Used equipment – assess options to source quality used equipment that meets the required specifications. Conduct trade-off studies to ensure used pieces of equipment are cost effective to the project.

- Basic & detailed engineering – initiate basic and detailed engineering work to finalise engineering designs and prepare work packages for procurement.

For and on behalf of SRK Consulting (UK) Limited



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SRK Consulting (UK) Limited

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Glossary

Term	Definition
Assay:	The chemical analysis of mineral samples to determine the metal content.
Capital Expenditure:	All other expenditures not classified as operating costs.
Composite:	Combining more than one sample result to give an average result over a larger distance.
Concentrate:	A metal-rich product resulting from a mineral enrichment process such as gravity concentration or flotation, in which most of the desired mineral has been separated from the waste material in the ore.
Crushing:	Initial process of reducing ore particle size to render it more amenable for further processing.
Cut-off Grade (“CoG”):	The grade of mineralised rock, which determines as to whether or not it is economic to recover its metal content by further concentration.
Dilution:	Waste, which is unavoidably mined with ore.
Dip:	Angle of inclination of a geological feature/rock from the horizontal.
Fault:	The surface of a fracture along which movement has occurred.
Footwall:	The underlying side of an orebody or stope.
Gangue:	Non-valuable components of the ore.
Grade (“G”):	The measure of concentration of uranium within mineralised rock.
Hangingwall:	The overlying side of an orebody or slope.
Haulage:	A horizontal underground excavation which is used to transport mined ore.
Igneous:	Primary crystalline rock formed by the solidification of magma.
ICP-MS	Inductively coupled plasma – mass spectrometer; standard analytical technique
Kriging:	An interpolation method of assigning values from samples to blocks that minimizes the estimation error.
Level:	Horizontal tunnel the primary purpose is the transportation of personnel and materials.
Lithological:	Geological description pertaining to different rock types.
LoM Plans:	Life-of-Mine plans.
Material Properties:	Mine properties.
Milling:	A general term used to describe the process in which the ore is crushed and ground and subjected to physical or chemical treatment to extract the valuable metals to a concentrate or finished product.
Mineral/Mining Lease:	A lease area for which mineral rights are held.
Mining Assets:	The Material Properties and Significant Exploration Properties.
Ongoing Capital:	Capital estimates of a routine nature, which is necessary for sustaining operations.
Ore Reserve:	See Mineral Reserve.
Pillar:	Rock left behind to help support the excavations in an underground mine.
RoM:	Run-of-Mine.
Sedimentary:	Pertaining to rocks formed by the accumulation of sediments, formed by the erosion of other rocks.
Shaft:	An opening cut downwards from the surface for transporting personnel, equipment, supplies, ore and waste.
Sill:	A thin, tabular, horizontal to sub-horizontal body of igneous rock formed by the injection of magma into planar zones of weakness.
Stope:	Underground void created by mining.
Stratigraphy:	The study of stratified rocks in terms of time and space.
Strike:	Direction of line formed by the intersection of strata surfaces with the horizontal plane, always perpendicular to the dip direction.
Sulfide:	A vulphur bearing mineral.

Term	Definition
Tailings:	Finely ground waste rock from which valuable minerals or metals have been extracted.
Thickening:	The process of concentrating solid particles in suspension.
Total Expenditure:	All expenditures including those of an operating and capital nature.
Uniform Conditioning ("UC")	A method for estimating the recoverable resource (tonnes and grade) which can be extracted as a series of small selective mining scale blocks ("SMU's") above a defined cut off grade from a larger ordinary kriged block
Uranium units	1.0 per mil = 1000 ppm = 0.10 % eU. And 0.1000 % eU = 0.1179 % eU_3O_8
Variogram:	A statistical representation of the characteristics (usually grade).

Abbreviations and Units

Abbreviation	Unit or Term
%	percent
A	ampere
A/m^2	amperes per square meter
ANFO	ammonium nitrate fuel oil
°C	degrees Centigrade
cfm	cubic feet per minute
CIL	carbon-in-leach
CoG	Cut-off-Grade
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
cfm	cubic feet per minute
Crec	core recovery
CPS	counts per second
°	degree (degrees)
DCF	Discounted cashflow
dia.	Diameter
doh	Direct operating hours
€	Euro
eU	Equivalent uranium assay value; determined radiometrically
eU_3O_8	Equivalent U_3O_8; determined radiometrically
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ft	foot (feet)
ft^2	square foot (feet)
ft^3	cubic foot (feet)
G&A	General and Administrative project costs
g	gram
gal	gallon
g-mol	gram-mole
gpm	gallons per minute
gpt	grams per tonne

Abbreviation	Unit or Term
ha	hectares
HDPE	Height Density Polyethylene
HG	High grade
hp	horsepower
ICP	induced couple plasma
ID^2	inverse-distance squared
ID^3	inverse-distance cubed
IFC	International Finance Corporation
ILS	Intermediate Leach Solution
IX	Ion Exchange
kA	kiloamperes
kg	kilograms
kg/m^3	Kilograms per cubic metre
kg/t eU	Kilograms per tonne of equivalent uranium metal
km	kilometer
km^2	square kilometer
kt	thousand tonnes
ktpa	Kilotonnes per annum
ktpd	thousand tonnes per day
ktpy	thousand tonnes per year
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
kWh/t	kilowatt-hour per metric tonne
L	liter
LG	Low grade
Lps	liters per second
lb	pound
LHD	Long-Haul Dump truck
LLDDP	Linear Low Density Polyethylene Plastic
LoM	Life-of-Mine
m	meter
m^2	square meter
m^3	cubic meter
M lcm	Million loose cubic metres
m/month	Metres per month
masl	meters above sea level
MDA	Mine Development Associates
mg/L	milligrams/liter
Mlb	million pounds
mm	millimeter
mm^2	square millimeter
mm^3	cubic millimeter
MME	Mine & Mill Engineering
Mo	molybdenum

Abbreviation	Unit or Term
MoO_2	Molybdenum oxide
Mt	million tonnes
MTW	measured true width
MW	million watts
m_{vert}/m_{hor}	Vertical metres per horizontal metre
m.y.	million years
NGO	non-governmental organisation
NI 43-101	Canadian National Instrument 43-101
OSC	Ontario Securities Commission
op hr	Machine operating hours
%	percent
PLC	Programmable Logic Controller
PLS	Pregnant Leach Solution
PMF	probable maximum flood
ppb	parts per billion
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
RC	rotary circulation drilling
RoM	Run-of-Mine
RQD	Rock Quality Description
SEC	U.S. Securities & Exchange Commission
s	second
SG	specific gravity
SMU	Selective mining unit
SPT	standard penetration testing
st	short ton (2,000 pounds)
SX	Solvent extraction
t	tonne (metric ton) (2,204.6 pounds)
t eU	Tonnes of equivalent uranium metal
t/doh	Tonnes per direct operating hour
tph	tonnes per hour
tpd	tonnes per day
tpy	tonnes per year
TSF	tailings storage facility
TSP	total suspended particulates
$t_{waste}:t_{RoM}$	Tonnes of waste per tonne of run-of-mine
µ	micron or microns
U	uranium
U_3O_8	Uranium expressed as an oxide; common units by which uranium is sold
USD/kg	US dollars per kilogram
USD/kg U	US dollars per kilogram of equivalent uranium
USD/lb U_3O_8	US dollars per pound of U_3O_8
USD/t	US dollars per tonne
USD/t_{metal}	US dollars per tonne of uranium metal
USD/t_{RoM}	US dollars per tonne of run-of-mine

Abbreviation	Unit or Term
USDk	Thousand US dollars
USDm	Million US dollars
eU_3O_8	Equivalent Uranium as determined by gamma log derivations
V	vanadium
V_2O_5	Vanadium expressed as an oxide; common units by which vanadium is sold
VFD	variable frequency drive
W	watt
XRD	x-ray diffraction
yr	year