ROCHE

In collaboration with:

GENIVAR Golder Associates SGS

NI 43-101 Report

Feasibility Study for the Kipawa Project Temiscamingue Area, Québec, Canada

Submitted to

MATAMEC

Matamec Explorations, Inc.

Prepared by:

Guy Saucier, Eng.
Claude Noreau, Eng.
Pierre Casgrain, Eng.
Philippe Côté, Eng.
Eric Larochelle, Eng.
Michel Bilodeau, Eng.
Roche Ltd, Consulting-Group

Al Hayden, P. Eng.
EHA Engineering

Eric Poirier, Eng.
Michel Garon, Eng.
Genivar

Valérie Bertrand, Geo.
Mayana Kissiova, Eng.
Michel Mailloux, Eng.
Marc Rougier, P. Eng.
Golder and Associates

Yann Camus, Eng.
Gaston Gagnon, Eng.
SGS Canada Inc.

Roche's Ref.: 061623.003

Effective Date: September 4, 2013

Issue Date: October 17, 2013

Date and Signature

This Report entitled "Feasibility Study for the Kipawa Project", issue date October 17, 2013 was prepared and signed by the following authors:

"Signed and dated"
Guy Saucier, Eng.
October 17, 2013

"Signed and dated"
Claude Noreau, Eng.
October 17, 2013

"Signed and dated"
Pierre Casgrain, Eng.
October 17, 2013

"Signed and dated"
Philippe Côté, Eng.
October 17, 2013

"Signed and dated"
Éric Larochelle, Eng.
October 17, 2013

"Signed and dated"
Michel Bilodeau, Eng.
October 17, 2013

"Signed and dated"
Al Hayden, P. Eng.
October 17, 2013

"Signed and dated"
Éric Poirier, Eng.
October 17, 2013

"Signed and dated"
Michel Garon, Eng.
October 17, 2013

"Signed and dated"
Valérie Bertrand, Geo.
October 17, 2013

"Signed and dated"
Mayana Kissiova, Eng.
October 17, 2013

"Signed and dated"
Michel Mailloux, Eng.
October 17, 2013

"Signed and dated"
Marc Rougier, P. Eng.
October 17, 2013

"Signed and dated"
Yann Camus, Eng.
October 17, 2013

"Signed and dated"
Gaston Gagnon, Eng.
October 17, 2013

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Guy Saucier, do hereby certify that:

1 I am currently employed as Vice President, Mining and Mineral Processing at Roche Ltd, Consulting Group, Suite 400, 33, St-Jacques West, Montréal, QC, Canada, H2Y 1K9;

2 I graduated from École Polytechnique, University of Montréal (Montréal, Qc, Canada) with a B. Ing in Geological Engineering in 1983;

3 I am a Senior Geological Engineer, Member of the Ordre des Ingénieurs du Québec (#37711), and a member of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), PDAC and SME;

4 I have worked as a geological engineer in the mineral industry for 30 years. My technical expertise includes resources evaluation, projects evaluation, mine design, and mine planning. I have been involved in several scoping studies and feasibility studies. I have participated in worldwide projects in gold, rare earths, base metals, iron, coal, bauxite and industrial minerals;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I have supervised the development of the technical content in the following sections (1, 2, 4, 5, 21, 25, 26);

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;

9 I participated in the "Preliminary Economic Assessment Study for Kipawa Project" prepared by Roche for Matamec Explorations Inc. and issued on March 14, 2012;

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation;

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Montreal, October 17, 2013

Original signed and sealed

Signed " Guy Saucier "

Guy Saucier, Eng.
OIQ # 37711

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Claude Noreau, do hereby certify that:

1 I am currently employed as Senior Project Manager at Roche Ltd, Consulting Group, Suite 700, 1350 Royale Street, Trois-Rivières, QC, Canada, G9A 4J4;

2 I graduated from Université du Québec à Chicoutimi, (Chicoutimi, Qc, Canada) with a B.Sp. Sc.A. in Electrical Engineering in 1975, from Université de Sherbrooke (Sherbrooke, Qc, Canada) with a Master in Engineering in 1982 and from Université du Québec à Montréal (Montréal, Qc, Canada) with a Master in Business Administration (MBA) in 2002;

3 I am a member of the Ordre des Ingénieurs du Québec (#28953);

4 I have worked as an engineer and manager in the mining and metallurgy industry for 38 years. My technical expertise includes project evaluation, process design, operational general arrangement and maintenance. I have participated in aluminum/alumina, bauxite, iron and, more recently, rare earths projects;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I have a shared responsibility in the development of sections 3, 24 and 25;

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;

9 I have had no prior involvement with Matamec;

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation;

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Trois-Rivières, October 17, 2013

Original signed and sealed

Signed " Claude Noreau "

Claude Noreau Eng., M.Eng., MBA
OIQ #28953

Certificate of Qualified Person

To accompany the Report entitled “NI 43-101 Report - Feasibility Study for the Kipawa Project” dated September 4, 2013.

I, Pierre Casgrain, do hereby certify that:

1 I am currently employed as Senior Mining Engineer, Mining and Mineral Processing at Roche Ltd, Consulting Group, Suite 400, 33, St-Jacques West, Montréal, QC, Canada, H2Y 1K9;

2 I graduated from Laval University (Québec, Qc, Canada) with a B.Sc. A in Mining Engineering in 1988;

3 I am a Senior Mining Engineer, Member of the Ordre des Ingénieurs du Québec (#101321);

4 I have worked as a mining engineer in the mineral industry for 25 years. My technical expertise includes mining production and supervision, reserves evaluation, projects evaluation, mine design, and short and long term mine planning. I have been involved in several scoping studies and feasibility studies. I have participated in worldwide projects in gold, rare earths, base metals and industrial minerals;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have visited the project property on June 13 and 14, 2011;

7 I am responsible for authoring section 15 as well as co-authoring sections 16, 18, 20, 24 and 25;

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101.

9 I participated in the “Preliminary Economic Assessment Study for Kipawa Project” prepared by Roche for Matamec Explorations Inc. and issued on March 14, 2012.

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Montreal, October 17, 2013

Original signed and sealed

Signed " Pierre Casgrain "

Pierre Casgrain, Eng.
OIQ # 101321

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Philippe Cote, do hereby certify that:

1 I am currently employed as Project Manager, Mining and Mineral Processing at Roche Ltd, Consulting Group,1389 Galilee Avenue, Suite 220, Quebec (Quebec), G1P 4G4;

2 I graduated from Laval University (Qc, Canada) with a B.Eng., Materials and Metallurgical Engineering, Extractive Metallurgy/Ore Processing Option in 2002;

3 I am a Metallurgical Engineer, Member of the "Ordre des Ingenieurs du Quebec" (#128326);

4 I have worked as a metallurgical engineer in the mineral industry since my graduation from university. My technical expertise includes plant operation, test work supervision, preparation of mass and metallurgical balances and design criteria, computer modelling and simulation, equipment sizing, and capital and operating estimates. I have been involved in several engineering studies from scoping to feasibility studies and EPCM project. I have participated in worldwide projects in gold, rare earths, base metals and iron ore;

5 I have read the definition of "qualified person" set out in National Instrument 43-101(NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I have participated in the development of the technical content in the following sections: 13, 17, 24, 25;

8 I am independent of the issuer as described in section 1.5 of Regulation Nl43-101.

9 I participated in the "Preliminary Economic Assessment Study for Kipawa Project" prepared by Roche for Matamec Explorations Inc. and issued on March 14, 2012.

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Quebec, October 17, 2013

Original signed and sealed

Signed " Philippe Côté "

Philippe Côté, Eng.

OIQ# 128326

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report - Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Eric Larochelle, do hereby certify that:

1 I am currently employed as Vice President, Specialty Metals & Hydrometallurgy at Roche Engineering Inc., Consulting Group, Suite 502, 9815 Monroe, Sandy, UT, USA, 84070;

2 I graduated from McGill University (Montréal, Qc, Canada) with a B. Eng in Chemical Engineering in 1989;

3 I am a Senior Chemical Engineer, Member of the Ordre des Ingénieurs du Québec (#112819), and a member of the SME;

4 I have worked as a chemical engineer in the mineral industry for 24 years. My technical expertise includes hydrometallurgical process evaluation, projects evaluation and plant design. I have been involved in several scoping studies and feasibility studies. I have participated in worldwide projects in specialty metals, rare earths, base metals and industrial minerals;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I am responsible for co-authoring Sections 13, 17 and 25;

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;

9 I have had no prior involvement with Matamec;

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Sandy, October 17, 2013

Original signed and sealed

Signed " Eric Larochelle "

Eric Larochelle, Eng.
OIQ # 112819

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Michel L. Bilodeau, do hereby certify that:

1 I am a retired (June 2009) Associate Professor from the Department of Mining and Materials Engineering of McGill University, 3450 University St., Montreal, QC, Canada H3A 2A7, and have continued teaching on a contract basis the mineral economics course of the mining engineering program at McGill in the Winter terms of 2010, 2011 and 2012;

2 I am a graduate of Ecole Polytechnique de Montreal with a B.Eng. in Geological Engineering (1970), and of McGill University with a M.Sc. (App.) in mineral exploration (1972) and a Ph.D. in mineral economics (1978);

3 I am a member in good standing of the Ordre des Ingénieurs du Québec (#23799);

4 I have taught continuously in the areas of engineering economy, mineral economics and mining project feasibility studies in the mining engineering program dispensed by McGill University since my graduation from university, and have carried out in the capacity of independent consultant, several assignments related to the economic/financial analysis of mining projects;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience in the mineral industry that includes teaching for more than 30 years and consulting activities over the past 20 years, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I am responsible for authoring section 22 as well as co-authoring sections 3 and 25;

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;

9 I participated in the "Preliminary Economic Assessment Study for Kipawa Project" prepared by Roche for Matamec Explorations Inc. and issued on March 14, 2012.

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.

11 As of the date of this certificate, to the best of my knowledge, information and belief, the parts of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Montreal, October 17, 2013

Original signed and sealed

Signed " Michel L. Bilodeau "

Michel L. Bilodeau, Eng., M.Sc.(App), Ph.D.
OIQ # 23799

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Alfred S. Hayden, do hereby certify that:

1 I am currently President of EHA Engineering Ltd., Consulting Metallurgical Engineers, Box 2711, Postal Station B, Richmond Hill, ON, Canada, L4E 1A7;

2 I graduated from the University of British Columbia (Vancouver, BC, Canada) in 1967 with a Bachelor of Applied Science in Metallurgical Engineering;

3 I am a member of the Canadian Institute of Mining, Metallurgy and Petroleum and a Professional Engineer and Designated Consulting Engineer registered with Professional Engineers Ontario;

4 I have worked as a metallurgical engineer for a total of 46 years since my graduation from university;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I am responsible for co-authoring sections 13 and 25 of the Technical Report;

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;

9 I participated in the "Preliminary Economic Assessment Study for Kipawa Project" prepared by Roche for Matamec Explorations Inc. and issued on March 14, 2012;

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation;

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

October 17, 2013

Original signed and sealed

Signed " Alfred S. Hayden "

Alfred S. Hayden, P. Eng.

GENIVAR

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Feasibility Study for the Kipawa Project", dated September 4, 2013.

I, Michel Garon, do hereby certify that:

1 I am currently employed as the Rouyn-Noranda Office Manager and Senior Mining Engineer by GENIVAR at 152, Murdoch Avenue, Rouyn-Noranda, Quebec, J9X 1E2;

2 I graduated with a Bachelor's Degree in Applied Sciences from the Université de Montréal (Montreal, Quebec) in 1975 and with a Master's Degree from the same university in 1976;

3 I am a registered member of the Ordre des Ingénieurs du Québec (OIQ member no. 28151);

4 I have over 35 years of experience as an engineer in the mining industry. My experience has been acquired mostly with Noranda in various technical and management positions in mining and smelting operations. I have been working with GENIVAR since June 2006 as Senior Mining Engineer and was involved in a number of pre-feasibility and feasibility studies for base metal and gold mining projects;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I was responsible for the production of the following sections of the report: 24.2.1, 24.2.2, 24.2.3, 24.2.4, 24.2.5 and 25.15;

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;

9 I have not had any prior involvement with Matamec;

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation;

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Rouyn-Noranda, September 4, 2013

Original signed and sealed

Signed "Michel Garon"

Michel Garon, Eng., M.A.Sc.
OIQ # 28151

GENIVAR

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Eric Poirier, do hereby certify that:

1 I am currently employed as the Director of Electricity and Control – Industrial Mining by GENIVAR Inc., 1075, 3rd Avenue East, Val-d'Or, QC, J9P 0J7;

2 I graduated from Université du Québec à Chicoutimi (Chicoutimi, Qc) with a B. Ing in Electrical Engineering in 1996 and a B.Ing, in Computer Science Engineering in 1997;

3 I am a registered member of the Ordre des Ingénieurs du Québec (OIQ #120063), the Professional Engineers Ontario (PEO #100112909), the Association of Professional Engineers and Geoscientists of the Province of Manitoba (APEGM #33233) and the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists (NAPEG #L2229);

4 I have worked as an electrical engineer in the mining industry for 15 years. My technical expertise includes electrical distribution, cost estimation, automation and instrumentation. I have been involved in many scoping studies and feasibility studies. I have participated in worldwide projects as Electrical designer or as multidisciplinary project manager;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have not visited the project property;

7 I was responsible for the production of the following sections of the report : 17.5 to 17.11, 18 (except 18.1.1 and 18.1.13) and 25.7 to 25.9;

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;

9 I have had no prior involvement with Matamec;

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation;

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Val-d'Or, October 17, 2013

Original signed and sealed

Signed "Eric Poirier"

Eric Poirier, Eng.
OIQ # 120063

CERTIFICATE OF AUTHOR

Valérie Johanne Bertrand

To accompany the report entitled, "NI 43-101 Technical Report Feasibility Study for the Kipawa Project". Submitted to Matamec Explorations Inc. dated September 04, 2013, I, Valérie J. Bertrand, géo., do hereby certify that:

1. I am an Associate and Senior Geochemist employed at Golder Associates ltd. located at 32 Steacie Drive, Kanata Ontario. K2K 2A9, Canada.
2. I graduated with a Bachelor of Science degree in Geology from the University of Ottawa in Ottawa, Ontario in 1991 and have a Master of Applied Science degree in Mining Engineering from the University of British Columbia in Vancouver, B.C. which I obtained in 1999.
3. I am a registered Professional Geoscientist in Ontario (membership number 1458) and am also a member in good standing of l'Ordre des Géologues du Québec (membership number 1221) and of the Association of Professional Engineers, Geologists and Geophysicists of the Northwest Territories (membership number L1811).
4. I have worked as a geoscientist since my graduation from the University of Ottawa. For the past 14 years I have been employed with Golder Associates Limited. During this period I have fulfilled the role of geochemist on mining projects directing and completing environmental geochemistry investigations on mine wastes, soils and water. I currently hold the position of Associate, Senior Geochemist.
5. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purpose of NI 43-101.
6. I visited the property in October 2012 for the purpose of carrying out the environmental geochemistry testing program. During this visit, I viewed the proposed open pit mine location, discussed the geology of the deposit with the Matamec project geologist, viewed rock samples of each rock type and ore type and collected samples for geochemical analysis.
7. I am responsible for Sections 20.4.2, 20.5.1.4 and 20.5.2.4 of the Technical Report.
8. I am independent of the Issuer as described in Section 1.5 of NI 43-101.
9. I have been involved in baseline studies on geochemistry for the project and have authored the Draft Geochemistry Baseline Report dated May, 2013.
10. I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.
11. As of the date of this certificate, to the best of my knowledge, information and belief, the portions of the Technical Report for which I am responsible contain all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading;
12. I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Dated this 17th day of October, 2013

Original signed and sealed

Signed "Valérie J. Bertrand"
Valérie J. Bertrand, Géo. M.A.Sc.
Associate, Senior Geochemist

CERTIFICATE OF AUTHOR

Mayana Kissiova

To accompany the report entitled, "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013, submitted to Matamec Explorations Inc. on October 17, 2013, I, Mayana Kissiova, Eng. (Qc), do hereby certify that:

1. I am an Associate and Senior Tailings Management Engineer employed at Golder Associés Ltée, 1001, Boul. de Maisonneuve West, 7th floor, Montréal, Québec, Canada, H3A 3C8.
2. I graduated from the University of Civil Engineering and Architecture, Sofia (Bulgaria) with an Engineering degree in civil engineering in 1992 and from the Ecole Polytechnique de Montréal (Qc, Canada) with a Master in Engineering degree in 1995.
3. I am a Senior Tailings Management Engineer, Member of the Ordre des Ingénieurs du Québec (# 110 251).
4. I have worked as an engineer in the tailings management field for 18 years. My technical expertise includes geotechnics, tailings management and dyke design. I have been involved in several scoping, pre-feasibility and feasibility level studies.
5. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purpose of NI 43-101.
6. I visited the property in August 2012 for the purpose of carrying the site selection study and the subsequent geotechnical field investigation.
7. I have supervised the development of the technical content in the following sections: 17.1; 18.1.1; 20.4.1, 20.4.3.2, 20.5.1.1, 20.5.1.2 through 20.5.1.3, 20.5.1.5, 20.5.1.6, 20.5.2.1 trough 20.5.2.3, 20.5.2.5 trough 20.5.2.8, 20.6, 20.7; 25.10, 25.11, 25.12 and 25.13.
8. I am independent of the Issuer as described in Section 1.5 of NI 43-101.
9. I have been involved in the technical studies on tailings management for the project and have authored the Draft Tailings Management Reports issued between July and September 2013.
10. I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.
11. As of the date of this certificate, to the best of my knowledge, information and belief, the portions of the Technical Report for which I am responsible contain all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading;
12. I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Dated this 17th day of October, 2013

Original signed and sealed

Signed "Mayana Kissiova"
Mayana Kissiova, Eng. (Qc)
Associate, OIQ # 110 251

Golder Associates

CERTIFICATE OF AUTHOR

Michel Mailloux

To accompany the report entitled, "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4th, 2013, I, Michel Mailloux, Eng., P.Eng., do hereby certify that:

1. I am an Associate and Hydrogeologist employed at Golder Associates ltd. located at 32 Steacie Drive, Kanata Ontario. K2K 2A9, Canada.
2. Graduated with a Bachelor of applied Science in Geological Engineering from the Laval University in Quebec City, Quebec in 1998 and have a Master of Earth Science degree in Hydrogeology from the Quebec University – INRS Georessources Quebec City, Quebec which I obtained in 2002.
3. I am a registered Professional Engineer in Ontario (membership number *100200796*) and am also a member in good standing of l'Ordre des ingénieurs du Québec (membership number 126263).
4. I have worked as a hydrogeologist since 2000. For the past 10 years I have been employed with Golder Associates Limited. Since 8 years, I have fulfilled the role of hydrogeologist on mining projects directing and completing hydrogeological investigations and studies on new mine development and tailing management facilities. I currently hold the position of Associate, Hydrogeologist.
5. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purpose of NI 43-101.
6. I visited the property in August 2012 for the purpose of preparing the environmental baseline studies, pit slope and tailing facilities investigations.
7. I am responsible for sections 16.2.1, 20.1, 20.2, 20.3, 20.4.6, 20.5.1.7, 20.5.2.9, 20.8, 25.1, 25.2, 25.4.5, 25.10 and 25.11 of the Technical Report.
8. I am independent of the Issuer as described in Section 1.5 of NI 43-101.
9. I have been involved in baseline environmental studies for the project and lead the hydrogeological investigations/studies of the pit and tailing management facilities areas.
10. I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.
11. As of the date of this certificate, to the best of my knowledge, information and belief, the portions of the Technical Report for which I am responsible contain all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading;
12. I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Dated this 17th day of October, 2013

Original signed and sealed

Signed "Michel Mailloux"
Michel Mailloux, Eng., P.Eng. M.Sc.
Associate, Hydrogeologist

Golder Associates

CERTIFICATE OF AUTHOR

Marc Rougier

To accompany the report entitled, "NI 43-101 Technical Report Feasibility Study for the Kipawa Project dated September 4th, 2013, I, Marc Rougier, P.Eng, do hereby certify that:

1. I am a Principal e and Senior Geological Engineer employed at Golder Associates Ltd. located at 6925 Century Avenue, Suite #100, Mississauga, Ontario, Canada L5N 7K2.
2. I graduated with a Bachelor of Applied Science degree in Geological Engineering, Geotechnical option, from Queen's University at Kingston, Ontario in 1991.
3. I am and have been a registered Professional Engineer in Ontario (membership number 90423880) since 1995. I am also registered in the Northwest Territories and Newfoundland and Labrador.
4. I have worked as a geotechnical and rock mechanics engineer t since my graduation from Queen's University. For the past 16 years I have been employed with Golder Associates Limited. During this period I have fulfilled the role of geotechnical engineer on mining projects directing and completing slope stability assessments, designs and remedial measures for studies, operations and closure. I currently hold the position of Principal, Rock Engineering Group.
5. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purpose of NI 43-101.
6. I have not visited the property.
7. I am responsible for the engineering geology and rock slope design aspects of Sections 16, 20 and 25 of the Technical Report.
8. I am independent of the Issuer as described in Section 1.5 of NI 43-101.
9. As a consulting engineer I have been involved in rock slope engineering open pit slope design studies and the provision of slope design recommendations for the past 20 years.
10. I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.
11. As of the date of this certificate, to the best of my knowledge, information and belief, the portions of the Technical Report for which I am responsible contain all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading;
12. I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Dated this 17th day of October, 2013

Original signed and sealed

Signed "Marc Rougier"

Marc Rougier, P. Eng.
Principal, Senior Geological Engineer, Rock Engineering Group

Golder Associates Ltd.
6925 Century Avenue, Suite #100, Mississauga, Ontario, Canada L5N 7K2
Tel: +1 (905) 567 4444 Fax: +1 (905) 567 6561 www.golder.com

SGS

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Yann Camus, do hereby certify that:

1 I am project engineer with SGS Canada Inc. - Geostat with an office at 10 Blvd Seigneurie East, Suite 203, Blainville, Quebec, Canada, J7C 3V5;

2 I am a graduate from École Polytechnique de Montréal in 2000;

3 I am an engineer and a registered member of the Ordre des Ingénieurs du Quebec (#125443);

4 I have worked as a geological engineer continuously since my graduation from university. My technical expertise includes resources evaluation. I have been involved in several resource, pre-feasibility and feasibility studies as well as preliminary economic assessments. I have participated in worldwide projects in rare earths, rare and base metals, iron, bauxite and industrial minerals;

5 I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;

6 I have visited the Property on November 10 and 11, 2008 and on July 3 and 4, 2012 for the gathering of independent samples, the verification of drill holes locations and inspection of the area;

7 I have supervised the development of the technical content in the following sections (6, 7, 8, 9, 10, 11, 12, 14, 23 and 25);

8 I am independent of the issuer as described in section 1.5 of Regulation NI 43-101.

9 I have been involved in 2007 on work related to the mineral property. I conducted relative density measurements of core samples sampled to the project. I have not visited the project site during that occasion. I participated in the preparation of a Resource Report for the project in 2010. I participated in the "Preliminary Economic Assessment Study for Kipawa Project" prepared by Roche for Matamec Explorations Inc. and issued on March 14, 2012.

10 I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation.

11 At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;

12 I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Blainville, October 17, 2013

Original signed and sealed

Signed "Yann Camus"

Yann Camus, Eng.

OIQ # 125443

SGS

Certificate of Qualified Person

To accompany the Report entitled "NI 43-101 Report – Feasibility Study for the Kipawa Project" dated September 4, 2013.

I, Gaston Gagnon, do hereby certify that:

1. I am a mining engineer with SGS Canada Inc. - Geostat with an office at 10 Blvd Seigneurie East, Suite 203, Blainville, Quebec, Canada, J7C 3V5;
2. I am a graduate from Laval University of Quebec City in 1964;
3. I am an engineer and a registered member of the Ordre des Ingénieurs du Quebec (#15918);
4. I have worked as a mining engineer since my graduation from university. My technical expertise includes underground and open pit mining, projects design and evaluation. I have been involved in several preliminary and pre-feasibility economic assessments. I have participated in Canadian rare earths project, base metals and industrial minerals;
5. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;
6. I have not visited the Property.
7. I have supervised the technical content of section 19, and I collaborated to the content of sections 3 and 25.
8. I am independent of the issuer as described in section 1.5 of Regulation NI 43-101;
9. I have had no prior involvement with Matamec;
10. I have read Regulation NI 43-101 and the Technical Report has been prepared in compliance with this Regulation;
11. At the effective date of the Technical Report, to the best of my knowledge, information and belief, the part of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading;
12. I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

Blainville, October 17, 2013

Original signed and sealed

Signed "Gaston Gagnon"

Gaston Gagnon, Eng.
OIQ # 15918

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1.0 SUMMARY

The following report is a NI 43-101-compliant Feasibility Study Report (Report) on the Kipawa Joint Venture (JV) Heavy Rare Earth Project. The JV partners are Matamec Explorations, Inc. (Matamec) and Toyota Tsusho Corp. (TTC). Matamec is a junior mining exploration company whose main focus is in developing the Kipawa heavy rare earths deposit and exploring over 35 km of strike length in the Kipawa Alkalic Complex for rare earths mineralization on its Zeus Property.

Matamec has retained Roche Ltd, Consulting Group (Roche), GENIVAR Inc. (Genivar), Golder Associates (Golder) and SGS Geostat (SGS), among others (the Authors) to prepare a Feasibility Study Report on the Kipawa deposit.

The Report effective date is September 4th, 2013.

Among the recommendations proposed and the additional upside opportunities for the Kipawa Deposit, it is important to mention that even if a first metallurgical pilot plant testwork program was performed in the second half of 2012, it is necessary to conduct a second metallurgical pilot plant testwork program in addition to the bench scale testwork conducted up to now. This pilot plant testwork will be an important step to confirm the final sizing of few equipment and the optimization of reagent consumption prior to detailed engineering. The second pilot plant will also help to confirm improvements in regards to the recovery rates since conservative numbers were used for this study.

1.1 Project Description

The Kipawa deposit is located on the Zeus Property, 50 kilometres east of the town of Temiscaming and 140 kilometres south of Rouyn-Noranda, Quebec. All claims are 100% owned by Matamec and are in good standing. Resources are not subject to any third party royalties.

Figure 1.1 - Location Map (modified from Google Maps)

Access to most parts of the property is provided by a network of logging roads of variable quality. The towns of North Bay, Temiscaming and the municipality of Kipawa are all connected by well-maintained paved roads and Temiscaming is, in addition, linked to North Bay, Sudbury, Pembroke and Smith Falls via a railroad operated by Ottawa Valley Railway.

The Kipawa mining site will consist of the open pit mine, a waste dump, a low grade stockpile and a high grade truck loading facility. The mine equipment maintenance facility will be also located at the mine site. A 10 km haul road will be built to bring the ore to the metallurgical site. The metallurgical site will consist of the ore process plant which will combine the crushing, grinding, magnetic separation and hydrometallurgical circuits. There will be two dry tailing storage facilities; one storage facility will be for the rejects of the magnetic separation located just by the process plant and one other storage facility for the hydrometallurgical tailing located about 4 km south of the process plant. The administration office, assay laboratory and warehouse will also be located on the metallurgical site. The employee's parking and the main electrical sub-station will be located near the town of Temiscaming.

The ore deposit is defined by three enriched horizons within the "Syenite Complex", which contains the REO (Light Rare Earth Oxides: La_2O_3, Ce_2O_3, Pr_2O_3, Nd_2O_3 and Sm_2O_3; Heavy Rare Earth Oxides: Eu_2O_3, Gd_2O_3, Tb_4O_7, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3 and Lu_2O_3; and Y_2O_3). The total ore tonnage of the mine is 19.8 million tonnes. With the current measured and indicated resources, the project is scheduled for 15.2 years excluding a two year pre-production period to remove the overburden and level the top of the pit and the construction of the ore process plant and related infrastructure. There is potential for the addition of future resources which could increase this life span.

1.2 Geology, Mineral Resource and Mineral Reserves

The Kipawa Alkaline Intrusive Complex of peralkaline syenite and granite is less than 200 metres thick. It's an elongated, V-shaped body folded around a major southeast plunging anticline. The west limb of this fold includes the Kipawa deposit, which is entirely included within the lower syenite layer of the complex. This mineralized syenite layer is a concordant sheet 50 to 80 meters thick that gently dips 20 to 30 degree to the south-west. The deposit outcrops over 1.4 km along strike with an additional outcrop discovered 220 m to the north-west during the summer 2011 exploration campaign.

Rare earth-yttrium-zirconium mineralization at the Kipawa deposit is contained in medium grained silicate minerals. Grains are distinct and generally well crystallized. Three minerals are presently considered economical in the Kipawa deposit, namely eudialyte (a sodic silicate), yttro-titanite/mosandrite (titanite silicate) and britholite (calsic silico-phosphate) for the rare-earth and yttrium, with minor amounts of apatite also present. Vlasovite/gittensite (sodic silicates) and eudialyte (sodic silicate) are also considered for a potential zirconium by-product.

Three vertically-stacked mineralized zones have been defined based on their spatial characteristics: the Eudialyte (60% of existing rare earth-yttrium resources), Mosandrite (25% of existing rare earth-yttrium resources) and Britholite (15% of existing rare earth-yttrium resources) zones. Despite their name, the different zones contain a mix of the potentially economic minerals. The name simply indicates the dominant REE mineral present in that zone. The main Eudialyte zone, for example, consists of intermixed eudialyte (51%) and mosandrite/yttro-titanite (39%) with trace britholite (10%). It sits near the top of the syenite body and is not associated with any large calco-silicate horizon. Note that all zones outcrop at surface.

Uranium and thorium, while present, are considered contaminants in the main REE-Zr mineralization. Average values of Th (193 ppm, i.e. 0.019%) and especially U (22 ppm, i.e. 0.002%), though higher than the surrounding rocks, remain low in the mineralized syenite portion of the Kipawa deposit. Initial results suggest that most of the thorium is contained in coarse-grained urano-thorite and ekanite crystals while the uranium is disseminated within said urano-thorite and rare-earth minerals.

1.2.1 Mineral Resources

The terms "mineral resource" and "mineral reserve" is defined by the Canadian Institute of Mining, Metallurgy and Petroleum as the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM council.

The Kipawa Deposit resource are 10,478,000 tonnes at 0.46% TREO in the measured category, 13,379,000 tonnes at 0.36% TREO in the indicated category and 3,268,000 tonnes at 0.31% TREO in the inferred category. The total of measured and indicated resource now stands at 23,857,000 tonnes at 0.41% TREO representing 88% of the total resource. These results are at a 0.2% TREO cut-off and are not limited by an open pit. The overall total tonnage is about 10% greater than the last resource (see press releases dated June 30 and July 7, 2011).

The Kipawa deposit's mineral resource estimates were updated by SGS Canada – Geostat. The drilling done since the 2011 PEA (see press release dated January 30, 2011) totaling 14,293 m was included and permitted to outline some measured resources for the first time in the history of the project. The database now totals 293 drill holes totaling 24,571 and 13 trenches totalling 631 m. Historical Unocal holes are not in the count and were not used for the estimates. The mineralized zones were interpreted on vertical sections and meshed into volumes as per industry standards. Ordinary kriging was used to estimate the block model with block size set at 10 m x 5 m x 5 m. The measured and indicated resources required drill grids of 25 m and 50 m respectively. Resources extrapolated beyond 30 m of those drill grids are considered inferred.

1.2.2 Mineral Reserves

Table 1.1 - In-Pit Mineral Reserves and Grade

In-Pit Mineral Reserves	Metric Tonnes (t)
Proven (51.7% of the deposit)	10,221,000
Probable (48.3% of the deposit)	9,548,000
Total Proven and Probable	19,769,000
Total Grade	**Percent (%)**
La_2O_3	0.0588
Ce_2O_3	0.1195
Pr_6O_{11}	0.0146
Nd_2O_3	0.0550
Sm_2O_3	0.0123
Eu_2O_3	0.0015
Gd_2O_3	0.0119
Tb_4O_7	0.0022
Dy_2O_3	0.0147
Ho_2O_3	0.0032
Er_2O_3	0.0101
Tm_2O_3	0.0016
Yb_2O_3	0.0096
Lu_2O_3	0.0013
Y_2O_3	0.0943
TREO	0.4105

By using SGS Geostat model, the mineral reserve for this FS was prepared, estimated and supervised by Roche using a cut-off value of $48.96/t with 5% dilution and a mining recovery of 95.2%. The Kipawa open-pit design utilized a marginal (or milling) cut-off value of $48.96/t and a break even cut-off value of $60.70/t. Included in the reserves are 632,000 tonnes of low grade material lying between these 2 cut-offs values. This material will be sent on a low grade stockpile, close to the mine site, and will be processed at the end of the operation after mine depletion.

1.2.3 Design Basis

The Total Rare Earth Oxides (TREO) diluted grade is 0.4105% including a Dysprosium (Dy_2O_3) diluted grade of 0.0147%. The recoveries for each element vary from 65% to 74% for a TREO average of 70% for the 10 main REO which are (La_2O_3, Ce_2O_3, Pr_2O_3, Nd_2O_3, Sm_2O_3, Eu_2O_3, Gd_2O_3, Tb_4O_7, Dy_2O_3 and Y_2O_3). A total production of TREO is expected to be 55,529 tonnes over the mine life. When the mine will be in full production an average of 3,760 tonnes per year of TREO will be produced.

1.3 Open Pit Mining

The mine will produce an average of 1,332,250 tonnes of ore per year (3,650 tonnes per day) and has an average stripping ratio (waste:ore - without the overburden) of 0.94 with a mine life of 15.2 years. A standard 55 tonnes mining truck and shovel operation will bring the drilled and blasted material out of the mine to their respective destinations (waste dump, low grade stockpile or high grade loading facility). Off Road haulers will transport the ore to crushing facility.

One (1) front wheel loader with a bucket size of 5.25 m³ will be used for production. The selected front wheel loader will load three (3) 55-tonne mine trucks.

At the high grade ore loading facility located at the mine site, an excavator with a 6.5 m³ bucket size will re-handle the ore and load eight (8) 40-tonne road haulers. A second excavator will be available for replacement at the mine site, if required. Mining ramps and roads will have a width of 20.7 m and a maximum gradient of 10% which respects regulations for 2-lane traffic in all seasons.

The open pit mine is designed to be mined with a double benching arrangement and includes a 14 m bench for every 60 m of vertical height which does not intersect the ramp. The mining will take place between elevation 370 and 245 on 5 m benches to minimize the dilution and to maximize the mining recovery. The dilution and the ore loss per block were estimated at 5% and 4.8%, respectively. This level of dilution and ore loss is consistent with the North American mining industry.

The mining plan completed by Roche includes 19.769 million tonnes of ore at 0.4105% of TREO and requires the removal of 1.3 million tonnes of overburden and 18.7 million tonnes of waste rock resulting in a life-of-mine stripping ratio (W:O) of 0.94 to 1. It is anticipated to remove all of the overburden during the pre-production period.

The mining plan will produce 55,500 tonnes of TREO for the entire mine life averaging more than 3,650 tpd of TREO during the full production years (Years 2 to 14). The main revenue contributors are dysprosium oxide, followed by neodymium oxide, yttrium oxide, and terbium oxide.

After pre-production overburden stripping, the first production phase will consist of mining higher grade ore in order to reduce the payback period. The second and final phase will consist of mining the remaining ore while focusing on completing the eastern pit, so it can be used to store 1.7 Mm^3 of waste material until the end of the mine life.

The ramp up production for the first year has been considered at 66% of the average annual production tonnage.

1.4 Mineral Processing

Given the objective to produce a final grind P_{80} around 850 microns, with minimal fines and the relatively low ore impact strength, it seemed unnecessary to consider two stages of grinding. Instead the focus was on utilizing crushing and screening as much as possible, with one stage of grinding. The simulations of 4 main options indicate that a 2- or 3-stage crushing circuit (2-stage crushing plant was chosen for this study after optimization with Sandvik) followed by a rod mill provides the best option, expected to deliver the maximum product yield in the target size range.

Magnetic separation tests was performed in May 2012 at both Eriez and Outotec installation on each size fraction individually as well as mixed together. The SLon magnetic separation supply by Outotec shows much more promise and produces a better separation than Eriez Wet High Intensity Magnetic Separator (WHIMS). Results show that the fines fraction does not recover as well as the middle and coarse fraction. The coarse and middle size fractions show a recovery of over 90% but fines (-75 µm) are at only 70%. For the SLon magnetic wet separation, the process recommended by Outotec is a low gauss rougher, followed by a cleaning of the magnetics. The cleaned highly magnetic stream is the magnetic wastes. The low gauss tail is directed to the second pass high gauss magnetic separation. The magnetic portion from this second pass is the RE mineral concentrates. Outotec recommends the following operating condition with their SLon separators:

- Stage 1: 0.2 to 0.3 Tesla, 300 pulse/min, 3 mm matrix;
- Stage 2: 1 Tesla, 25 pulse/min, 3 mm matrix.

Beneficiation pilot plant was operated at SGS Mineral Services at Lakefield in May-June 2012. An overall recovery of 77.4% Y was achieved in 40.8% of the mass, including the fines. Recoveries were gradually increasing towards the end of the operation, and the best separation achieved was 83.6% Y recovery in the same 40.8% mass.

By end of 2012, more testwork on Magnetic separation was performed on variability sample and global composite. Dry, WHIMS and SLon magnetic separation were performed, with the objective of comparing all 3 methods side-by-side with the same material. Overall, 79% Y recovery in 40% of the mass was obtained with the global composite for dry testing. In comparison, only 72% in 40% of the mass was obtained with the WHIMS testwork on global composite. SLon provided the best recovery out of the three with 80% Y recovery in 40% of the mass.

The global composite was tested with varying magnetic intensity and pulse rate on the SLon separator. It was found that a 0.3 T and 300 rpm pulse rate provides the best rejection of magnetic materials as a first pass. With the materials generated from the first pass, the high intensity second pass was tested again with varying conditions. The optimum condition for the second pass is found to be 1 T and 25 rpm. The SLon results are then plotted on a curve to determine correlations between head grade, mass pull and overall recovery of the 2 SLon passes. From the Recovery vs. Grade curve (Figure 13.9), the head grade has minimal effect on the Y recovery through the SLon separator. The correlation is much more pronounced between the Recovery and the Mass Pull (Figure 13.10). With the curves, it is possible to conclude that with a head grade of 0.075% Y, which is similar to the Global composite and to the average life of mine ore, a recovery of 82.5% Y in 45% mass is achievable with the SLon.

Testwork were conducted at Outotec with a SLon unit on the magnetic separation tails collected from the first stage low intensity separator contains as high as 5.5% REE losses in 11% of the mass rejected. The cleaning SLon unit was operated at 0.4 T intensity and 300 rpm pulsation using a 3mm matrix. In spite of the result being based on limited tests and is un-optimised, it shows a positive recovery in recovering the lost REE. By allowing the recovered stream to be combined with the low intensity non-mag stream, and then process them together into the high intensity magnetic separation, an improvement of 3.2% recovery can be achieved with an additional 2.3% mass. In doing so, the overall recovery of the beneficiation circuit can be increased to 85% in 45% mass.

1.5 Process Plant

The process plant feed design is 1,332,250 tonnes of ore per year or 3,650 tonnes of ore per day.

The bulk material conveyed by trucks from the open pit will be discharged at the primary crushing area. The crushing system will be an open loop type, with a primary and a secondary crusher. The primary crushing will take place in the primary crushing building. The bulk material will go through various mechanical equipment such as a rock breaker, a grizzly screen, a dump hopper apron feeder, a roll crusher and then will be directed to the secondary crushing building via conveyor #1. Once the material has reached the secondary crushing area, the oversize material will go through various equipment such as a screen, a surge hopper, a vibrating feeder and then a cone crusher. After the material has gone through the secondary crushing building, it will be conveyed via conveyor #2 to the crushed ore storage silo. Throughout the crushing process, dust collection installed in appropriate locations, will recover dust produced. The storage silo will have a storage capacity of 18 hours at a production rate of 3,650 tonnes per day, with a live capacity is 1,558 m³ (2,804 tonnes @ 1.8 SG).

The crushed ore will be conveyed to the process plant directly in the grinding circuit. The entire process plant building dimensions will be 133.3 m long, 60 m wide with a height of 25 m (under the trusses). The grinding circuit will have one rod mill, classifier, a set of cyclones and two pumps (one in operation and one spare) to feed the cyclones. The magnetic separation area will be located next to the grinding circuit and will include 5 magnetic separators with a possibility of 6 if required.

In another area of the building, there will be tanks for leaching, re-pulping, neutralization and precipitation, filters, a thickener, the required pumps and sump pumps. Reservoirs will also be there for reagents storage and distribution. Outside the building there will be thickeners, fresh and process water tanks as well as chemical reactive storage (limestone, lime, sulfuric acid, sodium carbonate, etc.).

1.5.1 Fresh and Process Water Distribution

A tank will be installed to provide the process plant with fresh water for different applications. The total capacity of the tank will be 1,835 m³. From the pump house (area of 80 m²), the water flow will be split and will go to different locations. Part of the water will be directed to a potable water treatment location. The other part will be used for the crushing, the ore storage and the process plant operations. Also, part of the water within that tank will be used for process plant fire protection.

1.5.2 Electrical and Building Services

No plumbing will be installed in the crusher shelters to feed domestic water. A dry type toilet will be available for the operator. Two air exchangers (4000 & 10000 CFM) will be put in with an electric heating coil for each shelter. Ventilation hoods will be installed for each of the crushers. The shelters will be heated by electric unit heaters.

In the process plant building, plumbing will be put in to provide water and drainage to the offices' bathrooms, to hands washing stations in the electrical and mechanical shops and to 5 emergency showers in the plant with floor drainage. An air conditioning unit will be installed on the roof top of the building for the main offices, the wet lab as well as the control room. Other units will provide air conditioning to the room containing the computer servers and the offices of the electrical and mechanical shops. Heating will be provided by electric baseboards for the offices, the wet lab and the control room; electric unit heaters will be used for the electrical room and electric coils will be installed in the shops. The plant area will be heated by a glycol water unit heater system.

Appropriate fire protection systems will be installed in both crushing areas and process plant.

Power distribution will be provided to the main offices through one 120/208 V panel, 3 phases. For the plant area, four 600 V panels, 3 phases, will be installed with two 600/120/208 V transformers and four 120/208 V panels, 3 phases.

1.6 Project Infrastructure

Access to the Kipawa Deposit is provided by a network of logging roads of variable quality leading to the nearest town of Temiscaming, Quebec. Temiscaming is located some 50 km west of the property. It is a small pulp and paper town (pop. 3,000) where a Tembec dissolving pulp and chemical by-product mill is located and employs over 950 people. It provides access to the Hydro-Quebec electric grid. North Bay (pop. 55,000) is the nearest large town, located 68 km to the south west of Temiscaming. It has the largest airport north of Toronto and is connected to Temiscaming and the larger metropolitan centres in Ontario and Quebec by a good highway and railway. Mining services are found in the Sudbury, Rouyn-Noranda and Val d'Or mining communities.

In this study, it is planned to build a power line 44 kV along the logging Maniwaki Road to provide power to the mining and processing facilities.

About 55 km of the Maniwaki Road will be used for the project and share with public and other logging companies. Then a four kilometer road will be built to reach the process plant site where the mill, administration and service building, a warehouse and a cold storage building can be found. The magnetic separation reject storage area is located also beside the process plant.

From the process plant site a 10 km road will be built to link the mine site where the open pit, waste rock storage area, ore stockpile and maintenance shop for the mining equipment can be found.

The last location to be developed will be the hydrometallurgic tailings storage facility which is located about 4 km south of the process plant site.

1.6.1 On-Site Infrastructure

1.6.1.1 Power

A 44 kV substation will be installed near the process plant for electrical distribution. Three transformers will distribute power to the process plant main electrical room. Three 750 kW diesel generators will also be installed on-site to deal with emergencies and will feed the 44 kV network with a step-up transformer. The cost of power is estimated at 5.97 ¢/kWh.

1.6.1.2 Process and Fresh Water

A pumping station will pump fresh water to the garage through a 2.875 km insulated and heat traced pipeline from Sheffield Lake. The nominal capacity of this pumping station will be 9 m^3/h. For that purpose, a building and an electrical room will be erected at that location. The water fed to the mine will not be treated. Therefore, potable water will be provided through water fountains.

The plant site fresh water will be provided by a pumping station located on the shore of the Des Jardins River. The total fresh water pumping capacity to the site will be 270 m^3/hr, of which, about 160 m^3/hr will be consumed by the process plant in normal operation. For that purpose, a building and an electrical room will be erected at that location. The water to the plant site (administration building, process plant, etc.) will be treated in a modular system installed in a container before being consumed.

The pumping system is designed with much emphasis given to easy maintenance and repair of equipment in order to reduce to a minimum the interruption of water supply to the entire site. Spare equipment is included in to address this issue.

For both mine site and process plant fresh water tanks, there will be water capacity allocated to fire protection. The lower section of the tank will be kept for that purpose, representing around 820 m^3 for the plant site and 220 m^3 for the mine site.

Tailings water drainage will be captured in a settling pond and tailings thickener overflow will be stored in a tank before being pumped through a 5.37 km pipeline to be reused as process water in the process plant. The total pumping capacity will be 225 m^3/hr.

1.6.1.3 Site Roads and Surface Pads

The on-site roads will give access to the following areas:

- Process plant facility & surrounding buildings;
- Open pit;
- Garage;
- Pumping stations;
- Tailings disposal area;
- Magnetic separation rejects disposal.

The width of the road between the plant and the open pit mine will be 11.6 m over a total length of about 10 km. A 65.5 m Acrow Panel bridge, single span, will be built on that road in order to cross the Kipawa River.

All surface water on the surface pad of the garage mine at site and the plant site will be managed. The surface water will flow to the peripheral drainage ditch and the ditch will discharge at the lowest point to a treatment pond. To prevent surface water to flow into the open pit and waste dump, a water drainage ditch will be dug around the open pit and waste dump to evacuate water to the treatment pond. Surface water in the open pit and at the garage site will also be evacuated into the treatment pond.

1.6.1.4 *Solid Waste, Water Treatment and Management*

At the mine site, waste water will be treated (from domestic usage only) through a BIONEST standard system. For the plant site, this will be done via a BIONEST - KODIAK turnkey system, located in a container which will allow for disinfection and phosphate removal before being returned to the environment.

Solid waste will be removed from the site by a contractor on a regular basis.

1.6.1.5 *Fuel Storage and Distribution System*

Fuel storage facilities will be in place at both plant and mine sites. Both will have a concrete slab for the vehicle filling area, concrete blocks to protect the installation and a membrane to recover any spill in the storage area. At the plant site, the fuel storage will include two diesel reservoirs of 50,000 litres each, for power generation and haulage trucks, and a gasoline reservoir of 10,000 litres for small vehicles and other equipment. At the mine site there will be three diesel tanks of 50,000 litres each, used for the mine fleet.

1.6.1.6 *Fence, Roads and Parking at Témiscaming and Plant Site*

A fence will be put in place at both mine and plant sites for a length of 700 m around the mine site garage and 1.65 km around the plant site. Access road between these sites will not be fenced. A parking lot will be available for a total of 150 vehicles near Témiscaming and from there, employees will be transported by bus to both plant and mine sites. At the plant site, there will be a parking lot for about 120 vehicles and two 53 ft vans.

1.6.1.7 *Security and Telecommunications*

The security officers, who will control the site access, will be located in a gatehouse that will be part of the administration building. There will be an alarm system for fire protection as well as a surveillance system for the site via cameras. Eleven (11) surveillance cameras will be installed to monitor the following areas: the gatehouse, overall plant site, the open pit, the garage, the 120 kV station, the bridge, the pumping stations and the powder magazine, all with pan, tilt and zoom functions. Another series of 18 cameras for process monitoring will also be installed in the process plant.

The telephone system will be an IP type with a total capacity of 100 lines with 15 digital lines. In each building, including the process plant, Ethernet connectivity will be available via the optic fibre network. A walkie-talkie radio system will also be used at the mine and plant sites with 30 radios, repeaters, chargers and antennas.

1.6.1.8 *Buildings*

The administration building (43.7 m x 19.5 m) will include office spaces mainly for the administrative personnel, the supervision and the technical staff of the mine department, the information technology personnel as well as for the purchasing agent and the medical staff. The gatehouse will be part of that building. It will also have conference rooms, a dry and a mechanical shop as well as space for training employees, first aid and mine rescue.

A building will be used as a warehouse (43.3 m x 19.5 m) with a total surface area of a little over 800 m² and there will be some room inside for parking the ambulance vehicle. A cold shed (43.3 m x 19.5 m) will be located next to the warehouse building.

The assay laboratory building will have the following dimensions: 21.3 m x 18.3 m for a total surface area of about 390 m^2. A garage door will allow reception of materials inside the building.

The garage building (53.0 m x 23.8 m, 16.1 m high) will have washing, lubrication, welding and repair areas for the large mine vehicles. There will be also a repair area for small vehicles and another one for miscellaneous jobs. A storage space will be available for parts and for oil and greases. On the first floor, office space will be used in that building by the maintenance staff as well as a lunch room and a conference room. A diesel fuel system will feed boilers and a main storage tank with a 6,820 litre capacity will be located outside of the building.

1.6.2 Off-Site Infrastructure

1.6.2.1 Main Access Road

The access road to the process plant has a total distance of 62 km, starting from the town of Témiscaming, using the existing Maniwaki Road for the first segment. This will be followed by 4.8 km of new road to be constructed. This new segment will be 9 meter wide to allow two-way traffic.

1.6.2.2 Power Line and 120 kV Substation

The power will be provided by Hydro-Québec via a 120 kV power line that will be put in place specifically for the project. Hydro-Québec will be in charge of designing, supplying and installing the 120 kV line, around 1.9 km long. A 120 kV substation, owned and maintained by Matamec, will be located near the town of Témiscaming. Power will be delivered to the plant site substation at 44 kV via a 64 km overhead line following the Maniwaki Road and the process plant main access road. Deforestation along the Maniwaki Road will be required for the overhead line installation. Power consumers along the road, before the process plant substation, like the tailings infrastructure, will be connected directly to the 44 kV line with a fused-disconnect operated by a ground accessible handle.

The total connected power will be 18 MW and the real power requirement will amount to 10 MW.

1.7 Ore, Waste Rock and Overburden Management

To minimize the visual impact of the waste and considering drainage, rock storage is separated into two distinct areas. Drainage ditches have been designed all around the rock storage facilities and a sedimentation pond will be made at the lowest elevation. Both waste dumps will have space to accommodate a total of 7.6 Mm^3 of materials. Once the eastern portion of the open pit is completed, the “in-pit” waste storage area will be used and will contribute to limit the visual impact, decrease the hauling cycle time, and reduce the amount of mining trucks during Year 12 to Year 15. The "in-pit" waste storage will have a capacity of 1.7 Mm^3 of waste material until the end of the mine life.

The overburden and the top soil removal from site preparation are evaluated at 1,328,480 tonnes and 130,760 tonnes, respectively. All the overburden and the top soil will be removed at the pre-production period (Year -1).

The low grade stockpile is needed to accumulate the marginal economical ore to be processed at the end of the mine life. The high grade stockpile (high grade rehandling pile) is required to rehandle the ore via other smaller trucks up to the crusher at 10 kilometres away. Both the low grade and high grade rehandling piles will be built on top of the waste rock storage Area 1, closer to the main access road. A second designed ramp will be developed on the north side to get access to the rehandling zone which will allow for more efficient and safer operations. During detailled design phase, the location of the stockpile may be reviewed depending of the level of groundwater protection required.

1.8 Tailings Management

The ore treatment at the Kipawa project consists of two different successive processes generating waste with different physical and geochemical characteristics. The tailings management of the two streams has been assumed to be conducted separately.

The first stream, generated by the magnetic separation process, is referred to as the MagSep reject. The concentrate produced from the magnetic separation process is to be directed to the hydrometallurgical process plant which will generate the second stream to be referred as the Hydromet tailing. Each stream represents approximately 55% and 45%, respectively, of the total waste tonnage generated.

1.9 Site Water Management

The purpose of the Kipawa Site Water Management is to control contact water at the site and thereby limit the risk of adverse effects from contact water on the natural environment.

1.10 Geotechnical

A geotechnical and hydrogeological investigation program was conducted by Golder during August 2012. The program consisted of surface mapping, geotechnical core logging of five inclined and oriented boreholes, hydrogeological testing of the boreholes, selection of samples for laboratory testing, and point load testing of the rock core. The information from the field investigation was used to characterize the rock mass, evaluate the structural fabric of the project area and assess the hydrogeological characteristics of the site. This information was used to support feasibility-level pit designs.

1.11 Public, First Nations and Regulatory Engagement

Since 2009, Matamec has invested a great deal of effort in conducting consultation activities and meetings with the public, First Nations and regulatory authorities. This has been achieved notably through the creation of a Harmonization Table as well as the holding of information and consultation meetings. A lot of people attended these information and consultation meetings. Matamec also opened an office in Témiscaming to consolidate its presence in the area, and has been in regular contact with the federal and provincial authorities.

One of the goals of these activities is to identify and address the issues raised by the stakeholders. The potential risk of environmental deterioration, the impacts on water bodies and wildlife and the impacts on recreational and traditional activities caused by the Project's mining activities are amongst the chief issues and concerns raised to date. However, the potential employment opportunities and economic benefits for the surrounding communities is also an important consideration for the stakeholders. These issues and concerns are common in the context of mining project development. The issues and concerns expressed during the information and consultation activities will be assessed during the ESIA. When needed, mitigation measures will be proposed to avoid or lessen the negative impact and enhance the positive effects.

Matamec is committed to work in partnership with the First Nations even though, to date, no recognition of First Nations treaty rights apply within the Project site. Very recently (January 2013), a Statement of Assertion of Aboriginal Rights and Title to traditional territories, which includes the Project area, was presented to the Government of Canada by Algonquin Nations. The purpose of the Statement of Assertion is to establish basis for a consultation and accommodation process regarding any development in a very extensive area which includes the Project site. However, in any event, Matamec has already committed itself to a consultation and accommodation process with two First Nations communities. Their involvement with the Project has been formalized with the signing of a "Memorandum of Understanding", which specifies the terms of collaboration between the two communities and Matamec in the preparation of the Project. As the Project progresses, Matamec will also initiate discussions with First Nations to negotiate an Impact Benefit Agreement.

1.12 Environment and Permitting

In spring 2012, Matamec hired the firm Golder & Associates to complete the baseline study that was started two years before and also to perform an Environmental and Social Impact Assessment which is planned to be completed by Q1 2014.

A complete program of geochemical characterization has been conducted during the year in order to classify all the different rock to be mined and also all the different waste and residue to be generated by the mine operation. No surprises were encountered and it showed that everything is manageable to meet the current regulation concerning environmental protection.

Further radiological analyses of leachates were carried out for safety purpose and as required under Directive 019 of the MDDEFP to evaluate the level of risk associated with possible leaching of radiogenic parameters from mine wastes, magnetic separation rejects and hydrometallurgical tailings. None of the samples analysed are classified as high risk waste based on radionuclide analyses in leachate. Analyses were also done on the solids themselves and so far only the hydrometallurgical tailings are classified as higher risk but very manageable. The implementation of proper management programs in regards to radioactive elements will ensure the safety of the workers and of the population during operation and after the mine closure.

All the required hydrological and hydrogeological studies were carried out as well and from this information, a water management program has been established and will be optimized at a further stage in the project.

From all the information collected during the FS it was decided to proceed with dry tailings even if it is much more expensive in operating costs in order to minimize any environmental risk related to the tailings management. It will also allow the operator to begin progressive site restoration during mine operation.

The mining lease was filed before the end of March 2012. The project notice to begin the Federal environmental permitting process was submitted before the end of Q1 2013. The restoration plan and environmental impact study commenced at the beginning of May 2012 and are still ongoing but are well advanced. The official application for the Certificate of Authorization to the MDDEFP is planned to be submitted by winter 2014.

1.13 Mine Closure

A conceptual closure plan will be prepared with respect to the "Guidelines for preparing a mining site rehabilitation plan and general mining site rehabilitation requirements" and the Québec *Mining Act*. The conceptual plan will be presented to the Ministère des Ressources naturelles (Ministry of Natural Resources) for approval before the beginning of the mining activities.

Over the course of the 15.2 years of mining activities, the project will have produced a total of 18.6 Mt (9.3 Mm^3) of waste rock, 10.9 Mt (7.5 Mm^3) of tailings from the magnetic separation process and 9.25 Mt (6.1 Mm^3) of tailings from the hydrometallurgical process. Overall, once all mining activities have ceased; two piles of dewatered tailings and one waste rock dump will remain on site. The geochemical assessment does not suggest rehabilitation works other than stabilizing the surface, controlling the erosion and providing for adequate surface water management.

A progressive rehabilitation program will be implemented in order to lower the environmental impact during the project. In general, surfaces will be reshaped in order to allow natural runoff patterns to form and will then be vegetated. At the end of the mining operations, the sediments found in the footprint of the water storage basin will be characterized and disposed of, in compliance with the applicable laws. The estimated rehabilitation cost for of the Matamec project after 15.2 years of operation is $23.1 M.

1.14 Operating Plan and Human Resources

The overall organization will be constituted of three (3) main areas: mine, process plant, and administration. The mine department will include operations, maintenance, geology, and mine engineering. The process plant will involve both operations and maintenance, and will also have resources in health and safety as well as training. The assay laboratory will be part of this department. Site management, accounting, purchasing, warehousing, information technology services, surface crew operation and logistic, human resources, health and safety, environment and public relations will be part of the administrative sector. The total workforce will include 229 employees.

1.15 Marketing Plan

The Rare Earth Elements (REEs) are typically defined as the fifteen lanthanide elements including yttrium and scandium; they form a group of technology enabling materials that are critical inputs for a wide range of everyday consumer products as well as a large number of cutting edge technologies. Strong magnetic, optical, electronic and catalytic properties have made certain rare earth compounds indispensable to a substantial portion of global industry, including but not limited to the automotive, consumer electronics, medical equipment and green technology sectors. In the late summer of 2010, a dramatic 72% cut to second half Chinese rare earth export quotas sent prices for all rare earth materials sky rocketing, capturing the attention of both multinational corporations and prominent government bodies, while also highlighting the need for diversification of the global supply chain.

The demand for heavy rare earth materials is expected to benefit from strong growth, particularly in the case of dysprosium, terbium and yttrium, which are likely to realize swiftly expanding consumption from both the permanent magnet and phosphor powder sectors. The permanent magnet sector (neodymium and dysprosium and to a lesser degree terbium) is generally forecasted to realize strong gains in annual consumption through the entirety of the next seven years. The combination of tightening Chinese supply along with growing demand suggests terbium, dysprosium and several other HREEs will see appreciating price levels. Though demand for yttrium is expected to expand, sufficient Chinese domestic production will likely be able to cope with rising phosphor powder demand.

The Rare Earth Oxide prices used for the Economic Evaluation are based on a contracted market survey by Asian Metals (one of world's largest metallurgical information providers) in conjunction with discussions with key industrial end-users which were important in defining the forecasted final prices of each rare earth oxide. Other sources consulted for review of the historical pricing data were websites and reports from Metal Pages, Roskill Information Service Limited and Industrial Minerals.

Furthermore, the refining cost to reach 99.9% oxides or even higher purity levels was not evaluated within the FS since refining was not considered in the scope of the FS. It was decided that since the forecasted prices are for 99.9% (min.) pure, individual oxides and Matamec will be producing two mixed Rare Earths concentrates; a mixed light rare earth concentrate that will contain the following REE's: Ce, La, Nd and Pr. With the second product, a mixed heavy rare earth concentrate that will contain the elements of: Sm, Eu, Gd, Er, Tb, Dy, Ho, Yb, Tm, Lu and Y. The projected selling prices for the concentrates will be based on their contained oxide pricing and will be reduced by a refining factor of 30% for the majority of the Rare Earths, but 40% for the REE's: Ho, Er, Yb, Tm and Lu. The higher discount was applied considering that these materials would require more costs associated to process them due to the higher degree of purity that is required by their associated end uses. It is considered that the respective discounts will cover all logistical costs for the material to be shipped to their intended point of separation.

Table 1.2 - REO Price Forecast for 2016

Rare Earth Oxides		FS Market Price Ex-Works Mine-Site (US$/kg REO)	Refining Cost (%)	REO Price* Ex-Works Mine Site (US$/kg REO)	Quantity Sold LOM (est.) (t REO)
Cerium	Ce	$5.90	30	$4.13	15,479
Lanthanum	La	$5.95	30	$4.17	7,952
Praseodymium	Pr	$75.40	30	$52.78	1,930
Neodymium	Nd	$75.00	30	$52.50	7,132
Samarium	Sm	$6.85	30	$4.80	1,679
Europium	Eu	$1,100.00	30	$770.00	215
Gadolinium	Gd	$59.40	30	$41.58	1,696
Terbium	Tb	$1,076.00	30	$753.20	321
Dysprosium	Dy	$713.00	30	$499.10	2,137
Holmium	Ho	$53.60	40	$32.16	474
Erbium	Er	$63.60	40	$38.16	1,063
Thulium	Tm	$1,200.00	40	$720.00	32
Ytterbium	Yb	$56.70	40	$34.02	555

Rare Earth Oxides		FS Market Price Ex-Works Mine-Site (US$/kg REO)	Refining Cost (%)	REO Price* Ex-Works Mine Site (US$/kg REO)	Quantity Sold LOM (est.) (t REO)
Lutetium	Lu	$1,400.00	40	$840.00	55
Yttrium	Y	$29.40	30	$20.58	13,522

*REO price after deduction of refining and transport – Ex-Works Matamec Plant Site

The Project is subject to a joint venture agreement (the "JVA") between Matamec and Toyotsu Rare Earth Canada Inc. ("TRECan"), a subsidiary of TTC (see press release dated July 12, 2012 for more details on the JV and the JVA). As at the date hereof, Matamec holds a 51% and TRECan a 49% interest in the Project (see press release dated August 8, 2013). The JVA contains a provision under which TTC shall become the off taker of the production from the Project, under the terms and conditions set out in the JVA and in the off-take agreement to be negotiated and executed by the parties. Negotiations to convert the agreement into contractual volumes will follow the completion of the FS. TRECan is a well-recognized strategic partner that has funded $16.0 million to Matamec to complete the FS. As a producer of mixed LRE and HRE compounds, which would then go to separation plants abroad, the Kipawa Project would expect to provide the majority of its product into the end-use application markets which represent the highest demand for the heavy rare earths, notably the hybrid and electric vehicle markets, the wind turbine markets and also the phosphors market into lighting market as well as other applications.

1.16 Risk Assessment and Management

Risk Identification, Assessment, and Management is an on-going process which will continue throughout the life of the project. All information presented in this report is valid for this stage of the process, but will change and be developed as the project evolves. Many risks have been identified, with 71 risks evaluated, and mitigation plans drawn up for eight (8) risks.

- Change in final product value not as expected for the life of mine in feasibility evaluation ($$);
- Market is taken by other producers before start-up;
- Conflict between stakeholders (communities, First Nations, ZEC) and promoter (Matamec);
- Project financing delayed by 2 years;
- Major decrease in demand of final product in the long term (quantity) (REE);
- Under evaluation of CAPEX;
- Higher radioactivity in the process plant tailings than anticipated;
- Bad Perception of the community concerning uranium/thorium.

The risk analysis has been performed with the participation of various delegates. Risks were identified for the current phase of the project, as well as for all subsequent phases of the project. Comprehensive mitigation plans will be developed for the remaining risks in further stages of the project. This is to be expected at this level of study.

1.17 Capital Cost Estimate (CAPEX)

The capital cost estimate covers the mineralized rock mining, processing and infrastructure required for the Kipawa HREE project based on the application of standard methods of achieving a FS Study with an accuracy of +/- 15%. The capital costs have been estimated at $374.4 million, of which $258.0 million are direct costs and $67.6 million are indirect costs such as engineering, procurement, construction management, owner's costs and a 15% contingency cost of $48.83 million included in the overall project as outlined below:

Table 1.3 - CAPEX Summary

Capital Cost Items	Cost (Million$ CAD)
Off-Site Installation near Temiscaming town	
Main Sub-Station / Hydro-Quebec Power / Parking	
Total	**9.76**
Inter-Site Services	
Power line 44kV / Communications / Part of Access road	
Total	**13.35**
Mine Site	
Mining Equip / Pre-Prod. / Roads / Shop / and others	
Total	**41.92**
Processing Plant Site	
Support Infrastructure	23.27
Process Plant	137.21
Fresh Water Supply	4.79
Tailings Storage Facilities / Pipelines / Effluent treatment	27.69
Total	**192.96**
Total Direct Costs	**257.99**
Total Indirect and Owner's Costs	67.56
Contingency (15%)	48. 83
Total Costs:	**374.40**

1.18 Operating Cost Estimate (OPEX)

The operating cost estimates were made for each step and compiled by Roche. The operating cost for both steps of the Matamec Kipawa operation covers mining, processing, tailings and water management, general and administration fees as well as infrastructure and services. The project operating estimate is based on the following parameters:

<u>Average per year</u>

- Tonnes of mineralized rock and waste mined per year: 2.5 million;
- Tonnes of mineralized rock milled per year: 1.3 million;
- Tonnes of mixed HRE concentrate: 1,516 tpy;
- Tonnes of mixed LRE concentrate: 2,137 tpy;
- Total manpower required for operation: 229 employees.

The overall operating cost for the Matamec Kipawa project is estimated at $78.5 million per year or $21.53/kg mixed TREO concentrate**.** A summary of the operating costs for the project is shown below:

Table 1.4 - OPEX Summary

Operating Cost	Units	Average
NMR *	$ /kg TREO	46.97
Mining	$ /kg TREO	4.97
Processing	$ /kg TREO	13.35
G&A	$ /kg TREO	3.18
Cash Costs	$ /kg TREO	21.53
TREO concentrate produced annually (average)	tpy	3,653

*NMR: Net Metal Return (grade x recovery x revenue)

1.19 Economic Analysis

An economic/financial analysis of the project has been carried out using a cash flow model. The model is constructed using annual cash flow in constant money terms (second quarter 2013). No provision is made for the effects of inflation. As required in the financial assessment of investment projects, the evaluation is carried out on a so called "100% equity" basis, i.e. the debt and equity sources of capital funds are ignored.

Table 1.5 - Economic Assumptions

Rare Earth Oxides	PEA Market Price FOB China 2016 (US$/kg REO)	FS Market Price Forecast Ex-W Mine-Site (US$/kg REO)	Quantity sold per year (avg. est.) (t REO)	Est. Revenue LOM** ('000's)
Ce_2O_3	5.00	5.90	1,018.4	$63,926
La_2O_3	10.00	5.95	523.2	$33,120
Pr_2O_3	75.00	75.40	127.0	$101,886
Nd_2O_3	75.00	75.00	469.2	$374,453
Sm_2O_3	9.00	6.85	110.5	$8,049
Eu_2O_3	500.00	1,100.00	14.1	$165,486
Gd_2O_3	30.00	59.40	111.6	$70,521
Tb_4O_7	1,500.00	1,076.00	21.1	$241,636

Rare Earth Oxides	PEA Market Price FOB China 2016 (US$/kg REO)	FS Market Price Forecast Ex-W Mine-Site (US$/kg REO)	Quantity sold per year (avg. est.) (t REO)	Est. Revenue LOM** ('000's)
Dy_2O_3	750.00	713.00	140.6	$1,066,608
Ho_2O_3	65.00	53.60	31.2	$15,246
Er_2O_3	40.00	63.60	70.0	$40,565
Tm_2O_3*	-	1,200.00	2.1	$22,824
Yb_2O_3*	-	56.70	36.5	$18,870
Lu_2O_3	320.00	1400.00	3.6	$46,496
Y_2O_3	20.00	29.40	889.6	$278,292
Exchange Rate (CAD $/US $)	-	1.0 / 1.0		
Discount Rate (%)	8%	10%		

*At PEA - No value was attributed to Tm and Yb because no prices were available.

** Est. Revenue LOM is calculated from Price After Refining x Quantity Sold LOM – Quantity Sold is rounded to nearest tonne(Section 1.14)

Table 1.6 - Technical Assumptions

Item	Unit	Base Case Value
Total Ore Mined	M tonnes	19.77
Processing Rate	M Tonnes / year	1.332
Life of Mine	years	15.2
Average Combined Process Recovery	%	70
Average Mining Cost	($ / tonne mined)	7.03
Average Processing Cost	($ / tonne milled)	36.57
Average General & Administration Costs	($ / tonne milled)	8.71

1.19.1 Financial Model and Results

A capital cost breakdown by item provides a preliminary capital spending schedule over a 2-year pre-production period. The total pre-production capital expenditures are evaluated at $374.4 million, excluding the working capital. The total sustaining capital requirement is evaluated at $37.7 million which includes rehabilitation expenditures. A working capital equivalent of 3 months of total annual operating costs is maintained throughout the production period. The initial working capital outlay is $11.2 million. Additional amounts are required or withdrawn as total annual operating costs increase or decrease. The total operating costs are estimated at $1,181 million for the life of the mine or an average of $58.9/tonne milled.

The financial results indicate a positive before-tax NPV of $260 million at a discount rate of 10%, a before-tax IRR of 21.6% and a payback period of 3.88 years.

Table 1.7 - Financial Model and Results

Revenues and Expenditures	Base Case (Million $CAD)
Total Mine Revenue	2,548.0
Pre-production Capital Expenditures	374.4
Sustaining Capital Expenditures (Incl. Rehab.)	37.7
Additionnal Working Capital Requirement	11.2
Mine Rehabilitation Costs	23.1
Total Operating Cost	1,181
Total Before-tax Cash Flow	960
Before-tax NPV @ 10%	260
Before-tax NPV @ 8%	344
Before-tax NPV @ 6%	450
Before-tax IRR (%)	21.6
Before-tax Payback Period (years)	3.88
Total After-tax Cash Flow	602
After-tax NPV @ 10%	128
After -tax NPV @ 8%	185
After -tax NPV @ 6%	257
After -tax IRR (%)	16.8
After -tax Payback Period (years)	4.12

1.19.2 SENSITIVITY ANALYSIS

A sensitivity analysis has been carried out on the base case scenario described above to assess the impact of changes in REE market prices, total pre-production capital costs and operating costs on the project's NPV @ 10% and IRR. Each variable was examined independently. An interval of +/-30% with increments of 10% were used for all three variables. The project's before-tax viability is not significantly vulnerable to the under-estimation of capital and operating costs, taken independently. The net present value is more sensitive to variations in operating expenses. As expected, the NPV is most sensitive to variations in REO prices, followed by recovery, operating costs and by capital costs.

1.20 Next Stage Work Plan

In order to continue to advance the project on multiple fronts, the following key milestones could be targeted:

Table 1.8 - Key Milestones

Milestone	Timeline
Environmental and Social Impact Study	Q1 2014
Second Pilot Plant (SGS Lakefield)	Fall 2013
Environmental Process – Federal and Provincial	Q3 2013 to Q4 2014
Development of off-take Agreement	2014
Financing CAPEX Process	2014
Detailed Engineering	2014 to mid-2015
Mine Construction	Q1 2015 to Q4 2016
Start-up of Mining Operation	Q4 2016

Furthermore, financing milestones have been targeted as follows:

- Securing financing to take Matamec into the development stage before the construction phase begins. The Company intends to secure financing from financial institutions;
- Completion of an off-take agreement with Toyota Tsusho Corp.

1.21 Additional Upside Opportunities for the Kipawa Deposit

In the course of the FS, a number of additional opportunities have been identified that have the potential to add value to the project.

It is important to mention that the second metallurgical pilot plant testwork program planned should be conducted in addition to the bench scale and first pilot plant testwork conducted up to now. This second pilot plant testwork will be important to confirm, prior to detailed engineering, final sizing of some equipment. The second pilot plant will also help to confirm improvements in regards to the recovery rates since conservative numbers were used for the FS.

Opportunities of improvement in the metallurgical process are:

- Recycling and regeneration circuits for reagent used in purification of bulk rare earth carbonate generated from the main hydrometallurgical;
- To further improve reagent selection and recoveries;
- To test alternative impurity removal methods;
- Potential to separate a specific components from the bulk mixed REE product at the Hydrometallurgical Plant;
- Potential to further separate into mixed LREE, MREE and HREE products with separation plant.
- Potential to recover zirconium and other by-products;

On the geological and mining side, some similar optimization opportunities also exist:

- Mineral resources on the Kipawa deposit can be increased by verification of lateral and down dip extensions by drilling.
- Develop alternative materials handling scenarios to reduce the amount of rehandling between the mine and the crusher;
- Investigate the potential of setting aside the marginal waste rock close to the marginal cut-off grade in a context of future increase in RE prices;
- Optimize the usage of mine haulers between the mine and the crusher;
- Investigate alternative mining method scenarios using mining contractors.

1.22 Conclusions and Recommendations

The Authors have reviewed and assessed the available information in preparing this Report and have developed conclusions and recommendations. The Authors believe that such information is valid and appropriate considering the status of the project and the purpose for which the report has been issued.

Among the proposed recommendations and the additional upside opportunities for the Kipawa Deposit, it is important to mention that metallurgical pilot plant testwork should be carried out in addition to the bench scale testwork conducted up to now. This pilot plant testwork will be an important step to confirm, prior to detailed engineering, final sizing of some equipment. The second pilot plant will also help confirm improvements in regards to the recovery rates since conservative numbers were used for this Report.

1.22.1 Geology and Resources Estimation, Exploration Potential

In relation to resources, the deposit is currently considered open both laterally and at depth, though to varying degrees and present potential for increasing tonnage.

1.22.2 Metallurgy

The process has been tested and is proven except for the removal of one impurity in the final purification. At the time of writing this Report, the required testwork results were not yet available. The final purification still has to confirm the removal of a few hundred ppm of aluminium from the concentrates in order to meet the buyers' specifications. Additional Process works are proposed.

1.22.3 Mining

As described in the previous section some upside opportunities exist in the mining area and could be completed during the detailed engineering phase.

1.22.4 Environmental Aspects and Permitting

The collection of field data to establish the baseline study started in 2010. The collection of data has been completed in Q2 2013 and the complete baseline study is planned to be completed by Q3 2013.

In parallel to the baseline, a complete Environmental and Social Impact Assessment (ESIA) is being concluded as well and should become available during winter 2014.

1.23 Future Works

It is also recommended to conduct some additional work prior or in parallel to the detailed engineering phase in order to better optimise some aspects. A preliminary evaluation of the costs involved has been done and is presented below. These costs will have to be re-evaluated as the project progresses.

1.23.1 Geology and Resources – Cost Estimation (Optional)

Exploration at depth (19 DDH, 1800 m - high priority) :	$320,000
Exploration north-west extension (9 DDH, 850 m - high priority):	$150,000
Regional exploration (20 DDH, 2000 m - low priority) :	$350,000
Wilcat Grid – 400m spacing (35 DDH, 5000 m - low priority):	$875,000
Total Exploration:	**$1,695,000**

1.23.2 Metallurgy – Cost Estimation

Optimization testwork - short term :	$50,000
Pilot Plant #2 (Beneficiation and Hydromet):	$1,660,000
Pilot Plant for purification circuit :	$600,000
Complementary testwork at equipment supplier facilities and others:	$310,000
Total Metallurgy:	**$2,620,000**

1.23.3 Environmental Aspect and Permitting – Cost Estimation

a)	Redaction of the Federal EIS and permit application:	$900,000
b)	Completion of the Provincial Certificate of Authorization application:	$105,000
c)	Completion of the baseline study:	$136,000
d)	Kinetic Column testwork, results analysis and reporting:	$132,000
e)	Completion of Geotechnical drilling for dam and water basin design:	$150,000
f)	Advance dam and water basin design for permitting purpose:	$185,000
g)	Water Quality modelling:	$ 45,000
h)	Dust modelling:	$125,000
i)	Follow-up during permitting process:	$250,000
j)	Contingency:	$ 90,000
	Total Environmental and Permitting:	**$2,118,000**

1.23.4 COMMUNICATION AND SOCIAL AWARENESS

Public Engagement Sessions with the First Nations communities as well as with the local population and the government(s) and local authorities.

Engagement Projects with the First Nations communities and the local population.

Total Communication and Projects: $1,500,000

1.23.5 ENGINEERING AND ECONOMICAL STUDIES

Review the marketing, market study and strategy. Complete an off-take agreement with TTC prior to detail engineering phase.

1.23.6 TOTAL FUTURE WORKS COST

The total future works cost prior to detailed engineering phase will be in the amount of **$6,238,000 CAD** and not including the exploration program and Matamec's administration fees.

2.0 INTRODUCTION

2.1 Project Location

The Kipawa deposit is located on the Zeus Property, 50 kilometres east of the town of Temiscaming and 140 kilometres south of Rouyn-Noranda, Quebec. All claims are 100% owned by Matamec and are in good standing. Resources are not subject to any third party royalties.

Figure 2.1 - Location Map (modified from Google Maps)

Access to most parts of the property is provided by a network of logging roads of variable quality. The towns of North Bay, Temiscaming and the village of Kipawa are all connected by well-maintained paved roads and Temiscaming is, in addition, linked to North Bay, Sudbury, Pembroke and Smith Falls via a railroad operated by Ottawa Valley Railway.

2.2 Project Description

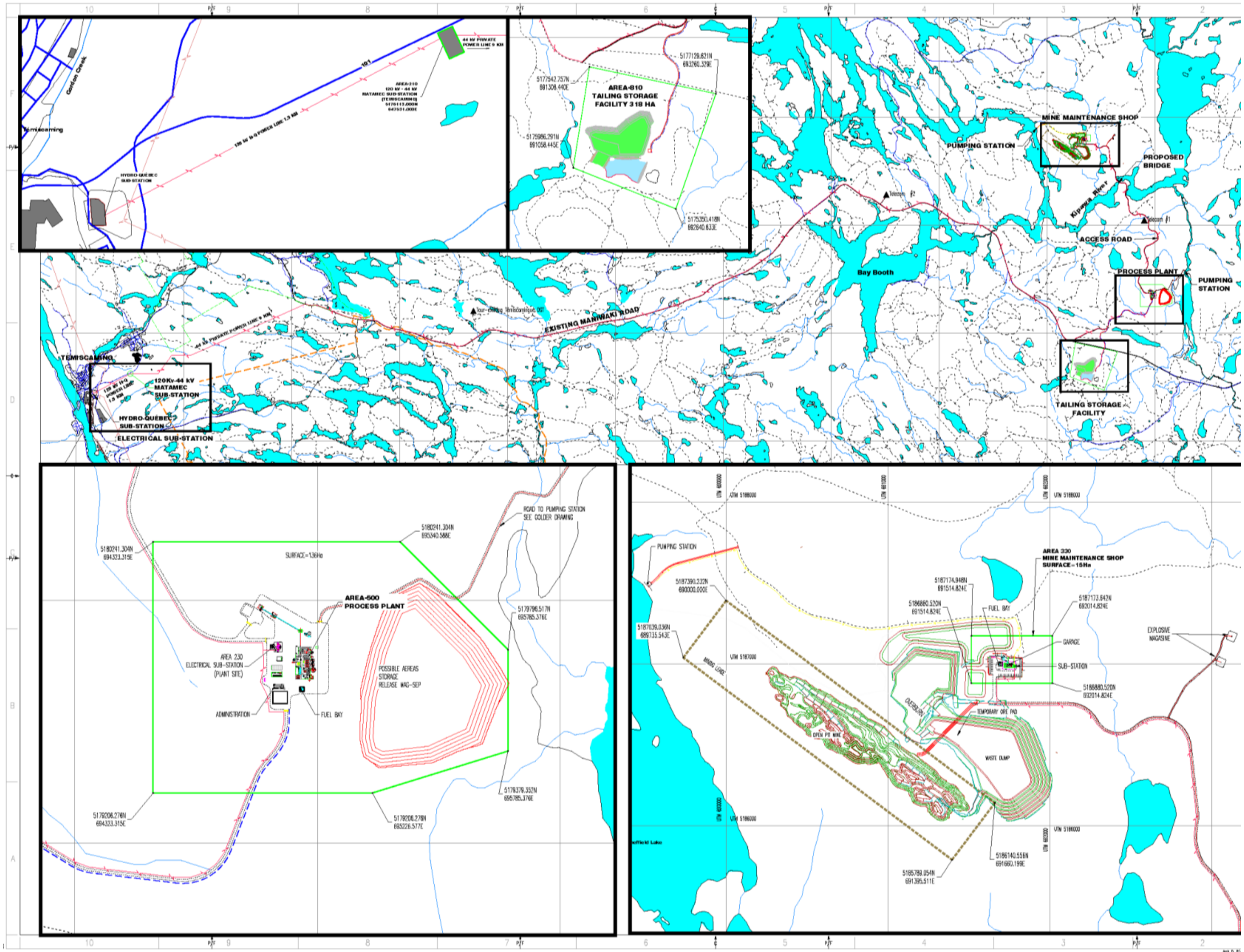
The Kipawa mining site will consist of the open pit mine, a waste dump, a low grade ore stockpile and a high grade ore loading facility. The mine equipment maintenance facility will be also located at the mine site. A 10.9 km haul road will be built to bring the ore to the Hydromet Plant Site. The Hydromet Plant Site will consist of the ore process plant which will combine the crushing, grinding, magnetic separation and hydrometallurgical circuits. There will be two tailings storage facilities; one storage facility will be for the rejects of the magnetic separation located adjacent to the process plant and one other storage facility for the hydrometallurgical tailing located about

4 km south of the process plant. The administration office, assay laboratory and warehouse will also be located on the Hydromet Plant Site. The employee's parking and the main electrical sub-station will be located in the town of Temiscaming.

The ore deposit is defined by 3 enriched horizons within the "Syenite Complex", which contains the rare earth oxides (REO). In this report, the REO consist of the Light Rare Earth Oxides, LREO: La_2O_3, Ce_2O_3, Pr_2O_3, Nd_2O_3 and Sm_2O_3; Heavy Rare Earth Oxides, HREO: Eu_2O_3, Gd_2O_3, Tb_2O_3, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3 and Lu_2O_3; and Y_2O_3. The total ore tonnage of the mine is of 19.8 million tonnes. With the current measured and indicated resources, the project is scheduled for 15.2 years excluding a two years pre-production period to remove the overburden and level the top of the pit and the construction of the ore process plant and related infrastructure. There is potential for the addition of future resources which could increase this life span.

Figure 2.2 shows the location of the mine's infrastructure.

Figure 2.2 - Location of the Mine Site, Metallurgical Site, Tailings, and Electrical Sub-Station



2.3 Design Basis

The Total Rare Earth Oxides (TREO) diluted grade is 0.4105% including a Dysprosium (Dy_2O_3) diluted grade of 0.0147%. The recoveries for each element vary from 68% to 74% for a TREO average of 70% for the 10 main REO which are (La_2O_3, Ce_2O_3, Pr_2O_3, Nd_2O_3, Sm_2O_3, Eu_2O_3, Gd_2O_3, Tb_2O_3, Dy_2O_3, Y_2O_3). A total production of TREO is expected to be 55,500 tonnes over the mine life. When the mine will be in full production an average of 3,760 tonnes per year of TREO will be produced.

The mine will produce an average of 1,332,250 tonnes of ore per year (3,650 tonnes per day) and has an average stripping ratio (without the overburden) of 0.94. A standard truck and shovel operation will bring the drilled and blasted material out of the mine to their respective destinations (waste dump, low grade stockpile or high grade loading facility). Road trucks will pick up the ore and bring it to the metallurgical site. The plant has been designed to be able to produced 1,332,250 tonnes per year.

Once at the Metallurgical Plant Site, the ore will be dumped into a crusher dump hopper feeding a 2-stage crushing circuit. The crushed ore will then be stored into a 2,800 tonnes silo. The crushed ore will then be grinded in a single stage grinding circuit. A magnetic separation (MagSep) circuit will recover the rare earth as a concentrate. The reject from the MagSep circuit will be pumped to the dewatering circuit and transported to the MagSep rejects storage facility located outside and nearby the process plant. The magnetic rare earth concentrate will be sent into the regrind mill followed by a thickening circuit and then to the hydrometallurgical process (acid leaching, neutralisation, impurities removal and the final precipitation) which will then produce the rare earth concentrates. This last concentrate will then be processed through a purification circuit which will remove the last impurities and also produce the HREE and LREE concentrates. The final products of the process plant are a concentrate of heavy rare earth and a concentrate of light rare earth.

Power to both the mine site and the hydromet plant site will be provided by a new power line to be connected to the Hydro-Québec network. The total real power requirements are 10 MW.

The tailings produced from the hydrometallurgical process will be pumped to a thickening facility located by the hydrometallurgical tailings storage facility (TSF). Solids will be dewatered and then disposed dry into the TSF. During operation there will be progressive restoration and then final restoration and reclaiming will be completed at mine closure for the TSF site as well as the other sites.

2.4 Purpose and Scope of Study

The following report is a Feasibility Study (FS) on the Kipawa deposit located on the Zeus Property own by Matamec, which holds a 100% interest in the Zeus property (the Property). The property is located in the Temiscamingue region of Quebec, 140 km south of Rouyn-Noranda and 90 km north-east of North Bay, Ontario. The size of the property is 15,244 ha.

Matamec is a junior mining exploration company whose main focus is in developing the Kipawa heavy rare earths deposit and exploring over 35 km of strike length in the Kipawa Alkalic Complex for rare earths mineralization on its Zeus Property.

Matamec has retained Roche Ltd, Consulting Group (Roche), GENIVAR Inc. (Genivar), Golder Associates (Golder) and SGS Geostat (SGS), among others to complete a Feasibility Study Report on the Kipawa deposit. A detailed list of each party's involvement is described in Section 2.5.

The Report effective date is September 4th, 2013.

2.5 Study Participants and Responsibilities

A detailed list of persons responsible for preparing this Report is presented in Table 2.1.

The Authors of this Report are not qualified to comment on issues related to legal agreements, royalties, permitting, and environmental matters. The Authors have relied upon the representations and documentations supplied by the Company management. The Authors have reviewed the mining titles, their status, the legal agreement and technical data supplied by Matamec, and any public sources of relevant technical information.

Table 2.1 - Persons Who Prepared or Contributed to this Feasibility Study

Person Position and Employer	Professional Designation	Independent of Matamec	Date of Last Site Visit	Exclusive Responsability	Shared Responsability
Guy Saucier Roche Ltd., Consulting Group	Eng.	Yes	No	1, 2, 4, 5, 21, 26	25
Claude Noreau Roche Ltd., Consulting Group	Eng.	Yes	No		24, 25
Pierre Casgrain Roche Ltd., Consulting Group	Eng.	Yes	June 13 and 14, 2011	15	16, 18, 20, 24, 25
Philippe Côté Roche Ltd., Consulting Group	Eng.	Yes	No		13, 17, 24, 25
Éric Larochelle Roche Ltd., Consulting Group	Eng.	Yes	No		13, 17, 25
Michel Bilodeau Roche Ltd., Consulting Group	Eng.	Yes	No	22	25
Al Hayden EHA Engineering Ltd.	P. Eng.	Yes	No		13, 25
Éric Poirier GENIVAR Inc.	Eng.	Yes	No		17, 18, 25
Michel Garon GENIVAR Inc.	Eng.	Yes	No		24, 25
Valérie Bertrand Golder Associates Ltd	P.Geo.	Yes	October 2012		20
Mayana Kissiova Golder Associés Ltée	Eng.	Yes	August 2012		17, 18, 20, 25
Michel Mailloux Golder Associates Ltd	Eng.	Yes	August 2012		20, 25
Marc Rougier Golder Associates Ltd	P.Eng.	Yes	No		16, 20, 25
Yann Camus SGS Canada Inc. – Geostat	Eng.	Yes	November 10 and 11, 2008	6, 7, 8, 9, 10, 11, 12, 14, 23	25
Gaston Gagnon SGS Canada Inc. – Geostat	Eng.	Yes	No	19	25

2.6 NI 43-101 Disclosure

The technical information in this report has been prepared in accordance with Canadian regulatory requirements by independent Qualified Persons, or under the supervision of, as set out in National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101").

The Mineral Resource and Mineral Reserve estimates set out in this report were classified according to the *CIM Definition Standards - For Mineral Resources and Mineral Reserves* (as adopted by CIM Council in November 2010).

Readers are advised that Mineral Resources not included in Mineral Reserves do not demonstrate economic viability. Mineral Resource estimates do not account for mineability, selectivity, mining loss and dilution. These Mineral Resource estimates include Inferred Mineral Resources that are normally considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that Inferred Mineral Resources will be converted to Measured and Indicated categories through further drilling, or into Mineral Reserves, once economic considerations are applied.

Technical information in this report was reviewed and adopted by all QP (Qualified Person) for each individual section and by Bertho Caron, VP Project Development & Construction (Eng.) and Aline Leclerc, VP Exploration (Geo.), Matamec's Qualified Persons.

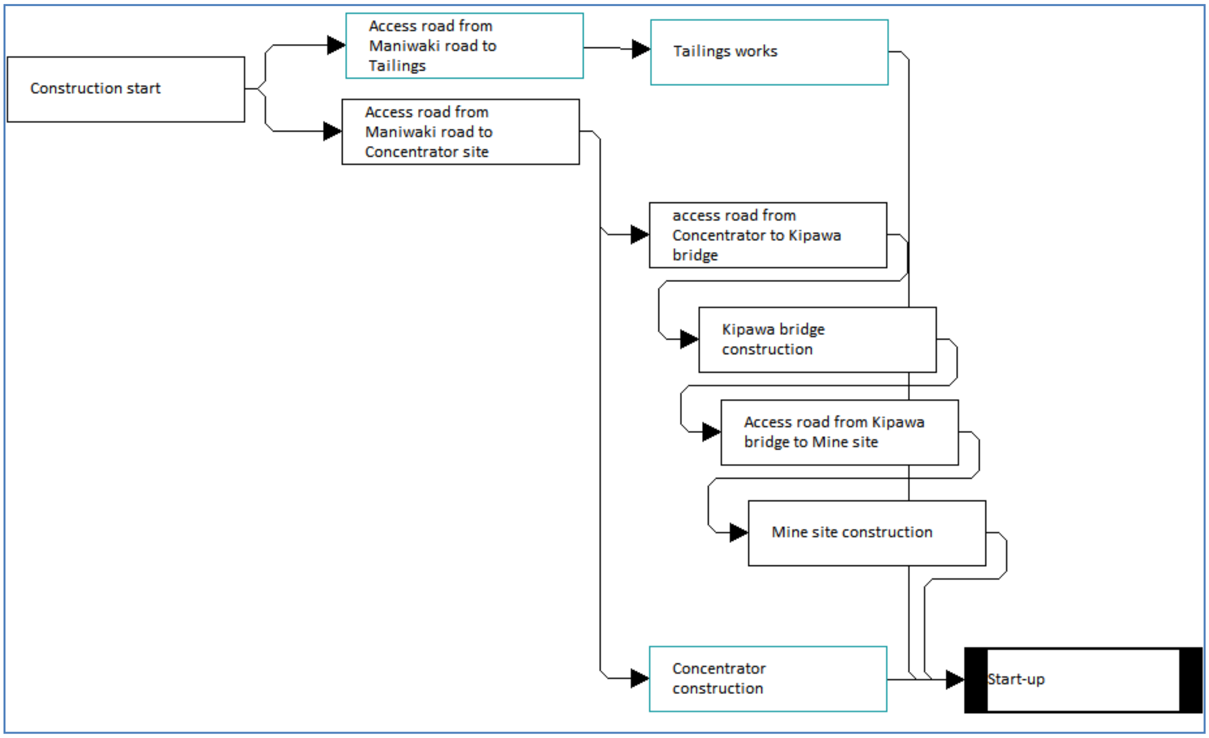
2.7 Project Target Time Line and Assumptions

Matamec plans to implement the Kipawa project based on the project schedule presented in Section 24.1, which illustrates the summary of project schedule with key dates and milestones. Once Matamec approved this schedule, it will be the Master Schedule which will follow all progress of the Project during the execution phase. The main assumptions related to the project target time line are listed as follow:

1. The permitting is not addressed in the schedule as it is out of the scope of this study;
2. It is assumed that the concrete will come from existing facilities in Temiscaming at the beginning then a small batching plant will be setup at site to complete the initial construction;
3. Optimization of the project, especially related to the construction phase could be necessary to allow critical construction activities to start on-time;
4. Temporary power is assumed to be available from diesel generators for starting up of the project construction and later by the permanent power line from Hydro-Québec. The diesel generators will remain at site and be used as emergency power supply.

The key logic of the project is presented in Figure 2.3.

Figure 2.3 - Key Project Activities



2.8 Units and Currencies

All measurements in this report are presented using the International System of Units (SI units), such as metres (m) and metric tonnes (tonnes), unless mentioned otherwise. Monetary units are in Canadian dollars ($CAD) unless when specified in United States dollars ($USD).

Abbreviations used in this report are listed below (Table 2.2).

Table 2.2 - Frequently Used Acronyms and Abbreviations

Abbreviations	Description
Chemistry	
Sc	Scandium
Y	Yttrium
La	Lanthanum
Ce	Cerium
Pr	Praseodymium
Nd	Neodymium
Pm	Promethium
Sm	Samarium
Eu	Europium

Abbreviations	Description
Gd	Gadolinium
Tb	Terbium
Dy	Dysprosium
Ho	Holmium
Er	Erbium
Tm	Thulium
Yb	Ytterbium
Lu	Lutetium
Sc_2O_3	Scandium oxide
Y_2O_3	Yttrium oxide
La_2O_3	Lanthanum oxide
Ce_2O_3	Cerium oxide
Pr_2O_3	Praseodymium oxide
Nd_2O_3	Neodymium oxide
Pm_2O_3	Promethium oxide
Sm_2O_3	Samarium oxide
Eu_2O_3	Europium oxide
Gd_2O_3	Gadolinium oxide
Tb_2O_3	Terbium oxide
Dy_2O_3	Dysprosium oxide
Ho_2O_3	Holmium oxide
Er_2O_3	Erbium oxide
Tm_2O_3	Thulium oxide
Yb_2O_3	Ytterbium oxide
Lu_2O_3	Lutetium oxide
REE	Rare Earth Element(s)
REO	Rare Earth Oxide(s)
TREE	Total Rare Earth Element(s)
TREO	Total Rare Earth Oxide(s)
LREE	Light Rare Earth Element(s)
LREO	Light Rare Earth Oxide(s)
HREE	Heavy Rare Earth Element(s)
HREO	Heavy Rare Earth Oxide(s)
RE	Rare Earth
U	Uranium
U_3O_8	Uranium oxide
Cb	Columbium (currently Niobium)
Cb_2O_5	Columbium (V) oxide
Nb	Niobium (formerly Columbium)
Nb_2O_5	Niobium (V) oxide
Th	Thorium
ThO_2	Thorium oxide
Au	Gold

Abbreviations	Description
Zr	Zirconium
ZrO_2	Zirconium oxide
	General
N	North
E	East
W	West
S	South
NE	North-East
NW	North-West
SE	South-East
SW	South-West
AACEI	Association for the Advancement of Cost Engineering International
ACQ	Quebec Construction Association
AEV	Air Entry Value
ALS	ALS Chemex Laboratories
BFA	Bench Face Angle
CAD	Canadian Dollar (currency)
CAL-SIL	Calc-Silicate Complex
CAPEX	Capital Expenditure Estimate
CBS	Cost Breakdown Structure
CDE	Canadian Development Expenses
CEE	Canadian Exploration Expenses
CIM	Canadian Institute of Mining, Metallurgy and Petroleum
CM	Construction Management
des Jardins	Rivière des Jardins
DDH	Diamond Drill Hole
DFO	Department of Fisheries and Oceans
DTH	Down-the-Hole
dwg	Drawing
EA	Environmental Assessment
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
EIA	Environment Impact Assessment
El.	Elevation
EPAD	Environmental Protection Administrative Department
EPCM	Engineering, Procurement, Construction, and Management
EQA	Environment Quality Act
ESIA	Environmental and Social Impact Assessment
EU	European Union
EUR	Euro (currency)
EXW	Ex-Works
F.S.	Factor of Safety

Abbreviations	Description
FEFLOW	Finite Element Subsurface Flow System
FOB	Free-on-Board / Freight-on-Board
FRP	Fibre Reinforced Plastic
FS	Feasibility Study
G&A	General and Administration
GBP	British Sterling Pound (currency)
Golder	Golder Associées Ltée
GN	Gneiss
GSC	Geological Survey of Canada
GTC	General Terms And Conditions
HDPE	High-Density Polyethylene
HG	High Grade (ore)
HGF	High Grade Loading Facility
HQ	Hydro-Québec
HSE	Health, Safety, and Environment
HSS	Health Safety and Security
HVAC	Heating, Ventilation, and Air Conditioning
Hydromet	Hydrometallurgy (hydrometallurgical)
IBA	Impact Benefit Agreement
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ID	Inner-Diameter
IDS	Inverse Distance Squared
IR	Infrared
IRA	Inter-Ramp Angle
IRP	Internal Review Process
IRR	Internal Rate of Return
JVA	Joint-Venture Agreement
LG	Low Grade (ore)
LOM	Life of mine
MagSep	Magnetic Separation
Matamec	Matamec Exploration Inc.
MCC	Motor Control Center
MMER	Metal Mining Effluent Regulations
MMU	Mobile Mixing Unit
MRC	Municipalité Régionale de Comté
MRNF	"Ministère des Ressources Naturelles et de la Faune "
NBCC	National building Code of Canada
NORM	Naturally Occurring Radioactive Materials
NPR	Neutralization Potential Ratio
NPV	Net Present Value
NRCan	Natural Resources Canada
NSR	Net Smelter Return

Abbreviations	Description
ø	Diameter
OPEX	Operating Expenditure Estimate
OSA	Overall Slope Angle
P&ID	Piping and Instrumentation Diagram
PCM	Procurement, Construction & Management
PCN	Project Change Notice
PEA	Preliminary Economic Assessment
PEP	Project Execution Plan
PFS	Pre-Feasibility Study
PGA	Peak Ground Acceleration
PH	Phlogopite
PLC	Programmable Logic Controller
PMP	Probable Maximum Precipitation
POV	Pre-Operational Verification
QA/QC	Quality Assurance (QA), Quality Control (QC)
R&D	Research and Development
R^2	Correlation Coefficient
RCM	Regional County Municipality
RMB	Chinese Yuan (currency)
ROW	Rest of World
RQD	Rock Quality Designation
SGS	SGS Canada Inc.
SI	International System
SPA	Sales and Purchase Agreement
SPT	Standard Penetration Test
SY	Syenite
TMF	Tailings Management Facility
TOL	Temporary Operating License
TRECan	Toyotsu Rare Earth Canada Inc.
TTC	Toyota Tsusho Corp
US	United States of America
USD	United States Dollars (currency)
UV	Ultraviolet
VFD	Variable Frequency Drives
W:O	Waste to Ore (Strip Ratio)
WBS	Work Breakdown Structure
WPC	Work Packages Code
WSB	Water Storage Basin
WTO	World Trade Organization
XRF	X-Ray Fluorescence
YM	Yttrium-medium
YR	Yttrium-rich
ZEC	"Zone d'exploitation contrôlée", Controlled harvesting zones

Abbreviations	Description
	Units
K (suffix)	Thousand
M (suffix)	Million
B (suffix)	Billion
M (prefix)	Million (mega)
k (prefix)	Thousand (kilo)
G (prefix)	Billion (giga)
°C	Degrees Celsius
$/kg	Dollars per kilogram
$/L	Dollars per litre
$/t	Dollars per tonne
$/y	Dollars per year
%	Percent
¢/kWh	Cents per kilowatt-hour
°	Degree
µm	Micrometre (micron)
A	Amperes
CFM	Cubic feet per minute
cm	Centimetre
ft	Feet
g	Grams
g	G-forces (acceleration)
g/t	Grams per tonne
Ga	Billion years (giga-annum)
h	Hours
ha	Hectares
hp	Horsepower
hr	Hours
in	Inches
km	Kilometre
kN	Kilonewtons
kN/m^3	Kilonewtons per cubic metre
KPa	Kilopascals
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-hour
L	Litres
L/day	Litre per day
L/kg	Litres per kilogram
$L/m^2/d$	Litres per square metre per day
L/min	Litres per minute
L/week	Litre per week

Abbreviations	Description
m	Metre
m/m	Metres (vertical) per metre (horizontal)
m/s	Metres per second
m^2	Square metres
m^3	Cubic metres
m^3/d	Cubic metres per day
m^3/day	Cubic metres per day
m^3/s	Cubic metres per second
m^3/yr	Cubic metres per year
Ma	Million years (mega-annum)
mm	Millimetre
mm/year	Millimetres per year
Mm^3	Million cubic metres
MPa	Megapascals
Mt	Million tonnes
Mtpy	Million metric tonnes per year
MVA	Megavolt-amperes
MW	Megawatts
N	Newton
ppb	Parts per billion
ppm	Parts per million
rpm	Rotations per minute
SG	Specific gravity
sq.ft.	Square feet
t	Tonnes (metric)
T	Tesla
t/m^3	Tonnes per cubic metre
tpa	Metric tonnes per annum (year)
tpd	Metric tonnes per day
tpy	Metric tonnes per year
TSF	Tailings storage facilities
V	Volt
wk	week
w/w%	Weight percent
y	Years
yr	Years

Note about the Use of Abbreviations in Various Sections of the Report.

As detailed below, the HREO definition used in historical and geological parts is based on scientific facts. The HREO definition used in the resource and reserve estimates parts are different to meet the industry practice.

- TREO = sum of La_2O_3 + Ce_2O_3 + Pr_2O_3 + Nd_2O_3 + Sm_2O_3 + Eu_2O_3 + Gd_2O_3 + Tb_2O_3 + Dy_2O_3 + Ho_2O_3 + Er_2O_3 + Tm_2O_3 + Yb_2O_3 + Lu_2O_3 + Y_2O_3
- HREO ratio = $\frac{\mathrm{HREO}+\mathrm{Y_2O_3}}{\mathrm{TREO}} * 100\%$

History and Geological – Sections 6.0 to 11.0

- LREO = sum of La_2O_3 to Gd_2O_3
- HREO = sum of Tb_2O_3 to Lu_2O_3

Resource / Reserve and QA/QC - Sections 12.0 to 15.0

- LREO = sum of La_2O_3 to Sm_2O_3
- HREO = sum of Eu_2O_3 to Lu_2O_3

Cautionary Note: Section 23.0 (Adjacent Properties) incorporates HREO from different sources that does not always disclose its definition and could not be thoroughly verified.

3.0 RELIANCE ON OTHER EXPERTS

The following participants contributed to this Report:

The study was developed under the supervision of Guy Saucier, Eng. (Roche) and under the coordination of Claude Noreau, Eng. (Roche) who acted as Project Manager.

The resource estimations as well as the verification of the Matamec geological database and QA/QC program were performed by Yann Camus, Eng. from SGS.

The selection of the metallurgical samples used to perform the testwork was performed under the supervision of Frédéric Fleury, Geo., project geologist, working for Gestion Aline Leclerc Inc. (Gestal). The supervision of metallurgical testwork was also directly performed by Matamec under the supervision of Eliza Ngai, P.Eng. (Matamec) and Al Hayden, P.Eng. (EHA).

Based on the testwork, Philippe Côté, Eng., Eric Larochelle, Eng., both from Roche, and Al Hayden, P.Eng (EHA) developed the process design criteria, sized and selected the process equipment. They also performed mass and water balance for the process plant.

The pit design, mine planning and mining equipment selection were performed by Pierre Casgrain, Eng. (Roche) using the block model developed by SGS.

The access roads, electrical supply, and various site layouts were developed by Genivar under the supervision of Eric Poirier, Eng. Genivar. They also designed various buildings (including concentrator building) and related infrastructure.

Environmental and Safety Consideration were covered by Valerie Bertand, Geo., Mayana Kissiova, Eng., Michel Mailloux, Eng. and Marc Rougier, P.Eng. from Golder.

The geotechnical aspects of the open pit were covered by Marc Rougier, P.Eng. from Golder. Golder also carried out the geochemical characterization of the ore, the waste rock, and the tailings, which was undertaken by Valérie Bertrand, M.A.Sc., P.Geo. Golder was also responsible for the development of the tailings management system, the overall water management, the closure plan, as well as the ore and waste rock dumps. Mayana Kissiova, Eng. M.Eng. covered the tailings management aspect and the ore and waste rock dumps, as well as was responsible for water management and the closure aspects. All hydrogeological aspects whether for the open pit or tailings management were covered by Michel Mailloux, Eng. M.Sc.

The Risk Assessment was carried out under the supervision of Claude Noreau, Eng. The capital and operating costs were assembled by Guy Saucier, Eng. (Roche) based on information provided by each party.

Dr. Michel Bilodeau, Eng. performed the financial analysis based on information provided by the Client. The market study was performed by Gaston Gagnon, Eng. from SGS Geostat.

The operational and organisational plan was developed by Michel Garon, Eng. (Genivar).

The project schedule was developed under the supervision of Claude Noreau, Eng. from Roche.

The Authors have reviewed and assessed the available information in preparing this Report and have developed conclusions and recommendations. The Authors believe that such information is valid and appropriate considering the status of the project and the purpose for which the report has been issued.

3.1 Market Study & Contracts

For the purpose of this technical report, SGS has relied mainly on information provided by Matamec for the section entitled Market Studies and Contracts.

Most of the marketing data were obtained from the *Rare Earth Market Assessment and Price Forecast Report* prepared by Asian Metals for Matamec on June 30, 2013.

Unlike common metals, REEs plus yttrium and scandium are not sold on public exchanges and therefore evaluating their prices is not straightforward. Prices for these metals tend to fluctuate strongly due to relatively small and growing markets, limited production outside Chinaé and speculation as to the future demand. For this study, metal prices which were derived from the Asian Metals Report, were verified and compared by SGS to ascertain that the forecasted prices are within the ranges of other experts.

3.2 Economic Analysis

For the Economic Analysis contained in this Report (Section 22.0), Michel Bilodeau relied on information provided by Marc Robert, CPA, CA, (Marc Robert CPA Inc.). Mr. Robert prepared the corporate and mining tax model associated with the financial analysis of the project.

3.3 Risk Assessment and Management

Claude Noreau, Eng., P. Eng., MBA relied on the work of Michel Labrecque for Section 24.3 – Risk Assessment and Management. Michel Labrecque, a management consultant, provided Roche documents based on brainstorming sessions, risk identification, evaluation and conclusions related to the October 2012 - August 2013 period.

3.4 Public, First Nations and Regulatory Engagement

The involvement by Golder Associates Ltd. (“Golder”) in the public consultation process was limited. Golder attended some public assembly and open house meetings during the month of November 2012, but relied predominantly upon information provided by Matamec in November and December 2012 concerning the public consultation aspects of this Technical Report (“Public Consultation Information”). The public consultation summary presented in Section 20.3 of this Technical Report is based upon such Public Consultation Information, including, without limitation, meeting summaries. Golder has not confirmed the accuracy or the completeness of the Public Consultation Information and Golder does not attest to or assume responsibility for the Public Consultation Information. Golder also does not attest to or assume responsibility for the accuracy or completeness of the statements, opinions or recommendations contained in Section 20.3 to the extent that such rely upon Public Consultation Information.

3.5 Legal

The Authors of this Report are not qualified to comment on issues related to legal agreements. The Authors have relied upon the representations and documentations supplied by the Company management. The Authors have reviewed the mining titles, their status, the legal agreement and technical data supplied by Matamec, and any public sources of relevant technical information.

4.0 PROPERTY DESCRIPTION AND LOCATION

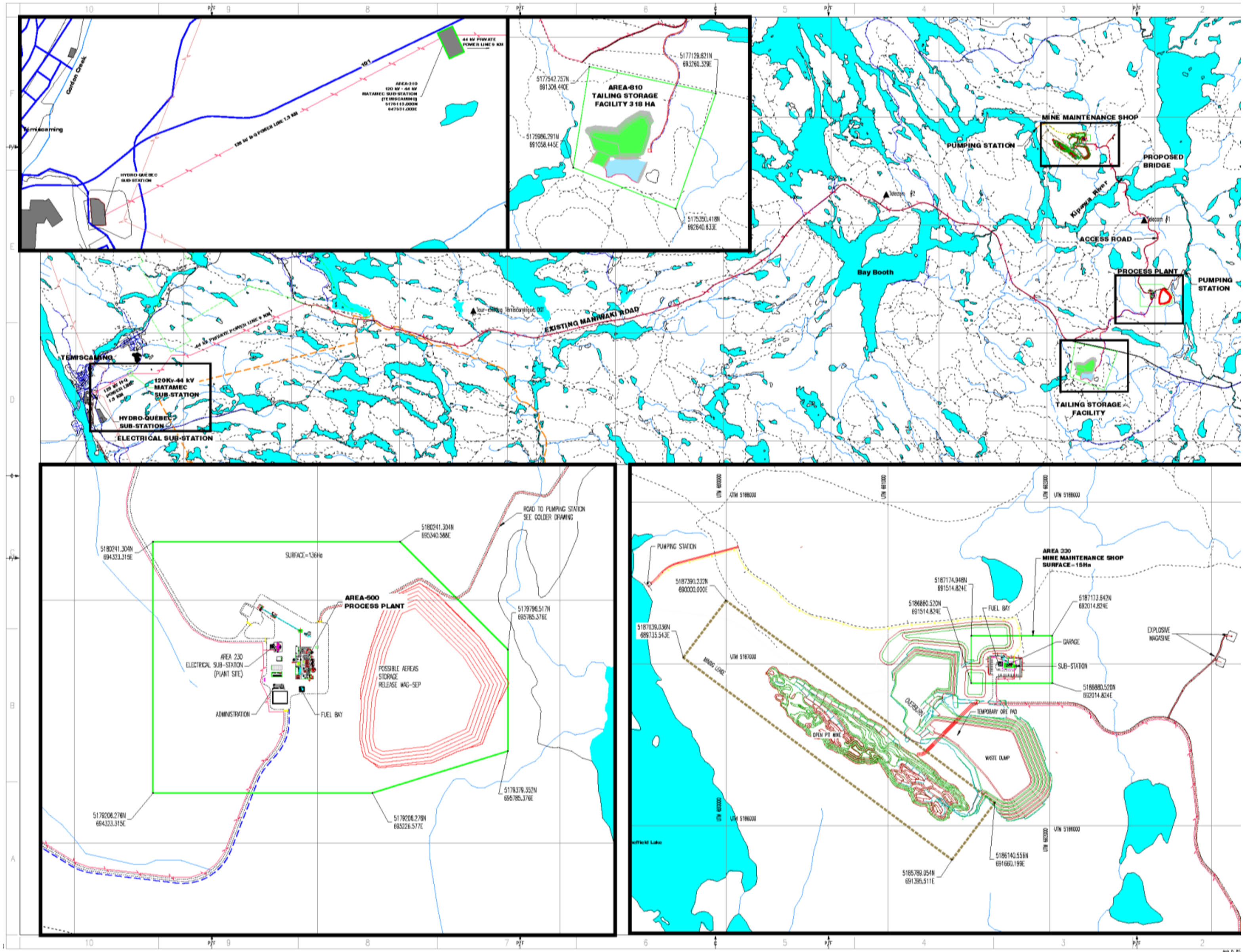
4.1 Project Description

The Kipawa mining site will consist of the open pit mine, a waste dump, a low grade ore stockpile and a high grade ore loading facility. The mine equipment maintenance facility will be also located at the mine site. A 10.9 km haul road will be built to bring the ore to the Hydromet Plant Site. The Hydromet Plant Site will consist of the ore process plant which will combine the crushing, grinding, magnetic separation and hydrometallurgical circuits. There will be two tailings storage facilities; one storage facility will be for the rejects of the magnetic separation located adjacent to the process plant and one other storage facility for the hydrometallurgical tailing located about 4 km south of the process plant. The administration office, assay laboratory and warehouse will also be located on the Hydromet Plant Site. The employee's parking and the main electrical sub-station will be located in the town of Temiscaming.

The ore deposit is defined by 3 enriched horizons within the "Syenite Complex", which contains the rare earth oxides (REO). In this report, the REO consist of the Light Rare Earth Oxides, LREO: La_2O_3, Ce_2O_3, Pr_2O_3, Nd_2O_3 and Sm_2O_3; Heavy Rare Earth Oxides, HREO: Eu_2O_3, Gd_2O_3, Tb_2O_3, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3 and Lu_2O_3; and Y_2O_3. The total ore tonnage of the mine is of 19.8 million tonnes. With the current measured and indicated resources, the project is scheduled for 15.2 years excluding a two years pre-production period to remove the overburden and level the top of the pit and the construction of the ore process plant and related infrastructure. There is potential for the addition of future resources which could increase this life span.

Figure 4.1 shows the location of the mine's infrastructure.

Figure 4.1 - Location of the Mine Site, Metallurgical Site, Tailings, and Electrical Sub-Station



4.2 Project Location

The Kipawa deposit is located on the Zeus Property, 50 kilometres east of the town of Temiscaming and 140 kilometres south of Rouyn-Noranda, Quebec. All claims are 100% owned by Matamec and are in good standing.

Figure 4.2 - Location Map (modified from Google Maps)

Access to most parts of the property is provided by a network of logging roads of variable quality. The towns of North Bay, Temiscaming and the village of Kipawa are all connected by well-maintained paved roads and Temiscaming is, in addition, linked to North Bay, Sudbury, Pembroke and Smith Falls via a railroad operated by Ottawa Valley Railway.

4.3 Ownership and Agreements

4.3.1 Mineral Rights

After verification in the Gestim Database of the Ministère des Ressources Naturelles et de la Faune ("MRNF"), of the 486 claims (28 674 ha) comprising the property in NTS sheets 31L09, 31L15 and 31L16, 464 claims are 100% owned by Matamec and are in good standing as of August 29th, 2013, with expiry dates ranging from September 9, 2013 to November 18, 2015, and 14 claims are 75% owned by Matamec and 25% owned by Toyotsu Rare Earth Canada and are in good standing as of August 29th, 2013, with expiry dates ranging from July 16, 2014 to June 6, 2015 (Appendix 2.1).

In addition, and as mandated by Québec law, the 8 claims surrounding the deposit that are 75% owned by Matamec and 25% owned by Toyotsu Rare Earth Canada have been officially suspended by order of the Minister des Resources Naturelles, while Matamec's mining lease application is under review. All of these 8 claims have a June 6th, 2015 expiry date (Appendix 2.1).

4.3.2 Project Ownership

After the completion of the Feasibility Study and when TRECan will have completed its investment of $16 M into the project then the property will be still shared by Matamec and TRECan, but at a new ratio where Matamec will be owner at 51% and TRECan at 49%. Matamec will remain the official operator of the joint venture and by this fact of the project.

4.3.3 Land Ownership

The Kipawa project and deposit is located 50 km East of Temiscaming town in Quebec, Canada and it is on public crown land. The claims as mentioned previously are owned by the Matamec/TRECan joint venture.

There are no owner of surface rights in the vicinities of the Kipawa project potential mine and infrastructure.

4.4 Royalties Obligations

In the previous PEA study on the Kipawa project, it was mentioned that few royalties were in force over few claims related to the Kipawa deposit. Since then, all the royalties were bought by Matamec. The Kipawa project or property has no royalties in force anymore and is free of any debts.

4.5 Environmental Liabilities

This Subject is covered in Section 20.0 - Environment Studies, Permitting, and Social or Community Impact.

5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

This section has been taken from the previous NI 43-101 compliant report: “Preliminary Economic Assessment Study for Kipawa Project” by Roche Ltd. and SGS Geostat dated March 2012.

5.1 Accessibility

The Kipawa Project is located 50 km East of Témiscaming town. In order to access the project it is the intent to use the existing Maniwaki road which is a good quality gravel road. At kilometre 50 it will be necessary to build a 4 kilometre road toward the North to access the process plant site; then from the plant site to access the mine, it will be necessary again to build a 10 kilometre road toward the North with a bridge of 60 m long to pass over the Kipawa River. All the new access roads will be on public land but however for private usage by the mine during operation. At the end of the mine operation, these access roads will be turned over to the Ministry of Natural Resources.

The Maniwaki road is owned by the Ministry of Natural Resources, but it is mostly maintain by the main industrial users. There are no fees to use that road except that maintenance costs have to be assumed for the feasibility study.

The new roads to be built are part of the Kipawa project planned capital expenditures. The maintenance of all these roads is part of the estimated operated cost. However, since TEMBEC is already using the Maniwaki road, there are possibilities to share with them the cost to maintain this road.

5.2 Physiography

The altitude of the property is between 295 m to 395 m above sea level with total relief of about 100 m. A gentle rolling topography characterizes this area, overlain with an extensive cover of glacial till. At least one esker was identified close to the working area and bedrock is seldom exposed. Drainage is toward the Kipawa River, which crosses the southern part of the property in an east-west direction. Lower parts of the property contain small lakes and swamps. The area is characterized by a mixed forest, which was partially logged.

5.3 Climate

This region presents a variation of the continental climate, which is characterized by hot summer and cold winter temperatures. The amount of precipitation is moderately high (94 cm per year, a quarter as snow) and the ground is generally free of snow from mid-May until the beginning of November.

5.4 Local Resources and Infrastructure

The nearest town is Témiscaming, Québec, some 50 km west of the property. It is a small pulp and paper town (3,000 residents). Groceries, fuel and limited services and supplies may be obtained there. North Bay is the nearest large town. It has a population of about 55,000 residents and is connected to the larger metropolitan centres in Ontario by a good highway, railway and scheduled airline services.

The towns of North Bay, Témiscaming and the village of Kipawa are all connected by well maintained paved roads and Témiscaming is in addition linked to North Bay, Sudbury, Pembroke and Smith Falls via a railroad operated by Ottawa Valley Railway.

6.0 HISTORY

6.1 Introduction

This section is modified from Zeus first NI 43-101 Technical Report (Knox, Heymann and Fleury, June 2009) with additions from Matamec's drilling report (Fleury, 2013). See Figure 6.1 for location of showings in and around the Zeus property.

Exploration was initiated in the region after gold-uranium mineralization was found in 1957 at Hunter's Point, some 26 km northwest of the Zeus property (best value of 0.97% U and 10 g/t Au over 22.5 m of channel sampling (Tetu, 1983), best grab value of 6.8% U and 38 g/t Au (Rive, 1972)). Subsequent exploration, along with the recognition of the Kipawa Peralkaline Complex which underlies part of the Zeus property (Lyall 1959); can be divided in three broad periods:

- **Period I**

Prior to 1985, most of the exploration work was oriented towards uranium and was concentrated near the eastern shore of Sheffield Lake (where a large, 600 m long airborne radioactive anomaly was outlined) and near the south shore of the Kipawa River (the KR zone). A variety of companies were involved at this stage, notably Valdez, Nuspar, Hollinger, Imperial Oil and Talisman.

- **Period II**

From 1985 to 1991, exploration focused on minerals containing rare metals, which were found in significant amounts by drilling programs undertaken during the previous period of exploration. Unocal Canada Ltd was the sole claim owner and operator during this phase of exploration and targeted specifically on Y (for colour TVs) and on Zr as a possible by-product. Unocal ceased its operations as a mineral exploration company in 1990, leaving the field open to the prospectors and then junior companies of Period III. Although a large part of Period II's historical exploration work was concentrated in the Sheffield area (including drilling and large scale trenching), other sectors of the Peralkaline Complex also underwent extensive exploration.

- **Period III**

From 1991 to the present, buoyed by sharply increasing global demand for REE sources outside China, exploration broadened to include all rare earth elements. Matamec Explorations, present holder of the claims, began its efforts early in this cycle circa 2007, but was soon followed by companies such as Aurizon Mines, Fieldex Exploration, Globex Mining and later Forum Uranium. Matamec's ongoing efforts concentrated both on the deposit itself (with a broad exploration and definition drilling effort) and on the property at large, leading to the discovery of numerous new REE showings.

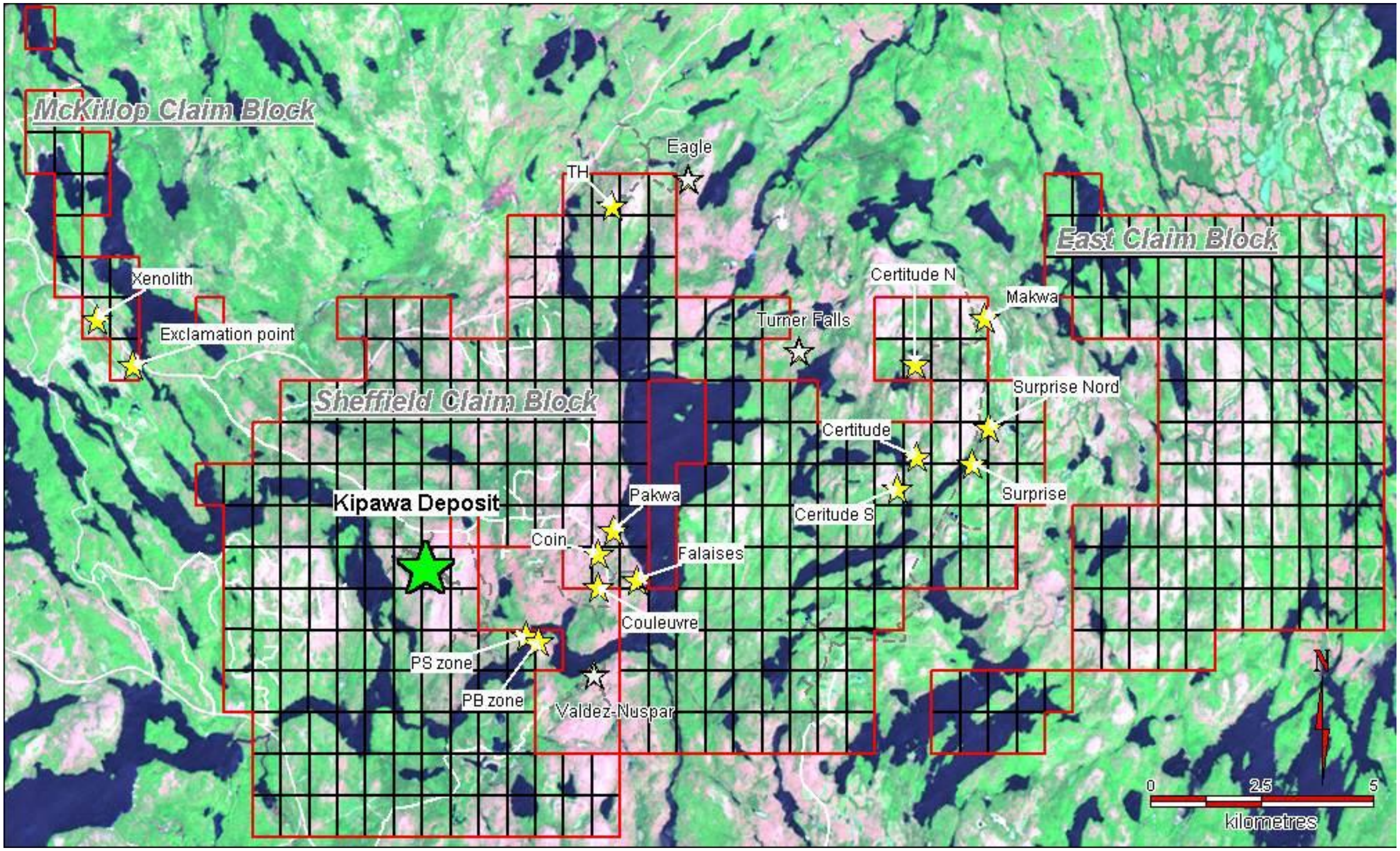
Periods from I to III are discussed in more detail in the following sub-sections.

6.2 Exploration Work Pertaining to Period I (1956 to 1984)

Exploration efforts carried out near the limits of Zeus property were first reported in 1956, in an informational Report (Dugas, 1956). Brennan Lake Uranium Syndicate was interested in an exposure of amazonite observed on one of the islands in Sairs Lake, located close to but outside the present limits of the Zeus property. Dugas (1956) described the drill core recovered from 5 short holes and observed weak radioactive spots and one yellow stain occurrence in the core. Chemical assays of 11% uranium oxide (U_3O_8) and 16.1% columbium oxide (Cb_2O_5) are also reported but this information seems to have been obtained verbally from the owner of the drill core, Mr. A-J. Cunningham. The location of the drill holes was also reportedly inaccurate (Dugas, 1956).

Two years later, Hollinger Québec Exploration Co. Ltd (Hollinger) tested radiometric anomalies delineated just east of Sheffield Lake, in the Sheffield claim block of the current Zeus property. Thirteen short holes were drilled but no assays were recorded in the assessment files (Unknown author, 1958). However, the presence of eudialyte (described as “eucolite”) and britholite was reported in the drill logs and it appears that assays for rare earth elements and niobium were done at this time.

Figure 6.1 - Location of REE Showings in and Around the Zeus Property (Matamec's Claims=Black)



During 1969 and 1970, Imperial Oil Ltd, in joint venture with Sturdy Mines Ltd, carried out two drilling programs along the Sheffield Zone. The first drilling program consisted of 6 short holes (S-1 to S-6) mostly drilled at the southeastern end of the Sheffield zone, for a total of 149.9 metres (491.8 ft). The second drilling program (V-1 to V-10) covered a longer portion of the Sheffield zone, for a total of 902 metres (2958 ft). A total of 8 holes (V-1 to V-8) were drilled along the Sheffield zone and 2 holes (V-9 to V-10) were drilled at Bald Mountain. Again, no assays appear on the drill logs provided to the government assessment files but a summary of U_3O_8 and ThO_2 assays is provided in one of the reports (Willars 1970a and b, best values of 0.13% U, 1.19% Th). In conjunction with anomalous values of uranium and thorium obtained in a few samples, unusual minerals were noticed and initially described as rhodonite, sphene and a brown radioactive mineral (Willars, 1970a). Later, Dr. Gittins, a mineralogist at the University of Toronto was contracted by Sturdy Mines and identified 20 very rare minerals, including eudialyte, eucolite, mosandrite, britholite and thorite. His findings initiated a number of academic papers on many of the exotic and rare minerals that were found in this area, leading to the recognition of the Kipawa Alkaline Complex. Sturdy Mines concluded that radioactivity was due chiefly to thorium and theorized that the radioactive area could be an assemblage of large patches rather than one continuous band (Willars, 1970a).

An airborne radiometric survey was conducted for Sturdy mines in 1969 (Schuur, 1969 GM 25493). It covered the southern portion of Villedieu, McLachlin and Reclus Townships. During the same years, another airborne radiometric survey was conducted for Laduboro Oil Ltd (Blanchet et. al, 1969), and covered the southern portion of Villedieu and the northern portion of Sébille Townships. Follow-up work of ground scintillometer surveys, geological mapping and trenching of an anomalous area south of Kipawa River led to the discovery of significant uranium mineralization (0.14% U over 0.3 m, Cukor and Tayor 1978, GM33960). This anomalous zone, initially identified as the Pond zone and now known as the Valdez-Nuspar zone, is located between Sheffield and Sairs lakes, some 200 m outside the Zeus property limits.

In the McKillop claim group forming the north-western part of the current Zeus property, a ground gamma ray spectrometer survey together with a geochemical soil survey were also undertaken in 1969 by Ryanor. The survey focused on areas where contact between the quartzite member and gneissic rocks was postulated to be present, a geological context similar to the one observed at Hunter's point (Gledhill, 1969, GM25981). A part of these surveys is located on the Zeus property. The surveys resulted in three anomalous areas: two single-station anomalies on the radiometric survey and one 480 m north-south uranium anomaly in the soil survey, the southern half of which is included in Matamec's claims.

The property then remained relatively unexplored until the late 1970s when renewed interest for uranium sparked exploration activity in the area. Valdez Resources Industries Ltd and Nuspar Resources Ltd carried out several exploration campaigns from 1977 to 1979, including drilling programs, in the Valdez-Nuspar zone defined by Laduboro Oil, south of Kipawa River (0.09% U over 1.6 m and 0.2% Y, 0.2% La and 0.1% Ce over 0.45, 0.7 and 0.6 m respectively, Cukor and Tayor 1978, GM33960 and GM34637).

Late exploration performed by Nuspar Resources included more regional-scale work covering an area now partly located in the Zeus property. Their objective was to obtain a better geological, structural and tectonic picture and to find additional radioactive occurrences on their property. Radon-gas and scintillometer surveys identified a possible extension of the Valdez-Nuspar Zone (uranium and/or rare earths) in both eastern and western directions, for a length of about 1.3 and 0.9 km, respectively. Almost 600 m of the postulated eastern extension of the Valdez-Nuspar zone is therefore located within the Zeus Property. Other zones of interest, including Sheffield, Bald Mountain, Fire and West Sairs Lake areas, were also identified in this study.

6.3 Exploration Work Pertaining to Period II (1985 to 1991)

The discovery of anomalous yttrium mineralization in the Pajarito peralkaline granite and quartz syenite in New Mexico (Mariano, 1984) initiated a search for yttrium in eudialyte from varied geologic localities on a world-wide level. A study of yttrium in various eudialytes was carried out by Mariano (1985) and eudialyte with the highest Y content was found to occur at Pajarito, New Mexico, and Kipawa, Quebec. The main interest in yttrium-bearing minerals came as a consequence of the discovery of ion-adsorbed Y and REE in the south China clays which had a profound effect on the source and world market price for these elements. It was believed that easily-dissolved Y and HREE in eudialyte would be a source that could compete economically with the south China clays.

In 1985, Unocal of Canada therefore staked the east side of Sheffield Lake and progressively extended the size of their claim block during several exploration programs ranging from 1987 to 1990. Their goal was to evaluate the Y-Zr potential of the property, including a general evaluation of its lanthanide potential. Exploration work included geological mapping, rock chip sampling, airborne radiometric-magnetic-VLF surveys on the Kipawa Peralkaline Complex and adjacent metasediments (Gidluck, 1989), ground radiometric and magnetic surveys, a soil geochemical survey, trenching, channel sampling and diamond drilling (Knox, 1988 and 1990, Allan, 1991, Gidluck, 1988). In addition, six half-ton bulk samples were collected from trenches, four of those samples being sent to Mountain States Research Laboratories for preliminary metallurgical testing (Ramadorai and Bhappu, 1991). A mineralogical study of the yttrium-bearing minerals was concurrently undertaken by Dr. Mariano (Mariano, 1990a and 1990b).

Exploration work conducted by Unocal concentrated on three mineralized zones, which they identified as the Main Zone (identified in this report as the Kipawa deposit), the PB/PS Zones and the KR Zone (also identified in this report as the Valdez-Nuspar Zone). The first two zones (Sheffield and PB/PS) are entirely included in the Zeus property. As for the KR zone, only its supposed eastern extension (last 600 m) is included in the Zeus property.

In 1990, best and most continuous yttrium values were thought to occur in the upper part of the syenite gneiss unit (situated at the base of the Kipawa Peralkaline Complex), in areas containing eudialyte, yttro-titanite/mosandrite and minor britholite. Yttrium values contained in the britholite of calc-silicate rocks and in the yttro-titanite of syenitic rocks belonging to the lower part of the syenite unit were considered by J. Allan to be too erratic to be included in a resource calculation. Therefore, the drilling program of 1990 was designed in such a way that drill holes were vertical and short so that a maximum number could be drilled to test the most favorable upper syenite portion of the calc-silicate/syenite complex. Only a few holes penetrated into the lower calc-silicate dominant part of this unit and none tested the down-dip extension of the deposit at depth (i.e. towards the south-west). In addition, the poorly exposed 620 m long central section of the Sheffield Zone, separating the East and West Main Zones, was also judged to show yttrium values too discontinuous to be systematically drilled and was therefore not included in the resource calculation (Allan, 1991).

By the end of the 1980s, Unocal had accrued a 5.3 billion dollar debt load due to a series of takeover attempts by external parties (most notably by T. Boone Pickens Jr in 1985). With the forced resignation of CEO Fred Hartley in 1988, Unocal began a period of re-structuring, notably divesting itself of all its non-US mineral assets including its Kipawa Y-Zr property (International Directory of Company Histories).

The property thereafter lay dormant for nearly seventeen years.

Table 6.1 - Summary of Historical Drilling Programs on the Zeus Property

Company / Year	# Holes/ Total length	Location and Results
Hollinger /1958	13 DDH / 589 m	Sheffield Lake. No assays, but presence of eucolite and britholite noted in drill logs.
Manzutti /1966	4 DDH / 195 m	North of Sairs Lake Zirconium minerals observed
Sturdy Mines / 1970	6 "Winkie" DDH / 150 m 9 DDH / 758 m	Sheffield Lake. Low uranium content associated with thorite. Delineation of new radioactive zones.
Unocal / 1988	12 DDH / 980 m (88-KU-01 to 88-KU-12)	Sheffield Lake (main zone). Yttrium and zirconium mineralization over a length of 1 250 m. Best intersection ranging from 0.10% Y_2O_3 over 5 m, to 0.18% Y_2O_3 over 25 m
Unocal /1990	27 DDH / 1531 m (90-KU-13 to 90-KU-34)	22 DDH at Sheffield Lake (Main Zone) for a total of 1074 m. 5 DDH at PB zone for a total of 457 m. Best intersection: 0.12% Y_2O_3, over 18 m in drill hole 90-KBZ-4 (PB Zone).

6.4 Exploration Work Pertaining to Period III (1992 to Present)

The present Zeus property, initially identified as the Villedieu Project, was initiated in 1997 when a few claims covering rare minerals occurrences of the Kipawa Complex were optioned to Ressources Minérales Mistassini Inc. by prospector Gérard Houle. In the fall of 2002, with the assistance of a Québec Government prospector help program (volet A-1), a limited lithogeochemical and till sampling program was undertaken in collaboration with Inlandsis Consultants (Charbonneau, 2003). Lithogeochemical samples were collected along 6 geological traverses, one being located in the north of the west claim block. In addition, till samples were collected along an east - west traverse, some 2 km south of the property. High abundance of minerals such as zircon, sodic amphibole, sphene and fergusonite were observed in the heavy mineral concentrates obtained from the till samples, which reflected the alkaline affinity of the complex.

In 2003, the Zeus Property, which at the time consisted of 11 map designated cells (CDC), was transferred to Matamec Explorations Inc. Additional claims were progressively acquired from 2003 to 2013, significantly enlarging the Zeus property until it reached its present size of 486 claim cells in January 2013.

Exploration work carried out by the emitter, all of it belonging to Exploration Period III, is detailed in Section 9.0 (Exploration).

7.0 GEOLOGICAL, SETTING AND MINERALIZATION

7.1 Geological Setting

The following section has been adapted from Matamec's drilling report (Fleury, 2013) and from Zeus first NI 43-101 Technical Report (Knox, Heymann and Fleury, June 2009). It describes the regional geology and then the geology specific to the Kipawa Deposit. See Section 7.2 for a description of the mineralization itself.

7.1.1 Regional Geology

The Zeus property is located in the parautochthonous zone of the Grenville geological province, specifically 55 km south of its contact with the Superior province (Figure 7.1). Lithologies consist mostly of proterozoic gneiss with metamorphic grade ranging from green schist to as high as amphibolite-granulite (kyanite and sillimanite were observed in the Kipawa complex by Rive 1972).

With the exception of the Kipawa Complex, all local lithological units settled in place via two northwest-southeast thrust faults during the Grenvillian Orogeny, which is known to have peaked in the region at about 1060 Ma (based on Rb-Sr and U-Pb zircon age determinations elsewhere in the Grenville Province (Emslie and Hunt 1990)).

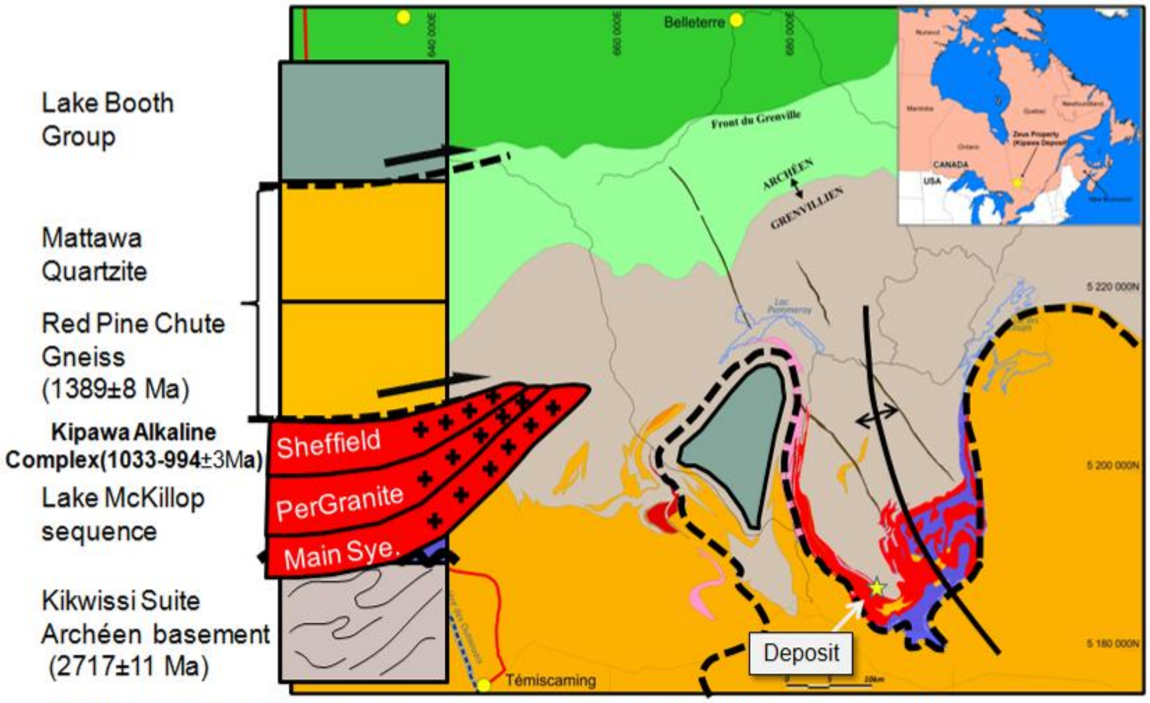
7.1.1.1 Stratigraphic Column

The main regional rock units are, from bottom to top of the local stratigraphic column, (1) archean quartzo-feldspathic biotite gneiss of the Kikwissi Suite, often referred to as Basement Gneiss (2.71 Ga), (2) a relatively thin section of meta-sediments from the McKillop Group including: quartzite, muscovite gneiss and minor marble. All of which lays uncomformably over the Kikwissi gneisses. A first grenvillian thrust fault overlaid (3) orthogneiss from the Red Pine Chute Group, composed of alkali biotite granites and syenites (1.39 Ga), and (4) quartzites from the Mattawa Group over this assemblage. A second late grenvillian thrust fault finally overlaid (5) allochthonous amphibolites, pelites and granites of the Lac Booth Group on top of the Mattawa quartzites (Allan 1992, Van Breemen and Currie 2004). See Figure 7.1.

The Kipawa Alkalic Complex then inserted itself between the Kikwissi and McKillop/Red Pine Chute Groups circa 1.03 Ga, either through purely magmatic processes, or helped along through progressive anatexy caused by heat from the upper slab settling in place, as suggested by Van Breeman and Curry (2004). The Kipawa Alkaline Complex itself is an intrusive, concordant folded sheet of mildly peralkaline syenite and granite less than 200 m thick (Currie and Van Breemen, 1996). Unocal geologists divided this 200 m into an upper or "Sheffield" syenite to south-west, a peralkaline granite in the middle, and another "Main" syenite to the north-east. The Main syenite is on average 50 to 80 metres thick and is the host rock for the REE mineralization found at the Kipawa deposit. Rocks from the complex have been initially dated at 900 Ma (muscovite) and 1290 Ma (nepheline) by the potassium-argon method (Aarden and Gittins, 1974). Recently obtained U-Pb ages on zircon - from 1389 ± 8 Ma to 1033 ± 3 Ma for the syenite complex - suggest a low cooling and late metasomatic activities associated with emplacement at the onset of peak metamorphism of the Grenvillian Orogeny (Van Breemen and Currie 2004).

The peralkaline granite and the Main syenite units of the Kipawa complex and the Kikwissi gneisses (regional unit 1) have been encountered in local drill holes. Small, heavily metasomatised lenses of unit 2, the MacKillop paragneisses, have also been encountered.

Figure 7.1 - Stratigraphic Column at Kipawa



U-PB ages on Zircons by Van Breeman et Currie (2004) and Currie and Van Breeman (1996)
1012±16 Ma by MC-ICP-MS (Wu et al 2010)

7.1.1.2 Structure

Property gneiss were then deformed during at least two phases, namely D1 which created north-east trending regional folds leaning towards the north-west, and D2, which created north-west trending folds leaning south-south-west (Rive, 1972). The regional Sairs Lake Antiform, which houses the Kipawa deposit on its west flank, is from this later phase. On surface, the Complex therefore has an elongate, V-shaped body folded around this major southeast plunging anticline. The west limb of this fold, which includes the Kipawa deposit and the PB-PS zones (and is also the interpreted source of the PS Zone boulders), has a fairly linear shape that parallels the northwest trending McKillop Lake. In the mineralized area around the Kipawa deposit, the concordant sheet dips gently to the south-west with a dip between 20 and 30 degrees. Whereas the east limb of the anticline, which include the TH, Falaises, Couleuvre and Coin showings, has a more irregular shape (See Figure 7.1).

Faults trending 260°N affect the entire region and can clearly be seen on aerial photographs. Shear zones trending 65°N are also common on the regional scale (Blanchet, Dépatie et Morin, 1969).

7.1.1.3 Glacial Geology

The area was covered by glaciers during the last glacial high 18,000 years ago. Local glacial movement can be measured on glacial striae, chattermarks and the elongation of radiometric anomalies in the PB zone (Allan, 1991). Movement in the region seems exclusively towards the south-west (210°N). The younger south-south-west component that also affects Val d'Or and northern Temiscamingue seems entirely absent here (Charbonneau, 2003).

7.1.2 Kipawa Deposit

The Kipawa Deposit is also known as the Sheffield Deposit or Unocal's Main Zone, is wholly contained within the Main syenite portion of the Kipawa Alkaline complex. At the site, the complex shows modest small-scale internal folding, but is, at the deposit scale, an almost entirely undeformed, gently south-west dipping linear slab.

The various lithologies found in the mineralized area and deposit-scale alterations are described in the following sub-sections.

7.1.2.1 Lithologies

The Kipawa Alkaline Complex has been divided into two main units in the mineralized areas (See schematic section Figure 7.2): a peralkaline granite gneiss unit to the south-west (structural top) and a syenite gneiss unit to the north-east (structural bottom), with the latter containing the rare earths, yttrium and zirconium mineralization as well as interlayered lenses of calc-silicate rocks. This syenite unit is closed off by a thin, metric layer of monzonite gneiss attributed to contact metamorphism and finally the granitic gneisses of the Kikwissi suite to the north-east (structural bottom).

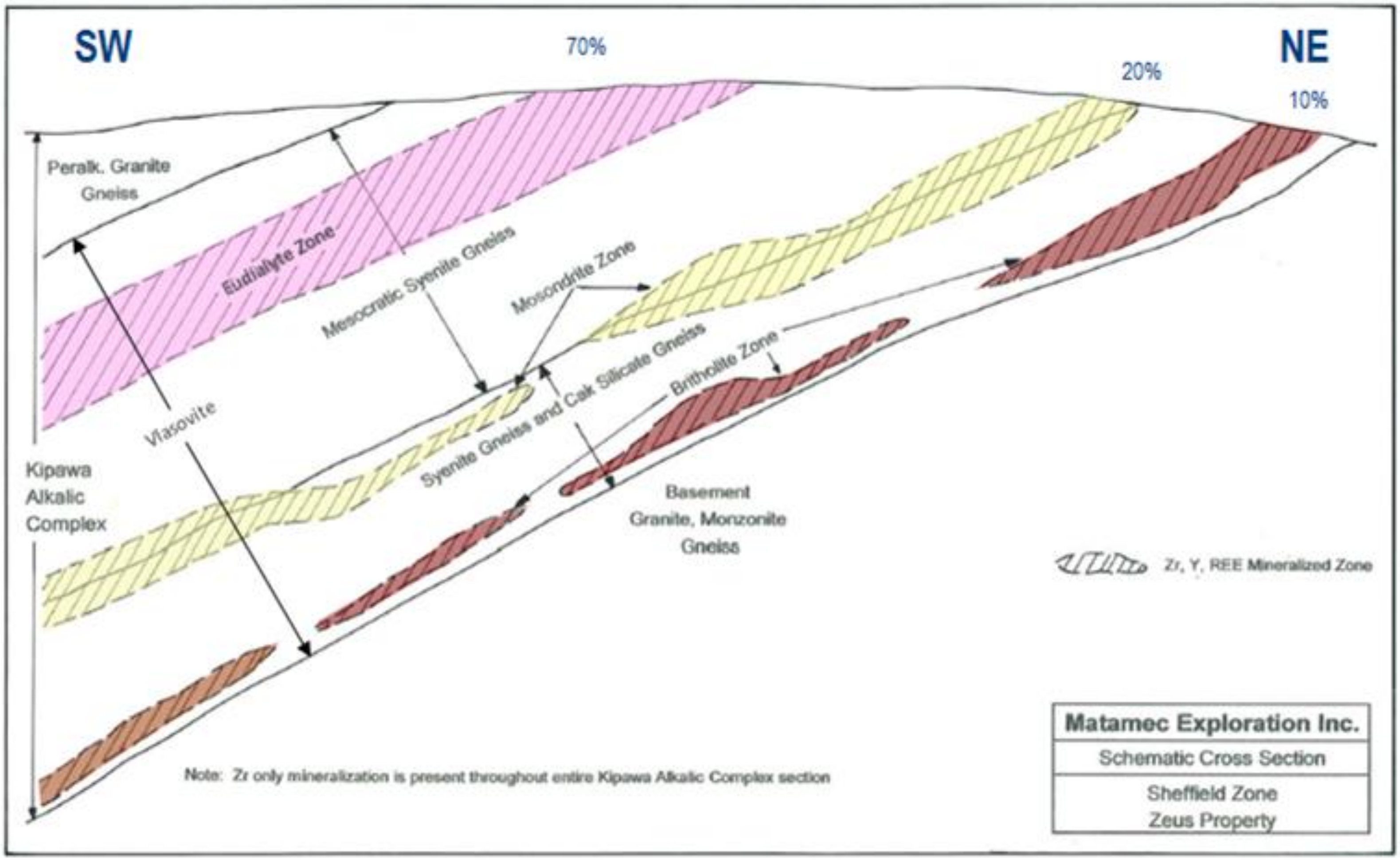
The syenite unit is subdivided into five broad rock types: leucocratic syenite, mesocratic syenite, mafic syenite, augen syenite gneiss and silver-gray amphibolites. Contacts between these types are gradual to abruptly gradual. The calc-silicate rocks interlayered within comprise impure marbles, phlogopite-amphibole-calcite rocks and diopside-feldspar rock. Contacts between these and the syenite units are abruptly gradational (i.e. contact can be identified to within 1 to 10 cm).

Each of these rock types is described in more details below, in the approximate order in which they are encountered in drill holes. In these descriptions, the following granulometric definitions were used:

Table 7.1 - Grain Size Descriptions

Description	Grain diameter (mm)
Fine grained	0.1 - 1
Medium grained	1 - 5
Coarse grained	5 - 15
Very coarse grained	15 - 30
Pegmatitic	30 and up

Figure 7.2 - Schematic Cross-Section of the Kipawa Deposit, looking NW



- Peralkaline Granitic Gneiss:

Visually, the peralkaline granitic gneiss is identical to the leucocratic syenite or mesocratic syenites, but unmineralized in terms both of rare earths and zirconium. It is light grey to orange grey and poorly to moderately-well foliated. It is composed of fine grained clear glassy feldspar and 15% to 30% mafic minerals (medium grained to coarse grained black and minor dark green amphiboles, showing up as large clumps or very fine needles). Minor fine-grained pyrite, graphite, galena and ultra-trace creamy stubbies can also occur (creamy stubby being the field name for vlasovite/gittensite). Sometimes, up to 20% angular quartz is also observed. As this is often the unit closest to surface, decimetric bands of orange meteoritic alteration along fractures is common in its upper five metres.

- Leucocratic Syenite Gneiss:

The leucocratic syenite is black and white, medium to coarse grained and goes from almost massive to moderately foliated. Foliation is defined by mineral segregation and by some parallel alignment of the amphiboles. This rock is composed of 15% to 20% dark green and black amphiboles and 80% to 85% fine-grained clear glassy feldspar. Although mostly homogeneous, this lithology can contain small patches of feldspar augen with very coarse-grained vlasovite, mesocratic patches and some centimetric intervals of coarse grained silver-grey amphibolites (see below for a description of these two lithologies).

Exotic minerals are mostly creamy stubbies with sparse mosandrite. Mafic rich patches usually feature more abundant creamy stubbies, some zircon, occasional light brown unidentified mineral (possibly sphene, fosterite or baestnasite?) and/or fluorite.

- Mesocratic Syenite Gneiss:

Mesocratic syenite is medium grey and medium to coarse grained. It is composed by 20% to 50% black and dark green amphibole and by 50% to 80% fine grained clear glassy white feldspar. It can contain some white feldspar augens. It is moderately to poorly foliated with foliation defined by mineral segregation and by some parallel alignment of the amphibole. This lithology can contain bands of calc-silicate lithologies, mostly fine grained diopside feldspar rock, more abundant bands of silver-grey amphibolite and some biotitite "dykes". It can contain coarse grained feldspar zones with green amphiboles.

Exotic minerals are fine grained creamy stubbies disseminated throughout in bands and patches, disseminated eudialyte and the occasional medium grained thorite patches.

- Diopside Gneiss:

Diospide gneiss is defined as medium grained to coarse grained mesosyenite with almost all dark green mafics. This green mafic has historically been described as "diopside" and the term "diopside gneiss" has been kept to remain consistent. It is well to strongly foliated and composed of 30 to 40% medium grained to coarse grained dark green and minor black amphibole and by fine grained clear glassy feldspar. It can have up to 20% white feldspar augen. Most of this lithology is associated with a ductile deformation zone characterized by strong foliation and the prevalence of large, centimetric feldspar augen.

Exotic minerals are 1% creamy stubbies, trace to 1% white mosandrite and vlasovite.

- Mafic syenite gneiss:

Mafic syenite is medium grained to coarse grained to very coarse grained. It is poorly foliated to well foliated. Foliation is defined by mineral segregation and by some parallel alignment of the amphibole. It is composed of 50 to 55% dark green to black amphiboles and dark green diopside. It contains some diospide rich patches and some mafic bands.

Exotic minerals are eudialyte, finely disseminated mosandrite, creamy stubbies and dark purple fluorite.

- Silver-grey amphibolites:

Silver-grey amphibolite is massive and composed of 50 to 75% equant, coarse grained amphibole in a matrix of 25% fine grained feldspar. Amphibole is greenish black to bluish-grey with a characteristic silver reflection and has been identified by micro-probe analysis as richterite. It sometime contains chalk-white tremolite or minor phlogopite.

Exotic minerals are purple fluorite, eudialyte, mosandrite, vlasovite, creamy stubbies and thorite.

- Calc-Silicate Complex:

The calc-silicate lithologies described below are interlayered within the various syenitic units described above. The calc-silicate complex is composed of diopside-phlogopite-feldspar rock, diopside-feldspar rock, massive feldspar rock, marble, calcite-amphibole rock, calcite-pyroxene rock. These lithologies usually change rapidly within a given calc-silicate interval (on the decimetric scale). Each, with the exception of massive feldspar rock, is described in more details below.

The Diopside-phlogopite-feldspar rock is fine grained to medium grained and weakly foliated (defined by parallel alignment of phlogopite). It contains 20% feldspar and 50% to 30% deep green diospide. Exotic minerals are purple fluorite, glassy yellow sphene and flesh-coloured euhedral zircon.

The Diopside-feldspar rock varies from fine grained diopside rock, to medium grained diopside-feldspar rock to coarse grained mesocratic diopside syenite gneiss. It is composed of 35% fine grained to medium grained mafic minerals, mainly diopside. Highly irregular, coarse grained phlogopite bands are also present. Exotic minerals are disseminated purple fluorite, mosandrite, eudialyte, vlasovite, honey-brown glassy minerals and zircon.

The Diopside-phlogopite rock is fine grained, medium green and massive. It is composed of 10% interstitial feldspar and very coarse phlogopite porphyroblast disseminated or in bands. Exotic minerals are purple fluorite, very coarse grained flesh-coloured zircon patches and very fine grained elongated bone-white crystals of mosandrite.

Marbles are medium grained to coarse grained, massive and composed of calcite with various amounts of bright orange chondrodite (hydrated olivine), phlogopite, dark and glassy diopside, purple fluorite, silver-grey amphiboles and britholite.

- Monzonite Gneiss:

The Monzonite gneiss is slightly tan-coloured and black. It is poorly foliated. It is composed of 20% to 30% medium to coarse grained mafic minerals, mainly black amphiboles and by 70% to 80% glassy felsic minerals. Felsic minerals are fine grained feldspar and some quartz. Sometimes, biotitite bands are present. Grain size and mafic minerals decrease downwards from the syenite contact, as do general radioactivity. Gneiss becomes granodioritic and then granitic downwards. This is possibly a contact-metamorphosed portion of the granitic gneiss.

- Granitic Gneiss:

The Kikwissi granitic gneiss is orangy-pink and black in colour, fine to medium grained and moderately to very poorly foliated. It is leucocratic with 10% mafic minerals (amphibole and biotite). Felsic minerals are feldspar and quartz. Bright red hematite staining on fracture faces is sometimes present.

- Others:

All these lithologies are occasionally cut by small, decimetric fine-grained biotitite intervals with sharp, millimetric borders of sheared white feldspars (these are interpreted as altered mafic dykes) and, in one instance in trench T-1, by a syenitic pegmatite with gem-class eudialyte, mosandrite and agrellite minerals (the "specimen pit").

7.1.2.2 Alteration

Rocks in the Kipawa Deposit are overwhelmingly fresh and unaltered, and this particularly true of the West Zone, which contains the majority of existing resources. Three alteration types do cover specific parts of the deposit.

Light surface alteration is the most common alteration observed in drill core. It consists of decimetric, orangy ferric staining around small joints and fractures in the first 5 to 10 metres from surface. This is attributed to normal infiltration of meteoritic waters into the rock mass with no significant mineral change.

Moderate silicification is observed in the eastern part of the deposit. The rock in this section is noticeably harder to drill, with core surface showing a polished sheen that easily sheds the mark of logging crayons. This silicified zone extends roughly from line 2150 onwards to the east.

Lastly, moderate hematization is also present, mostly in the south-eastern part of the central zone. The rock in this section is stained in various shades of red, making mineral identification difficult. Disseminated grains of dusty red hematite are also commonly observed. This moderately hematized zone extends roughly from line 2050 to line 2200, with scattered sectors of light hematization also present to the extreme east of the deposit (line 2500 onwards) and to the extreme south of the West Zone (last one, sometimes two holes of drill sections going from 1200 to 1800).

7.2 Mineralization

The following sections have been adapted from Matamec's drilling report (Fleury, 2013) and from Zeus first NI 43-101 Technical Report (Knox, Heymann and Fleury, June 2009)

Rare earth-yttrium-zirconium mineralization at the Kipawa deposit is contained in medium grained silicates disseminated in meso to mafic syenites and impure marbles (up to 20% per volume). Grains are distinct and generally well crystallized.

Three minerals are presently considered as an economical source of rare earths on the Kipawa deposit, namely eudialyte (a sodic silicate), yttro-titanite/mosandrite (titanite silicate) and britholite (calcic silico-phosphate) for rare-earth-yttrium. Minor apatite (a phosphate) is also present in places, furnishing some of the light rare earths. Vlasovite/gittinsite (sodic and calcic silicates) and eudialite (sodic silicate) were once considered as a source for a possible zirconium by-product, but this is no longer the case. Each of these is described in the sections below, followed by a short section on ore genesis.

7.2.1 Spatial Distribution

While vlasovite and its alteration mineral gittinsite are spread in a fairly uniform manner throughout the syenitic body, this is not the case for the other minerals. Specifically, three vertically-stacked mineralized zones have been defined based on their spatial characteristics: the Eudialyte, Mosandrite and Britholite zones (See Figure 7.2). Despite their name, the different zones contain a mix of potentially economic minerals. The name simply indicates the dominant REE mineral present in that zone.

The Eudialyte zone consists of intermixed eudialyte and mosandrite/yttro-titanite with trace britholite (usually identified as "honey-brown mineral"). It sits near the top of the syenite body and is not associated with any large calco-silicate horizon. The Eudialyte zone represents 57% of the rare earth-yttrium resources defined in this Report.

The Mosandrite zone also consists of intermixed eudialyte and mosandrite/yttro-titanite but with a much lesser relative quantity of eudialyte and some added britholite. It sits between the Eudialyte and Britholite zone and is, in part, associated with the first major calc-silicate horizon. It incorporates 23% of rare earth-yttrium resources defined in this Report.

Lastly, the Britholite zone consists of intermixed mosandrite/yttro-titanite and britholite. It sits at or very near the lower contact of the complex and is mainly contained within the bottom calc-silicate horizon which almost always includes marbles. The Britholite mineralized zone is mostly fairly thin, discontinuous in grade and incorporates roughly 20% of existing rare earth-yttrium resources.

In plan view, all these zones cover the same general area, namely a rough rectangle 1.45 km long (north-west to south-east) and 200 m wide (north-east to south-west).

7.2.2 Description of REE minerals

Figure 7.3 - Kipawa Eudialyte[1]

Though the least REE enriched, Eudialyte (Figure 7.3) is the most abundant of all of Kipawa's REE bearing minerals (about 50% visually-speaking). It is a sodic Y-Fe-Zr silicate and is considered a potentially economic source for REE (maximum 10 w/w% of REE in the mineral, up to 66% HREE+Y/TREE at Kipawa) and Zr (9 w/w% in the mineral). Eudialyte at Kipawa is bright pink, to reddish-pink, to dull red with no cleavage planes or obvious crystal faces as opposed to the almandine garnets found at Surprise Showing, for example). Based on experience, the change of colour seems to be associated with high REE content, the brighter the pink, the more enriched the eudialyte. This mineral is generally disseminated and appears in irregular centimetric to decimetric bands. It is often associated with the more mafic syenite intervals (mesosyenites and mafic syenites), and with silver-grey amphiboles in particular where it is interstitial. It is sometimes seen as rather spectacular irregular haloes around vlasovite crystals.

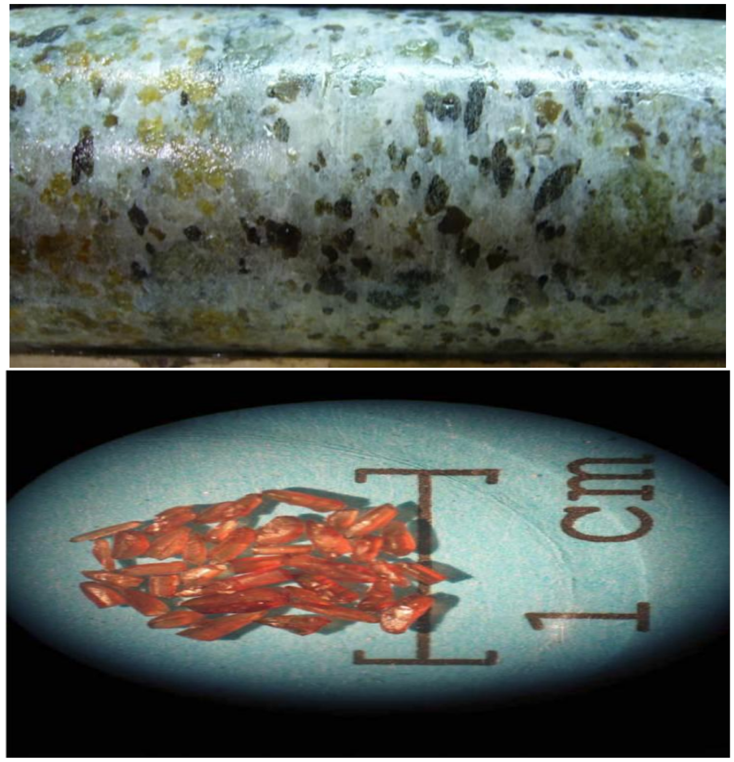
1 $Na_5(Y,Ca)_6(Fe_2+,Mn_2+)_3Zr_3(Si,REE)(Si_{25},0_{73})(O,OH,H_2O)_3(CL,OH)_2$ - Kipawa eudialyte (in pink) may contain Y and HREE in amounts exceeding 4 wt%. The mineral is easily dissolved in weak acids. Sample is a pegmatitic syenite from the specimen pit at Kipawa (sodic amphibole, albite, quartz, traces of agrellite).

Figure 7.4 - Kipawa Mosandrite[2]

Mosandrite (Figure 7.4) comes in second in terms of REE enrichment and relative abundance (about 40% of REE minerals visually). It is a sodic and calcic titanium silicate which is considered a potentially economic source for REE (maximum 20 w/w% of REE in the mineral, up to 36% HREE+Y/TREE at Kipawa). Mosandrite occurs in three distinct colours, either pale medium brown, greenish-white or bone white (see also "green mosandrite" in Other Minerals below). It is thought that the bone-white, chalkier variety is an altered version of the first two. In all cases, mosandrite shows elongate crystals with feathery terminations. It should be noted that while mosandrite sensu-stricto does exist at Kipawa, a certain number of crystals visually identified as "mosandrite" turned out to be an yttrium-rich version of titanite under lab analysis (Mariano, 2008). Mosandrite is almost always disseminated or in small radiating clumps. It is mostly associated with the more mafic syenite intervals (mesosyenites and mafic syenites) and with diopside-feldspar rock intervals.

2 $(Y,Ca)TiSiO_5$ - Previously identified as only mosandrite, this mineral seems in fact to be a mix of yttro-titanite, mosandrite and, tentatively identified, but not confirmed, minasgeraisite and nacareniobsite (Mariano, 2008). Sample is from trench 2 of the Sheffield Zone (Yttro-titanite in bone yellow, disseminated eudialyte in pink, sodic amphibole in dark grey, albite in white).

Figure 7.5 - Kipawa Britholite[3]

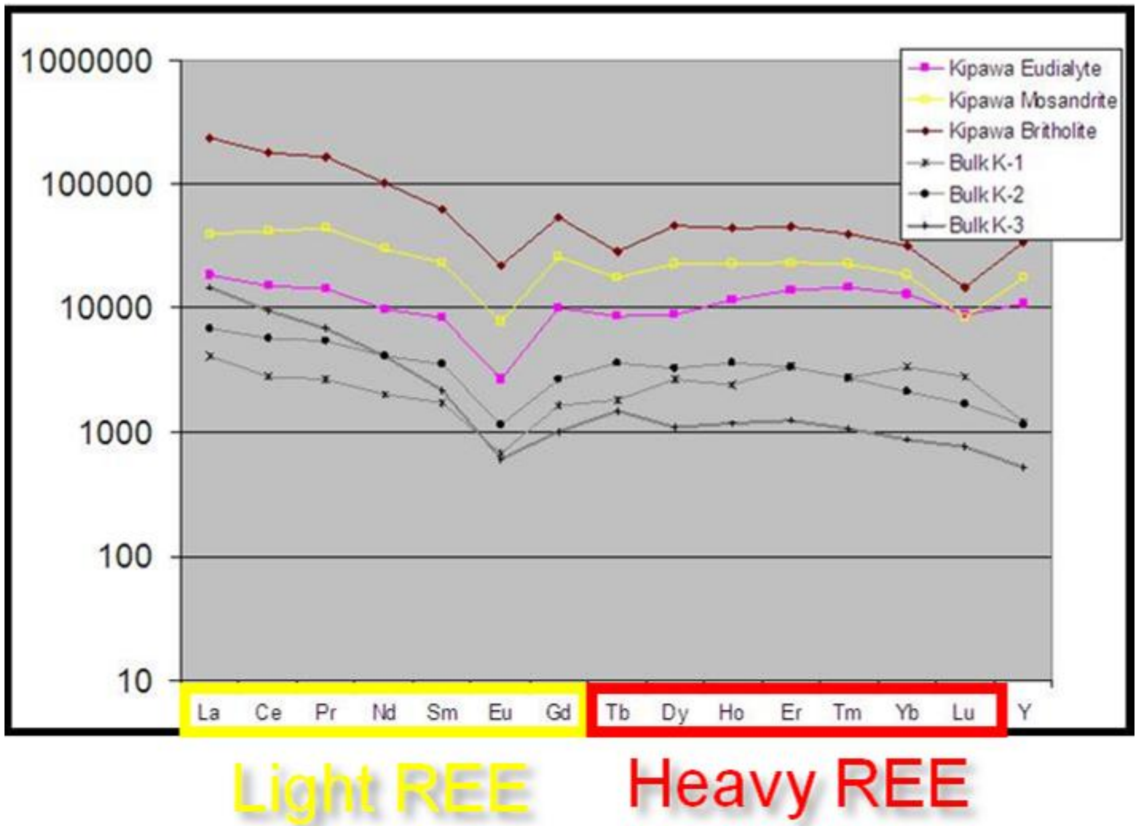


Britholite (Figure 7.5) is last in terms of overall abundance (about 10% of REE minerals visually), but the first in terms of total REE content in the resource. It is calcic silico-phosphate which is considered a potentially economic source of REE at Kipawa (maximum 63 w/w% of REE in the mineral, up to 40% HREE+Y/TREE at Kipawa). Britholites are dark chocolate brown to caramel coloured, glassy with a resinous sheen and are radiometrically active (britholite readily accepts Th in its structure). Grains are usually prismatic, disseminated and were thought to be exclusively associated with calcareous intervals, particularly the marble-skarns of the Britholite Zone. Another variety, termed "honey-brown mineral" in the logs, has been observed but not formerly identified as britholite, hence the informal terminology. The grains are elongated, and associated with syenite as high in the sequence as the Eudialyte zone; otherwise, it is visually identical to the classic britholite. Identification of britholite on core surface is often difficult due to its dark colour and common association with the visually similar phlogopite, especially in the marbles. Identification on split core surfaces is much easier.

All REE-bearing minerals at Kipawa show a "flat" profile on a chondrite-normalized plot, typical of HREE-enriched deposits (Figure 7.6), with, as mentioned above, britholite the most enriched in TREO but slightly less relatively enriched in HREO compared to the other two (curve leaning right), and eudialyte showing the least absolute TREO content but the most favorable HREO enrichment profile (curve almost flat with a bump in the heavies).

[3] (REE,Y,Ca)5(SiO_4,PO_4)3(OH,F) - This moderately radioactive mineral shows the best REE enrichment of all REE-bearing minerals on the Zeus property, 10 times greater than the more prevalent eudialyte. NQ core (top) shows a chondrodite (orange), phlogopite (pale brown) marble with abundant britholite (dark brown). Sample concentrate (bottom) has been separated by heavy liquids from a boulder originating in the PB river zone (photo courtesy of A. Mariano).

Figure 7.6 - Chondrite Normalized Plot of REE-Bearing Minerals and Historic Bulk Samples



Other REE-bearing minerals observed at Kipawa during Matamec's drilling campaign include trace to ultra-trace of agrellite (fibrous, greenish-white, mostly in late veins and in the specimen pit pegmatite), apatite (pale green), miserite (dark purplish, opaque), "green mosandrite" (not mosandrite, despite its field name, being a very saturated dark forest green, very glassy, massive, conchoidal fracture) and "hiortdahlite" (cloudy/dirty tan opaque crystals in vague bands). Some of these have only been tentatively identified.

7.2.3 Ore Genesis

The current understanding is that the rare element mineralization occurring in the 50-metre band along the basal contact of the Kipawa Peralkaline Complex results from the assimilation of marbles from the McKillop meta-sedimentary sequence (fluorine-rich per-alkaline magma) and settling of those marble xenoliths at the base of the complex. This assimilation introduced calcium into the melt, removed silicate and, most importantly, removed fluorine from the melt (via the precipitation of Ca-F minerals like Kipawa's purple fluorite). Rare-earth solubility in alkaline magmas being proportional to the amount of fluorine contained in the melt (Salvi and Williams-Jones, 2005). This conditioned the local precipitation of primary rare-element-bearing minerals in the Ca-enriched "pond" at the bottom of the chamber, i.e. along the basal contact (as modified from Knox, Heymann and Fleury, 2009).

Followed a series of minor metasomatic fluid events which partially altered vlasovite into gittensite, re-mobilized Zr (to form multi-generational creamy-stubbies and slightly mineralize/further alter the upper contact of the monzonite) and hematized certain sectors of the complex (near the historical East Zone most notably).

Marchand and Robert (1979) describe ore genesis at the Kipawa deposit in similar terms, proposing that the Grenville sediment series and the basement gneiss were intruded by a syenitic magma (the so-called Kipawa Peralkaline Complex) which differentiated into a 3-phase lopolith, namely a peralkaline granite, a syenite and a mafic syenite phase (mostly observed in the Sheffield zone). Rare earths and radioactive minerals issued from the syenitic melt were concentrated within the mafic syenite phase, possibly due to the assimilation of limestone. With the period of intense deformation associated with the Grenville Orogeny, a partial melting of the mafic phase and the sediment series produced in situ migmatisation. Radioactive and rare earths minerals were remobilized and concentrated into linear sills within the contact zones between the peralkaline intrusive and the sediment series. Accordingly, the mineralization is found along the contact between the Kipawa Peralkaline Complex and sedimentary paragneiss.

A different point of view was proposed by Van Breemen and Currie (2004). They rather invoke in-situ, metasomatic growth to explain the setting of all REE mineralization at Kipawa. The origin of the syenite is possibly related to anatexis of material metasomatized by flow of alkaline solutions along a major shear surface. They used crystallization of new zircon in the margins of the syenite to suggest that metasomatism continued from 1035 to 990 Ma before present, redistributing alkalis, fluorine, rare-earth elements and zirconium.

8.0 DEPOSIT TYPES

This section has been adapted from Zeus first NI 43-101 Technical Report dated June 2009 (Knox, Heymann and Fleury).

The association of radioactive mineralization with rare elements in the vicinity of the Kipawa Complex is likely to represent a polymetallic deposit type of rare elements (Zr, Y, Nb, Be, U, Th, Ta, REE and Ga) associated with peralkaline syenite occurrences. In Canada, this association does occur in other peralkalic complexes such as Strange Lake, Flower River, Red Wine and Thor Lake, although none of these deposits have as yet resulted in sizeable production of rare elements. The size of these polymetallic deposits is highly variable and ranges from less than one million tons to hundreds of millions of tons.

In the general area of the Zeus property, exploration was initiated by the discovery of the Hunter's Point showing, some 25 km to the northwest of the property. At Hunter's Point, high uranium contents are found in quartzites, and are associated with gold. Up to now and based on aggressive exploration programs that took place at Hunter's Point from 1959 to 1967, uranium in quartzite appears to be of limited extent in the area. In contrast, the known radioactive showings on or near the Zeus property are associated with rocks of the Peralkaline Complex and are often associated with REE and other rare elements.

The Thor Lake/Nechalacho REE-Ta-Be-Nb-Zr deposit is located in the Northwest Territories about 100 km south-east of the city of Yellowknife. The complex mineralization present at Thor Lake consists of phenacite (Be), bastnasite (Y, LREE), xenotime (Y, HREE), ferrocolumbite (Ta, Nb), fergusonite (HREE) and secondary zircons (HREE) set in a peralkaline syenitic intrusion. As of (July)2012, the estimated Measured Mineral Resources in the Basal Zone are 8.90 million tonnes, grading 1.64% TREO and 21.7% HREO/TREO and Indicated Mineral Resources in the Basal Zone at 63.76 million tonnes grading 1.52% TREO and 21.41% HREO/TREO. Avalon Rare Metals Inc. has issued positive feasibility study results in their press release dated April 17, 2013. (http://avalonraremetals.com/projects/thor_lake).

The Strange Lake zirconium-HREE-niobium-beryllium deposit in Quebec-Labrador is in a circular peralkaline granite complex about 6 km in diameter (Currie 1985. Most of the REEs at Strange Lake are in gadolinite, bastnasite, and kainosite, with most recent resources reported in 2010 as consisting of Indicated Resource of 36.4 million tonnes grading 1.16% TREO, 2.17% zirconium oxide (ZrO_2), 0.24% niobium (V) oxide (Nb_2O_5), 0.05% hafnium oxide (HfO_2) and 0.12% beryllium oxide (BeO) with a further Inferred Resource of 14.4 million tonnes grading 1.11% TREO, 2.02% ZrO_2, 0.21% Nb_2O_5, 0.05% HfO_2 and 0.09% BeO. The deposit is presently in the Pre-Feasibility study stage and is being developed by Quest Rare Minerals Ltd (http://www.questrareminerals.com/strangelakeproject.php). Alkaline complexes in the Shallow Lake and Letitia Lake areas in Labrador, about 250 km southeast of Strange Lake, also include rocks with high yttrium content (Currie 1976; Miller 1988).

At Kipawa, mineralization is contained in three main minerals: eudialyte (Y, Zr and REE), mosandrite (Y and REE) and britholite (Y and REE). Major deposits of eudialyte not presently in production exist in the Lovozero and Khibiny massifs of Russia (once mined for Ti, Nb, Ta and REE in loparite), in the Ilimaussaq intrusion located in east Greenland, at the Parajito Mountain deposit of New Mexico (2.4 Mt @ 0.18% Y_2O_3 and 1.2% ZrO_2 in a 10 km^2 dome-shaped syenite intrusion (Sherer 1990)) and at the Nora Karr deposit in Sweden, presently being developed by Tasman Metals Ltd (2011 Inferred Mineral Resource of 60.5 million tonnes grading 0.54% TREO and 1.72% ZrO_2, http://www.tasmanmetals.com/s/Norra-Karr.asp).

Reported britholite deposits are uniformly small in tonnage and often associated with carbonatites. A britholite-bearing carbonatite dyke in Mesozoic carbonatite at Oka, Quebec, is a REE resource of unknown size and grade, though probably small in volume (Mariano 1989). Strider Resources is exploring for britholite at its Eden Lake property, Manitoba. Eden Lake britholite is found in pegmatitic pockets within a larger monzonitic intrusive complex (Arden and Haldens 1999). In South Africa, small REE reserves have been estimated for britholite-bearing veins in the Pilanesberg peralkaline complex (Lurie 1986). Britholite can also be found in the Lovozero-Khibiny massifs of Russia as well as at its type locality of Naujakasik in the Ilimaussaq intrusion of southern Greenland.

9.0 EXPLORATION

This section describes exploration work carried out by Matamec on the Zeus property. For historical work, please refer to Section 6.0.

This section is modified from Zeus first NI 43-101 Technical Report (Knox, Heymann and Fleury, June 2009) with additional material from Matamec's drilling report (Fleury, 2013).

Matamec conducted a series of 10 to 20-day exploration campaigns on the property (June 2007; May, July, September and November 2008; May, June and September 2010; May, June, July and November 2011; May, June, April and September 2012), focusing their efforts on rare earths (Leclerc and Fleury, 2007, Fleury and Leclerc, 2008a, b, c and d, Fleury and Leclerc 2010, Fleury 2010, Doyon and Fleury 2011, Fleury 2011, Giguere 2012a and b and Fleury 2012a and b). These campaigns included scintillometer ground traverses, hand sample collecting, channel sampling of the old Unocal trenches, trail cutting, soil sampling, hand plus mechanical trenching, this last often followed by channel sampling.

Year 2007 saw a general going-over of the property with mineralogy expert Anthony Mariano and senior geological consultant Alex Knox, re-localizing and re-sampling old showings and mapping the general accesses. Green field exploration that year was focussed on areas surrounding existing showings and on sites with easy access, i.e. road sides and lake borders.

The 2008 campaign began with green field exploration on some newly acquired claims and some trail-cutting along a new forestry road granting access to the Kipawa deposit. June 2008 saw the acquisition by Matamec of unpublished papers and reports by Unocal Canada. An important milestone was the achievement of their 1989 airborne radiometric survey. Armed with this new data, four new rare earth showings were discovered that year (TH, Surprise, Falaises and Couleuvre – SeeFigure 6.1Figure 6.1) with varying mineralogy. Best values were obtained from grab samples coming from the Couleuvre and TH showings, respectively >11.34% and 7.2% TREE, combined with 0.93% and 2.16% yttrium. The Surprise showing also shows Nb enrichment (up to 1.17% Nb). A few rare-earth enriched boulders were also located, most notably a pair located 800 m north of the Sheffield Zone (0.08% Y, >1.0% Zr and >2.0% TREE and a single highly enriched boulder south-west of Sairs lake (>10.4% TREE and 1.8% yttrium). In November, four of Unocal's 12 sampled trenches (T-1, T-3, T-8 and T-11) were re-sampled and re-analyzed for the full suite of rare-earths under the supervision of SGS-Geostat, an independent resource consultant. Historical Y and Zr analysis were validated (though Zr showed a 15% bias towards lower values for the new analysis) with a best interval of 1.17% TREE at 20% HREE+Y/TREE and 0.53% Zr over 33 metres in trench T-1 (about 13 m true width, Y.Camus 2009). Concomitantly, a mineralogical study of rare-earth-bearing minerals from the Sheffield Zone was undertaken by Dr. Mariano (Mariano, 2008 a and b), while Laval University in Quebec City started a mineralogical study of the new showings (Tuall 2009).

Early 2009 saw the publication of a NI 43-101 Technical Report on the Kipawa deposit, available on SEDAR (Knox, Heymann and Fleury 2009), summarizing exploration and metallurgical work on the deposit to date. In 2009, it was a difficult year to get financing, owing mostly to the impending collapse of major banks throughout America and Europe (the sub-prime loans scandal). Matamec only ventured out into the field late in the year when the rare earth market started to take off and financing could be secured. In addition to the November-December 2,342 m drilling campaign (detailed in Section 10.0), the remaining eight Unocal sampled trenches were re-sampled with a best interval of 1.23% TREE at 35% HREE+Y/TREE and 0.63% Zr over 61.5 metres in trench T-2 (unpublished data).

The 2010 campaign focussed on developing the newly discovered showings. In May, exploration focussed on the Surprise area: the showing was mechanically trenched (best channel interval of 5.26% TREO + Y_2O_3 with 44% HREO+ Y_2O_3/TREO, 3.6% ZrO_2, 3.9% Nb_2O_5, 0.06% Ta_2O_5 over 2 metres), the surrounding area explored and a 48-kilometre soil survey was carried out. This last survey delimited two large soil anomalies, one centred on Surprise itself, the other one kilometre to the west centred on a steep cliff. In June, efforts were focussed on the TH Showing, and, to a lesser degree, the Falaises and PB-PS showings. TH was mechanically stripped and channel sampled (best interval returning 1.3% TREO with 31% HREO+ Y2O3/TREO and 0.7% ZrO2 over 1.5 m), two new REE showings were found near Falaises (showings Falaises Annie and Coin) and Kipawa-style mineralized boulders were found at the PS and PB zones. Matamec's second drilling campaign on the deposit (2,131 m) took place in July 2010 (See Section 10.0 for detail). In September, efforts were focussed on finding the east and west extensions of the Kipawa deposit. To that end, five hand trenches were dug and channel sampled. Most mineralization found at this time seems to be concentrated at the north-west end of the deposit, with very little to the south-east. September 2010 ended with a regional, wide area soil survey centred on the hill on the west side of Sheffield Lake, facing the deposit (15 kilometres of line, September 2011 report-GM65906). Two favorable soil anomalies were defined based on this survey. Lastly, Matamec concluded the 2010 season with its third drilling campaign on the deposit (3,330 m) which extended from December 2010 to early February 2011 (See Section 10.0 for detail).

The Summer and Autumn of 2011 campaign focused on three areas:, first, the Kipawa deposit itself with mechanical stripping at both the NW and SE extensions and soil sampling on the SE extension all the way to the PS showing; second, on the Falaises showings (line cutting, detailed prospecting, manual stripping and channel sampling), and third, on the Surprise showing with mostly prospection, two small manual trench and an airborne radiometric+mag survey that also covers the newly acquired East Block of claims (Desaulniers 2011). The trenches on each side of the deposit lead to the discovery of eudialyte mineralization 220 metres to the north-west of previously known mineralization, with a best value of 9.7 m @ 0.65% TREO with 26% HREO+ Y_2O_3/TREO (July 28th, 2011 press release and Fleury 2013). The south-east extension contains some mineralized outcrops (best value of 3.9% TREO+ Y_2O_3 with 30% HREO+Y_2O_3/TREO) and a series of more or less linear soil anomalies loosely link the main deposit with the PS showing to the south-east (Fleury 2012a). Three (3) new REE showings are discovered at this time, two in the McKillop area to the north-west of the property (the Exclamation Point and Xenolith showings, both rich in allanite, Fleury 2012a) and, in radiometric and soil anomalies to the east, the Certitude, Certitude Nord and Certitude Sud showings situated one kilometre west of the Surprise showing (See Figure 6.1). Some of the samples there show both Nb and Ta enrichment similar to the Surprise showing (Fleury 2013). Concurrently, a property wide mapping effort is underway, leading to an updated geological map of the region (Giguere 2012a).

Also in 2012, Matamec publishes a detailed Preliminary Economic Study on the Kipawa Deposit (March 14th, 2012, available on SEDAR). The study is carried out by Roche Ltd and includes an updated NI 43-101 resource estimate (17.7 Mt @ 0.435% TREO (33% HREO + Y_2O_3/TREO) Indicated and 6.8 Mt @ 0.37% TREO (32% HREO + Y_2O_3/TREO) Inferred, both at a cut-off grade of 0.2% TREO). For \$316M CAN total capital investment, Roche forecasted 13 year mine life and 36.9% internal rate of return (IRR); giving the project \$606M CAN before tax net present value (NPV) with discounted cash flow at 8%.

Year 2012 was marked by a major definition campaign on the Kipawa Deposit (16,152 metres, excluding slope stability drilling, see Section 10.0 for detail), but also a 15 DDH exploration drilling campaign on the PS showing (results not yet announced or published), and exploration, mapping and mechanical trenching, mostly in the

Surprise/Certitude area, the East Block and in some prospective spots discovered during the mapping campaign of the previous year (results not yet announced or published).

The current Feasibility Study carried out by Roche and GENIVAR began that year(2012).

9.1 Exploration Potential

The Kipawa deposit is presently considered open both laterally and at depth, though to various degrees.

At depth: After Matamec's 2012 campaign, the deposit's extension at depth is fairly well defined. Eight sections remain open at a 0.22% TREO and 0.05% Y_2O_3 cut-off level and are considered worthy for further exploration holes. With the possible exception of sections 2340 to 2407 to the east, open sections present only moderate opportunities to increase tonnage as they are bounded on each sides by sections that are themselves closed off.

The possibility remains of finding other REE enriched lenses similar to the Kipawa deposit, and the possibility at depth should not be ignored. It is unlikely that the only spot where the right conditions for REE precipitation occurred just happened to be at surface. It is likely that these favourable conditions occurred in other places. The Kipawa deposit was discovered because it was the only one that was outcropping. However, it could not be the only one in existence in the region. Indeed, it has been seen from boulders of Kipawa-style mineralization at the PB and PS showings that at least one other lens existed and outcropped at one time. That being said, no geophysical method has presently been found to detect Kipawa-type mineralization at depth and in-depth exploration would therefore have to rely on a regular "blind/Wildcat" drilling grid. Such a grid is in the planning stage in Matamec's offices.

North-West extension: Prospects for this area were greatly increased with the discovery of eudialyte mineralization in one of Matamec's 2011 mechanical trenches (see July 28th, 2011 press release), 220 m north-west of Unocal's last trench (which only contained mineralization in the Mosandrite Zone). Extent of this mineralization and continuity with existing resource blocks are to be a focus point in Matamec's next drilling effort.

South-East extension: The immediate south-east seems to be fairly blocked by the unmineralized trench T-9. Trenching efforts in this area in 2010 and 2011 encountered either very modest grades (2010) or relatively thick overburden (more than 3 m) which prevented mechanical trenching (2011).

However, based on thickness and grade, two adjacent sections remain consistently and strongly open at depth in the area preceding trench T-9. Furthermore, this area is located at the edge of the hill. There is also strong evidence of Kipawa-style REE mineralization two km further south-east, as found in the boulders of the PB and PS zones and as defined during Matamec's 2012 drilling campaign at PS (1,420 m). A fold, a slight change in dip (combined with the change in topographic surface) or the beginning of an *en echelon* secondary lens to the south would be consistent with a barren trench T-9 and those open sections. Further above-ground exploration of this prospective area is, therefore, fully warranted and strongly recommended, along with exploration drill-sections in the two kilometers separating the deposit and the PS zone (included in the "Regional Exploration" budget section of Table 9.1 below).

A provisional budget is presented in below, with an average cost of $ 175 per metre, all inclusive:

Table 9.1 - Provisional Budget for Future Drilling

Target	Nb of DDH	Length (m)	Budget (K$)	Priority
Exploration at depth	19	1,800	320	High
North-west extension	9	850	150	High
Regional exploration	20	2,000	350	Low
Wildcat grid (400 m spacing)	35	5,000	875	Low
Total:	**83**	**9,650 m**	**1,695 K$**	

10.0 DRILLING

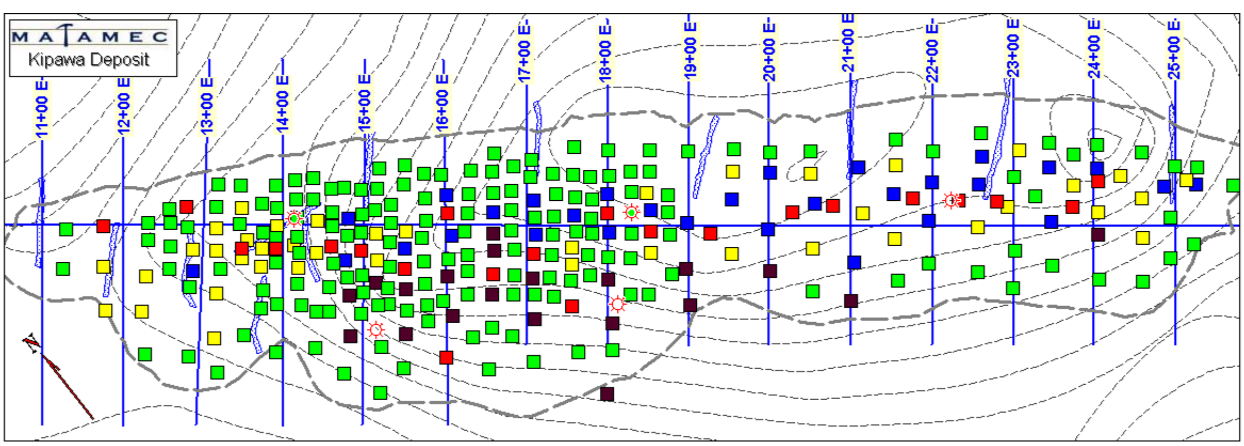
This section has been adapted from Matamec's drilling campaign report entitled "Zeus Property; 2009-2012 drilling campaigns" by Fleury (2013).

Drilling was initiated on the properties in 1956 by Brennan Lake Uranium Syndicate interested in the uranium potential. No database of this work is available. In 1958, Hollinger Québec Exploration Co. Ltd tested radiometric anomalies with 13 short holes but no assays were recorded in the assessment files (GM07733). Between 1969 and 1970, Imperial Oil Ltd in joint venture with Sturdy Mines Ltd carried out two drilling program mostly on the southeastern end of the Sheffield zone. A total of 16 holes for a total of 1,051.9 metres were drilled, but again no assay results were provided to the Government's assessment files. At the end of the 70s, Valdez Resources Ltd and Nuspar Resources Ltd carried out several drilling programs in the Valdez-Nuspar zone (south of the Kipawa River) with good results (GM33960 and GM34637).

In 1985, Unocal of Canada staked the claims and initiated a 3 years drilling campaign with the goal of evaluating the Y-Zr potential of the property. Drilling was done in the eastern and western parts of the Kipawa deposit. A total of 34 holes, designated KU-01 to KU-34 for "Kipawa Unocal", were drilled between 1988 and 1990 for a total of 2,053.7 metres (see Table 11.1 for drilling summary). Results from these holes are not used for this study and the resource estimates. Location of the drill holes by Unocal are presented in Figure 10.1Figure 10.1 - Location of Matamec Drill Holes at the Kipawa Deposit.

In 2009, Matamec initiated its own exploration drilling program. Matamec's campaigns presently total 293 drill holes (24,581 m) going from hole KM-35 to hole KM-296, from hole KMH-01 to KMH-22 and from hole GM-01 to GM-05. Hole designation is comprised of the letters K for Kipawa, M for Matamec, H for HQ caliber and G for Geotechnical and a sequential number. In the case of the KM holes, that number follows Unocal's 34 historical KU holes on the deposit. Twins are designated by the word "Twin" and the number of the original Unocal hole they are twinning (Ex. Twin05 is twinning Unocal hole KU-05). All of Matamec's drilling done to date was in NQ caliber (4.5 cm diameter), save for the 22 HQ caliber holes (6.3 cm diameter) drilled to collect material for metallurgical testing. All of these holes are used in the present version of the NI 43-101 resource estimate and their location is presented in Figure 10.1.

Figure 10.1 - Location of Matamec Drill Holes at the Kipawa Deposit[4]



[4] (2009=Blue, 2010=Brown, 2010-2011=Yellow, 2012=Green, HQ=Red, GM=Circles. Dark gray = pit outline. Contour lines=5 m)

The Winter 2009 campaign (holes KM-35 to KM-61) aimed to: (1) Increase existing resources by connecting the east and west historic resource blocks and (2) Convert historical resources into 43-101 compliant resources. To that end, Matamec first located as many historical holes as possible and refreshed/re-picketed Unocal's 1988 baseline to better georeference historical work and resources. Twenty-One (21) holes (1,645 m) were then drilled at roughly 50 m centres in the 700-metre zone separating historic resource blocs. In addition, six holes were drilled in the sparsely drilled historic East Zone to increase resource definition there (KM-42 to KM-47, 396 m) and four historical holes (Twin05, 07, 14 and 20, 302 m) were twinned to confirm historic analysis. All holes, including located historical holes, were surveyed to centimetric precision at the end of the campaign and azimuth and dip of casings were also surveyed at that time. All casings were left in place.

The Summer 2010 campaign (holes KM-62 to KM-81) aimed to increase resources by exploring the down-dip extension of the central zone drilled in the previous campaign - which showed not only sections open down-dip, but also grade increasing down-dip on each of those sections. To that end, nineteen holes (2,039 m) were drilled in the south-west portion of the central zone at 50 and 100 m centres. In addition, one hole was drilled down-dip of an open section in the historical East Zone (KM-79, 93 m). All holes were surveyed to centimetric precision at the end of the campaign and all casings were left in place.

The Winter 2010-2011 campaign (holes KM-82 to KM-123) shifted focus from exploration to definition. The campaign's main objective was therefore to bring up the drilling grid to 50 m centres everywhere and 25 m centres in the high-grade core of the historical West Zone (2,725 m). In addition, four holes were drilled to explore the north-west extension of the deposit (KM-82 to KM-85, 294 m), two holes were drilled to better define open sections in the historical East zone (KM-117 and KM-122, 159 m), and two historical holes were twinned in the East zone to further validate historical values (Twin09 and Twin32, 152 m). All holes were surveyed to centimetric precision at the end of the campaign and all casings were left in place.

The Summer 2012 campaign (holes KM-124 to KM-296) aimed to: (1) Bring all resources within the proposed Preliminary Economic Assessment Study pit shell up to Indicated Resources and (2) Bring the quality of resources for the first half of the mine-life of the proposed mine up to the Measured category. To that end, the extended West Zone was drilled at 25 m centres and the north and south side of the future pit were drilled at 50 m centres. In addition, 22 HQ caliber holes (KMH-01 to KMH-22) were drilled on every other section (i.e. roughly at 50 m interval along the deposit) to gather material for metallurgical variability studies (see Section 13.0 for detail), and five NQ caliber holes (GM-01 to GM-05) were drilled at 90° to the future pit-walls to gather slope stability data (these last were done under the supervision of personnel from Golder and Associates), see Section 16.0 for detail. All KM, KMH and GM holes are used in the current resource estimate. All holes were surveyed to centimetric precision at the end of the campaign, though no casing was left in place for this sequence of drilling.

Table 10.1 - Drilling Summary on the Zeus Property

Year	Company	Holes Drilled	Total Metres	Location
1958	Hollinger	13 DDH	589 m	Kipawa deposit
1966	Manzutti	4 DDH	195 m	North of Sairs Lake
1966	Manzutti	6 "Winkie"	150 m	Kipawa deposit
1970	Sturdy Mines	21 DDH	1,738 m	Kipawa deposit
1988	Unocal	12 DDH	980 m	Kipawa deposit
1990	Unocal	27 DDH	1,531 m	Kipawa deposit and PB zone
2009	Matamec Explorations	31 DDH	2,343 m	Kipawa deposit
2010	Matamec Explorations	20 DDH	2,132 m	Kipawa deposit
2010-2011	Matamec Explorations	42 DDH	3,330 m	Kipawa deposit
2012	Matamec Explorations	173 DDH	14,278 m	Kipawa deposit
2012	Matamec Explorations	22 HQ DDH	1,875 m	Kipawa deposit
2012	Matamec Explorations	5 DDH (Slope stab.)	599 m	Kipawa deposit
2012	Matamec Explorations	15 DDH	1, 424 m	PS zone

11.0 SAMPLE PREPARATION, ANALYSES AND SECURITY

Matamec analyzed the entire length of favorable lithological horizon, going from the end of the per-alkaline granite at structural top to the beginning of the monzonitic basement gneiss at structural bottom. In addition, in order to ensure complete sampling, at least 3 m of extra sampling (2 samples) was added to both the bottom and top of the sampled interval for each hole. Sample lengths are usually no more than 1.5 m and rarely less than 0.5 m in length and, if possible, their beginning and end correspond to changes in lithology, mineralogy or apparent grade.

11.1 Logging and Sampling Procedure

A geologist first makes sure that all core segments are connected, compact and facing the same way around, then checks that all measuring block placement and box numbering are correct before measuring the beginning and end points of each core box and recording it in an Excel sheet along with any length of un-recovered core. For the 2012 campaign only, the geologist then measured and recorded RQD data in the same Excel sheet.

Lithology, mineralization, structures, alteration and sample location are then entered in turn by the geologist in a Geoticlog database located on a dedicated logging computer, while the beginning and end of each sample is marked with a coloured pen and an official ALS Chemex Laboratories ("ALS") sample tag with "from-to" sample measurements inscribed is inserted in the core box at the end of the sample. QA/QC standards and blanks are inserted into the analysis sequence here. The geologist then takes photos of the logged, unsplit core, three photos per table of four to five core boxes, with additional zoom-in on items of interest. The core is then racked and ready for splitting.

A technician then splits the samples in two, lengthwise, using a hydraulic splitter. One half of the sample is put in a plastic bag with one third of the official ALS sample tag, while the other third is tacked down to the core box at the end of the sample. The bag is securely sealed with electric tape, inserted into a larger rice bag which is itself sealed with tape and inscribed with the sample numbers within and then stored at the camp site under the supervision of the field geologist. The field geologist also keeps the original ALS sample booklets (comprising the last third of the sample tags) as well as photos of the core. Electronic data is backed up daily on a thumb drive, with an extra copy transferred to the field geologist personal computer for extra safety.

Once enough sample bags are accumulated, the geologist fills out an ALS Request for Analysis Form, checks that all bags are present and accounted for as they are loaded into a company pick-up truck or closed boxes for a flatbed truck, and then sends the samples out to ALS Chemex's facilities in Val d'Or, Quebec.

11.2 Density Measurement Procedure

In order to estimate the tonnage of the Zeus deposit with better precision, an extensive density measurement was undertaken in November 2012.

Before 2012, a fixed density of 2.86 t/m^3 was used for all Syenite rock (mineralized or not). For this report and in light of the 2012 density program results, it was decided to use 2.88 t/m^3 for the Eudyalite zone, 2.92 t/m^3 for the Mozandrite and Britholite zones and 2.8 t/m^3 for the remaining Syenite unit that is less mineralized.

The 2012 density measurement program consisted of 360 samples taken in 2012 drill holes across the deposit so that the values would be useful for data interpolation. These density measurements were made using the immersion method which is the most precise and allows for less measurement mistakes. The core drill samples, corresponding to assay intervals, were weight in the air and in the water in order to determine the density. The setting of the instruments and the first 2-days of measurements were done under the supervision of Jean-Philippe Paiement, M.Sc., Geo. from SGS Canada Inc. The setup is depicted in Figure 11.1.

The scale used is precise to the 0.1 g and the water temperature was kept at 20°C using an aquarium water heating system. First, the dry drill cores were weighted in a basket on the top tray of the scale and then the sample was submerged in the water and weighted again using the hook on the underside of the scale. In order to determine the density, the following formula was used:

- Density = Mass in air / (Mass in air - Mass in water)

If the sample was too large to fit in one basket, two measurements were made and the final density was determined using the weighted average of each density value.

Figure 11.1 - Pictures of the Scale Setup Used for the Evaluation of the Samples Density

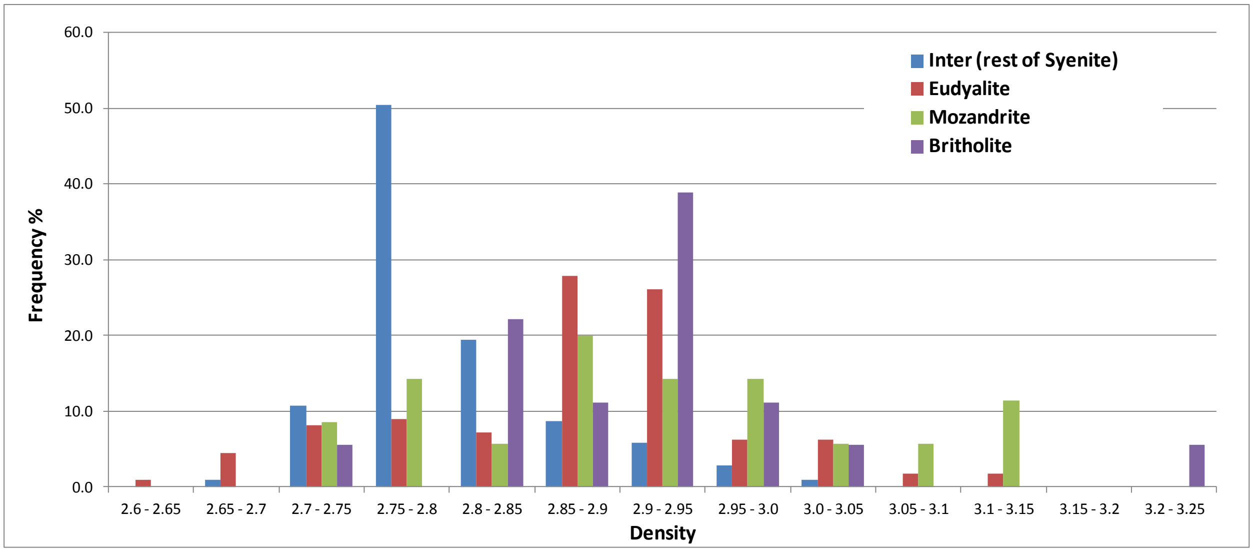
Upon receiving the final data from the density, each sample was linked to its corresponding zone and rock types. Basic statistics were conducted on the data in order to highlight any differences between mineralized zones and waste material. The density data was then added to the assay Table and imported in Genesis© were it was composited in 1.5 m composites. These composites were then exported following the zones they were in. This resulted in a set of 268 composites with similar lengths.

The differences between zones range from 0.00 t/m^3 to 0.11 t/m^3 as seen in Table 11.1. These differences represent a difference in tonnage of 110,000 tonnes for 1 million m^3 of rock. Furthermore, the distribution of the data shows a different density for mineralized material and un-mineralized material. Figure 11.2 shows single mode distribution between 2.75 t/m^3 and 2.80 t/m^3 for the Inter zone (corresponding to the less mineralized material), whereas the three (3) mineralized zones show a bi-modal distribution with a higher mode and a mode corresponding to the Inter zone mode. In light of the 2012 density program results, it was decided to use 2.88 t/m^3 for the Eudyalite zone, 2.92 t/m^3 for the Mozandrite and Britholite zones and 2.8 t/m^3 for the remaining Syenite unit that is less mineralized.

Table 11.1 - Density Measurements Statistics for Each Rock Type

ZONE	Count	Minimum	Maximum	Mean	Std Error on Mean	95% Confidence Interval
Eudyalite	111	2.65	3.14	2.88	0.01	±0.6%
Mozandrite	35	2.75	3.14	2.92	0.02	±1.3%
Britholite	18	2.75	3.21	2.92	0.02	±1.5%
Inter (rest of Syenite)	103	2.70	3.03	2.81	0.01	±0.4%

Figure 11.2 - Histogram of the Densities for Each Rock Type



11.3 Sample Preparation, Analyses and Security

11.3.1 Sample Preparation and Security

The 2012 drilling campaign was managed by Frédéric Fleury, Geo. of Gestion Aline Leclerc Inc. (Gestal). The drilling company is Performax Drilling (first drill) with Pelletier Drilling as a subcontractor (second drill). The drilling crew for 2 drills over 2 shifts consists of 4 drillers, 4 helpers, a foreman and a mechanic. The diamond drill core is delivered in wooden core boxes to the core shack by this crew. The core shack is located right on the Kipawa deposit (see Figure 11.3). The core from the drill holes is logged and sampled in that core shack by the Gestal crew composed of 2 technicians and 2 geologists (see Figure 11.4 for the core splitter and Section 11.1 for more details about the logging procedures). The core and samples are then transported 14 km away by Gestal crew to the Charette camp and temporarily stored there (see Figure 11.5). About every week, along with the Gestal crew shift changes, the samples are taken to the ALS Chemex (ALS) laboratories in Val d'Or by a Gestal employee.

Figure 11.3 - Core Shack on the Kipawa Deposit Site

Figure 11.4 - Hydraulic Core Splitter in the Core Shack

Figure 11.5 - Temporary Storage at the Charette Camp

11.3.2 Sample Analyses

Bagged samples are taken to ALS in Val d'Or where they are crushed to 70% passing 2 mm, and then riffled until a 250 g fraction is obtained. This fraction is then pulverized until 85% passed 75 micrometer, bagged and shipped to

ALS's analysis facilities in Vancouver B.C. where a prepared sample (0.200 g) is added to a lithium metaborate flux (0.90 g), mixed well and fused in a furnace at 1000°C. The resulting melt is then cooled and dissolved in 100 mL of 4% HNO_3 / 2% HCl solution. This solution is then analyzed by inductively coupled plasma - mass spectrometry for Ag, Ba, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Lu, Mo, Nb, Nd, Ni, Pb, Pr, Rb, Sm, Sn, Sr, Ta, Tb, Th, Tl, Tm, U, V, W, Y, Yb, Zn and Zr (ALS Chemex method ME-MS81). Over limits assays, mostly in Zr, Th and the rare earths, were re-analysed through either XRF pellets (for Th and Zr, method XRF10), or further controlled dilution of the solution prior to another round of ICP-MS for the rare earths (method Me-MS81h). ALS maintains ISO 17025 certification, the highest accreditation available for QA/QC.

Rejects, pulps and half-core witnesses for the 2009, 2010 and 2010-2011 campaigns as well as pulps for the 2012 campaign are being kept at Gestal's Val d'Or storage facilities, while rejects and half-core witnesses for the 2012 campaign are being kept at Matamec's Rue de la Carrière facility in Temiscaming, Quebec. All witnesses will be kept for at least five years following the end of their respective campaign. No witnesses have so far been discarded.

11.3.3 Quality Assurance and Quality Control (QA/QC) Procedures

Matamec Explorations adheres to strict quality control procedures, including the use of standards, blanks and the re-analysis of pulp duplicates at an outside laboratory. SGS Geostat proceeded to collect independent samples. Considering potential revenue attached to each element, the focus was put on the following four elements: Dy, Nd, Tb, and Y.

The Light Rare Earth Oxides, Heavy Rare Earth Oxides and Total Rare Earth Oxides were also statistically analyzed.

11.3.3.1 Analytical Standards

Two samples out of every 25 are established standards purchased from Brammer International or CANMET and inserted by Matamec Explorations. Those two standards include: (1) A low grade zirconium standard (either Sy-4 or Bram308) and (2) One of three alternating rare-earth standards (either Bram310, Bram312 or Bram317). Note that Bram308 also doubles as a very low grade rare-earth standard, and that Bram317 was progressively phased out of the 2012 campaign and not replaced (this standard was giving too many false negatives, prompting unneeded re-analysis). All standards were in bulk powder format, from which 5 g was weighed and bagged by Matamec technicians for each sample required. Standards are included directly in the field sampling chain, ensuring that they are analyzed in-line with other samples sent to the Laboratory.

Out of the 1,044 standards sent during the 2012 drilling campaign, SGS Geostat highlighted only 2 standard mistakes (see Figure 11.6). Matamec had already re-submitted the samples surrounding the 2 bad standards as part of their own QA/QC procedures and, as the re-submitted standards fell within acceptable ranges and at SGS's prompting, replaced the old values with the new ones in the analysis database. Overall, the standards have therefore been well managed by Matamec and ALS and returned satisfactory results.

SGS Geostat verified each standard individually for performance. Each of the 4 standards was ordered by sample number. The expected values available for the standards were used to verify the accuracy of ALS and to determine potential assaying bias (see Table 11.2). The expected value for Tb is missing for the standard BRAM308 and was therefore not used. A deviation of more than ±3 standard deviation is considered as an analytical failure. A deviation of more than ±2 standard deviation is considered as an analytical warning.

Figure 11.6 - Analytical Results Grouped by Standard Type (Dy)

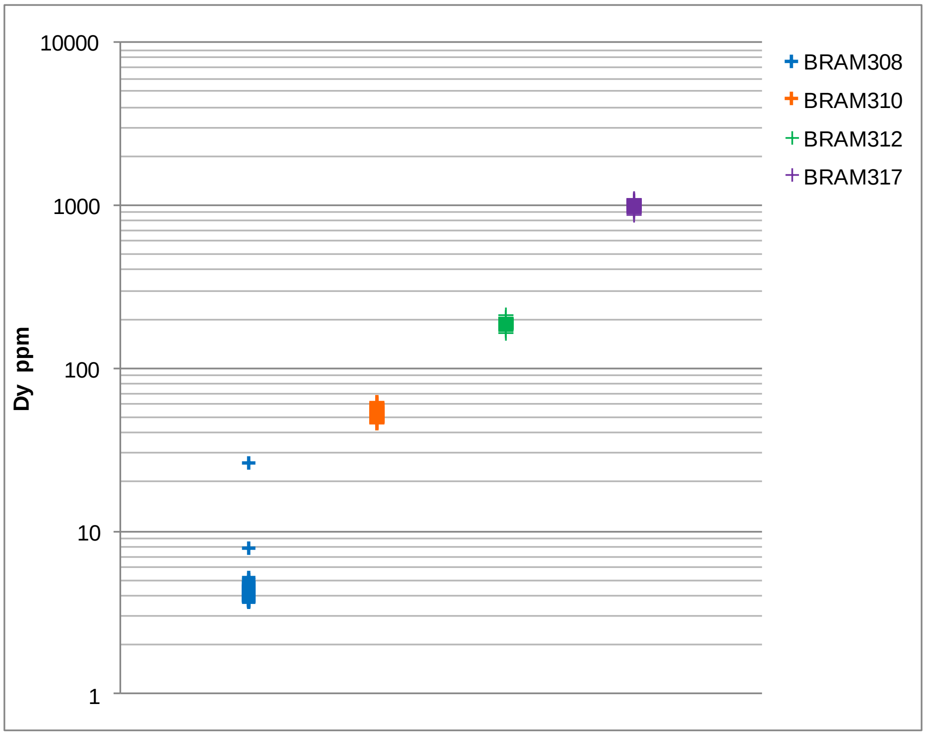


Table 11.2 - Expected Values and Performance Gates for the Different Standards Used

REE	Bram308			Bram310			Bram312			Bram317		
	Expected mean	Stdev		Expected mean	Stdev		Expected mean	Stdev		Expected mean	Stdev	
	ppm	ppm	C.V.	ppm	ppm	C.V.	ppm	ppm	C.V.	ppm	ppm	C.V.
Dy	4.0	0.3	9%	49.0	5.1	10%	183	17	10%	1045	87	8%
Nd	23.1	1.2	5%	23.7	2.1	9%	1595	86	5%	2058	86	4%
Tb	0.7	-	-	7.3	1.1	15%	36	2.0	6%	169	9.0	5%
Y	33.0	3.9	12%	449	32	7%	977	47	5%	6304	315	5%
La	32.3	4.3	13%	17.1	1.8	11%	2361	145	6%	2131	85	4%
Ce	60.6	5.9	10%	17.7	1.7	10%	187	8.0	4%	171	16	10%
Pr	6.9	0.5	8%	5.6	0.5	10%	476	26	6%	582	44	8%
Sm	4.2	0.3	8%	13.5	0.9	6%	284	26	9%	569	52	9%
Eu	1.0	0.2	17%	0.3	-	-	65	4.0	6%	8.0	0.6	7%
Gd	3.6	-	-	28.1	3.6	13%	225	26	12%	789	17	20%
Ho	1.1	0.1	8%	10.5	1.0	9%	36	4.0	11%	201	-	-
Er	4.0	1.7	17%	31.8	3.2	10%	96	9.0	9%	595	17	3%
Tm	0.8	0.1	9%	5.0	0.5	11%	13	1.0	9%	73	7.0	10%
Yb	6.8	0.9	13%	32.1	4.0	12%	88	11	12%	448	26	6%

REE	Bram308			Bram310			Bram312			Bram317		
	Expected mean	Stdev		Expected mean	Stdev		Expected mean	Stdev		Expected mean	Stdev	
	ppm	ppm	C.V.	ppm	ppm	C.V.	ppm	ppm	C.V.	ppm	ppm	C.V.
Lu	1.3	0.2	13%	4.8	0.5	11%	12	1.0	70%	57	4.0	8%
Zr	8252	296	3%	-	-	-	-	-	-	-	-	-

BRAM308 is considered as a very low grade REE standard with expected values significantly lower than other standards. For Nd, 22 samples failed the QA/QC of ±3 standard deviations and represents 4% of the values. Furthermore, the gap between the expected mean and the assays mean is 8.5%. This is still very acceptable for the QA/QC verifications since the grades are on the very low side. Figure 11.7 to Figure 11.9 show the performance of ALS in regard to BRAM308 for Dy, Nd and Y. Tb Expected values were not available for BRAM 308.

The standard BRAM310 represents a low grade REE standard and shows very good results with only five failures (2%), all for Y. The difference between expected mean and observed mean appears to be a relatively high for Y. This can explain the failure of Y values. However, this was considered acceptable since the difference between averages is of +10% and at about 1.5 standard deviation from the expected value. Figure 11.10 to Figure 11.13 show the performance of ALS in regard to BRAM310 for Dy, Nd, Tb and Y.

BRAM312 is considered as a medium REE grade standard. Only 4 samples failed the QA/QC with values higher than ±3 standard deviation gates, representing 2% failures. Y grade, however, has assay values globally over the expected values by 7%. This is considered as acceptable for the resource estimates of this Report.Figure 11.4 to Figure 11.7 show the performance of ALS in regard to BRAM312 for Dy, Nd, Tb and Y.

BRAM317 is considered as a high REE grade standard. A total of 15 samples failed for the Y on a total of 73 (20% failure rate). This was due again to an apparent over estimation of the Y grades by 12%. However, others elements are well correlated with the expected values.Figure 11.18 to Figure 11.21 show the performance of ALS in regard to BRAM317 for Dy, Nd, Tb and Y.

Figure 11.7 - Standard BRAM308 Analytical Results for Dy

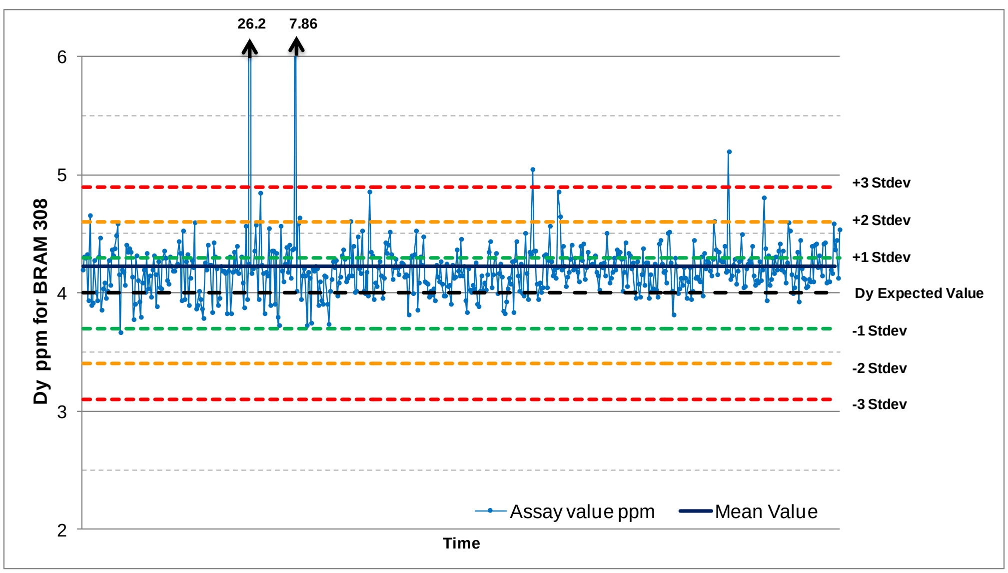


Figure 11.8 - Standard BRAM308 Analytical Results for Nd

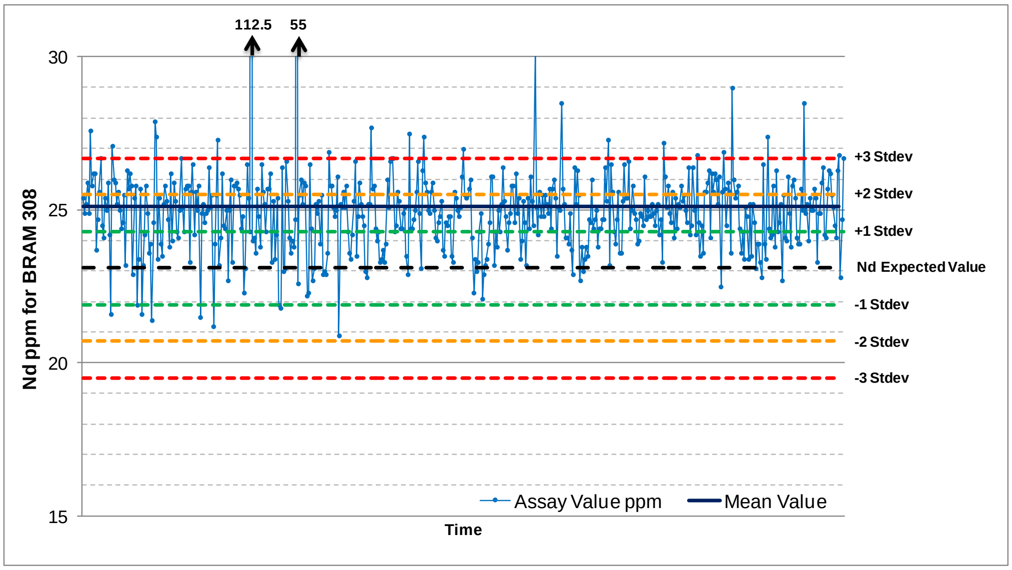


Figure 11.9 - Standard BRAM308 Analytical Results for Y

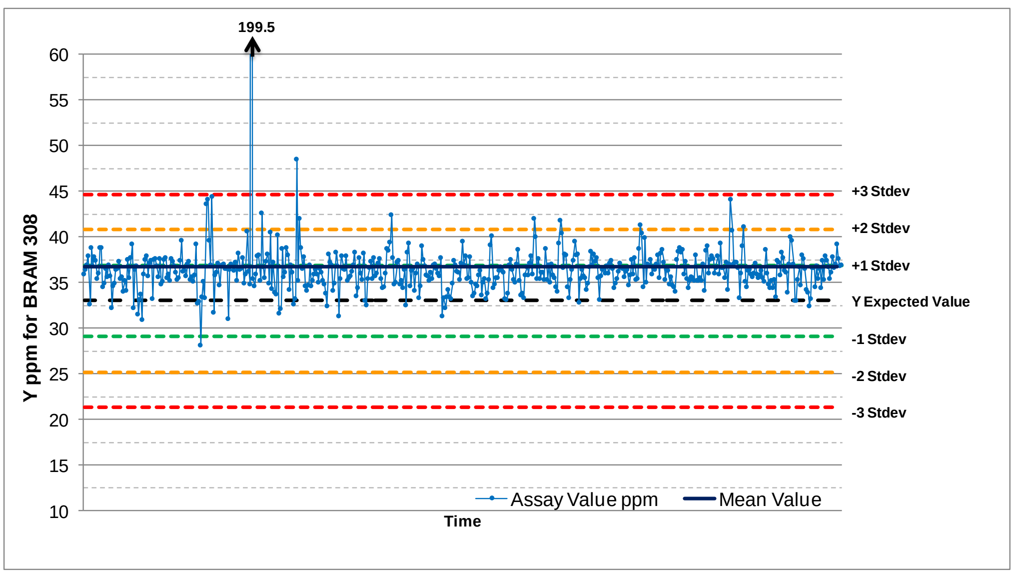


Figure 11.10 - Standard BRAM310 Analytical Results for Dy

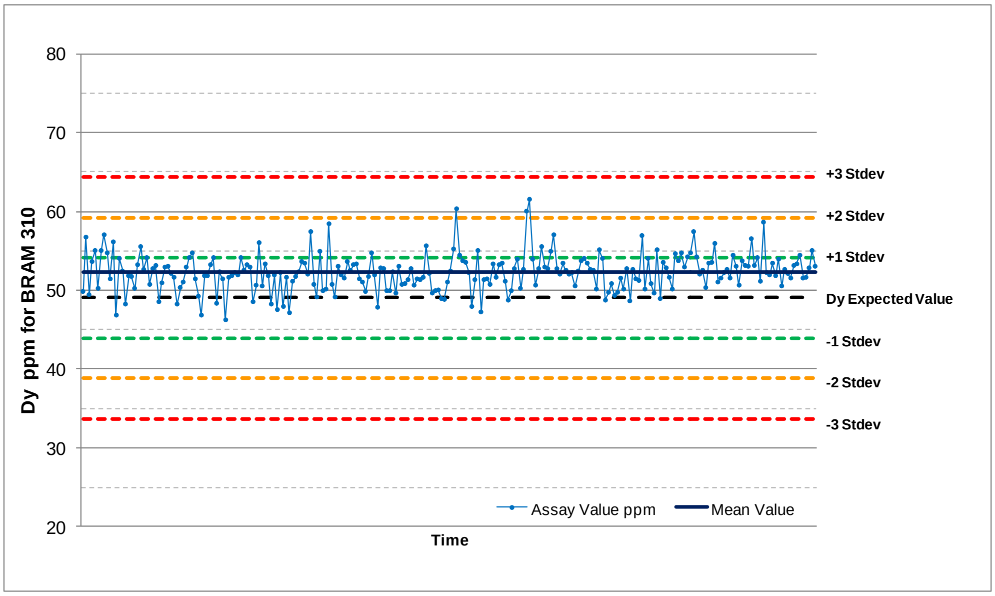


Figure 11.11 - Standard BRAM310 Analytical Results for Nd

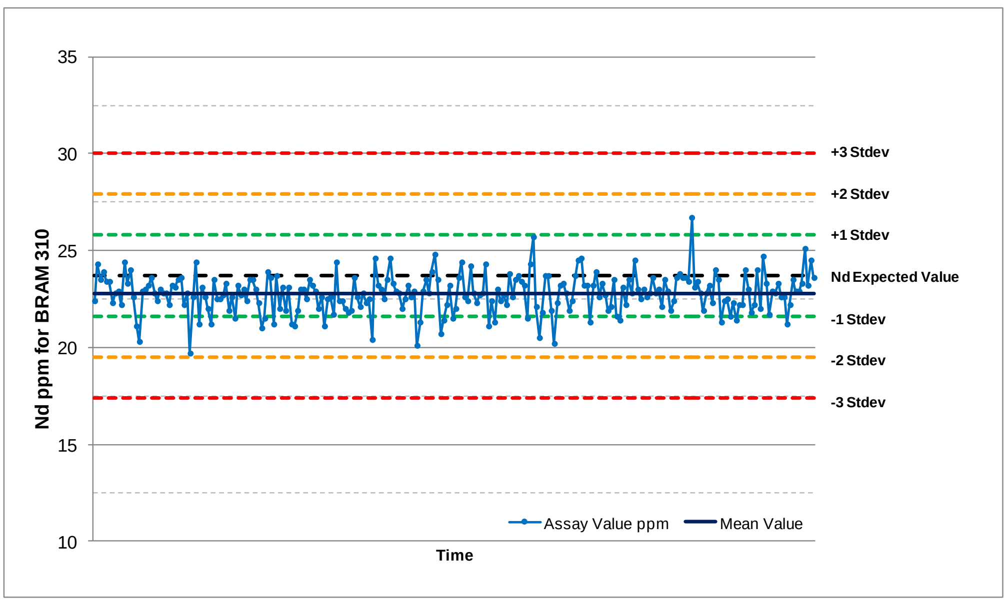


Figure 11.12 - Standard BRAM310 Analytical Results for Td

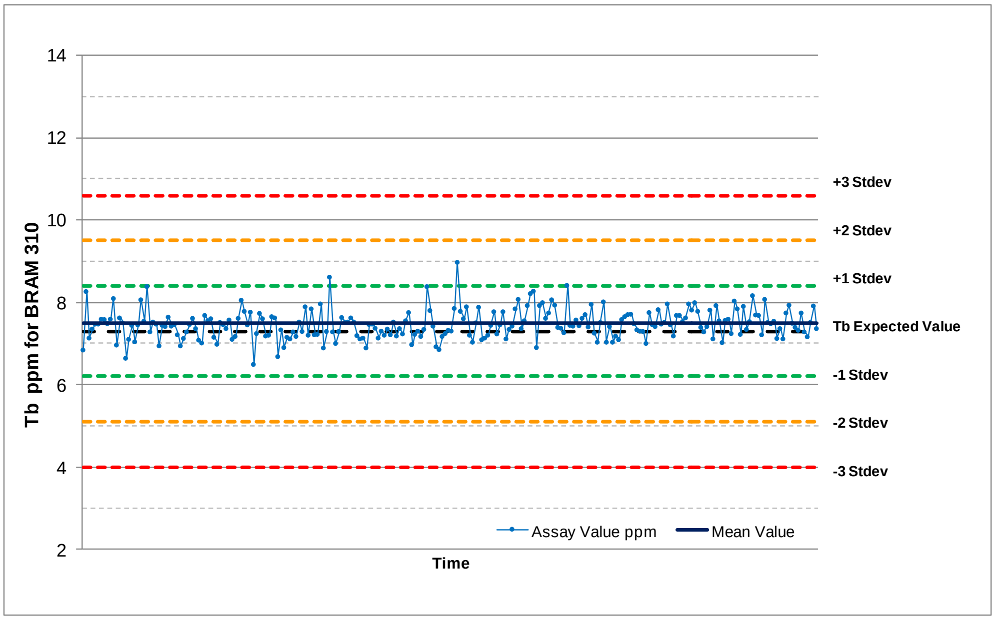


Figure 11.13 - Standard BRAM310 Analytical Results for Y

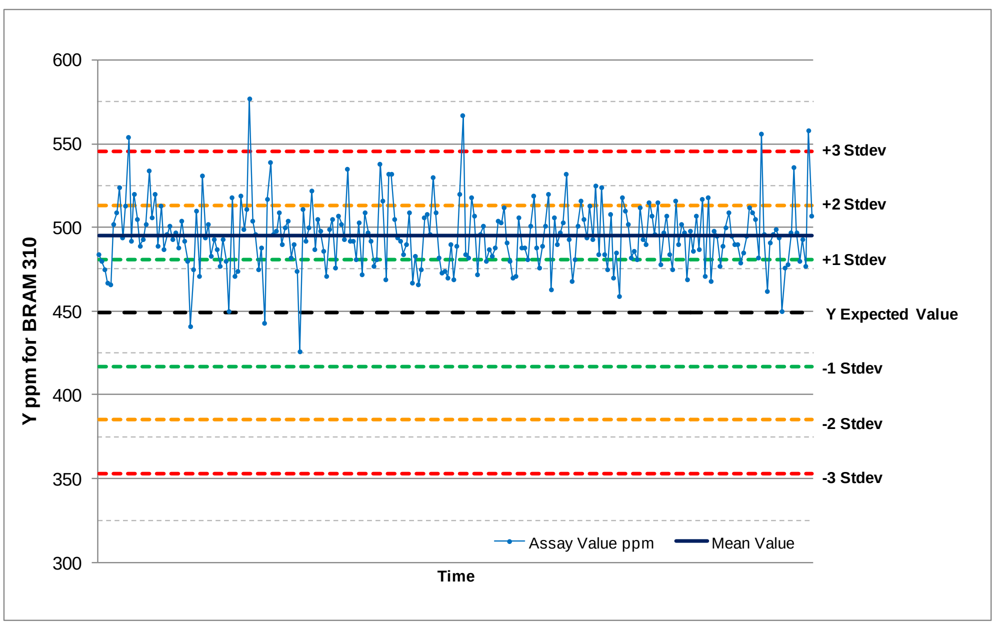


Figure 11.14 - Standard BRAM312 Analytical Results for Dy

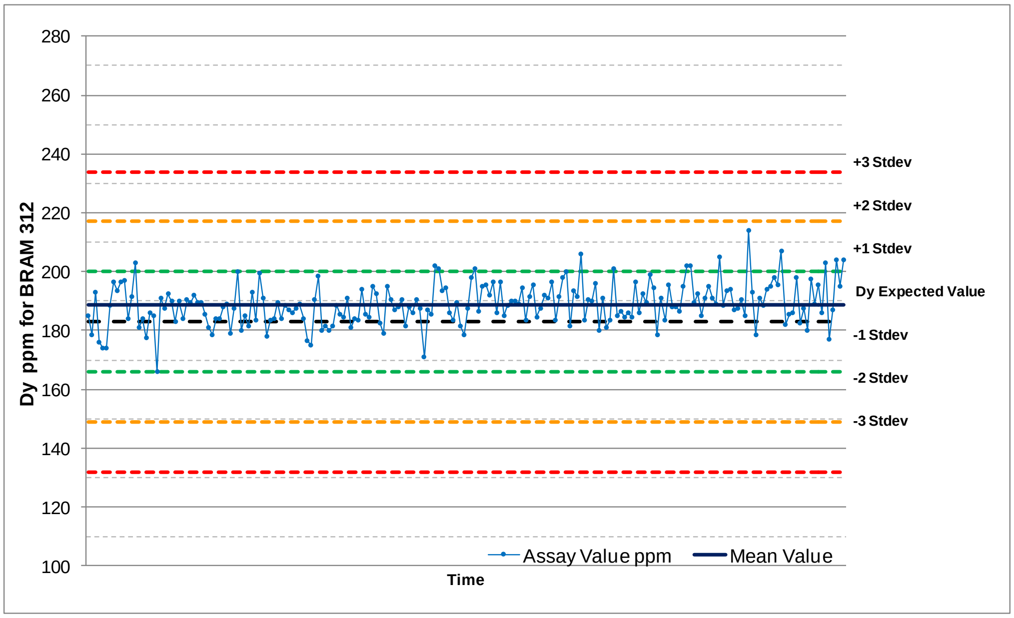


Figure 11.15 - Standard BRAM312 Analytical Results for Nd

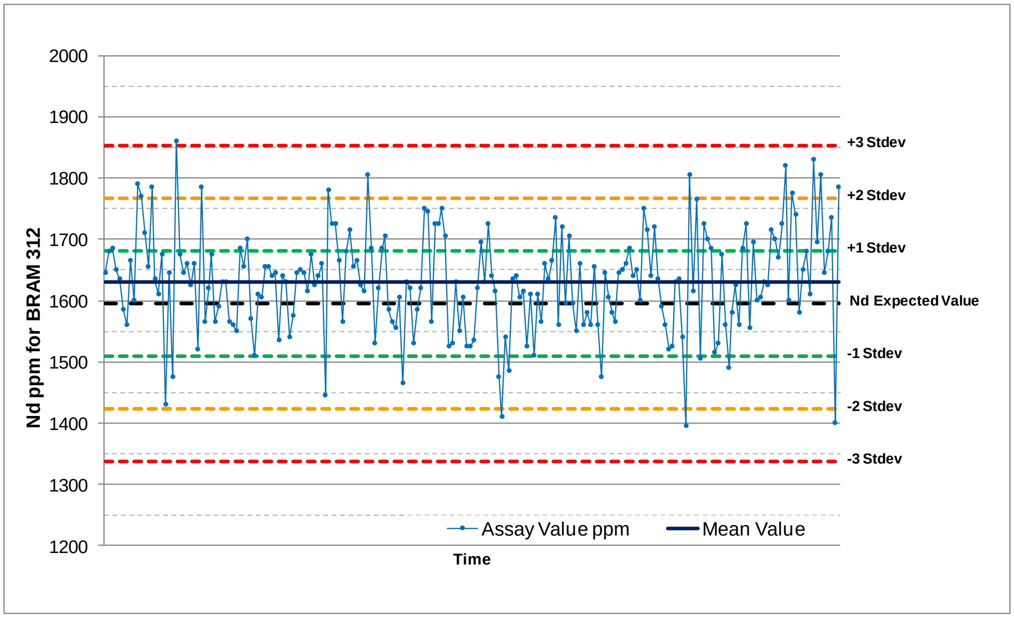


Figure 11.16 - Standard BRAM312 Analytical Results for Tb

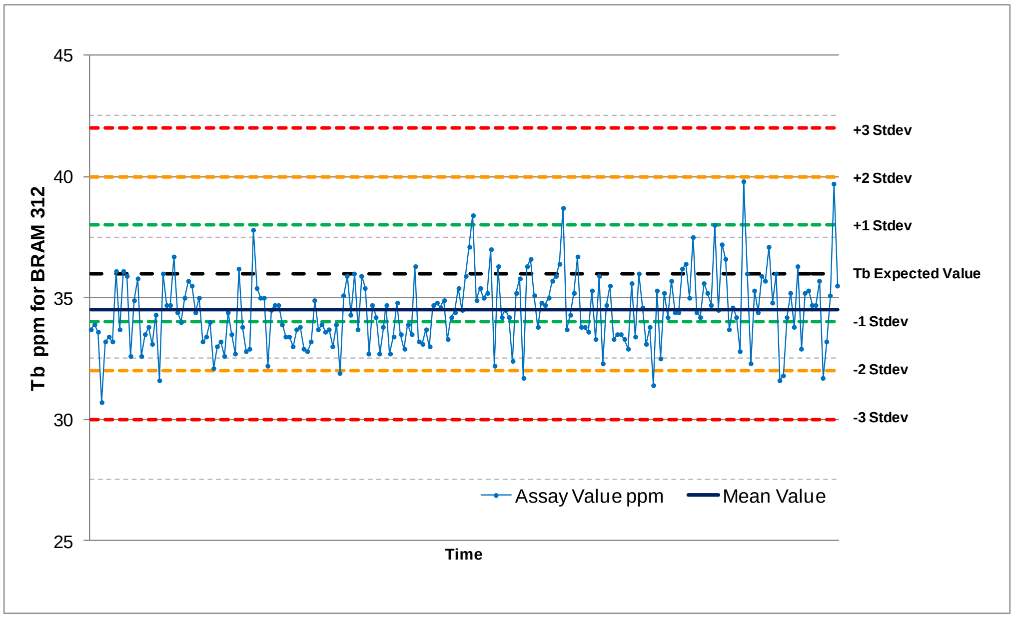


Figure 11.17 - Standard BRAM312 Analytical Results for Y

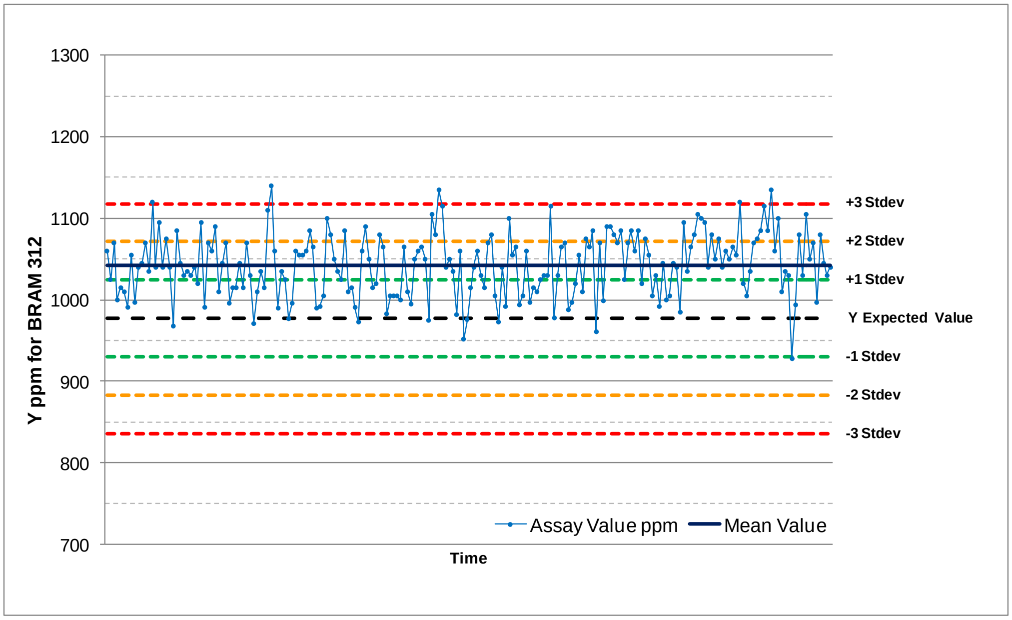


Figure 11.18 - Standard BRAM317 Analytical Results for Dy

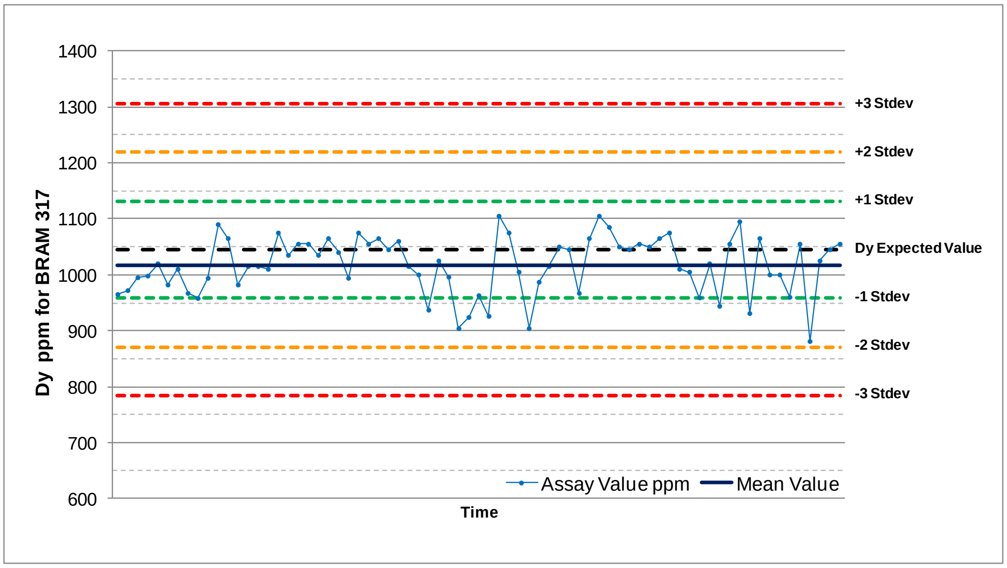


Figure 11.19 - Standard BRAM317 Analytical Results for Nd

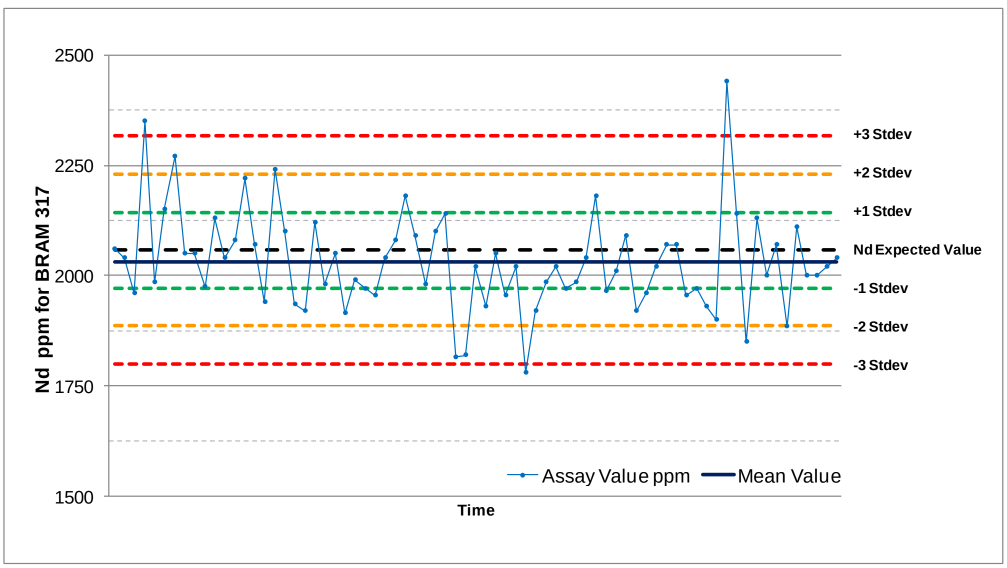


Figure 11.20 - Standard BRAM317 Analytical Results for Tb

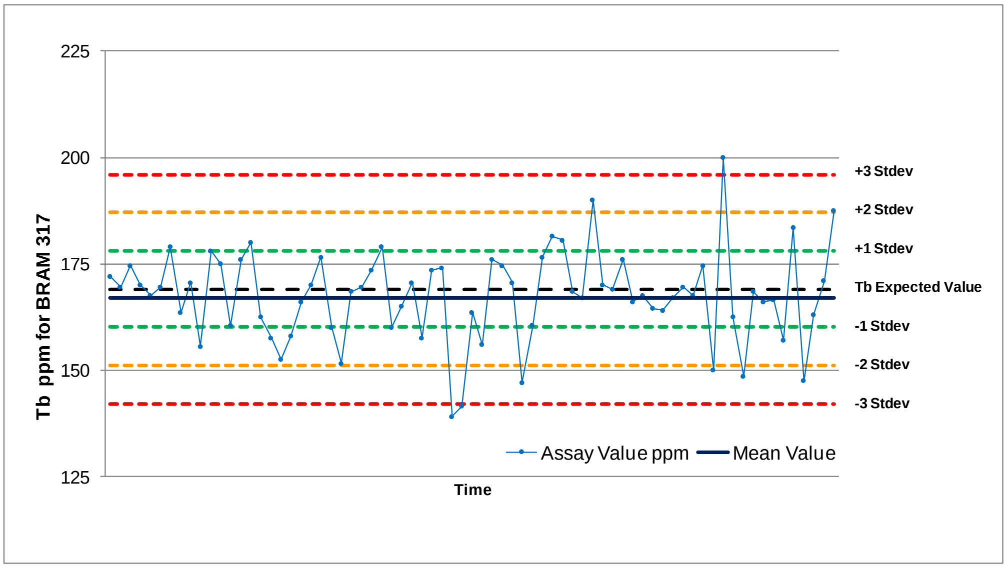
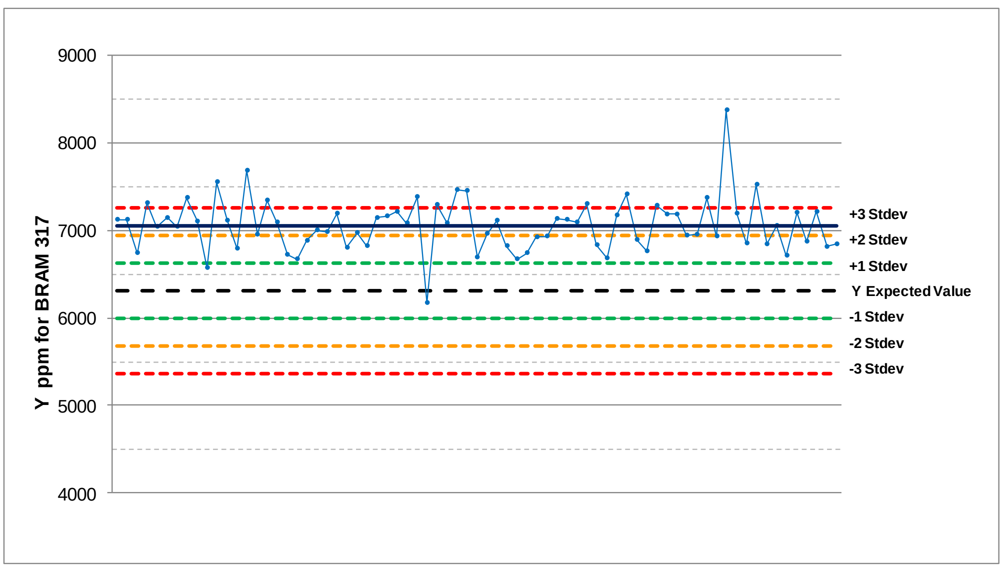
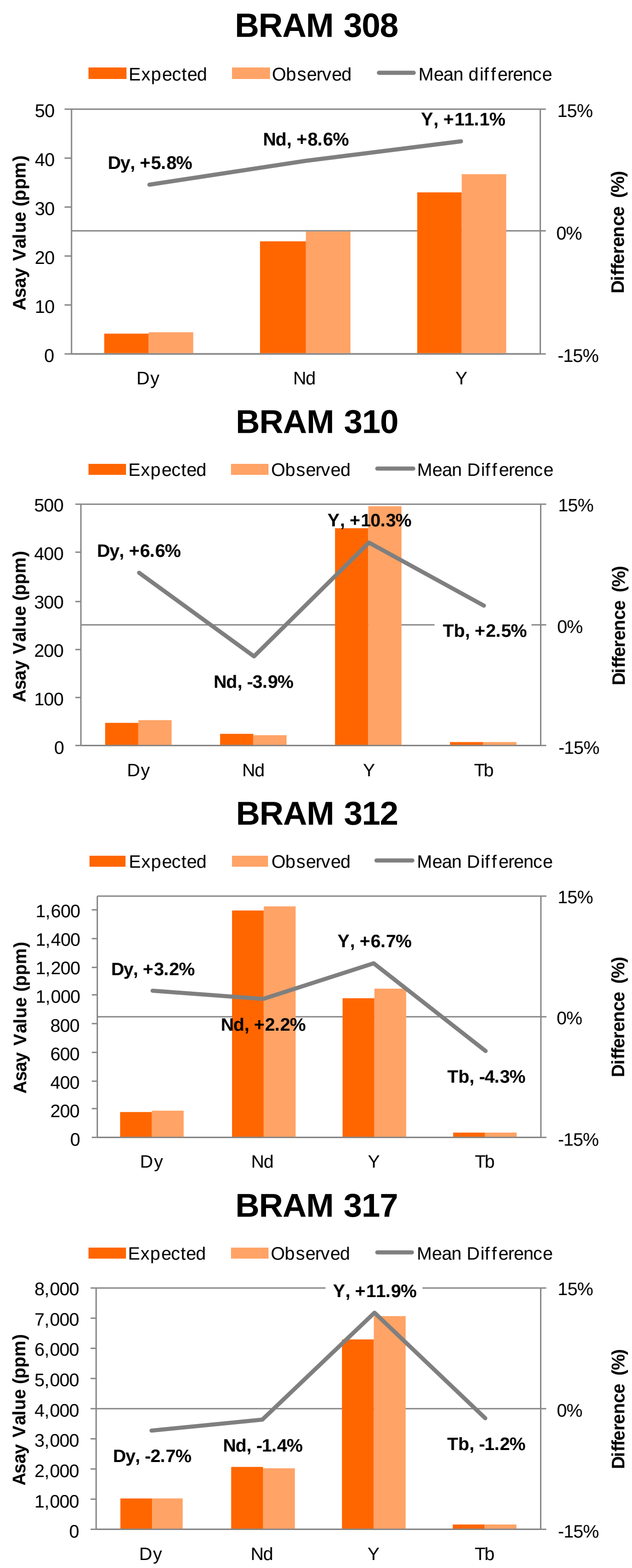


Figure 11.21 - Standard BRAM317 Analytical Results for Y



The results showed in Figure 11.22 outlines a bias in Y grades. The overall mean difference between expected values and measured values is approximately 10%.

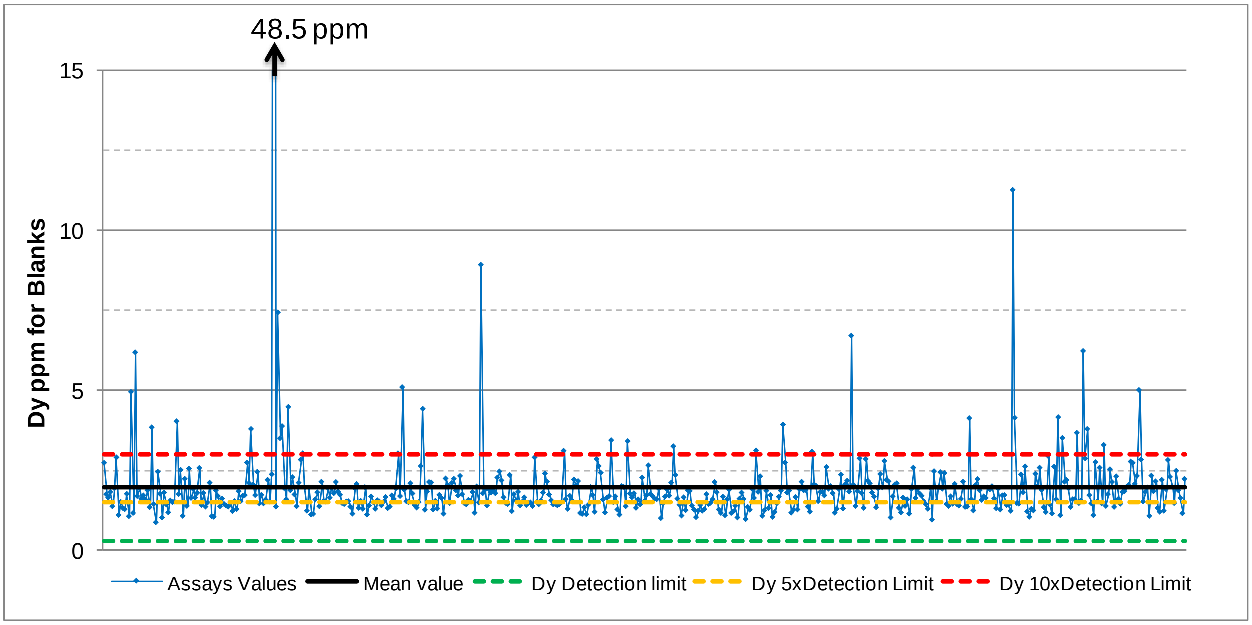
Figure 11.22 - Standards Values vs. Assay Values



11.3.4 Analytical Blanks

During the 2012 drill program, quartz material (ALS Quartz) was inserted as blanks. One sample out of every 25 was sent to the laboratory as a blank material. The material is a quartzite purchased from ALS Chemex Val d'Or and inserted by Matamec Explorations. A total of 524 blanks are in the database. As a result, one sample may have been contaminated or may have been replaced by a sample.

Figure 11.23 - Blank Analytical Results for Dy and Nd



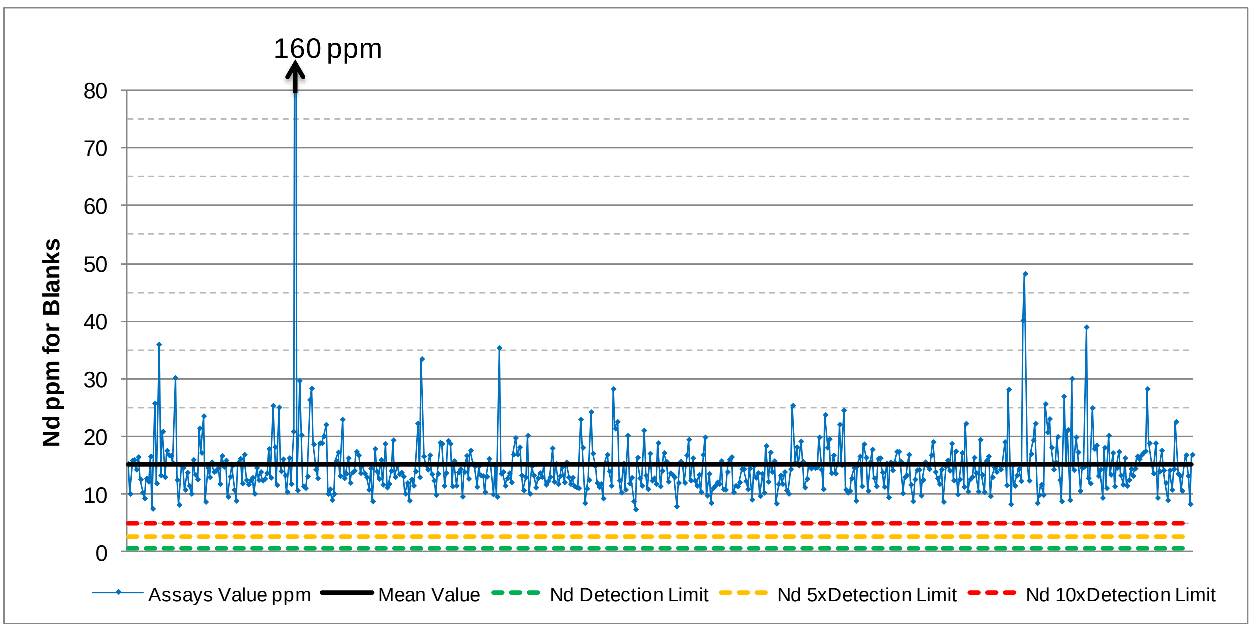
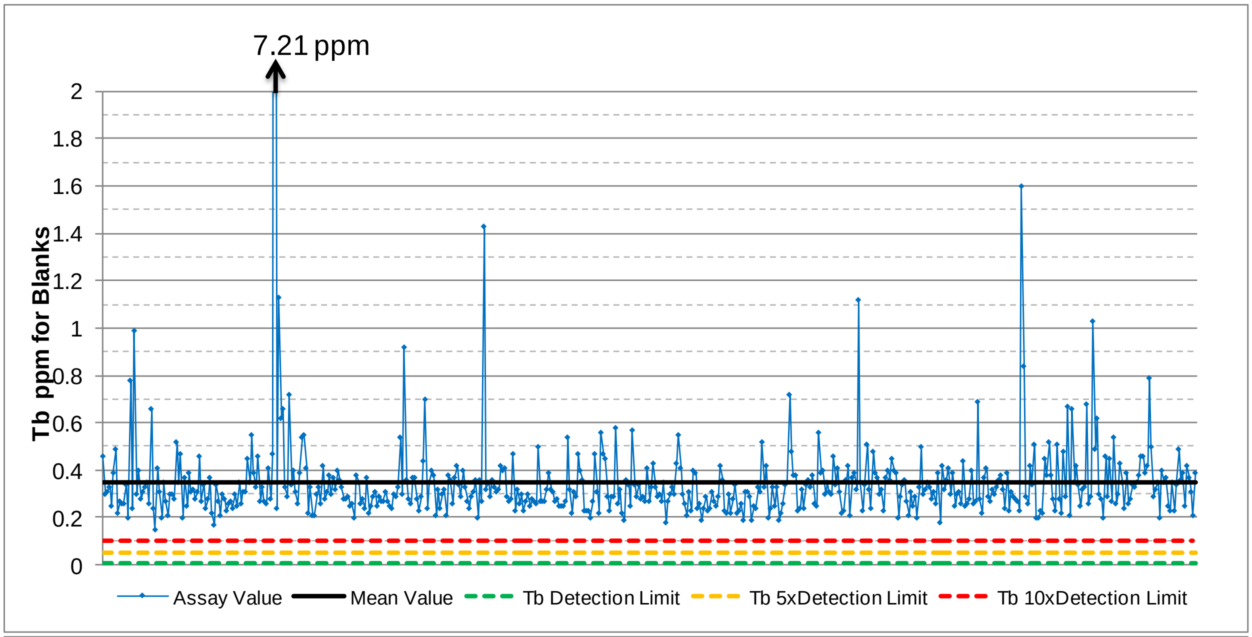
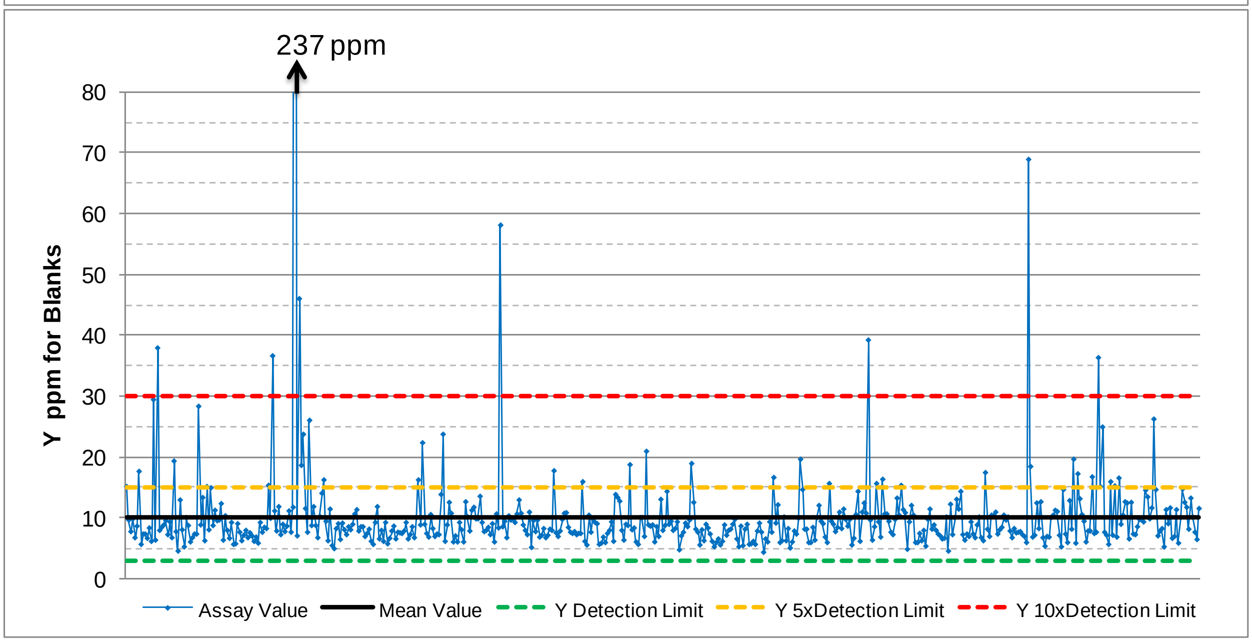


Figure 11.24 - Blank Analytical Results for Tb and Y





The blanks material is very low in REE without a doubt and should be efficient to detect contamination problems. One blank sample returned some REE mineralization. SGS Geostat believes that it may due to an isolated manipulation error and the results are actually not those of the blank material. Since it is an isolated case, SGS Geostat believes that the blanks results are adequate.

11.3.4.1 Analytical Duplicates

The QA/QC analysis made by SGS Geostat for each sample in Matamec Explorations' project shows good overall correlation. Except for rejects, the dispersion was under 15% and it is considered acceptable for REE analysis. The differences between the pairs were all (except for -8.2% in ACT re-analysis) under ±5% for the averages and that is acceptable.

The rejects samples duplicates show high variability that is not well understood at this stage. Recurrent High dispersion and bias in pair values are found and this should be discussed and verified with ALS. Those errors should be investigated to find the possible sources. Overall, SGS Geostat confirms that the QA/QC used for Matamec is adequate and QA/QC duplicates are considered acceptable.

Primary Analysis

A primary visual analysis was made by comparison of originals data versus duplicates data in plotted charts. SGS Geostat concluded using the correlation coefficient (R^2) that the plotted results showed an overall good correlation.

However, an improved statistical analysis was set up using the sign test and dispersion index, in order to determine differences between the pairs and possible analytical biases. The sign test goal is to determine if the count of high or low duplicates shows a bias of statistical significance. This test is also dependant on the number of values. The dispersion index determines the heterogeneity of the values and it is independent of the number of values. Generally, the REE values can vary in a single mineral and therefore the dispersion will be attached to these types of samples. For example, it will be expected that the core duplicates will have a higher dispersion than the rejects and the rejects than the pulps.

Statistical Analysis

Table 11.4 reports the analytical summary for the most economically important elements used in the QA/QC analysis by SGS Geostat.

The "Pulps from lab" and the "Pulps Chosen" return good global correlation with low dispersion <10%. A bias was found in the data analysis (excepted for Nd), but with a low differences range between -0.3% and -0.1%. This bias was considerate insignificant and does not invalidate the data.

The SGS Geostat core duplicates vs. ALS original analyses produced high dispersions (between 10% - 14%) and differences as it was expected for core sample. Those differences are mostly due to the variation of REE grade in the duplicate core sample. Nothing special is noted that could invalidate the ALS data.

The analysis of the pairs of ACT returns a good overall correlation. The dispersion range is small (between 8% and 11%) and can be considered acceptable for data from two different laboratories. However, a high difference was found only for Y element (Dup = Original + 8.2%). This error is focussed only on this element.

The rejects data analysis returns recurrent several issues. For those samples it was expected to obtain a lower dispersion than the core duplicates and a higher than pulps. However, results show the highest dispersion of the QA/QC process. The number of samples (614), was considered sufficient to obtain a significant bias analysis for each element. This bias in reject shows consistent lower grades for the duplicates. This should be discussed and verified with ALS.

Table 11.3 - QA/QC Summary of Sign Tests and Dispersion Indexes Results for the 4 Critical Elements and the TREO, HREO, LREO

REE	Dup Pulp Lab	Dup Pulp Chosen	Dup Rejects Chosen	Dup Pulp ALS vs. ACT	Dup Core ALS vs. SGS
N	359	254	614	247	50
Difference between the originals values average and duplicates average					
Nd	-0.2%	2.3%	-1.3%	-3.8%	2.5%
Tb	-0.3%	0.3%	-2.9%	0.5%	3.8%
Dy	-0.3%	0.9%	-1.9%	1.9%	3.2%
Y	-0.1%	0.9%	-1.4%	-8.2%	-4.3%
TREO	-0.3%	1.7%	-2.1%	-4.1%	-0.8%
LREO	-0.3%	2.3%	-2.4%	-3.5%	0.3%
HREO	-0.2%	0.1%	-1.8%	0.4%	2.7%
D.I.: Dispersion index (standard deviation of repetitions over average grade)					
Nd	4%	6%	17%	8%	10%
Tb	5%	7%	17%	8%	14%
Dy	4%	5%	22%	8%	13%
Y	3%	5%	16%	11%	12%
TREO	3%	4%	15%	8%	10%
LREO	3%	5%	16%	9%	10%
HREO	4%	5%	17%	8%	13%

Difference between the originals values average and duplicates average	Bias sure at 99.9% +
	Bias sure at 99% +
	Bias sure at 95% +
Identification of bias by signs test.	Not conclusive (under 95% confidence)

11.3.5 Special Mentions about the Yttrium (Y)

When putting all the QA/QC results together, SGS Geostat noted that the Yttrium grade given by ALS was found higher than any other labs or higher than all expected values for the standards. Table 11.4 shows that ALS may be estimating the Yttrium about 10% higher than Actlab or the expected values for the standards. Because the Yttrium accounts for only about 7% of the expected revenues on the project, this possible 10% of overestimation translates into a possible overestimation of the revenues by 0.7%. The situation was verified by ALS, they estimate the overestimation to 2 to 3.5%. An updated calibration method will resolve this problem in future analysis. Overall, this observation does not disqualify the data for the production of the feasibility study.

Table 11.4 - Compilation of all QA/QC results for Yttrium

	Y (ppm)	N	Expected value	Duplicate	Original ALS Average	Difference	Bias Confidence (Sign Test)
ALS vs. OTHERS	Blank	523	0		10.02	NA	NA
	Std BRAM308	521	33		36.65	+11%	99.9%+
	Std BRAM310	242	449		495.28	+10%	99.9%+
	Std BRAM312	208	977		1042	+7%	99.9%+
	Std BRAM317	73	6304		7055	+12%	99.9%+
	Actlab Pulp Dup	247		1057.2	1151.8	+9%	99.9%+
	SGS Core Dup	50		1619.9	1693.4	+5%	94% *

*: Not Conclusive

ALS vs. ALS	ALS Pulp Dup (in-house)	359		619.4	620.1	+0.1%	Good results
	ALS Pulp Dup (Gestal)	254		1293.4	1282.1	-0.9%	Good results
	ALS Rejects Dup (Gestal)	614		546.4	553.9	+1.4%	Good results

11.3.6 Conclusion

Overall, the standard analysis indicates good correlation between the expected and the assay values. However, the standards analysis outlines a bias in Y grades. The overall mean difference between expected values and measured values is around 10%. Matamec Explorations team should keep in mind that the Y grades may be overestimated. A linear correction could be a solution but SGS Geostat believes that the dataset is adequate for the preparation of this Study.

The blank analyses also show good overall correlation with some possible contamination maybe due to the high grade of samples.

The duplicates statistical analysis conducted by SGS Geostat on the results returns good correlation overall for all elements. The analytical results show low overall differences between pairs (±0.1% to ±8.2%) meaning a good reproducibility. The signs test on elements population did not outline significant bias in the results except for rejects samples with the duplicates slightly under the original grades (1.3% to 2.9% lower, see Table 11.3). The dispersion results under 15% show acceptable values for all groups in correlation with each sample types (core, pulp) except for rejects which have higher recurrent dispersion than it was expected (over 15%).

The rejects QA/QC samples show unexpectedly high dispersion index. The 614 samples are considered sufficient to obtain a significant bias for each element with lower grade for the duplicates. The dispersion index would have been expected to be lower than core duplicates sent to SGS Geostat, but was found higher. The rejects analysis process should be investigated in order to verify the following steps:

i. Calibration of laboratories equipment can be sources of linear biases;

ii. Rejects sample collection which could potentially affect the dispersion.

The QA/QC analysis made by SGS Geostat on each sample for Matamec project shows overall good correlation. Reject sample analysis are subject to high dispersion and bias in pair values. Those errors should be investigated to find the sources of error. However, for which reasons, SGS Geostat confirmed that the QA/QC used for Matamec is adequate and noted errors are considered acceptable at this stage.

12.0 DATA VERIFICATION

During the July 2012 site visit, Yann Camus, Eng. of SGS Geostat completed independent sampling of chosen core available at the core shack. The author also measured the location of some drill holes with a handheld GPS. Finally, as part of the data verification, SGS Geostat also conducted a verification of the drill hole database supplied by Matamec for errors and discrepancies.

12.1 Independent Sampling

The objective of the check sampling verification program was to confirm the presence of rare earth element ("REE") values in the mineralization outlined during the 2012 drilling campaign. Three (3) drill holes were independently sampled: 12-KM-140, 12-KM-183 and 12-KM-198. SGS Geostat selected a set of 50 mineralized intersections corresponding to samples analyzed by Matamec at ALS. SGS Geostat selected all the samples and supervised the sampling from the core boxes kept for reference by Matamec. The remaining half-core was split in two and a quarter of the core was left in the boxes. The other quarter of the core was sent to SGS Mineral laboratory in Toronto and Lakefield. Figure 12.1 summarizes the sampling and analytical procedure use by SGS Geostat compare to Matamec procedure. Figure 12.2 illustrates correlation diagrams of Dy, Nd, Tb and Y analytical results for the original and duplicate samples.

Figure 12.1 - Comparison between Matamec (ALS) and SGS Sampling and Analytical Procedures

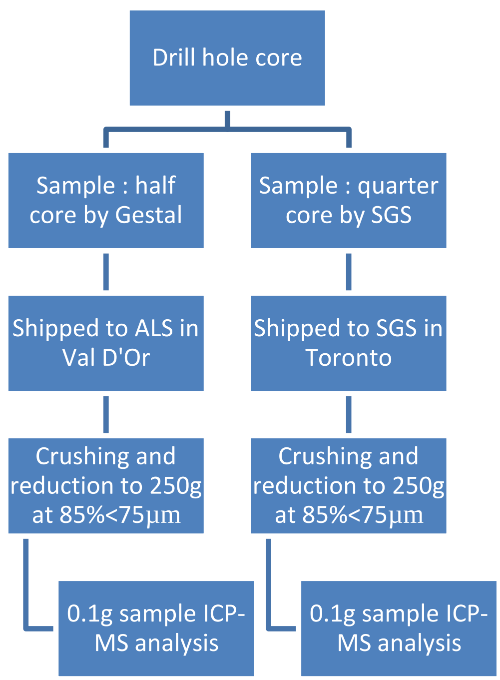


Figure 12.2 - Diagram Showing Correlations for Dy, Nd, Tb and Y Analytical Results between ALS and SGS

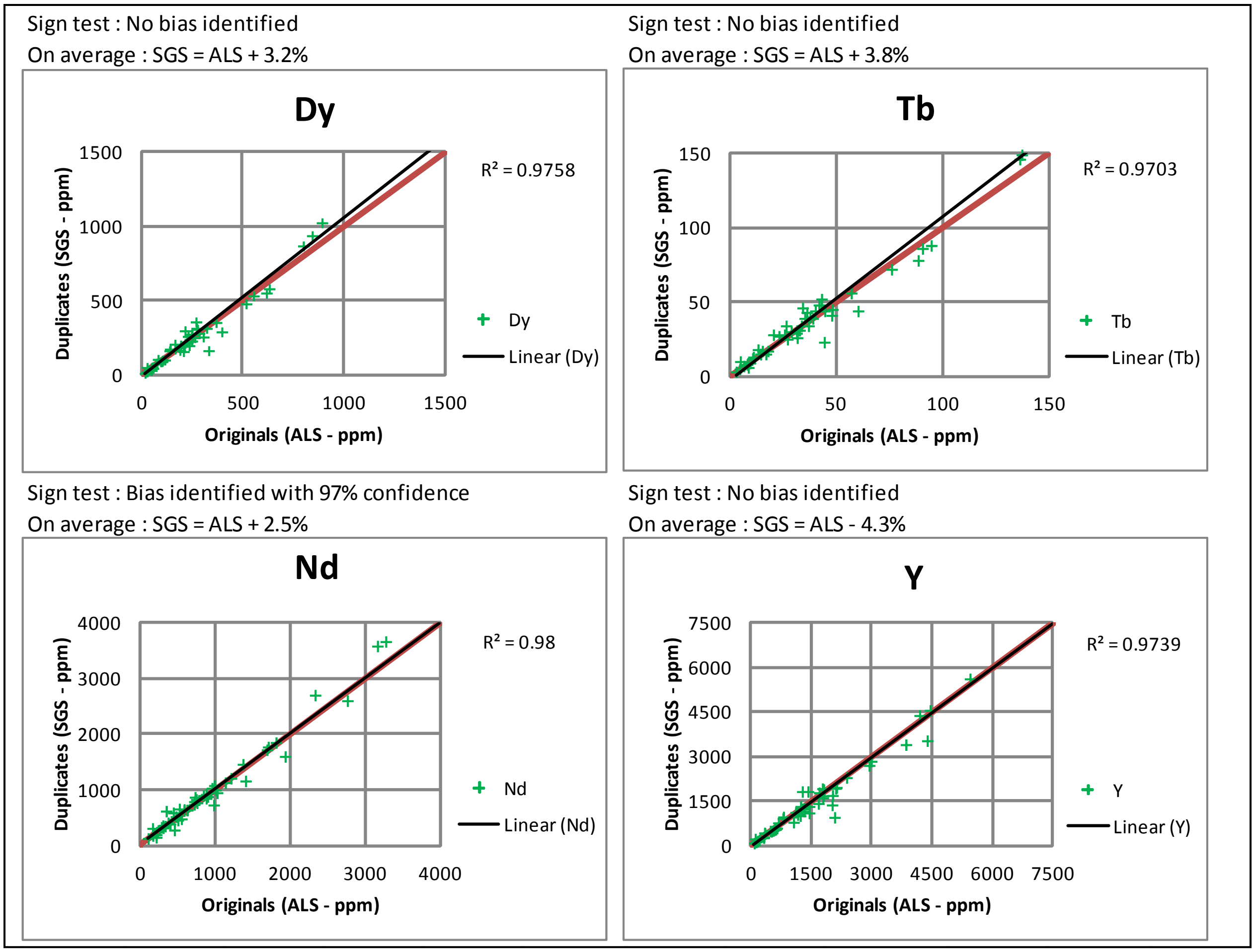


Figure 12.3 - Sample to Sample Comparisons between ALS and SGS for Dy, Nd, Tb and Y

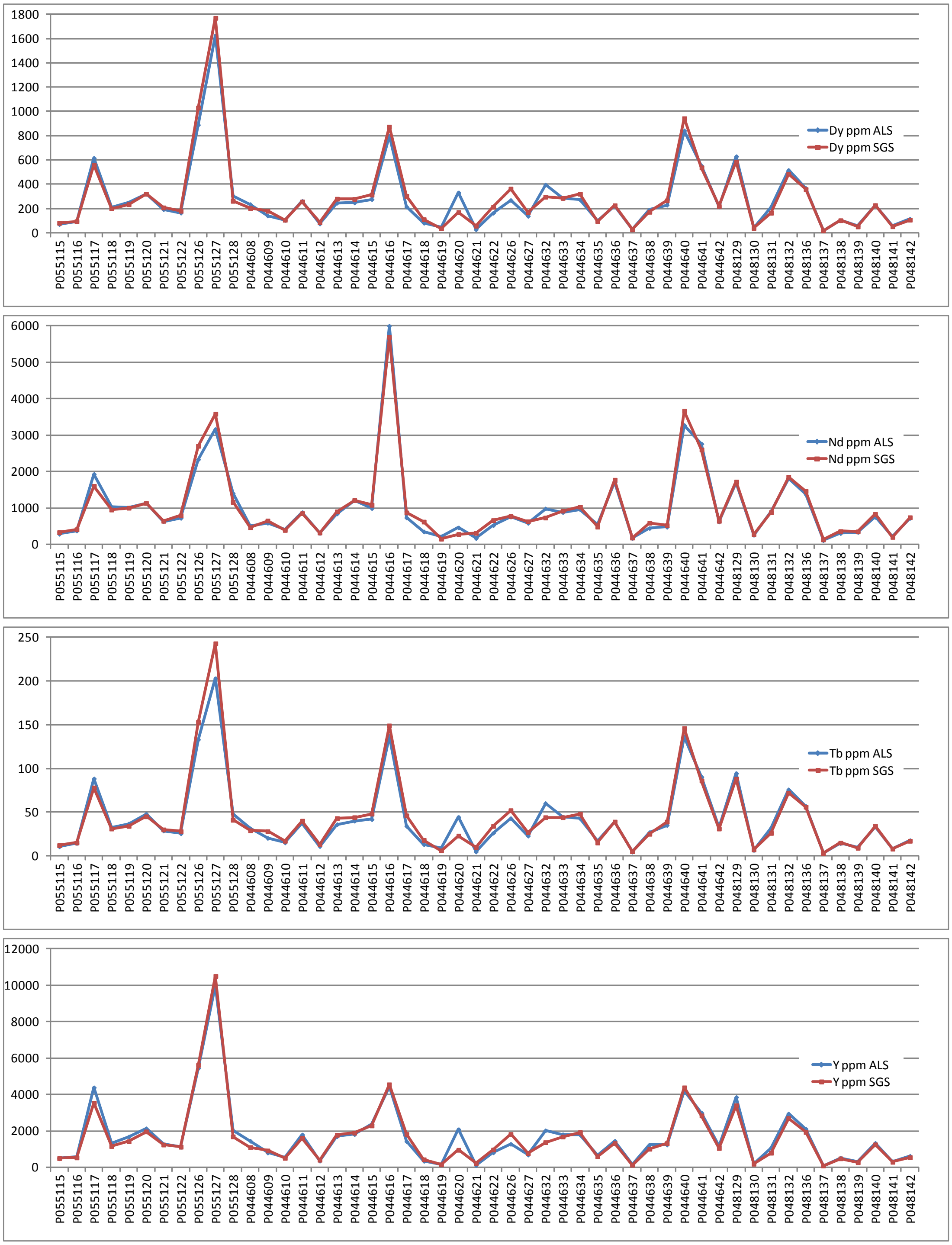


Table 12.1 - Average Difference between ALS and SGS Independent Samples

REE	Dup Core ALS vs. SGS
N	50
Nd	SGS = ALS + 2.5%
Tb	SGS = ALS + 3.8%
Dy	SGS = ALS + 3.2%
Y	SGS = ALS - 4.3%
TREO	SGS = ALS - 0.8%
LREO	SGS = ALS + 0.3%
HREO	SGS = ALS + 2.7%
Identification of bias by signs test.	
Bias sure at 99.9% +	
Bias sure at 99% +	
Bias sure at 95% +	
Not conclusive (under 95% confidence)	

The analytical results for Dy, Nd, Tb and Y as plotted in the diagrams above (See Figure 12.3) show a good correlation and validate the reproducibility of the analytical results returned by ALS. The Sign test on single element population (See Table 12.1) outlined a possible underestimating bias on the Nd. More investigation would be needed to understand and prove an actual bias but since the ALS values are lower than SGS on average, the resources are considered on the conservative side. The statistical analysis conducted on the complete results does not outline any significant analytical bias in the data.

12.1.1 Measurement of Drill Holes with Handheld GPS

During the site visit by SGS Geostat, a total of 20 collars were measured by handheld Garmin GPS to roughly verify their location and also to acknowledge the state of the monuments in place for each drill hole. Out of the 20 visited collars, 19 were from the 2012 drilling campaign and 1 was from the 2009 campaign. Out of the 19, 14 had a wooden stick protruding with the identification (see Figure 12.4 for examples, the stick was broken and lying on the ground for 1 of them) and 5 missed the identification. All of the 20 handheld GPS readings were easily matched with the corresponding collar using the identification for 14 and using the X and Y coordinates for the 6 others. All handheld GPS coordinates fall within 10 m in X and Y and within 20 m in Z compared to the drill hole database professional GPS coordinates supplied by Matamec.

Figure 12.4 - Pictures of the Stick Marking the Holes 12-KM-166 and 12-KM-179

12.1.2 Verification of the Drill Hole Database and Assays Certificates

SGS Geostat validated the digital drill hole database supplied by Matamec for the following information: collar location, azimuth and dip, hole length, survey data and analytical values. The verification did not return any significant errors or discrepancies. The coordinates and azimuths used are on a local grid but the UTMs are also available.

SGS Geostat did a verification of the drill hole database comparing it to the assays certificates from ALS. Out of the 18 analytes for 840 samples corresponding to 15,120 grade values contained within 9 ALS certificates, no errors were encountered. All in all, the equivalent of 7.2% of the 2012 assays were verified for the present report with no difference found between the certificates and the drill hole database. SGS Geostat believes the database is of excellent quality.

12.1.3 Data Verification Conclusion

The analytical results SGS Geostat independent sampling program confirmed the presence of Zr and REE mineralization in the selected samples and validated Matamec's analytical results used in the current mineral resource estimation. The independent measurement of collars with handheld GPS returned satisfactory results. The validation of the drill hole database assays compared to assays certificates found a very high level of professionalism. The author and SGS Geostat are in the opinion that the analytical data contained in the final drill hole database is of good quality and is adequate to support the mineral resource estimates for the feasibility study.

13.0 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 Sampling Matamec

The geological team from Matamec Explorations designed, gathered, and supplied four separate bulk samples to the metallurgical team: (1) sample composed of drilling rejects for bench-scale testing in 2010; (2) a 15 metric tonnes bulk sample which provided feed material for the first pilot plant in 2011; (3) a series of 8 mini-bulk samples composed of half HQ cores (6.35 cm diameter) for the variability study in 2012; and (4) a 24 t bulk sample to provide material for the second pilot plant scheduled to be run during Fall 2013. The methods used for assembling each sample are provided below, in Sections 13.1.1 to 13.1.4.

13.1.1 2010 Bench scale

The 2010 bulk sample was composed of 100 kg of reject material from the 2009 drilling campaign (holes KM-35 to KM-61, and TWIN 05, 07, 14, and 20, see Appendix 3.1 for location of these holes).

Samples were first defined on the freshly-drilled NQ core by a geologist based on lithological, mineralogical, and apparent grade criteria. The core was then split in half by a technician using a hydraulic splitter. One half of the core was bagged in a clearly identified bags and was sent to ALS Chemex Val d'Or for processing, while the other half was kept in the box for future reference. ALS crushed this material one sample at a time to 70% passing 2 mm and the resulting material carted until 250 g could be separated out. Silica was run through the crushing system after each sample. The remainder of the 2 mm material, i.e. the rejects, was then bagged one sample per bag and sent to Gestion Aline Leclerc's secure facility in Val d'Or for storage.

Four-hundred fifty-one (451) samples (representing 417 m of core, or 20% of the campaign) were then selected to be part of the 2010 bulk based on zones defined at a cut-off grade of 0.1% Y2O3 (0.5% TREO equivalent) with a minimum zone thickness of 2.5 m (zones must begin and end on an above cut-off grade sample). These samples were gathered by technicians out of Gestion Aline Leclerc's storage facility and sent to ExploLab in Val d'Or where each sample was split in half, with one-half returned to storage, and one-half homogenized by mineralized zone (Eudialyte Zone, Mosandrite, Zone and Britholite Zone). Homogenized samples were first put into 45-gallon drums, then split into 5 gallon drums identified with MAT-ZEUS, the name of the zone, the number of the 45-gallon drum, and a sequential number (e.g. MAT-ZEUS Eudialyte 2.1 de 4). 100 kg from the Eudialyte zone, as well as 25 kg from both the Mosandrite and the Britholite zone were put in 1 kg bags before being inserted in their respective 5-gallon container. 100 kg (one 45-gallon drum from the Eudialyte zone) was sent to SGS Mineral Services in Lakefield for testing, the remainder (ten 5-gallon drums from the Eudialyte zone, four 5-gallon drums from the Mosandrite zone (one in 1 kg bags), and one 5-gallon drums from the Britholite zone (entirely in 1 kg bags) was put back in Gestion Aline Leclerc's secure storage facilities in Val D'Or.

This sample is judged highly representative of the high-grade mineralized sections of the deposit as a whole, as it has a wide spatial footprint and does not discriminate base on lithology. Expected head grade based on analysis was 0.62% TREO with 44% HREO and 445 ppm Th.

13.1.2 2011 First Pilot

The 2011 bulk sample was composed of 15 t of material blasted from trenches T-3, T-13 and T-8, 5 t from each respectively (see Appendix 3.2 for bulk sample sections). All three (3) samples come from the Eudialyte zone. Selection of the three intervals was based on lithology, nature of mineralization and grade (as returned by channel samples cut by Matamec in 2008 and 2009), with the target grade being the 2010 resource estimate of 0.63% TREO with 32% HREO (at a cut-off grade of 0.5% TREO).

T-3 was blasted first in December 2010, during the 2010-2011 drilling campaign, while T-13 and T-8 were blasted consecutively in late December 2011. Both followed the same operational sequence. First, F.Fleury, Geo., identified the beginning and the end of the target channel samples with flagging and spray paint (the beginning and end of each sample having being marked by a cross-cut when initially sampled). Certified blasting personnel from Les Pierres du Nord inc. then moved in, drilled shallow blasts holes at 2 feet intervals and detonated explosives in the holes. The blast zone at T-3 consisted of a 4 m long by 2 m wide by 1.5 m deep area. This was considered too big to give good fragmentation as large boulder remained in the pit after collection. Blast zones in T-13 and T-8 were 8 m long (4 channel samples), 60 cm wide and 60 cm deep. This provided good fragmentation and corresponded well with the 5 t target, though some material was left in place after collection. Matamec and blasting personnel then gathered up the material under the supervision of a geologist, with strict instruction to gather pieces of all sizes and appearances (not just big or small, and not just mineralized pieces). The geologist noted down a general description of each blast material as it was being gathered and took photos. Blasted material was put in clean re-conditioned 45 gallon drums with closing lids (22 drums from T-3, 20 drums each from T-13 and T-8, each identified in spray paint with T and the trench number), loaded up on a tractor trailer from the Performax drilling company (2009) or on a Moruka with a small shovel rented from Technominex (2010), transferred to a flatbed at the road side and then stored in Home Hardware Centre de Rénovation FLD inc.'s fenced yard in Témiscaming until it could be picked up by a transporter from Gardewine Transport inc. and taken to SGS in Lakefield.

Geological description of material from the three (3) blasts is as follows (F.Fleury, Geo.):

Bulk 2010-T-3 (22 drums, 5 t, channel sample 546 to 547) is composed of medium grained to coarse grained fairly mafic mesocratic syenite (30 to 40% green amphiboles) with at least one major, 20 cm silver-grey amphibolites band running through it. Mineralization is composed of medium to coarse grained eudialyte (3-4% overall) with trace mosandrite, a few grains of what could be britholite and some brick red thorite. Rock is unaltered and fresh-looking.

Bulk 2011-T-13 (20 drums, 5 t, channel sample H905663 to 66) is composed mostly of black and white medium grained mesocratic syenite with abundant brown medium grained to very coarse grained elongate mosandrite (up to semi-massive in some zones, 10% overall). Silver-grey amphibolite bands are also common. Minor diopside-feldspar rock and phlogopite-calcite rock (Too cold to react with acid?) were also observed and the entire interval seems unusually rich in coarse grained to very coarse grained, euhedral, flesh-coloured zircons (1% throughout) many with darker, glassy, euhedral cores. Fluorite and apatite in trace overall but fluorite can be very abundant in spots. Eudialyte is a very minor component of overall mineralization in this sample.

Bulk 2011-T-8 (20 drums, 5 t, channel sample 596 to 599) is overwhelmingly mesosyenitic, medium grained, with a few silver-grey amphibolite intervals (about 5% of overall sample). No major calc-silicates. Mineralization is 5% disseminated to banded medium-grained eudialyte, mostly dullish red with a few patches and late veins of the brilliant pink variety. Sample also includes about 1-2% medium-grained mosandrite, trace thorite and trace agrellite.

Table 13.1– 2010-2011 15t Bulk Sample

			Expected Grade			Actual Grade from SGS Analysis		
Concentrate	**Source**	**Tonnes**	**TREO (%)**	**% HREO**	**Th (ppm)**	**TREO (%)**	**% HREO**	**Th (ppm)**
T-3	T-3	5	0.61	39	176	0.51	36	322(*)
T-8 and T-13	T-8 + T-13	10	0.56	29	298	0.55	31	276
	Total	15	0.57	32	257	0.54	33	291
Kipawa Deposit Resources	2010		0.63	32	-	0.63	32	-

(*)Thorium is almost entirely contained within medium to coarse grained Thorite and Ekanite crystals. Nugget effects are therefore not uncommon.

Based on channel samples, the expected grade for this bulk was 0.57% TREO with 32% HREO. This corresponds with the 0.63% TREO with 32% HREO grade of the 2010 resource estimate, which was the feed grade target for the pilot plant operations. SGS analysis on this bulk sample return an average of 0.54% with 33% HREO, which is slightly below what was expected but still remains within acceptable limits. In addition, plant feed assay taken semi-continuously during the course of the pilot plant's operation returned an average of 0.12% Y_2O_3, which compares well with and validated the expected grade of 0.13% Y_2O_3 based on channel samples (vs. 0.15% Y_2O_3 based on 2010 resources). Later resource calculations would drop the average grade of the deposit down to 0.43% TREO (2012 PEA resources). This 15 t sample as a whole is therefore judged representative of the slightly more enriched Eudialyte zone of the Kipawa deposit, which contains the majority of the defined resources. It is composed primarily of syenite (with a little bit of calc-silicates) and the main mineralization is a mix of eudialyte and mosandrite with only accents of britholite.

13.1.3 2012 Variability Study

The 2012 variability samples were composed of 8 distinct mini-bulks weighing between 150 and 430 kg each (2.2 t of material total). This material was assembled from half HQ-caliber cores drilled especially for this purpose during the summer 2012 drilling campaign (holes KMH-01 to KMH-22, (Appendix 3.1 for location of these holes). Each mini-bulk was meant to test the effects of changes in grade, lithology or mineralogy on the process established by the first pilot plant.

Samples were first defined on the freshly-drilled HQ core by a geologist based on lithological, mineralogical, and apparent grade criteria. The core was then split in three by a technician using a hydraulic splitter and one quarter of the core bagged in a clearly identified bag which was sent to ALS Chemex Val d'Or for analysis while the other quarter was kept in the box for future reference. The remaining half was put in a new HQ box, with the beginning and end of each sample marked in crayon and a sample tag tacked at the end of each sample (the latter half of the holes also had the depth marked in crayon on the box at 3 m intervals for ease of reference), then racked at Charrette camp while waiting for analysis results to arrive. Charrette camp was always manned during this period, either by the geological team or by a paid custodian.

Five-hundred three (503) samples (representing 517 m of core, or 28% of the campaign) were then selected to be part of the 2012 variability study based on grade (0.7% (high), 0.4% (mid) and 0.2% (low) TREE as compared with the 2012 PEA resources of 0.43% TREO at the 0.2% TREO cut-off), lithological domains (Syenite, high-calcite calc-silicates (skarns, marbles, calcareous diopside-feldspar rock and calcareous silver-grey amphibolites) and low calcite calc-silicates (diopside-feldspar rock and phlogopitites)) and mineralogy (high eudialyte content vs. high mosandrite content). Efforts were made to avoid changing multiple parameters at once, but also to cover other criteria as well, such as shallow vs. deep (to detect the presence of possible surface leaching of contaminants) and East Zone vs. West Zone. As a comparison value, the percentages of each mineral and each of the defined lithological domains was estimated based on the visual logging of the 22 HQ holes (See Table 13.2). The composition of a ninth, Global composite mini-bulk was then estimated by mixing various proportions of the first 8 composites. The Global composite is meant to be representative of the deposit as a whole.

Table 13.2 - 2012 Variability Study Composite Samples

			Expected Grade from Quarter Core Analysis			Mineralization (relative %)			Calc-silicates (% length)			Actual Grade from SGS Analysis		
Variability Composites	**kg**	**% in Global**	**TREE (ppm)**	**HREE (%)**	**Th (ppm)**	**Eud**	**Mos**	**Bri**	**High calcite**	**Low calcite**	**Total**	**TREE (ppm)**	**HREE (%)**	**Th (ppm)**
#1: West + High Eu	432	10	0.70	38	292	82	17	1	3	13	16	0.65	37	264
#2: Shallow + High Mos	150	6	0.42	31	295	15	85	0	18	11	29	0.40	34	262
#3: Mid TREE	305	10	0.47	35	386	65	31	4	18	12	30	0.44	35	385
#4: Low TREE	312	32	0.24	31	184	54	42	3	15	10	25	0.22	30	154
#5: High TREE	295	8	0.86	34	460	54	34	13	15	3	18	0.71	34	351
#6: Meso/Leuco Syenite	249	26	0.40	30	220	59	38	3	0	0	0	0.38	30	227
#7: High calcite Calcs	252	4	0.40	33	219	43	54	2	100	0	100	0.37	32	209
#8: Low calcite Calcs	272	4	0.40	35	215	21	75	4	0	100	100	0.38	36	242
Global Composite	250	100	0.43	32	259	55	41	3.8	13	11	24	0.38	32	238
Kipawa Deposit resources			0.43	32	304	56	38	5	13	9	22	0.43	32	304

These samples were gathered by a technician under the supervision of F. Fleury, Geo., put into clearly marked bags and then loaded up on shipping pallets in the fenced yard of Home Hardware Centre de Rénovation FLD inc. in Témiscaming until they were picked up by a transporter from Gardewine Transport inc. the following day and taken to SGS Mineral Services in Lakefield, Ontario.

While there is some internal variability between the expected assays and the actual obtained analysis from SGS, most of it assigned to using half-core duplicates, the end results are still within the expected range for both grade and HREO enrichment. The samples are therefore judged as representative based on those two criteria and on general lithology, this last as established by the original logs and the inspection of the core by a geologist while the samples were being assembled. QEMSCAN data on the Global composite do show more apatite then expected for the deposit though, so a mis-identification in the mineralization of one or more of the composite bulk samples is probable and possibly systematic to the logging process. The geological team therefore recommended performing a mineralogical study of the various composites (through QEMSCAN or binocular microscope) before the samples were used in the study, or retaining a small sample at each step of the process (feed, high magnetic rejects, low magnetic rejects, mineral concentrate and leach tail) so that a mineralogical study could be carried out should any problems or questions arise. The latter recommendation was taken and a sample of each sample at each step of the process is currently in storage at SGS. In view of the observed internal variability of the deposit at this scale, the team also recommends that the composition of future "blended" bulks only be decided and carried out after analysis of the individual components has taken place.

13.1.4 2012 Second Pilot

The 2012 bulk sample was composed of 24 t of material blasted from trenches T-1, T-3, T-13, T-12, T-11 and T-10, 2 to 5 t from each (see Table 13.3 below). These samples were taken across all zones of the deposit. Selection of these intervals was based on lithology, nature of mineralization (as estimated from statistical work on the logging of the 2012 metallurgical holes) and grade (as returned by channel samples cut by Matamec in 2008 and 2009), with the target grade being the 2012 in-pit resource estimate of 0.42% TREE with 32% HREE (at a cut-off grade of 0.2% TREO). Maximum flexibility was asked in the creation of this bulk sample, as neither the resource numbers nor the results of the variability testing were known at the time of gathering. Metallurgists therefore wanted to be able to mix and match. To that end, the 2012 bulk sample is truly composed of 7 mini-bulk samples, each with its own characteristics (as listed on Table 13.3).

Blasting and gathering for this bulk took place in November 2012 and followed the same operational sequence as the 2010 and 2011 bulks. First F. Fleury, Geo. identified the beginning and the end of the target channel samples with flagging and spray paint (the beginning and end of each sample having being marked by a cross-cut when initially sampled). Certified blasting personnel from Les Pierres du Nord inc. then moved in, drilled shallow blasts holes at 2 feet intervals and detonated the holes. Blast zones for 2.5 t sites (T-1, T-12, T-11m and T-10) were 4 m long (2 channel samples), 60 cm wide and 60 cm deep, while blast zones for 5 t sites (T-3s, T13w and T-11s) were 6 m long (3 channel samples), 6 0 cm wide and 60 cm deep. This provided good fragmentation and corresponded well with the target tonnages (little material was left in place after collection). Matamec and blasting personnel then gathered up the material under the supervision of a geologist, with strict instruction to gather pieces of all sizes and appearances (not just big or small, and not just mineralized pieces). The geologist noted down a general description of each blast material as it was being gathered and took photos. Blasted material was put in clean re-conditioned 45 gallon drums with closing lids (8 drums from 2.5 t sites, 16 drums from 5 t sites, each identified in spray paint with T, the trench number and a sequential number), loaded up on a Moruka with a mini shovel rented from Machinerie Helène Champoux, transferred to a flatbed at the road side and then stored at Matamec's fenced yard on Rue de la Carrière in Témiscaming until it could be picked up by a transporter from Gardewine Transport inc. and taken to SGS.

Geological description of material from the seven (7) blasts is as follows:

Bulk 2012-T-1 (Medium grade West Zone, 8 drums, 2.5 t, channel sample 520 and 521) is a fine to medium grained leucocratic syenite (15-20% mafics, including some silver-grey amphiboles). Rock is slightly friable, lightly altered and gneissic in texture, showing local leucocratic to mesocratic banding. Mineralization is composed of pinkish-red eudialyte (some centimetric crystals), trace britholite (dark brown with a slight tint of honey) and rare traces of white mosandrite (anhedral to subeuhedral). Trace glassy yellow sphene, millimetric and subeuhedral, was also observed.

Bulk 2012-T-3s (High Eudialyte, 16 drums, 4.8-t, channel sample 537 to 539) is a medium grained to coarse-grained mesocratic syenite (40% mafics), rising to locally mafic, with mafics composed entirely of silver-grey amphiboles. Rock shows a very light orange surface alteration in spots. Mineralization is composed of 2-3% medium to coarse-grained eudialyte with trace to 1% brown, elongate mosandrite. Trace brick red thorite, in nicely euhedral, centimetric crystals, was also observed.

Bulk 2012-T-13w (High Mosandrite, 16 drums, 4.8 t, channel sample H905663 to H905665) is a mesocratic syenite with leucocratic banding (30% mafics overall: 75% silver grey, 25% green amphiboles). Surface alteration is weak in colour, but does make the rock friable. Feldspars show a slight brownish tinge. Mineralization is 3-5% brown mosandrite in centimetric elongate crystals (0.5 to 4 cm in length). Trace purple fluorite in 2-3 mm crystals and trace of more or less euhedral flesh-coloured zircons. Some rare quartz veins also observed.

Bulk 2012-T-12 (Low calcite calc-silicates, 8 drums, 2.4t, channel sample H905613 to H905614) is composed of two lithologies. The first (80% of the rock) is a medium grained leucocratic feldspar-diopside rock (20% mafics) with 8% disseminated silver-grey amphiboles. Light surface alteration. Mineralization is composed of 1% brown mosandrite in centimetric euhedral crystals. Also contains 2% fine to medium grained purple fluorite. Note that this is less mafic than the diopside-feldspar rock the team was expecting to find at this location based on Meusy's 1990 mapping of the trenches. The second lithology (20% of the rock) is a medium to coarse-grained feldspar and diopside phlogopitite. The majority of this lithology has been reduced to sand by the blast, solid blocks remaining being feldspar and diopside enriched compared to the whole. Efforts were made to gather a representative portion nonetheless. Mineralization is composed of 1% brown mosandrite in crystals 0.5 to 1.5 cm in length. Trace to 1% flesh-coloured zircons (millimetric to centimetric) and some trace of fine-grained purple fluorite were also observed.

Bulk 2012-T-11n (High calcite calc-silicates, 8 drums, 2.4 t, channel sample 575 to 576) is also composed of two lithologies, firstly diopside-silver grey amphibole-feldspar rock (70% of the rock) in the proportions 60% diopside, 30% silver grey amphiboles and 10% feldspar. This rock is dark green to shiny grayish-black with centimetric to pluricentimetric crystals and no visible surface alteration. It includes trace brown mosandrite with some white mosandrite in spots, trace flesh-coloured zircons and trace brick red thorite. Historical trench mapping by Meusy also mentions trace calcite. Secondly, a fine to medium-grained phlogopite-chondrodite marble (30% of the rock). The marble is locally friable.

Bulk 2012-T-11s (Low grade syenite, 16 drums, 4.8 t, channel sample 584 to 586) is a medium grained leucocratic syenite (20% mafics). The feldspars here show a marked yellow tinge. Mineralization is composed of trace brown mosandrite (up to 3% locally in some rare spots) and ultra-trace anhedral crystals of fine grained, pinkish-red eudialyte. Light traces of flesh coloured zircons and trace brick red thorite in small elongate crystals.

Bulk 2012-T-10 (Medium grade East, 8 drums, 2.4 t, channel sample H905634 to H905635) is a medium-grained leucocratic syenite (20% mafics). Feldspars tinged a pale orangish colour from mild to medium surface alteration, moderately friable. Trace mosandrite, trace matte to glassy millimetric yellow sphene, trace very small millimetric flesh-coloured zircons.

Table 13.3 - 2012 24t Bulk Sample

Concentrate	Source	Tonnes	Expected Grade TREO (%)	Expected Grade % HREO	Expected Grade Th (ppm)	Actual Grade from SGS Analysis TREO (%)	Actual Grade from SGS Analysis % HREO	Actual Grade from SGS Analysis Th (ppm)
Mid-grade West	T-1	2.4	0.41	24	439	0.48	37	312
High eudialyte	T-3s	4.8	0.77	38	791	0.59	41	1100(*)
High mosandrite	T-13w	4.8	0.61	36	151	0.59	38	112
Low calcite calc	T-12	2.4	0.47	25	197	0.55	32	181
High calcite calc	T-11n	2.4	0.30	26	132	0.23	28	59.3
Low-grade	T-11s	4.8	0.16	28	196	0.19	37	283
Mid-grade East	T-10	2.4	0.41	24	436	0.36	27	345
	Total	24	0.47	30	348	0.44	36	389
Kipawa Deposit Resources			0.43	32	304	0.43	32	304

(*)Thorium is almost entirely contained within medium to coarse grained Thorite and Ekanite crystals. Nugget effects are therefore not uncommon.

The expected grade for this bulk (based on channel samples) was 0.47% TREO with 30% HREO which was set deliberately a little higher than the target grade of 0.42% TREO with 35% HREO, based on experience with the two previous bulk samples. This proved wise but unnecessary, as the observed head grade of this bulk is 0.44% TREO with 36% HREO. This 24 t sample, though slightly more enriched in Th then desired (from mini-bulk T3s) and slightly less diopside-rich (from mini-bulk T-12), is therefore judged roughly representative of the Kipawa deposit as a whole, in terms of both grade and lithologies. Mineralogical representativity is harder to judge, but the bulk should be dominantly eudialyte with a strong proportion of mosandrite and a minor component of britholite, which is consistent with the author's understanding of the deposit.

13.2 Historical Test Review

Testing of Kipawa mineral concentrate materials commenced in early 2010 at SGS Mineral Services. The initial testwork program focuses on the leaching and filtration of Eudialyte, since it is known that the filtration of silicate minerals is problematic. Without the ability to solubilize and separate the residue from the pregnant solution, it is useless to develop the rest of the treatment process. After achieving reasonable extraction and filtration results, beneficiation testwork started. In parallel, the remainder of the hydrometallurgical process was developed progressively. The following chapter outlines the development of the metallurgical process in the order they appear on the flowsheet.

13.2.1 Magnetic Separation

Magnetic Separation testing on the Kipawa ore was initiated in September 2010 at SGS Mineral Services. Initial tests were carried out with a dry magnetic separator, a wet magnetic separator, and an electrostatic separator. The best separation was found using dry magnetic separator, and hence focus was placed on using dry magnets to generate a mineral concentrate. As Kipawa's main REE bearing minerals are all paramagnetic, a two-stage magnetic separation process was used. Feed material is first passed through a low gauss rougher, which removes the highly magnetic portion into the magnetic wastes stream. The remainder of the materials is then fed to the second high gauss magnetic separation stage. In this second pass, the magnetic portion is the REE mineral concentrates. The non-magnetic material from the high gauss recovery is the non-magnetic wastes.

Size-by-size testwork was carried out by separating the feed into size fractions. It was found that feed with +20 mesh sizes did not respond well to the magnets due to their large sizes, and fines of -200 mesh were too fine for separation with dry magnets. Therefore, the target grind size feeding the magnetic separation circuit was selected as less than 20 mesh, and a desliming circuit is included in the flowsheet for removing the -200 mesh materials. Generally, approximately 10% of the mass has a particle size of -200 mesh. Excellent recoveries were achieved with the dry magnets. By using a -20 mesh feed enriched with REE for these testing, as high as 90% recovery with 35% mass pull was resulted into the REE mineral concentrates, including the recombining of the fines portion.

In parallel, some wet magnetic separation testing were revisited and reattempted. A wet circuit is preferred for operations, because it would allow for a greater flexibility in selecting crushing and grinding equipment. A wet circuit would greatly reduce the issue of dusts and material handling, which is particularly important in terms of health and safety because of the uranium content in the ore. However, the wet magnetic separation results were consistently lower than the dry separation in spite of optimising the magnetic intensity, grind size, and size fractions used in the testing.

13.2.2 Leaching

The initial leach tests using the Kipawa ore used acid baking with water leaching as the REE extraction method, which is a known leach method used on other common REE bearing minerals. Upon further investigation, it was found that Eudialyte is easily dissolved, and at room temperature, atmospheric sulphuric acid leach is sufficient to solubilize the REE into solution.

Over 40 bench scale leach tests were carried out on the Kipawa mineral concentrate. Feed particle size, percentage solid, acid dosage and residence time were all progressively investigated individually and optimised to achieve highest REE extraction.

13.2.2.1 Particle Size

Leaching tests were carried out with P_{80} feed size ranging from 18 microns to 240 microns. The results are highlighted in Table 13.4. For tests carried out with very similar parameters and conditions, data revealed that different feed particle P_{80} sizes did not affect the extraction of REE. This result concurred with the coarse-grain and non-inter-grown nature of the ore. Mineralogical analysis further confirmed that the mineral concentrate is well liberated at a coarse grind size. Hence, a design particle P_{80} size of 150-180 microns was selected.

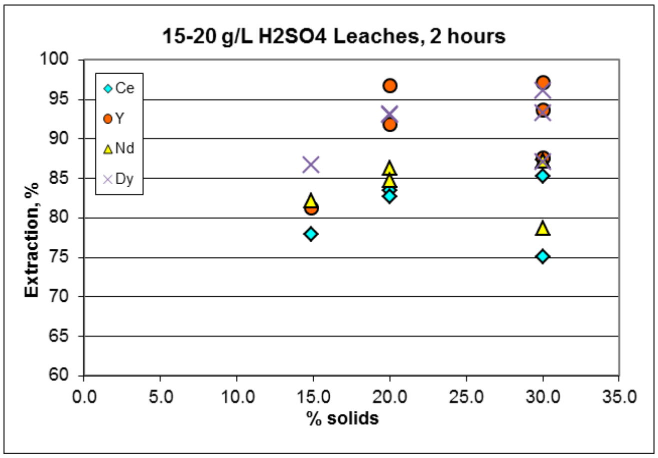
Table 13.4 - Effect of Particle Size on REE Extraction

Test ID	Particle Size P_{80}	% solids	Time (h)	Acid Dose (kg/t)	Free Acid (g/L)	Filtration Time (h)	Extraction TREE%
PL-4	17.6	20	3	763	189	10	88.9
PL-1	240	20	3	763	235	60	84.3
PL-6	21.6	20	3	300	58	300	89.0
PL-9	180	20	3	300	61	360	93.9
PL-18	118	20	2	120	16	30	88.7
PL-17	159	20	2	120	14	8	89.1

13.2.2.2 Percent Solids

Early CL testwork was carried out at a low percent solid of 15 - 20%, to establish the maximum possible extraction (i.e. unhindered by saturation in solution). In order to minimize acid dosages, the % solids were increased. It was found that at 30%, as shown in Figure 13.1, that extraction remains similar to the 20% level. Based on bench testing, a solid density of 30% was selected as the design criteria for the pilot plant.

Figure 13.1 - Effect of % Solids on REE Extraction



13.2.2.3 Acid Dosage

The initial acid dosage for the concentrate leach was in excess of 600 kg/t of mineral concentrate. Since the cost of acid contributes significantly to the reagent cost, efforts were placed on reducing the acid consumption. At the same period of time, percent solids optimisation testing was also ongoing which affected the strength of acid in solution. Therefore, instead of recording the initial acid dosage, the free acid at discharge was targeted.

Shown by Figure 13.2 and Figure 13.3 below, the leach extraction did not increase substantially above around 20 g/L of Free Acid (FA) at discharge. Therefore, 20 g/L of FA was selected as the optimal acid level. Tests with 20 g/L at discharge with 30% solids typically consume around 60 kg of acid per tonne of feed. Including the FA remaining in solution, the total acid addition is approximately 120 kg/t. The HREE extraction is typically slightly better than the LREE at around 90% and 80-85%, respectively.

Figure 13.2 - Effect of Free Acid on REE Extraction

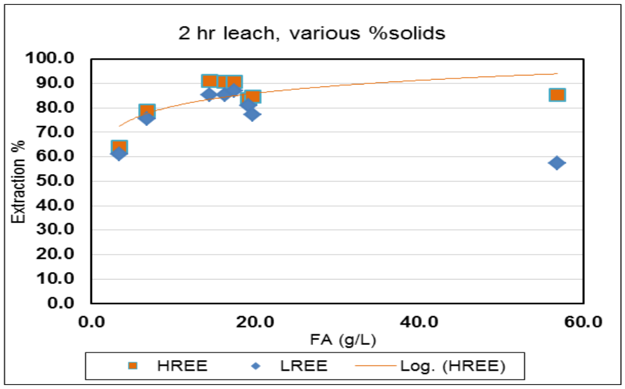
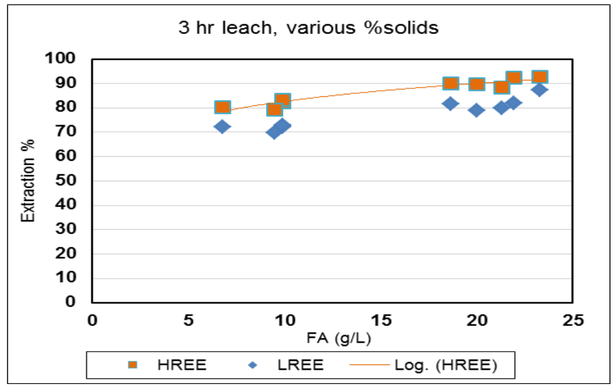


Figure 13.3 - Effect of Free Acid on REE Extraction



The depressed LREE was thought to be because of double-salt precipitation, due to high concentration in the PLS. Some kinetic samples taken showed a decrease in LREE concentration towards the end of the leach test, which supported this theory. Therefore, one test was carried out where the leached pulp was slurried down from 30% to 20% at the end of the test before filtration, to see if saturation and double-salt precipitation is the cause. The test results however did not show an improvement to the LREE extraction. The lowered LREE extraction is therefore believed to be due to the mineralogy.

13.2.2.4 Residence Time

The relationship between residence time and extraction are shown in Figure 13.4 and Figure 13.5. For both the 10 g/L FA at 30% solids scenario, and the 20 g/L FA at 15% solid scenario below, the extraction increases beyond 8 hours and 3 hours, respectively. However, when test was carried out at 20 g/L and 30% solids, which is near the optimal conditions, the trend is no longer observed. The time for reaching the maximum extraction is not clearly defined by the results as shown in Figure 13.6. It was decided to select three hours of residence time for the pilot plant, and to collect kinetic data for further definition of the optimal time.

Figure 13.4 - Effect of Residence Time on REE Extraction

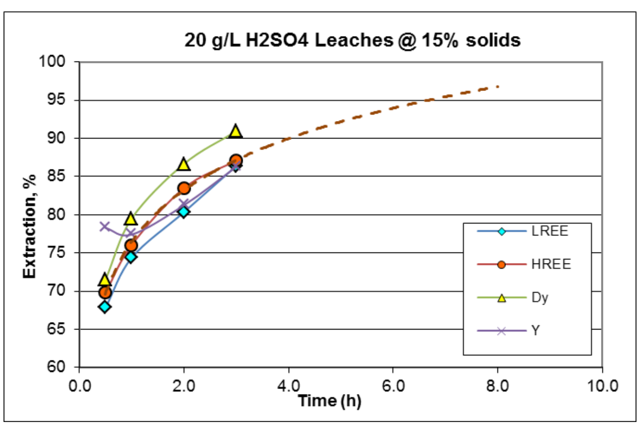


Figure 13.5 - Effect of Residence Time on REE Extraction

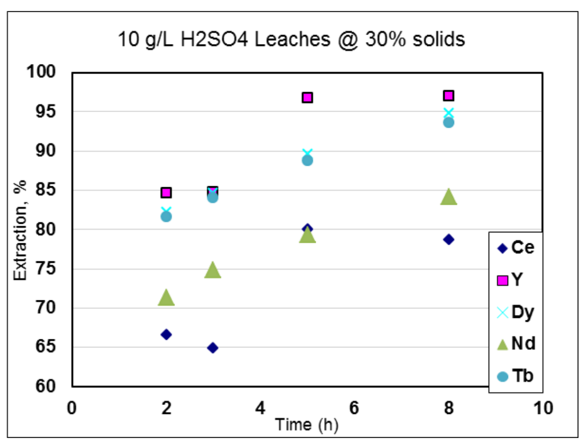
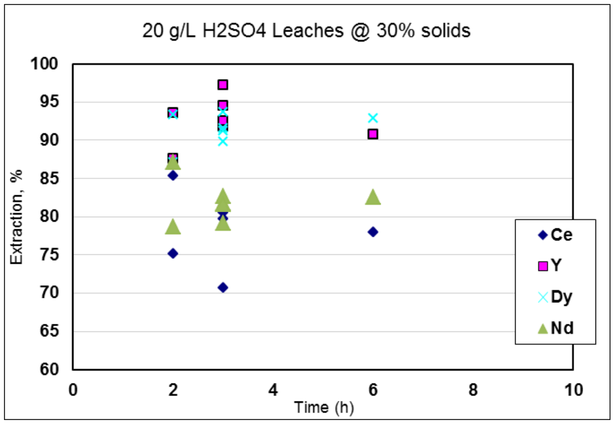


Figure 13.6 - Effect of Residence Time on REE Extraction



13.2.3 Neutralization

With the good extraction response from bench scale sulphuric acid leaching on the mineral concentrate, preliminary precipitation curves of the pregnant leach solution (PLS) were established using limestone ($CaCO_3$), lime (CaO), magnesia (MgO), and oxalic acid ($H_2C_2O_4$). The intent was to determine if the impurities can be selectively precipitated from the REE by raising the pH gradually.

The precipitation curves generated showed that impurities such as Zr, Fe, and Th could be precipitated ahead of REE equally well using limestone, lime, or MgO. Considering the cost of the neutralization reagent and their effectiveness, it was decided that limestone would be a good choice to move forward with. In addition to the impurities, gypsum would also be precipitated in this step from acid neutralization using limestone.

13.2.4 Impurities Removal

Before the REE can be precipitated as bulk chemical concentrate, a step to remove impurities is required. Both solvent extraction and ion exchange were tested at the laboratory.

13.2.4.1 Solvent Extraction

A preliminary solvent extraction shake-out test was carried out. Major crud/emulsion formation was observed as an intermediate layer between the organic and aqueous phases, which substantially slows down the phase disengagement.

The solvents tested are as follows:

i. 5% D_2EPHA (extractant) with TBP (modifier) and Orfom SX80 (diluent);

ii. 5% Ionquest 801 (extractant) with TBP (modifier) and Orfom SX80 (diluent);

iii. 5% Cyanex 272 (extractant) with Tridecanol (modifier) and Orfom SX80 (diluent);

iv. 5% Primene JM-T (extractant) with Tridecanol (modifier) and Orfom SX80 (diluent);

v. 5% Alamine 336 (extractant) with Tridecanol (modifier) and Orfom SX80 (diluent).

The above list covers each member of the phosphoric (D_2EHPA) / phosphonic (Ionquest) / phosphinic (Cyanex) family, as well as including a primary amine (Primene) and a quaternary amine (Alamine). The shake-out tests were done at both low and high Aqueous-to-Organic solvent ratios, and a 4-point isotherm was also generated for each solvent.

Based on the assays and results, it was concluded that Primene and D_2EPHA are two good choices for use as reagent for solvent extraction in removing impurities but keeping REE in solution.

13.2.4.2 Ion Exchange

Ion exchange resins were also considered in addition to solvent extraction for this application because typically an IX circuit is more economical than a SX circuit for low solution concentrations.

Dow resins were mixed with a beaker of PLS for a 24 hour period. The results were very encouraging as the solution assays before and after showed loading of impurities on the resin, but no REE. Therefore, Ion exchange using Dow resin was selected in the process flowsheet ultimately for removing impurities from the neutralization PLS.

13.2.5 RARE EARTH BULK PRECIPITATION

Precipitation of REE as carbonates is the preferred choice for bulk precipitation because of carbonate's ease of dissolution comparing to oxide and others. Three types of carbonate were tested: sodium carbonate (Na_2CO_3), ammonium carbonate (NH_4CO_3), and ammonium bi-carbonate (NH_4HCO_3). After Pre-Neutralization of the PLS using limestone, the solution was progressively neutralized using the three aforementioned reagents to precipitate the REE.

Due to the environmental concerns of using reagents containing ammonium/ammonia, it was decided that sodium carbonate is the preferred choice.

A sodium carbonate precipitation curve was constructed for REE and remaining major impurities Ca, Mg and Mn. Based on the separation between the REE and impurities, a final pH was selected as the target pH for the bulk REE Precipitation of carbonate.

13.2.6 PURIFICATION CIRCUIT DEVELOPMENT

The purification circuit was developed after the completion of the first Beneficiation and Hydrometallurgical circuit pilot plant in summer of 2012, using the rare earth carbonate generated from the pilot plant. The details of the pilot plant operation will be discussed in Section 13.3.

Bulk Rare Earth carbonate generated from Week 2 of the pilot plant contains approximately 36.8% REO. In spite of removing over 99% of many impurities in the pilot plant processes, some final purification of the bulk RE precipitates is still required for meeting the specification provided by the end-user. The end-user specification tightly limits the level of certain impurities in order to arrive at a high purity REE product acceptable by downstream refineries.

The process development of the purification circuit is outlined in the following sections. This flowsheet will need to be further validated with additional bench and pilot testing. In addition, in order to reduce the reagent costs associated with the purification process, some processing circuits were included to allow for recycling or regeneration of reagents. These recycling and regeneration circuits will also need to be further confirmed through testwork.

13.2.6.1 Dissolution

In the Dissolution step, the objective is to solubilize all of the rare earth in the mildest conditions possible. Test results showed that consistently over 99% of the REE were dissolved at this step.

13.2.6.2 Impurities Removal

Initial attempts were made to determine if REE can be selectively separated from impurities. Selected neutralization and precipitation reagents were tried.

An effective reagent and process was ultimately selected for the flowsheet, with room for further optimization.

13.2.6.3 Rare Earth Solvent Extraction

An initial series of shake-out tests were carried out by using a selected organic extractant solvent. It was found that near complete loading of heavy rare earth is observed while most light rare earth remains in the solution (raffinate). This indicates that a clean separation between the heavy and light rare earth is achievable.

13.2.6.4 Heavy Rare Earth Stripping and Precipitation

A series of stripping tests were carried out to determine the optimal stripping agents for the loaded organics solvent. Results all showed excellent stripping of the HREE, and also showed a preference of stripping off HREE before LREE. It is anticipated that this stripped solution, enriched in HREE, can be produced directly as an on-spec HREE product.

13.2.6.5 Light Rare Earth Precipitation

The raffinate solution from solvent extraction contains most of the light rare earth elements. The LREE will be precipitated from this raffinate solution to form the LREE product.

13.3 Pilot Plant and Laboratory Variability Test Results

13.3.1 Sample Preparation

This section covers the Sample Preparation portion of the 1st Matamec beneficiation pilot plant in summer 2012. Nineteen (19) drums containing a total of 5,539.4 kg of material from the Kipawa Resource were received at the SGS site in Lakefield, Ontario in October 2011, and were labelled “2011 Comp”. Ten (10) of the 19 drums (3,478.8 kg) were retained from a previous phase, which had been crushed to -¾”. This material was further crushed to -¼” and labelled “2011 Comp”. An additional 40 drums containing 11,354.8 kg of material were received in January, 2012. This material was crushed to -¼” and labelled “2012 Comp”. For laboratory testing, approximately 100 kg of material was riffled out from the 2012 Comp and riffled further into 10 kg charges.

Two of the 10 kg charges were stage crushed to -14 mesh, and two charges were stage crushed to -20 mesh. The -14 mesh and -20 mesh samples were kept separate and rotary riffled into 2 kg charges. A 2 kg charge from each top size was then screened to separate the -60 mesh material, and the -60 mesh material was further screened to divide the -200 mesh fines. An additional 2 kg charge of the -20 mesh sample was screened at 200 mesh to in order to separate the fines.

The remainder of 3,478.8 kg of 2011 Comp, and 11,254.8 kg of 2012 Comp made up the pilot plant feed and were continually processed during the pilot plant campaign.

13.3.2 CRUSHING AND GRINDING CIRCUIT DESIGN

The initial ore hardness tests were limited to Point Load Tests (PLT) performed on 10 fragments from three trenches by Queen's University in Ontario, Canada, and Bond Ball and Rod Mill work index testing carried out at SGS in Lakefield. The sample was collected in 2011. The average PLT result was used to estimate the JKMRC DWT A*b index, using the relationship defined in the JKMRC Mine-to-Mill project. The tests results suggest the Kipawa ore is in the soft range of resistance to impact breakage and is relatively soft in terms of ball mill grindability. This is also seen in the size distributions and energy requirements shown in the SGS pilot plant grinding tests completed on 15 tonnes of ore from the three trenches.

Matamec has requested that Dr. Toni Kojovic of SimSAGe Pty Ltd. explore and scope out potential crushing and grinding circuit options.

The performance across the 11 grinding tests performed during the pilot plant's operation shows significant variability in the apparent ore hardness and feed size across the tests, which agrees with the high variability noted in the point load tests for the trench samples. Table 13.5 shows the key operating statistics for PP-09, one of the two pilot grinding tests supplied with complete grinding information. The data mean and variation are included for comparison.

Table 13.5 - Summary of SGS PP-09 Grinding Test information

Feed Rate (kg/h)	Mill Load (kg)	Mill Speed	D/C % Solids	Power (kW)	Feed F80 (µm)	Prod P80 (µm)	Net Spec Power (kWh/t)	Oper WI (kWh/t)
190	149	45	62	0.51	2886	440	2.70	13.7
Mean Values								
194	142	44	66	0.48	2811	504	2.48	10.1
Variation (SD/Mean x 100)								
5%	10%	11%	9%	24%	21%	9%	24%	22%

The design options simulation study evaluated several circuit options, while aiming to produce a final grind P_{80} around 850 microns, with minimal fines. Given this objective and the relatively low ore impact strength, it seemed unnecessary to consider two stages of grinding. Instead the focus was on utilizing crushing and screening as much as possible, with one stage of grinding.

The primary purpose of the modelling and simulations was to evaluate the performance of several circuit flowsheets at the proposed design production rate of 185 tph (4,110 tpd and 92.5% availability). For the crushing section, the simulations were run at 50% availability or 342.5 tph. The main options considered were:

i. Primary crushing followed by AG mill in closed circuit with screens;

ii. Primary crushing followed by SAG mill in closed circuit with screens;

iii. Two-stage crushing followed by Rod Mill in closed circuit with screens;

iv. Three-stage crushing followed by Rod Mill in closed circuit with screens.

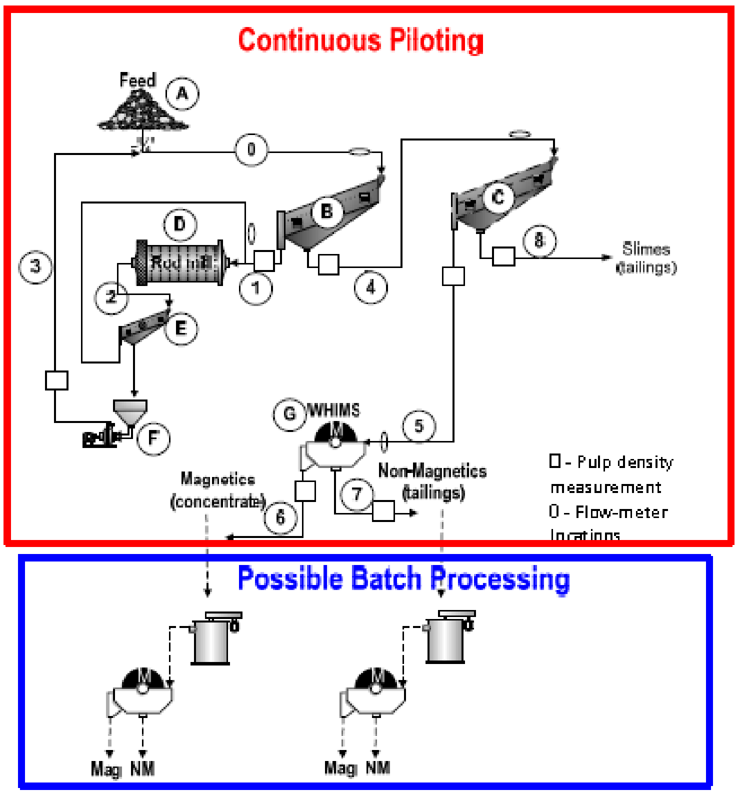
The simulation results clearly demonstrate the value of multi-stage crushing before grinding in terms of the reduced fines generation and overall yield of final product in the target size range. Attempting to achieve the final product using only a primary crusher followed by an AG or SAG mill requires more power to deal with the coarse feed size, which inevitably generates more slimes than desired and a wider final product size distribution.

The simulations indicate that a two (2) or three (3)-stage crushing circuit followed by a rod mill provides the best option, expected to deliver the maximum product yield in the target size range. Further testing is recommended to confirm the ore hardness characteristics (impact and grindability) of the Kipawa feed material.

13.3.3 SGS Beneficiation Pilot Plant Flowsheet

Figure 13.7 illustrates the schematic of the pilot plant flowsheets. The pilot plant was operated for approximately three (3) weeks, processing a total of 15 tonnes of feed material.

Figure 13.7 - SGS Pilot Plant Flowsheet Schematics



13.3.4 Magnetic Separation

Wet magnetic testing of Kipawa ore was performed in May 2012 at the testing facility of two major equipment suppliers. Magnetic separation tests were performed on each size fraction individually as well as mixed together. From these testing, one type of wet magnetic separation showed highly promising results overall, hence is the preferred separator unit for the process. It was noticed that the fines fraction does not recover as well on this unit as the middle and coarse fraction. The coarse and middle size fractions show a recovery of over 90% but only 70% recovery for the fines (-75 µm).

The process recommended by the preferred equipment supplier is a low gauss rougher, followed by a cleaning of the magnetics. The cleaned highly magnetic stream is the magnetic wastes. Similar to the original flowsheet, the low gauss tail is directed to the second pass high gauss magnetic separation. The magnetic portion from this second pass is the RE mineral concentrates.

The beneficiation pilot plant was operated at SGS Mineral Services in Lakefield in May-June 2012. SGS has only one (1) of the preferred wet magnetic separator unit at their facility, and therefore it was not possible to operate the optimal circuit using the preferred units. Instead, the preferred unit is used for the second stage high intensity separation in the pilot circuit setup, while a different, non-ideal magnetic separator unit was used for the first stage low intensity separation. Upon starting up of the circuit, it was quickly known that the non-ideal magnetic separator was not performing and no magnetic tails were rejected in the first separation.

In order to mitigate the issue, it was decided that all the materials will be processed in phases through the one preferred unit. This however would increase significantly the manpower and time involved. Due to time constraints in completing the pilot plant, a decision was made to treat the material in reverse order to the actual flowsheet. The material is first processed through the high intensity separation on the magnetic separator unit, and hence reject a significantly amount of the mass to the non-mag tails. The substantially smaller remaining magnetic portion is then repassed through the low intensity separation to reject the magnetic tails.

The recoveries from the pilot plant magnetic separations are included in Table 13.6. An overall recovery of 77.4% Y was achieved in 40.8% of the mass, including the fines. Recoveries were gradually increasing towards the end of the operation, and the best separation achieved was 83.6% Y recovery in the same 40.8% mass.

Table 13.6 - Overall Magnetic Separation Recovery from Pilot Plant

Stage	Stream	Mass, %		Y Grade	Y Distribution, %	
		Stage	Overall	%	Stage	Overall
1st Pass	Feed	100.0	100.0	0.105	100.0	100.0
	Non-Mags	36.7	36.7	0.03	11.0	11.0
	Mags	46.5	46.5	0.14	62.4	62.4
	Slimes	16.8	16.8	0.17	26.6	26.6
Repass	Re-Pass Mags	48.4	22.5	0.06	18.6	11.6
	Re-Pass Non-Mags	51.6	24.0	0.23	81.4	50.8

Stream	Mass, %	Y Grade, %	Y Dist, %
Final Conc (Re-pass NM + Slimes)	40.8	0.20	77.4
Final Tails (1st Pass NM + Repass Mags)	59.2	0.04	22.6
Head (calc)	100.0	0.11	100.0

13.3.5 HYDROMETALLURGICAL PILOT PLANT FLOWSHEET

Following the completion of the beneficiation pilot plant, the hydrometallurgical pilot plant was operated at SGS Mineral Services in Lakefield during July 2012. The pilot plant was operated continuously for two (2) five-day campaigns with a throughput of approximately 15 kg/h dry feed.

The main objectives of the pilot plant were to:

1. Validate the process developed from the bench scale in a larger, continuous operation;
2. Understand the Solid-Liquid-Separation behaviour of various slurries;
3. Generate a bulk rare earth product, such that the characteristics and impurities content can be known, and further development work can be done to purify this bulk product.

A summary of the pilot plant result is including in the following sections.

13.3.6 Leaching

The mineral concentrate feed was first slurried to 30%, then leached in a train of 4 tanks in series providing a total residence time of over 3 hours. The free acid is added to tanks 1 and 2, and adjusted to reach 20 g/L in tanks 3 and 4. The concentrate leach feed has a grade of 0.566% LREE, 0.332% HREE, and totalled 0.897% REE. After leaching, REE were solubilized into the PLS solution, hence the REE contained in the residue were reduced to 0.101% LREE, 0.027%HREE, and 0.128 total REE. Comparing the amount of REE metals leached out into the PLS to those remained in the leach residue, the extraction of the LREE, HREE and total REE were calculated as 84%, 93% and 88% extraction respectively.

EHA Engineering performed calculations on the Leach Kinetics of the feed mineral concentrate. Based on the leaching data collected from the pilot plant operations, EHA Engineering suggested a 35% solids leach at a residence time of five (5) hours in a series of five (5) tanks for maximum extraction.

An extensive Solid-Liquid Separation program was carried out during the pilot plant by Pocock Industrial Inc. for the characterization of the leach residue slurry, selection of flocculant, and for the sizing of thickening and filtration equipment. Hychem AF305 was selected as the flocculant of choice, as it is effective in improving the solution clarity and thickening/filtration characteristics of the pulp. A final report from Pocock which includes with all data and results is available.

13.3.7 Pre-Neutralization

In the pilot plant, three Pre-Neutralization (PN) tanks were originally provided for the neutralization step with limestone. Due to the slow reactions of limestone, an additional tank was later installed to provide approximately 3 hours of total residence time. With the kinetic data obtained during the pilot, EHA Engineering suggests a 6 hours retention time in 5 tanks for design, with allowance for an additional tank to increase to a total of 8 hours.

The operating pH of the PN was optimised during the second week of pilot plant. Based on the assays obtained from the pilot plant, it was found that the new target pH allows for good rejection of impurities such as iron, zirconium, and thorium, while lowering the precipitation of REE into the neutralized PN cake.

13.3.8 Impurities Removal

In the pilot plant, two (2) operating ion-exchange columns in series and one (1) standby were provided. The Dow resins in the column gradually changed in colour from bright orange to dark red as it was loaded with metals. Assays revealed excellent impurities removal and negligible REE loading onto the resins.

As a part of the off-line pilot plant testing, a 20-week long loading and elution cycle test was operated. In addition to finding the loading capacity and the effectiveness of the elution, the main purpose of the cycle test is to identify if any fouling or degradation of the resins occurred after a number of load-elute cycles. This is important in order to validate the select resins is suitable for operating in this environment for the long term.

An eluant screening test was carried out with the following 4 reagents and conditions:

i. 150 g/L H_2SO_4 at 45°C;

ii. 52.5 g/L NaCl + 20 g/L H_2SO_4 at ambient temperature;

iii. 76.5 g/L $NaNO_3$ + 40 g/L H_2SO_4 at ambient temperature;

iv. 76.5 g/L $NaNO_3$ + 20 g/L H_2SO_4 at ambient temperature.

The first test where 150 g/L of sulphuric acid at 45°C was used was found to be the most effective in removing loaded metals from the resins. Another elution test was performed using 150 g/L sulphuric acid at 60°C and was found to improve upon on the 45°C results, and hence was selected as the eluant reagent.

The shape and pattern of the initial few load-elute cycles fluctuates, but it stabilizes by cycle 5 and remains unchanged for the remaining cycles. The consistency of the loading indicates minimal poisoning of the resin occurred.

13.3.9 Bulk Rare Earth Precipitation

One of the major purposes of the pilot plant is to generate a bulk rare earth precipitate (REP) and understand its characteristics. Due to the low REE content in the mineral concentrate, bench testing usually only generates a couple of grams of bulk REE precipitates and cannot be properly assayed or characterized.

The REE precipitation circuit operated without issue during the pilot plant, with well over 99% precipitation of all REE. The REP cake is a fine creamy yellow powder which thickened well. The cake contains 81% moisture.

13.3.10 Process Optimisation Following the Pilot Plant

The pilot plant was completed without major issues or difficulties, and the process showed an operable flowsheet that can generate a rare earth carbonate with over 35% REO and significantly reduced impurities.

Following this first pilot plant campaign, a few area of weaknesses in the process flowsheet were identified.

It was noted that process was developed based on one sample from the deposit, taken from a trench in the Syenite zone. In order to increase the confidence of the process design in handling feed material across the entire mineral deposit, the existing flowsheet needs to be validated by a variety of feed material from Kipawa. This is addressed by the variability testwork program, which is described in Section 13.3.11.

For the beneficiation side, the key issue identified was the equipment selection. It is evident that a good magnetic separation equipment is required in order to produce good separation results. This could be addressed by ensuring the preferred equipment is available for the next pilot plant operation, and that suitable operating strategies and parameters are selected.

For the hydrometallurgical pilot plant, the key issues highlighted from the operation are related to the Pre-Neutralization circuit. An extensive optimization program was carried out on the PN circuit to address these issues, in order to improve the operability of the process and to reduce reagent comsumption and rare earth losses in this step.

13.3.11 VARIABILITY TESTING SAMPLE SELECTION

A total of eight (8) drill core samples were selected from the Kipawa deposit for variability testing. The eight (8) samples were taken from areas of different mineralogy, lithology, and grade, which represent the variation of feed ore throughout the life of mine. The sampling process was discussed in Section 13.1.3. From the variability samples, a global composite (GC) was compiled which represents average feed across the entire deposit from the mine. Information of the GC and variability samples is included in Table 13.7.

The global composite (GC) and the eight (8) variability samples were tested with the existing flowsheet to verify if the metallurgical process could handle feed variation. Solid-Liquid separation tests were also performed on these samples to fully ensure the thickening and filtration characteristics are well understood and controlled.

Table 13.7 - Global Composite and 8 Variability Samples

From SGS Assays	REE (ppm)						Mineralization (relative %)			Calc-silicates (% length)		
	Lights	Heavies	Total	Ratio (%)	Th (ppm)	U (ppm)	Eud	Mos	Bri	High calcite	Low calcite	Total
Composite #1: West **AND** High Eu	3510	2033	5543	0.37	271	37	82	17	1	3	13	16
Composite #2: Shallow **AND** High Mos	2294	1193	3487	0.34	262	34	15	85	0	18	11	29
Composite #3: Mid TREE	2461	1315	3775	0.35	385	37	65	31	4	18	12	30
Composite #4: Low TREE	1325	588	1913	0.31	154	21	54	42	3	15	10	25
Composite #5: High TREE	3782	2041	5822	0.35	326	49	54	34	13	15	3	18
Composite #6: Meso/Leuco Syenite	2274	1003	3277	0.31	227	30	59	38	3	0	0	0
Composite #7: High calcite Calcs	2196	1051	3246	0.32	209	45	43	54	2	100	0	100
Composite #8: Low calcite Calcs	2097	1175	3272	0.36	242	38	21	75	4	0	100	100
Global Composite	2216	1073	3290	0.33	238	32	55	41	3.8	13	11	24

13.3.12 MINERALOGY AND GRINDABILITY

The mineralogical characteristics of the global composite were investigated using QEMSCAN and X-ray diffraction (XRD). XRD was also carried out on the eight (8) variability samples.[5]

The grindability of the global composite and variability samples were also investigated. A summary of the results are included in Table 13.8. The various grinding indices confirmed a relatively soft and homogeneous ore body.

Table 13.8 - Kipawa Variability Samples Overall Grindability Summary

Sample	Rel. Density	JK Parameters			RWI	BWI	AI
Name	SMC	A x b	t_a	DWI	(kWh/t)	(kWh/t)	(g)
C1	2.94	159	1.41	1.84	6.4	11.3	0.55
C2	2.87	263	2.37	1.09	5.8	11.9	0.11
C3	2.84	152	1.39	1.86	6.7	12.1	0.15
C4	2.90	184	1.65	1.57	6.4	11.9	0.21
C5	2.90	190	1.70	1.53	7.4	12.0	0.15
C6	2.83	176	1.61	1.60	6.3	11.5	0.20
C7	2.92	362	3.21	0.81	7.9	12.9	0.07
C8	2.98	132	1.15	2.26	7.1	12.4	0.17
GLOBAL COMP 16.0+13.2	2.79	196	1.81	1.43	6.5	13.2	0.17
GLOBAL COMP 22.4+19.0	2.98	210	1.82	1.42			
GLOBAL COMP 31.25+26.5	2.86	197	1.79	1.45			

5 Results are included in the SGS report "The mineralogical characteristics of one composite sample from the Kipawa Deposit, Quebec"

13.3.13 MAGNETIC SEPARATION

By end of 2012, more testwork on magnetic separation was performed on the variability sample and global composite. Dry and wet magnetic separations were performed, with the objective of comparing them side-by-side with the same material, to determine the effectiveness of each. All feed materials were first crushed to the P_{80} - 20 mesh particle size.

Using the preferred wet magnetic separator unit and procedure, 85% Y recovery in 45% of the mass can be achieved on the global composite overall.

13.3.13.1 Dry Magnetic Separation

Initial dry magnetic testing on the global composite was carried out by dividing the material into two (2) size fractions: -20+70 mesh, and -70+200 mesh. Particles less than 200 mesh were screened out from the test, as it is known from previous testing that they do not to respond well on the dry magnets.

The dry magnetic separation test on the global composite was repeated in a bulk 16-kg scale, and found to correspond to the initial results well. Overall, including the fine fractions of 9.7% mass, the Y recovery was approximately 79% in 40% of the mass for dry magnetic separation. The recovery was reasonable comparing to other historical dry magnetic separation results, when the head grade was taken into account.

Following the global composite, the eight (8) variability samples were also tested on the dry magnetic separator utilising the same operating parameters. C2 performed the best on the magnets, while both C7 and C8 responded poorly. C7 and C8 are samples comprised of 100% Calco-silicates, which is believed to have adversely affected performance. (Figure 13.8 and Table 13.9).

Figure 13.8 - Dry Magnetic Separation - Global and Variability Composites Results

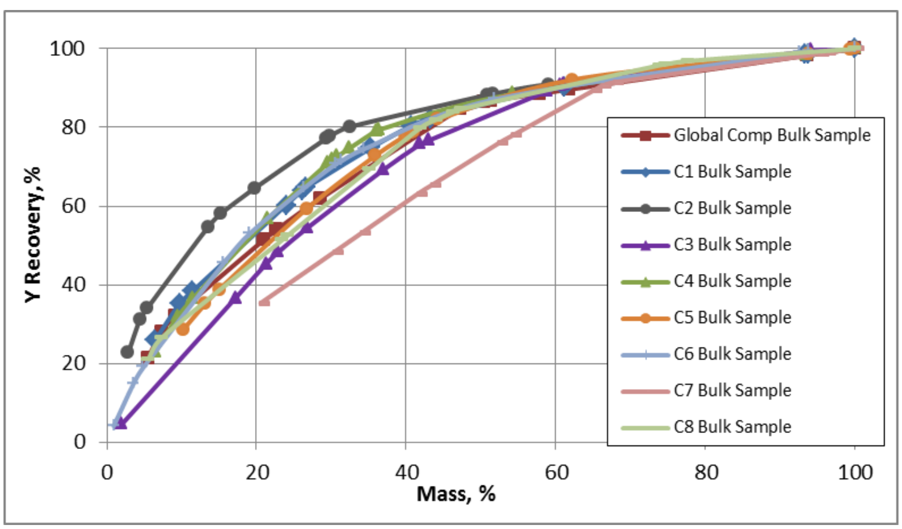


Table 13.9 - Dry Magnetic Separation Results - Global and Variability Composites Results

Sample	Y Head Grade	Mass pull at 80% recovery	Recovery at 40% mass pull
C1	0.146	38.5%	82%
C2	0.084	30.3%	86%
C3	0.088	47.0%	74%
C4	0.039	38.0%	81%
C5	0.141	37.6%	82%
C6	0.072	33.2%	84%
C7	0.080	55.2%	60%
C8	0.083	43.0%	75%
Global Composite	0.090	42.0%	79%

13.3.13.2 Wet Magnetic Separation

The global composite was first tested with varying magnetic intensity. After selecting the optimal conditions for the first pass and generated materials, the high intensity second pass was tested again with varying conditions. Using the same parameters defined by the global composite as optimal, the eight (8) variability samples were then tested accordingly (Table 13.10). One interesting observation was noted on C4 and C7 of the results. For these two composites, the first pass mag tails assay has Y content higher than the feed, indicating that even a low gauss setting is sufficient to magnetically attract the paramagnetic rare earth minerals for C4 and C7. This has not been observed previously in any other sample. Because of this behaviour, the first pass magnetic separation was removed for C4 and C7 treatment. This behaviour is not evident in the processing of the Global Composite, presumably because the combination of the other composites diluted or eliminated the effect.

Table 13.10 - Wet Magnetic Separation Results - Global and Variability Composites Results

Sample	Y Head Grade	Mass Pull	Corresponding recovery
C1	0.136	54.1%	85%
C2	0.073	42.5%	81%
C3	0.088	52.3%	82%
C4	0.044	52.2%	85%
C5	0.134	54.1%	86%
C6	0.072	41.5%	78%
C7	0.069	65.0%	89%
C8	0.090	70.5%	87%
Global Composite	0.070	47.4%	84%

The results were plotted on a curve to determine correlations between head grade, mass pull and overall recovery of the two (2) passes. From the Recovery vs. Grade curve (Figure 13.9), it can be seen that the head grade has minimal effect on the Y recovery through the wet separator. The correlation is much more pronounced between the Recovery and the Mass Pull (Figure 13.10). With the curves, it is possible to conclude that with a head grade of 0.75% Y, which is similar to the global composite and to the average life of mine ore, a recovery of 82.5% Y in 45% mass is achievable.

Figure 13.9 - Wet Magnetic Separation, Global and Variability Composites, Recovery vs. Grade

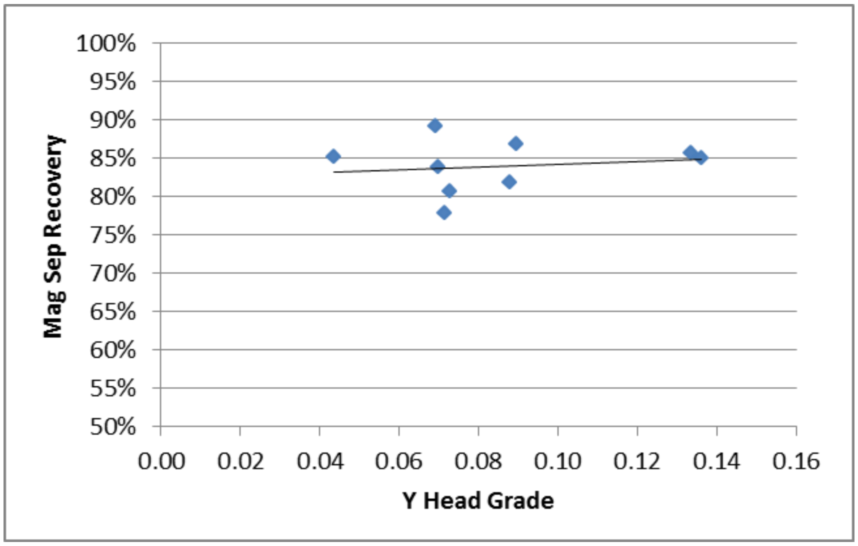
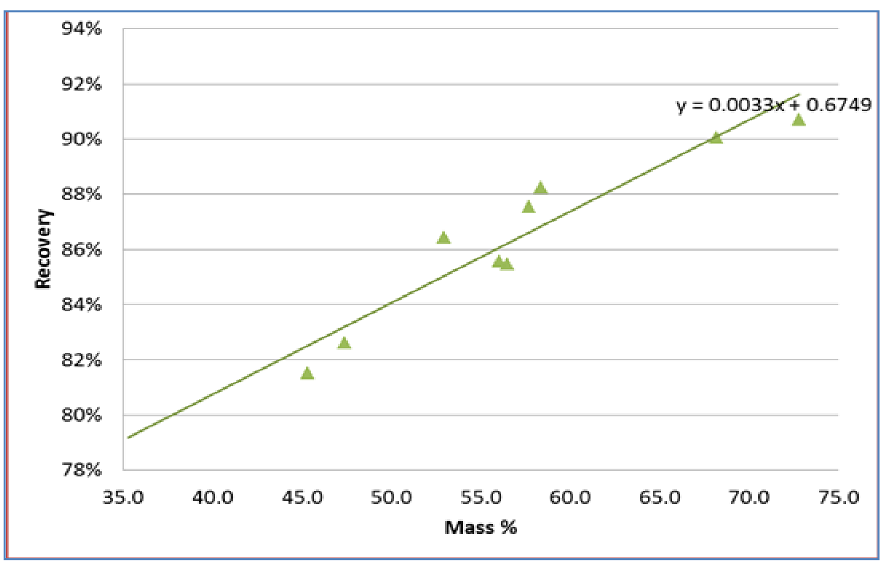


Figure 13.10 - Wet Magnetic Separation, Global and Variability Composites, Recovery vs. Mass



13.3.13.3 Cleaning on Magnetic Tails

Magnetic separation tails collected from the first stage low intensity separator contain as high as 5.5% REE losses in 11% of the mass rejected with a Y grade of 367 ppm, compared with the non-mag reject grade of 158 ppm. This is the most significant loss of REE in the beneficiation plant. In order to reduce the losses, the magnetic separation tails stream will be reprocessed to clean and regain the REE entrainments.

Testwork was conducted using the preferred wet magnetic separator unit on this stream. In spite of the result being based on limited tests and being un-optimised, it shows a positive recovery of the lost REE. By allowing the recovered stream to be combined with the low intensity non-mag stream and processing them together into the high intensity magnetic separation, an improvement of 3.2% recovery can be achieved with an additional 2.3% mass. In doing so, the overall recovery of the beneficiation circuit can be increased to 85% in 45% mass from 82.5%.

13.3.14 LEACH

The leach conditions derived from previous bench testing and pilot plant operation (20 g/L FA, 35% solids, 5 hours at a particle P_{80} size of 180 microns) were further verified with additional bench leaches with good confirmatory results. These conditions were adapted as the base case for the variability testing.

Leach results from the GC and eight (8) variability samples were lower than expected, at around low to mid 80% RE extraction. Some mineralogical works were carried out on the GC residue. XRD and QEMSCAN determined the RE minerals were well liberated, but many particles including eudialyte and apatite remains un-attacked by the acid. It was thought that composite 7 and 8 which contains high calcites might be the culprit in lowering the extraction, because these has not been tested at the lab before (all samples tested previously in bench and pilot plant were from Syenite zone). However, leach extraction of individual variability samples showed good extraction from composite 7 and 8, hence eliminating this possibility. Figure 13.11 and Figure 13.12 below show the leach extraction and residue grades of the GC and variability samples.

Figure 13.11 - Leach Extraction of GC and Variability Samples

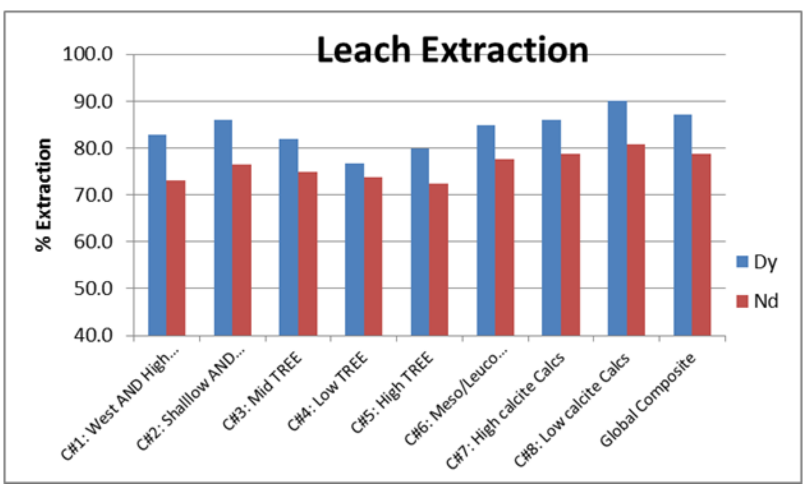
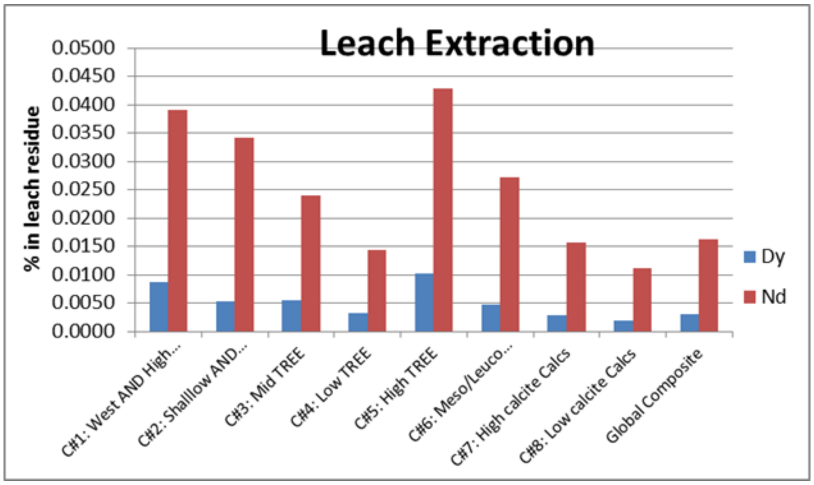
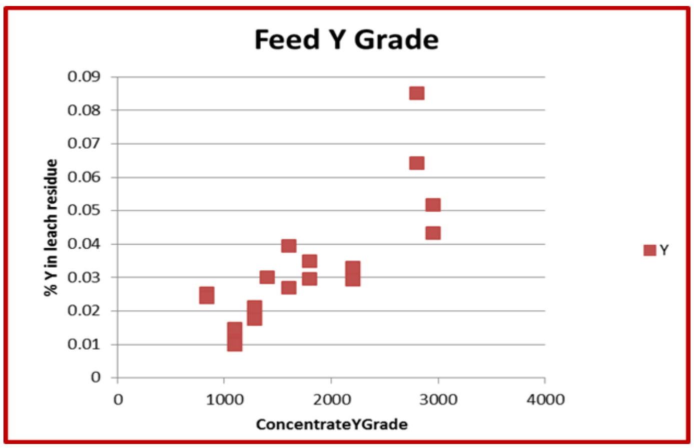


Figure 13.12 - Leach Residue of GC and Variability Samples



Diagnostic leach testing was carried out on the GC, and results indicate improvement in extraction with a more diluted PLS (by decreasing % solids or by replacing leach solution with fresh solution part way through the leach), or by increasing the acid strength.

Figure 13.13 - Feed Y Grade vs. Residue Y Grade



13.3.15 Pre-Neutralization

The results from the Pre-Neutralization optimisation program were initially adopted as the base case for the Variability testing.

However, results from the Pre-Neutralization of GC leach PLS revealed a different REE precipitation pattern then previous results. For the GC solution, substantial amount of REE precipitation was already observed at the low pH level, and relatively minimal further precipitation occured as pH increases and approaches the initial target. A pH isotherm was performed on the GC leach PLS, to re-evaluate the precipitation trend of this solution and to redefine the optimal operating pH target. As a result of this investigation, a different PN methodology was adopted and a new pH target selected. With this change, lower REE losses also resulted at this processing step. As an added benefit, a higher amount of Fe (>95%) was precipitated and rejected, which is important for maintaining low iron in the final bulk rare earth carbonate product. The much reduced REE precipitation along with good rejection of Fe highlighted the advantages of the newly optimised PN flowsheet.

13.3.16 Impurities Removal and Rare Earth Precipitation

The Impurities Removal and Rare Earth Precipitation test was carried on the global composite only. Since the rare earths are solubilized in solution at this point in the flowsheet, these processes are driven by chemistry only. GC was tested to validate the process. As expected, the response of the GC sample is similar to previous pilot plant and bench scale test findings.

14.0 MINERAL RESOURCES ESTIMATES

Resource estimates on the Kipawa deposit were updated from estimates of June 1st, 2011. For verification, a first block model was estimated with settings similar to the 2011 estimation. Since the quantity of data available for the preparation of this report was greatly augmented, the methodology of estimation was changed. SGS Geostat believes this methodology should better forecast local grades for the mine planning.

The resource was treated as two different types of mineralization in order to optimize the resources. The less mineralized syenite rock host was estimated although no significant grade of REE was found. A model was created for the REE enriched horizons within the Syenite body. The REE enriched horizons includes the Eudialyte, Mosandrite and Britholite zones. The Syenite zone consists of the Syenite body minus the Eudialyte, Mosandrite and Britholite zones.

14.1 Drill Hole Database

Matamec provided SGS Geostat with the electronic version of the drilling campaign data. The data was imported into a Geobase format emphasising on the collar identifications, deviations, lithologies and assay results (See Table 14.1). Only data related to the Kipawa deposit were conserved in the database. The database was then verified as explained in Section 12.0. Matamec drilling covers all areas that were previously covered by Unocal drilling. Consequently, for this Study and for the first time, all historical drilling by Unocal (with incomplete assays) was removed from the resource estimates.

Table 14.1 - Summary of Database Entries Used for the Estimates

Field	Number of entries
Collars (drill holes + segments of sampled trenches)	348
Deviations	1,186
Lithologies	3,011
Assays	17,458

A total of 293 drill holes are included in the database. Historical Unocal holes are not in the count. Drilling used for the estimates totals 24,571 metres. All the holes were surveyed using a Reflex instrument. A total of 593 deviation measurements were recorded with measurement taken at the end of the casing followed by every 45 to 75 m. Holes are numbered using the year of drilling, KM for Kipawa Matamec and the hole number following the sequence of drilling (i.e. 09-KM-05). Holes are drilled using NQ tubing.

A total of 12 sampled trenches totalling 631 m are also included in the drill holes database. Sampled trenches are numbered from 1 to 13 (with the 5 missing) and separated in different segments following the assay intervals for a total of 55 individual segments with its own survey information.

Drill holes and trenches are surveyed using the UTM projection. A total of 3 coordinate systems exist on the project (The UTM, the old Local and the Grid39 Local). In 2011, the old local was still used for the resource. For the purpose of the new resource modelling, the data was plotted using the local grid 39 system.

Matamec casing location and orientations were surveyed by Corriveau J.L. & Ass. Inc. using a GPS station (centimetric precision).

The conversion from UTM to local grid39 is:

- Rotation of 37.175564 degrees counter-clockwise around 0,0,0
- Translation X, Y, Z of 2585355.22015,-4550001.49932,0.

Exploratory data also included the lithological data from the drill hole logs. The lithology entries were used to build the geological model and to limit the mineralized intervals. The database contains 3,011 entries for the 348 drill holes and segments sampled trenches. Lithology entries are coded using Matamec's rock codes.

The database contains 17,458 assay results with 18 variables (La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, Zr, U and Th) each. A total of 1,826 entries are from Matamec's 2009 drilling program (10%, includes twins 5, 7, 14 and 20), 2,037 entries are from Matamec's 2010 drilling program (12%), 1,682 entries are from Matamec's 2011 drilling program (10%, includes twins 9 and 32), 11,589 entries are from Matamec's 2012 drilling program (66%) and 324 entries are from Matamec's trenches (2%).

Assays were made into mineralized intervals. The mineralized intervals were created based on the presence of assays and the geological interpretation on sections. The mineralized intervals were retained and named after the corresponding enriched REE zones (Eudialyte, Mosandrite and Britholite). The mineralized intervals contained in the syenite body were also modelled. The enriched REE zones contain 875 mineralized intervals ranging in length from 0.98 to 45.21 metres. A total of 329 intervals are in the Eudialyte, 252 are in the Mosandrite and 294 are in the Britholite zones. In addition, a total of 347 mineralized intervals are in the Syenite zone.

14.2 Composite Data

Each of the four different resource volumes (Eudialyte, Mosandrite, Britholite and Syenite) received its set of composites. Composites were generated at 1.5 m intervals for each volume totalling 7,555 composites for the enriched REE zones (4,177 for the Eudialyte, 2,149 for the Mosandrite and 1,229 for the Britholite). In addition, 5,057 composites were generated for the Syenite zone. The composites are generated inside the mineralized intervals which are separated between 3 individual REE enriched zones and the Syenite zone and are used separately for the resource estimation of its respective blocks. Because the trenches are split into small segments (55 in total) in the database, the composites from these small segments had to be renamed to the name of the sampled trenches (12 in total). Otherwise, the setting for the estimation of blocks called "maximum composites per drill hole" would not be applied correctly. Table 14.2 shows the composites statistics with 2 Mosandrite composites at zero grades omitted.

Table 14.2 - Statistics on the Composites for the Eudialyte, Mosandrite and Britholite Zones

Statistics Composite				
% TREO	Eudyalite	Mozandrite	Britholite	All
Count	4177	2147	1229	7553
Min	0.009	0.013	0.009	0.009
Max	5.141	5.206	3.469	5.206
Mean	**0.489**	**0.357**	**0.259**	**0.414**
Median	0.357	0.235	0.196	0.280
Stdev	0.473	0.415	0.228	0.435
C.V.	96.8%	116.4%	88.2%	105.1%

14.3 Specific Gravity

The density estimation is explained in Section 11.0. For this report and in light of the 2012 density program results, it was decided to use 2.88 t/m^3 for the Eudyalite, 2.92 t/m^3 for the Mozandrite and Britholite and 2.8 t/m^3 for the rest of the Syenite that is less mineralized.

14.4 Geological Interpretation

Since four types of mineralization are considered in the resource estimates, the geological modelling of the resource included four separate 3D models and meshed envelopes. A surface was updated in order to model the overburden-fresh rock contact from all available drill hole information. The surface was generated using X, Y, Z points from lithological contact in drill holes. Both the topography surveyed in 2010 and the drill hole collars was also used to refine the topographic surface used for the modelling and resource estimates.

14.4.1 Syenite Body

Using Matamec's geological interpretation sections and occasionally assay, the Syenite body was modelled on sections. The lithology entries included in the Syenite body comprise: Leuco Syenite, Meso Syenite, Mafic Syenite, Calco-Silicate Complex, minor Peralkaline Granite Gneiss and Green rocks (historical designation of a diopside-rich lithology, now included in the Calc-silicate complex). The modelling was done on 67 individual sections using prisms. The prisms were then linked to one another creating a meshed envelope for the Syenite body (See Figure 14.1 and Figure 14.2).

Figure 14.1 - Typical Geological Section for the Syenite Body Model

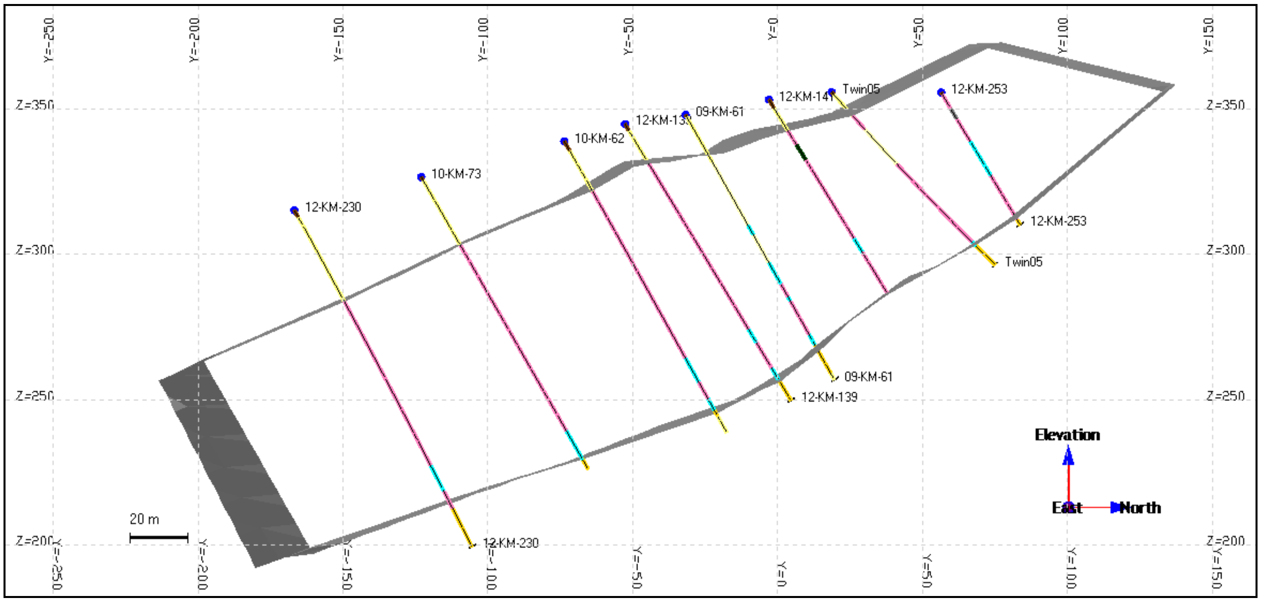
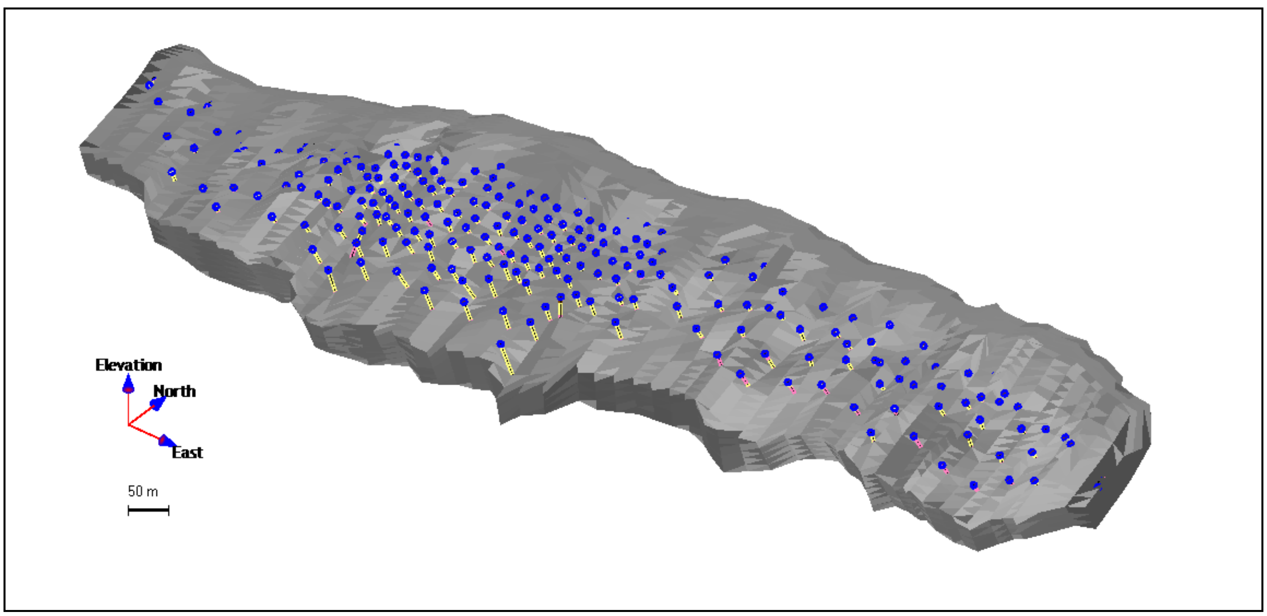


Figure 14.2 - 3D View of Syenite Body Meshed Envelope



14.4.2 REE ENRICHED MINERALIZATION ZONES

The second geological model (containing the enriched resource) was made for the REE enriched zones within the Syenite body. These zones correspond to mineralogical specific zones in which higher values of REE are found. The model was made on 67 individual sections and prisms were traced using lithology entries and assay results in the form of a value for the combined REE. Prisms were then linked to create three meshed envelopes corresponding to three different REE enriched zones at different depths in the Syenite body (See Figure 14.3 and Figure 14.4)

Figure 14.3 - Typical Geological Section with the 3 REE Enriched Zones Modelled

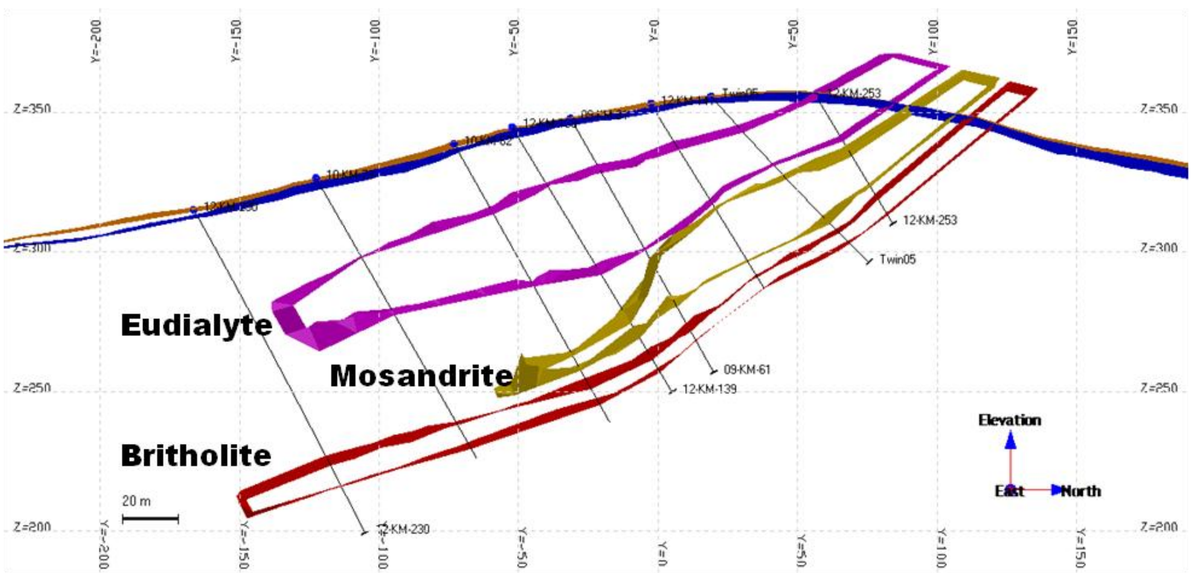
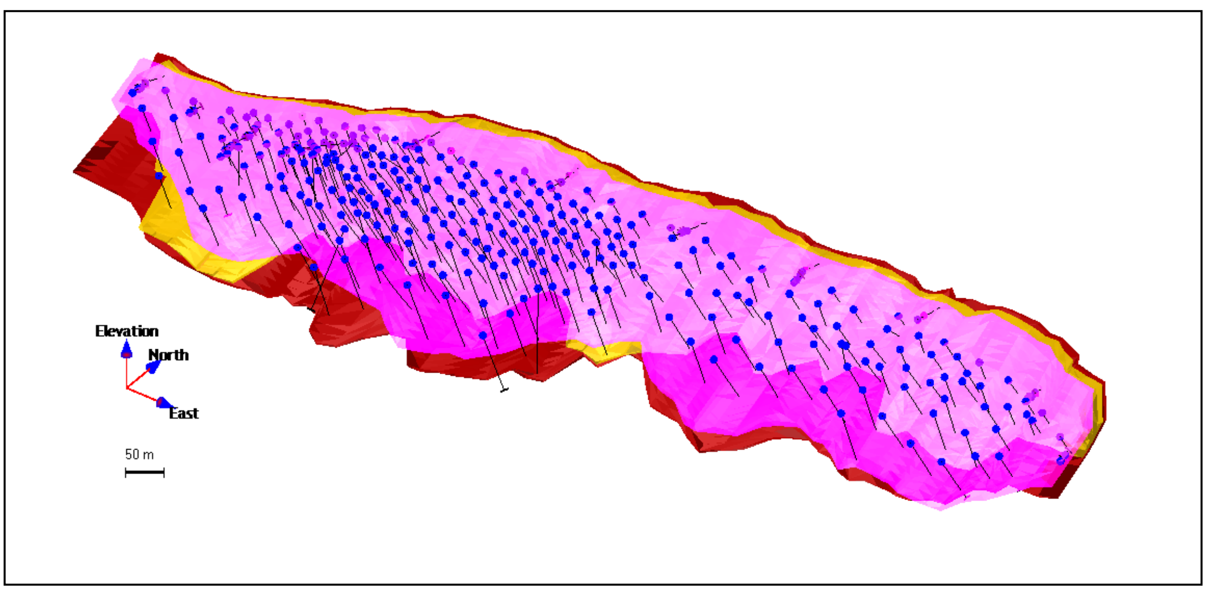


Figure 14.4 - 3D View of the Three REE Enriched Zone Envelopes



14.5 Resource Block Modelling

Using the meshed envelopes created from the geological model, four different block models were created for each specific mineralized zones.

The three envelopes created for the REE enriched zones were used to generate three block models for REE enriched zone mineralization. The block size was set at 10 m x 5 m x 5 m for a total of 99,541 blocks and a volume of 24,885,000 m^3 (5,946,000 m^3 for Eudialyte, 2,722,000 m^3 for Mosandrite, 2,285,000 m^3 for Britholite and 13,933,000 m^3 for the remaining of the Syenite body). Each block has a density and estimated values for Zr plus each individual REE element plus U and Th (total of 19 variables for each block). The meshed envelopes were made to be higher than the overburden / fresh rock contact; the block models were cut by the surface of the overburden by having each block attributed a percentage.

14.5.1 Variography

In summary, it was quite difficult to get a low nugget effect in all the datasets. The best variograms were found by unfolding the composites and putting all layers that dips at -23° on average. It was decided to use normalized variograms with all sills at 1. Out of hundreds of variograms created, it was found that 4 models of variograms fitted all data adequately:

- Variogram 1: for LREE in Eudyalite;
- Variogram 2: for HREE and Y in Eudyalite;
- Variogram 3: for LREE, HREE and Y in Mosandrite and LREE in Britholite;
- Variogram 4: for HREE and Y in Britholite.

Variograms 1 and 2 are of 0.6 of nugget effect with 2 spherical components with respective sills of 0.2 and 0.2 ranging from 10 metres to 120 metres. Variogram 3 is of 0.8 of nugget effect with a single spherical component with a sill of 0.2 ranging from 5 metres to 50 metres. Variogram 4 is slightly different from Variogram 3 in that the range of the spherical component ranges from 10 metres to 50 metres. The normalized variograms are presented in Figure 14.5 to Figure 14.8.

Figure 14.5 - Variogram 1 for LREE in Eudyalite

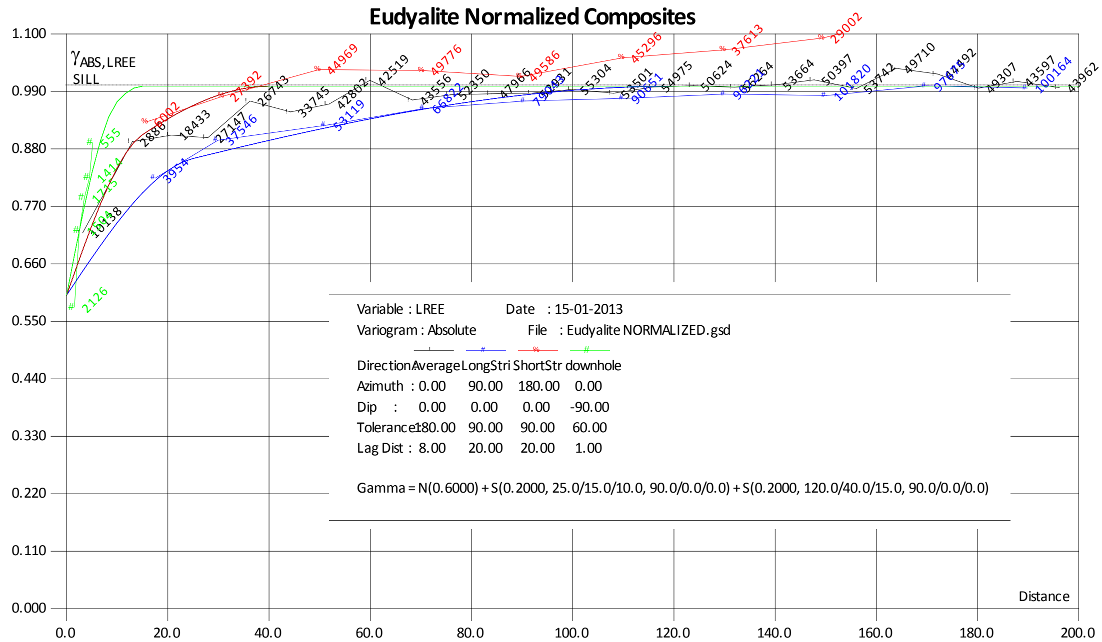


Figure 14.6 - Variogram 2 for HREE in Eudyalite (Also Valid for Y in Eudyalite)

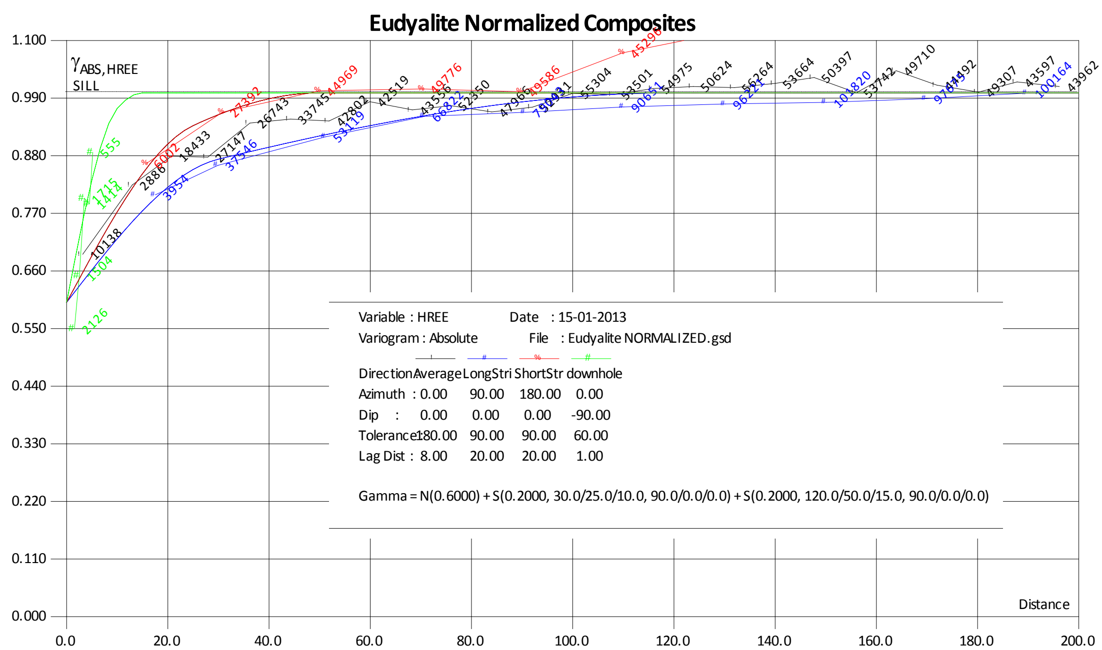


Figure 14.7 - Variogram 3 for LREE in Mosandrite
(Also Valid for HREE and Y in Mosandrite and LREE in Britholite)

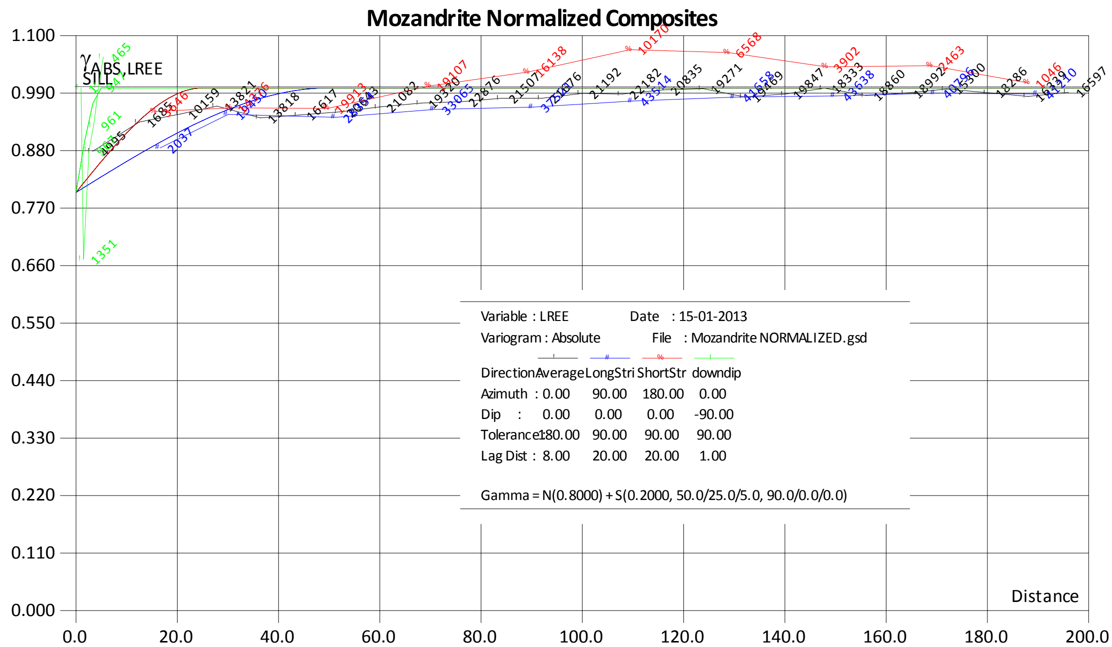
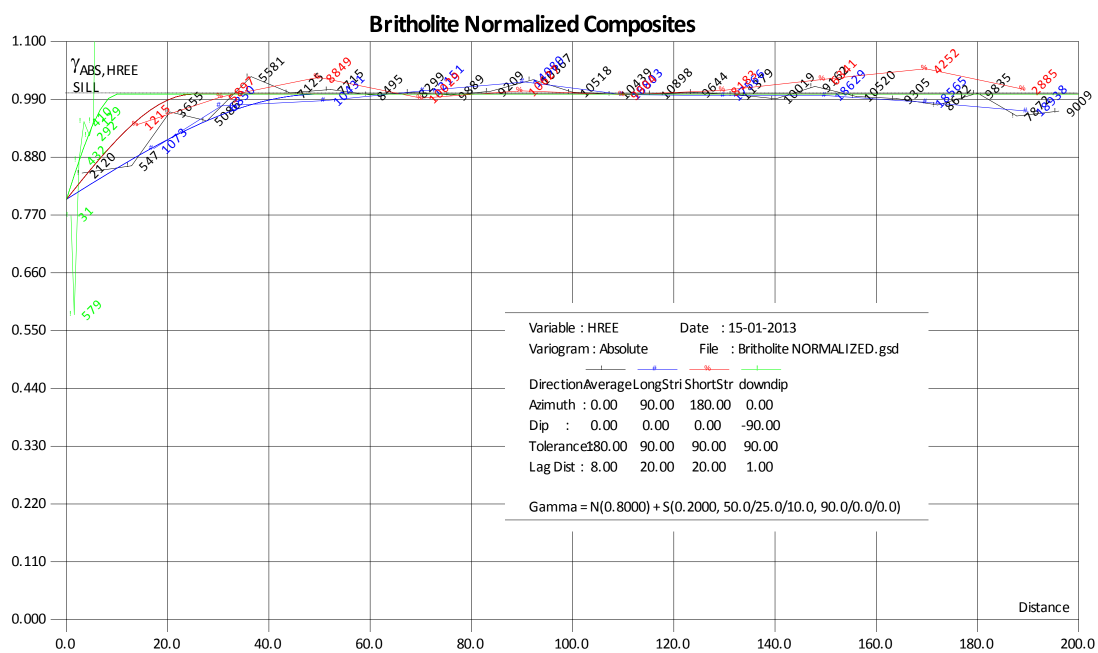


Figure 14.8 - Variogram 4 for HREE in Britholite (Also Valid for Y in Britholite)



14.5.2 Grade Interpolation Methodology

For interpolation of the grades for the REE elements (including Y) in the enriched zones, the kriging method was used. For U, Th and Zr and all variables in the Syenite zone, Inverse Distance Squared (IDS) was used. A single orientation for the search ellipsoid was used for all block models since they have the same general orientation and shape (Azimuth 180° and dip of -23°). The azimuth is on the local grid. A total of 3 ellipsoid sizes were used to do 3 estimation passes (first pass: major axis: 50 metres x intermediate axis: 35 metres x minor axis: 15 metres, second pass: 100 x 75 x 30 metres and third pass: 150 x 105 x 45 metres).

For the estimates, in all cases, a maximum of 4 composites were selected from any given drill hole. For the kriging, during the first pass, a minimum of 10 and maximum of 16 composites were used, for the second and third passes, a minimum of 6 and maximum of 16 composites were used. For the IDS, during the first pass, a minimum of 6 and maximum of 8 composites were used, for the second pass, a minimum of 10 and maximum of 12 composites were used and for the third pass, a minimum of 3 and maximum of 12 composites were used. The IDS used the ellipsoid altered lengths for the estimation.

All blocks were estimated. Inside the Eudialyte, Mosandrite and Britholite, the values range from 136 to 4,001 ppm of Y. Each block has a value for all 19 variables, x, y, z coordinates of the block centres and for block percent inside the REE Enriched Mineralization and under the overburden-fresh rock contact surface. The conversion from metal concentrates to oxides concentrates were done after the estimation of the block model.

All useful drill holes and trenches were used in the estimation. None of the older drill holes from Unocal were used. The block model is presented below (See Figure 14.9). The formulas used for the conversions from metal content to oxide content are presented below (See Table 14.3).

Figure 14.9 - REE Enriched Zone Block Models

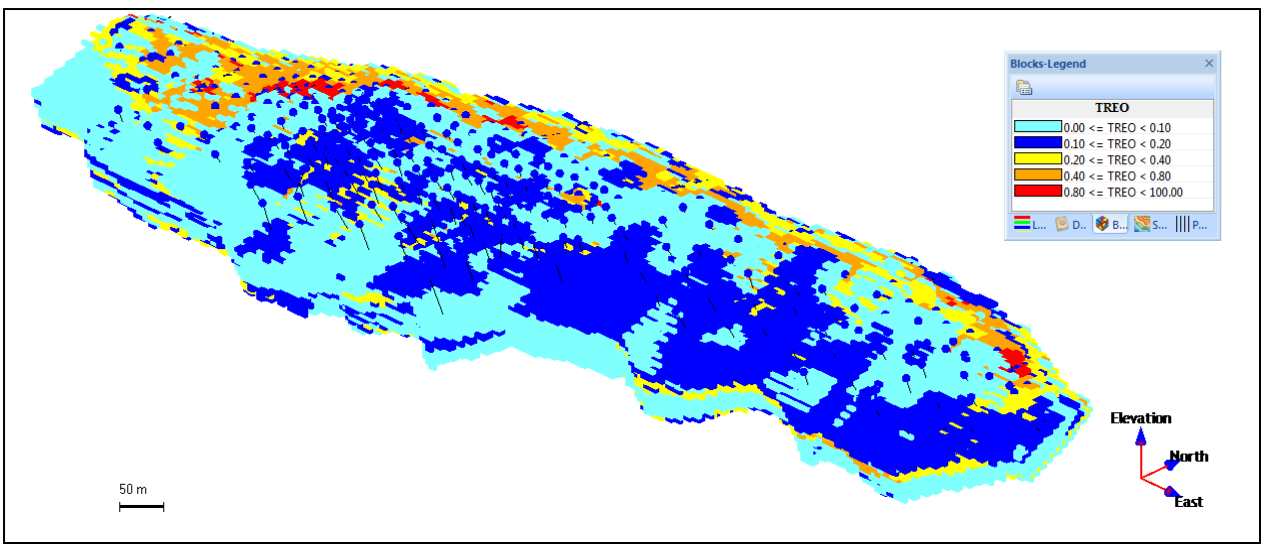


Table 14.3 - Formulas for the Conversion from Metal Concentrates to Oxides Concentrate

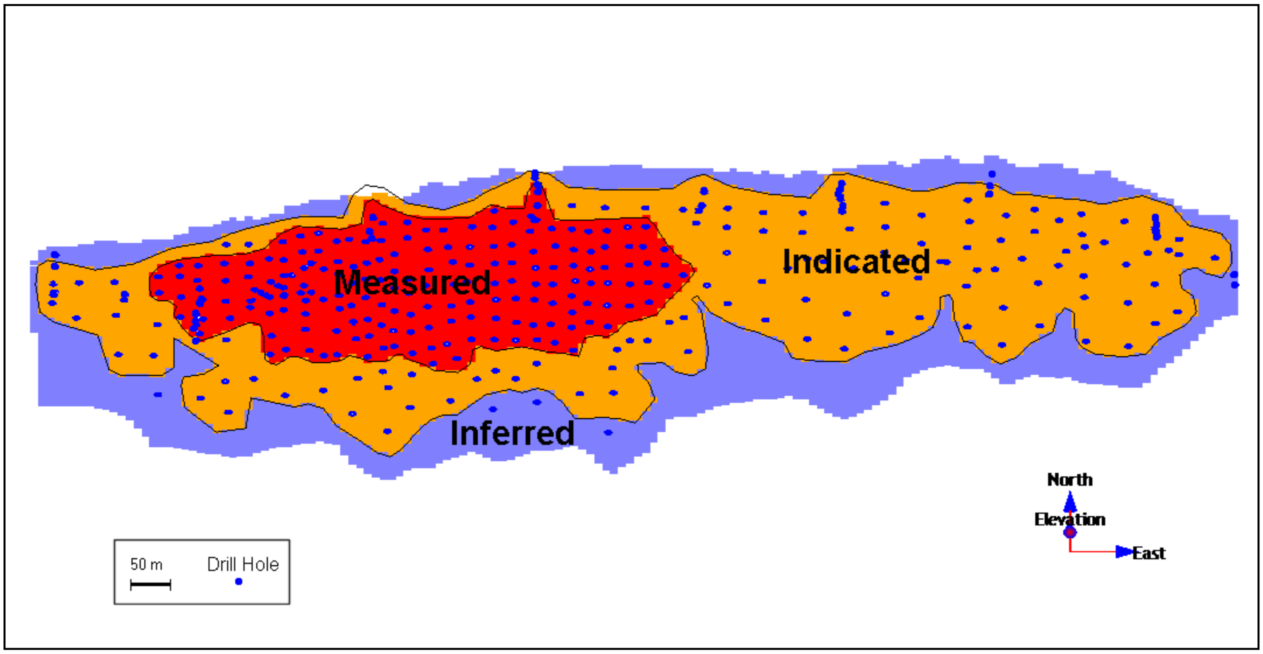
Conversion from	To	Formula
Ce(ppm)	Ce2O3(%)	Ce_ppm*1.171/10000
La(ppm)	La2O3(%)	La_ppm*1.173/10000
Nd(ppm)	Nd2O3(%)	Nd_ppm*1.166/10000
Pr(ppm)	Pr2O3(%)	Pr_ppm*1.170/10000
Sm(ppm)	Sm2O3(%)	Sm_ppm*1.160/10000
Eu(ppm)	Eu2O3(%)	Eu_ppm*1.158/10000
Gd(ppm)	Gd2O3(%)	Gd_ppm*1.153/10000
Tb(ppm)	Tb2O3(%)	Tb_ppm*1.151/10000
Dy(ppm)	Dy2O3(%)	Dy_ppm*1.148/10000
Ho(ppm)	Ho2O3(%)	Ho_ppm*1.146/10000
Er(ppm)	Er2O3(%)	Er_ppm*1.143/10000
Tm(ppm)	Tm2O3(%)	Tm_ppm*1.142/10000
Yb(ppm)	Yb2O3(%)	Yb_ppm*1.139/10000
Lu(ppm)	Lu2O3(%)	Lu_ppm*1.137/10000
Y(ppm)	Y2O3(%)	Y_ppm*1.270/10000
Zr(ppm)	ZrO2(%)	Zr_ppm*1.3508/10000
U(ppm)	UO2(%)	U_ppm*1.1344/10000
Th(ppm)	ThO2(%)	Th_ppm*1.1379/10000

14.5.3 MINERAL RESOURCE CLASSIFICATION

The resource classification is based on a geometric and proximity approach. Envelopes were created for the measured and indicated resources and the blocks with centres outside the given envelope were considered as inferred. The measured and indicated resource envelope was traced on a plan with limits falling between 10 to 12 metres for measured and between 20 to 25 metres for indicated from closer drill hole collar (See Figure 14.10). Hence, the section spacing of 25 m is adequate for measured resources and 50 m is adequate for indicated resources.

Block models were then extracted to create a query to add the classification to the estimated block models.

Figure 14.10- REE Enriched Zone Block Model with the Measured and Indicated Resources Envelopes (Blue Dots can be DDH or Trenches)



14.6 Mineral Resource Estimates

Resource estimation tables were created using Microsoft Excel software and to add up blocks data. Each block model was exported from Genesis into the Excel spreadsheet. Tonnage for each block is known and can be calculated from block size (10 m x 5 m x 5 m), density and percent below overburden surface.

Each of the 18 variables (REE, Y, Zr, U, and Th) were transformed from element value in ppm to oxide percent. Single element ppm is multiplied by the oxide conversion factor and divided by 10,000 to get the oxide grade in percent.

An average grade was then estimated for each model using different cut-off grades and different cut-off elements. Cut-off values were selected based on economic assumptions.

The resource estimates are presented below (See Table 14.4 to Table 14.6).

Table 14.4 - Global Resource Estimates of REE Enriched Zones at Different Cut-Off including the base case at 0.2% TREO

Zone	Classification	Tonnage	Volume	Density	Y2O3	LREO*	HREO*	TREO*	La2O3	Ce2O3	Pr2O3	Nd2O3	Sm2O3	Eu2O3	Gd2O3	Tb2O3	Dy2O3	Ho2O3	Er2O3	Tm2O3	Yb2O3	Lu2O3	ZrO2	UO2	ThO2
		t	m^3	t/m^3	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Eudialyte	**Measured**	6,332,000	2,199,000	2.88	0.117	0.327	0.068	0.511	0.076	0.150	0.018	0.068	0.015	0.0019	0.015	0.0027	0.018	0.0040	0.012	0.0019	0.011	0.0015	0.961	0.0033	0.028
Mosandrite		3,846,000	1,317,000	2.92	0.082	0.221	0.050	0.353	0.048	0.103	0.013	0.048	0.011	0.0013	0.010	0.0019	0.013	0.0028	0.009	0.0014	0.009	0.0013	1.030	0.0041	0.024
Britholite		1,858,000	636,000	2.92	0.063	0.164	0.037	0.263	0.037	0.076	0.009	0.034	0.007	0.0009	0.007	0.0013	0.009	0.0021	0.007	0.0011	0.007	0.0011	1.024	0.0029	0.024
Syenite		5,979,000	2,135,000	2.80	0.017	0.048	0.011	0.076	0.011	0.022	0.003	0.011	0.002	0.0003	0.002	0.0004	0.002	0.0005	0.002	0.0003	0.003	0.0005	1.099	0.0017	0.013
TOTAL		**18,014,000**	**6,287,000**	**2.87**	**0.071**	**0.195**	**0.042**	**0.308**	**0.044**	**0.090**	**0.011**	**0.041**	**0.009**	**0.0011**	**0.009**	**0.0016**	**0.011**	**0.0024**	**0.008**	**0.0012**	**0.008**	**0.0011**	**1.028**	**0.0029**	**0.022**
	tonnes				*12,765*	*35,124*	*7,528*	*55,418*	*7,988*	*16,154*	*1,965*	*7,390*	*1,628*	*202*	*1,562*	*292*	*1,926*	*430*	*1,357*	*213*	*1,352*	*194*	*185,200*	*518*	*3,938*
Eudialyte	**Indicated**	8,382,000	2,910,000	2.88	0.084	0.237	0.051	0.372	0.055	0.108	0.013	0.050	0.011	0.0014	0.011	0.0021	0.013	0.0030	0.009	0.0014	0.008	0.0012	0.834	0.0025	0.024
Mosandrite		3,478,000	1,191,000	2.92	0.076	0.213	0.048	0.337	0.045	0.099	0.012	0.046	0.010	0.0013	0.010	0.0018	0.012	0.0027	0.009	0.0014	0.009	0.0013	1.035	0.0041	0.024
Britholite		3,398,000	1,164,000	2.92	0.060	0.166	0.036	0.262	0.037	0.077	0.009	0.035	0.008	0.0009	0.007	0.0014	0.009	0.0020	0.007	0.0011	0.007	0.0011	1.019	0.0030	0.024
Syenite		19,308,000	6,896,000	2.80	0.017	0.052	0.010	0.079	0.012	0.024	0.003	0.011	0.002	0.0003	0.002	0.0003	0.002	0.0005	0.002	0.0003	0.002	0.0004	0.831	0.0010	0.006
TOTAL		**34,565,000**	**12,161,000**	**2.84**	**0.043**	**0.124**	**0.026**	**0.194**	**0.028**	**0.057**	**0.007**	**0.026**	**0.006**	**0.0007**	**0.005**	**0.0010**	**0.007**	**0.0015**	**0.005**	**0.0007**	**0.005**	**0.0008**	**0.871**	**0.0019**	**0.014**
	tonnes				*14,967*	*43,007*	*9,111*	*67,085*	*9,727*	*19,739*	*2,424*	*9,134*	*1,983*	*246*	*1,895*	*349*	*2,281*	*508*	*1,604*	*257*	*1,710*	*261*	*300,941*	*647*	*4,897*
Eudialyte	**Measured+ Indicated**	14,714,000	5,109,000	2.88	0.098	0.275	0.058	0.432	0.064	0.126	0.015	0.058	0.013	0.0016	0.013	0.0023	0.015	0.0034	0.010	0.0016	0.010	0.0013	0.889	0.0028	0.026
Mosandrite		7,323,000	2,508,000	2.92	0.079	0.217	0.049	0.345	0.046	0.101	0.013	0.047	0.010	0.0013	0.010	0.0019	0.012	0.0028	0.009	0.0014	0.009	0.0013	1.033	0.0041	0.024
Britholite		5,255,000	1,800,000	2.92	0.061	0.165	0.036	0.262	0.037	0.077	0.009	0.035	0.008	0.0009	0.007	0.0013	0.009	0.0020	0.007	0.0011	0.007	0.0011	1.021	0.0029	0.024
Syenite		25,287,000	9,031,000	2.80	0.017	0.051	0.010	0.079	0.012	0.023	0.003	0.011	0.002	0.0003	0.002	0.0004	0.002	0.0005	0.002	0.0003	0.002	0.0004	0.894	0.0012	0.008
TOTAL		**52,579,000**	**18,448,000**	**2.85**	**0.053**	**0.149**	**0.032**	**0.233**	**0.034**	**0.068**	**0.008**	**0.031**	**0.007**	**0.0009**	**0.007**	**0.0012**	**0.008**	**0.0018**	**0.006**	**0.0009**	**0.006**	**0.0009**	**0.925**	**0.0022**	**0.017**
	tonnes				*27,732*	*78,131*	*16,640*	*122,503*	*17,715*	*35,893*	*4,389*	*16,523*	*3,610*	*449*	*3,456*	*641*	*4,207*	*938*	*2,962*	*470*	*3,062*	*455*	*486,140*	*1,166*	*8,835*
Eudialyte	**Inferred**	2,076,000	721,000	2.88	0.058	0.190	0.036	0.284	0.046	0.086	0.010	0.039	0.008	0.0011	0.008	0.0015	0.009	0.0020	0.006	0.0009	0.006	0.0008	0.732	0.0019	0.015
Mosandrite		451,000	154,000	2.92	0.090	0.263	0.055	0.407	0.056	0.123	0.015	0.057	0.012	0.0015	0.012	0.0022	0.014	0.0031	0.010	0.0015	0.010	0.0013	0.927	0.0039	0.027
Britholite		1,359,000	465,000	2.92	0.053	0.161	0.032	0.246	0.036	0.075	0.009	0.034	0.007	0.0009	0.007	0.0012	0.008	0.0018	0.006	0.0009	0.006	0.0010	0.993	0.0031	0.022
Syenite		13,330,000	4,761,000	2.80	0.017	0.059	0.010	0.086	0.014	0.027	0.003	0.012	0.002	0.0003	0.002	0.0004	0.002	0.0005	0.002	0.0003	0.002	0.0004	0.665	0.0007	0.003
TOTAL		**17,215,000**	**6,101,000**	**2.82**	**0.026**	**0.088**	**0.016**	**0.131**	**0.021**	**0.041**	**0.005**	**0.018**	**0.004**	**0.0005**	**0.003**	**0.0006**	**0.004**	**0.0009**	**0.003**	**0.0004**	**0.003**	**0.0005**	**0.706**	**0.0011**	**0.007**
	tonnes				*4,539*	*15,218*	*2,751*	*22,508*	*3,550*	*6,996*	*850*	*3,179*	*644*	*79*	*596*	*105*	*668*	*147*	*465*	*76*	*530*	*85*	*121,556*	*185*	*1,132*

Resource with no cut-off   * LREO: Light Rare Earth Oxides = La2O3 to Sm2O3   HREO: Heavy Rare Earth Oxides = Eu2O3 to Lu2O3   TREO: Total Rare Earth Oxides = LREO + HREO + Y2O3

Effective date: January 1, 2013

Zone	Classification	Tonnage	Volume	Density	Y2O3	LREO*	HREO*	TREO*	La2O3	Ce2O3	Pr2O3	Nd2O3	Sm2O3	Eu2O3	Gd2O3	Tb2O3	Dy2O3	Ho2O3	Er2O3	Tm2O3	Yb2O3	Lu2O3	ZrO2	UO2	ThO2
		t	m^3	t/m^3	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Eudialyte	**Measured**	6,024,000	2,092,000	2.88	0.121	0.338	0.070	0.529	0.079	0.155	0.019	0.070	0.016	0.0020	0.015	0.0028	0.018	0.0041	0.013	0.0019	0.011	0.0015	0.959	0.0034	0.029
Mosandrite		3,135,000	1,073,000	2.92	0.091	0.249	0.055	0.396	0.054	0.116	0.014	0.053	0.012	0.0015	0.011	0.0021	0.014	0.0032	0.010	0.0016	0.010	0.0014	1.019	0.0042	0.026
Britholite		1,278,000	438,000	2.92	0.073	0.194	0.041	0.309	0.044	0.091	0.011	0.040	0.008	0.0010	0.008	0.0015	0.010	0.0024	0.008	0.0012	0.008	0.0011	0.940	0.0029	0.023
Syenite		42,000	15,000	2.80	0.065	0.216	0.038	0.318	0.052	0.100	0.012	0.044	0.009	0.0010	0.008	0.0015	0.010	0.0022	0.007	0.0010	0.006	0.0008	0.737	0.0019	0.016
TOTAL		**10,478,000**	**3,618,000**	**2.90**	**0.106**	**0.294**	**0.062**	**0.461**	**0.067**	**0.135**	**0.016**	**0.061**	**0.014**	**0.0017**	**0.013**	**0.0025**	**0.016**	**0.0036**	**0.011**	**0.0017**	**0.011**	**0.0014**	**0.974**	**0.0036**	**0.027**
	tonnes				*11,100*	*30,759*	*6,482*	*48,341*	*7,017*	*14,176*	*1,716*	*6,428*	*1,422*	*178*	*1,367*	*257*	*1,692*	*376*	*1,177*	*181*	*1,104*	*151*	*102,007*	*373*	*2,881*
Eudialyte	**Indicated**	7,790,000	2,705,000	2.88	0.088	0.247	0.053	0.387	0.057	0.112	0.014	0.052	0.012	0.0015	0.011	0.0021	0.014	0.0031	0.009	0.0014	0.009	0.0012	0.842	0.0026	0.025
Mosandrite		2,790,000	955,000	2.92	0.086	0.240	0.053	0.379	0.050	0.112	0.014	0.052	0.012	0.0014	0.011	0.0021	0.014	0.0030	0.010	0.0015	0.010	0.0014	1.029	0.0044	0.027
Britholite		2,725,000	933,000	2.92	0.064	0.182	0.038	0.284	0.040	0.085	0.010	0.038	0.008	0.0010	0.008	0.0015	0.010	0.0022	0.007	0.0011	0.007	0.0011	0.957	0.0030	0.024
Syenite		75,000	27,000	2.80	0.031	0.190	0.024	0.245	0.043	0.089	0.011	0.040	0.007	0.0008	0.006	0.0010	0.006	0.0013	0.004	0.0006	0.004	0.0007	0.922	0.0019	0.013
TOTAL		**13,379,000**	**4,620,000**	**2.90**	**0.082**	**0.232**	**0.050**	**0.364**	**0.052**	**0.106**	**0.013**	**0.049**	**0.011**	**0.0014**	**0.011**	**0.0020**	**0.013**	**0.0029**	**0.009**	**0.0014**	**0.009**	**0.0012**	**0.905**	**0.0030**	**0.025**
	tonnes				*11,000*	*30,983*	*6,688*	*48,671*	*6,955*	*14,243*	*1,746*	*6,575*	*1,464*	*184*	*1,412*	*265*	*1,737*	*384*	*1,198*	*185*	*1,160*	*163*	*121,077*	*403*	*3,375*
Eudialyte	**Measured+ Indicated**	13,814,000	4,796,000	2.88	0.102	0.287	0.060	0.449	0.066	0.131	0.016	0.060	0.013	0.0017	0.013	0.0024	0.016	0.0035	0.011	0.0016	0.010	0.0013	0.893	0.0029	0.027
Mosandrite		5,924,000	2,029,000	2.92	0.089	0.245	0.054	0.388	0.052	0.114	0.014	0.053	0.012	0.0014	0.011	0.0021	0.014	0.0031	0.010	0.0015	0.010	0.0014	1.024	0.0043	0.026
Britholite		4,002,000	1,371,000	2.92	0.067	0.186	0.039	0.292	0.042	0.087	0.010	0.039	0.008	0.0010	0.008	0.0015	0.010	0.0022	0.007	0.0012	0.008	0.0011	0.951	0.0029	0.024
Syenite		117,000	42,000	2.80	0.043	0.199	0.029	0.271	0.046	0.093	0.011	0.041	0.008	0.0009	0.007	0.0012	0.007	0.0016	0.005	0.0007	0.005	0.0007	0.856	0.0019	0.014
TOTAL		**23,857,000**	**8,238,000**	**2.90**	**0.093**	**0.259**	**0.055**	**0.407**	**0.059**	**0.119**	**0.015**	**0.055**	**0.012**	**0.0015**	**0.012**	**0.0022**	**0.014**	**0.0032**	**0.010**	**0.0015**	**0.009**	**0.0013**	**0.935**	**0.0033**	**0.026**
	tonnes				*22,100*	*61,742*	*13,170*	*97,012*	*13,972*	*28,419*	*3,462*	*13,003*	*2,886*	*362*	*2,779*	*521*	*3,429*	*761*	*2,375*	*366*	*2,263*	*314*	*223,084*	*776*	*6,256*
Eudialyte	**Inferred**	1,678,000	583,000	2.88	0.063	0.210	0.039	0.312	0.051	0.095	0.011	0.043	0.009	0.0012	0.009	0.0016	0.010	0.0022	0.007	0.0010	0.006	0.0009	0.710	0.0019	0.016
Mosandrite		409,000	140,000	2.92	0.095	0.278	0.058	0.431	0.059	0.130	0.016	0.060	0.013	0.0016	0.012	0.0023	0.015	0.0033	0.010	0.0016	0.010	0.0014	0.940	0.0041	0.028
Britholite		1,088,000	373,000	2.92	0.056	0.174	0.034	0.264	0.039	0.081	0.010	0.037	0.008	0.0009	0.007	0.0013	0.008	0.0019	0.006	0.0010	0.006	0.0010	0.915	0.0030	0.020
Syenite		93,000	33,000	2.80	0.025	0.198	0.021	0.244	0.043	0.093	0.011	0.043	0.007	0.0008	0.005	0.0009	0.005	0.0011	0.003	0.0005	0.003	0.0006	1.139	0.0011	0.009
TOTAL		**3,268,000**	**1,129,000**	**2.90**	**0.064**	**0.206**	**0.039**	**0.309**	**0.047**	**0.095**	**0.012**	**0.043**	**0.009**	**0.0011**	**0.009**	**0.0016**	**0.010**	**0.0022**	**0.007**	**0.0011**	**0.007**	**0.0010**	**0.819**	**0.0025**	**0.019**
	tonnes				*2,081*	*6,740*	*1,281*	*10,102*	*1,552*	*3,103*	*376*	*1,409*	*300*	*37*	*281*	*51*	*331*	*72*	*223*	*35*	*220*	*32*	*26,771*	*82*	*608*

Resource with TREO* > 0.20%   * LREO: Light Rare Earth Oxides = La2O3 to Sm2O3   HREO: Heavy Rare Earth Oxides = Eu2O3 to Lu2O3   TREO: Total Rare Earth Oxides = LREO + HREO + Y2O3

Effective date: January 1, 2013

Table 14.5 - Global Resource Estimates of REE Enriched Zones at Different Cut-Off (continued)

Zone	Classification	Tonnage	Volume	Density	Y2O3	LREO*	HREO*	TREO*	La2O3	Ce2O3	Pr2O3	Nd2O3	Sm2O3	Eu2O3	Gd2O3	Tb2O3	Dy2O3	Ho2O3	Er2O3	Tm2O3	Yb2O3	Lu2O3	ZrO2	UO2	ThO2
		t	m^3	t/m^3	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Eudialyte		5,137,000	1,784,000	2.88	0.132	0.369	0.076	0.576	0.086	0.169	0.020	0.077	0.017	0.0022	0.016	0.0031	0.020	0.0044	0.014	0.0021	0.012	0.0016	0.965	0.0037	0.032
Mosandrite		2,064,000	707,000	2.92	0.108	0.301	0.064	0.473	0.065	0.140	0.017	0.064	0.014	0.0017	0.013	0.0025	0.017	0.0037	0.012	0.0018	0.011	0.0015	0.986	0.0044	0.029
Britholite	**Measured**	584,000	200,000	2.92	0.090	0.240	0.049	0.380	0.056	0.113	0.013	0.048	0.010	0.0012	0.010	0.0019	0.012	0.0029	0.009	0.0014	0.009	0.0012	0.819	0.0029	0.025
Syenite		15,000	5,000	2.80	0.104	0.286	0.059	0.448	0.066	0.132	0.015	0.059	0.013	0.0015	0.012	0.0024	0.016	0.0036	0.011	0.0016	0.009	0.0012	0.626	0.0021	0.015
TOTAL		**7,799,000**	**2,696,000**	**2.89**	**0.122**	**0.341**	**0.071**	**0.534**	**0.078**	**0.157**	**0.019**	**0.071**	**0.016**	**0.0020**	**0.015**	**0.0028**	**0.019**	**0.0041**	**0.013**	**0.0020**	**0.012**	**0.0016**	**0.959**	**0.0038**	**0.031**
	tonnes				*9,520*	*26,612*	*5,522*	*41,654*	*6,080*	*12,276*	*1,483*	*5,546*	*1,227*	*154*	*1,179*	*221*	*1,453*	*322*	*1,002*	*152*	*916*	*123*	*74,777*	*296*	*2,385*
Eudialyte		5,347,000	1,857,000	2.88	0.103	0.283	0.062	0.449	0.065	0.129	0.016	0.060	0.014	0.0017	0.013	0.0025	0.016	0.0036	0.011	0.0017	0.010	0.0014	0.879	0.0030	0.030
Mosandrite		1,715,000	587,000	2.92	0.104	0.294	0.064	0.462	0.061	0.138	0.017	0.064	0.014	0.0017	0.013	0.0025	0.016	0.0037	0.012	0.0018	0.011	0.0016	0.992	0.0047	0.030
Britholite	**Indicated**	815,000	279,000	2.92	0.089	0.230	0.052	0.371	0.051	0.107	0.013	0.048	0.011	0.0013	0.010	0.0020	0.013	0.0030	0.010	0.0015	0.009	0.0013	0.921	0.0035	0.030
Syenite		6,000	2,000	2.80	0.031	0.282	0.027	0.340	0.064	0.132	0.016	0.060	0.010	0.0011	0.007	0.0012	0.007	0.0015	0.004	0.0006	0.004	0.0006	1.180	0.0017	0.012
TOTAL		**7,883,000**	**2,725,000**	**2.89**	**0.102**	**0.280**	**0.061**	**0.443**	**0.063**	**0.129**	**0.016**	**0.060**	**0.013**	**0.0017**	**0.013**	**0.0025**	**0.016**	**0.0036**	**0.011**	**0.0017**	**0.010**	**0.0014**	**0.908**	**0.0034**	**0.030**
	tonnes				*8,032*	*22,085*	*4,836*	*34,953*	*4,931*	*10,157*	*1,245*	*4,696*	*1,056*	*134*	*1,025*	*193*	*1,271*	*281*	*872*	*133*	*814*	*111*	*71,591*	*269*	*2,377*
Eudialyte		10,483,000	3,640,000	2.88	0.117	0.325	0.069	0.511	0.075	0.149	0.018	0.068	0.015	0.0019	0.015	0.0028	0.018	0.0040	0.012	0.0019	0.011	0.0015	0.921	0.0033	0.031
Mosandrite	**Measured+ Indicated**	3,779,000	1,294,000	2.92	0.106	0.298	0.064	0.468	0.063	0.139	0.017	0.064	0.014	0.0017	0.013	0.0025	0.017	0.0037	0.012	0.0018	0.011	0.0015	0.989	0.0045	0.030
Britholite		1,399,000	479,000	2.92	0.089	0.234	0.051	0.374	0.053	0.110	0.013	0.048	0.010	0.0013	0.010	0.0019	0.013	0.0030	0.009	0.0015	0.009	0.0013	0.878	0.0032	0.028
Syenite		21,000	7,000	2.80	0.083	0.285	0.050	0.417	0.066	0.132	0.016	0.059	0.012	0.0014	0.011	0.0021	0.013	0.0030	0.009	0.0013	0.008	0.0011	0.784	0.0019	0.014
TOTAL		**15,682,000**	**5,421,000**	**2.89**	**0.112**	**0.311**	**0.066**	**0.488**	**0.070**	**0.143**	**0.017**	**0.065**	**0.015**	**0.0018**	**0.014**	**0.0026**	**0.017**	**0.0038**	**0.012**	**0.0018**	**0.011**	**0.0015**	**0.933**	**0.0036**	**0.030**
	tonnes				*17,552*	*48,697*	*10,358*	*76,607*	*11,011*	*22,433*	*2,728*	*10,242*	*2,282*	*288*	*2,204*	*414*	*2,725*	*603*	*1,874*	*286*	*1,730*	*234*	*146,368*	*565*	*4,762*
Eudialyte		860,000	299,000	2.88	0.078	0.253	0.048	0.379	0.061	0.115	0.014	0.052	0.011	0.0014	0.011	0.0020	0.013	0.0028	0.008	0.0012	0.007	0.0010	0.744	0.0022	0.020
Mosandrite		316,000	108,000	2.92	0.108	0.314	0.066	0.488	0.066	0.147	0.018	0.068	0.015	0.0018	0.014	0.0026	0.017	0.0038	0.012	0.0018	0.011	0.0016	0.997	0.0045	0.032
Britholite	**Inferred**	223,000	76,000	2.92	0.071	0.215	0.042	0.329	0.048	0.100	0.012	0.045	0.010	0.0011	0.009	0.0017	0.011	0.0024	0.008	0.0012	0.007	0.0011	0.841	0.0031	0.022
Syenite		9,000	3,000	2.80	0.031	0.271	0.027	0.328	0.057	0.128	0.016	0.059	0.010	0.0010	0.007	0.0012	0.007	0.0015	0.004	0.0006	0.004	0.0007	1.539	0.0014	0.014
TOTAL		**1,408,000**	**487,000**	**2.89**	**0.083**	**0.261**	**0.051**	**0.395**	**0.060**	**0.120**	**0.014**	**0.055**	**0.012**	**0.0015**	**0.011**	**0.0021**	**0.013**	**0.0029**	**0.009**	**0.0014**	**0.008**	**0.0011**	**0.821**	**0.0029**	**0.023**
	tonnes				*1,173*	*3,676*	*714*	*5,563*	*846*	*1,691*	*204*	*769*	*167*	*21*	*157*	*29*	*188*	*41*	*126*	*19*	*117*	*16*	*11,564*	*40*	*324*

Resource with TREO* > 0.30%   * LREO: Light Rare Earth Oxides = La2O3 to Sm2O3   HREO: Heavy Rare Earth Oxides = Eu2O3 to Lu2O3   TREO: Total Rare Earth Oxides = LREO + HREO + Y2O3

Effective date: January 1, 2013

Zone	Classification	Tonnage	Volume	Density	Y2O3	LREO*	HREO*	TREO*	La2O3	Ce2O3	Pr2O3	Nd2O3	Sm2O3	Eu2O3	Gd2O3	Tb2O3	Dy2O3	Ho2O3	Er2O3	Tm2O3	Yb2O3	Lu2O3	ZrO2	UO2	ThO2
		t	m^3	t/m^3	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Eudialyte		4,122,000	1,431,000	2.88	0.145	0.404	0.083	0.632	0.093	0.186	0.022	0.084	0.019	0.0024	0.018	0.0034	0.022	0.0049	0.015	0.0023	0.013	0.0018	0.974	0.0040	0.035
Mosandrite		1,287,000	441,000	2.92	0.124	0.351	0.074	0.549	0.076	0.164	0.020	0.075	0.016	0.0020	0.016	0.0029	0.019	0.0043	0.014	0.0021	0.012	0.0017	0.985	0.0044	0.034
Britholite	**Measured**	164,000	56,000	2.92	0.117	0.300	0.063	0.480	0.067	0.140	0.017	0.062	0.013	0.0016	0.013	0.0025	0.016	0.0038	0.012	0.0018	0.011	0.0014	0.850	0.0032	0.032
Syenite		9,000	3,000	2.80	0.137	0.308	0.075	0.521	0.070	0.141	0.017	0.065	0.015	0.0018	0.015	0.0030	0.020	0.0047	0.014	0.0022	0.013	0.0016	0.725	0.0026	0.019
TOTAL		**5,582,000**	**1,931,000**	**2.89**	**0.139**	**0.388**	**0.080**	**0.608**	**0.089**	**0.179**	**0.022**	**0.081**	**0.018**	**0.0023**	**0.017**	**0.0032**	**0.021**	**0.0047**	**0.015**	**0.0022**	**0.013**	**0.0017**	**0.972**	**0.0041**	**0.034**
	tonnes				*7,780*	*21,682*	*4,483*	*33,946*	*4,944*	*10,007*	*1,209*	*4,520*	*1,002*	*126*	*964*	*181*	*1,187*	*262*	*813*	*123*	*730*	*96*	*54,278*	*227*	*1,908*
Eudialyte		2,988,000	1,037,000	2.88	0.126	0.330	0.074	0.530	0.074	0.151	0.019	0.070	0.016	0.0021	0.016	0.0030	0.020	0.0044	0.013	0.0020	0.012	0.0016	0.896	0.0036	0.036
Mosandrite		920,000	315,000	2.92	0.124	0.358	0.076	0.558	0.074	0.168	0.021	0.078	0.017	0.0021	0.016	0.0030	0.020	0.0044	0.014	0.0021	0.013	0.0017	0.969	0.0050	0.033
Britholite	**Indicated**	198,000	68,000	2.92	0.122	0.271	0.072	0.465	0.057	0.125	0.016	0.060	0.014	0.0018	0.014	0.0028	0.019	0.0044	0.014	0.0021	0.012	0.0016	0.947	0.0041	0.038
Syenite		1,000	-	2.80	0.039	0.369	0.037	0.445	0.077	0.175	0.021	0.081	0.014	0.0013	0.010	0.0016	0.010	0.0020	0.005	0.0008	0.006	0.0010	2.029	0.0019	0.020
TOTAL		**4,106,000**	**1,420,000**	**2.89**	**0.125**	**0.333**	**0.075**	**0.533**	**0.073**	**0.153**	**0.019**	**0.072**	**0.016**	**0.0021**	**0.016**	**0.0030**	**0.020**	**0.0044**	**0.013**	**0.0020**	**0.012**	**0.0016**	**0.915**	**0.0040**	**0.035**
	tonnes				*5,146*	*13,676*	*3,061*	*21,883*	*2,999*	*6,299*	*775*	*2,936*	*666*	*85*	*651*	*123*	*812*	*180*	*554*	*84*	*504*	*67*	*37,572*	*162*	*1,449*
Eudialyte		7,109,000	2,468,000	2.88	0.137	0.373	0.079	0.589	0.085	0.171	0.021	0.078	0.018	0.0022	0.017	0.0032	0.021	0.0047	0.014	0.0022	0.013	0.0017	0.941	0.0038	0.035
Mosandrite	**Measured+ Indicated**	2,207,000	756,000	2.92	0.124	0.354	0.075	0.553	0.075	0.166	0.020	0.076	0.017	0.0021	0.016	0.0030	0.020	0.0043	0.014	0.0021	0.013	0.0017	0.979	0.0047	0.033
Britholite		362,000	124,000	2.92	0.120	0.284	0.068	0.472	0.061	0.132	0.016	0.061	0.014	0.0017	0.014	0.0027	0.018	0.0041	0.013	0.0020	0.012	0.0015	0.903	0.0037	0.035
Syenite		9,000	3,000	2.80	0.130	0.313	0.072	0.515	0.071	0.143	0.017	0.066	0.015	0.0018	0.014	0.0029	0.019	0.0045	0.014	0.0021	0.012	0.0016	0.822	0.0025	0.019
TOTAL		**9,688,000**	**3,352,000**	**2.89**	**0.133**	**0.365**	**0.078**	**0.576**	**0.082**	**0.168**	**0.020**	**0.077**	**0.017**	**0.0022**	**0.017**	**0.0031**	**0.021**	**0.0046**	**0.014**	**0.0021**	**0.013**	**0.0017**	**0.948**	**0.0040**	**0.035**
	tonnes				*12,926*	*35,358*	*7,544*	*55,828*	*7,943*	*16,306*	*1,985*	*7,456*	*1,668*	*211*	*1,615*	*304*	*1,999*	*442*	*1,367*	*207*	*1,234*	*164*	*91,850*	*390*	*3,357*
Eudialyte		255,000	88,000	2.88	0.093	0.314	0.057	0.463	0.076	0.142	0.017	0.064	0.014	0.0018	0.013	0.0024	0.015	0.0033	0.010	0.0015	0.008	0.0011	0.767	0.0031	0.025
Mosandrite		177,000	61,000	2.92	0.129	0.382	0.079	0.591	0.080	0.180	0.022	0.083	0.018	0.0022	0.017	0.0032	0.021	0.0046	0.014	0.0022	0.013	0.0017	0.925	0.0047	0.032
Britholite	**Inferred**	3,000	1,000	2.92	0.104	0.279	0.061	0.444	0.058	0.130	0.016	0.061	0.013	0.0016	0.013	0.0025	0.016	0.0037	0.011	0.0017	0.010	0.0014	1.056	0.0029	0.033
Syenite		-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000
TOTAL		**435,000**	**150,000**	**2.90**	**0.108**	**0.341**	**0.066**	**0.515**	**0.077**	**0.157**	**0.019**	**0.072**	**0.016**	**0.0019**	**0.015**	**0.0027**	**0.017**	**0.0038**	**0.012**	**0.0017**	**0.010**	**0.0014**	**0.834**	**0.0038**	**0.028**
	tonnes				*469*	*1,487*	*286*	*2,241*	*337*	*685*	*83*	*313*	*68*	*8*	*65*	*12*	*76*	*17*	*50*	*8*	*45*	*6*	*3,631*	*16*	*121*

Resource with TREO* > 0.40%   * LREO: Light Rare Earth Oxides = La2O3 to Sm2O3   HREO: Heavy Rare Earth Oxides = Eu2O3 to Lu2O3   TREO: Total Rare Earth Oxides = LREO + HREO + Y2O3

Effective date: January 1, 2013

Table 14.6 - Global Resource Estimates of REE Enriched Zones at Different Cut-Off (continued - 2)

Zone	Classification	Tonnage	Volume	Density	Y2O3	LREO*	HREO*	TREO*	La2O3	Ce2O3	Pr2O3	Nd2O3	Sm2O3	Eu2O3	Gd2O3	Tb2O3	Dy2O3	Ho2O3	Er2O3	Tm2O3	Yb2O3	Lu2O3	ZrO2	UO2	ThO2
		t	m^3	t/m^3	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Eudialyte	**Measured**	2,892,000	1,004,000	2.88	0.165	0.451	0.093	0.709	0.104	0.208	0.025	0.094	0.021	0.0026	0.020	0.0038	0.025	0.0055	0.017	0.0026	0.015	0.0019	0.977	0.0044	0.039
Mosandrite		683,000	234,000	2.92	0.143	0.409	0.085	0.637	0.088	0.191	0.024	0.087	0.019	0.0023	0.018	0.0034	0.023	0.0050	0.016	0.0024	0.014	0.0018	0.924	0.0046	0.039
Britholite		50,000	17,000	2.92	0.147	0.354	0.079	0.581	0.077	0.166	0.020	0.074	0.016	0.0020	0.016	0.0031	0.021	0.0048	0.015	0.0023	0.013	0.0016	0.897	0.0033	0.039
Syenite		4,000	1,000	2.80	0.141	0.385	0.079	0.604	0.091	0.178	0.021	0.078	0.017	0.0020	0.016	0.0032	0.021	0.0049	0.015	0.0022	0.013	0.0017	0.611	0.0023	0.016
TOTAL		**3,629,000**	**1,257,000**	**2.89**	**0.160**	**0.442**	**0.092**	**0.694**	**0.101**	**0.204**	**0.025**	**0.092**	**0.020**	**0.0026**	**0.020**	**0.0037**	**0.024**	**0.0054**	**0.017**	**0.0025**	**0.015**	**0.0019**	**0.965**	**0.0044**	**0.039**
	tonnes				*5,820*	*16,036*	*3,321*	*25,177*	*3,654*	*7,410*	*895*	*3,338*	*740*	*93*	*715*	*134*	*883*	*195*	*605*	*91*	*535*	*69*	*35,026*	*161*	*1,400*
Eudialyte	**Indicated**	1,472,000	511,000	2.88	0.150	0.378	0.087	0.616	0.083	0.173	0.021	0.082	0.019	0.0024	0.019	0.0036	0.023	0.0052	0.016	0.0024	0.014	0.0019	0.897	0.0043	0.041
Mosandrite		496,000	170,000	2.92	0.144	0.421	0.089	0.654	0.087	0.198	0.024	0.092	0.020	0.0025	0.019	0.0036	0.023	0.0052	0.016	0.0024	0.015	0.0019	0.984	0.0049	0.039
Britholite		41,000	14,000	2.92	0.179	0.300	0.109	0.588	0.051	0.133	0.019	0.078	0.020	0.0027	0.021	0.0044	0.030	0.0069	0.021	0.0032	0.017	0.0022	1.089	0.0055	0.060
Syenite		-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000
TOTAL		**2,008,000**	**695,000**	**2.89**	**0.149**	**0.387**	**0.088**	**0.624**	**0.083**	**0.178**	**0.022**	**0.084**	**0.019**	**0.0025**	**0.019**	**0.0036**	**0.024**	**0.0052**	**0.016**	**0.0024**	**0.014**	**0.0019**	**0.923**	**0.0044**	**0.041**
	tonnes				*3,001*	*7,770*	*1,772*	*12,542*	*1,670*	*3,585*	*443*	*1,686*	*386*	*49*	*380*	*72*	*473*	*104*	*321*	*48*	*287*	*38*	*18,529*	*89*	*824*
Eudialyte	**Measured+ Indicated**	4,363,000	1,515,000	2.88	0.160	0.427	0.091	0.678	0.097	0.196	0.024	0.089	0.020	0.0026	0.020	0.0037	0.024	0.0054	0.017	0.0025	0.015	0.0019	0.950	0.0044	0.039
Mosandrite		1,179,000	404,000	2.92	0.144	0.414	0.087	0.644	0.087	0.194	0.024	0.089	0.020	0.0024	0.019	0.0035	0.023	0.0051	0.016	0.0024	0.014	0.0018	0.949	0.0047	0.039
Britholite		91,000	31,000	2.92	0.162	0.330	0.093	0.584	0.065	0.151	0.020	0.076	0.018	0.0023	0.018	0.0037	0.025	0.0058	0.018	0.0027	0.015	0.0019	0.983	0.0043	0.048
Syenite		4,000	1,000	2.80	0.141	0.385	0.079	0.604	0.091	0.178	0.021	0.078	0.017	0.0020	0.016	0.0032	0.021	0.0049	0.015	0.0022	0.013	0.0017	0.611	0.0023	0.016
TOTAL		**5,637,000**	**1,951,000**	**2.89**	**0.156**	**0.422**	**0.090**	**0.669**	**0.094**	**0.195**	**0.024**	**0.089**	**0.020**	**0.0025**	**0.019**	**0.0037**	**0.024**	**0.0053**	**0.016**	**0.0025**	**0.015**	**0.0019**	**0.950**	**0.0044**	**0.039**
	tonnes				*8,821*	*23,806*	*5,092*	*37,719*	*5,324*	*10,995*	*1,338*	*5,024*	*1,126*	*143*	*1,095*	*206*	*1,356*	*300*	*925*	*140*	*821*	*107*	*53,556*	*251*	*2,225*
Eudialyte	**Inferred**	47,000	16,000	2.88	0.109	0.370	0.068	0.547	0.089	0.167	0.020	0.076	0.017	0.0021	0.016	0.0029	0.019	0.0040	0.012	0.0017	0.010	0.0013	0.726	0.0044	0.025
Mosandrite		110,000	38,000	2.92	0.150	0.440	0.092	0.682	0.090	0.207	0.025	0.096	0.021	0.0026	0.020	0.0038	0.024	0.0054	0.017	0.0025	0.015	0.0020	0.962	0.0049	0.038
Britholite		1,000	-	2.92	0.125	0.319	0.071	0.516	0.066	0.149	0.018	0.070	0.015	0.0019	0.016	0.0030	0.018	0.0045	0.014	0.0020	0.011	0.0014	1.036	0.0026	0.031
Syenite		-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000	0.0000	0.000
TOTAL		**158,000**	**54,000**	**2.91**	**0.138**	**0.418**	**0.085**	**0.641**	**0.090**	**0.195**	**0.024**	**0.090**	**0.020**	**0.0024**	**0.019**	**0.0035**	**0.023**	**0.0049**	**0.015**	**0.0023**	**0.013**	**0.0018**	**0.892**	**0.0047**	**0.034**
	tonnes				*218*	*662*	*135*	*1,014*	*142*	*308*	*37*	*143*	*31*	*4*	*30*	*6*	*36*	*8*	*24*	*4*	*21*	*3*	*1,410*	*7*	*54*

Resource with TREO* > 0.50%   * LREO: Light Rare Earth Oxides = La2O3 to Sm2O3   HREO: Heavy Rare Earth Oxides = Eu2O3 to Lu2O3   TREO: Total Rare Earth Oxides = LREO + HREO + Y2O3

Effective date: January 1, 2013

15.0 MINERAL RESERVES ESTIMATES

15.1 Pit Optimisation Approach

Initially, the mineral resources were integrated into Gemcom GEMS by SGS. Gemcom GEMS is a computer program that provides collaborative geology and mine planning capabilities. The block model is made of 232 columns by 150 rows by 62 levels. The blocks sizes are 10 m by 5 m by 5 m, totalling 2,157,600 blocks. Each block contained the rock code and the density of the overburden, the host rock, and the mineralized rock, as well as grade attributes (in percent) for each of the 15 following rare earth oxides:

1. Lanthanum oxide (La_2O_3)
2. Cerium Oxide (Ce_2O_3)
3. Neodymium oxide (Nd_2O_3)
4. Praseodymium (Pr_2O_3)
5. Samarium (Sm_2O_3)
6. Europium (Eu_2O_3)
7. Gadolinium (Gd_2O_3)
8. Terbium (Tb_2O_3)
9. Dysprosium (Dy_2O_3)
10. Holmium (Ho_2O_3)
11. Erbium (Er_2O_3)
12. Thulium (Tm_2O_3)
13. Ytterbium (Yb_2O_3)
14. Lutetium (Lu_2O_3)
15. Yttrium (Y_2O_3)

All Rare Earth grade values originate from the resources block model delivered to Roche by SGS on January 28, 2013.

In order to classify the resource as measured or indicated, an attribute class value was assigned to each blocks. Since there are a number of economic products, an attribute was created in order to combine all Rare Earth element grade values and was define as the Total Rare Earth Oxide (TREO). The TREO represents a weighted summation of all the Rare Earth Oxide (REO) together into one element. The TREO is obtained by combining the fifteen oxide elements mentioned above and it is expressed in the same unit of the REO elements.

To calculate the TREO value for each block, the Gems block model was exported by Roche into a spreadsheet. The TREO value was then used for the pit optimization process. The monetary value per tonne was based on the grade values of each element contained within each block, as well as the value and recovery of each element. The following equation displays this concept:

$$Value\ TREO = \sum_{i=1}^{15} Value\ Oxide\ i * Grade\ i * Recovery\ i$$

Where:
"*Value TREO*" is the sum of the values of the fifteen oxide expressed in $US/tonne;
"*Value Oxide*" is the monetary value of each oxide element expressed in $US/tonne;
"*i*" is the index of summation for the fifteen oxides;
"*Grade*" is the grade of each oxide in percent.
"*Recovery*" is the expected overall processing recovery of each oxide in percent

Metallurgical and marketing factors are important considerations for the mineral reserve estimate. An appropriate level of metallurgical testwork and consideration of the marketability of various oxide products has been undertaken at the requisite level of confidence for the given Mineral Resources domains by the Qualified Persons. The individual oxide prices were supplied by the Client, based on current available data. According to Matamec's considerations, the oxide pricing was reduced by 30% to include the transport and refining cost in Asia which seems conservative. More detail from pricing may be obtained in Marketing Plan (Section 19.0). Prior to calculating block values in the deposit models, metallurgical recoveries were calculated and used to estimate recoverable grades for each block. The metallurgical recovery used in the pit optimization process is the overall processing recovery which combines the magnetic separation and the leaching recovery for each oxide independently. The recoveries per oxides originated from collaborative works between processing experts and/or consultants of Matamec, and Roche metallurgical and processing teams. The recoveries have also been verified by Roche metallurgical simulation (METSIM) during the course of this feasibility study. After metallurgical testwork review on March 21st, 2013, Matamec provided Roche with the validated recoveries for the pit optimization process.

Table 15.1 shows the commodity prices and the respective oxide recoveries applied in the optimization process.

Table 15.1 - Commodity Prices and Process Recoveries Used for Pit Optimization

REO	Commodity Price ($USD/kg)	Magnetic Recovery (%)	Leach Recovery (%)	Overall Recovery (%)
Ce_2O_3	5.60	83.5	69.0	57.62
La_2O_3	7.00	83.5	80.0	66.80
Nd_2O_3	45.50	83.5	76.0	63.46
Pr_2O_3	45.50	83.5	75.0	62.63
Sm_2O_3	17.50	83.5	82.0	68.47
Eu_2O_3	1,050.00	83.5	87.0	72.65
Gd_2O_3	49.00	83.5	90.0	75.15
Tb_2O_3	840.00	83.5	91.0	75.99
Dy_2O_3	462.00	83.5	93.0	77.66
Ho_2O_3	63.00	83.5	94.0	78.49
Er_2O_3	63.00	83.5	94.0	78.49
Tm_2O_3	210.00	83.5	93.0	77.66
Yb_2O_3	63.00	83.5	90.0	75.15
Lu_2O_3	210.00	83.5	78.0	65.13
Y_2O_3	21.00	83.5	93.0	77.66

The optimum pit limit determination which ascertains the economic limits of the ultimate mine in three dimensions was carried out using Gemcom Whittle© software Version 4.4. This software operates using the 3-D Lerchs-Grossman algorithm. Under fixed slope angles, the Lerchs-Grossman algorithm, based on graph theory, guaranteed always to yield the true optimum pit. The pit shell generation was not constrained by any infrastructure or environmental impediments.

After a series of iterations to refine the optimum solution, one pit shell was selected and a complete, or dressed pit design, was created thereafter. The design of the pit was completed following geotechnical considerations, mining regulations and consistent mining experiences. Dilution and mining losses were estimated prior the estimation of the mineral reserves using a long-term operational cut-off grade (sometimes called processing cut-off grade). The pit design, reserves evaluation, and life of mine (LOM) plan and have all been performed using Gemcom Gems© version 6.4.3.

The geological blocks model used during the optimisation process was constrained only by geotechnical parameters per zone as developed by Golder (Section 16.1). The ore selection method for assessing the mineralized material was carried out using the "Cash flow method". In this method, the cut-off parameters are determined by comparing the cash flow from processing the mineralized block versus mining it as waste. The mineralized block is selected only if the cash flow for processing it is higher than the cash flow for mining the block as waste. The cash flow return decides if the mined material is sent to the processing facilities or to the waste dump. Coupled with changing the revenue factor associated to each block, the pit optimiser software then produced different nested pit outlines (shells) with varying tonnages and economic potential.

15.2 Cut-Off Grade Determination

The cut-off grade is a critical parameter to establish in order to estimate the ore reserve and later on to design the mining operation. Its value can significantly alter the ultimate pit design and of course the financial model. The cut-off is the minimum grade above which the material is considered economical to mine and process. To determine the cut-off grade, the commodity forecast prices and all the operating mining and milling costs need to be established with precision. No royalties are applicable for this project.

In the scope of this study, two different cut-off grades were calculated.

The first cut-off grade is the **break-even cut-off grade** which includes all fixed direct mining and milling operating cost and the overhead cost. All material mined above this grade will be considered high grade ore. The purpose of this grade is to distinguish whether the mineralized rock can be treated for an economic profit during a regular production year. The break even cut-off grade for this project corresponds to a value of $60.70 per tonne.

The second cut-off is the **marginal cut-off grade**. All material above this grade and below the break-even cut-off will be considered low grade in this study. The purpose of this grade is to increase the ore reserves and tonnes to be milled but also to lower the waste-to-ore ratio. Once extracted from the pit, all rock below the break even cut-off grade may contain sufficient grade to be profitable especially at the end of the mine life once some of the costs (general and administration, waste and mining costs) are significantly reduced or eliminated. This low grade ore will be stockpiled in a separate pile from the waste so it can be milled at the end of the mine life or as a temporary feed if economic conditions are improved from time to time (e.g. an increase in revenue or an operating cost reduction).

The marginal cut-off grade for this project corresponds to a value of $48.96 per tonne. The material with a lower value than $48.96 per tonne should be considered uneconomical and disposed as waste.

The marginal cut-off grade were used in the reserve estimation with Gemcom Gems© version 6.4.3 in Section 15.6.

15.3 Dilution and Mining Recovery

Dilution occurs when waste is sent to the processing plant. Similarly, ore loss occurs when ore is misclassified as waste and sent to the waste dump.

The dilution and mining recovery (ore loss) are significant factors which have major economic influence over a mining project. The impact of dilution will results in a loss of operating profit. The economic analysis includes the mining dilution and the ore losses associated with the selective mining units, the geometry and the spatial representation of the mineralized zones. Some dilution factors are uncontrollable such as geological structures.

However, recommendations to minimize dilution are available and are explained in the ore control section in this Report (Section 16.7.4).

The mining method is bench blasting with the rare earth bearing ore comprised of competent mafic rock types. The major contributors to dilution will be associated to the geometry of the deposit, as the Kipawa orebody mineralized ore is comprised of wide, regular and competent mafic material.

Every block inside the optimal pit design was taken from the block model and imported into an Excel spreadsheet along with their localisation, dimension, and respective grades. A total of around 129,000 (57,000 without the overburden) measured and indicated blocks were used and estimated. The inferred blocks have been removed from the calculation as per NI-43-101 standards.

The evaluation of the dilution was done by applying a dilution percent to each block within the pit design. The dilution attributed to discrete blocks in direct contact with non-economical blocks (waste) has been evaluated numerically. For example, if a block is totally within the orebody and the contiguous blocks are economical blocks higher than the marginal cut-off grade (ore), then the dilution percentage for this single block will be 0%. If the block bounds or crosses the delimitation between ore and waste then a dilution is applied accordingly to the percentage of waste in the block. This percentage depends on several operational factors including the width of the loading bucket (2.1 m), the height of the face (5 m), the angle of the orebody (+/- 30°), the angle of the mucking face (+/- 50°) and the blast movement (2 m).

One important factor is the planned displacement of the broken muck once it is blasted. Blasting causes movement of the rock and can be detrimental to the accurate delineation of the ore and waste regions within the resulting muck pile. Gilbride et al. (1995) and Taylor (1995) report that theoretical blast-induced ore dilution depends upon several factors including blast design, free face conditions, rock mass properties and the geological environment and geometry. At Kipawa, the mineralisation zones occur inside the syenite gneiss and the calc-silicate complex, the two main rock type of the deposit. The syenite gneiss can contain interlayered calc-silicate bands but the contact between these interlayered bands and the syenite gneiss is well-defined. At the deposit scale, the Kipawa deposit is nearly undeformed. In these conditions, a 2 m vertical displacement and a 2 m horizontal displacement was used to evaluate the dilution factor associated with blasting. This displacement has been regularly observed and measured in similar open pit mining operations that are using these particular drill & blast configurations. The ore block boundaries in the blasted bench can be adjusted to compensate for the measured movement using electronic blast movement transmitters that provides accurate three-dimensional movement vectors.

As verification, manual counting on two representative benches, bench 350 and 320, has been performed. The numerical method appears to be suitable for evaluating the dilution.

Finally, the dilution was increased by 25% to consider other unforeseen factors such as irregular contact continuity, and interpretation variations and for contingency.

The final estimated dilution factor is calculated from the average of each block dilution values. Table 15.2 presents the numerical calculation results.

Table 15.2 - Dilution Calculation Results

Dilution Factors	Horizontal Displacement	Vertical Displacement	Bucket Dimension	Orebody Dipping	Isolated Block	25% Factor
Minimum Value	0%	0%	0%	0%	0%	-
Maximum Value	40%	32%	42%	15.36%	100%	-
Average	1.068%	0.901%	1.105%	0.485%	0.115%	0.919%
TOTAL	**4.593%**					

For the present study, the dilution factor of 4.6% and was rounded up to 5%. It is very important to note that this value assumes that the recommendations mentioned in the Ore Control (Section 16.7.4) and good mining practices in general will be followed.

Given the relatively uniform contacts, the limitations of the geological control methods in the field, and the limits of the selectivity of the ore extraction method, mining recovery is set to 95.24%, which is equivalent to 4.76% of ore loss. Combined, the mining recovery and dilution factors ensure that no additional amount of reserves was generated in the calculation of reserves (dilution factor (1.050) multiplied by the mining recovery (0.9524) equals 1). The dilution and the mining recovery will be used for the reserve estimation in Section 15.6.

15.4 Pit Optimisation Parameters

The optimization process with Gemcom Whittle© was done using the parameters shown in Table 15.3.

Table 15.3 - Pit Optimisation Parameters

Parameter	Value
Overall Slope Angle	50-52
Mining Cost ($/t mined)	5.96
Mining Recovery Fraction	0.9524
Mining Dilution Fraction	1.050
Ore Selection Method	Cash Flow
Cost of Processing ($/t milled)	48.99
"TREO Value" Process Recovery (%)[6]	100%
"TREO Value" Selling Price ($/t)[7]	1
Range revenue - Start Factor	0.2
Range revenue - End Factor	1.2
Step Size	0.02
Nested pit shells produced	51

6 Processing Recovery is 100% in optimisation since it has already been factored into the Value TREO.
7 Selling Price is $1/t since it has already been factored into the Value TREO.

Parameter	Value
Initial Capital Cost ($)	380,000,000
Discount rate per period (%)	10%
Processing limit (Year 1) (t)	999,188
Processing limit (Year 2 to 15) (t)	1,332,250

The “Cost of Processing” as defined here includes the cost of rehandling ore from the high grade loading facility near the pit to the crusher facility, the processing cost for both process facilities and the G & A cost. The selling prices used for revenue are derived from forecasted prices as described in the previous section. In summary, the selling prices used in Whittle are based on the forecasted oxide prices which have been reduced by 30% to cover transport and refining charges.

15.5 Pit Optimisation Results

In the generation of the pit shells, revenue factors are used to scale base case prices up or down, in order to control what nested pits are to be produced. The fixed intervals method has been used for the revenue factors in this report. The fixed intervals method provides a constant step size in revenue factor per nested pit produced. The revenue factor is applied to the element price for all elements contributing to the value of a block. No costs are factored by the revenue factor.

The optimisation process has resulted in 51 nested pit shells ranging between a revenue factor of 0.2 and 1.2. An asymmetric revenue factor has been applied on a second optimization process with the purpose of obtaining a better precision over the possible selected pits located between 0.6 and 1.1. The increase pit size per increment revenue factor has been fixed at 0.02. The results from Gemcom Whittle© are presented in graph form Figure 15.1.

The three curves are representing 3 different operating conditions:

a) The blue line represents the discounted open pit value for Best Case scenario which consists of mining per successive pushback. The best Net Present Value (NPV) for this curve is returned by Pit #41;

b) The red line represents the discounted open pit value for Worst Case scenario which consists of mining bench per bench. The best NPV for this curve is returned by Pit # 25;

c) The green line represents the discounted open pit value for Specified Case defined by the user. The specified mining scenario consists of mining an inner pit which returns the best Internal Rate of Return (Pit #10) then mining the remaining pit size. The best NPV for this curve is returned by Pit #25.

The results of the optimization process are also presented in Figure 15.1. It can be seen from Figure 15.1 that the NPV is fairly constant which means that the revenue are relatively insensitive to the pit size variation beyond Pit #25. Only the best case scenario shows a slightly increasing NPV beyond Pit #28.

After methodical analyses, Pit #30 has been selected because it presents one of the best NPV coupled with the fact that it offers a realistic possibility of NPV improvement when optimizing the mine plans towards the best case scenario. The NPV of Pit #30 is only 0.17% less than the optimum solution of the specified case scenario (Pit #25) but present an NPV 2.1% higher than Pit #25 on the best case scenario curve. On the specified scenario curve, Pit # 30 shows 14.4 % more ore than Pit #25.

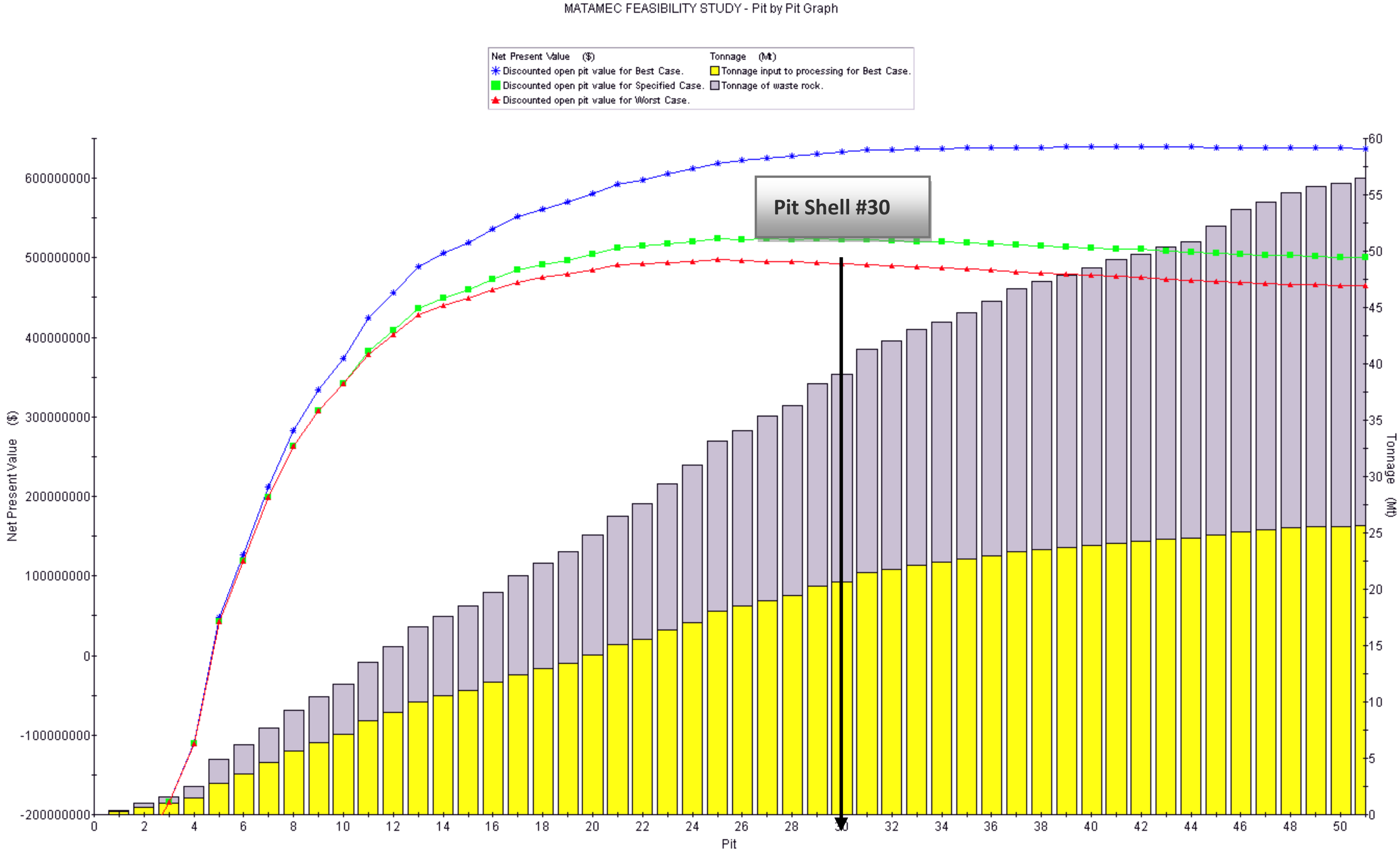
In conclusion, though Pit #30 is not the optimum solution for the specified scenario curve, this pit shell offers a better potential on the best case scenario curve and the risk associated with the increased size is limited and counterbalanced by a higher REO output.

The Whittle results for Pit Shell #30 are presented in Table 15.4. These results are not representative of the final financial results nor of the reserves.

Table 15.4 - Whittle Results for Pit Shell #30

Parameter	Value
Ore (tonnes)	20,629,881
Waste (tonnes)	18,459,881
Total mined (tonnes)	39,089,762
Strip Ratio (W:O)	0.89
La_2O_3 grade (%)	0.0580
Ce_2O_3grade (%)	0.1180
Nd_2O_3 grade (%)	0.0540
Pr_2O_3 grade (%)	0.0140
Sm_2O_3 grade (%)	0.0120
Eu_2O_3 grade (%)	0.0020
Gd_2O_3 grade (%)	0.0120
Tb_2O_3 grade (%)	0.0020
Dy_2O_3 grade (%)	0.0140
Ho_2O_3 grade (%)	0.0030
Er_2O_3 grade (%)	0.0100
Tm_2O_3 grade (%)	0.0020
Yb_2O_3 grade (%)	0.0090
Lu_2O_3 grade (%)	0.0010
Y_2O_3 grade (%)	0.0930
TREO grade (%)	0.4040
Measured blocks (%)	57.3%
Indicated (%)	42.7%
Pit depth (m)	140
Initial Capital Cost ($)	380,000,000
Discount rate per period (%)	10
Processing limit (Year 1) (t)	999,188
Processing limit (Years 2 to 15) (t)	1,332,250
Mine Life (years)	15.73
Before-tax specified NPV ($M US)	522.87
Before-tax payback period (year)	2.8
Before-tax IRR (%)	33.50

Figure 15.1 - Pit Selection Graph



15.6 Mineral Reserves Statement

Mineral Reserves are the parts of Mineral Resources which result in an estimated tonnage and grade that is the basis of an economically viable project after taking account of all factors. The mineral reserves for the project were executed by applying the relevant economic and design criteria to the resource model in order to define the economically extractable portions of the resource.

The reserve estimation involved the utilization of several parameters against the mineral resource values. The key assumptions, parameters, and methods are described previously in this section and included open pit design, cut-off grade determination, dilution, and mining recovery. Each parameter is explained in more detail in the preceding sections. The cut-off grade as defined in Section 15.2 was set at $48.96 per tonne. The dilution and the mining recovery as defined in Section 15.3 was set at 5%. No additional tonnages were added to the Mineral Reserves as the dilution and the mining recovery have been estimated as equal. Only the non-economical grade around economical resources is affecting the grade of each oxide individually in the Mineral Reserve statement.

This study include adequate information on mining, processing, metallurgical, economic and other relevant factors (legal, environmental, socio-economic and government) that demonstrate, at the time of reporting, that economic extraction can be justified. The mineral reserve includes diluting materials and allows for losses that may occur when the material is mined.

The reserves were developed in accordance with CIM Best Practice Guidelines for Estimation of Mineral Resources and Mineral Reserves, and CIM Definition Standards for Mineral Resources and Mineral Reserves. They are disclosed in this report in accordance with the new NI 43-101 Mineral Project Disclosure Standards that came into effect on June 30, 2011.

Mineral reserves are subdivided into probable mineral reserves and proven mineral reserves. A probable mineral reserve has a lower level of confidence than a proven mineral reserve.

A probable mineral reserve is the economically mineable part of an indicated, and in some circumstances a measured mineral resource demonstrated by at least a preliminary feasibility study. This study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified.

A proven mineral reserve is the economically mineable part of a measured mineral resource demonstrated by at least a preliminary feasibility study. This study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction is justified.

The proven and probable reserves are provided in Table 15.5. The mineral reserves were estimated using Gemcom Gems software at a cut-off value of $48.96/t for a total diluted proven and probable reserve estimate of 19.769 million tonnes at $141.56/t or 0.4105% of TREO. Tonnage estimates for mineral reserves are dry tonnage with no account for moisture.

These reserves are based on the ultimate pit designs discussed in detail in Section 16.0 of this Report. The Mineral Reserve statement is effective from June 21, 2013 and has been prepared under the supervision and the responsibility of Roche's Qualified Persons.

Since the disclosure includes the results of an economic analysis of the mineral resources, it is important to state that mineral resources that are not mineral reserves do not have demonstrated economic viability.

Table 15.5 - Mineral Reserves Statement

Classification	Tonnage	Average Density	Y_2O_3	La_2O_3	Ce_2O_3	Pr_2O_3	Nd_2O_3	Sm_2O_3	Eu_2O_3	Gd_2O_3	Tb_2O_3	Dy_2O_3	Ho_2O_3	Er_2O_3	Tm_2O_3	Yb_2O_3	Lu_2O_3	TREO	Value
	t	t/m^3	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	$/t
Proven	**10,218,867**	**2.89**	**0.1011**	**0.0637**	**0.1286**	**0.0156**	**0.0586**	**0.0130**	**0.0016**	**0.0125**	**0.0023**	**0.0155**	**0.0034**	**0.0107**	**0.0017**	**0.0101**	**0.0014**	**0.4400**	**150.05**
tonnes			10,335	6,508	13,144	1,595	5,989	1,329	166	1,278	240	1,582	351	1,098	169	1,035	142	44,960	
Probable	**9,550,047**	**2.89**	**0.0870**	**0.0535**	**0.1098**	**0.0135**	**0.0511**	**0.0115**	**0.0015**	**0.0112**	**0.0021**	**0.0138**	**0.0031**	**0.0095**	**0.0015**	**0.0090**	**0.0013**	**0.3793**	**132.48**
tonnes			8,305	5,111	10,488	1,290	4,882	1,099	139	1,065	200	1,318	291	905	139	864	121	36,219	
Proven + Probable	**19,768,914**	**2.89**	**0.0943**	**0.0588**	**0.1195**	**0.0146**	**0.0550**	**0.0123**	**0.0015**	**0.0119**	**0.0022**	**0.0147**	**0.0032**	**0.0101**	**0.0016**	**0.0096**	**0.0013**	**0.4105**	**141.56**
tonnes			18,640	11,619	23,632	2,885	10,871	2,428	305	2,343	440	2,900	642	2,003	308	1,899	263	81,178	

15.6.1 MINERAL RESERVES VERSUS MINERAL RESOURCES

Table 15.6 and Table 15.7 present a summary comparison between the Reserves Estimates and the base case Resources Estimates at 0.2% TREO as shown in Table 14.4.

The cut-off value for the Reserve Estimates is $48.96/t. The LREO represents the light rare earth oxide and includes all elements from La_2O_3 to Sm_2O_3. The HREO represents the heavy rare earth oxide and includes all elements from Eu_2O_3 to Lu_2O_3. The TREO are representing the summation of the LREO and the HREO, as well as yttrium oxide (Y_2O_3).

The Mineral Resources use a cut-off expressed in % TREO, while the Mineral Reserves rely on a cut-off value expressed in terms of $/t. This is justified since the oxides each have a different value, and their weighting in the TREO varies. This means that two different samples with the same % TREO grade can have a monetary value very different from each other. By using the $/t value, it is ensured that only economic material is mined.

In order to compare both Mineral Resources and Reserves, a linear regression has been performed to determine the closest cut-off grade of TREO in relation to the marginal cut-off value of $48.96/t used for the reserves. Figure 15.2 shows the linear regression for grades between 0.10 and 0.30% TREO. The block model distribution represents a value of 0.154% with correlation coefficient of 90%. The closest Resources cut-off grade for comparison is 0.2% TREO.

Figure 15.2 - TREO Grade vs. TREO Value for Matamec Block Model

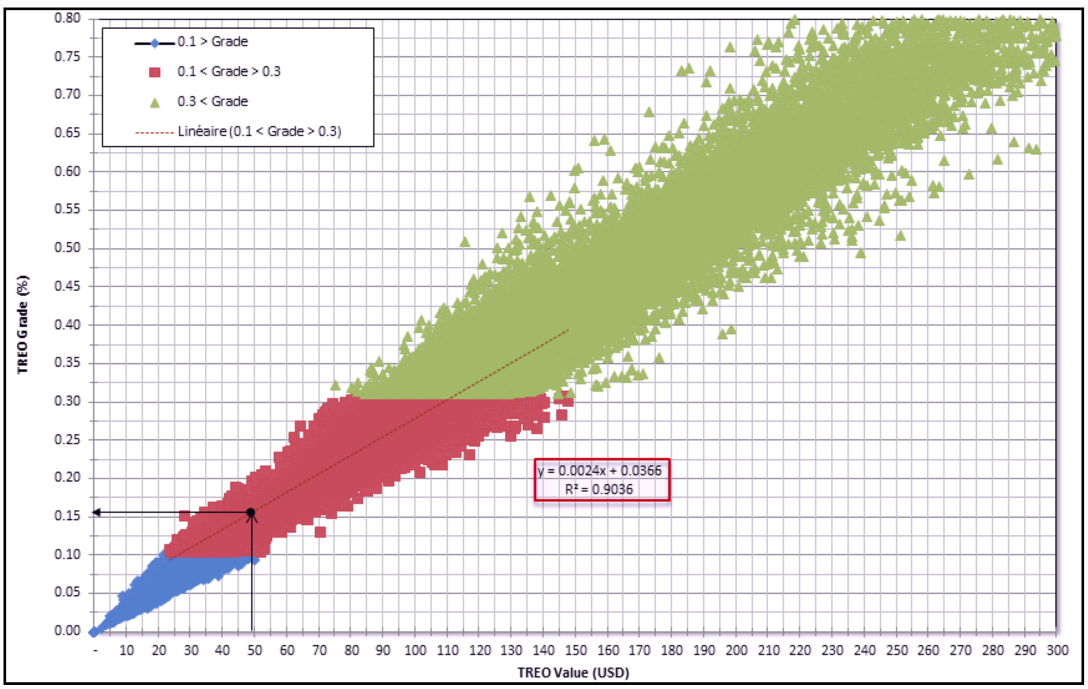


Table 15.6 - Mineral Reserves Summary with $48.96/t cut-off value (Effective May 15, 2013)

Classification	Tonnage	Average Density	Y_2O_3	LREO	HREO	TREO	UO_2	ThO_2
	t	t/m^3	%	%	%	%	%	%
Proven	**10,218,867**	**2.89**	**0.101**	**0.279**	**0.059**	**0.440**	**0.0034**	**0.026**
tonnes			10,335	28,564	6,060	44,960	349	2,665
Probable	**9,550,047**	**2.89**	**0.087**	**0.239**	**0.053**	**0.379**	**0.0031**	**0.026**
tonnes			8,305	22,871	5,043	36,219	293	2,502
Proven + Probable	**19,768,914**	**2.89**	**0.094**	**0.260**	**0.056**	**0.4105**	**0.0032**	**0.026**
tonnes			18,640	51,435	11,103	81,178	642	5,166

Table 15.7 - Mineral Resources Summary with 0.20% TREO cut-off grade (Effective January 1, 2013)

Classification	Tonnage	Average Density	Y_2O_3	LREO	HREO	TREO	UO_2	ThO_2
	t	t/m^3	%	%	%	%	%	%
Measured + Indicated	**23,857,000**	**2.90**	**0.093**	**0.259**	**0.055**	**0.407**	**0.0033**	**0.026**
tonnes			22,100	61,742	13,170	97,012	776	6,256
Inferred	**3,268,000**	**2.90**	**0.064**	**0.206**	**0.039**	**0.309**	**0.0025**	**0.0196**
tonnes			2,081	6,740	1,281	10,102	82	608

The Proven and Probable tonnage from the Reserve Estimates are representing 82.9% of the Measured and Indicated tonnage from the Resource Estimates. Compared to the Measured and Indicated Resources, the Proven and Probable Reserves are showing consistent grade discrepancy of about 1.1%, 0.4%, 1.8% and 0.9% for the Yttrium oxide, the LREO, the HREO and the TREO respectively.

In summary, the reserves have been shown to be economic and Roche believes that they are reasonable for the statement of proven and probable reserves.

15.7 Exploration Potential

The Kipawa deposit is presently considered open both laterally and at depth, though to various degrees.

At depth: After Matamec's 2012 campaign, the deposit's extension at depth is fairly well defined. Eight sections remain open at a 0.22% TREO and 0.05% Y_2O_3 cut-off level and are considered worthy for further exploration holes. With the possible exception of sections 2340 to 2407 to the east, open sections present only moderate opportunities to increase tonnage as they are bounded on each sides by sections that are themselves closed off.

The possibility remains of finding other REE enriched lenses similar to the Kipawa deposit, and the possibility at depth should not be ignored. It is unlikely that the only spot where the right conditions for REE precipitation occurred just happened to be at surface. It is likely that these favourable conditions occurred in other places. The Kipawa deposit was discovered because it was the only one that was outcropping. However, it could not be the only one in existence in the region. Indeed, it has been seen from boulders of Kipawa-style mineralization at the PB and PS showings that at least one other lens existed and outcropped at one time. That being said, no geophysical method has presently been found to detect Kipawa-type mineralization at depth and in-depth exploration would therefore have to rely on a regular "blind/Wildcat" drilling grid. Such a grid is in the planning stage in Matamec's offices.

North-West extension: Prospects for this area were greatly increased with the discovery of eudialyte mineralization in one of Matamec's 2011 mechanical trenches (see July 28th, 2011 press release), 220 m north-west of Unocal's last trench (which only contained mineralization in the Mosandrite Zone). Extent of this mineralization and continuity with existing resource blocks are to be a focus point in Matamec's next drilling effort.

South-East extension: The immediate south-east seems to be fairly blocked by the unmineralized trench T-9. Trenching efforts in this area in 2010 and 2011 encountered either very modest grades (2010) or relatively thick overburden (more than 3 m) which prevented mechanical trenching (2011).

However, based on thickness and grade, two adjacent sections remain consistently and strongly open at depth in the area preceding trench T-9. Furthermore, this area is located at the edge of the hill. There is also strong evidence of Kipawa-style REE mineralization two km further south-east, found in the boulders of the PB and PS showings. A fold, a slight change in dip (combined with the change in topographic surface) or the beginning of an *en echelon* secondary lens to the south would be consistent with a barren trench T-9 and those open sections. Further above-ground exploration of this prospective area is, therefore, fully warranted and strongly recommended.

A provisional budget is presented in below, with an average cost of $ 175 per metre, all inclusive:

Table 15.8 - Provisional budget for future drilling

Target	Nb of DDH	Length (m)	Budget (K$)	Priority
Exploration at depth	19	1,800	320	High
North-west extension	9	850	150	High
Regional exploration	20	2,000	350	Low
Wildcat grid (400 m spacing)	35	5,000	875	Low
Total:	**83**	**9,650 m**	**1,695 K$**	

16.0 MINING METHOD

16.1 Geotechnical Parameters

A geotechnical and hydrogeological investigation program was conducted by Golder during August 2012 (see report in Appendix 4.1). The program consisted of surface mapping, geotechnical core logging of five inclined and oriented boreholes, hydrogeological testing of the boreholes, selection of samples for laboratory testing, and point load testing of the rock core. The information from the field investigation was used to characterize the rock mass, evaluate the structural fabric of the project area and assess the hydrogeological characteristics of the site. This information was used to support feasibility-level pit designs. The borehole and field mapping locations are shown in Figure 16.1.

Figure 16.1 - Field Program Borehole and Mapping Locations

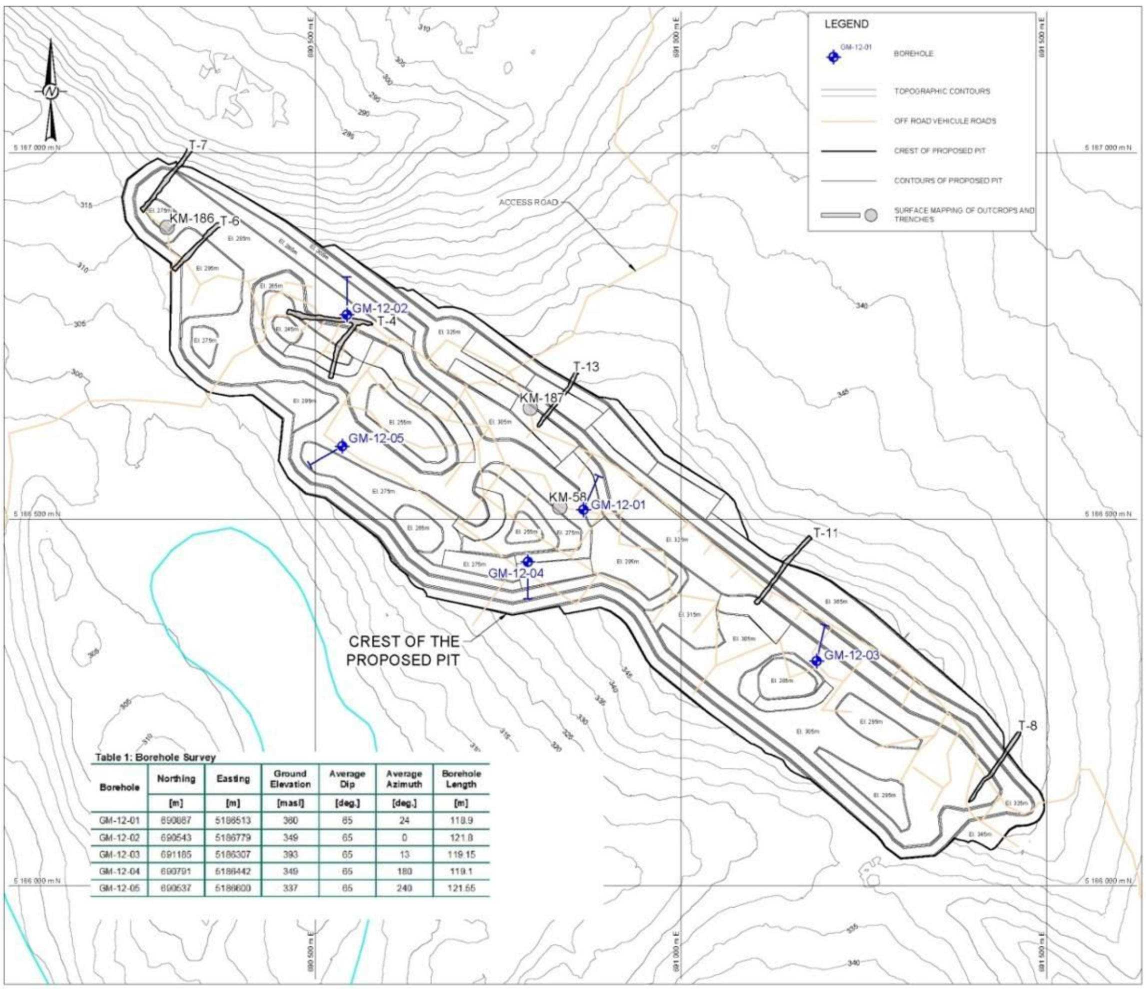


Table 1: Borehole Survey

Borehole	Northing	Easting	Ground Elevation	Average Dip	Average Azimuth	Borehole Length
	[m]	[m]	[masl]	[deg.]	[deg.]	[m]
GM-12-01	690887	5186513	360	65	24	118.9
GM-12-02	690543	5186779	349	65	0	121.8
GM-12-03	691185	5186307	393	65	13	119.15
GM-12-04	690791	5186442	349	65	180	119.1
GM-12-05	690537	5186600	337	65	240	121.65

16.1.1 Regional Stress

There are no in-situ stress measurements for the Kipawa project. The project site is located on the top of a hill. Regional stresses are considered gravitational, with horizontal forces considered equivalent to the vertical gravitational loading in all directions.

16.1.2 Engineering Geology

For analysis purposes, the rock mass was simplified into four basic rock types, which can be described as follows:

- Syenite (SY), representing the Kipawa Alkalic Complex, and host of the mineralization at the site;
- Calc-Silicate Complex (CAL-SIL), usually observed as lenses within the SY unit;
- Gneiss (GN), located below the SY unit;
- Phlogopite (PH), occurring as bands within the calc-silicate complex; while limited in extent, these bands may be associated with local stability problems within the proposed pit, depending on location.

For the rock mass at Kipawa, the CAL-SIL unit occurs as discontinuous lenses within the SY unit, and the PH unit as pods or blebs within the CAL-SIL unit, as shown in Figure 16.2.

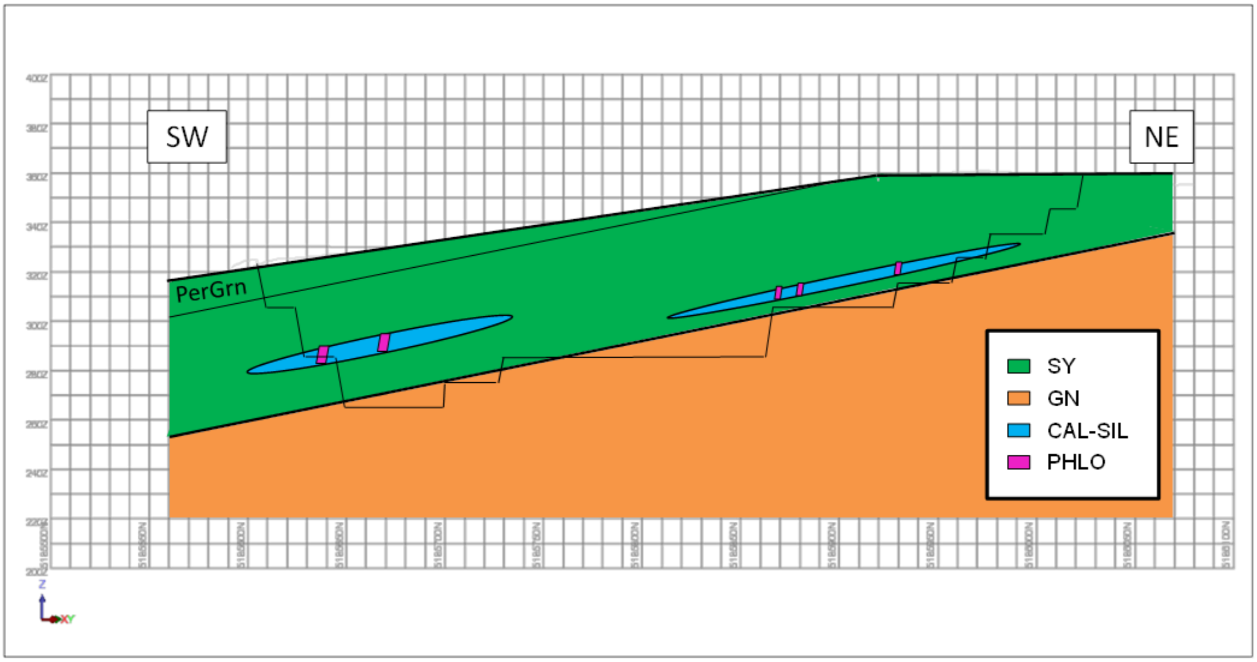
Based on the geometry of the deposit and the test results, the rock mass was grouped into two geotechnical domains: the Syenite (SY) containing all the syenite variants and the calc-silicate zones, as well as the mineralization; and the Granite Gneiss (GN). The salient laboratory and rock mass classification results for these groups are shown in Table 16.1

Table 16.1 - Summary of Rock Properties[1]

Rock Type	RQD	Fracture Spacing (m)	Discontinuity Friction Angle[2]	UCS (MPa)	RMR_{76}	Q'	GSI
SY	98 / 88	1.6 / 0.7	27°	107 / 79	87 / 70	51 / 22	87
GN	99 / 97	2.6 / 1.0	33°	77 / 56	82 / 69	54 / 24	82
Notes:	1. Values are given as Average / Lower Bound. 2. Residual friction angles for joint sets from lab testing. Cohesion = 0 kPa.						

The rock quality designations for the SY and GN are high (98% and 99%, respectively). Rock mass classification using RMR 76 classification system (Bieniawski, 1976) for these units indicates that both units are Very Good. The mineralized zones at the Kipawa site are all located within the SY geotechnical domain; the GN domain represents the waste rock in the footwall of the deposit.

Figure 16.2 - Schematic Showing Simplified Rock Units



16.1.3 MAJOR STRUCTURES AND DISCONTINUITIES

No major structures were identified at the deposit scale. Because the rock mass is not divided by any major structures, and the structural orientations are similar between the SY and GN geotechnical domains, the rock mass is considered one structural domain for analyses purposes. A stereoplot showing the concentrations of the measured discontinuity orientations and the major planes is shown in Figure 16.3. The major plane orientations and descriptions are presented in Table 16.2. These plane orientations were used for the kinematic assessment of the rock slopes.

Figure 16.3 - Stereoplot Showing Discontinuity Orientations Measured at Kipawa (Includes Measurements From Surface Mapping and Oriented Core)

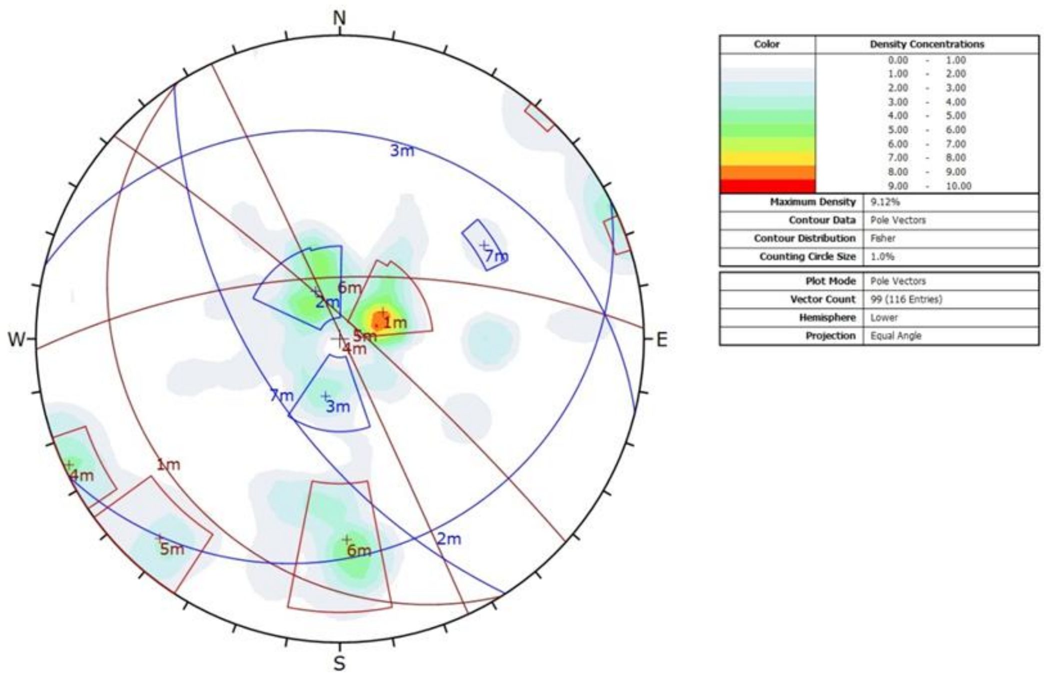


Table 16.2 - Discontinuity Sets Identified from Field Program

Set	Dip	Dip Direction	Major/Minor	Description
1	**20**	**236**	**major**	These sets represent the foliation at the site. Main orientation is shallowly dipping to the southwest (Set 1); some variation with dip to southeast (set 2) and to north (set 3). Sets 2 to 3 represent minor variation of the foliation based on oriented core.
2	21	155	minor	
3	22	14	minor	
4	**89**	**65**	**major**	Subvertical to steeply northeast dipping major sets are observed across the site. Both sets observed together in the same outcrop.
5	**84**	**41**	**major**	
6	**67**	**358**	**major**	Steeply north-dipping major set.
7	59	237	minor	Minor set dipping moderately to the southwest.

Review of the discontinuity populations indicates a flat-lying foliation dipping south, discontinuity sets dipping subvertically to the northeast and steeply to the north, with a few random joint orientations observed. The joints were widely spaced with limited persistence.

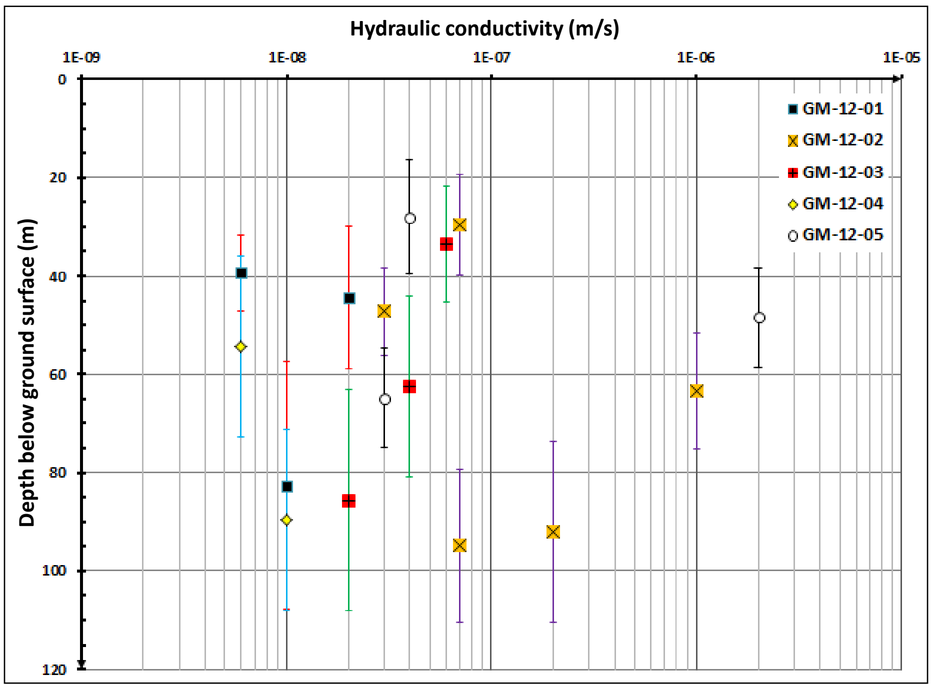
16.2 Hydrogeological Considerations and Modelling

The hydrogeological conditions in the vicinity of the pit were defined based on the fieldwork conducted at the site in August 2012 and February 2013. The results of these investigations are summarized in Golder (2013c) and

Golder (2013d). The pit is situated close to the boundary of the watershed between Sheffield Lake to the west and the smaller Lakes 7, 8 and 9 to the east. The site is overlain by a shallow veneer of overburden (between 2.5 and 6.5 m) composed primarily of silty sand. Hydraulic conductivity within the overburden is estimated at $3x10^{-6}$ m/s, measured in one observation well. The first packer test interval in each borehole was started at the approximate elevation of the water table. The depth to the water table was closer to ground surface at the bottom of the slope, and greatest near the crest of the hill.

The variation of the hydraulic conductivity within the rock as a function of depth is shown in Figure 16.4. The majority of tests conducted at the site have a hydraulic conductivity between $1x10^{-8}$ m/s and $7x10^{-8}$ m/s. However, in two of the boreholes, higher hydraulic conductivities were measured between 40 and 80 m. The phreatic surface at the site is situated in the bedrock, and the flow of groundwater in the vicinity of the pit is to the west, in the direction of Sheffield Lake.

Figure 16.4 - Hydraulic Conductivity of Rock as a Function of Depth



16.2.1 Open Pit Predicted Water Inflow

To estimate the potential inflow of water into the pit, the rock was modelled using the software FEFLOW (Version 6.1), developed by the firm WASY Ltd. This model uses the finite element method to solve the equations of groundwater flow. Modelling was performed using a representative section of the pit, oriented southwest-northeast. The model considered a pit 300 m wide at its widest point, with a depth of 100 m, which correspond to the maximum dimensions of the proposed pit.

The rock mass was subdivided into four distinct units, based on hydraulic conductivity. These units are summarized in Table 16.3. The limiting conditions imposed on the model were as follows:

- Hydraulic head set at 280 m elevation at the southwest limit of the section, corresponding to the elevation of Sheffield Lake.

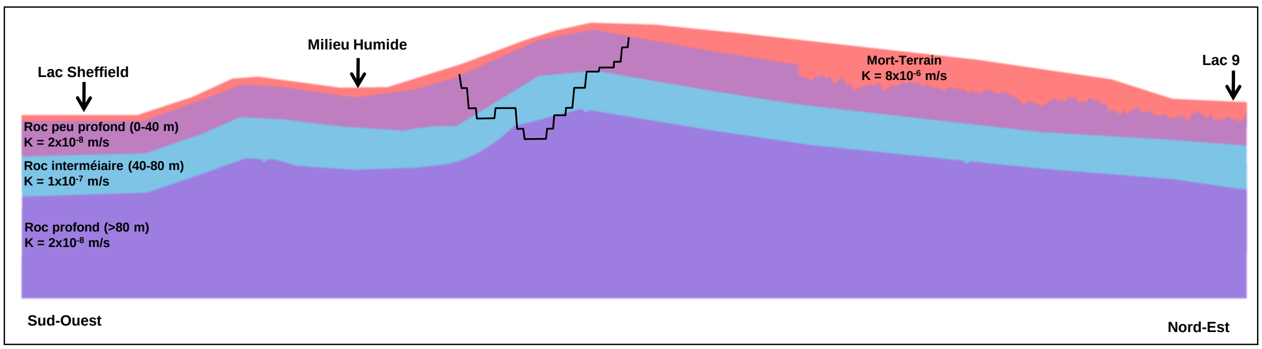
- Hydraulic heat set at an elevation 296 m at the northeast limit of the section, corresponding to the elevation of one of the small lakes in this area.
- Limit of the drain type assigned to the surface of the wetlands situated to the southwest of the pit.

A schematic of the groundwater model is shown in Figure 16.5.

Table 16.3 - Hydrogeological Parameters Assigned to the Model

Hydrogeological Unit	Hydraulic Conductivity (m/s)
Overburden	$8x10^{-6}$
Shallow Rock (0 - 40 m depth)	$2x10^{-8}$
Intermediate Rock (40 - 80 m depth)	$1x10^{-7}$
Deep Rock (> 80 m depth)	$2x10^{-8}$

Figure 16.5 - Schematic of Hydrogeology Model



An infiltration rate of 255 mm/year, corresponding to 27% of the precipitation was assigned to the northeast of the pit. At the southeast of the pit, the rate of infiltration rate of 91 mm/year (10% of precipitation) was assigned based on the thin cover of overburden in this area. A sensitivity analysis of the model to these parameters was conducted by varying the infiltration by a factor of +/- 1.75, and by varying the hydraulic conductivities from 50% to 200% of the geometric mean.

Based on the different simulations that were performed, the infiltration of groundwater into the pit is estimated at between 200 m^3/day and 600 m^3/day. The most likely scenario, however, is groundwater inflow into the pit at an estimated rate of 300 m^3/day.

16.3 Open Pit Slope Assessment

Pit slope design recommendations were provided for the Feasibility Study in the Golder (2012a) report for 10 m bench heights. These recommendations were refined for 5 m bench heights in the Golder (2012b) technical memorandum. This section summarizes the rock slope stability analysis results and the recommended bench configurations that were provided to the project.

The Kipawa pit will be excavated in competent rock with a combination of flat-lying joints dipping to the southwest, and steeply dipping sets to the northwest and northeast. Because of the competence of the rock mass and the shallow pit depth, the slope stability within the rock slopes of the pit will be controlled by the orientation of the pit walls relative to the discontinuities. The pit design must be such that the benches retain rock debris from the pit slopes and that the inter-ramp angles limit the potential for break back and debris.

16.3.1 OVERBURDEN

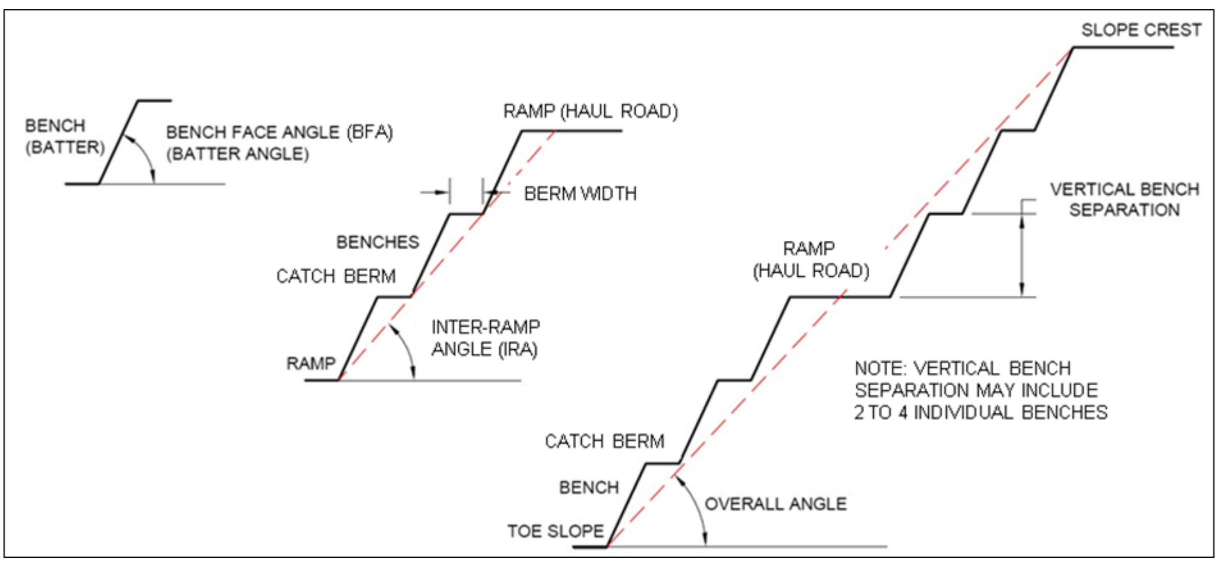
The Kipawa pit is located on a ridge slope covered with a thin veneer of overburden (3 to 5 m, typical from current investigation). Consequently, a slope design in overburden slopes was not performed.

16.3.2 ROCK SLOPE DESIGN DEFINITIONS

A pit slope has three major components: bench configuration, inter-ramp slope angle, and overall slope, as illustrated in Figure 16.6. The bench configuration is defined by vertical bench separation (or bench height), catch berm width (or berm width) and bench face angle (BFA, or batter). The inter-ramp slope is formed by a series of inter-ramp slopes separated by haul roads.

The inter-ramp angle (IRA) corresponds to the angle subtended by a line joining the toe of the benches on the wall and the horizontal. The overall slope angle corresponds to the angle formed by the line joining the toe of the lowest bench with the pit crest and the horizontal. Therefore, the incorporation of ramps into a wall will result in a slope that has a shallower overall slope angle than the inter-ramp angle.

Figure 16.6 - Schematic Representation of Bench Face Angle (BFA), Inter-ramp Angle (IRA) and Overall Slope Angle (OSA)

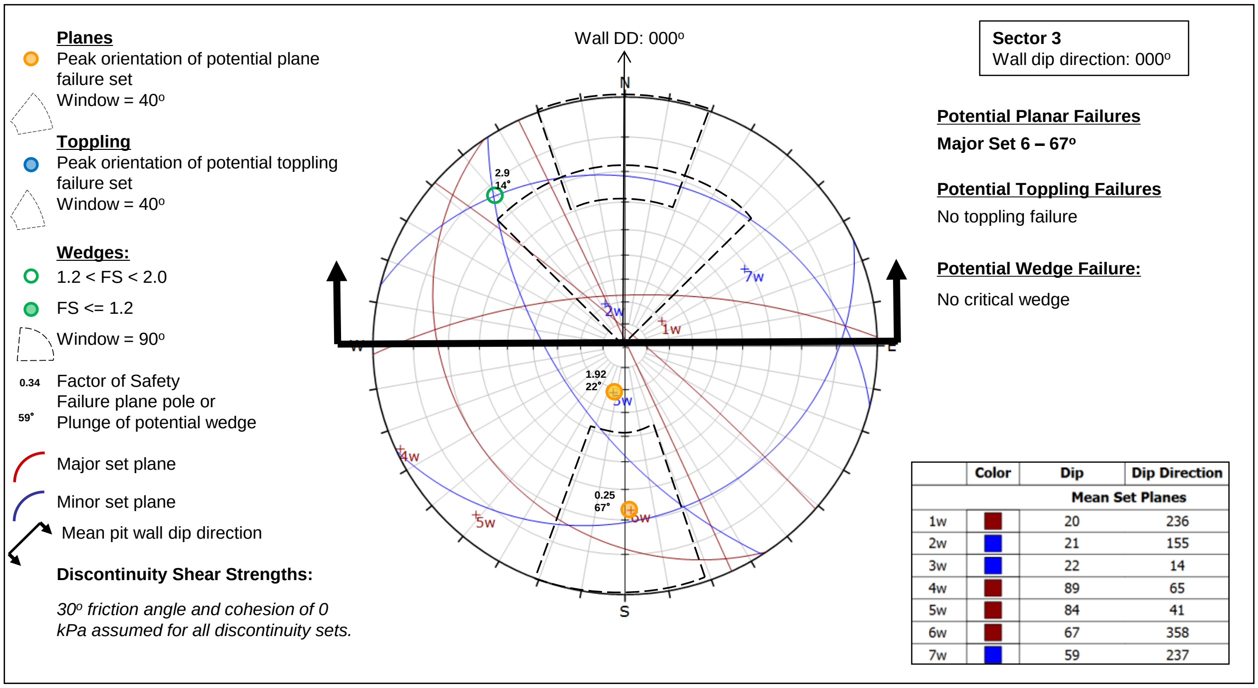


16.3.3 KINEMATIC ASSESSMENT

The kinematic assessments indicate that the bench configurations for some wall orientations will be controlled by the potential planes and wedges involving structures assumed to be potentially continuous. For the purposes of this assessment, all discontinuities were assigned a design friction angle of 30° and no cohesion (0 kPa). This is considered representative based on the observations made during core logging, where most of the discontinuities measured were planar and rough, with no infilling.

Results of the kinematic assessment are presented in the Golder 2012 Technical Memorandum (Golder 2012a), repeated in the Golder 2013 report (Golder 2013b) (Appendix 4.1), and refined for 5 m bench heights in the Golder 2013 Technical Memorandum (Golder 2013a) (Appendix 4.2). Figure 16.7 exemplifies the kinematic analysis for the hanging wall slopes on the south side of the Kipawa pit.

Figure 16.7 - Example of Kinematic Analyses for the Slope with Dip Direction of 000° (North Facing Slope) Based on the Rock Mass Fabric



	Color	Dip	Dip Direction
		Mean Set Planes	
1w		20	236
2w		21	155
3w		22	14
4w		89	65
5w		84	41
6w		67	358
7w		59	237

16.3.4 Slope Design Recommendations

The following are slope design recommendations for ultimate pit slopes in rock. The rock mass was assigned a single structural fabric domain and divided into five design sectors based on wall orientation, and kinematic assessments were determined for each sector. Of these five sectors, only Sector 3 was found to be controlled by structure via planar failure on a set dipping 67° to the north.

The slope designs for the Kipawa pit are summarized in Table 16.4, and the design sectors are shown in Figure 16.8. Schematics showing the designs for the slopes for each sector are shown in Figure 16.9.

Table 16.4 - Recommended Pit Slope Angles for the Kipawa Rock Slopes

Design Sector	Wall Dip Direction (°)	Bench Face Angle (°)	Vertical Bench Separation[1] (m)	Berm Width[2] (m)	Inter-Ramp Slope Angle (°)
3	000° (+/- 20°)	67[3]	10	7	42
1, 2, 4, 5	All others	85[4]	10	7	52
Notes:	1. Vertical bench separation assumes that double benching (2 x 5 m) is applied to all slopes. 2. The berm width is based on the modified Richie formula, with an additional 0.5 m for minor crest loss. If significant crest loss occurs, wider berms may be required to contain rock falls. The limited maximum inter-ramp heights are also a mitigating factor. 3. Bench face angles in Design Sector 3 will be controlled by the potential for planar failure on joints dipping 67° towards 358°. Due to the shallow angle of this BFA, trim blasting is sufficient for this sector. 4. Formation of 85° bench face angles requires application of pre-split / pre-shear wall control. If trim blasted walls are used, based on experience, 70° bench face angles will be achieved, and the inter-ramp slope angle affected accordingly.				

Figure 16.8 - Design Sectors for the Kipawa Pit

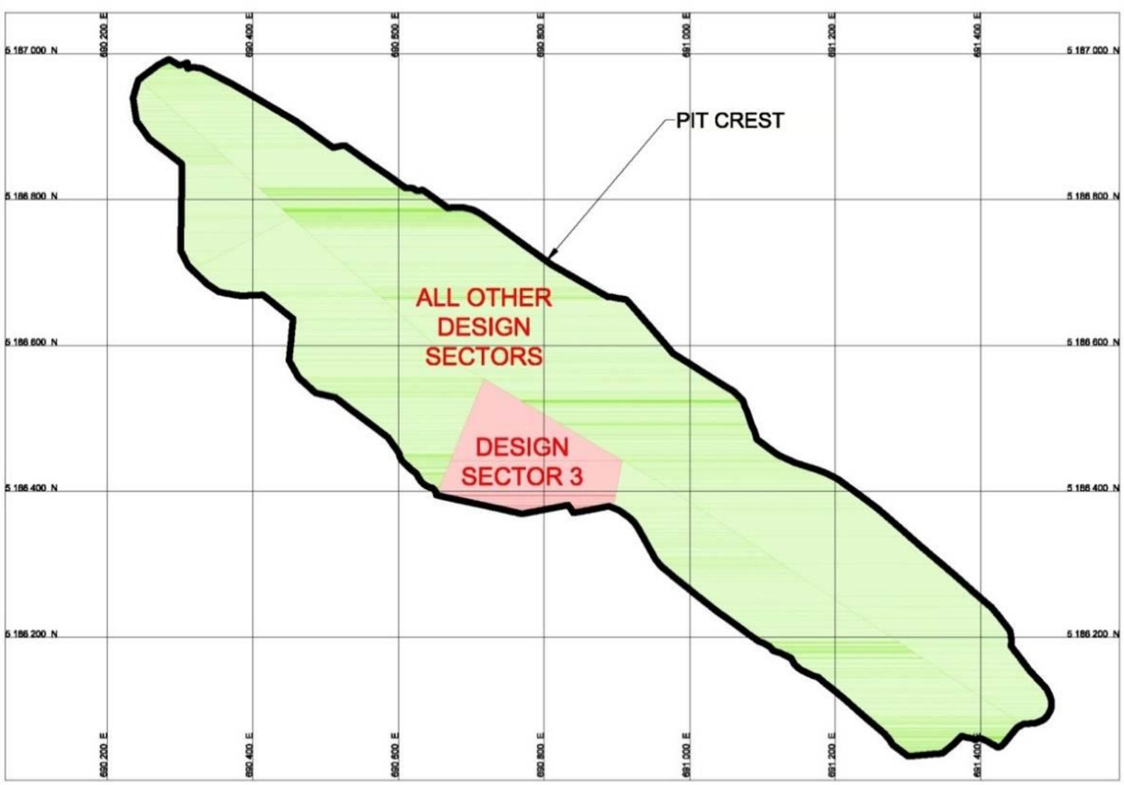
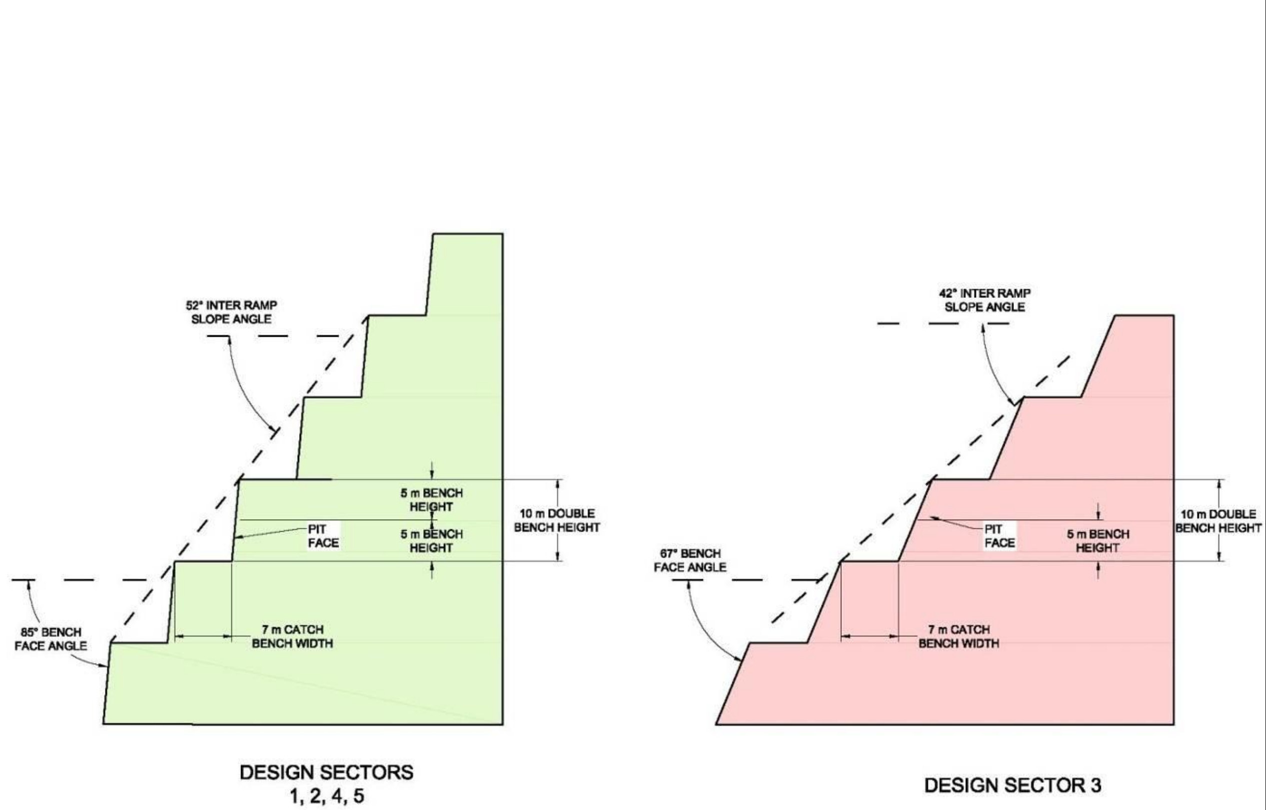


Figure 16.9 - Slope Designs for the Kipawa Pit



16.4 Mining Strategy

The Kipawa Project is designed to be a hard rock open pit operation. The shallow mineral reserves and the orebody geometry make a truck and shovel bench mining operation ideal. The required mill feed throughput is set at 1.332 million tonnes per year (Mtpy, million tpy), which represents 3,650 tonnes per day (tpd) of mineralized rock.

The Life of Mine schedule of the pit is designed according to the following principles:

- Maintain two access ramps to the pit for as long as possible to improve flexibility and productivity of the operations.
- Focus on high grade material in the first couple years of production to maximize the return on the investment. This is similar to using a dynamic cut-off grade to get a higher cut-off grade at the beginning of production and lowering it over the years. This is done to achieve a short payback period minimizing the risk of the investors.
- Focus should then be put on mining the East side of the pit in order to use it as waste storage starting on year 12, thus reducing the waste handling costs and time.
- Lower grade material that is not economical to process immediately will be stored separately from the waste so that it can be milled once the operating costs decrease at the end of the mine life.
- The stripping of the overburden will be executed immediately in the pre-production year.

The mining operation will be responsible for extracting all ore and waste from the open pit. Waste material will be placed near the pit in waste rock storages at a location determined by the drainage area of the pit. High grade ore will be sent to a rehandling pile. From there, it will be loaded into different haul trucks that will bring the ore to the crusher at the process facility 10.9 km from the site. In addition to direct open pit mining activities, the mine operation group will be responsible for maintaining all roads from the mine to the milling site, the integrity of the open pit, and the maintenance of the mining equipment.

The production mining equipment consists of one (1) down-the-hole (DTH) drill rigs for production and pre-splitting, and a front end loader with three (3) 55-tonne haulage trucks. Auxiliary equipment to support the mining operation will include two (2) dozers, two (2) graders, and one (1) excavator. The excavator and loader were selected for their compatibility; should one of them breakdown. The auxiliary excavator has the capacity of loading the haulage truck when preventive maintenance will be made on the loading equipment. There will also be support equipment with key functions on the mine site and that will not be directly involved with the production (i.e. water/sand truck, pickups and service trucks).

The aggregates for stemming and road building will be produced and supplied by a contractor.

16.5 Mine Design

Refer to Section 15.0 Mineral Reserves Estimates for all optimisation parameters. Geotechnical considerations are established by sector.

In order to provide 1,332,250 tpy (3,650 tpd) of ore to the processing plant, detailed pit designs were generated using Gemcom GEMS, version 6.4.3. The Whittle Pit Shell #30 was used as guidelines for creating the ultimate pit design. Other designs such as phased pit (sequencing) design, annual life of mine (LOM) designs, and first year production design per quarter have been prepared and will be explained in the current section.

16.5.1 Pit Constraints

The geometry of the pit was based primarily on geotechnical considerations, equipment size, and ore control. Pit slope configurations used in the ultimate pit design were derived from “Adjustments to pit slope angles for Kipawa rock slopes”, a geotechnical technical memorandum written by Golder Associates (April 11th, 2013). A summary of the slope criteria used is shown in Table 16.5.

Table 16.5 - Recommended Conceptual Pit Slope Angles for Kipawa Rock Slopes

Design Sector [8]	Wall Dip Direction (°)	Bench Face Angle(°)	Vertical Double Bench Separation (m)	Berm Width (m)	Inter-Ramp Slope Angle (°)
1	217	85	10	7.0	52
2	037	85	10	7.0	52
3	000	67	10	7.0	42
4	040	85	10	7.0	52
5	090	85	10	7.0	52

[8] Design sectors from Golder Associates Technical Memorandum “Ajustments to pit slope angles for Kipawa Rock slopes” from April 2013.

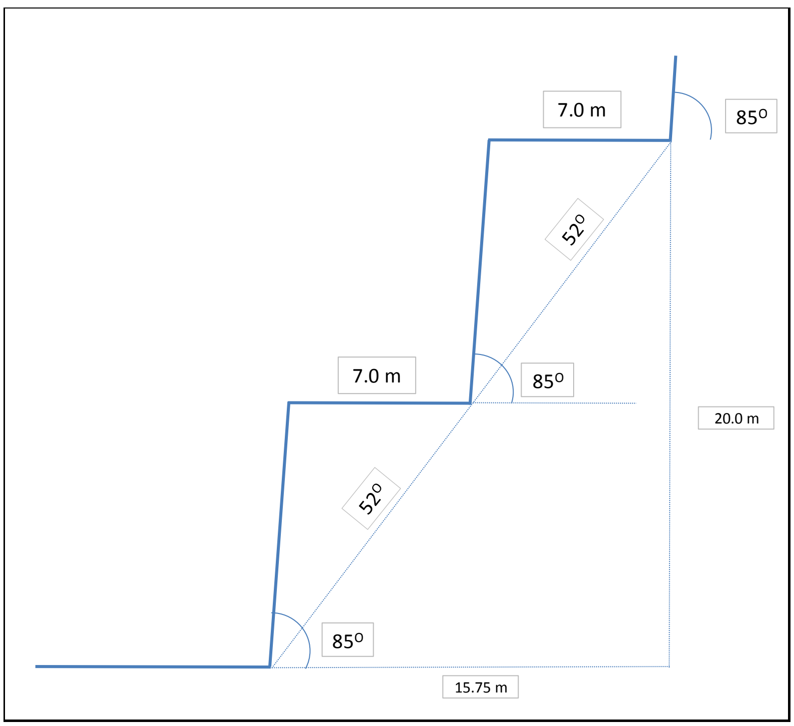
16.5.2 Bench Design

The bench height was designed following the type, the lithology, and the orientation of the mineralization. The bench height has been determined in order to maintain a balance between mining productivity, dilution, and mining recovery. For these reasons, the bench height has been set to 5 m. Double-benching is planned to increase the size of the berm and therefore increase the safety of the operation. A 13-14 m bench was left for every 60 m vertical height which did not intersect the ramp. This was done to increase the geotechnical safety factor, as well as to reduce the danger of falling rock into the lower pit levels. The parameters presented in Table 16.5 have been based on Golder's recommendations.

- Bench height, double-bench mining: 5 m and 10 m;
- Berm width: 7 m;
- For sectors 1, 2, 4 and 5: Bench face angle: 85°. Inter-ramp angle: 52°;
- For sector 3: Bench face angle: 67°. Inter-ramp angle: 42°;

The conceptual pit slope angle for the mine site, except Sector 3, is outlined in Figure 16.10.

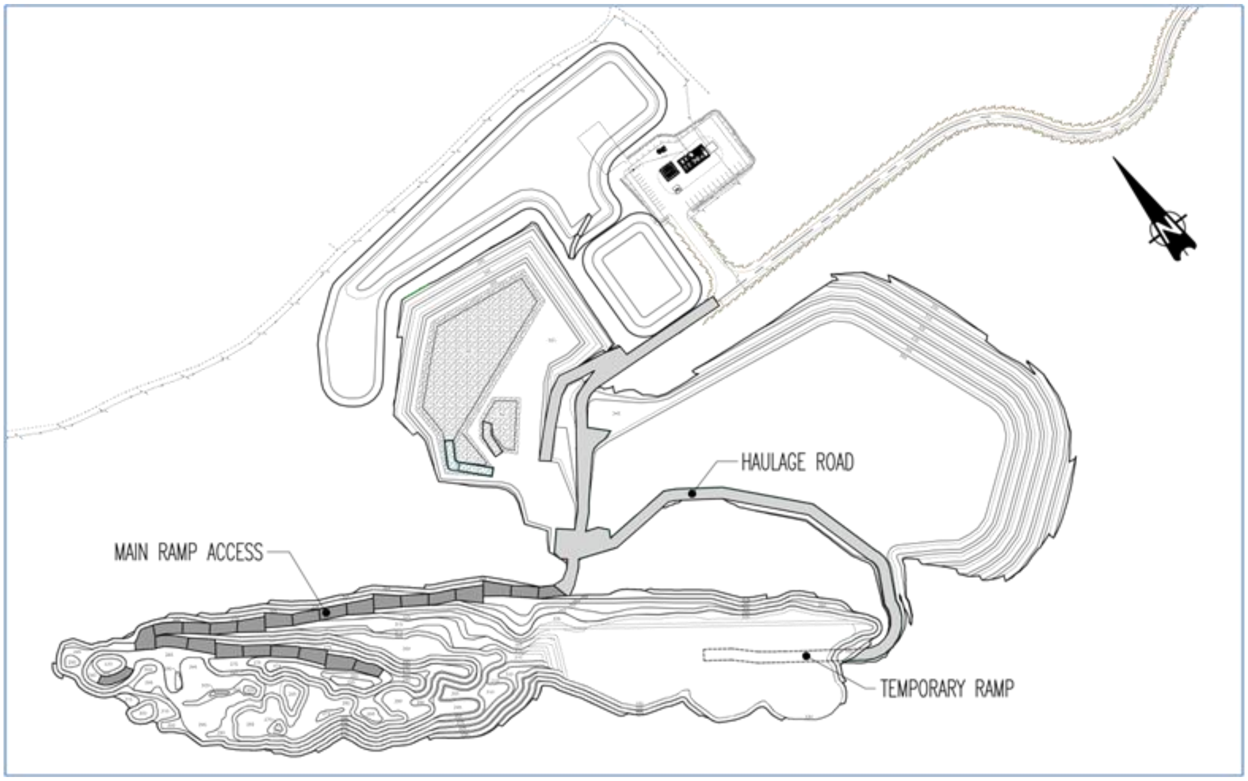
Figure 16.10 - Conceptual Pit Slope Design for Sectors 1, 2, 4, and 5



16.5.3 Ramp and Haul Road Design

Figure 16.11 highlights the ramp and haul road in the vicinity of the pit.

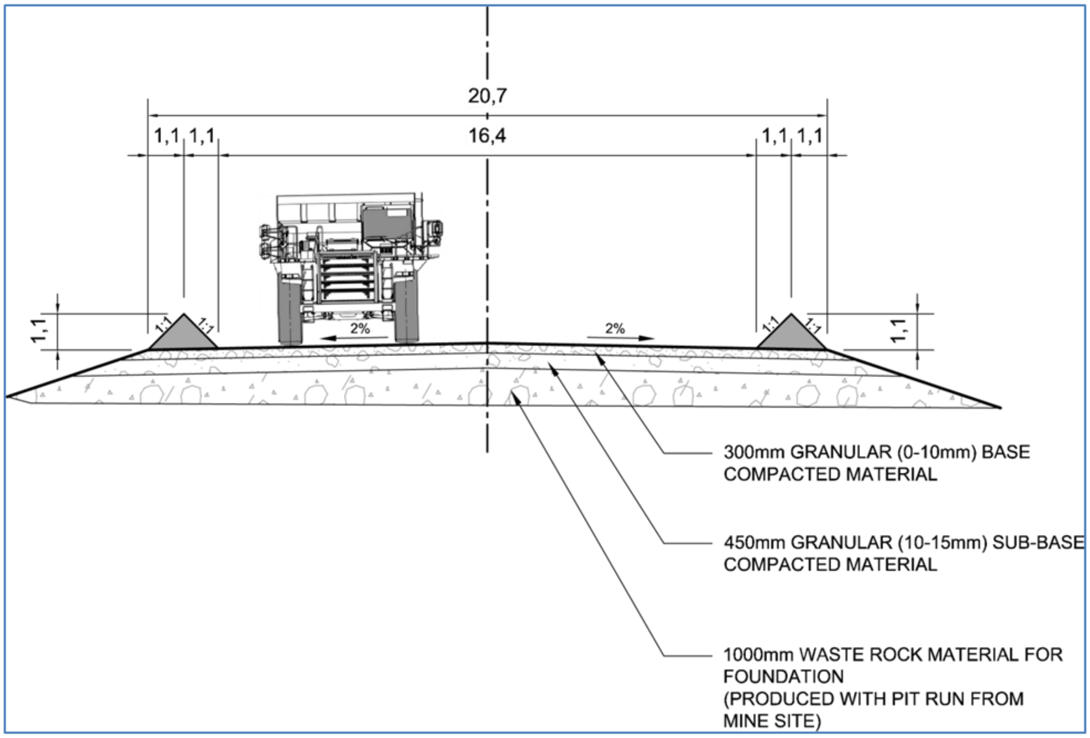
Figure 16.11 - Highlighted Ramp Figure (Plan View)



The main ramp access is located on the north side of the open pit, on the mineralisation footwall, but also in consideration of the location of waste rock storage and topography. A secondary access will be used for the initial years of the mine life, until Year 6. This temporary ramp will be located in the south-east section of the pit. All ramps and mining access road will have a width of 20.7 m, allowing for two-lane traffic. This width includes safety berm bumpers on the crest of the road that are higher than the radius of the wheel of the 55-tonnes truck, the largest wheel equipment using the road. These roads are designed to have a travelled width of approximately 16.4 m. The ramps from Bench 260 and deeper will be reduced to 15.6 m; and will allow for single lane traffic. All ramps and roads have been designed to comply with the "Réglement sur la santé et la sécurité du travail dans les mines (section 2.1 r14)".

Roads are designed to have a maximum centreline gradient of 10% at all times. In turning areas, the inner road gradient may be up to 12% for a short distance which is still acceptable and still below the manufacturer tolerance for hauling equipment. The turning radius is set to a minimum of 30 m, which is above the manufacturer's specifications. All switchbacks are designed with flat turnaround to avoid the inner road gradient getting too steep. From the centreline, road will be constructed with a transversal slope of 2% for water drainage alongside the road. Figure 16.12 shows a typical mining road section including dimensions.

Figure 16.12 - Typical Mining Road Section

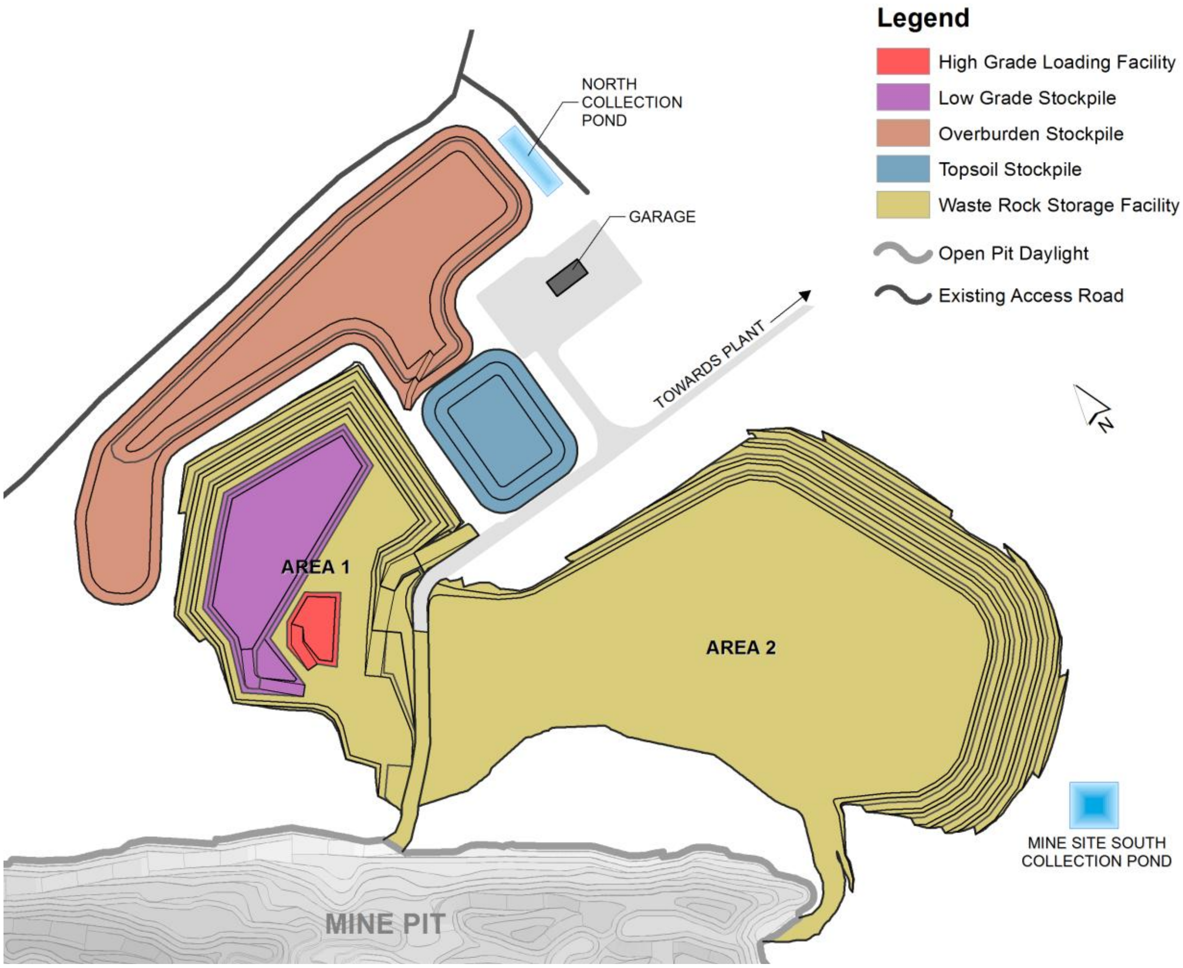


16.5.4 STORAGE AREAS AND STOCKPILES

The storage areas include an overburden storage area, a top soil storage area, and two (2) waste rock storage areas. The low grade stockpile and the high grade loading facility will be located on top of waste storage Area #1. These storages are located within the drainage area except for the overburden storage which is well constrained by roads (Figure 16.13).

The overburden and top soil storage areas will be the first to be filled during the pre-production period. Waste rock produced will mainly be used for roads, MagSep starter berm, construction, as well as waste storage Area #1 foundation. Waste storage Area #2 has a larger capacity and will be in use once waste storage Area #1 is filled. Around Year 12, the eastern pit will be mined out and available for waste storage, reducing the truck travel time. More details on the waste rock management and design of these facilities are provided in Section 20.4.3 - Waste Rock Management.

Figure 16.13 - Waste Storage Areas and Stockpiles



16.5.5 Overburden Pile Design

All the overburden will be removed during the pre-production period (Year -1). The overburden removed from the pit location will be stored to the north of the waste storage Area #1 and garage. This location was chosen because although it is outside the south collection pond drainage area defined in Section 20.6.2 by Golder, it is an area well constrained by roads. The overburden storage area water runoff and seepage will be routed to the north collection pond. The top soil will be stored separately from the overburden in order to be reused for concurrent reclamation. To participate to the revegetation success, a layer of top soil will be placed over the waste rock storage facility edge as soon as the final limit will be achieved. The overburden and the top soil have been designed with a 3H: 1V face angle. The overburden pile is designed with a 5 m bench height over 3 benches. The total volume of overburden expected is 907,000 m^3. The top soil pile is designed with a 6 m bench height over 2 benches. The total volume of top soil expected is 98,000 m^3. The overburden and the top soil storage area will have a height of 15 m and 12 m, respectively. The overburden and top soil stockpiles can be seen in Figure 16.13 above.

16.5.6 Stockpile Design

Both the low grade and high grade stockpiles are located on top of the waste storage Area #1. The stockpile foundation will be created progressively as the waste storage builds up towards the east. During production, the mine haulers will bring low and high grade ore from one of the two ramps and dump the material at its proper location starting from the west and going east.

The purpose of the low grade stockpile is to bring low value ore to the hydromet plant site only at the end of the mine production life. The low grade stockpile is designed following the same geotechnical parameters and ramp guidelines applied to the waste storage area. The low grade stockpile has been designed using 10 m high double benches with a bench face angle of 38° which corresponds to the angle of repose of the broken ore. At every second bench, a 7 m wide berm is considered for rock fall catchment. The low grade stockpile total height is 10 m. The ramp is single lane with a 15.8 m width and is designed with a gradient of 8%.

The ore mined will be transported out of the pit and accumulated on a high grade stockpile. This area is called "High Grade Loading Facility" (HGF). From this location, the high grade ore will be re-loaded in smaller road haulers and transferred to the crusher site. As with the low grade stockpile, the HGF will also be located on top of the waste storage Area #1 but closer to the access road. The road haulers will use a restricted ramp to get access to this loading facility. This ramp is in line with the main access road leading to the crusher at the hydromet plant site. The HGF will fluctuate in dimension every day. The HGF shown in Figure 16.13 is equivalent to 10 days of stockpiling. The HGF is designed following the same geotechnical parameters and ramp guidelines applied to the waste storage area. It has been designed using a bench face angle of 38° which corresponds to the angle of repose of the broken ore. The HGF total height is 5 m. The ramp is single lane with 15.8 m width and is designed with a gradient of 8%.

16.5.7 DEWATERING

The Life of Mine yearly requirements for the pit dewatering is presented in Table 16.6. The selection of the dewatering equipment for the Kipawa mine requires information related to the inflow of water into the pit and the system total head. The maximum daily pumping rate from the pit has been estimated at 900 m^3 per day over the life of mine as presented in Section 20.6 - Site Water Management (Table 20.11). In order to take into consideration any adverse operational conditions that may occur and which may impact the production, the power requirement for the dewatering equipment has been established based on twice the maximum daily pumping rate.

In Table 16.6, the total head is the equivalent height difference between the discharge elevation and the suction elevation of the pump. The total head includes static and dynamic head estimations. The static head is assessed using the elevation difference between the discharge location (at the top of the pit) and the bottom level of the pit in any given year. The bottom level of the pit was determined in the long-term planning. The dynamic head loss was calculated using the Hazen-William equation. This equation, presented in Table 16.6, relates the flow of water to the physical properties of the pipe. Due to the small inflow of water into the pit and the relatively small vertical change in elevation, the piping system is based on using 152 mm inner-diameter (ID) high density polyethylene (HDPE) SDR 15.5 pipe. The HDPE pipe is a smooth walled pipe that reduces the friction and adds mining flexibility. The SDR 15.5 has a sufficient wall thickness to withstand the internal pressure over the mine life. The piping system will follow the main access ramp up to the discharge elevation of 375 m.

When the water reaches the top of the pit, it will be channelled through collection ditches and will flow down by gravity into the Mine Site South Collection Pond. At the end of the mine life, a total length of 1,500 m of pipes will be required from the bottom of the pit to the discharge location.

The pumping equipment is estimated using both the power and the total head requirements at the end of each year. It is assumed that the pumps will be located as close as possible to the sump to minimize the suction lift and therefore maximize their flow capacity. The results show that a 55 hp single stage pumping system for a 61 m total head is required during the first 7 years of the mine life. A Godwin CD 140M pump or the equivalent has been considered for CAPEX's purposes.

After Year 7, the mine will need a 2-stage dewatering system. At this time, a first CD 140M pump (or equivalent) will be installed close to a sump at the bottom mining level to bring the water to an intermediate sump on elevation 320 m. A second CD 140M (or equivalent) will then pump the water out of the pit from the intermediate sump to the discharge location at elevation 375 m.

At Year 12, a new 150 hp pump will be bought since the total head at the end of the mine life will be 83 m. A Godwin HL 110M or equivalent is a suitable pump for this application. For CAPEX's purposes, no quotations were requested for the pumping system cost. CostMine 2012 was used to establish the dewatering price of each pump and piping.

The life expectancy of the pumps was estimated to be three years. The sustaining and replacement capital cost of the pumps and the piping system are included in the CAPEX. It is considered that the pipe sections will be bought at the same time that a replacement pumps will be required.

In order to avoid any groundwater pressure build up close to the wall, regular slightly upwards drainage holes drilled out at 10 m vertical intervals will be performed using the mine drilling equipment. The mine water will then be collected in the mine sump and evacuated through the pumping system.

The dewatering pumps will be diesel fuel powered. Other options exist but have not been considered at this time.

Table 16.6 - Life of Mine Power and Total Head Requirements for Pit Dewatering

Dirty water specific gravity	1.10
Ratio Length of pipe : depth of pipe	8.00
Type of pipe	HDPE Nominal OD 6 in, SDR 15.5
Diameter of pipes (ID)	5.97 in
Hazen Williams equation applies for dynamic head calculation	$H = 0.2083 \times (100/C)^{1.852}(Q^{1.852}/d^{4.8655})(L/100)$
C (pipe roughness coefficient)	140.0
Power (W) is estimated from	P = 9.81 x Total Head x Flow x SG
One stage pumping efficiency	50%
Two stages pumping efficiency	25%

		One stage pumping								Two stage pumping							
		Year -1	**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**
Level of Pond (datum)	(m)	375.0	375.0	375.0	375.0	375.0	375.0	375.0	375.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0
Depth of Mining (datum)	(m)	360.0	360.0	345.0	345.0	335.0	330.0	325.0	320.0	310.0	285.0	310.0	305.0	300.0	295.0	280.0	245.0
Static Head	(m)	15.0	15.0	30.0	30.0	40.0	45.0	50.0	55.0	10.0	35.0	10.0	15.0	20.0	25.0	40.0	75.0
Continuous Flow	(m^3/hr)	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Spring Dewatering Factor	(%)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%
Net Pump Utilization (average)	(%)	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
Pumping Flow Rate	(m^3/hr)	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5
Number of pumping stage		1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
Dynamic Head	(m)	1.6	1.6	3.1	3.1	4.2	4.7	5.2	5.8	1.0	3.7	1.0	1.6	2.1	2.6	4.2	7.9
Total Head	(m)	16.6	16.6	33.1	33.1	44.2	49.7	55.2	60.8	11.0	38.7	11.0	16.6	22.1	27.6	44.2	82.9
Power Required	(KW)	11.2	11.2	22.4	22.4	29.8	33.5	37.3	41.0	14.9	52.2	14.9	22.4	29.8	37.3	59.6	111.8
Power Required	(hp)	15	15	30	30	40	45	50	55	20	70	20	30	40	50	80	150
Pump 1 type or equivalent		Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M
Pump 2 type or equivalent		-	-	-	-	-	-	-	-	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin CD140M	Godwin HL110M	Godwin HL110M	Godwin HL110M

16.6 Open Pit Mine Production Schedules

The key features of the planned mine schedule are as follows:

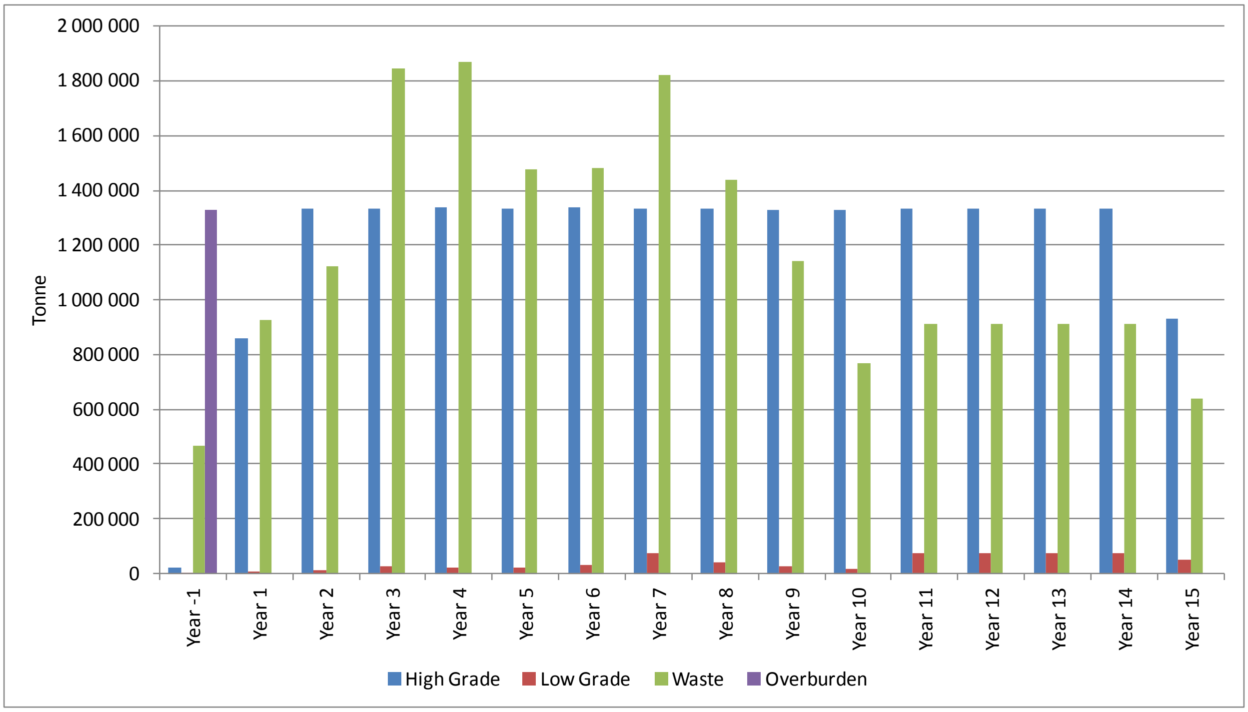
- The mine will operate 361 days per year with 4 days allowed for weather delays;
- The mill feed is scheduled to operate 365 day per year;
- The mine will feed the mill at an average of 1,332,250 tonnes of ore per year (3,650 tonnes per day);
- The mill feed from the first year will be fixed at 66% of the overall capacity and will increase gradually per quarter allowing a smooth start-up period for the mill;
- The production plan is developed on an annual basis except for Year 1 where a quarterly production schedule was done;
- Pre-stripping from inside the pit totals 1.8 Mt and will be completed during the pre-production period (Year -1);
- The highest rate of annual vertical advancement is eight (8) benches of 5 m (or 40 m) in Year 8 and nine (9) benches of 5 m (or 45 m) in Year 15;
- The two (2) pit access ramps used in the first 6 years of operation will increase safety and provide ore blending flexibility.
- The East side of the pit will be mined out at the end of Year 11, providing most of the space for in-pit waste storage from Year 12 until the end of the mine life;
- The average productivity of the main loading units is 252 tph for ore and 232 tph for waste material;
- Road trucks will re-handle all the ore and bring it to the crusher site, 10.9 km from the mine site;
- The mine and the rehandling equipment can sustain maximum material movement of 8.8 and 9.5 kt/d, respectively.

A standard truck and shovel operation will bring the drilled and blasted material out of the mine to their respective destinations (waste dump, low grade stockpile, or high grade loading facility).

The Life of Mine is 15.2 years of which 0.5 year will be attributed to stockpile reclaiming. A total production of TREO is expected to be close to 55,500 tonnes over the mine life. When the mill will be fully operational, an average of 3,760 tonnes per year of TREO will be produced, as opposed to an average of 3,650 tpy over the life of mine.

Figure 16.14 presents the life of mine production scheduled for the Kipawa mine site per type of material mined.

Figure 16.14 - Mine Production Schedule per Material Type



16.6.1 Mine Phases

The mine's exploitation will be carried out in 3 phases: Pre-production, Phase 1, and Phase 2. The stripping ratio (W:O) for each phase will be 20.81, 0.86, and 0.93, respectively, for an overall stripping ratio of 0.94.

16.6.1.1 Pre-Production

This phase of the mine plan focuses on removing overburden, levelling the pit, and extracting waste rock to give access to mineralised zones. This phase will occur one year prior to the beginning of production Phase 1. The surface of the pit will be stripped completely to level the area and to provide pit run material for the construction of the high grade loading facility, the low grade stockpile pad, the site infrastructure foundation and the MagSep starter berm.

Waste rock will be produced for the temporary and final mine access development. Since both accesses end on top of a hill, 150 m long slots ramps will be excavated on a height of 5 m and 10 m for the temporary and final ramps, respectively. These will be made in order to improve safety (by reducing the blind spots) and to increase productivity (by reducing the hauling cycle time) of the operation. The material produced by these slot ramps will be available for the construction phases and the mining road networks.

Table 16.7 details the waste rock volumes produced in the pre-production phase as well as what will be required for the site development and for the construction period.

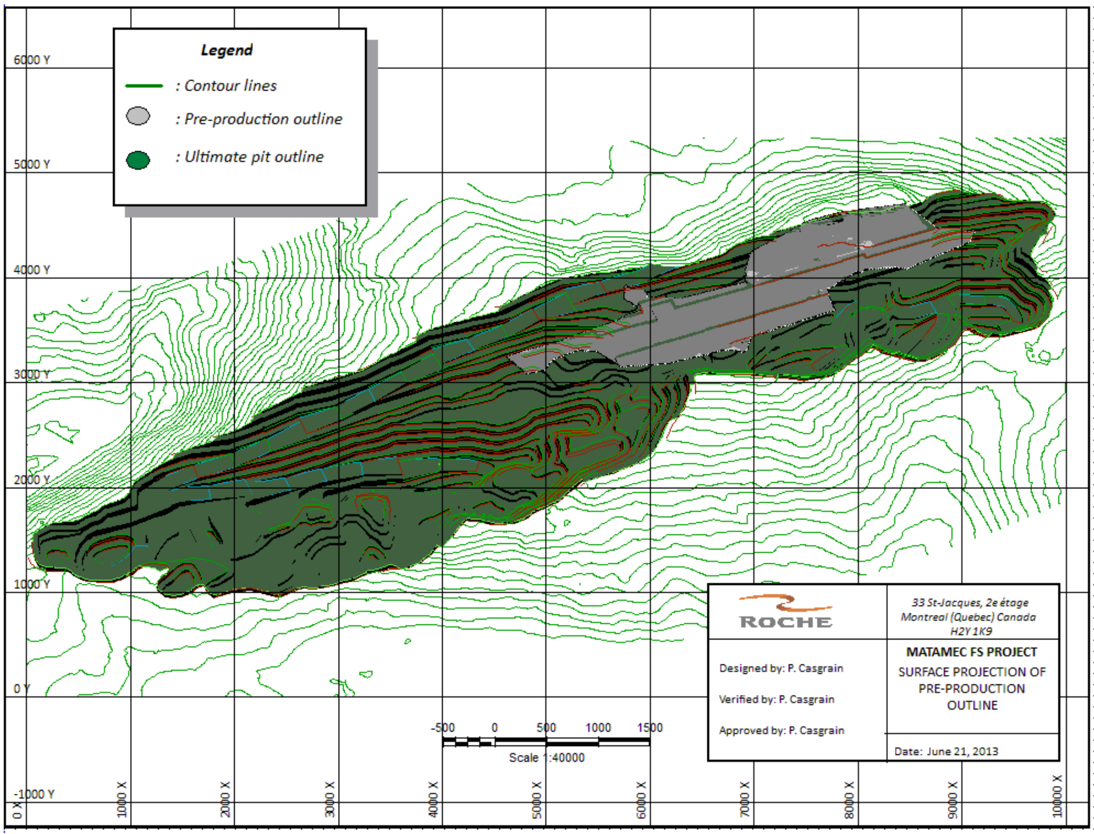
Table 16.7 - Pre-Production Waste Volume for Development and Construction

Waste Rock Required	**Volume (m^3)**
LG pad, HG pad and Temporary Ramp	168,000
Starting peripheral Berm for MagSep construction	67,000
Central drain construction for MagSep construction	5,000
Garage and other mining ancillary roads	12,750
Sub Total Required	***252,750***
Waste Rock Produced	**Volume (m^3)**
Pit access development, East access	(4,600)
Pit access development, West access	(14,300)
Sub Total Produced	***(18,900)***
Net Volume Required	**233,850**

The pre-production excavation will take place in the eastern side of pit since it is where the production Phase 1 will be carried out. A total of 467,700 tonnes (233,850 m^3) of waste rock will be used in pre-production phase for site preparation. During this phase, 22,000 tonnes of ore will be stockpiled. This stage of development will take less than a year to complete. The mining will take place from elevation 375 m to 360 m.

Figure 16.15 shows an isometric projection of the pre-production outline highlighted in grey.

Figure 16.15 - Pre-Production Outline - Isometric Projection



16.6.1.2 Phase 1

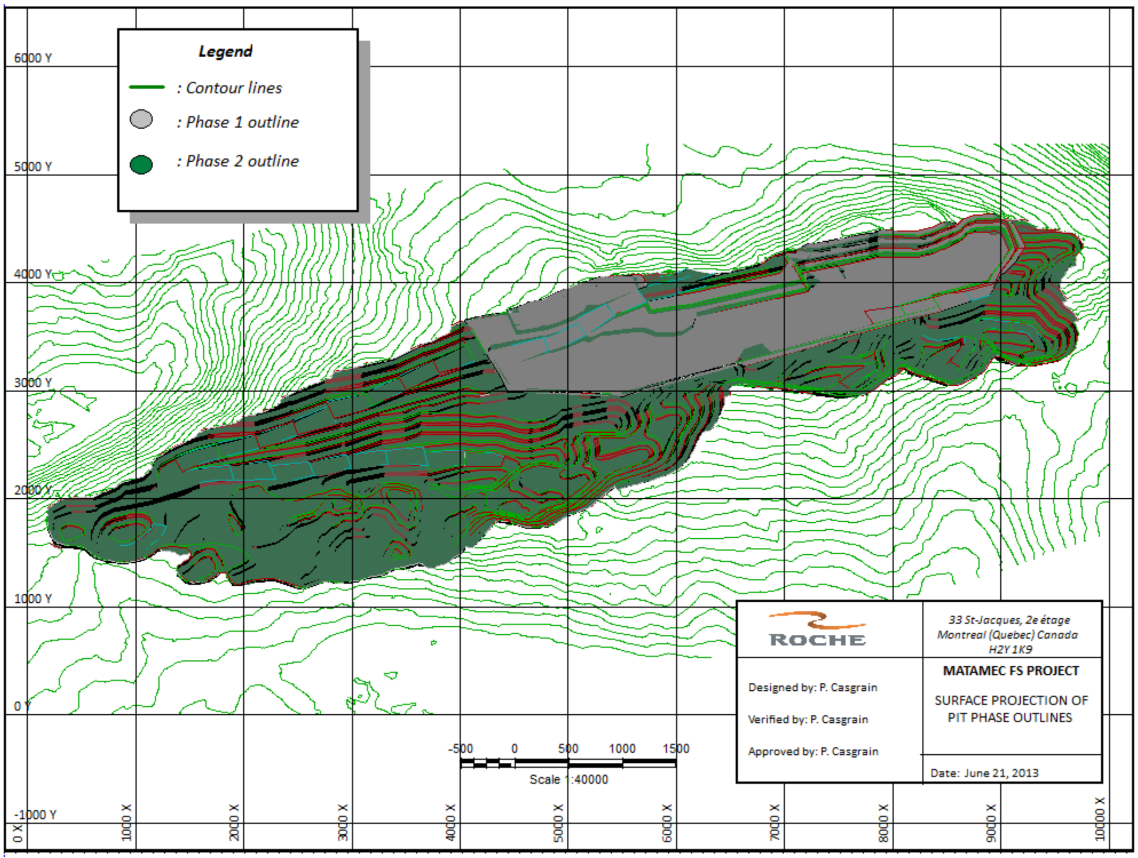
Phase 1 encompasses the mining production around Pit Shell #10 which produced the best internal rate of return in Whittle. Phase 1 of the mine production will be from Year 1 to the second quarter (Q2) of Year 3. A total of 2,657,000 tonnes of ore and 2,277,000 tonnes of waste are planned for this phase. The overall stripping ratio waste to ore (W:O) for this phase is 0.86. The lower stripping ratio in the early years is due to the removal of waste material in the pre-production phase.

This phase encompasses several levels between the elevation 370 and 345. The production will be centred in the east side of the pit. The objective of the first phase of production is to mine the high grade material found at relatively shallow depths to decrease the payback period of the initial investment. Two (2) ramps will allow a high degree of production and ore blending flexibility and will increase the operation safety. These ramps will be temporary and will only be in service for the duration of this phase. Having a secondary access will permit haulage trucks to have a dedicated circulation route, thus minimizing delays due to the presence of other equipment and increasing productivity. In the case of an unforeseen event compromising a ramp access, production would also be possible from the other access ensuring the realisation of production schedule.

This phase will be mined bench by bench. The boundaries of this temporary pit are established by the design of the phase and do not reach the limits of the ultimate pit design except on the North East. Once the phase will be finished, the boundaries will be pushed back to reach the limits of the ultimate pit.

Figure 16.16 shows an isometric projection of Phase 1. Phase 1 is highlighted in grey.

Figure 16.16 - Phase 1 Production Outline - Isometric Projection



16.6.1.3 Phase 2

Phase 2 of the mining sequence consists of pushing back Phase 1 to the ultimate pit. Phase 2 will last for 11.5 years which correspond to the remaining life of mine. The mining sequence will focus on having at least two active levels, allowing flexibility in extraction locations, ensuring mill requirements and assuring the supply of ore during thawing season. A total of 17,112,000 tonnes of ore and 15,906,000 tonnes of waste are planned for this phase. The overall stripping ratio waste to ore (W:O) for this phase is 0.93.

From Year 12 until the end of the mine life, waste will be sent back into the eastern section of the pit. 3.4 million tonnes of waste are expected to be stored in this section of the mine. This will reduce the cycle time and reduce the visual impact of the waste stockpiles outside the pit.

16.6.2 LONG-TERM PLANNING

For each year, reports including tonnes and grades of waste, low grade and high grade ores by bench and by rock type were produced. These annual production reports were compiled on an annual basis from Year-1 through Year 15 to produce the life of mine plan.

The long term planning is directly linked with maintaining a continuous ore feed to the mill while getting as much as possible a constant supply of dysprosium oxide over the mine life. The mill feed of 865,000 tonnes for the ramp up period (Year 1) and an average of 1,332,250 tonnes per year for the subsequent years (Year 2 to Year 14) were respected. The stripping ratios vary slightly during the long term planning as the waste quantities fluctuate from bench to bench. Nevertheless, the variations in waste tonnage from a year to another remain manageable within the same mining fleet and decrease steadily from Year 9 to Year 15. In this plan, usually two or three benches are mined every year which makes it a reasonable and realistic plan. The production distribution per bench is presented in Table 16.8 for the complete mine life. The complete data is presented in Appendix 5.1.

Table 16.8 - Life of Mine Plan Production by Bench

MINE PRODUCTION DISTRIBUTION PER BENCH																
Bench	YEAR															
	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
375	x															
370	x	x		x												
365	x	x		x												
360	x	x	x	x												
355			x	x												
350			x	x												
345			x	x	x			x								
340					x	x		x								
335					x	x	x	x								
330						x	x	x								
325							x	x	x							
320								x	x	x	x					
315									x	x	x					
310									x	x	x	x				
305										x		x	x			
300										x			x	x		
295										x				x	x	
290										x					x	
285										x					x	x
280															x	x
275																x
270																x
265																x
260																x
255																x

MINE PRODUCTION DISTRIBUTION PER BENCH																
Bench	YEAR															
	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
250																x
245																x

The life-of-mine (LOM) plan is presented in Table 16.9. The grades are all diluted values. The dilution grade was estimated block by block by considering the contact geometry in the mineralized zones, the blasting practices and the mining selectivity of the operations. The grade of the dilution is estimated separately within each of the mineralized zones from contiguous blocks to blocks below the marginal cut-off grade ($48.96/t). For more detail, see Section 15.0.

The life of mine development is presented via detailed plans which also show waste storage facilities and stockpiles progression over the years in Appendix 5.2.

Table 16.9 - Life of Mine Production Details

	Year	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Mine Production																			
Dilution	(%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Mining loss	(%)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	
Total Mining																			
Ovb		1 328 480	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1 328 480
Waste		467 600	928 351	1 124 568	1 845 702	1 868 271	1 477 137	1 482 287	1 821 700	1 439 102	1 143 672	766 692	911 893	911 893	911 893	911 893	638 325		18 650 978
HG Ore		22 424	861 128	1 332 391	1 331 338	1 336 466	1 334 502	1 335 644	1 334 534	1 332 213	1 329 596	1 328 140	1 331 603	1 331 603	1 331 603	1 331 603	932 122		19 136 911
LG Ore		46	9 253	9 849	26 855	23 755	22 377	32 069	73 479	40 668	26 395	16 252	74 686	74 686	74 686	74 686	52 260		632 003
Total		**1 818 550**	**1 798 732**	**2 466 808**	**3 203 895**	**3 228 492**	**2 834 016**	**2 850 000**	**3 229 713**	**2 811 983**	**2 499 663**	**2 111 084**	**2 318 182**	**2 318 182**	**2 318 182**	**2 318 182**	**1 622 708**		**39 748 372**
SR (W:O)		20.81	1.07	0.84	1.36	1.37	1.09	1.08	1.29	1.05	0.84	0.57	0.65	0.65	0.65	0.65	0.65		0.94
Total tonne mined (5 Year Plan)		**1 818 550**					**13 531 943**					**13 502 443**					**10 895 436**		
By Rock Type	ρ																		
Ovb	1.80	1 328 480																	1 328 480
Syenite	2.77	89 850	561 266	692 452	672 602	834 087	683 126	745 760	1 108 800	903 917	755 883	308 378	670 482	670 482	670 482	670 482	469 318		10 507 368
Eudialite	2.88	19 313	693 787	1 099 509	614 993	898 153	806 533	853 842	922 993	818 897	1 071 591	948 360	882 759	882 759	882 759	882 759	617 932		12 896 940
Mozandrite	2.92	5 267	200 308	220 652	718 701	455 699	529 014	476 495	437 654	411 442	81 203	361 136	424 866	424 866	424 866	424 866	297 406		5 894 440
Britholite	2.92		6 159	5 316	38 550	14 341	24 466	44 566	69 157	143 417	193 964	23 463	121 962	121 962	121 962	121 962	85 373		1 136 619
Encaissant	2.77	375 640	337 212	448 879	1 159 049	1 026 212	790 877	729 337	691 109	534 310	397 022	469 747	218 113	218 113	218 113	218 113	152 679		7 984 525
Total		**1 818 550**	**1 798 732**	**2 466 808**	**3 203 895**	**3 228 492**	**2 834 016**	**2 850 000**	**3 229 713**	**2 811 983**	**2 499 663**	**2 111 084**	**2 318 182**	**2 318 182**	**2 318 182**	**2 318 182**	**1 622 708**	**0**	**39 748 372**
Total volume mined (m^3)		**914 601**	**635 966**	**871 193**	**1 134 118**	**1 144 419**	**1 001 725**	**1 007 444**	**1 143 836**	**993 575**	**882 527**	**741 915**	**814 576**	**814 576**	**814 576**	**814 576**	**570 196**	**0**	**14 299 819**
Total volume mined (5 Year Plan)		**914 601**					**4 787 422**					**4 769 297**					**3 828 500**		**14 299 819**
Mine (HG) grade (diluted)																			
	tonnes	22 424	861 128	1 332 391	1 331 338	1 336 466	1 334 502	1 335 644	1 334 534	1 332 213	1 329 596	1 328 140	1 331 603	1 331 603	1 331 603	1 331 603	932 122	0	19 136 911
Ce2O3	(%)	0.098%	0.126%	0.143%	0.127%	0.137%	0.136%	0.131%	0.114%	0.122%	0.121%	0.145%	0.105%	0.105%	0.105%	0.105%	0.105%		0.1220%
Dy2O3	(%)	0.013%	0.016%	0.018%	0.016%	0.017%	0.017%	0.016%	0.014%	0.015%	0.015%	0.017%	0.012%	0.012%	0.012%	0.012%	0.012%		0.0150%
Er2O3	(%)	0.009%	0.012%	0.013%	0.011%	0.012%	0.011%	0.011%	0.010%	0.010%	0.010%	0.012%	0.008%	0.008%	0.008%	0.008%	0.008%		0.0103%
Eu2O3	(%)	0.001%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.001%	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0016%
Gd2O3	(%)	0.011%	0.013%	0.015%	0.013%	0.014%	0.014%	0.013%	0.011%	0.012%	0.012%	0.014%	0.010%	0.010%	0.010%	0.010%	0.010%		0.0121%
Ho2O3	(%)	0.003%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.003%	0.003%	0.003%	0.004%	0.003%	0.003%	0.003%	0.003%	0.003%		0.0033%
La2O3	(%)	0.043%	0.056%	0.066%	0.058%	0.065%	0.065%	0.064%	0.056%	0.061%	0.062%	0.073%	0.054%	0.054%	0.054%	0.054%	0.054%		0.0600%
Lu2O3	(%)	0.001%	0.002%	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0013%
Nd2O3	(%)	0.048%	0.061%	0.068%	0.060%	0.064%	0.063%	0.060%	0.052%	0.055%	0.056%	0.066%	0.047%	0.047%	0.047%	0.047%	0.047%		0.0561%
Pr2O3	(%)	0.013%	0.016%	0.018%	0.016%	0.017%	0.017%	0.016%	0.014%	0.015%	0.015%	0.018%	0.012%	0.012%	0.012%	0.012%	0.012%		0.0149%
Sm2O3	(%)	0.011%	0.014%	0.015%	0.013%	0.014%	0.014%	0.014%	0.012%	0.012%	0.013%	0.015%	0.010%	0.010%	0.010%	0.010%	0.010%		0.0125%
Tb2O3	(%)	0.002%	0.002%	0.003%	0.002%	0.003%	0.003%	0.002%	0.002%	0.002%	0.002%	0.003%	0.002%	0.002%	0.002%	0.002%	0.002%		0.0023%
ThO2	(%)	0.015%	0.032%	0.036%	0.031%	0.032%	0.034%	0.033%	0.026%	0.027%	0.026%	0.027%	0.019%	0.019%	0.019%	0.019%	0.019%		0.0266%
Tm2O3	(%)	0.001%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0016%
UO2	(%)	0.002%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.003%	0.003%	0.003%	0.004%	0.003%	0.003%	0.003%	0.003%	0.003%		0.0033%
Y2O3	(%)	0.077%	0.106%	0.117%	0.104%	0.112%	0.106%	0.106%	0.094%	0.097%	0.098%	0.113%	0.078%	0.078%	0.078%	0.078%	0.078%		0.0962%
Yb2O3	(%)	0.008%	0.011%	0.012%	0.011%	0.011%	0.011%	0.011%	0.010%	0.010%	0.010%	0.011%	0.008%	0.008%	0.008%	0.008%	0.008%		0.0098%
TREO	(%)	0.339%	0.442%	0.496%	0.441%	0.476%	0.464%	0.454%	0.397%	0.420%	0.422%	0.496%	0.353%	0.353%	0.353%	0.353%	0.353%		0.4189%
Stockpiling (LG) grade (diluted)																			
	tonnes	46	9 253	9 849	26 855	23 755	22 377	32 069	73 479	40 668	26 395	16 252	74 686	74 686	74 686	74 686	52 260	0	632 003
Ce2O3	(%)	0.032%	0.053%	0.045%	0.045%	0.046%	0.048%	0.046%	0.049%	0.046%	0.048%	0.050%	0.043%	0.043%	0.043%	0.043%	0.043%		0.0452%
Dy2O3	(%)	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%		0.0054%
Er2O3	(%)	0.004%	0.003%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%		0.0039%
Eu2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0006%
Gd2O3		0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.005%	0.004%	0.004%	0.005%	0.005%	0.004%	0.004%	0.004%	0.004%	0.004%		0.0044%
Ho2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0012%
La2O3		0.014%	0.027%	0.022%	0.021%	0.022%	0.023%	0.022%	0.025%	0.023%	0.024%	0.025%	0.022%	0.022%	0.022%	0.022%	0.022%		0.0226%
Lu2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0008%
Nd2O3	(%)	0.018%	0.025%	0.022%	0.022%	0.022%	0.022%	0.022%	0.023%	0.022%	0.023%	0.024%	0.021%	0.021%	0.021%	0.021%	0.021%		0.0216%
Pr2O3		0.005%	0.007%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.005%	0.005%	0.005%	0.005%	0.005%		0.0057%
Sm2O3		0.004%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%		0.0047%
Tb2O3		0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0008%
ThO2		0.016%	0.009%	0.018%	0.015%	0.012%	0.012%	0.016%	0.015%	0.016%	0.013%	0.020%	0.013%	0.013%	0.013%	0.013%	0.013%		0.0135%
Tm2O3		0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0007%
UO2	(%)	0.002%	0.002%	0.002%	0.003%	0.002%	0.002%	0.002%	0.002%	0.002%	0.001%	0.002%	0.001%	0.001%	0.001%	0.001%	0.001%		0.0015%
Y2O3	(%)	0.032%	0.035%	0.036%	0.032%	0.033%	0.034%	0.035%	0.034%	0.034%	0.034%	0.036%	0.036%	0.036%	0.036%	0.036%	0.036%		0.0354%
Yb2O3	(%)	0.005%	0.004%	0.004%	0.005%	0.004%	0.004%	0.005%	0.004%	0.005%	0.004%	0.004%	0.005%	0.005%	0.005%	0.005%	0.005%		0.0046%
TREO	(%)	0.127%	0.172%	0.155%	0.152%	0.155%	0.160%	0.159%	0.163%	0.158%	0.161%	0.168%	0.156%	0.156%	0.156%	0.156%	0.156%		0.1575%
Total tonnes moved		**1 818 550**	**1 798 732**	**2 466 808**	**3 203 895**	**3 228 492**	**2 834 016**	**2 850 000**	**3 229 713**	**2 811 983**	**2 499 663**	**2 111 084**	**2 318 182**	**2 318 182**	**2 318 182**	**2 318 182**	**2 022 836**	**231 875**	**40 380 375**
Total volume moved (m^3)		**914 601**	**635 966**	**871 193**	**1 134 118**	**1 144 419**	**1 001 725**	**1 007 444**	**1 143 836**	**993 575**	**882 527**	**741 915**	**814 576**	**814 576**	**814 576**	**814 576**	**711 366**	**81 808**	**14 522 797**

16.6.3 MILL FEED

The mill feed will be constituted of ore transported from the mine to the mill taking into account the ramp-up period plus the ore reclaimed from the low grade stockpile. Table 16.10 presents the mill feed per rare earth oxide per year, as well as the origin of the mill feed per rock type (syenite, eudialyte, mosandrite, and britholite).

Mill ramp up has been considered at 66% for the first Year. More details about the first year of production are discussed in Section 16.6.4- Short Term Planning.

The ore is split in two categories: high grade (HG) and low grade (LG) ore. The HG ore corresponds to the mineralized material that returns a TREO value higher than the break-even cut-off value of $60.70/t. The HG ore represents 19,136,911 tonnes @ 0.4189% TREO and will be processed first from Year 1 to Year 15. The LG ore corresponds to the mineralized material portion between the HG ore and the marginal cut-off value of $48.96/t. The LG ore represents 632,003 tonnes @ 0.1575% TREO will be reclaimed from the stockpile between Year 15 and Year 16. The overall mill feed represents 19,768,914 @ 0.4105% TREO.

Using the recoveries from the metallurgical testwork on July 22nd, 2013 provided by Matamec, Table 16.11 shows the production details per oxide element and the revenue per year expected throughout the mine life. The production values per oxide are obtained by multiplying the mill feed of each element with its associated grade and with the overall mill recoveries (the magnetic separation and the leaching recoveries). The production details per oxide are estimated for every year.

MATAMEC

Table 16.10 - Mill Feed Plan Details

	Year	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Mill Feed Production																			
Working days		365	365	365	366	365	365	365	366	365	365	365	366	365	365	365	366	64	5 908
Mill theoretical capacity		0	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	1 332 250	21 316 000
Mill Production ramp-up (%)		0%	66%	100.0%	99.9%	100.3%	100.2%	100.3%	100.2%	100.0%	99.8%	99.7%	100.0%	100.0%	100.0%	100.0%	100.0%	17.4%	92.7%
Cumulative stockpile	**(t)**	**46**	**9 299**	**19 148**	**46 003**	**69 758**	**92 135**	**124 204**	**197 683**	**238 351**	**264 746**	**280 998**	**355 684**	**430 370**	**505 057**	**579 743**	**231 875**	**0**	
tonnes		46	9 299	19 148	46 003	69 758	92 135	124 204	197 683	238 351	264 746	280 998	355 684	430 370	505 057	579 743	231 875	0	
Ce2O3	(%)	0.032%	0.053%	0.049%	0.047%	0.047%	0.047%	0.047%	0.048%	0.047%	0.047%	0.047%	0.047%	0.046%	0.046%	0.045%	0.045%		
Dy2O3	(%)	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%		
Er2O3	(%)	0.004%	0.003%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%		
Eu2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		
Gd2O3	(%)	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%		
Ho2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		
La2O3	(%)	0.014%	0.027%	0.025%	0.022%	0.022%	0.022%	0.022%	0.023%	0.023%	0.023%	0.023%	0.023%	0.023%	0.023%	0.023%	0.023%		
Lu2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		
Nd2O3	(%)	0.018%	0.025%	0.023%	0.022%	0.022%	0.022%	0.022%	0.022%	0.022%	0.022%	0.023%	0.022%	0.022%	0.022%	0.022%	0.022%		
Pr2O3	(%)	0.005%	0.007%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%		
Sm2O3	(%)	0.004%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%		
Tb2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		
Tm2O3	(%)	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%		
Y2O3	(%)	0.032%	0.035%	0.035%	0.034%	0.033%	0.034%	0.034%	0.034%	0.034%	0.034%	0.034%	0.035%	0.035%	0.035%	0.035%	0.035%		
Yb2O3	(%)	0.005%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.005%	0.005%	0.005%	0.005%		
TREO	(%)	0.127%	0.172%	0.163%	0.157%	0.156%	0.157%	0.158%	0.160%	0.159%	0.160%	0.160%	0.159%	0.158%	0.158%	0.158%	0.158%		
Reclaiming	**(t)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**400 128**	**231 875**	**632 003**
tonnes		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	400 128	231 875	632 003
Ce2O3	(%)																0.045%	0.045%	0.0452%
Dy2O3	(%)																0.005%	0.005%	0.0054%
Er2O3	(%)																0.004%	0.004%	0.0039%
Eu2O3	(%)																0.001%	0.001%	0.0006%
Gd2O3	(%)																0.004%	0.004%	0.0044%
Ho2O3	(%)																0.001%	0.001%	0.0012%
La2O3	(%)																0.023%	0.023%	0.0226%
Lu2O3	(%)																0.001%	0.001%	0.0008%
Nd2O3	(%)																0.022%	0.022%	0.0216%
Pr2O3	(%)																0.006%	0.006%	0.0057%
Sm2O3	(%)																0.005%	0.005%	0.0047%
Tb2O3	(%)																0.001%	0.001%	0.0008%
Tm2O3	(%)																0.001%	0.001%	0.0007%
Y2O3	(%)																0.035%	0.035%	0.0354%
Yb2O3	(%)																0.005%	0.005%	0.0046%
TREO	(%)																0.158%	0.158%	0.1575%
Total volume reclaimed	**(m^3)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**141 170**	**81 808**	**222 978**
MILL FEED*																			
Syenite	(t)	0	10 311	15 400	23 821	0	0	350	1 750	6 300	10 177	2 100	3 397	3 397	3 397	3 397	2 378	0	86 176
Eudialite	(t)	0	708 780	1 098 789	613 000	895 610	801 446	841 246	884 771	807 018	1 051 784	946 177	846 512	846 512	846 512	846 512	592 558	0	12 627 227
Mozandrite	(t)	0	164 096	215 214	682 708	432 282	513 390	452 131	379 916	375 551	73 671	356 765	375 776	375 776	375 776	375 776	263 043	0	5 411 872
Britholite	(t)	0	365	2 988	11 809	8 574	19 666	41 917	68 097	143 344	193 964	23 098	105 918	105 918	105 918	105 918	74 143	0	1 011 636
Reclaiming	(t)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	400 128	231 875	632 003
Total Rock	**(t)**	**0**	**883 552**	**1 332 391**	**1 331 338**	**1 336 466**	**1 334 502**	**1 335 644**	**1 334 534**	**1 332 213**	**1 329 596**	**1 328 140**	**1 331 603**	**1 331 603**	**1 331 603**	**1 331 603**	**1 332 250**	**231 875**	**19 768 914**
Grade	**(%)**	**0.000%**	**0.439%**	**0.496%**	**0.441%**	**0.476%**	**0.464%**	**0.454%**	**0.397%**	**0.420%**	**0.422%**	**0.496%**	**0.353%**	**0.353%**	**0.353%**	**0.353%**	**0.294%**	**0.158%**	**0.4105%**
Milling Rate	**(tpd)**	**0**	**2 421**	**3 650**	**3 638**	**3 662**	**3 656**	**3 659**	**3 646**	**3 650**	**3 643**	**3 639**	**3 638**	**3 648**	**3 648**	**3 648**	**3 640**	**3 650**	**3 346**
Mine Feed grade per element (diluted)																			
Ce2O3	(%)		0.126%	0.143%	0.127%	0.137%	0.136%	0.131%	0.114%	0.122%	0.121%	0.145%	0.105%	0.105%	0.105%	0.105%	0.087%	0.045%	0.1196%
Dy2O3	(%)		0.016%	0.018%	0.016%	0.017%	0.017%	0.016%	0.014%	0.015%	0.015%	0.017%	0.012%	0.012%	0.012%	0.012%	0.010%	0.005%	0.0147%
Er2O3	(%)		0.011%	0.013%	0.011%	0.012%	0.011%	0.011%	0.010%	0.010%	0.010%	0.012%	0.008%	0.008%	0.008%	0.008%	0.007%	0.004%	0.0101%
Eu2O3	(%)		0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.001%	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.0015%
Gd2O3	(%)		0.013%	0.015%	0.013%	0.014%	0.014%	0.013%	0.011%	0.012%	0.012%	0.014%	0.010%	0.010%	0.010%	0.010%	0.008%	0.004%	0.0119%
Ho2O3	(%)		0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.003%	0.003%	0.003%	0.004%	0.003%	0.003%	0.003%	0.003%	0.002%	0.001%	0.0032%
La2O3	(%)		0.056%	0.066%	0.058%	0.065%	0.065%	0.064%	0.056%	0.061%	0.062%	0.073%	0.054%	0.054%	0.054%	0.054%	0.045%	0.023%	0.0588%
Lu2O3	(%)		0.002%	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.0013%
Nd2O3	(%)		0.060%	0.068%	0.060%	0.064%	0.063%	0.060%	0.052%	0.055%	0.056%	0.066%	0.047%	0.047%	0.047%	0.047%	0.040%	0.022%	0.0550%
Pr2O3	(%)		0.016%	0.018%	0.016%	0.017%	0.017%	0.016%	0.014%	0.015%	0.015%	0.018%	0.012%	0.012%	0.012%	0.012%	0.010%	0.006%	0.0146%
Sm2O3	(%)		0.014%	0.015%	0.013%	0.014%	0.014%	0.014%	0.012%	0.012%	0.013%	0.015%	0.010%	0.010%	0.010%	0.010%	0.009%	0.005%	0.0123%
Tb2O3	(%)		0.002%	0.003%	0.002%	0.003%	0.003%	0.002%	0.002%	0.002%	0.002%	0.003%	0.002%	0.002%	0.002%	0.002%	0.002%	0.001%	0.0022%
Tm2O3	(%)		0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.0016%
Y2O3	(%)		0.105%	0.117%	0.104%	0.112%	0.106%	0.106%	0.094%	0.097%	0.098%	0.113%	0.078%	0.078%	0.078%	0.078%	0.065%	0.035%	0.0943%
Yb2O3	(%)		0.011%	0.012%	0.011%	0.011%	0.011%	0.011%	0.010%	0.010%	0.010%	0.011%	0.008%	0.008%	0.008%	0.008%	0.007%	0.005%	0.0096%
TREO	**(%)**	**0.000%**	**0.439%**	**0.496%**	**0.441%**	**0.476%**	**0.464%**	**0.454%**	**0.397%**	**0.420%**	**0.422%**	**0.496%**	**0.353%**	**0.353%**	**0.353%**	**0.353%**	**0.294%**	**0.158%**	**0.4105%**

* The small ore production (22 kt) produced in Year -1 will be processed in Year 1

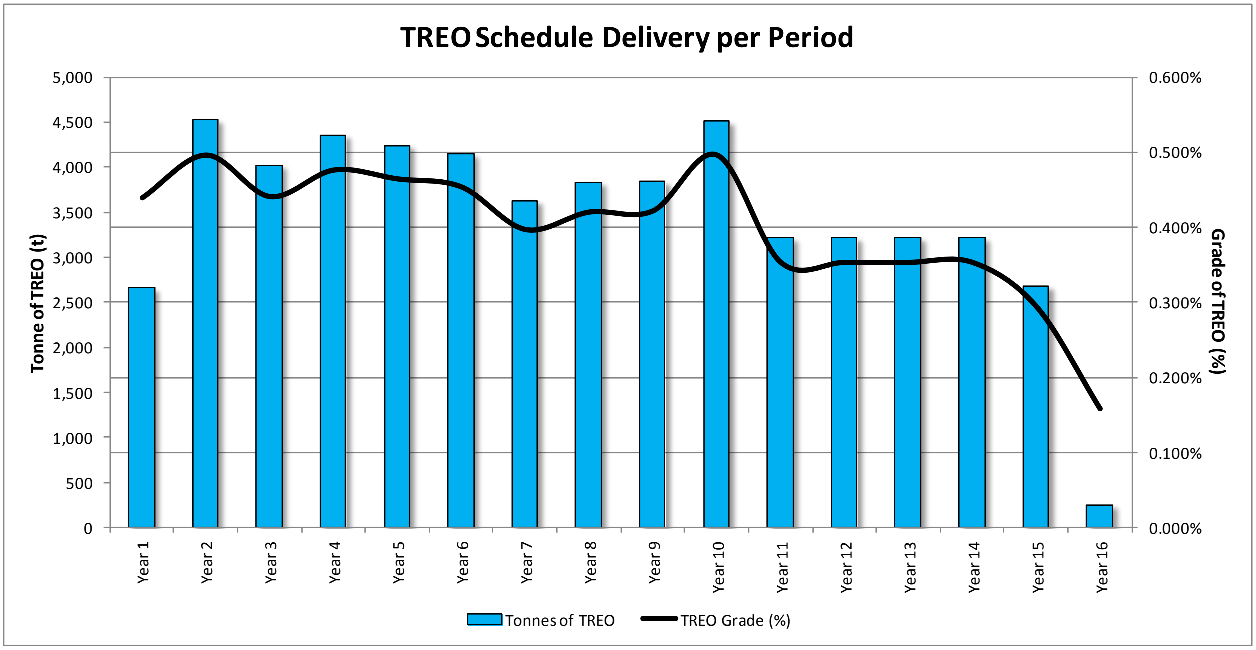
Table 16.11 - Production Details per Elements and Potential Revenue[9]

	Mining & Processing																								
		PP-3	**PP-2**	**PP-1**	**Q1 Y1**	**Q2 Y1**	**Q3 Y1**	**Q4 Y1**	**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**	**Total**
	Processing																								
	Mill Feed (t)	0	0	0	150,780	172,571	257,646	302,562	883,552	1,332,391	1,331,338	1,336,466	1,334,502	1,335,644	1,334,534	1,332,213	1,329,596	1,328,140	1,331,603	1,331,603	1,331,603	1,331,603	1,332,250	231,875	**19,768,914**
	TREO Grade (%)			*0.000%*	*0.396%*	*0.390%*	*0.458%*	*0.477%*	*0.439%*	*0.496%*	*0.441%*	*0.476%*	*0.464%*	*0.454%*	*0.397%*	*0.420%*	*0.422%*	*0.496%*	*0.353%*	*0.353%*	*0.353%*	*0.353%*	*0.294%*	*0.158%*	*0.4105%*
	Magnetic Recovery (%)	Leach Recovery (%)		**TREO Production (tonnes)**																					
Ce2O3	85%	77%		0	111	128	220	269	727	1,246	1,111	1,202	1,190	1,150	996	1,066	1,054	1,264	912	912	912	912	757	69	**15,479**
La2O3	85%	80%		0	51	59	102	126	337	603	528	592	597	588	512	559	565	665	491	491	491	491	406	36	**7,952**
Nd2O3	85%	77%		0	55	61	106	129	349	590	523	564	549	526	457	484	486	575	413	413	413	413	346	33	**7,132**
Pr2O3	85%	79%		0	15	17	29	35	94	159	142	152	150	143	124	132	132	156	111	111	111	111	93	9	**1,930**
Sm2O3	85%	82%		0	13	14	25	31	83	141	123	134	129	125	109	114	116	135	95	95	95	95	80	8	**1,679**
Eu2O3	85%	83%		0	2	2	3	4	11	18	16	17	17	16	14	15	15	18	12	12	12	12	10	1	**215**
Gd2O3	85%	85%		0	13	14	25	31	83	142	124	136	130	126	110	116	118	137	96	96	96	96	80	7	**1,696**
Tb2O3	85%	86%		0	3	3	5	6	16	27	24	26	25	24	21	22	23	26	18	18	18	18	15	1	**321**
Dy2O3	85%	87%		0	16	18	32	40	106	179	156	172	164	161	142	147	151	171	120	120	120	120	100	9	**2,137**
Ho2O3	85%	87%		0	4	4	7	9	24	40	35	38	36	36	32	33	34	38	26	26	26	26	22	2	**474**
Er2O3	85%	85%		0	11	13	22	27	73	121	108	115	109	109	97	99	101	114	80	80	80	80	67	7	**1,437**
Tm2O3	85%	81%		0	2	2	3	4	11	18	16	17	16	16	14	15	15	17	12	12	12	12	10	1	**211**
Yb2O3	85%	75%		0	10	11	19	23	62	98	92	94	89	90	81	82	81	93	69	69	69	69	60	7	**1,206**
LuO3	85%	62%		0	1	1	2	3	7	11	11	11	10	10	9	9	9	10	8	8	8	8	7	1	**138**
Y2O3	85%	85%		0	103	114	206	253	674	1,134	1,008	1,090	1,028	1,026	907	938	942	1,089	750	750	750	750	628	60	**13,522**
TREO				**0**	**409**	**461**	**807**	**989**	**2,657**	**4,526**	**4,017**	**4,358**	**4,240**	**4,147**	**3,626**	**3,830**	**3,839**	**4,509**	**3,212**	**3,212**	**3,212**	**3,212**	**2,679**	**250**	**55,529**
	Potential Revenue																								
	Amount ('000)			$ -					$ 138,153	$ 232,213	$ 205,388	$ 222,141	$ 212,768	$ 208,939	$ 183,711	$ 191,022	$ 193,739	$ 223,250	$ 156,984	$ 156,984	$ 156,984	$ 156,984	$ 131,618	$ 12,593	**$2,783,471**
	$/Kg TREO			*#DIV/0!*					*$51.99*	*$51.30*	*$51.13*	*$50.98*	*$50.18*	*$50.38*	*$50.66*	*$49.87*	*$50.46*	*$49.51*	*$48.87*	*$48.87*	*$48.87*	*$48.87*	*$49.12*	*$50.45*	*$50.13*
	$/ t Processed			*#DIV/0!*					*$156.36*	*$174.28*	*$154.27*	*$166.22*	*$159.44*	*$156.43*	*$137.66*	*$143.39*	*$145.71*	*$168.09*	*$117.89*	*$117.89*	*$117.89*	*$117.89*	*$98.79*	*$54.31*	*$140.80*
	Production Cost																								
	Amount ('000)			$0					$65,378	$77,348	$78,773	$79,013	$78,227	$78,401	$79,254	$80,684	$77,795	$77,090	$77,402	$77,025	$77,764	$77,630	$76,208	$22,672	**$1,180,665**
	$/ Kg TREO								*$24.60*	*$17.09*	*$19.61*	*$18.13*	*$18.45*	*$18.90*	*$21.86*	*$21.06*	*$20.26*	*$17.10*	*$24.09*	*$23.98*	*$24.21*	*$24.17*	*$28.44*	*$90.84*	*$21.26*
	$/t Processed								*$73.99*	*$58.05*	*$59.17*	*$59.12*	*$58.62*	*$58.70*	*$59.39*	*$60.56*	*$58.51*	*$58.04*	*$58.13*	*$57.84*	*$58.40*	*$58.30*	*$57.20*	*$97.78*	*$59.72*

[9] TREO production (tonnes) is based on mill feed grade calculations for each REO and may slightly differ from mineral reserves estimate. Differences in “$/t Processed” in this table ($140.80) and calculated based on mineral reserves ($141.56, Section 15.0) is less than 0.5%.

To correlate to the production details per element and revenue (Table 16.11), Figure 16.17 illustrates the TREO schedule delivery per year from the mine feed plan.

Figure 16.17 - TREO Schedule Delivery per Year



From this graph, it can be noted that a higher tonnage of TREO is anticipated at the start of the production and generally steadily decrease over the life of mine. This is partly due to the natural geology of the deposit but also the high grading of Phase 1 to obtain higher revenues at the beginning of production and a shorter payback period.

Figure 16.18 illustrates the percentage of rare earth oxides' relative to the TREO production. This figure demonstrates that more than three-quarters (75%) of the TREO are produced from Ce_2O_3, Y_2O_3, La_2O_3, and Nd_2O_3 with 28%, 24%, 14%, and 13%, respectively.

Finally, Figure 16.19 illustrates the percentage of rare earth oxides relative the total TREO potential revenues. Here, potential revenues assume 100% of all REO are sold, when only a fraction of four (4) REO (Er_2O_3, Tm_2O_3, Yb_2O_3, LuO_3) are assumed to be sold in the economic model (Section 22.0).The main contributors for the potential TREO revenue at Kipawa are attributed to the heavy rare earth oxide (HREO) with 69%, as seen in Figure 16.19. The main revenue contributors are Dy_2O_3, Nd_2O_3, Y_2O_3, and Tb_2O_3.

In summary, based on Figure 16.19, it appears that LREO, HREO, and Yttrium represent 21%, 69% and 10% of the potential revenue, respectively.

Figure 16.18 - Rare Earth Oxides Relative Production

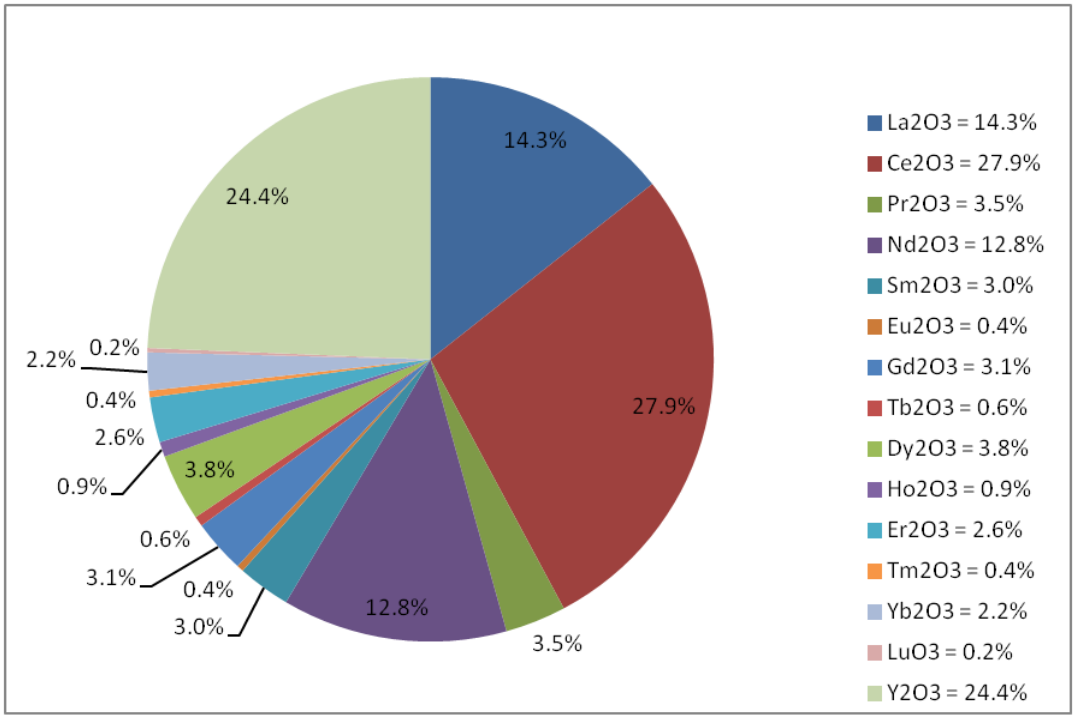
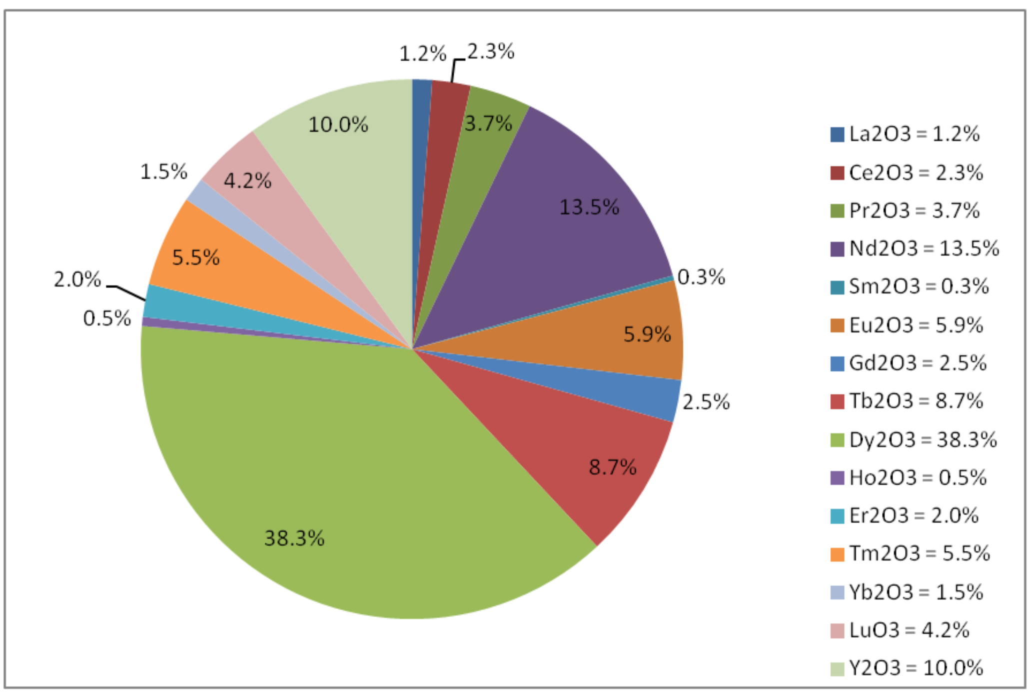


Figure 16.19 - Rare Earth Oxides Relative Potential Revenue



16.6.4 SHORT-TERM PLANNING

The pre-production period will remove 1,328,000 tonnes of overburden and around 470,000 tonnes of waste. This waste will be used to build infrastructure such as the starter MagSep berm, the roads, and the stockpile floors (See Table 16.7 for details). Around 22,000 tonnes of ore are also expected to be recovered but will only be sent to the mill during the following year (Year 1). The short term mining scenario shows an increase in ore feed from quarter to quarter to allow a progressive mill ramp up production The ramp up production per quarter is 45%, 52%, 77% and 91% respectively for Q1, Q2 Q3 and Q4. In the first year of production, it is estimated that the ramp up production in the mills will average around 66% of the normal production (883,500 tonnes). To take in consideration the potential issues linked with the initial start-up of a new milling operation, both mine production and grades will be steadily increasing over this first year. Table 16.12 presents a realistic production plan which takes into consideration the possible additional requirement of waste to complete the infrastructures in the first quarter and also the progressive increase of ore production and grade during the mill ramp-up period.

Figure 16.20 to Figure 16.23 present the mining development per quarter for the first year of operation.

At the beginning of the second year of production, both mine and mill will be operating at full capacity.

Table 16.12 - Short-Term Plan Detailed per Quarter with Pre-Production

	Year	-1	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	1 TOTAL
Short Term Production							
Working days		365	91	91	91	91	365
Mill theoretical capacity		0	333 063	333 063	333 063	333 063	1 332 250
Mill Throughput objective		0	150 780	172 571	257 646	302 562	883 559
Mill Production ramp-up (%)		0%	45%	52%	77%	91%	66%
Total Mining							
Ovb		1 328 480	0	0	0	0	0
Waste		467 600	143 247	188 279	280 582	316 243	928 351
HG Ore		22 424	128 354	172 569	257 644	302 560	861 128
LG Ore		46	1 492	4 189	732	2 840	9 253
Total		**1 818 550**	**273 093**	**365 037**	**538 958**	**621 643**	**1 798 732**
SR (W:O)		20.81	1.10	1.07	1.09	1.04	1.07
By Rock Type	ρ						
Ovb	1.80	1 328 480					
Syenite	2.77	89 850	100 137	117 143	154 759	189 229	561 266
Eudialite	2.88	19 313	109 528	131 508	207 284	245 468	693 787
Mozandrite	2.92	5 267	23 513	46 529	65 848	64 418	200 308
Britholite	2.92				5 839	320	6 159
Encaissant	2.77	375 640	39 916	69 858	105 229	122 209	337 212
Total		**1 818 550**	**273 093**	**365 037**	**538 958**	**621 643**	**1 798 732**
Total volume mined (m³)		**914 601**	**96 643**	**129 106**	**190 382**	**219 835**	**635 966**
Total volume moved (m³)		**914 601**	**96 643**	**129 106**	**190 382**	**219 835**	**635 966**
MILL FEED*							
Syenite	(t)	0	321	5 526	2 123	2 341	10 311
Eudialite	(t)	0	128 483	129 710	207 286	243 310	708 780
Mozandrite	(t)	0	21 976	37 335	47 872	56 911	164 096
Britholite	(t)	0	0	0	365	0	365
Reclaiming	(t)	0	0	0	0	0	0
Total Rock	**(t)**	**0**	**150 780**	**172 571**	**257 646**	**302 562**	**883 552**
Grade	**(%)**	**0.000%**	**0.396%**	**0.390%**	**0.458%**	**0.477%**	**0.439%**
Milling Rate	**(tpd)**	**0**	**1 652**	**1 891**	**2 824**	**3 316**	**2 421**
Mine Feed grade per element (diluted)							
Ce2O3	(%)		0.113%	0.113%	0.131%	0.136%	0.126%
Dy2O3	(%)		0.015%	0.014%	0.017%	0.018%	0.016%
Er2O3	(%)		0.011%	0.010%	0.012%	0.012%	0.011%
Eu2O3	(%)		0.002%	0.002%	0.002%	0.002%	0.002%
Gd2O3	(%)		0.012%	0.012%	0.013%	0.014%	0.013%
Ho2O3	(%)		0.003%	0.003%	0.004%	0.004%	0.004%
La2O3	(%)		0.050%	0.050%	0.058%	0.061%	0.056%
Lu2O3	(%)		0.001%	0.001%	0.002%	0.002%	0.002%
Nd2O3	(%)		0.055%	0.054%	0.063%	0.065%	0.060%
Pr2O3	(%)		0.014%	0.014%	0.017%	0.017%	0.016%
Sm2O3	(%)		0.012%	0.012%	0.014%	0.015%	0.014%
Tb2O3	(%)		0.002%	0.002%	0.003%	0.003%	0.002%
ThO2	(%)		0.026%	0.029%	0.031%	0.037%	0.032%
Tm2O3	(%)		0.002%	0.002%	0.002%	0.002%	0.002%
UO2	(%)		0.004%	0.003%	0.004%	0.004%	0.004%
Y2O3	(%)		0.094%	0.091%	0.110%	0.115%	0.105%
Yb2O3	(%)		0.010%	0.010%	0.012%	0.012%	0.011%
TREO	**(%)**	**0.000%**	**0.396%**	**0.390%**	**0.458%**	**0.477%**	**0.439%**

* The small ore production (22 kt) produced in Year -1 will be processed in Year 1

Figure 16.20 - Production Plan: Year1, Quarter 1

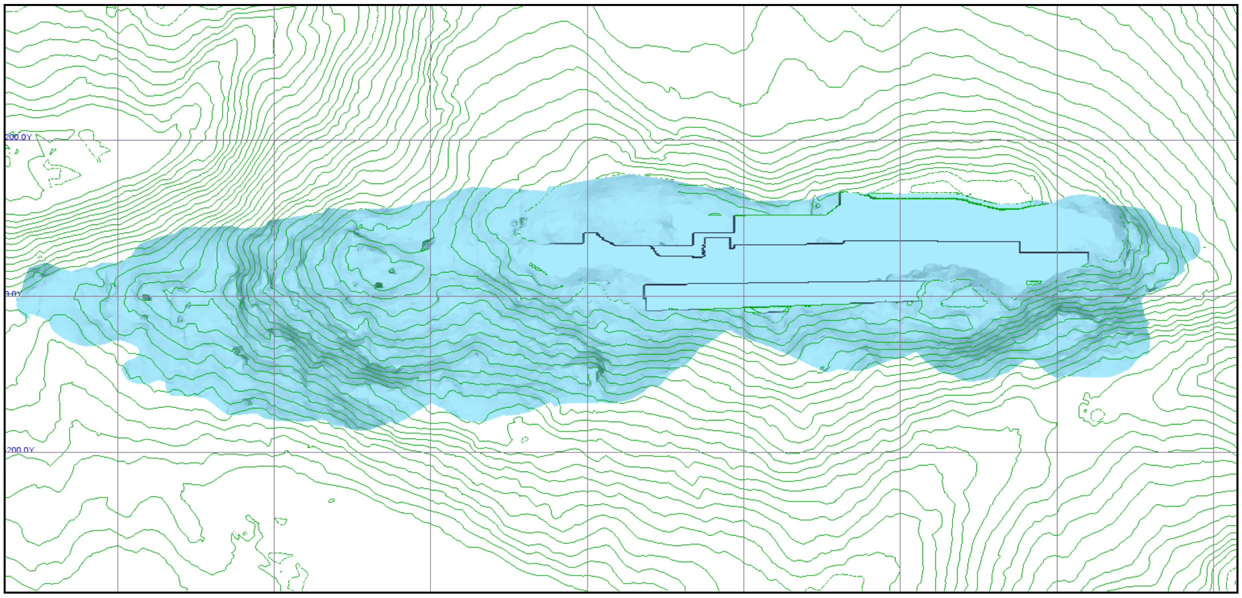


Figure 16.21 - Production Plan: Year1, Quarter 2

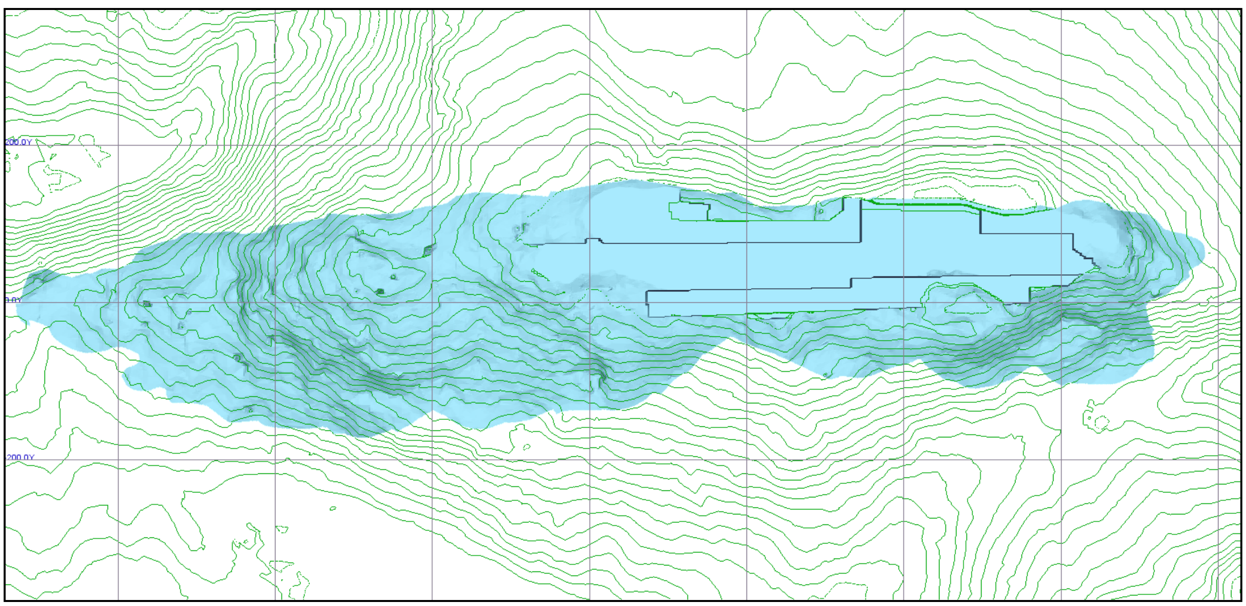


Figure 16.22 - Production Plan: Year1, Quarter 3

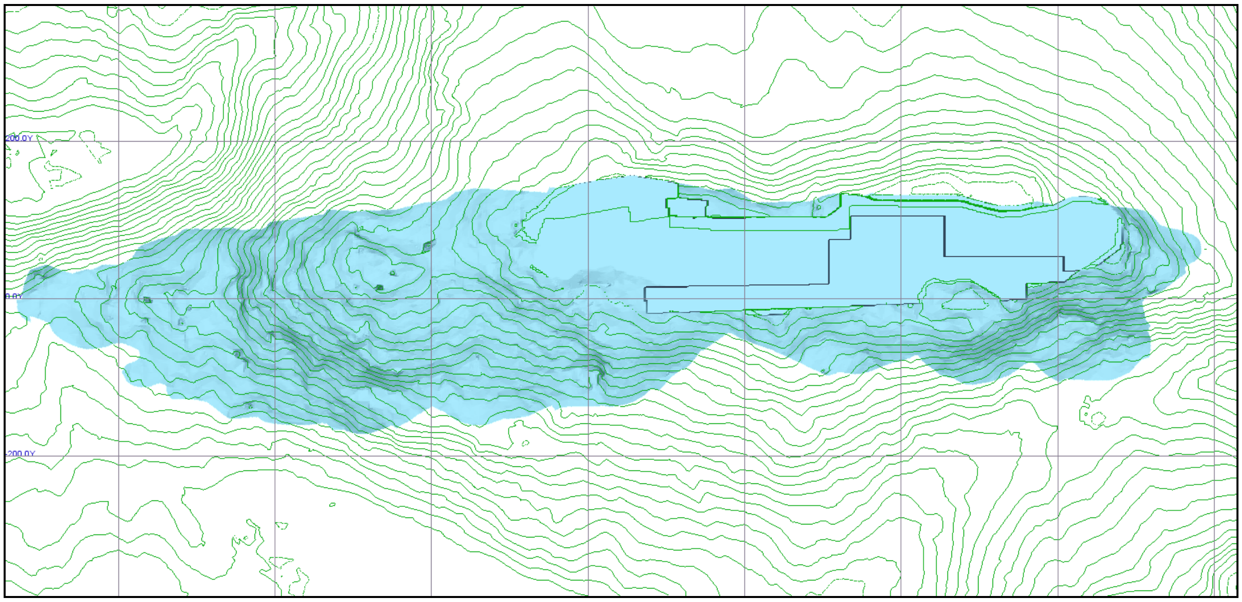
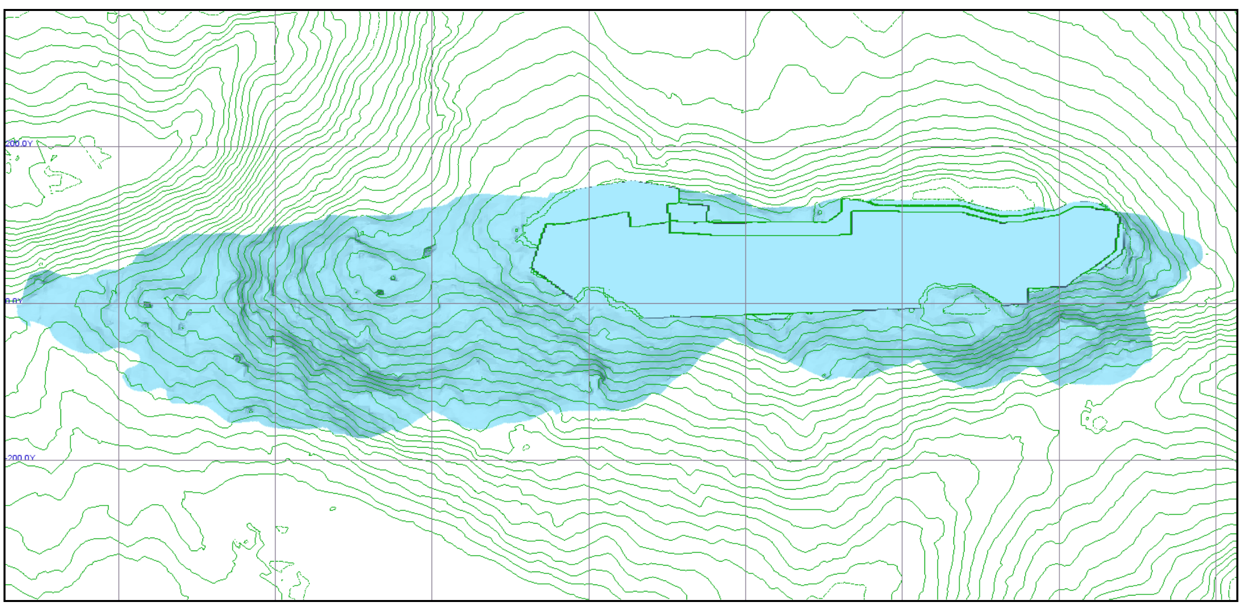


Figure 16.23 - Production Plan: Year1, Quarter 4



16.7 Equipment Selection and Open Pit Mine Operations

16.7.1 EQUIPMENT SELECTION CRITERIA

The mining equipment was selected based on the mining method and the required productivity. Suppliers were contacted and submitted budgetary quotations for major equipment. The auxiliary equipment was selected to match the production equipment based on experience of similar operations.

16.7.2 EQUIPMENT AVAILABILITY AND USAGE

Delays in the mining operation are estimated at 3 hours per day, yielding 21 working hours per day. When taking into account fleet availability and operator efficiency, the net operating hours estimated are 14.8 hours per day. For the ore re-handling fleet, which will operate only by day due to the crusher availability, the net operating hours are estimated to be 7.8 hours per day. Table 16.14 describes how the “Hours per Year” were evaluated for the equipment and the last column is the expected mine life provided by the manufacturer.

16.7.3 DRILLING AND BLASTING

A down-the-hole drill will be used for production drilling, presplit purposes, and drainage holes. The planned hole diameter is 114.3 mm (4.5“), with a hole depth of 5 m and an additional 0.91 m of sub-drill. As drilling pattern, the burden and spacing is planned to be 3.14 m by 3.63 m, respectively. All other drilling and blasting designed information is presented in Table 16.13. The proposed model for this drill is the Sandvik DR540 DTH drill or equivalent. Daily drilling needs have been estimated at 270 m, including pre-slitting and potential redrills, which will require one (1) drill rig working both day and night shifts.

Horizontal drainage drilling will also be performed at regular intervals on every second bench (10 m) to remove water pressure build-up inside the bench.

Table 16.13 - Drill and Blast Design Parameters

Data		Value	Unit
Geology			
	Rock type:	Syenite	
	Density:	2.86	t/m^3
	P-Wave velocity:	3500-7000	m/s
Physical			
	Blasting type:	Bench blasting	
	Height:	5	m
	Humid hole %:	0.75	
	Tonnage per blast:	49 630	t
Drilling			
	Hole diameter:	114.3	mm
	Burden:	3.14	m
	Spacing:	3.63	m
	Sub-drill:	0.9	m
	Hole depth:	5.9	m
	Drilling yield factor:	26.8	m/m^3
	ROP:	47.7	m/h
Explosive and Accessories			
	Explosive type:	Bulk Emulsion	
	Density:	1.2	g/cm^3
	VOD:	5 000	m/s
	Initiation system type:	Non Electric cap	
	Delay:	42-500ms	
	Detonator length:	8.0	m
	Hole collar:	2.2	m
	Stemming type:	Crushed 10 mm	
	Explosive column:	3.7	m
	Total consumption per blast:	13 940	kg
	Mass Powder Factor:	0.281	kg/t

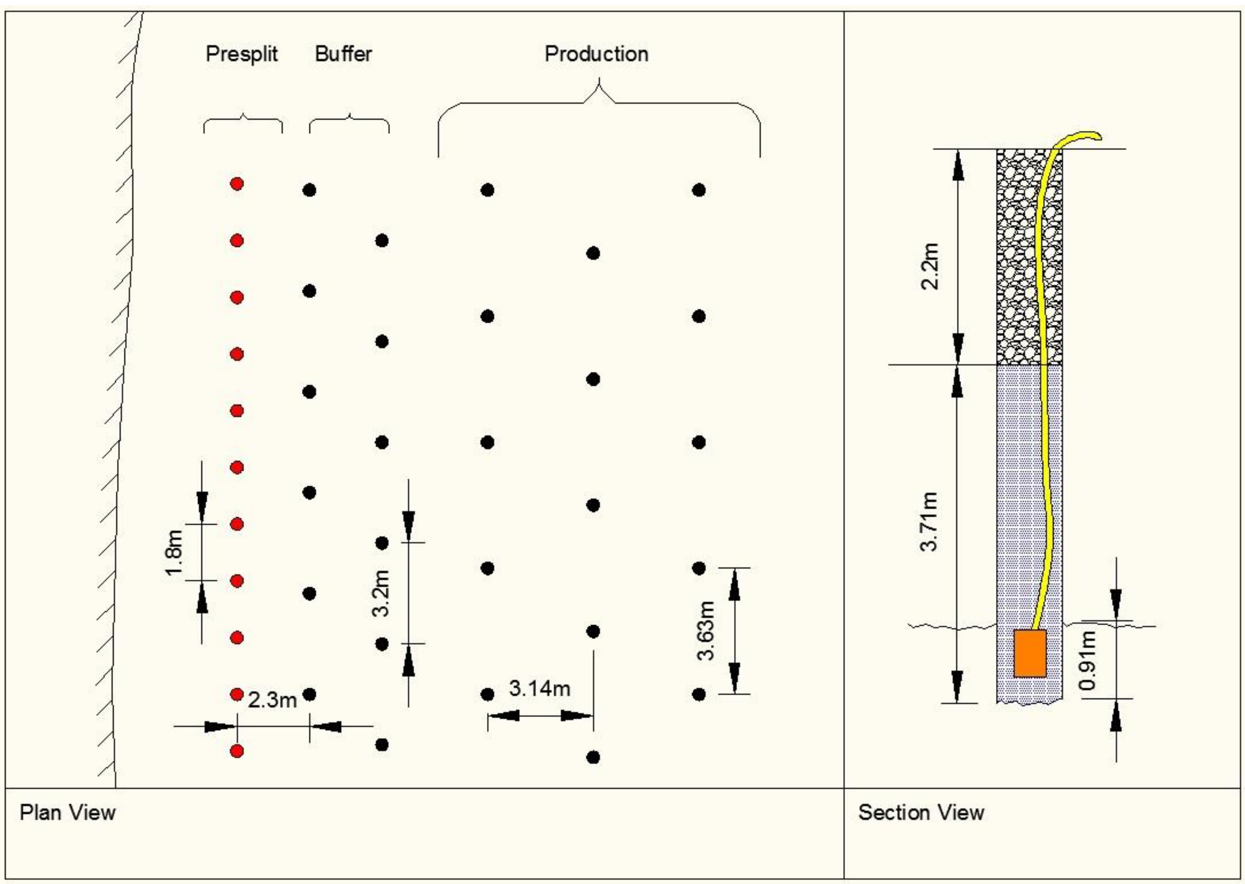
Table 16.14 - Overall Equipment Effectiveness and Expected Life

Equipment	Scheduled Hours	Availability	Available Hours	Use of Availability	Gross Operating Hours	Effectiveness	Net Daily Operating Hours	Hours per Year	Expected Life (Hours)
Hydraulic Excavator	24	80%	19.2	95%	18.2	90%	14.8	5401	32,500
Off-Highway Truck	24	80%	19.2	95%	18.2	90%	14.8	5401	42,000
Off Road Hauler	12	80%	9.6	95%	9.1	90%	7.8	2859	50,000
Wheel Loader	24	80%	19.2	95%	18.2	90%	14.8	5401	36,000
Auxiliary Excavator	24	85%	20.4	50%	10.2	87%	8.9	3241	24,500
Dozer	24	85%	20.4	75%	15.3	86%	13.2	4806	28,000
Grader	24	85%	20.4	50%	10.2	86%	8.8	3204	24,500
Water Truck	24	85%	20.4	40%	8.2	65%	5.3	1937	42,000
Fuel & Lube Truck	24	85%	20.4	45%	9.2	83%	7.6	2783	25,000
Pickup Truck	24	85%	20.4	50%	10.2	85%	8.7	3167	15,000
DTH Drill	24	80%	19.2	95%	18.2	90%	16.4	5996	40,000
Pump	24	85%	20.4	25%	5.1	85%	4.3	1583	20,000
Lowbed	24	85%	20.4	25%	5.1	85%	4.3	1583	25,000
Stemming Loader	24	85%	20.4	50%	10.2	85%	8.7	3167	12,500
Mechanic Field Service Truck	24	85%	20.4	50%	10.2	85%	8.7	3167	25,000
Worker Shuttle Bus	24	80%	19.2	95%	18.2	90%	16.4	5996	25,000
Portable Diesel Lights	24	85%	20.4	50%	10.2	85%	8.7	3167	25,000

It is expected that there will be about one production blast per week, not counting the pre-splitting. The explosives will be contracted from a supplier. This supplier will provide the required infrastructure and an emulsion truck. Whenever a blast is scheduled the supplier will bring the truck to the loading area and company blasters will assist the loading, will connect, and will initiate the blast.

All production holes will be single primed with a total non-electrical initiation system. This safe and productive initiation method offers safety and wide operational flexibility. The selected explosive product for production blasts will be bulk emulsion, except for the pre-split holes which will use packaged emulsion. The typical blast pattern developed for the project is illustrated in Figure 16.24.

Figure 16.24 – Drilling and Blasting Pattern



16.7.4 ORE CONTROL

The effectiveness of ore grade control at an operating mine relies on both the quality and quantity of the samples collected. It is therefore essential to optimize ore grade control procedures. The procedures require the analysis of sample quality and the spatial distribution of the samples.

The results are to be reconciled against planned production and actual plant data. Minimizing the difference between planned versus actual production will improve business performance.

Grade control procedures includes detailed geological controls on grade distribution, optimal sample spacing, sample collection, sample preparation and analysis, quality control and optimization of the costs and benefits. During the reconciliation step, it is important to considers the uses of resource models for short and long-term mine planning, mining selective units, dilution, losses and ore allocation records, stockpile records, plant feed records and production results.

In order to ensure efficiency of the ore grade control, it is recommended to collect one sample per production drill-hole and one sample every three holes located within the buffer area in proximity to the ultimate pit wall. No sample will be taken from the pre-split holes as they mark the position of the final wall. Samples collection will be conducted by drillers with the help of grade control technicians.

Ore control quality is everyone's responsibility. Good communication and coordination between all participants (geologists, grade control technicians, engineers, surveyors, supervisors, shovel operators, truck operators, dispatchers, etc.) will greatly help minimize dilution and improve productivity.

Although it is impossible to eliminate all dilution factors, several recommendations can be implemented to optimize ore control, such as:

- Ensure complete training of personal to allow best practice for work supervision and execution;
- Perform field supervision to ensure the dig plan is properly followed and that the shovel operator is mucking the face accordingly to the proper orebody dip direction;
- Mark the ore zones using flags by geologists and surveyors;
- Use blast movement monitoring (BMM) devices to establish the actual movement of the rock after blasting. The purpose of these devices is to confirm that the displacement assumptions are correct and to revise them if necessary. Since the displacement can vary along the face height, the use of new technology such as BMM sensors is recommended;
- Reduce rock's movement by blasting. A commonly used method is the confinement of the blasted muck with the use of choke blasting. Once mucking of the previous blast is completed, it is suggested to leave a buffer zone of 3 to 5 m of materials, in order to minimize the spreading of the rocks;
- Monitor and adjust the tie-in pattern when blasting in order to control the blast movement which affects the dilution. The tie-in is normally prepared by an engineer and verified and approved by a mine geologist.

16.7.5 Loading and Hauling

A wheel loader will be used to load the blasted material into the haul trucks. The suggested model is a Komatsu WA600 loader with a bucket size of 5.25 m^3. This loader will need 7 passes to fill a haul truck. Based on material data available and machine ready hours estimates, a maximum productivity of 8,800 tpd is possible. This loading equipment will excavate inside of the open pit while another excavator, a Komatsu PC 1250-8 with a bucket size of 6.5 m^3, will be used to load trucks at the High Grade Loading Facility (HGF). This re-handling excavator will load the daily amount of ore required for the mill feed (3,650 tonnes). In the last years of the mine, the excavator will exchange places (pit and HGF) with the wheel loader due to smaller production areas which require digging trenches of 5 m or more.

The haul trucks to be used in-pit will be the off-road mining truck Komatsu HD 465-7. This model has a payload of 55 tonnes. They will dump the waste in the waste rock storages and unload the mineralized material in the ore re-handling point.

In order to obtain the expected required number of trucks, the cycle time was estimated for most years. The cycle time was estimated by calculating the distances from each bench to the dump point. The decreasing stripping ratio over the life of mine plan also affects the number of trucks required. Since the material to be removed on the top levels of the pit requires less cycle time and therefore less trucks, the fact that the stripping ratio is higher in the first years of the mine is beneficial to the total amount of trucks required through the mine life. This plan allows the mine to operate at a maximum of three trucks throughout the mine life.

From the HGF, the ore will be loaded into Western Star 6900XD dump trucks with a payload of 40 tonnes. They will then haul the ore to the crusher located 10.9 km south. Eight (8) trucks of this type are necessary since they will operate only in the daytime (12 hours) due to the crusher only operating on day shifts.

An additional two (2) Western Star haulage trucks will be used to move magnetically separated tailings from the processing facility to the dry tailings storage facility, for a total of ten (10) Western Star dump trucks.

16.7.6 Auxiliary and Support Equipment

The auxiliary equipment includes all other equipment that are essential for the mining operations. The following is an enumeration of these equipment and their respective tasks:

- Two (2) dozers will be required for cleanup at the storages and around the hydraulic excavators during their loading activities. They will also be used for drilling site preparation;
- Two (2) graders will maintain proper road conditions around the mine site and process facility, in the ramp and between the mine site and the mill;
- An auxiliary excavator will be used for wall scalling, road construction and mine cleaning purposes;
- A water and sand truck will provide a dust control for the road and an interchangeable box will be used to spread sand during the wintertime to overcome icy conditions;
- A fuel and lube truck will service the hydraulic excavators, dozers and other less mobile equipment, such as drills, to avoid delays in operations;
- Dewatering pumps will be required in the pit to keep the pit bottom free of water accumulation;
- A flatbed will be necessary to move any equipment that requires repairs, or to mobilize equipment to other areas.
- A skid steer loader will be used in the mechanical shop and to stem blast holes with aggregate;
- A mechanical service truck will be on site for troubleshooting and on-site preventive maintenance;
- Three (3) portable diesel lights will be used during the night shift so that mining activities can continue uninterrupted.

16.7.7 Fleet Management

As part of the equipment suppliers bid, an expected equipment life was also provided. Using these figures and knowing how many hours are needed to obtain the required production, a replacement program for major equipment has been produced. The yearly sustainable capital expenditures budget includes expenses at the given year when equipment needs to be replaced. Specifically for the trucks, it is assumed that the trucks are being used equally for any given year. At Matamec's request, three trucks will be purchased at the beginning of the project although only two would be normally needed for the first year of production. This is due to increase the flexibility in the event of a major breakdown on a given truck. The truck will also be available if needed to build starting infrastructure such as the tailings dam or the stockpile pads. Although the road haulers will only start being used to carry ore at the beginning of Year 1, five of them will be purchased in the pre-production year and will be available for the roads and tailings construction. The road hauling fleet will be increased to eight with the purchase of three more haulers at Year 1.

The trucks (both mining and road haulers), wheel dozers, excavator, and drills estimated hours are based on the planned production. The remaining equipment projected hours is based on the planned scheduled hours, the planned utilization, and the planned effectiveness for each.

Table 16.5 represents a summary of the equipment replacement schedule. The full detailed schedule including the planned hours of utilization for each piece of equipment is included in Appendix 5.3. Since a constant production is expected throughout the life of mine, the number of equipment will also remain constant. Therefore, the only sustainable capital expenses projected are replacement costs.

The column “Max. hours” is the expected life provided by the supplier. In the event that equipment’s life is due to end just before the end of the planned production (Year 15), it is assumed that the equipment will not be replaced unless a longer mine life due to additional resources happens. Other options for these pieces of equipment could be looked at such as renting or performing an overhaul. Year -1 equipment purchase cost is included into the initial Capital Expenditures. For the Years 1 through 13, the new replacement equipment cost is included into the Sustaining Capital at its given year.

16.7.8 Mine Maintenance

Mine maintenance is a crucial aspect of a low cost mine but is often overlooked as simply an expense, especially in a small mining operation. A regular maintenance program will reduce breakdowns and bring the equipment to their expected life and beyond. This maintenance will be performed internally by the company maintenance team at the mine site shop (for detail, Table 21.15). However, suppliers’ help may be required for major overhauls and refurbishments. The suppliers’ maintenance program must be followed and the costs associated with it should be viewed as an investment to reduce further sustaining capital expenses.

A major source of expenses is the cost of tire replacement. Tire costs have increased dramatically and their inventory have decreased in the recent years forcing mining companies to improve their tire management programs. The most effective way to reduce tire costs is to have well maintained roads. This will be achieved with the two graders and the water/sand truck. Better roads will also increase the truck productivity.

16.7.9 Health and Safety Considerations

A safe environment at the mine will not only save a great amount of money for the company by paying less insurance, but will also contribute to establish a good reputation with the local communities. To achieve this, measures need to be taken such as speed limits, installation of road signs, warning signs at the approach of high travelling or working areas, procedures at the stockpiles and waste storages, etc. A Health and Safety officer will oversee the general safety at the site.

Proper training of the workforce is an important component of a safe environment. A first aid attendant will be available in the event of an injury. Health and safety needs to have the support of management at every level to ensure the whole workforce takes it seriously. An important safety aspect is that the road haulers (Western Star) will not cross the heavy mining trucks’ travel way at any time during the mining haulage cycle.

Table 16.15 - Summary of the Equipment Replacement Schedule

				YEAR																
Equipment	**Proposed Brand**	**Numbers**	**Max. Hours**	**-1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Trucks	Komatsu HD465-7	3	42,000	3										1	2					
Hydraulic Excavator	Komatsu PC 1250-8	1	32,500	1																
Road Haulers	Western Star	8	50,000	5	3															
Wheel Loader	Komatsu WA600	1	36,000	1								1								
Auxiliary. Excavator	Komatsu PD360 LC-10	1	24,500	1								1								
Dozer	Komatsu D155AX-7	2	28,000	2					2						2					
Grader	Komatsu GD655	2	24,500	2							2									
Water/Sand Truck with Tanks	Komatsu HD465-7	1	42,000	1																
Fuel & Lube Truck	2460L Diesel	1	25,000	1								1								
Pick-up Truck	Chevrolet 3500HD	10	15,000	10		3	1	3	1	4		2	4	2	6		5			
DTH Drill	Sandvik DR540	1	40,000	1											1					
Pumps	Godwin CD140M	1	20,000	1								1				1				
Pumps	Godwin HL-110M	1	20,000														1			
Low bed + Tractor	Western Star 6900XD	1	25,000	1																
Stemming Loader	Komatsu WA150-6	1	12,500	1				1				1				1				
Mec. Service Truck	4ton cap hyd crane	1	25,000	1																
Worker Shuttle bus	Bluebird 48 pers.	1	25,000	1								1								
Portable Diesel lights	Type 4-1000W	3	25,000	3							3									

16.8 Open Pit Mining Costs

16.8.1 Mining Manpower

To accomplish the mine plan with the selected equipment, 109 people will be hired including 23 staff. There will be 74 employees assigned to the production. In addition, 25 employees will be assigned to the mine maintenance and there will be 10 technical support personnel including geologists.

Since the mine will operate 24 hours per day and 7 days per week, some employees will be required to work on a shift rotation. These workers will be working 12-hour shifts as part of a two-week repeating schedule; the first week working 4 days followed by 3 days off and the second week working 3 days followed by 4 days off. For positions that require night shifts, the workers will alternate runs of day shifts and runs of night shifts.

The employees working on a standard schedule, mainly staff employees, will be at the site from Monday to Friday, 8 hours per day.

Table 16.16 represents the manpower, their numbers for each position and their schedule. The annual cost for the mine in manpower is expected to be $11,344,200. The details of the salaries are explained in Section 21.1.4 of this Report.

16.8.2 Capital Mining Costs

Once the major equipment size and productivity were decided, potential suppliers were contacted to submit bids. These quotations were used for 95% of the capital mining equipment costs. Only minor costs such as pick-up trucks, fuel trucks, diesel lights, and dewatering equipment were estimated using the CostMine 2012 database. The total mining capital cost is $41.9 million including $13.5 million and $3.9 million for the equipment and the mine development (deforestation, stripping, excavation, levelling), respectively. Other than the equipment, the main mining capital expenses included the mine and access roads, the pre-production development activities (mainly overburden stripping), and the garage construction. The mining capital cost estimate can be found in Section 21.1.4.

For the sustaining capital expenditures, when a piece of equipment reaches its expected life as described in Section 16.7.7, the cost of this new equipment is spent at its respective year. Over the mine life, the sustaining CAPEX for the mine fleet growth and equipment replacement is approximately $12 M (Appendix 10.1).

16.8.3 Operation Mining Costs

The operational mining costs were estimated for every year using the equipment expected yearly utilization. Based on suppliers' quotations and similar projects, hourly cost including fuel consumption and consumables were determined. Annual mine operating cost is estimated at $18.1 M per year or $8.04 per tonne mined for ore, $5.93 per tonne of waste, and $7.03 per tonne mined of ore and waste combined. The detailed mining operating cost estimate can be found in Section 21.2.2.3.

Table 16.16 - Mine Manpower Requirement

MINE MANPOWER REQUIREMENTS		Schedule					Schedule		
Job Title	NUMBER	Day	Night	5/2	Job Title	NUMBER	Day	Night	5/2
MINE OPERATION					*MINE MAINTENANCE*				
STAFF:					*STAFF:*				
Mine & Maintenance Superintendent	1	X		X	Engineer Planner	1	X		X
Senior General Foreman	1	X		X	Foreman	2	X		
Mine Supervisor - Production	4	X	X		*HOURLY:*				
Mine Supervisor - Drill & Blast	2	X	X		Mechanic	6	X		
Mine Supervisor - Project	1	X		X	Welders	4	X		
Clerk	1	X		X	Electrician	2	X		
HOURLY:					Mechanic (Trouble shooter)	4	X	X	
Excavator Operator - Rehandling	2	X			Electro-Technician	2	X		
Production Loader Operator	4	X	X		Lube & Fuel Operator	4	X	X	
Dozer Operator	6	X	X		**TOTAL MINE MAINTENANCE**	**25**			
Grader Operator	6	X	X		*ENGINEERING (MINE)*				
Mining Truck Driver	12	X	X		*STAFF*				
Ore Transport Truck Driver	16	X			Technical Services Superintendent	1	X		X
Mine Helper - General	8	X	X		Senior Engineer	1	X		X
Mine Helper - Drill Doctor	2	X			Mining Engineer	1	X		
Production Drill Operator	4	X	X		Mine Technician	2	X		
Blaster Leadman	2	X			Surveyor - Production	1	X		
Blast Helper	2	X			Chief Surveyor	1	X		X
TOTAL MINE OPERATION	**74**				**TOTAL ENGINEERING (Mine)**	**7**			
GEOLOGY					**GRAND TOTAL MINE**	**109**			
STAFF:									
Senior Geologist	1	X		X					
Grade Control & Data Processing Tech.	1	X							
Mine Geologists	1	X							
TOTAL GEOLOGY	**3**								

17.0 RECOVERY METHODS

17.1 Geotechnical and Hydrogeological Field Investigation Summary

The foundation conditions at the location of the process plant, including the ore pad, the crusher, the ore storage area, as well as the surrounding process plant pad, were assessed by conducting a geotechnical investigation consisting of 14 boreholes and 14 test pits. The investigation locations were spread out in order to provide sufficient information on the key components of the mine infrastructure and were confirmed with the plant design team. The field results and subsequent laboratory testing on selected samples were used to determine the natural ground geotechnical properties, the bedrock depth, and hydrogeological conditions at the process plant area.

In general, there is little variability in the subsurface layers in the area. The surface soil stratigraphy is generally composed, from top to bottom, of a 0.1 m to 0.7 m organic cover overlying a dense to compact silty sand layer, the latter containing traces of gravel. The bedrock underneath the surface deposit was observed at depths varying between 1.10 m to 10.64 m. The location of boreholes and test pits is shown in Figure 17.1.

One layer of clayey silt and silty clay was encountered in the northern portion of the investigated area. The layer was encountered in one borehole located at the planned location of the crusher and in one test pit, in the north-east area (potentially outside of the planned pad). The measured thicknesses of this layer are 2.0 m and 2.7 m, respectively.

In the southern sector, a thin 0.6 m layer of organic silt overlying the sandy silt layer was also encountered in one test pit. However, this location is potentially at the south-east limit of the planned pad for the plant.

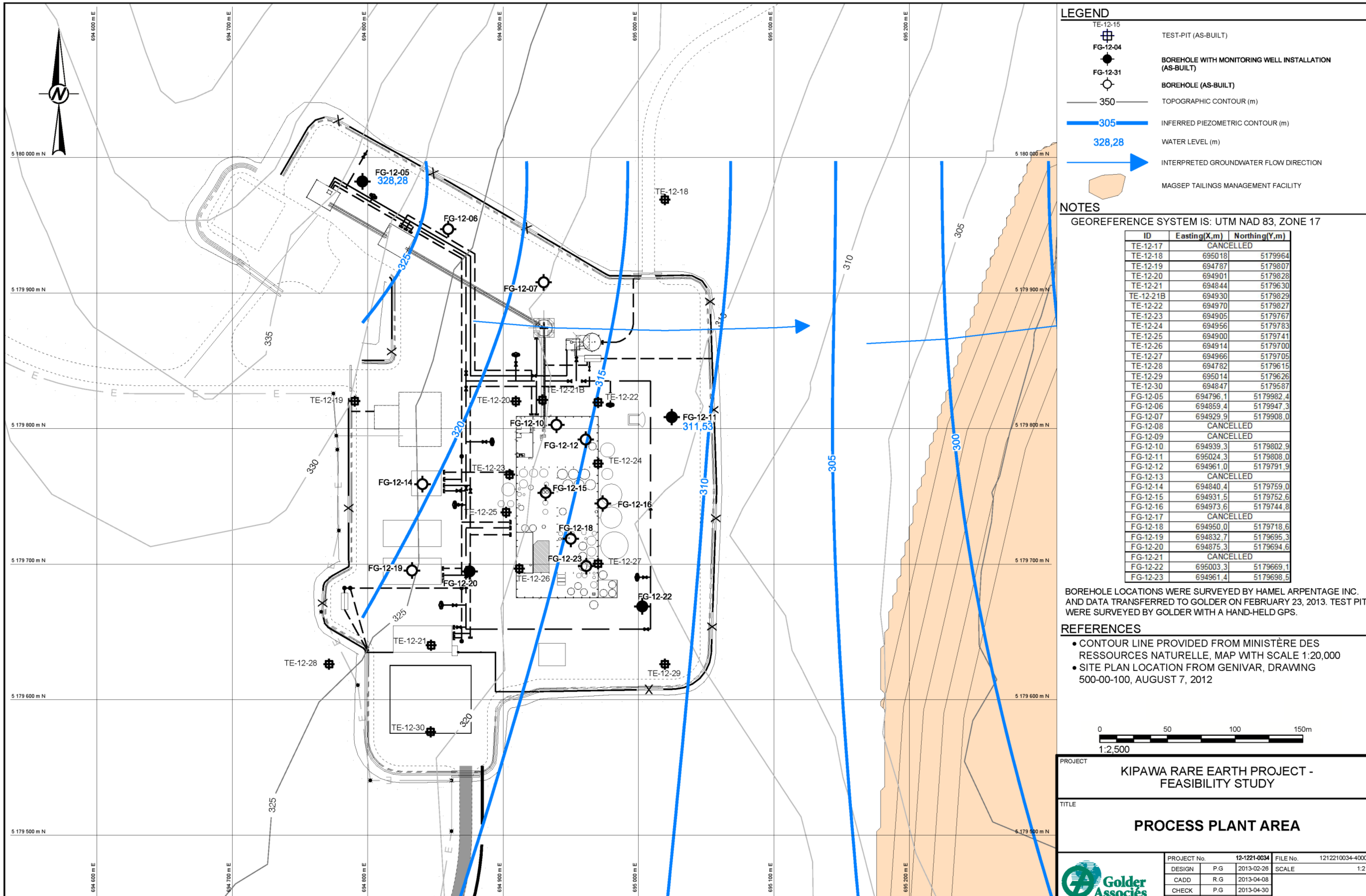
A total of four (4) observation wells were installed in the boreholes to assess the general hydrogeological conditions in the vicinity of the process plant area. The piezometry and the estimated flow direction are in accordance with the topography of the site. The elevation of the measured water table varies between 311.53 m (to the east) and 328.28 m (to the west). The underground water is inferred to flow from west to east toward the eastern wetlands and the adjacent Des Jardins River (see Figure 17.1). One hydraulic conductivity test was performed in the sand and silt horizon observed in the northern part of the process plant pad. The measured in-situ hydraulic conductivity for this surficial deposit is $2*10^{-6}$ m/s. Another test was performed in the bedrock horizon on the eastern part of the process plant pad with a measured hydraulic conductivity of $3*10^{-7}$ m/s. From the measured groundwater elevation and the inferred piezometric contour lines, the average calculated horizontal hydraulic gradient was established to be 0.058 m/m for the entire area, including the adjacent MagSep Tailings Management Facility.

Detailed results are presented in the Golder 2013 factual field investigation report.[10]

[10] Golder Associés, 2013, Rapport factual d'investigation géotechnique et hydrogéologique-Projet Kipawa, Report prepared for Matamec Explorations Inc. ref.:# 018-12-1221-0034-4000-Rev0, May 2013.

MATAMEC

Figure 17.1 - Process Plant Area



ID	Easting(X,m)	Northing(Y,m)
TE-12-17	CANCELLED	
TE-12-18	695018	5179964
TE-12-19	694787	5179807
TE-12-20	694901	5179828
TE-12-21	694844	5179630
TE-12-21B	694930	5179829
TE-12-22	694970	5179827
TE-12-23	694905	5179767
TE-12-24	694956	5179783
TE-12-25	694900	5179741
TE-12-26	694914	5179700
TE-12-27	694966	5179705
TE-12-28	694782	5179615
TE-12-29	695014	5179626
TE-12-30	694847	5179587
FG-12-05	694796,1	5179982,4
FG-12-06	694859,4	5179947,3
FG-12-07	694929,9	5179908,0
FG-12-08	CANCELLED	
FG-12-09	CANCELLED	
FG-12-10	694939,3	5179802,9
FG-12-11	695024,3	5179808,0
FG-12-12	694961,0	5179791,9
FG-12-13	CANCELLED	
FG-12-14	694840,4	5179759,0
FG-12-15	694931,5	5179752,6
FG-12-16	694973,6	5179744,8
FG-12-17	CANCELLED	
FG-12-18	694950,0	5179718,6
FG-12-19	694832,7	5179695,3
FG-12-20	694875,3	5179694,6
FG-12-21	CANCELLED	
FG-12-22	695003,3	5179669,1
FG-12-23	694961,4	5179698,5

17.2 Process Design Criteria

The process plant design criteria are based on various sources of information. These sources are:

i. Information provided by the client;

ii. Previous studies;

iii. Testwork conducted at SGS Mineral Services Lakefield, Pocock, or by varies equipment suppliers;

iv. Roche-Genivar's calculations or layouts;

v. Recommendations of Matamec sub-consultant consultants, such as SimSAGe Pty Ltd; and/or

vi. Industry standard practices or literature.

The plant capacity has been established at 1,332,250 tpy ROM, based on an ore processing rate of 3,650 tpd, a plant availability of 91%, 24 hours per day and 365 days of operation per year. This availability has been selected based on similar hydrometallurgical operations. This availability is also in the standard range for mineral beneficiation plant. The plant has been sized to meet the criteria and parameters as indicated in Table 17.1.

Table 17.1 - Kipawa Project General Process

Parameter	Value	Source
Days per year (d)	365	B
Crusher plant availability (%)	50.0%	A/B
Crusher operation per day (h)	12	C
Beneficiation process plant availability (%)	91.0%	A/B
Beneficiation process plant operation per day (h)	21.84	C
ROM processing rate (tpy)	1,332,250	A
ROM processing rate (tpd)	3,650	C
ROM processing rate (tph)	167.2	C
Fines weight recovery (%)	10.2%	D
Magnetic concentrate weight recovery (%)	34.8%	D
Overall mineral concentrate weight recovery (%)	45.0%	D
Mineral concentrate produced per year (tpy)	600,050	C
Magnetic separation tailings produced per year (tpy)	899,945	C
Grinding product size P_{80} (µm)	840	A
Regrind product size P_{80} (µm)	150	A
Hydrometallurgical process plant availability	91.0%	A/B
Hydrometallurgical process plant operation per day (h)	21.84	C
Source code A : Client / Matamec Exploration Inc. B : Roche's recommendations C : From Roche's calculations D : Laboratory testwork results		

17.3 Simplified Process Flow Diagram

Based on all the bench, pilot and variability testworks carried out on the Kipawa ore, a treatment process has been developed. This developed process has been proven suitable for handling and treating ore from across entire deposit throughout the mine's operating life. The simplified Process Flow Diagrams for the Mineral Processing, Hydrometallurgical and Purification process are illustrated in Figure 17.2, Figure 17.3 and Figure 17.4.

Figure 17.2 – Mineral Processing Process Flow Diagram

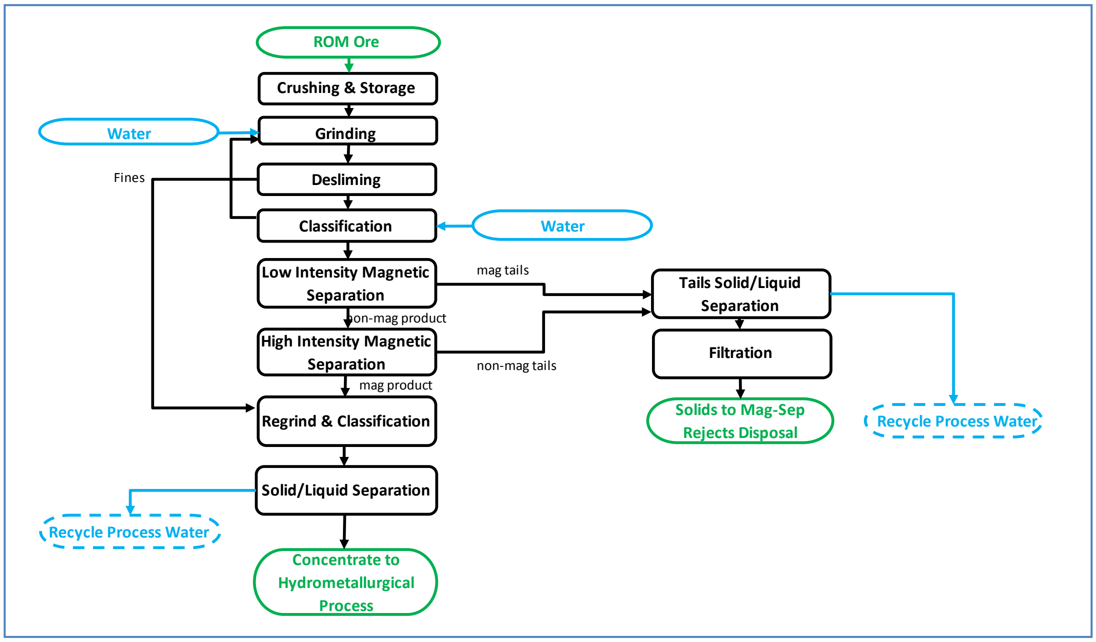


Figure 17.3 – Hydrometallurgical Process Flow Diagram

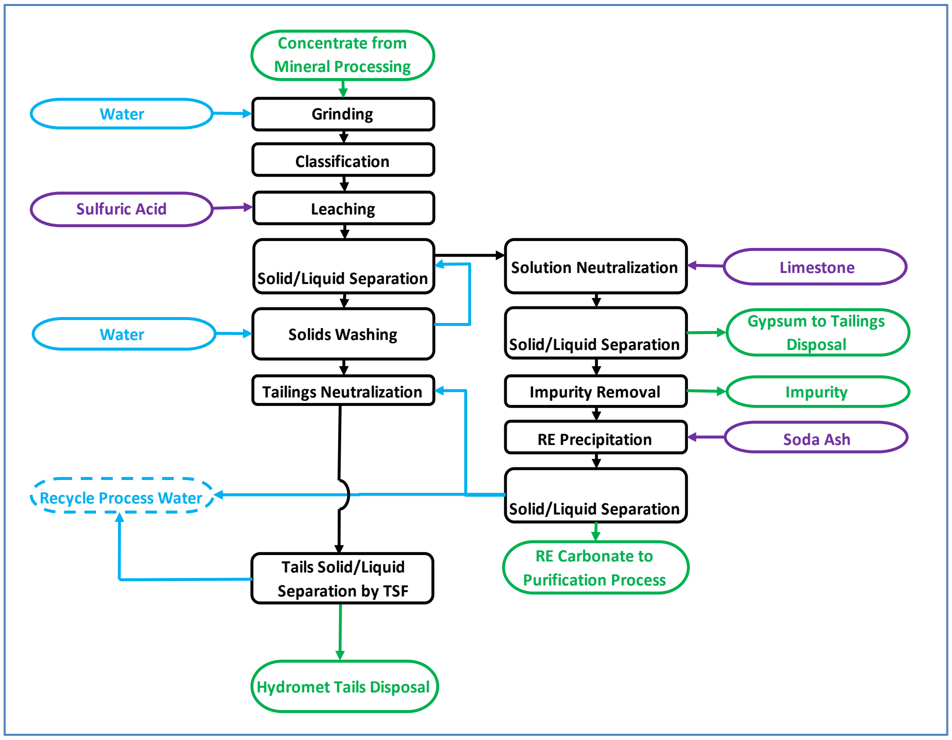
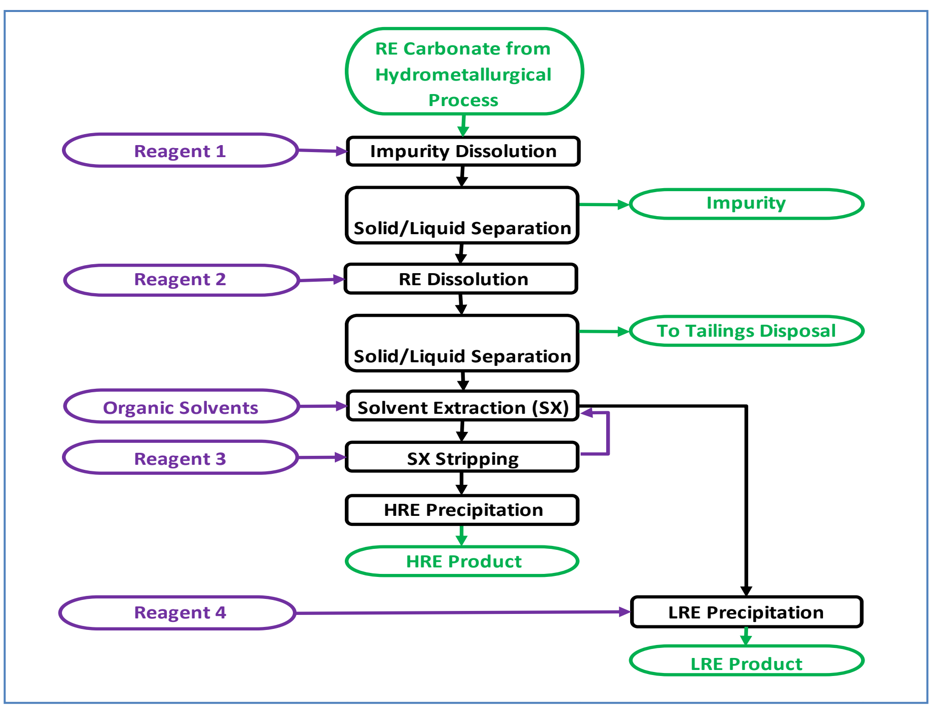


Figure 17.4 – Purification Process Flow Diagram



17.4 Mass and Water Balances

Based on the design criteria developed for the process plant and on the proposed flowsheet, a mass and water balance for 3,650 tpd has been developed for an average Rare Earth Oxides diluted grade of 0.4105%.

17.4.1 Mass Balance

The mass balance of the plant was calculated to provide tonnages and flow rates to different sections and equipment in the plant. However, the throughput, weight recovery, and product grade will vary depending on ore characteristics, such as ore hardness, magnetite content, and Rare Earth Oxides grade of the feed. Typically, the instantaneous throughput of the crushing and grinding circuit varies by ±20%. Therefore, additional capacity has been included as a requirement when selecting the size of equipment in the downstream process. In some cases, the solids density can be adjusted to a certain limit to compensate for the variation in throughput. The mass balance, from which Table 17.2 is issued, is based on pilot plant operated at SGS and variability testwork result. The results in these tables are representative of the pilot plant testwork but will vary depending of Rare Earth Oxides grade or minerals present in the feed.

Table 17.2 - Beneficiation Area Weight Recovery and Losses

Stream	Weight percentage (%) (from fresh feed)
Grinding Feed	100%
Grinding cyclones slimes to concentrate	10.2%
Rougher low intensity magnetic product to cleaner	16.1%
Cleaner low intensity magnetic product to rejects	13.0%
High Intensity magnetic separation feed	76.8%
High intensity non-magnetic product to reject	42.0%
High intensity magnetic product to concentrate	34.8%
Hydrometallurgical feed	45.0%

17.4.2 Water Balance

The global site water balance, which includes the tailings pond precipitation & evaporation, mine dewatering, site drainage and others, is included in the environmental part of the report, Section 20.6.

17.5 Design Facility Description

17.5.1 Process Equipment

The bulk material conveyed by trucks from the open pit will be discharged at the primary crushing area. The crushing system will be an open loop type, with a primary and a secondary crusher, based on a proposal prepared by Sandvik. Both primary and secondary crushers' areas will be covered with insulated fabric shelters. Foundations are required to attach the shelters adequately to the ground. Installation of equipment is planned to be executed with a crane before shelters installation.

In the primary crushing shelter, the bulk material will go through various mechanical equipment such as a rock breaker, a grizzly screen, a dump hopper apron feeder and a roll crusher and then will go to the secondary crushing building via conveyor #1. Dust will be controlled by the use of a dust collector with hoods and ducts. Once controlled, the dust will be brought back to conveyor #1 via a screw conveyor.[11] The primary crusher shelter will be equipped with an electrical room in a 6.1 m container and a garage door with an opening capacity to accommodate a boom truck for maintenance. The overall area within that building will be 300 m².

Once the material will reach the secondary crushing area, the material will travel through various equipment such as a screen, a surge hopper, a vibrating feeder and a cone crusher. A metal detector and a magnet will be installed on conveyor #1 before the cone crusher's chute to protect this equipment. The undersized material will go directly from the screen to conveyor #2 via a fine chute. Dust will be controlled by the use of a dust collector with hoods and ducts. Once controlled, the dust will be brought back directly to conveyor #2 via a rotary valve. After the material goes through the secondary crusher, it will be conveyed via conveyor #2 to the crushed ore storage silo. [12]

The secondary crusher building will be equipped with an electrical room in a 12.2 m container, a control room installed on top of this electrical container and a garage door with an opening capacity to accommodate a boom truck for maintenance. The overall area of the building will be 378 m². Maintenance mechanical equipment available in the building includes an air receiver, an air dryer, a dry air receiver, and an air compressor.

An insulated ore silo will be used for ore storage. The silo will have a storage capacity of 18 hours at a production rate of 3,650 tonnes per day, with a live capacity of 1,558 m^3 (2,804 tonnes @ 1.8 SG). Two pan feeders will extract ore under the silo. A monorail and a dust collector will be installed in the conveyor #2 head shelter on top of the silo to allow for maintenance. A dust collecting system and a sump pump will be installed underneath the silo, where heating and wall sheets will allow temperate conditions.

The stored crushed ore will be conveyed directly to the grinding circuit in the process plant on conveyor #4. The entire process plant building dimensions will be 133.3 m long, 60 m wide with a height of 25 m (under the trusses). The grinding circuit will have one rod mill, a classifier, a set of cyclones, and two pumps (one in operation and one on standby) to feed the cyclones. Sump pumps will be placed in strategic locations. A 25 tonne overhead crane with a 5 tonne auxiliary will be available for construction, repair, and maintenance, and will also cover the magnetic separation area.

The magnetic separation area will be located next to the grinding circuit and will include five (5) magnetic separators with a possibility of a sixth if required. Their own cooling and hydraulic units will be installed on the operation floor. Many slurry pumps will be used to transfer the slurry between stages or recirculate it when necessary. Sump pumps will also be installed in the area. On the basement floor, beside the magnetic separation area, a regrind mill will be installed with two pumps (one in operation and one on standby). These pumps will feed the regrind cyclones which will be installed at one of the highest point in the process plant.

In another area of the building, there will be tanks for leaching, re-pulping, neutralization and precipitation, as well as filters, a thickener, and the required pumps and sump pumps. Two (2) 20 tonne overhead cranes will cover this area. Reservoirs will also be there for reagents storage and distribution.

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11 For details on the process flow diagram, the reader is invited to consult the drawing 500-05-203.

12 For details on the process flow diagram, the reader is invited to consult drawing 510-00-121.

Safety showers and eyewash stations will be put in different areas of the building and there will be space allocated for offices, a training room, washrooms, a wet laboratory, a control room, two electrical rooms, instrumentation, electrical and mechanical shops, and a compressor room.

Outside the building there will be thickeners, fresh and process water tanks, and reagent storage (limestone, lime, sulfuric acid, sodium carbonate, etc.).

17.5.2 Fresh and Process Water Distribution

A tank will be installed to provide the process plant with fresh water for different applications. The total capacity of the tank will be 1,835 m^3. The tank will be installed outside, so a heating system will be installed to prevent freezing. A portion of the tank will be reserved for process plant fire protection. From the pump house besides the tank (area of 80 m^2), the water flow will be distributed to several locations. Some of the water will head to a potable water treatment location; the rest will be used for the crushing, the ore storage, and the process plant operations. In the process plant building, a main water distribution loop will be installed underneath the operation floor. The loop will be designed such that water will be available to all equipment requiring it. In-line water heaters will be installed for all applications requiring water heated to 12°C.

17.5.3 Electrical and Building Services

17.5.3.1 Crusher Shelters

No plumbing will be installed in those building to feed domestic water. A chemical toilet will be available for the operator.

Two (2) air exchangers (4,000 and 10,000 CFM) with an electric heating coil will be installed in each shelter. Ventilation hoods will be installed for each of the crushers. Shelters will be heated by electric unit heaters.

Fire protection will be provided by an air sprinkler system only for conveyors sections installed inside the shelters, and fire protection cabinets which will contain water hoses and portable extinguishers.

17.5.3.2 Ore Storage

For the ore storage silo, no plumbing will be installed there will be no sprinklers. The silo area will be heated by electric unit heaters. Power distribution will be supplied via one 600/120/208 V transformer and distribution panel, both installed in a dust resistant enclosure.

17.5.3.3 Process Plant Building

Plumbing will be installed in order to provide water and drainage to the office's bathrooms, to hands washing stations in the electrical and mechanical shops, and to five (5) emergency showers in the plant with floor drainage.

An air conditioning unit will be installed on the roof top of the building for the main offices, the wet lab, and the control room. Other units will provide air conditioning to the room containing the computer servers and the offices of the electrical and mechanical shops. The electrical rooms will be ventilated by a fan leading directly outside of the building. Electrical and mechanical shops will be ventilated with an air exchanger installed in the instrumentation shop, while the plant area will have a ventilation system with two air exchangers. Heating will be provided by electric baseboard heaters for the offices, the wet lab, and the control room, while electric unit heaters will be used for the electrical rooms and electric coils will be used in the shops. The plant area will be heated by a glycol heating system, heat being produced from two (2) electric boilers. Two (2) diesel boilers will act as backup in case of power outage. These boilers will also feed two heating coils for the heat exchangers. The boiler's diesel reservoir will be located outside of the building (3,640 litres).

For fire protection, water sprinkler systems will be installed for the main offices, the electrical and mechanical shops, as well as the plant area, with fire protection cabinets containing water hoses and portable extinguishers. The electrical room will be protected by a Novec 1230 inert gas system.

Power distribution to building services will be provided from dedicated transformers and panels installed in the electrical rooms.

17.6 Equipment Selection

The table below presents the main pieces of equipment selected for the process plant.

Table 17.3 - Main Pieces of Equipment

Equipment	Qty
Primary Crusher	1
Secondary Crusher	1
Spiral Classifier	1
Grinding Rod Mill	1
Cyclones	1
Rougher Magnetic Separator	2
Cleaner Magnetic Separator	1
Scavenger Magnetic Separator	2
Regrind Mill	1
Regrind Cyclones	1
Concentrate Ultra High Rate Thickener	1
MagSep Rejects Ultra High Rate Thickener	1
Sand Dewatering Unit	1
MagSep Rejects Pan Filter	1
1st Stage Leach High Rate Thickener	1
Leach Tank Scrubber	1
Leach Tank	6
Leach Residue High Rate Thickener	1
Leach Residue Clarifier	1
Reagent X Filter	1
Leach Residue Filter	4
Leach Reagent X Reactor	1
Pre-Neut'n Filter Press	2
Pre-Neut'n Tank	5
Pre-Neut'n Surge Tank	1
Releach Press Filter	2
Releach Tanks	2
Ion Exchange Fresh Water Storage Tank	1
Spent Eluate Tank	1
Impurity Removal Tank	2
Impurity Removal Filter	2
Ion Exchange Feed Sand Filter	2

Equipment	Qty
Ion Exchange	4
Spent Eluent Heater	1
REE Precipitation Tank	4
Barren Solution Filter	1
REE Precip. High Rate Thickener	1
REE Precip. Filter	2
Tailings Neut'n Tank	3
Fresh Water Pre-Heater Tank (5°)	1
Process Water Pre-Heater Tank (5°)	1
In-Line Fresh Water Heater (12°)	1
In-Line Fresh Water Heater (12°)	1
Hydromet Process Water Storage Tank	1
Beneficiation Process Water Tank	1
Limestone Verti-Mill	1
Limestone Storage Silo	1
Lime Slaker	1
Lime Storage Silo	1
Sodium Carbonate Storage Silo #1	1
Sodium Carbonate Storage Silo #2	1
Sodium Carbonate Mixing and Distribution Tank	1
Reagent Y Mixing Tank	1
Reagent Y Distribution Tank	1
Reagent X Mixing Tank	2
Sulfuric Acid Storage Tank	3

17.7 Site Layout and General Arrangements

Figure 17.5 illustrates a 3D general plant site layout. The administration building will be located in front of the parking area. The gatehouse will be part of this building to allow the security officers to control plant site access. Besides the administration building there will be the warehouse, cold shed, assay lab, and the waste water treatment facility.

Figure 17.5 - 3D General Plant Site Layout

17.8 Civil Layout and Site Topographical

Figure 17.6 illustrates a general plant site layout, Figure 17.7 shows the location of the MagSep rejects disposal area vs. the process plant site and Figure 17.8 indicates the location of the tailings disposal facility vs. plant site.

Figure 17.6 - General Site Layout

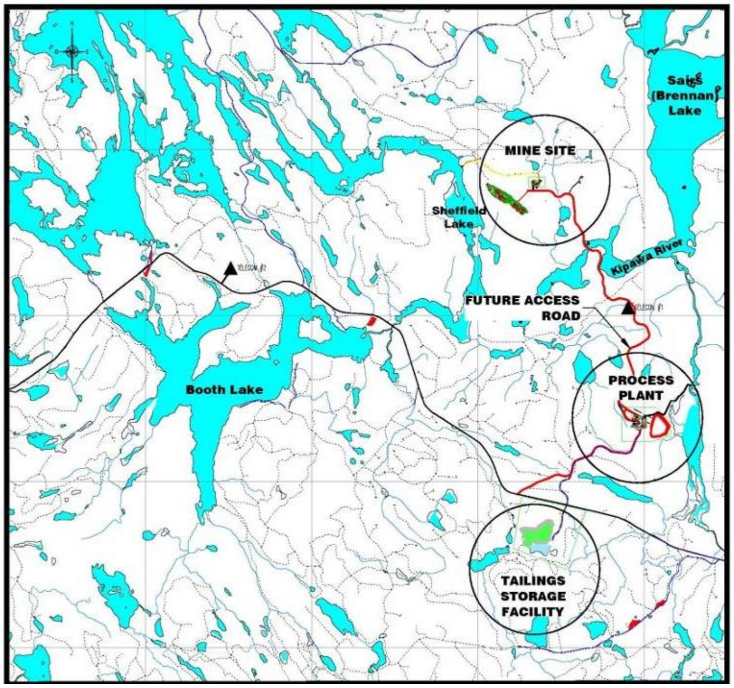
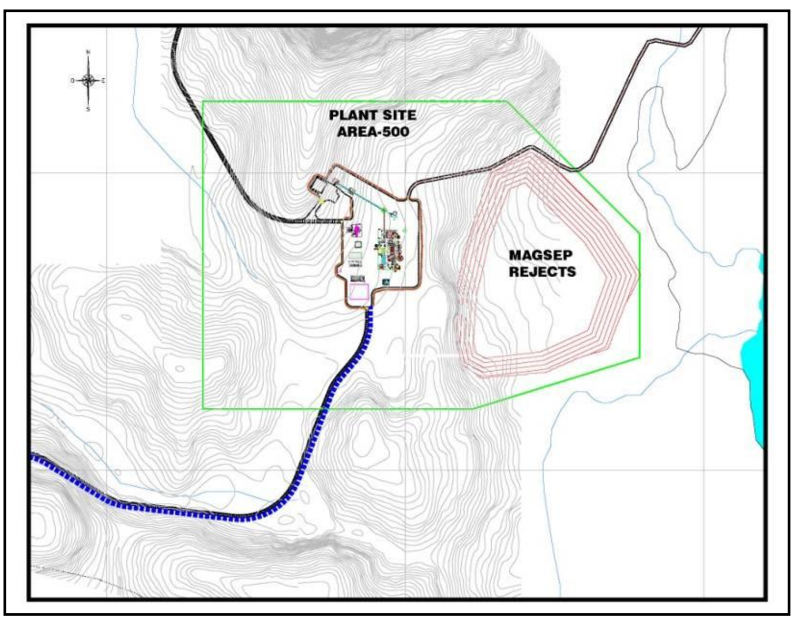
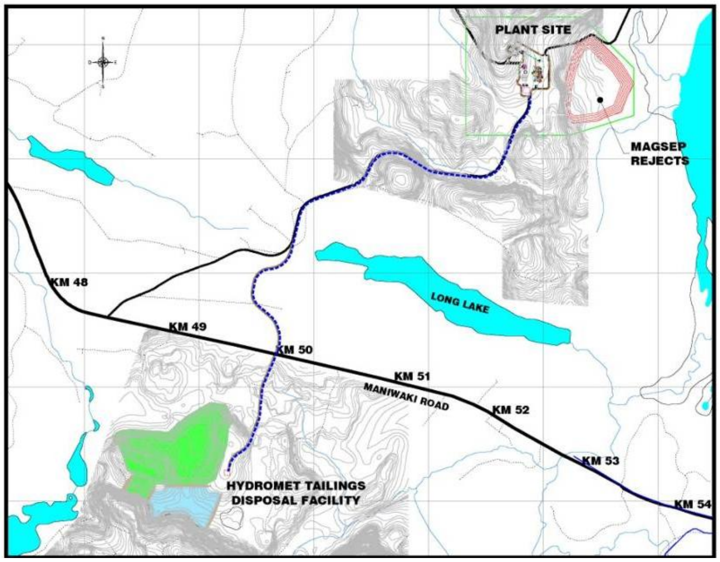


Figure 17.7 - Location of MagSep Rejects Disposal Area vs. Plant Site[13]



[13] Drawing 340-00-101 from GENIVAR. More detailed drawing in Appendix 1.

Figure 17.8 - Location of Tailings Disposal Facility vs. Plant Site [14]



17.9 Electrical Distribution

Process plant power will be fed by the 44 kV substation located near the plant. The 5 kV and 600 V feeder cables between the substation and the Main Electrical Room will be installed in a cable rack to support the cable trays having 60 m long with a 8 m high clearance under it.

The Main Electrical Room will contain 5 kV and 600 V switchgears, MCCs, battery chargers, services transformers and distribution panels, etc. The 5 kV switchgear will feed the 600 V transformers, Medium Voltage Starters, crusher area and the Electrical Room #2. PLC Cabinet and Telecommunications/Networking equipment will also be installed in this room.

Electrical Room #2 will also contain 600 V switchgears, MCCs, battery chargers, services transformers and distribution panels and a 5 kV transformer.

17.10 Control System

The process plant will have control systems that will enable the regulation of the most critical variables of the processes in order to reduce variability, increase efficiency and ensure safety in the plant. Various control loops will be implemented and will ensure proper measurements, comparisons, and adjustments, as required. The utilization of a number of sensors and transmitters will allow the adequate measurement of a number of variables that will be used to carry out control via programmable logic controllers (PLCs) which will trigger the activation of valves, pumps, and any other devices to bring the value of these variables to a determined set point.

A SCADA system installed in the control room will allow the operator to monitor and control all the process related equipment. Alarm logs, trends and historian software will keep track of the process values to allow optimization or troubleshooting.

[14] Drawing 300-00-101 from GENIVAR. More detailed drawing in Appendix 1

17.11 Processing Costs

Table 17.4 presents the distribution of the process plant operating costs.

Table 17.4 - Processing Costs

	Annual Cost $/year	Cost per		
		T. mined	T. milled	kg of TREO
Manpower	8,541,00	3.34	6.41	2.34
Energy	5,397,966	2.11	4.05	1.48
Fresh water	20,102	0.01	0.02	0.01
Reagents	22,343,520	8.73	16.77	6.12
Consumables	6,982,786	2.73	5.24	1.91
Other Processing	674,000	0.26	0.51	0.18
Tailings	4,765,000	1.86	3.58	1.31
Total	48,725,000	19.04	36.57	13.35

18.0 PROJECT INFRASTRUCTURE

18.1 On-Site Infrastructure

18.1.1 Geotechnical and Hydrogeological Field Investigation Summary

The on-site infrastructure consists primarily of the garage facilities. The foundation conditions at the location of the garage were assessed by conducting a geotechnical field investigation consisting of 2 boreholes and 8 test pits located as per the designer's requirements. The surface soil stratigraphy in this specific area is generally composed, from top to bottom, of an approximately 0.1 m organic cover overlying a dense to compact silty sand layer with the increasing presence of gravel particles with depth. The bedrock has not been intercepted in any of the boreholes and was not reached in the test pits. Drilling was interrupted at the depth of 17.5 m in borehole FG-12-01 and at the depth of 6.2 m in borehole FG-12-02 as the collected information was sufficient for this type of buildings. Figure 18.1 presents the locations of the boreholes and test pits for the mine site sector, including the garage area.

The water table was not measured in the boreholes drilled in the garage area. However, light water seepage was observed in the test pits, mainly within the first metre of depth.

Geotechnical and hydrogeological data were collected at the mine site sector, south and west of the garage, and corroborate the conditions observed in the vicinity of the garage. The information gathered for the mine site sector is described in Section 20.4 (Ore, Waste Rock and Overburden Management). The detailed results for the mine site sector, including the garage area, are presented in the Golder 2013 factual field investigation report.[15]

18.1.2 Power and Energy Systems

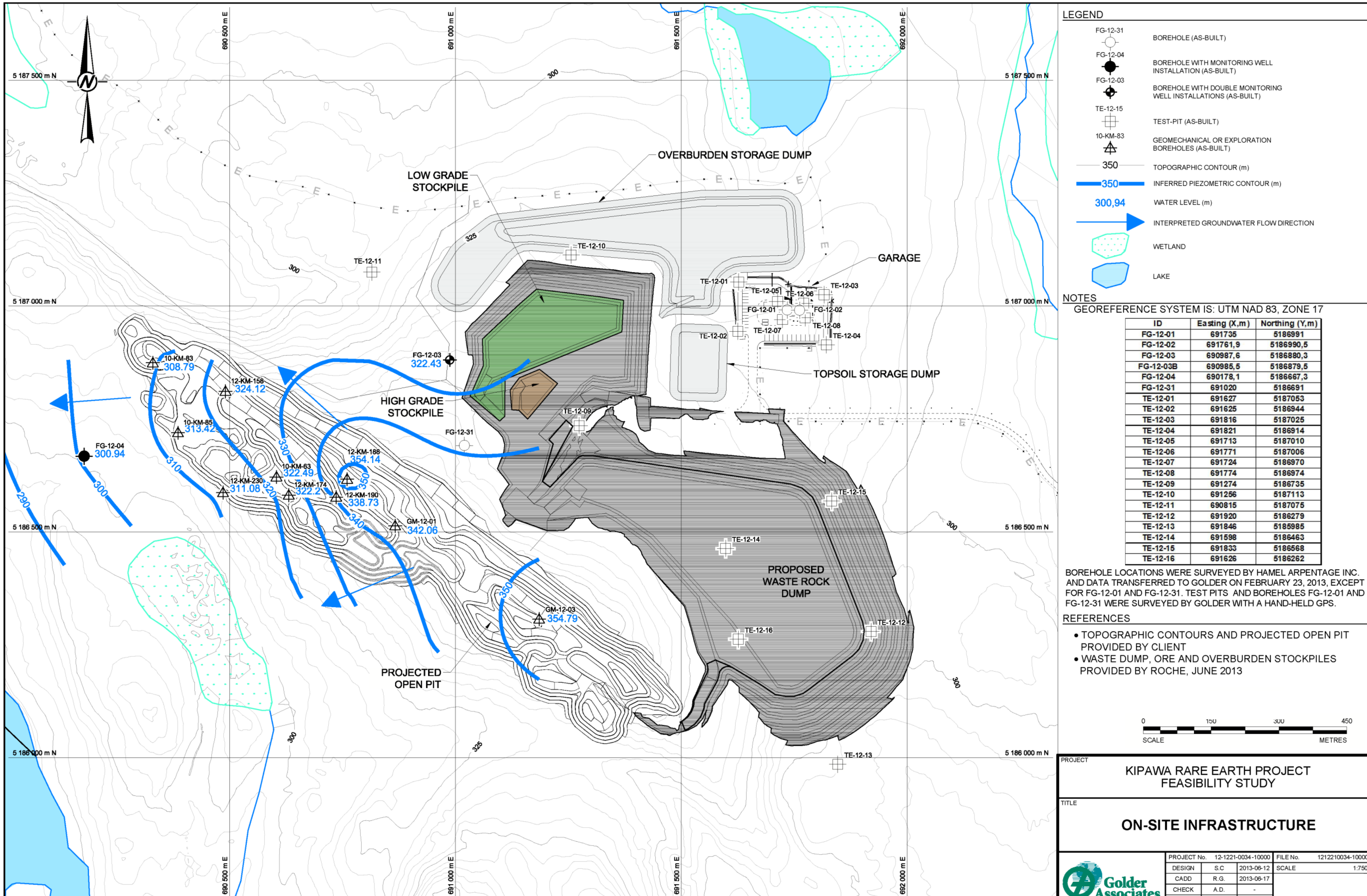
A 44 kV Substation will be installed near the process plant for electrical distribution. Three transformers will distribute power to the process plant main electrical room. From there, process plant equipment, including the crushing area, will be fed. The transformers will be installed on a concrete slab with a basin connected to a water/oil separator. The substation will be fenced (8 ft high with barbed wire).

The cost of power is estimated at 5.97 ¢/kWh.

Three 750 kW diesel generators will also be installed nearby this substation to deal with grid power losses and will feed the 44 kV network with a step-up transformer. The system will be supplied in four (4) modules, including one for the distribution switchgear.

[15] Golder Associés, 2013, Rapport factual d'investigation géotechnique et hydrogéologique-Projet Kipawa, Report prepared for Matamec Explorations Inc. ref.:# 018-12-1221-0034-4000-Rev0, May 2013.

Figure 18.1 - On-Site Infrastructure



ID	Easting (X,m)	Northing (Y,m)
FG-12-01	691735	5186991
FG-12-02	691761,9	5186990,5
FG-12-03	690987,6	5186880,3
FG-12-03B	690985,5	5186879,5
FG-12-04	690178,1	5186667,3
FG-12-31	691020	5186691
TE-12-01	691627	5187053
TE-12-02	691625	5186944
TE-12-03	691816	5187025
TE-12-04	691821	5186914
TE-12-05	691713	5187010
TE-12-06	691771	5187006
TE-12-07	691724	5186970
TE-12-08	691774	5186974
TE-12-09	691274	5186735
TE-12-10	691256	5187113
TE-12-11	690815	5187075
TE-12-12	691920	5186279
TE-12-13	691846	5185985
TE-12-14	691598	5186463
TE-12-15	691833	5186568
TE-12-16	691626	5186262

18.1.3 PROCESS AND FRESH WATER

18.1.3.1 Mine Site Fresh Water

A pumping station will pump the fresh water to the garage through a 2.875 km insulated and heat traced pipeline from Sheffield Lake. The nominal capacity of this pumping station will be 9 m³/h.

The mine site pumping station location will be on the shore of Sheffield Lake. For that purpose, a main building and an electrical room will be erected at that location. The main building will be equipped with the following maintenance tools: one (1) air compressor, two (2) monorails (each equipped with an electrical hoist run by a manual trolley), two (2) heavy duty electrical winches (one per pump) and two (2) safety heavy duty manual winches (one per pump), as well as a ventilation unit, an air heater, and double access door. The main purpose of the building and equipment is to allow the installation and maintenance of the submersible turbine multistage pumps. The electrical room will be equipped with a ventilation unit, a heating unit, an exhaust fan, Variable Frequency Drives (VFD) for each pump, a Motor Control Center (MCC), and a Programmable Logic Controller (PLC).

The steel pipeline, starting from the Sheffield Lake up to the pumping station building, will be installed inside a High-Density Polyethylene's (HDPE) casing.

Inside the pumping station building flanged steel piping will be used to connect to the HDPE pipeline. This pipeline will be 3" diameter at the beginning and 2" diameter for the majority of the line, with 2" of insulation. For further details, the reader must refer to drawings numbers 805-00-202 and 500-05-302.

This station will be powered from a 5 kV Teck cable lightly buried in the ground, coming from the garage electrical room.

The water fed to the mine will not be treated. Therefore, potable water will be provided through water fountains.

18.1.3.2 Plant Site Fresh Water

The plant site fresh water will be provided by a pumping station located on the shore of the Des Jardins River.

The total fresh water pumping capacity to the site will be 270 m³/hr of which, about 160 m³/hr will be consumed by the process plant in normal operation. Maximal capacity with all three pumps running simultaneously is possible for sufficient water distribution to the process plant if a problem occurs at the reclaim water pumping station.

For that purpose, a main building and an electrical room will be erected at that location. The main building will be equipped with the following maintenance tools: one (1) air compressor, two (2) monorails (each equipped with an electrical hoist run by a manual trolley), three (3) heavy duty electrical winches (one per pump) and three (3) safety heavy duty manual winches (one per pump), as well as a ventilation unit, an air heater, and double access door. The main purpose of that building and its equipment is to allow the installation and maintenance of the three submersible turbine multistage pumps The electrical room will be equipped with a ventilation unit, a heating unit, an exhaust fan, Variable Frequency Drives (VFD) for each pump, a Motor Control Center (MCC), and a Programmable Logic Controller (PLC).

The plant pumping station will have one fan for air evacuation and a power-driven louver. Heating will be provided by four electric unit heaters and heat trace will be installed to prevent piping from freezing. Power distribution will be supplied via a 5 kV / 600 V transformer fed by a 5 kV Teck cable installed along the pipeline. This cable will be connected in the main process plant electrical room medium voltage switchgear.

The pumping system is designed with much emphasis given to easy maintenance and repair of equipment in order to reduce to a minimum the interruption of water supply to the entire site. Spare equipment is included in to address this issue.

The steel pipeline starting from the Des Jardins River to the pumping station building will be installed inside a High-Density Polyethylene's (HDPE) casing.

Inside the pumping station building flanged steel piping will be used to connect to the HDPE pipeline. This pipeline will be 10" diameter at the beginning and 8'' diameter for the majority of the line, with 2" of insulation. The total length of this pipeline will be 2 km. [16].

The water to the plant site (administration building, process plant, etc.) will be treated in a modular system installed in a container before being consumed.

18.1.3.3 Fire Protection

For both mine site and process plant fresh water tanks, there will be water capacity allocated to fire protection. The lower section of the tank will be kept for that purpose, representing around 820 m^3 for the plant site and 220 m^3 for the mine site. This volume was determined following the FM Global standards. There will be two dedicated pumps for fire protection at the process plant pump house and two others at the mine. There will be a high pressure pump with a small capacity (Jockey pump) to maintain pressure in the fire protection system and all required monitoring control panel.

18.1.3.4 Reclaim Water

Tailings water drainage will be captured in a settling pond and tailings thickener overflow will be stored in a tank before being pumped through a 5.37 km pipeline to be reused as process water in the process plant. The total pumping capacity will be 225 m^3/hr.

For that purpose, a pumping station building and an electrical room will be erected on the shore of the sedimentation pond. The pumping station building will be equipped with the following maintenance tools: air compressor, monorails (each equipped with an electrical hoist run by a manual trolley), heavy duty electrical winches (one per pump), safety heavy duty manual winches (one per pump), as well as a ventilation unit, an air heater, and double access doors. The main purpose of the building and equipment is to allow for the installation and maintenance of all submersible turbine multistage pumps. The main building has the space required for the installation of a third water line and its mechanical equipment.

The electrical room will be a prefab building or a container equipped with a ventilation unit, a heating unit and an exhaust fan. This electrical room will also feed the tailings thickening equipment. The pumps will be connected with VFDs and other equipment in a Motor Control Center (MCC). A Programmable Logic Controller (PLC) panel will be installed in that electrical room for control and remote monitoring.

[16] For further details, the reader must refer to drawings numbers 805-00-204 and 500-05-302

Inside the pumping station building flanged steel piping will be used to connect to the HDPE pipeline. This pipeline will be 10'' diameter at the beginning and 8'' diameter for the majority of the line. The total length of this pipeline will be 2 km.[17]

This pipeline will not be insulated and heat traced because the system will recirculate if necessary to avoid freezing.

18.1.4 Site Roads and Surface Pads

The on-site roads will give access to the following areas:

- Process plant facility & surrounding buildings;
- Open Pit;
- Garage;
- Pumping stations;
- Tailings disposal area;
- Magnetic separation rejects disposal.

The width of the road between the plant and the open pit mine will be 11.6 m over a total length of about 10 km. A 65.5 m Acrow Panel bridge, single span, will be built on that road in order to cross the Kipawa River. For several sections of the roads, rock will have to be blasted and this material will be used for construction of the road. For the road surface, 900 mm of MG-112 and 200 mm of MG-20 materials will be put in place. Granular materials will be provided by borrow pits. In the open pit and process plant area, till and granular deposits were identified. Sand and gravel requirements will be provided from the following borrow pits: D-05, D-14, D-16, and D-08. Additional sand and gravel sources will need to be identified for the parking at Témiscaming and the 120 kV Main Sub-Station.

All surface water on the surface pad of the garage mine at site and the plant site will be managed. The surface water will flow to the peripheral drainage ditch and the ditch will discharge at the lowest point to the treatment pond designed by Golder. A segregation ditch will also be made to separate naturally flowing water and surface water that needs to be treated or tested.

To prevent surface water to flow into the open pit and waste dump, a water drainage ditch will be dug around the open pit and waste dump to evacuate water to the treatment pond. Surface water in the open pit and at the garage site will also be evacuated into the treatment pond.

The return period used for rainfall design is 1/10 years. [18]

18.1.5 Solid Waste, Water Treatment, and Management

At the mine site, waste water will be treated (from domestic usage only) through a BIONEST standard system. This will consist of a septic tank, a SA-6000 system having a capacity of 5 to 6 m³, and a service building that will be used for disinfection and phosphate removal.

For the plant site, this will be done via a BIONEST - KODIAK turnkey system, located in a container which will allow for disinfection and phosphate removal before being returned to the environment. The average treatment

[17] For further details, the reader must refer to the drawings numbers 830-00-201 and 500-05-303.

[18] Reference used for this is *Gestion des eaux pluviales en milieu urbain, Gilles Rivard 2005*

capacity will be 5.9 m^3/day at the mine site and 17.3 m^3/day at the plant site. The standard BIONEST system will be located approximately 60 m north-west of the garage at the mine site. The Kodiak system will be located about 25 m west of the administrative building and the warehouse.

Solid waste will be removed from the site by a contractor on a regular basis.

18.1.6 Fuel Storage and Distribution System

Fuel storage facilities will be in place at both plant and mine sites. Both will have a concrete slab for the vehicle filling area, concrete blocks to protect the installation, and a membrane to recover any spill in the storage area.

At the plant site, the fuel storage will include two diesel reservoirs of 50,000 litres each, for power generation and haulage trucks, and a gasoline reservoir of 10,000 litres for small vehicles and other equipment.

At the mine site there will be three diesel tanks of 50,000 litres each used for the mine fleet. This fuel will be used for filling the fuel tanker, haulage and mine trucks. A high flow dispenser with a hose reel is selected to fill the mine trucks, along with a low flow dispenser for other vehicles. A fence will be installed all around the storage area. The fuel will be delivered by tank truck on a daily basis from Rouyn-Noranda or a closer location.

18.1.7 Fence, Roads, and Parking at Témiscaming and Plant Site

A fence will be put in place at both mine and plant sites for a length of 700 m around the mine site garage and 1.65 km around the plant site. Access road between these sites will not be fenced.

A parking lot will be available for a total of 150 vehicles near Témiscaming and from there, employees will be transported by bus to both plant and mine sites. In this parking lot, lighting and power outlets for vehicles heating during winter will be available. Power will be supplied directly by Hydro-Québec, with a distinct account from Kipawa mine. There will be a prefabricated building installed on tripods with an integrated toilet room and a working space for a 24/7 security guard. A camera system will link this parking to the main gate at the mine, using Internet connection.

At the plant site, there will be a parking lot for about 120 vehicles and two 53 feet long vans.

18.1.8 Security and Access Control System

The security officer will control the site access and will be located in a gate at the entrance of the mine site. This gatehouse that will be part of the administration building. There will be an alarm system for fire protection and a surveillance system for the site via cameras. The cameras will be of the Ethernet type (Power Over Ethernet if possible) and all linked to the optic fibre network.

Eleven (11) surveillance cameras will be installed to monitor the following areas: the gatehouse, overall plant site, the open pit, the garage, the 120 kV station, the bridge, the pumping stations, and the powder magazine, all with pan, tilt and zoom functions.

A total of 18 cameras for process monitoring will be installed in the process plant (with adequate dedicated quartz or LED lighting):

- 6 in the crusher area, including the ore bin chute;
- 3 in the tunnel and process plant feed conveyor;

- 3 in the beneficiation sector;
- 6 in the Hydromet sector.

A DVR server with recording capability will be at the gatehouse. This server allows the operator to organize views on the screen, operate the cameras, and watch previously recorded images. The security officers will have access to the cameras via a 50'' TV screen in the gatehouse. The process plant and crusher operators will also have access to the process cameras via another 50'' TV screen.

18.1.9 TELECOMMUNICATIONS

The telephone system will be an IP type with a total capacity of 100 lines with 15 digital lines.

In each building, including the process plant, Ethernet connectivity will be available via fibre optic network.

A walkie-talkie radio system will also be used at the mine and plant sites with 30 radios, repeaters, chargers, and antennas.

18.1.10 MEDICAL FACILITIES

Medical facilities will be installed in the administration building and will provide space and equipment needed for the medical staff, a doctor, and a nurse. An ambulance vehicle will be parked in the warehouse building.

18.1.11 OFFICES, ASSAY LABORATORY, WAREHOUSE, WORKSHOP

The administration building (43.7 m x 19.5 m) will include office spaces mainly for the administrative personnel, the supervision and the technical staff of the mine department, the information technology personnel, the purchasing agent, and the medical staff. It will be a prefabricated building with its foundations. As mentioned, the gatehouse will be part of that building. It will also have conference rooms, a dry and a mechanical shop, as well as space for training employees, first aid, and mine rescue (Figure 18.2 and Figure 18.3).

Figure 18.2 - Ground Floor of Administration Building[19]

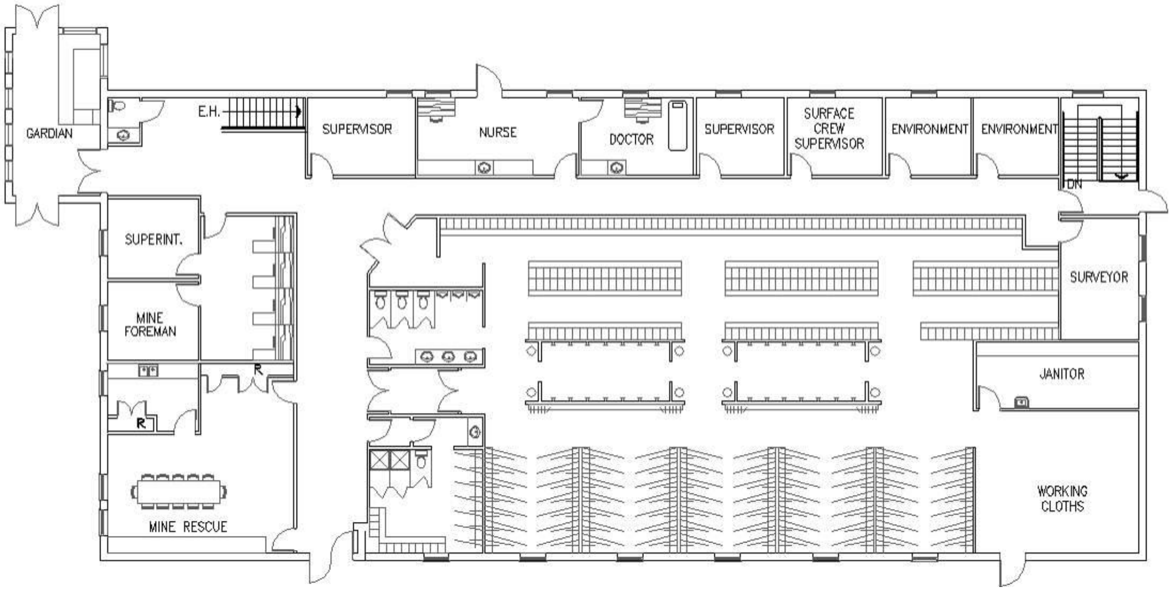
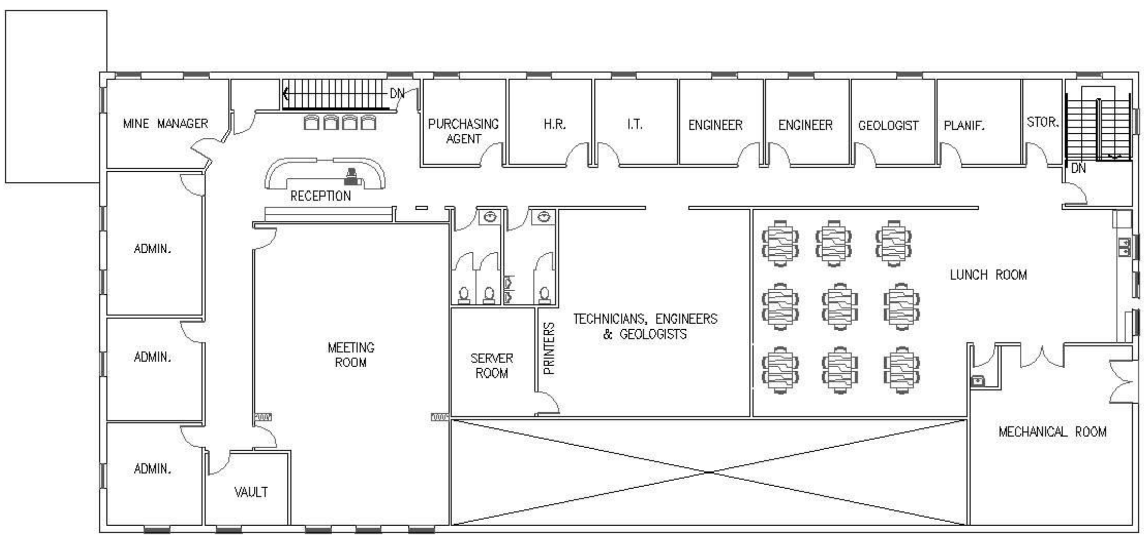


Figure 18.3 - First Floor of Administration Building[20]



A building will be used as a warehouse (43.3 m x 19.5 m) with a total surface area of a little over 800 m^2 and there will be some room inside for parking the ambulance vehicle. The floor will have four drains in the warehouse section and a basin with a gutter will provide water drainage in the ambulance area. A main fan as well as several others will ensure proper space aeration and an air exchanger will provide enough fresh air inside the building. In the ambulance area, an air evacuation system will be installed and this will be controlled by deleterious gas sensors.

19 Drawing 340-00-100 from GENIVAR. More detailed drawing in Appendix 1.

20 Drawing 340-00-101 from GENIVAR. More detailed drawing in Appendix 1.

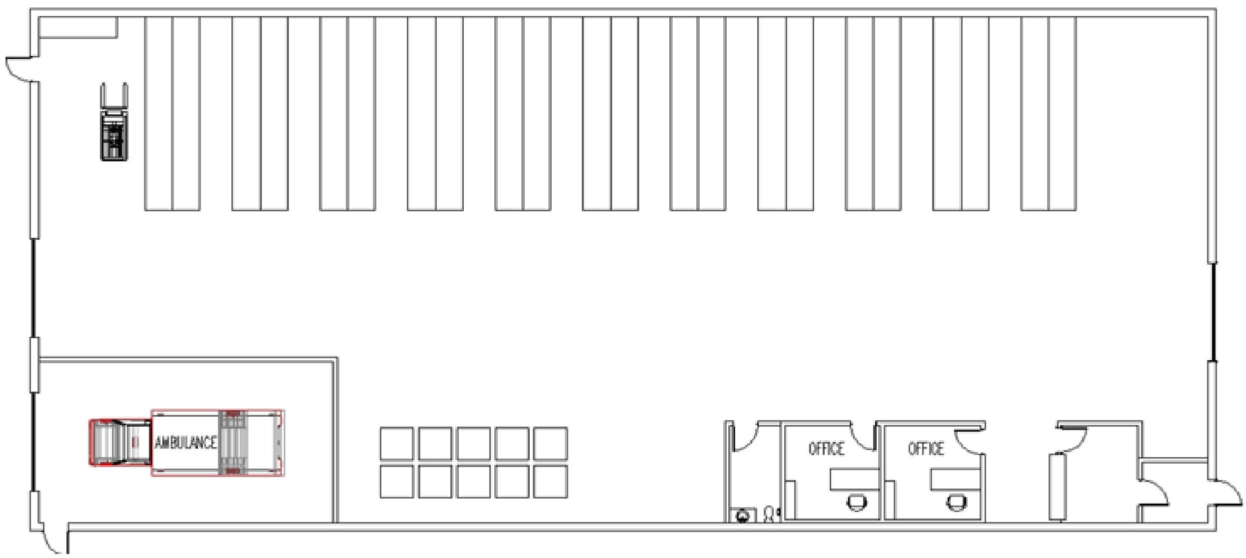
Fire protection will be available via water sprinklers. There will be fire protection cabinets with water hoses and fire extinguishers.

The building will be heated by electric unit heaters in the warehouse and ambulance sections, and electric baseboard heaters will heat offices and the bathroom.

A cold shed of identical dimensions (43.3 m x 19.5 m) will be located next to the warehouse building, but will not have any heating or offices.

Electrical power distribution feeder will come from the administration building.

Figure 18.4 - Ground Floor of Warehouse Building[21]



The assay laboratory building will have the following dimensions: 21.3 m x 18.3 m for a total surface area of about 390 m^2 (Figure 18.5). A garage door will allow reception of materials inside the building.

In the comminution area, preparation areas, and wet chemistry areas, waste water will be directed towards stainless steel reservoirs and pumped to the process water treatment plant. For the offices and bathrooms, waste water will be sent to the sanitary sewer.

Water will be supplied to the building from the site potable water system. Three emergency showers will be installed.

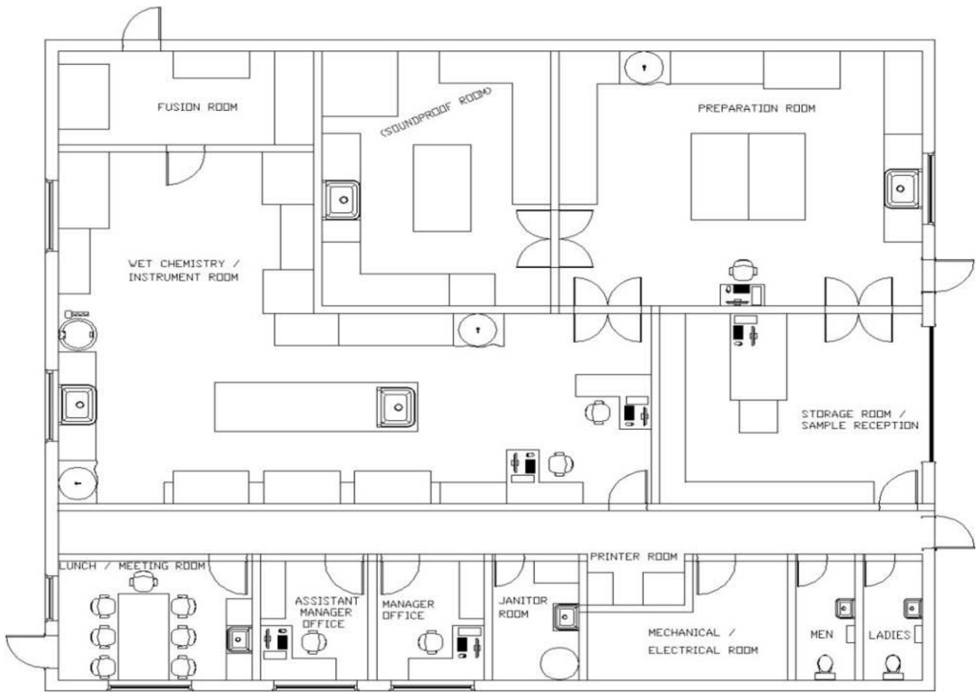
A dust collector will be installed for the fusion, comminution, and preparation areas. An air compensation unit of a heating/cooling type will be installed on the rooftop. Air heating will be provided by an electric coil and fresh air will be brought in by slot diffusers. Three laboratory hoods will be installed in the wet lab section with an evacuation fan on the rooftop of the building.

Water sprinklers will be installed for fire protection. There will be fire protection cabinets with water hoses and fire extinguishers.

[21] Drawing 342-00-100 from GENIVAR. More detailed drawing in Appendix 1.

Most of the building will be heated with electric baseboard heaters except for the storage area where a unit heater will be used. Power distribution for the lab will come from 44 kV / 600 V transformers installed on a post and connected to the 44 kV overhead line.

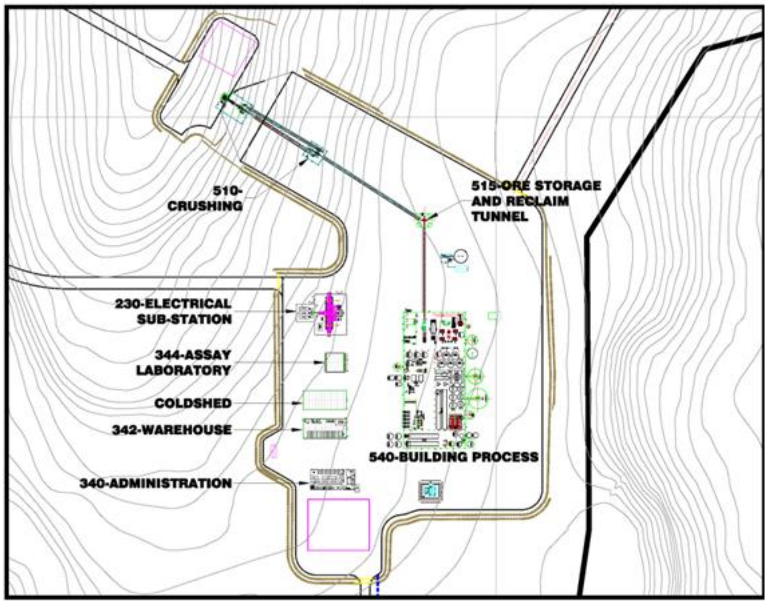
Figure 18.5 - Ground Floor of Assay Lab[22]



The aforementioned buildings (administration, assay lab, warehouse, and cold shed) are all located on the plant site as illustrated in Figure 18.6.

22 Drawing 344-00-101 from GENIVAR. More detailed drawing in Appendix 1.

Figure 18.6 - Location of Buildings on Plant Site[23]



18.1.12 Garage (Truck Shop)

The garage building (53.0 m x 23.8 m x 16.1 m high) will have washing, lubrication, welding, and repair bays for the large mine vehicles. There will be also one repair bay for small vehicles and another one for miscellaneous jobs. A storage area will be available for parts and for oil and greases. On the first floor, there will be office space to be used by the maintenance staff, as well as a lunch room and a conference room as illustrated in Figure 18.7 and Figure 18.8.

For the workspaces, the drainage from the floors will be directed towards a sand filter and then to an oil recovery system before being sent outside of the building. Drainage from the bathrooms and other sanitary facilities will be sent to a septic tank and a drainfield. Domestic water supply will be provided by a centrifugal pump dedicated to the building. The water treatment system will be located at the pump house.

A compressed air system will be available with a hose reel in the repair bay with an air tank to pump tires and pneumatic tools. A lubrication system will also provide five different lubricating oils through compressed air pumps that will feed oil to the lube bay area. Maintenance purpose oil and greases will be stored in the garage. The washbay will have a high pressure washing facility and two eyewash stations will be available in the garage.

Heating of the garage and the mechanical room will be provided by glycol water unit heaters fed via small electric boilers with diesel redundancy in case of power outage. Offices will be electric heated and the washbay will have infrared radiant heating above mobile equipment for ice removal.

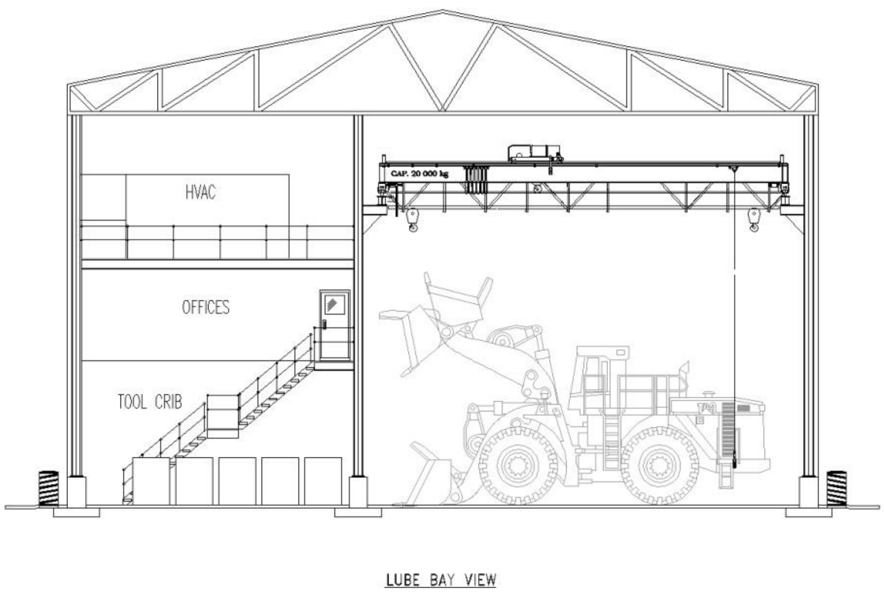
A diesel fuel system will feed the backup heating system's boilers and the main storage tank with a 6,820 litres capacity will be located outside of the building. A transfer pump will feed a smaller tank (455 litres) installed in the mechanical room.

[23] Drawing 300-00-101 from GENIVAR. More detailed drawing in Appendix 1

Ventilation of workspaces will be done through air exchangers with an average energy recovery of 50% and each of them will provide variable air flow in case of deleterious gas detection. The building will have air sprinklers for the offices area and water sprinklers for the garage area. There will be fire protection cabinets with water hoses and fire extinguishers.

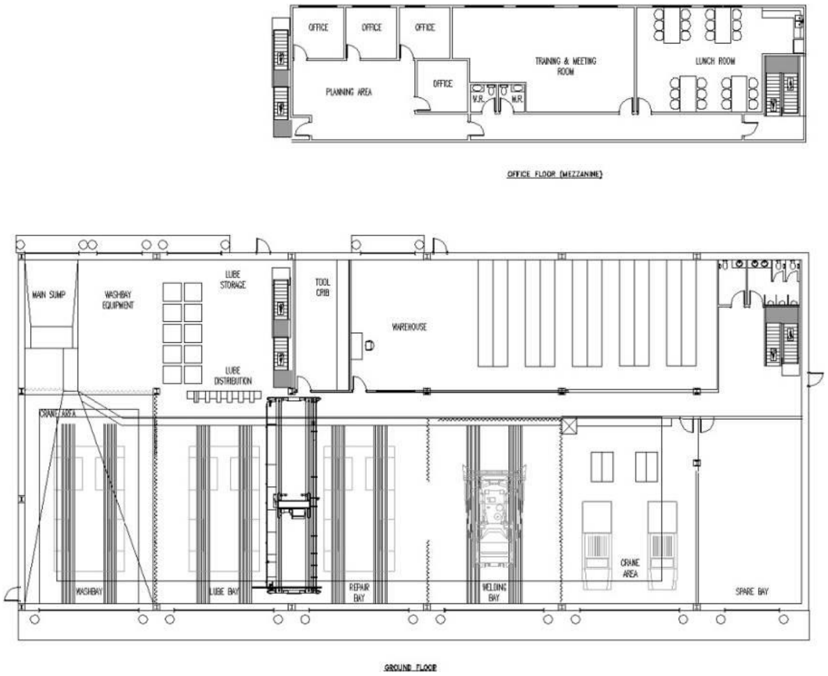
Electric power distribution will consist of a main switch, a metering box, and a 1,200 A, 600 V panel. In case of power outage, an emergency system will be available with an automatic transfer switch. For lighting and services, a 600/120/208 V transformer will feed distribution panel for convenience power outlets and lights.

Figure 18.7 - Elevation View of the Garage[24]



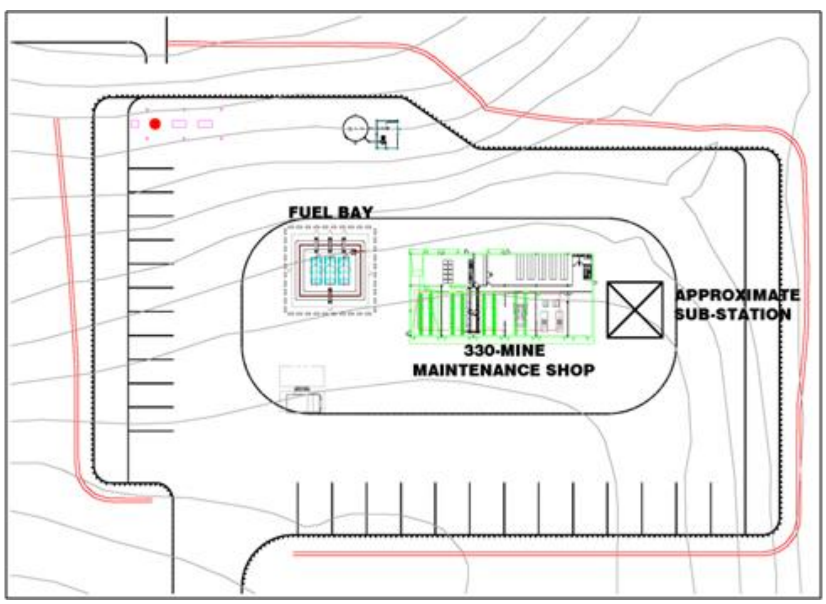
[24] Drawing 330-00-200 from GENIVAR. More detailed drawing in Appendix 1

Figure 18.8 - Ground Floor of the Garage[25]



The garage facility is located on the mine site as shown in Figure 18.9.

Figure 18.9 - Location of the Garage Building at the Mine Site[26]



25 Drawing 330-00-100 from GENIVAR. More detailed drawing in Appendix 1.

26 Drawing 300-00-101 from GENIVAR. More detailed drawing in Appendix 1.

18.1.13 EXPLOSIVES STORAGE AND HANDLING

The explosive supplier will acquire the required explosives license and will provide the two (2) magazines on a rental basis. The size of the magazines will allow for an appropriate quantity of explosives and accessories to be stored on site which will minimize the risks of blasting delays caused by prolonged shortages of products. One explosive magazine will have a capacity of 75,000 detonators for storing initiation systems from UN Class 1.1B[27] and its dimensions will be 2.4 m x 3.6 m. The second magazine will have a capacity of 25,000 kg of packaged explosives and boosters from UN Class 1.1D and its dimensions will be 3.6 m x 7.3 m. Packaged explosives will be necessary for presplitting and specific blasting applications.

The two explosive magazines will be installed on an isolated road between the garage and the hydromet plant. Located in a remote location at the East side of the mine, the magazines will be 2.25 km away from the open pit main ramp entrance. The magazines will be located at a minimum distance of 470 m from the closest infrastructure (main access road) on a restricted road that leads to a dead end (Figure 18.10). This location provides a suitable site meeting the Quantity - Distances criteria, rules and other regulations from the Explosive Regulatory Division of Natural Resources Canada (NRCan).

Site preparation will be required for this infrastructure during the pre-production phase. Site preparation will include:

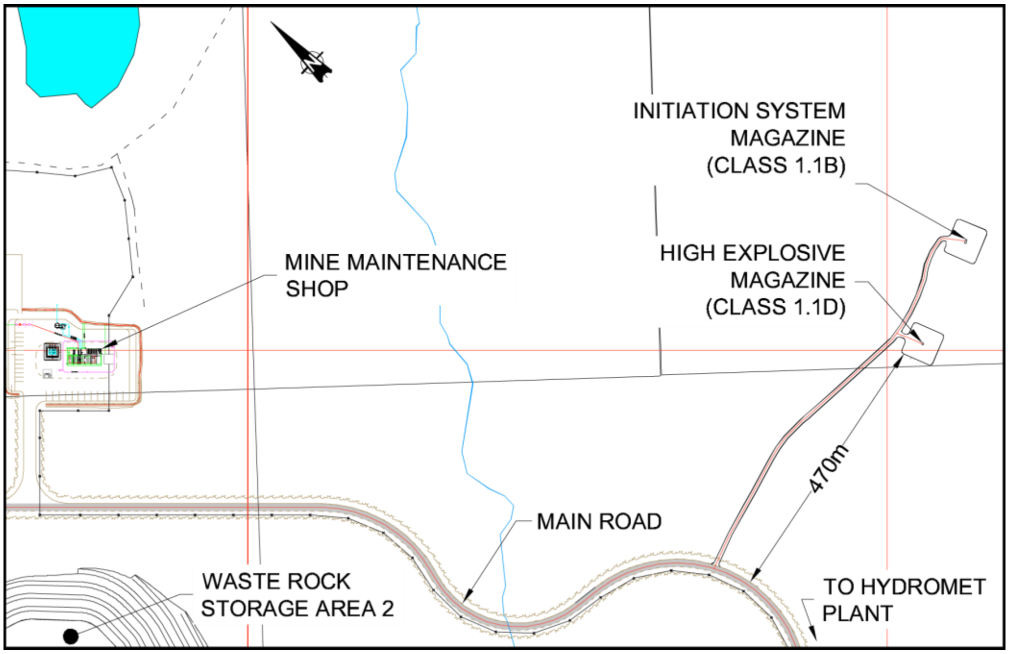
- Tree cutting and clearing;
- Road construction with ditches on both sides;
- Magazines area leveling and grading for water drainage;
- Compaction and concrete slab foundations for both magazines.

Only authorized and trained personnel will have access to the explosives storage area. The site will be enclosed by a fence and a lockable gate. Close to the magazines site , cameras and electrical lighting will be installed. The road and site will be maintained by Matamec's mine operation personnel.

The supplier's Mobile Mixing Unit (MMU) trucks will deliver explosives on request on a weekly basis. The emulsion will be handled on-site by the supplier's driver under the supervision of the Matamec's blasters. More details on the explosive type provided on-site by the supplier and the blasting techniques are described in Section 16.7.3 - Drilling and Blasting.

[27] UN Class 1.1B and 1.1D are a United Nations Explosives shipping classification code that differentiatedifferent explosive group by their shipping hazard.

Figure 18.10 - Explosive Magazines and Road Location



18.1.14 INFRASTRUCTURE COSTS

Table 18.1 below presents the cost of the main infrastructure of both plant and mine sites.

Table 18.1 - Cost of the Main Infrastructure

Infrastructure	Cost
Process Plant[28]	135,150,301
Roads (mine site roads, road between mine mtce shop and plant site, crusher access road at plant site)[29]	10,294,811
Process and Fresh Water Distribution (Water distribution, water pumping station and pipeline, fire protection and reclaim water system)[30]	9,296,420
Mine Garage[31]	7,541,910
Power (main substation and power distribution at plant site)[32]	5,898,361
Assay Laboratory[33]	3,941,757
Administration Building[34]	3,549,397
Plant Site Warehouse[35]	1,323,778

[28] Areas 510, 515, 520, 525, 530, 535, 540, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 572, 574, 576, 577, 580, 590, 598
[29] Areas 115, 310 (sub-proj 10 and 18)
[30] Areas 390, 570, 805, 830
[31] Area 330
[32] Area 230
[33] Area 344
[34] Area 340
[35] Area 342

18.2 Off-Site Infrastructure

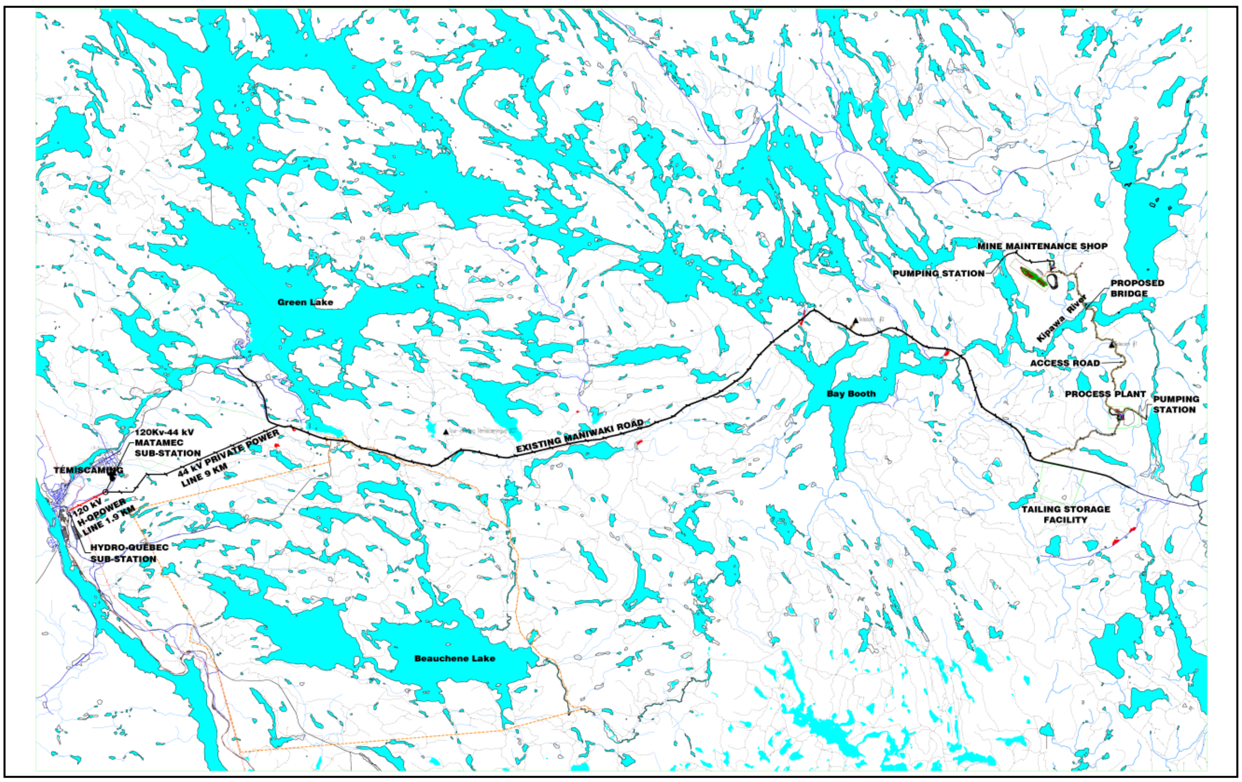
18.2.1 Main Access Road

The access road to the process plant has a total distance of 62 km, starting from the town of Temiscaming, using the existing Maniwaki Road for the first segment. This will be followed by 4.8 km of new road to be constructed. This new segment will be 9 metre wide to allow two-way traffic.

Granular material required for this road will come from borrow pits located nearby.

Main Access Road drainage will be designed to allow the natural flow of water. Culverts will be installed at strategic points to allow drainage and flow of existing streams and rivers. Ditches and culverts are designed with a return period of 10 years. Design will be calculated according to the "*Méthode Rationnelle"* and will follow the RNI recommendations (*Règlement sur les normes d'intervention dans les forêts du domaine de l'État*).[36]

Figure 18.11 - Main Access Road Outline from Temiscaming to the Kipawa Site[37]



18.2.2 Power Line and 120 kV Substation

Power will be provided by Hydro-Québec via a 120 kV power line that will be put in place specifically for the project. Hydro-Québec will be in charge of designing, supplying, and installing the approximately 1.9 km long 120 kV power line. A 120 kV substation, owned and maintained by Matamec, will be located near the town of Témiscaming. The main substation will include a concrete base, a 14 MVA 120 / 44 kV transformer, an incoming

36 *Gestion des eaux pluviales en milieu urbain, Gilles Rivard 2005; Tome II - Construction routière, Publications du Québec*

37 Drawing 300-00-101 from GENIVAR. More detailed drawing in Appendix 1.

and feeding portal structure, retention basins, an oil separator, and a prefabricated building for communication systems and breaker commands. The total connected power will be 18 MW and the real power requirement will amount to 10 MW.

Power will be delivered to the plant site substation at 44 kV via a 64 km overhead line following the Maniwaki road and the process plant main access road. Deforestation along the Maniwaki road will be required for the overhead line installation. Power consumers along the road, before the process plant substation, such as the tailings infrastructure will be connected directly to the 44 kV line with a fused-disconnect operated by a ground accessible handle.

18.2.3 Off-Site Infrastructure Costs

Table 18.2 below shows the costs of the off-site infrastructure.

Table 18.2 - Off-Site Infrastructure Costs

Infrastructure	Costs $
Power Line, 44 kV[38]	9,457,278
Power Line, 120 kV[39]	5,540,000
Main Substation, 120 kV[40]	3,573,998
Access Road, from Maniwaki Road to Process Plant Site[41]	2,252,864
Communications[42]	1,642,207

38 Area 220
39 Area 215
40 Area 210
41 Area 310
42 Area 225

19.0 MARKET STUDIES AND CONTRACTS

19.1 Rare Earth Market Overview

Portions of the marketing plan have been adapted from the "Rare Earth Market Assessment and Forecast Report" prepared by Asian Metal for Matamec dated June 30th, 2013.

The Rare Earth Elements (REEs) are typically defined as the fifteen lanthanide elements, yttrium, and scandium; they form a group of technology enabling materials that are critical inputs for a wide range of everyday consumer products as well as a large number of cutting edge technologies. Strong magnetic, optical, electronic, and catalytic properties have made certain rare earth compounds indispensable to a substantial portion of global industry, including but not limited to the automotive, consumer electronics, medical equipment, and green technology sectors. In the late summer of 2010, a dramatic 72% cut to second half (H2) Chinese rare earth export quotas sent prices for all rare earth materials sky rocketing, capturing the attention of both multinational corporations and prominent government bodies, while also highlighting the need for diversification of the global supply chain.

An analysis of the rare earth sector must first begin by recognizing that the projected rare earth global supply scenario differs substantially according to the individual rare earth compounds. The emergence of new rare earth mining ventures along with limited consumption growth prospects suggest certain rare earth materials will be in surplus before 2016; however, stringent Chinese policy and obstacles to the rapid development of mines outside of China will keep other materials in deficit through 2020. Likewise, there is no uniform downstream demand for rare earths. Demand for the majority of rare earth compounds and their corresponding products is driven by fundamentally different industries that will see varying degrees of growth or contraction in the upcoming years. Moreover, the elasticity of demand for rare earth compounds is unilaterally dependent upon the individual elements and their respective downstream industries.

It is necessary to identify the fundamentals behind supply and demand in the global rare earth industry in an effort to construct an accurate and informed rare earth oxide (REO) FOB China price forecast. A price model for the company's off-take; a mixed light rare earth oxide and mixed heavy rare earth chloride, and then input REO price forecast figures to provide for a corresponding off-take price forecast. Supply analysis suggests China will remain the central player in the production of heavy rare earth products through the remainder of the decade. As China works to increase domestic industry regulation, available export material will likely contract as illegal channels are shut down or restricted. The eventual ramp up to production of several Rest of World (ROW) HREE deposits, however, will help to alleviate tightness in supply by 2017 - 2018.

Meanwhile, demand for heavy rare earth materials is expected to benefit from strong growth, particularly in the case of terbium, dysprosium, and yttrium, which are likely to realize swiftly expanding consumption from both the permanent magnet and phosphor powder sectors. While an eventual transition away from fluorescent lighting towards more efficient LED alternatives will adversely impact demand for phosphor powders (yttrium and terbium) towards the end of the of the decade, the permanent magnet sector (dysprosium and to a lesser degree terbium) is generally forecasted to realize strong gains in annual consumption through the entirety of the next seven years. The combination of tightening Chinese supply along with growing demand suggests terbium, dysprosium, and several other HREEs will see appreciating price levels. Though demand for yttrium is expected to expand, sufficient Chinese domestic production will likely be able to cope with rising phosphor powder demand. High percentages of both terbium and dysprosium will fuel price appreciation for Matamec's mixed heavy rare earth compound, while neodymium is largely expected to drive price gains for the mixed light rare earth oxide compound.

19.2 Product Specification

The mined material from the Kipawa Deposit is processed through a number of beneficiation and metallurgical stages, the end products of the Kipawa processing plant will be a light mixed RE oxide and a heavy mixed RE chloride. The light mixed RE oxide will contain the following rare earths: Lanthanum (La), Cerium (Ce), Neodymium (Nd), and Praseodymium (Pr); while the heavy mixed RE chloride will contain the remaining rare earths: Samarium (Sm), Europium (Eu), Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Yttrium (Y), Holmium (Ho), Erbium (Er), Thulium (Tm), Ytterbium (Yb) and Lutetium (Lu). The estimated production levels are indicated in Table Table 19.1. The Kipawa Project will produce the rare earth compounds in-line with specifications provided by the potential off-take partners' purity specifications.

Table 19.1 - Kipawa Deposit Annual Production Estimate by REO

Rare Earth	Annual Production (t)
Contained within Kipawa's LRE Compound	
Lanthanum (La)	523
Cerium (Ce)	1018
Neodymium (Nd)	469
Praseodymium (Pr)	127
Contained within Kipawa's HRE Compound	
Samarium (Sm)	110
Europium (Eu)	14
Gadolinium (Gd)	112
Terbium (Tb)	21
Dysprosium (Dy)	141
Yttrium (Y)	890
Holmium (Ho)	31
Erbium (Er)	95
Thulium (Tm)	14
Ytterbium (Yb)	79
Lutetium (Lu)	9
Total	***3,653***

19.3 Rare Earth Supply and Demand Forecast

19.3.1 Evolution of the Worldwide Market - Rare Earth Supply Analysis and Projections

The global rare earth supply chain is currently in a period of flux for which the industry recognizes the importance of diversifying away from sole reliance on the Chinese model and is in the process of identifying and optimizing the necessary supply sources to achieve this goal. At present, the upstream portion of the rare earth supply chain are effectively monopolized by China, which accounts for over 92% of total upstream rare earth material supply. China has dominated the supply of rare earths during the past few decades and will likely remain the dominant supplier through the remainder of the decade, thus, any effective analysis of the rare earth supply chain must first take the Chinese production model into consideration. The remainder of the decade, however, will see gradual diversification of the global supply chain as multiple rest of world (ROW) mining projects reach production.

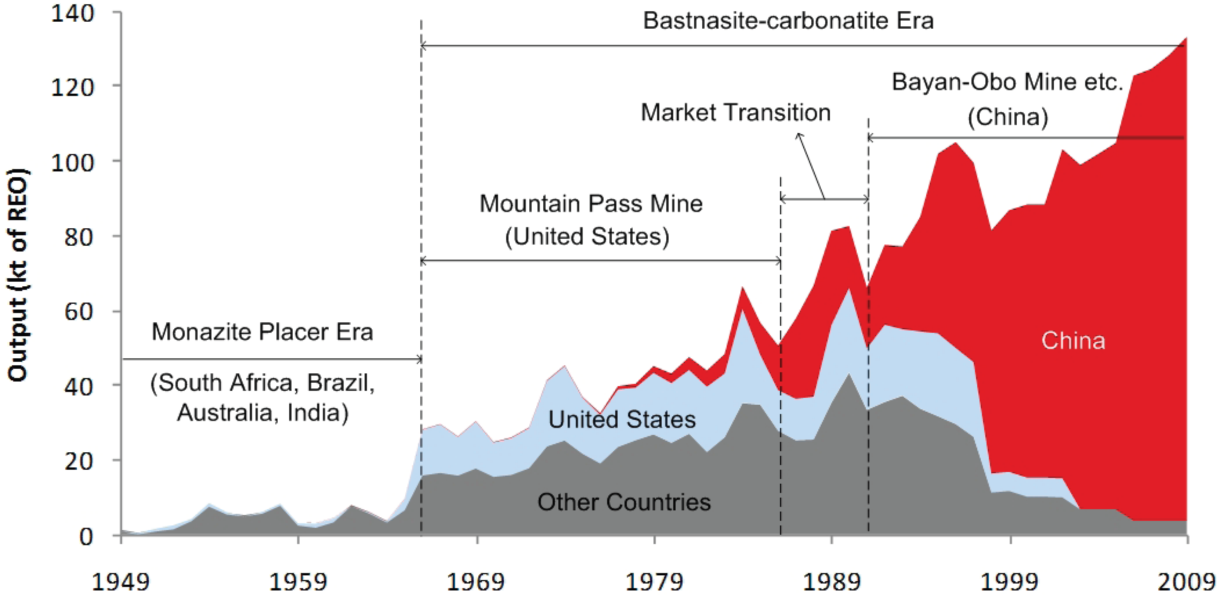
19.3.2 THE CHINESE PRODUCTION MODEL

In order to fully understand China's RE production model, it is important to identify the pivotal factors that defined its ascendance to global dominance. China's ability to corner the global supply of rare earths is predicated upon superior production economics, which is underpinned by substantial state backed investment and infrastructural support as well as region specific advantages. The sector is complex with different rare earths sourced from different regions, mined from different types of deposits, and processed using different techniques. Furthermore, the Chinese RE sector is in a transitional period, where several prevalent trends, primarily the current push towards increased regulation, industry consolidation, and reduced unauthorized production, will combine to profoundly shape the global supply outlook over the next several years.

19.3.3 CHINA'S ASCENDANCE TO DOMINANCE: STATE BACKED DEVELOPMENT

Although China's global dominance in the production of rare earth materials did not come about until the 1990s, its history spans back all the way to the 1950s. China's entry into the RE sector began in the late 1950s with the production of rare earth materials at the Bayan Obo deposit in Baotou, Inner Mongolia. 1963 saw the establishment of the Baotou Research Institute of Rare Earths, a state-backed applied research institution focused on the metallurgy, utilization, and application of new functional rare earth materials. The sector saw limited development through the remainder of the 1960s; however, in 1972 Xu Guangxian, a professor of Peking University, began to research rare earth separation and extraction, and in August of 1975, at the first Chinese rare earth conference in Beijing, introduced his theory on rare earth extraction. The Chinese government then dedicated substantial resources to the investigation and improvement of this theory, which led to the rapid improvement of the Chinese rare earth industry's processing capabilities. China had implemented policies aimed at securing global dominance in the production of rare earths long before Deng Xiaoping, the chief designer of China's then reforming and opening strategy, proclaimed, "the middle east has oil, China has rare earths."(1) Inclusion in important national development programs, namely, Program 863 in 1986 and Program 973 in 1997 (2), accelerated R&D efforts in the rare earth sector. Furthermore, the establishment of additional State Key Research Laboratories brought the total number of state-backed rare earth research institutions up to four, specifically the Baotou Research Institute of Rare Earths (the largest RE research institution in the world), the General Research Institute of Non-Ferrous Metals (not strictly focused on rare earths), the State Key Laboratory of Rare Earth Materials Chemistry and Applications (affiliated with Peking University), and the State Key Laboratory of Rare Earth Resource Utilization (affiliated with the Changchun Institute of Applied Chemistry). China simultaneously implemented policies to foster growth in the rare earth export market. From 1985 - 2003, it offered export rebates for many rare earth products, which led to the rapid expansion and development of China's domestic up-midstream rare earth production capacity. In addition to the allocation of substantial resources towards R&D in the sector, China further promoted growth by the establishment of special industrial development zones, such as the Baotou Rare

Figure 19.1 - Kipawa Deposit Annual Production Estimate by REO[43]



Earth Hi-Tech Industrial Development Zone. With the support of the state, constantly improving technologies, and a massive leap forward in processing techniques, China's rare earth production rapidly expanded, with increases to annual production capacity averaging at 40% from 1978 - 1989.

19.3.4 Regional Division

China's rare earth industry is comprised of three primary production bases, namely Baotou (Inner Mongolia), Sichuan, and a group of Southern Chinese provinces (Jiangxi, Guangdong, Guangxi, Hunan, and Fujian). The combined production capacity of these three bases is approximately 170,000 - 200,000 t per annum, with Baotou, Sichuan, and the Southern Chinese provinces conservatively accounting for 80,000 - 90,000 tpa, 60,000 tpa, and 30,000 - 50,000 tpa, respectively. The production bases are then classified under two technical production systems, one being light dominated and the other being heavy dominated. In a broad sense, Chinese rare earth production is characterized by LREE production in the more northern regions, primarily Inner Mongolia and partially in Sichuan. The production of the following MREEs (Sm, Eu, and Gd) is more or less split between the two systems. The types of rare earth deposits in these technical systems differ dramatically: Inner Mongolia and Sichuan feature hard rock deposits while the southern provinces focus on the unique Chinese ion adsorption (ionic) clay deposits. Furthermore, the majority of LREE production centers around a handful of massive mines whereas many of the ionic clay deposits tend to be smaller in size and relatively scattered. Consequently, the Chinese LREE mining sector is consolidated within a few major companies, including Sichuan Jiantong and Baotou Steel, whereas mining of the HREEs is historically more diversified and dispersed.

Although rising wages and environmental concerns have begun to erode some of China's initial advantages in terms of production, China continues to hold several unique strengths in the rare earth mining sector that enable it to enjoy reduced costs. By-product economics enable Baotou Steel's Bayan Obo mine in Inner Mongolia, currently the world's largest individual source for light rare earths, to produce rare earths at a fraction of the cost of many of

[43] Source: ChinaBrief Volume X Issue 22 November 5, 2010

its global competitors. Also an operating iron ore mine, Bayan Obo's rare earth production comes from the processing of iron ore tailings, thus marginalizing initial mining costs. Current rare earth production output for the Bayan Obo mine, roughly 25,000 t of REO per annum, is operating at only a fraction of total capacity.

The world's primary source for terbium, dysprosium, and yttrium, Southern China's infamous ionic clays endow China with a massive advantage in terms of HREE production. Ionic clays benefit from a very high proportion of HREOs to LREOs in their total rare earth oxide (TREO) grade. They are generally categorized as either yttrium-rich (YR) or yttrium-medium (YM) type deposits, with TREO grades containing approximately 60 - 65% and 12 - 20% Y content, respectively. Despite relatively low TREO grades (the Chinese industry average is around 0.05% TREO) simple and inexpensive processing techniques render these deposits economically practical. A relatively basic extraction method is used to directly produce ionic rare earth concentrate from the clay ore, vastly simplifying both the mining and ore beneficiation process. As a result, relatively small operations can still run efficiently with most deposits' resource reserves not exceeding 10,000 t. Nevertheless, the low barriers to entry and dispersed/remote nature of the ionic clay deposits have led to substantial amounts of illicit mining activity, significant environmental damage, and rapid resource depletion.

19.3.5 Refining Model

The production of midstream rare earth materials is complex, typically involving multiple processing stages before a marketable rare earth product is reached. China pioneered many of the advanced modern day rare earth refining techniques and remains on the forefront of the innovation frontier for this sector. At present, few, if any, operations outside of China have or are forecasted to have the processing/refining capacity necessary to manufacture the full spectrum and purities of the midstream rare earth materials produced under the current Chinese model. China has and will continue to retain a competitive advantage on the processing/refining side of the industry.

China's rare earth processing and refining capacity is huge, tremendously diversified, and highly competitive. Over the past two decades, substantial growth in the rare earth industry along with often times regionally isolated state-backed development efforts saw a large number of players enter the sector. Each of the three production bases possess the full technical capacity, including the various beneficiation, separation, and refining facilities, necessary to process upstream rare earth products into a wide range of finished mid/downstream materials. Although inherent differences in the deposit geology of the two technical production systems requires varying approaches to upstream processing (a more consolidated hard rock mining sector lends itself to centralized beneficiation plants, whereas metallurgical advantages enable ionic clay mines to still advance to the RE concentrate stage despite being more dispersed and remote), they are both similar in the sense that options beyond the RE concentrate stage are relatively diversified.

The processing/refining portion of the Chinese model is not consolidated, and while its highly competitive nature played a critical role in setting the low prices that ultimately enabled China to corner the global market, the efficiency and sustainability of the system are currently in question. There certainly are opportunities for economies of scale and industry consolidation would likely improve efficiency, however, China has been slow to drive forward consolidation, arguably due to concerns about job destruction. In many instances, escalating environmental and health safety concerns are directly linked with the processing/refining portion of the Chinese model, and as China works to address these issues the processing/refining sector is certain to see drastic change.

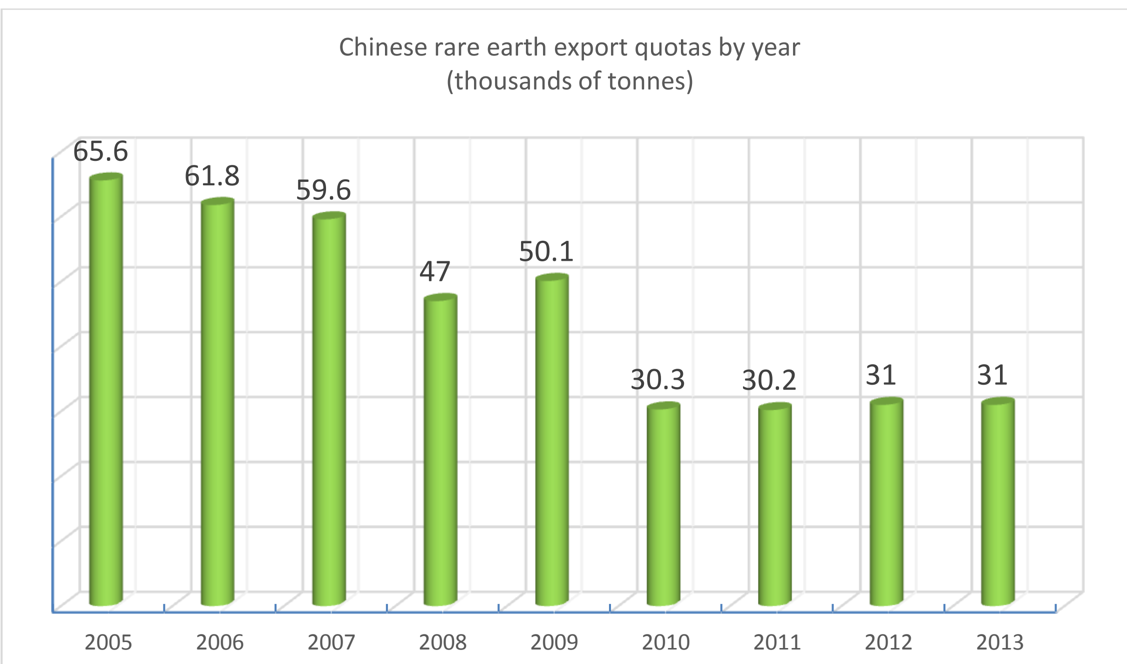
19.3.6 Addressing Sector Issues: Emerging Industry Trends

Several prominent trends within the Chinese rare earth sector are actively reshaping the global supply situation. Rapid growth in any industrial sector will of course be accompanied by a host of problems and the Chinese rare earth industry is no exception. The next few years will be a time of change as China actively works to increase regulation, promote industry consolidation, and decrease production in an effort to recognize economies of scale, prevent environmental degradation, improve health and safety standards, and avoid fuelling a black economy.

19.3.7 The Chinese Export Quota System

The Chinese export quota system has virtually dictated ROW supply for rare earths and this trend is likely to continue during the next several years. Since the 40% decrease in the 2010 Chinese rare earth export quotas, which had previously hovered above 50,000 t REO per annum, export quotas have remained in the 30,000 - 32,000 t REO per annum range. In early July of this year, The Chinese Ministry of Commerce (MOFCOM) announced the second round of allocations of rare earth export quotas for 2013, thus, making the total (H1 + H2) export quota allocation for 2013, 31,001 t REO. Specifically for 2013 H2, a total of 15,500 t of export quotas was allocated, comprising 13,821t of light rare-earth (LRE) products and 1,679 t of medium / heavy rare-earth (M/HRE) products, bringing the total for 2013 to 31,001 t, almost identical to the 2012 total of 30,996 t. The M/HRE: Total RE ratio has decreased slightly for the first time since the MOFCOM has separated quotas of M/HREs at the start of 2012[44].

Figure 19.2 - Domestic China RE Production Quota (2008 – 2013)[45]



44 Source: Industrial Minerals, July 2, 2013

45 Source : Asian Metal, June 30th, 2013

19.4 Applications of Rare Earth in Today's Mainstream products

The individual rare earth elements have taken turns in their value to science as the markets have changed. In other words, during the early 1960s, lanthanum was used in the optical glass industry. Cerium was widely used as a polishing agent. Didymium, a mixture of the elements praseodymium and neodymium, was widely used in the glass industry for colouring. However, at this time, there was no market for samarium and europium and large stock piles of these materials grew. Then, in 1965 the U.S. began to use europium as a red phosphor in color televisions. In the 1970s samarium became a key ingredient for a 'super magnet' – the samarium cobalt magnet. In the 1980's, it was the discovery of the neodymium-iron-boron (NdFeB) magnet that gave a boost to the uses where permanent magnets were applied in ever greater numbers. Today, permanent magnets dominate rare earth technology because of their ability to provide greater magnet power in vastly smaller sizes. Permanent magnets are magnets that, unlike electrical magnets, produce their own magnetic fields. Permanent magnets are what will be utilized when the application requires a compact light-weight solution to provide the ability to make computers smaller as well as uses in green technologies such as Electric Vehicles and Wind Turbines.

Knowledge of the applications and uses of the rare earth elements were not widely known prior to the critical period for the materials in late 2010 and into 2011. Since that time there has been numerous articles written on the subject of Rare Earths, it was only after these article and many news pieces that consumers became aware of the importance of these materials. These materials with their unique chemical and physical properties are the key to functionality of many of the electronic devices that are used by millions of people world-wide. The next generation of products that utilize rare earths will be are very exciting. What is of primary importance is that R&D departments of leading global organizations are permitted to use these materials in their research programs to their full extent without the concern of supply restrictions on these materials which has been seen in the recent past. Table 19.2 provides some of the many known applications that the rare earths are utilized today.

Table 19.2 - Rare Earth Demand by Application[46]

REE	Field of Application
Lanthanum	Glasses, ceramics; FCC & auto-catalysts, phosphors, pigments, accumulators
Cerium	Polishing powders, ceramics, phosphors, glasses, FCC & auto-catalysts, pigments, mischmetal, UV filters
Praseodymium	Ceramics, glasses, pigments
Neodymium	Permanent magnets, catalysts, IR filters, pigments for glass, lasers
Samarium	Permanent magnets, microwave filters
Europium	Phosphors
Gadolinium	MRI Contrast Agents, optical and magnetic detection, ceramics, Nuclear industry, crystal scintillators
Terbium	Magnets materials, Phosphors
Dysprosium	Magnetic materials, Phosphors, ceramics, nuclear industry
Holmium	Ceramics, lasers, nuclear industry
Erbium	Ceramics, dyes for glass, optical fibres, lasers, nuclear industry
Thulium	Electron bean tubes, visualisation of images in medicine
Ytterbium	Metallurgy, chemical industry
Lutetium	Medical equipment applications, single-crystal scintillators
Yttrium	Capacitors, phosphors, microwave filters, glasses, oxygen sensors, radars, lasers and superconductors

[46] Source: Pike Research 2011 Rare Earth Market Report

It is speculated that certain applications will increase the needed quantity of Rare Earth materials substantially such as the case for Permanent Magnets, Phosphors and Polishing Powders as well as Ceramics and others.

Table 19.3 - Global Rare Earths Demand in 2016 (REO +/- 15%)[47]

Applications	China	Japan & SE Asia	USA	Others	Total	Market Share
	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	%
Catalysts	14,500	2,500	6,500	1,500	25,000	15
Glass	6,000	1,000	1,000	1,000	9,000	6
Polishing	19,000	2,000	3,000	1,000	25,000	15
Metal Alloys	20,000	2,500	2,000	1,500	26,000	16
Magnets	28,000	4,500	2,000	1,500	36,000	22
Phosphors	9,000	2,000	1,000	500	12,500	8
Ceramics	4,000	2,000	2,000	1,000	9,000	6
Other	6,500	3,500	8,000	2,000	20,000	12
Total	107,000	20,000	25,500	10,000	162,500	100
Market Share (%)	66%	12%	16%	6%	100%	

Some of the Rare Earths will be in surplus by 2016 such as Lanthanum, Cerium, Samarium, and Praseodymium while others will show a deficit such as Neodymium, Dysprosium and Terbium as well as Yttrium, Erbium, and Europium.

Many of the deposits being in production or being studied produces or could produce a large percentage of their Rare Earth output as light Rare Earths already available from actual producers. Few deposits will offer the heavier Rare Earths such as Dysprosium and Terbium. The Rare Earths produced inside China or Rare Earths mined and concentrated elsewhere which will be processed in China, will doubtfully be exported and will be used in manufacturing in China. Any new project to be able to sell its Rare Earths refined and separated will need to be processed outside China which limits the number of refining and separation operations.

The company expects that the Kipawa project will offer the marketplace an increased supply of Dysprosium, Terbium and other Critical rare earths to the market. The output from the Kipawa will help reduce the dependency towards Chinese resources as well as its refining capacity, if the Matamec Zeus Rare Earths refined concentrates is processed outside China.

19.5 Outlook on Pricing

The Rare Earth Oxide prices used in the Feasibility Study are based on a contracted market survey by Asian Metals in conjunction with discussions with key industrial end-users which were important in defining the final prices of each rare earth oxide. Other sources consulted for review of the historical pricing data were websites and reports from Metal Pages, Roskill Information Service Limited and Industrial Minerals.

[47] Source IMCOA Sept 2012

The refining cost to reach 99.9% oxides or even higher purity levels was not evaluated within the FS since refining was not considered in the scope of the FS. It was decided that since the forecasted prices are for 99.9% pure, individual oxides and Matamec will be producing two mixed TREO concentrates, a light mixed rare earth concentrate that will contain the REE's: Ce, La, Nd and Pr. With the second product, a heavy RE concentrate that will contain Sm, Eu, Gd, Er, Tb, Dy, Ho, Yb, Tm, Lu and Y. The projected selling prices for the concentrates will be reduced by a refining factor of 30% for the majority of the Rare Earths, but 40% for the REE's: Ho, Er, Yb, Tm and Lu. The higher discount was applied considering that these materials would require more costs associated to process them due to the higher degree of purity that is required by their associated end uses. It is considered that the respective discounts will cover all logistical costs for the material to be shipped to their intended point of separation.

The model for the revenue for the Kipawa project is based on providing rare earths to the marketplace which have been separated into the individual oxides at purity levels that are required to meet the written specification of the end user. Table 19.4 outlines the outputs of each of the REO's and the revenue associated with it.

Table 19.4 - Kipawa Project Forecasted Revenue

2016 - 2017 REO Prices (forecasted)							
REO		**Price FOB Mine-Site (USD/kg REO)**	**Refining cost (%)**	**Price after refining (USD/kg REO) (A)**	**Quantity Sold per year (est.) (t REO)**	**Quantity Sold LOM (est.) (t REO) (B)**	**Revenue ('000's USD) (A x B)**
Cerium	Ce	5.90	30	4.13	1,018.4	15,479	63,928
Lanthanum	La	5.95	30	4.17	523.2	7,952	33,120
Praseodymium	Pr	75.40	30	52.78	127.0	1,930	101,865
Neodymium	Nd	75.00	30	52.50	469.2	7,132	374,430
Samarium	Sm	6.85	30	4.80	110.5	1,679	8,051
Europium	Eu	1,100.00	30	770.00	14.1	215	165,550
Gadolinium	Gd	59.40	30	41.58	111.6	1,696	70,520
Terbium	Tb	1,076.00	30	753.20	21.1	321	241,777
Dysprosium	Dy	713.00	30	499.10	140.6	2,137	1,066,577
Holmium	Ho	53.60	40	32.16	31.2	474	15,244
Erbium	Er	63.60	40	38.16	70.0	1,063	40,579
Thulium	Tm	1,200.00	40	720.00	2.1	32	22,788
Ytterbium	Yb	56.70	40	34.02	36.5	555	18,873
Lutetium	Lu	1,400.00	40	840.00	3.6	55	46,368
Yttrium	Y	29.40	30	20.58	889.6	13,522	278,283
							2,547,952

19.6 Pricing Examination for the Rare Earth Compounds

On July 11, 2012, Matamec and TRECan entered into a Joint Venture Agreement, part of which includes an off-take agreement by which Toyota Tsusho Corporation will be the off taker of the production from the Kipawa Project, under the terms and conditions of the JVA. Negotiations to convert the agreement into contractual volumes will begin following the completion of the feasibility study. TRECan is a well-recognized strategic partner that has committed $16.0M to Matamec to complete the definitive feasibility study. As a producer of mixed LRE and HRE compounds, which would then go to separation plants abroad, the Kipawa Project would expect to provide the majority of its product into the end-use application markets which represent the highest demand for the heavy rare earths, notably the hybrid and electric vehicle markets, the wind turbine markets and also the phosphors market into lighting market as well as other applications.

An important consideration for the project must be to calculate the value of the produced products as is. Since the project is located outside of China, a price forecast for company's off-take must be predicated upon ROW prices (FOB China prices). The REO basket value for each mixed rare earth compound can be calculated by multiplying the individual forecasted prices by their percentage content. A discount, based on the price discount to be factored in to convert the mixed RE compound and their corresponding REO's, can then be applied to the respective REO basket values to yield a price estimate for each of Matamec's mixed rare earth compounds.

For simplicity, the prices of both the light and heavy products are combined to provide a unified price. The projected selling price is as follows: $73.22/kg as REO, which was reduced $23.10/kg (32% as an average discount for the separation of the rare earths) to give a cumulative price of $50.12/kg for the products. The price presented takes into consideration the costs for the refinement and shows the high HREE content of the Kipawa mixed TREO concentrates being produced by Matamec will show favourably when compared with other rare earth mining operations or future projects.

20.0 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

20.1 Regional Environmental Setting

20.1.1 INTRODUCTION

The present chapter summarizes the environmental setting in which the Kipawa Project (Project) site is found and provides the information necessary to assess the potential constraints the environment can have on the project and the potential impacts the Project may have on its environment. The information presented below is based on literature reviews, information requests and field studies conducted in 2012 and 2013 (Golder, 2013a&b).

20.1.2 GENERAL SETTING

The Kipawa Project is located in the Témiscamingue region, approximately 45 km east of Témiscaming and the Ontario border (illustrated below, Figure 20.1). The Project sits in the boreal forest ecosystem, which has a humid continental climate. The climate is characterized by cold and dry winters, and warm and humid summers. Based on regional meteorological data, the average annual temperatures range between 19.3°C and -12.1°C. (Environment Canada, 2013). The region receives precipitation year round, having an annual average of approximately 709 mm of rain and 241 mm of snow. (Golder, 2013b).

The local topography has been shaped by past periods of glaciation that covered the entire Canadian Shield. The Project setting is marked with a generally flat topography having only small undulations with gentle slopes and a slight overall slope towards the Ottawa River, which is located to the west. Although developed, its drainage network is fairly fragmented and composed of several elongated lakes and rivers, which roughly cover 20% of the region's surface area. The proposed mine site and ore processing plant are located on a plateau about 300 m above sea level that, in part, slopes down towards the Kipawa River. The main features of the Project's environmental setting are illustrated below (Figure 20.1 and Figure 20.2).

A complete baseline study was conducted for all components of the biophysical and human environment of the Kipawa Project site. However, only components presenting potential constraints on the Project and components that may be impacted by the Project are discussed in subsequent sections.

Figure 20.1 - Regional Area

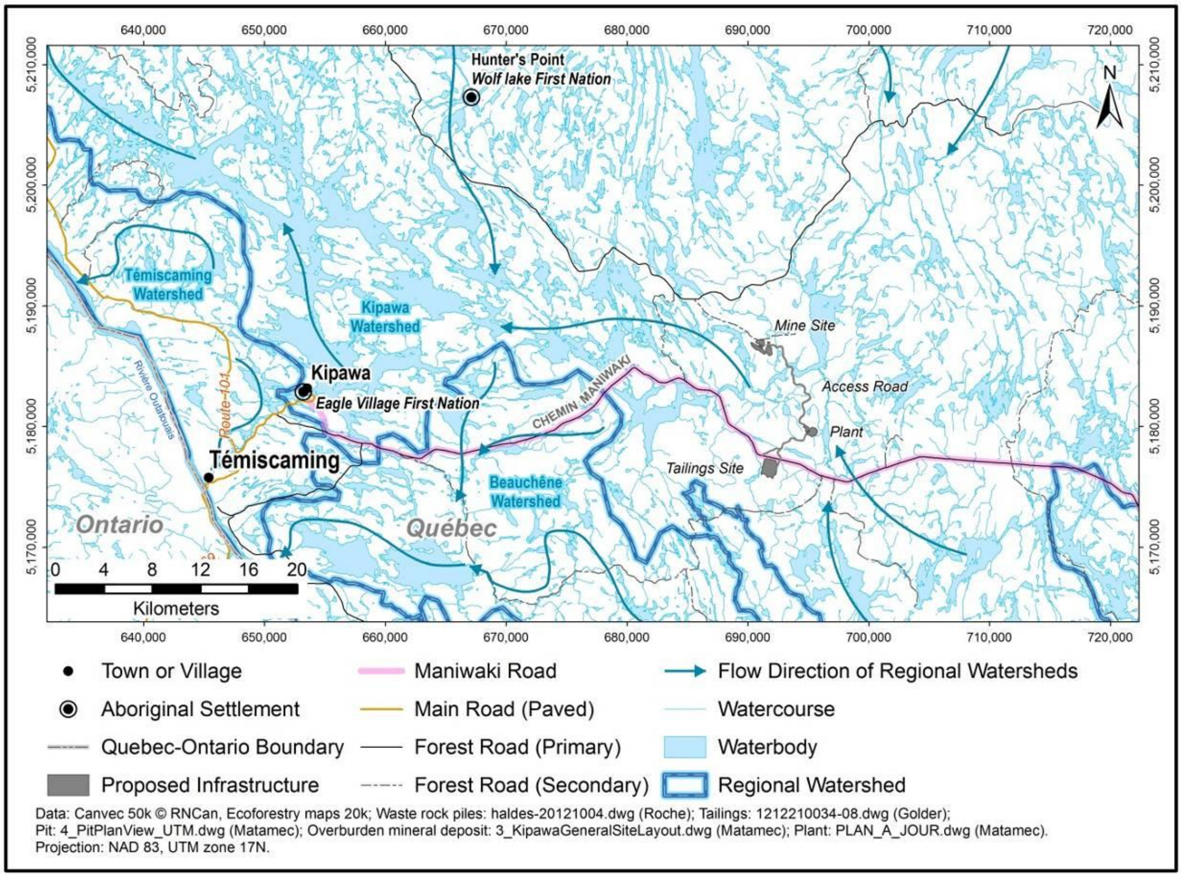
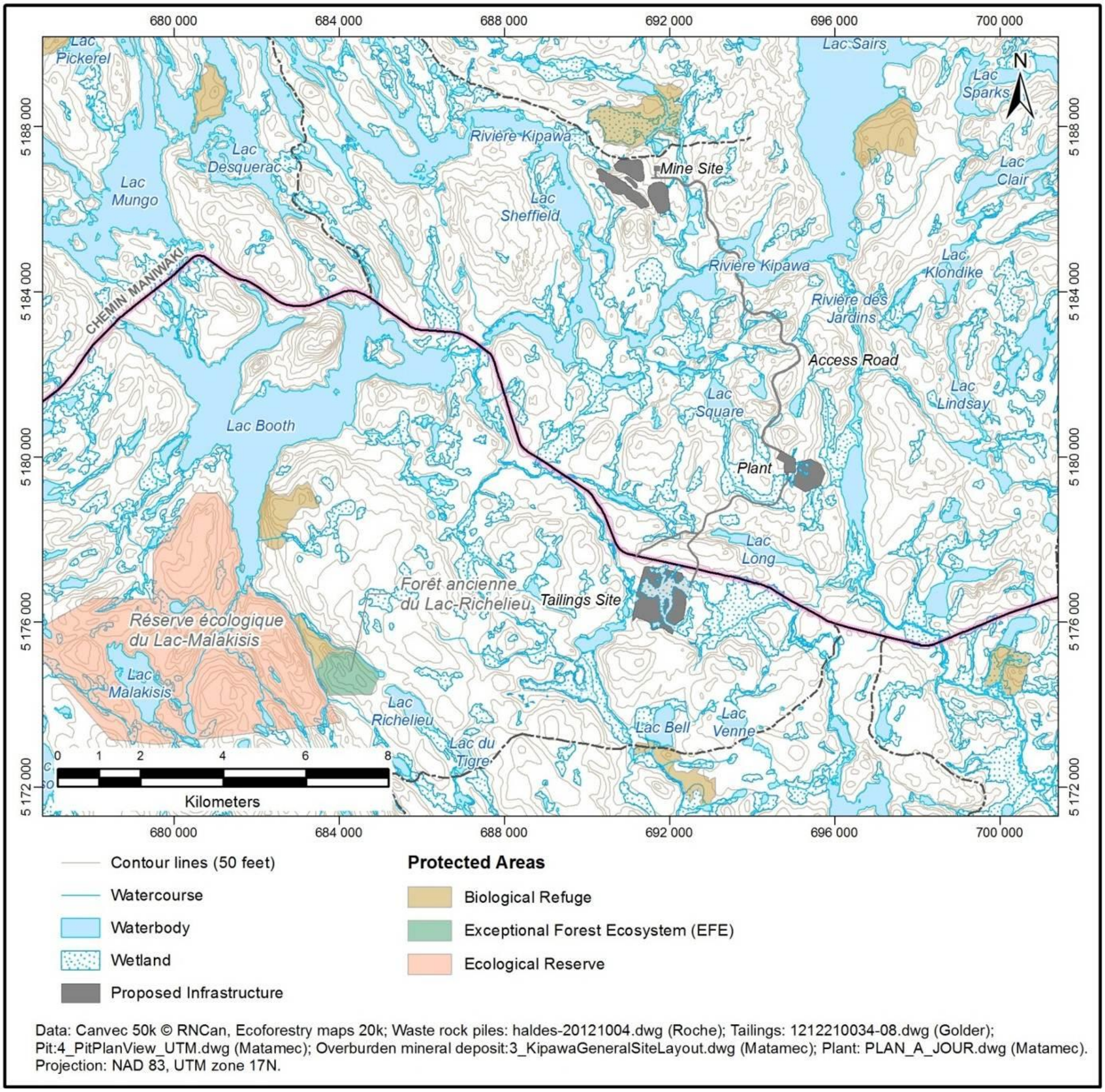


Figure 20.2 - Local Area



20.1.3 SOILS AND HYDROGEOLOGY

Located on the Canadian Shield, and more specifically in the geological Grenville Province, the bedrock underlying the Project site is dominated by an underlying metamorphic rocks mass composed of crystalline gneiss (Robitaille and Saucier, 1998).

The last period of glaciation has influenced the surficial deposits, which is considered dense and compact and is composed mainly of a thin and discontinuous till, which may include areas of exposed bedrock. To a lesser extent, there are also subtidal sediments and beach deposits resulting from glaciolacustrine deposits. These sediments are composed of sand, silty sand, boulders and gravel ranging from 1 to 20 m in thickness.

The hydrogeological layer composed of silty sand with gravels have an average hydraulic conductivity that is considered average to high. However, the main hydrogeological unit is composed of till and bedrock, has a hydraulic conductivity that is considered average to low, the conductivity decreasing with depth.

Groundwater flow directions observed coincided with the Project site's topography and surface water watersheds. It has been deduced that there is a general underground flow in a radial patter towards the Kipawa River. Potential groundwater receptors are class II aquifers (a potential source of drinking water) found within the surface deposit, and local rivers such as the Kipawa River. Groundwater samples were collected and analyzed to provide baseline information for impact analysis and design. No underground sewer, aqueduct, water network or water supply well is present at the Project site.

The Project site is subject to a certain seismic activity that is greater than the average seismic activity found in the Province of Québec. As part of the Western Québec Seismic Zone, the seismic activity is concentrated in two earthquake sub-zones: the first is found along the Ottawa River and a second, more active, zone is located along the Montréal-Maniwaki axis (NRC, 2013). Between 1980 and 2000, there were 16 registered earthquakes with a magnitude of more than 4 on the Richter scale, including an earthquake of magnitude 6.2 shook the region of Témiscamingue in 1935 (NRC, 2013).

20.1.4 PROTECTED AREAS AND SPECIES

None of the proposed infrastructure falls within the footprint of a protected area. Three types of protected areas are present within few kilometres of the proposed mine, plant and tailings sites. They include an ecological reserve, an exceptional forest ecosystem and two biological refuges (Figure 20.2). The Lac-Malakisis ecological reserve, a land preserved in its natural state and selected for its distinctive ecological characteristics is located more than 5 km to the west of the tailings site. Likewise, the old growth forest of Lac-Richelieu, located just over 5 km of the Project's tailings site, remains untouched by any recent natural event or anthropogenic activity and is recognized as an exceptional forest ecosystem. The closest biological refuges, comprised of forest management areas in which habitats and species are permanently protected, are located 300 m to the north of the mine site and 3 km to the south of the tailings site. No Migratory Bird Sanctuaries established by the Canadian Wildlife Service are present near the proposed mine site or infrastructure. Similarly, none of the 54 National Wildlife Areas are located near the Project site.

Field surveys conducted in 2012 identified the presence of protected species as per either the federal Species at Risk Act or the Québec Act respecting threatened or vulnerable species within the region of the Project. Table 20.1 lists the protected species observed during the 2012 field surveys. Three protected plant species were observed during the field surveys, but none were found within the Project's infrastructure footprint. Six protect bird species were observed during the 2012 field surveys. The presence of two protected reptiles was also noted. Although no protected mammal, fish or amphibian species were observed during the field surveys, it is possible that other protected species which were not identified by field work nonetheless occupy the Project site.

Table 20.1 - Protected Species Observed During 2012 Field Surveys

Protected Plant Species
Northeastern bladderwort (Utricularia rusipunata)
Northern maidenhair fern (Adiantum pedatum)
Bur-reed sedge (Carex sparganioides)
Protected Bird Species
Olive-sided flycatcher (*Contopus cooperi*)
Common nighthawk (*Chordeiles minor*)
Canada warbler (*Wilsonia canadensis*)
Chimney swift (*Chaetura pelagica*)
Rusty blackbird (*Euphagus carolinus*)
Bald eagle (*Haliaeetus leucocephalus*)
Protected Reptile Species
Northern ringneck snake (Diadophis punctatus edwardsi)
Snapping turtle (Chelydra serpentine)

20.1.5 SURFACE WATER ENVIRONMENT

The surface water environment includes a description of the local hydrology, water quality and fish and fish habitat present within the Project site.

20.1.5.1 Hydrology and Water Quality

The Project is located in the greater basin of the St. Lawrence River, specifically in the Ottawa River watershed. Locally, the Project site is located within the Kipawa River sub-watershed. Northwest of the proposed Project site, the Kipawa River widens into a vast labyrinth of interconnected waterways. This set of very irregular shapes is referred to as "Kipawa Lake" by the local Aboriginal and non-Aboriginal people. "Kipawa Lake" includes many lakes (some having their own names), islands, islets and large bays. Ultimately, the Kipawa River empties into the Ottawa River via two outlets controlled by dams (one north of Kipawa Lake and the other west of it).

The Project site comprises several watercourses and water bodies for which representative water quality samples were collected. Water samples were collected for all four seasons during the 2012-2013 field surveys. The water samples were analyzed and served to provide information on both concentrations of key elements and physiochemical parameters over seasonal changes in ambient flow, temperature and luminosity. It was found that lakes are potentially sensitive to acidification and the presence of oligotrophic to mesotrophic conditions (based on the concentrations of nitrogen and phosphorus). Natural concentrations for some metals were above applicable criteria; however, the majority of metals were found in concentrations that were either below the detection limit or were under their criteria.

20.1.6 FISH AND ITS HABITAT

The Project site is located near several lakes and rivers that are commonly used for recreational fishing. Namely, the Kipawa River or Sheffield and Sairs lakes (illustrated in Map 2) are valued recreational fishing areas within the Restigo controlled harvesting zone (ZEC). Twenty-eight fish species were observed in the region surrounding the Project site during the 2012 field surveys; moreover, spawning areas for the walleye (*Sander vitreus*), the northern pike (*Esox lucius*), the brook trout (*Salvelinus fontinalis*), the yellow perch (*Perca flavescens*) and the lake trout (*Salvelinus namaycush*) were also found. No protected fish species were observed. Some fish flesh analyses were conducted in walleye and northern pike specimens in a field study conducted in 2011 and provide average background concentrations for mercury and other elements.

20.1.7 TERRESTRIAL ENVIRONMENT

The terrestrial environment includes both the vegetation and wildlife that occupy the Project site.

20.1.7.1 Vegetation

The Project site is located within the western maple-yellow birch stand subdomain of the southern Laurentian natural region. According to the ecoforestry maps, 270 different groups of species are present in the area surrounding the Project site. Mixed stands occupy the majority of productive forest land in these territories, followed by hardwood and softwood stands. The rest of the lands classified as productive forests are occupied by recent clear-cuts whose canopies have not yet been differentiated. Tree harvesting is practised by the forestry industry on lands near the Project site.

The proposed mine site is partially covered by two red oak-sugar maple stands and one red oak-red maple stand, totalling 25 hectares of valued tree stands; however, these tree stands have not been granted a protected status. The only other red oak stands that are present in the area are located a little less than 5 km from the proposed infrastructure for the ore processing plant.

The wetlands communities were delineated during the 2012 field surveys and are illustrated in Figure 20.2.

The wetland communities include treed swamps, marshes, ponds, fens and bogs. Most of these communities are characterized by water saturated conditions for extended periods and may be flooded periodically. When evaluating communities found within the Project’s footprint, which includes a 300 m buffer area of the Project’s infrastructure, it was found that 5% of the mine site, 13% of the plant site, and 34% of the tailings site is comprised of wetland communities.

20.1.7.2 Wildlife

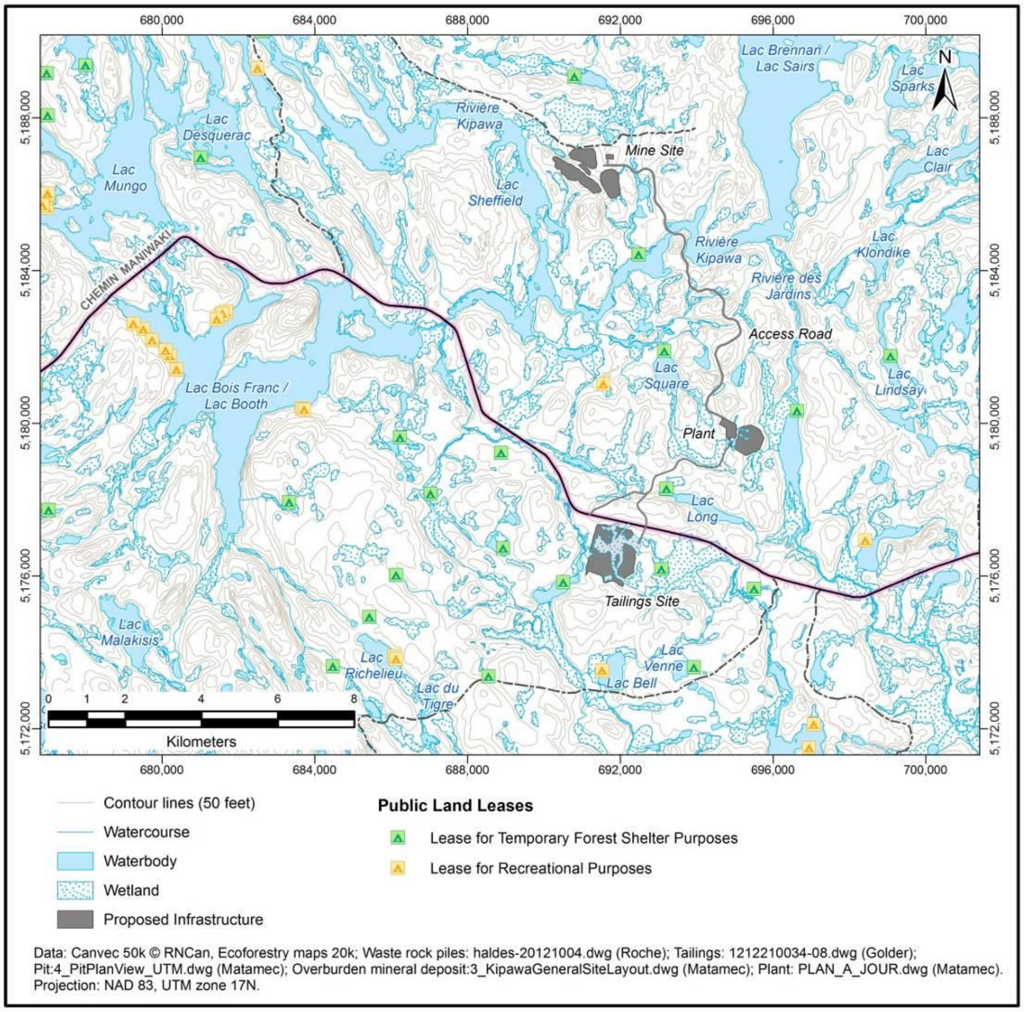
Wildlife studies included mammal, bird, reptile, and amphibian species. Generally speaking, the Project site is home to a number of mammals and bird (waterfowl) species that are valued in the context of hunting and trapping activities practised within the Restigo controlled harvesting zone. Specifically, species include the white-tailed deer, the moose, the black bear, the coyote, the Canada lynx, the gray wolf, the red fox, the North American beaver, the river otter, and the mink. A total of 81 bird species were identified, including 18 species of waterfowl and aquatic birds, 4 species of nocturnal raptors and 6 species of diurnal raptors. Field studies confirmed the presences of 11 amphibian species and 6 reptile species.

20.2 Land and Resource Use

The Project site is located within the non-organized territory of Les Lacs-du-Témiscamingue of the Témiscamingue Regional County Municipality. The Témiscamingue RCM has two main towns, Témiscaming and Ville-Marie, and incorporates two non-organized territories, four Algonquin communities, and 20 municipalities of which 17 are rural municipalities. The towns or villages in the closest proximity to the Project site are the town of Témiscaming and the rural municipality of Kipawa, which are located, by air, 45 km and 40 km, respectively, west of the proposed mine site. The Aboriginal communities in the closest proximity to the Project site are the community of Eagle Village First Nation, located on a reserve embedded within the municipality of Kipawa, and the Wolf Lake First Nation community, which does not have a reserve but maintains a traditional camp at Hunter's Point, located approximately 30 km northwest of the Project site. No residential area is located within or adjacent to the Project site.

Both Aboriginal and non-Aboriginal people use the land. A portion of the land is used by the forest industry for logging activities. Land use by non-Aboriginal people is mainly recreational, as evidenced by the presence of a large number of public land leases for camps and cottages. Non-Aboriginal presence on the territory includes visitors from Ontario and the United States, who use the land for recreational purposes. Land use of the general area of the Project site by Aboriginal people is diversified in type and frequency, and includes: hunting, fishing, trapping and gathering activities, the use of a canoe route and traditional places. To date, no recognition of Algonquin treaty rights apply within the Project site. A Statement of Assertion of Aboriginal Rights and Title to traditional territories covering 34,000 square kilometres, which includes the Project area, was presented to the Government of Canada by Timiskaming, Wolf Lake and Eagle Village Algonquin Nation members on January 11, 2013 (ANSPS, 2013). To the author's knowledge, the Canadian government has yet to assess this request.

Figure 20.3 - Public Land Leases



20.2.1 Heritage Resources

The cultural heritage directory of Québec and the National Historic Sites of Canada directory do not identify any historical place, heritage site, valued monuments or archeological sites within the Project site. The closest known archeological site is located approximately 10 km north-west of the Project site.

As part of the environmental and social studies of the Project, an archeological potential study was conducted in 2012. The study of the archeological potential within the Project area identified 25 areas with archeological potential. No site with archeological potential is located within the proposed infrastructure footprint; however, two potential archeological sites are located fairly close to proposed tailings site. The 2012 study recommended that an archeological inventory be made of the zones with archaeological potential before any of the planned development work take place.

20.2.2 SOCIO-ECONOMIC ENVIRONMENT

The area within 30 km of the Project site has no permanent residents (Golder, 2013b) and is only temporarily inhabited on a seasonal basis by people occupying either camps or cottages. The nearest populations are concentrated in the town of Témiscaming and the rural municipality of Kipawa. This local population counts approximately 3,350 persons (Statistics Canada, 2012) of which nearly 15% are Algonquin.

The Témiscamingue RCM is heavily dependent on the forest industry and lacks economic diversity. Likewise, the forest industry dominates the local economy in the municipalities of Témiscaming and Kipawa, as well as in the non-organized territory of Lacs-du-Témiscamingue. Tembec is the largest employer in the Témiscamingue RCM. In Témiscaming alone, Tembec's plant employs nearly 1,000 people. Although a significant proportion of the Témiscaming plant personnel live in Témiscaming or in Kipawa, some of the staff resides in Ontario and other areas in the Témiscamingue RCM. Other than the forestry industry, other industries such as tourism, hunting, fishing and exploration mining only make up for a small portion of the regions revenues. The lack of economic diversity explains in part the decreasing population of Témiscamingue (Statistics Canada, 2012).

20.3 Public, First Nations and Regulatory Engagement

Engagement relies primarily on communications and consultations with stakeholders. Matamec has initiated several consultation activities and meetings with the public, First Nations, and regulatory authorities and maintains a record of each consultation to summarize the meetings and monitor the preoccupations and comments raised during the consultation sessions. A specific consultation and communication approach was developed for the First Nations communities.

The information below concerns general consultation activities; although a specific section details the consultation activities for the First Nations communities. This last section also describes the agreements with the First Nations. Public, First Nations and regulatory engagement activities have been conducted entirely by Matamec. Information regarding these activities and their results has been transmitted to Golder to be taken into account in the ESIA.

20.3.1 FEDERAL, PROVINCIAL AND LOCAL GOVERNMENT

Since 2009, the project proponent has undertaken a consultation process. In 2011, this consultation process was made official when a committee was established to periodically inform and consult elected officials and key local and regional institutional stakeholders that may feel concerned by the project.

This working group, called the "Table d'harmonisation et de suivi du projet Kipawa de Matamec" (Harmonization Table), includes representatives from the following institutions and stakeholders:

- The Regional County Municipality of Témiscamingue;
- The mayors of the municipalities of Témiscaming and Kipawa;
- The President of Laniel non-organized territory Municipal Committee;
- The Band Council of Eagle Village First Nation;
- The Band Council of Wolf Lake First Nation;
- The development society of Témiscamingue (Société de développement du Témiscamingue);
- The Lake Témiscamingue School Board (Commission scolaire du Lac-Témiscamingue);
- The Québec Natural Resources Department (Ministère des Ressources naturelles);

- The forestry company Tembec;
- The Témiscaming-Kipawa Chamber of Commerce; and
- The controlled harvesting zone (ZEC Restigo).

From the Harmonization Table results three subcommittees: Education, Environment, and Economy and Business Opportunities. The Education Committee and the Environment Committee are currently active while that Economy and Business Opportunities should begin operations in 2013.

Other institutions have also been informed about the project by the proponent. These include the “Table de gestion intégrée des ressources du Témiscamingue”, Réserve Beauchêne, Envol adult education centre, “l’organisme du Bassin versant du Témiscamingue” and the Témiscamingue Mayor’s Assembly.

In addition, the project proponent has held public information and consultation meetings for the communities of Témiscaming and Kipawa in 2009, 2010, 2011, 2012 and 2013.

To date, the main issues and concerns raised by the aforementioned institutions and non-Aboriginal communities include the following:

- Potential risk of environmental deterioration caused by the mining activities of the project;
- Potential risks associated with chemical spills related to trucking;
- Potential risks of the project on Kipawa Lake;
- Potential employment opportunities and economic benefits for the surrounding communities;
- Potential effects of the project on wildlife; and
- Potential risks associated with the presence of radioactive substances in the rare earths for the health of surrounding communities and the surrounding natural environment.

To assure a presence in the region, Matamec opened an office in Témiscaming in 2012 and hired a director for regional relations. Since he started in 2011, the director has held numerous information and consultation meetings with the local communities and stakeholders.

In addition, Matamec has been in regular contact with the federal and provincial authorities.

20.3.2 First Nations Engagement and Agreements

Two Algonquin communities have expressed a particular interest in the project and are involved in its preparation: Eagle Village First Nation and Wolf Lake First Nation. Both communities are located about thirty to forty kilometres from the proposed mine site (by air). The leaders of the two communities, respectively Madeleine Paul and Mr. Harry St. Denis, were repeatedly encountered by the developer since 2009. Their engagement was formalized with the signature of a "Memorandum of Understanding" in July 2012. This document specifies the modalities of collaboration between the two communities and Matamec in the preparation of the project, including the involvement of the communities of Eagle Village First Nation and Wolf Lake First Nation in completing the environmental and social effects assessment. As the project progresses, Matamec will also initiate discussions with First Nations to negotiate an Impact Benefit Agreement (IBA).

Under the "Memorandum of Understanding" Eagle Village First Nation and Wolf Lake First Nation communities completed their own cultural impact assessment study describing the past and current traditional land and resource uses in the project area. They also completed their own socio-economic baseline report for the Project. These studies will contribute to the preparation of the environmental effects assessment of the project.

With the collaboration of Eagle Village First Nation and Wolf Lake First Nation leaders, Matamec held an information and consultation meeting with the two First Nations communities in 2011. More than a hundred people attended the meeting. A second and a third public meeting were held with the two communities; they took place in the fall of 2012 and in the spring of 2013. Both meetings involved around 75 people.

The main concerns expressed during these public information meetings were linked to the:

- Potential deterioration in the water quality of Kipawa Lake;
- Potential effects of the project on traditional activities taking place on these lands;
- Potential effects of the project on wildlife;
- Importance of community participation in the project (i.e., Eagle Village First Nation and Wolf Lake First Nation);
- Potential economic benefits for the surrounding communities; and
- Potential risks associated with the presence of radioactive substances in the rare earths.

Timiskaming First Nation, located approximately 120 km northwest of the Project site, participated in a Statement of Assertion of Aboriginal Rights and Title to traditional territories which includes the Project area, along with Wolf Lake First Nation and Eagle Village First Nation in January 2013 (ANSPS, 2013). As such, a third Algonquin First Nation, Timiskaming First Nation, will also be consulted in the next round of consultation activities conducted by Matamec.

20.4 Ore, Waste Rock, and Overburden Management

20.4.1 Geotechnical and Hydrogeological Field Investigation Summary

The foundation conditions at the mine site, including the waste rock dump, the high and low grade stockpiles, and the overburden and topsoil storage dumps were assessed by conducting a geotechnical site investigation consisting of 3 boreholes and 8 test pits. The investigation locations were selected to cover the footprint of the proposed temporary or permanent disposal areas and to provide sufficient information on the existing natural ground. The field results and subsequent laboratory testing on selected samples were used to determine the geotechnical properties, the bedrock depth and the hydrogeological conditions.

In general, there is little variability in the subsurface layer constituents but rather noticeable differences in the overburden layer thicknesses over the entire area. The superficial soil stratigraphy is generally composed, from top to bottom, of a 0.1 m to 0.3 m organic cover overlying a dense to compact silty sand layer. The bedrock underneath the superficial deposit was observed at depths varying between 0.30 m and 29.30 m. West of the outcrop, the rock surfaces at shallow depth (0.3 m) and plunges deeper to the northeast; towards the garage. As mentioned, the bedrock has not been intercepted in any of the boreholes and was not reached in the test pits at the garage location. Before being interrupted, the drilling was advanced to a depth of 17.5 m in borehole FG-12-01 and to a depth of 6.2 m in borehole FG-12-02, as the collected information was sufficient for the type of buildings proposed. Similarly, the drilling was interrupted at a depth of 10.31 m in borehole FG-12-31 located between the outcrop (open-pit) and the lower grade stockpile. Bedrock was observed at depths of 1.85 m (TE-12-11) and 29.30 m (FG-12-03) west of the overburden storage dump and the lower grade stockpile respectively. Bedrock was also observed in trenches at the easternmost limit of the waste rock dump to depths of 1.90 m (TE-12-13) and 4.00 m (TE-12-12). Figure 18.1 (On-Site Infrastructure, fig. 12.1) presents the locations of boreholes and test pits for the mine site sector; including the waste rock dump, the high and low grade stockpiles, the overburden and topsoil storage dumps.

A total of 3 observation wells were installed in the boreholes to assess the general hydrogeological conditions of the mine site sector. The measured water levels from these wells combined with the recorded water levels during the exploration drillings and the geomechanical investigation were helpful in defining the hydrogeological conditions of the area. The underground water is inferred to flow radially within or at the interface with the bedrock from the footprint of the projected open pit mainly toward the Kipawa River on the west side and possibly toward a tributary water stream to the Kipawa river on the east side. From the measured groundwater elevation and the inferred piezometric contour lines, the average calculated horizontal hydraulic gradient was established to be 0.159 m/m.

One hydraulic conductivity test was performed in the sand and silt horizon observed to the west of the low grade stockpile. The measured in-situ hydraulic conductivity for this surficial deposit is $3*10^{-6}$ m/s. Another test was performed in the bedrock on the western part of the outcrop with a measured hydraulic conductivity of the bedrock of $8*10^{-7}$ m/s. The calculated hydraulic vertical gradient at borehole FG-12-03 (B), with well installations in both bedrock and overburden, was established to be 0.63 m/m.

The collected geotechnical and hydrogeological data, as well as the detailed results for the mine site sector, are presented in Golder's 2013 factual field investigation report[48].

20.4.2 GEOCHEMICAL CHARACTERIZATION SUMMARY

The ore and waste rock to be generated by the mining operations were geochemically characterized to evaluate the risk for radioactivity, acid rock drainage and metal leaching. The results of this characterization were used to: (1) classify these wastes according to Quebec Directive 019[49], which establishes the environmental design guidelines for the waste facilities; and (2) identify constituents of potential environmental concern for mine waste and water management planning.

Seventy-two (72) samples of waste rock, ten (10) samples of ore and a subsample of a 15-kg composite ore sample were collected in October 2012 for geochemical analysis. It is important to note that according to the mine plan that became available in July 2013, fifteen (15) originally reporting to waste are now in the mineralized blocks and will constitute ore to be milled. Rock associated with these samples will not report to the waste rock pile. The results for waste rock described herein exclude samples that are now considered as ore. The results for these fifteen (15) samples are grouped together with those of the ore.

The sample selection rationale aimed at obtaining a spatially and geologically representative sample set of the estimated 18.7 Mt of waste rock to be extracted in terms of both lithological and spatial variation within the open pit. The number of samples collected was proportional to the estimated tonnage of waste by lithology provided by Matamec in October 2012. All samples were submitted for static geochemical testing to evaluate their chemical composition (major elements by ICP-AES; extractible metals following Method Ma.200 - Mét. 1.2, CEAEQ, 2010a),

48 Golder Associés, 2013, Rapport factuel d'investigation géotechnique et hydrogéologique-Projet Kipawa, ref.:# 018-12-1221-0034-4000-Rev0, May 2013..

49 Ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2012, Directive 019 sur l'industrie minière - version mars 2012, Gouvernement du Québec.

their potential for metal leaching (TCLP, SPLP, CTEU-9 leaching tests following method MA. 100 - Lix.com. 1.1, CEAEQ, 2010b), their potential to develop acid mine drainage (method MA. 110 - ACISOL 1.0, CEAEQ, 2010c), and their radiogenic potential. All testing was carried out and interpreted following the guidelines of Directive 019[49] established for environmental protection. In addition, for comparison purposes, the radioactivity results were compared to the standards set in the Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM), which have been adopted by the *Ministère de la Santé et des Services sociaux du Québec* for worker safety protection. Geochemical characterization according to Quebec Directive 019[49] is required for the design of mine waste containment facilities and for authorization of new mining projects in the province of Quebec.

The geochemical testing results show that none of the waste rock or ore samples are classified as potentially acid generating; they all have very low sulphur content.

Some samples are classified as leachable according to Directive 019[49]. These include: the syenite waste rock samples, the calc-silicate waste rock samples, the ore samples, as well as a portion of the peralkaline granitic gneiss (30% of samples) and the basal monzonitic gneiss (20% of samples). These rock types are leachable for lead, and, to a lesser extent, for zinc. Classification as "leachable" occurs when a sample exceeds the double criteria of (1) chemical composition of any parameter higher than soil criteria A for the Grenville Province (MDDEP, 2001) and (2) the TCLP leachate concentration for the same metal(s) in the same samples exceeds the criteria for groundwater reporting to the surface water (MDDEP, 2001). Mobility of these metals is also observed in the SPLP and CTEU-9 leaching tests, although the number of samples showing lead and zinc exceedances to the groundwater criteria is lower. These static leaching tests are aggressive and may overestimate the chemical load to the environment. Additional tests, including more realistic kinetic weathering tests, are planned as the project moves forward in order to obtain a more realistic evaluation of possible releases from the waste rock.

Although, some samples are classified as "leachable", none of the waste rock samples, nor the 15-kg composite ore sample, are classified as high risk. Only one of the ten ore samples is classified as high risk, as it has a TCLP leachate lead concentration that exceeds the criterion in Table 1 of Appendix II of Directive 019[49]. Further testing of the waste rock and the ore material will be carried out as the project moves forward, to verify the classification of this material.

Most waste rock samples including all the peralkaline granitic gneiss and the basal monzonitic gneiss waste rock samples are not radioactive according to the Directive 019[49] classification. Most of the ore is classified as radioactive and so are a few of the syenite and calc-silicate waste rock (5 of 30 samples of syenite and 1 of 2 samples of calc-silicate waste rock).

Further radiological analyses of static test leachates were carried out as required under Directive 019[49] to evaluate the level of risk associated with possible leaching of radiogenic parameters from mine waste. Fourteen (14) samples of waste rock were selected amongst the samples collected for the geochemical characterization program and for leaching tests where leachates were analyzed for radioactive parameters. In order for this first evaluation to be conservative in the assessment of chemical releases, the fourteen samples were selected based on them having the highest uranium and thorium concentrations of all the samples in the exploration database. Results showed that leachates from the samples analyzed do not exceed the limit for ionizing emissions. None of these highest uranium and thorium samples are classified as high risk waste based on radionuclide analyses in leachate.

The same radioactivity results were also compared to the standards set in the Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM), established for worker radiation protection (unlike Directive 019, guidelines established for environmental protection). The peralkaline granitic gneiss samples and the basal monzonitic gneiss samples do not exceed the NORM criteria. Some of the other waste rock types exceed the NORM criteria, including some of the syenite waste rock samples (12 of 30 samples) and some of the calc-silicate waste rock samples (1 of 2 samples). Most of the ore samples exceed the NORM criteria. Some leachates from the selected samples (as described above) exceed the NORM criteria for the syenite, the calc-silicate rock and the composite ore sample. These results imply that a worker dose assessment should be carried out on the waste rock from the lithologies that exceed the NORM criteria.

Since a portion of the peralkaline granitic gneiss and the basal monzonitic gneiss waste rock samples are classified as leachable under Directive 019[49], a groundwater protection assessment will be required to define the appropriate measures of protection, if any are necessary (see Section 20.4.6). Due to variations observed in the chemical composition of some lithologies, additional sampling and characterization of these lithologies are recommended.

The syenite and the calc-silicate waste rock are not high risk waste; however they are classified as leachable under Directive 019 and some of the syenite and calc-silicate waste rock samples are classified as radioactive. This classification results in a requirement to evaluate the level of groundwater protection that may be needed in the design and management of the waste rock containment facilities, if any are needed.

Given that only one of the ore samples has a high risk classification and that the other samples and the one 15-kg composite ore sample are not high risk, but classified leachable and radioactive, it is anticipated that the bulk of the material would require an evaluation of groundwater protection measures to be designed for the ore stockpile facility. Further testing of the ore material will be carried out if the project proceeds including more realistic kinetic weathering tests, to verify the classification of the ore and waste rock material, and better quantify probable metal releases from these materials.

20.4.3 WASTE ROCK MANAGEMENT

20.4.3.1 Waste Rock Storage Configuration and Sequencing

For the mine life, 18.65 Mt (9.3 Mm^3) of waste will be mined out and will be store on the north side of the open pit. The Waste Rock Storage location on the north side of the open pit is not compromising potential future resources and was selected for its proximity from the pit, and the drainage area to control the runoff water from the piles. The waste rock storage facility is shown in Figure 20.4. To minimize the visual impact of the waste, the rock storage are separated into two distinct areas: Area 1 is located on the western side of the main mining road leading to the maintenance shop (garage) while Area 2 is the main dump area and is located on the eastern side of the same road. The drainage was also taken into consideration when selecting the location, ensuring that all the waste rock storage development was made inside the same drainage area. With regards to the environment, drainage ditches have been designed all around the rock storage facilities to contain the runoff particles that can be carry out during rainy days. A sedimentation pond will be made at the lowest elevation at the east of Area 2 to collect the water draining from the waste storage ditches.

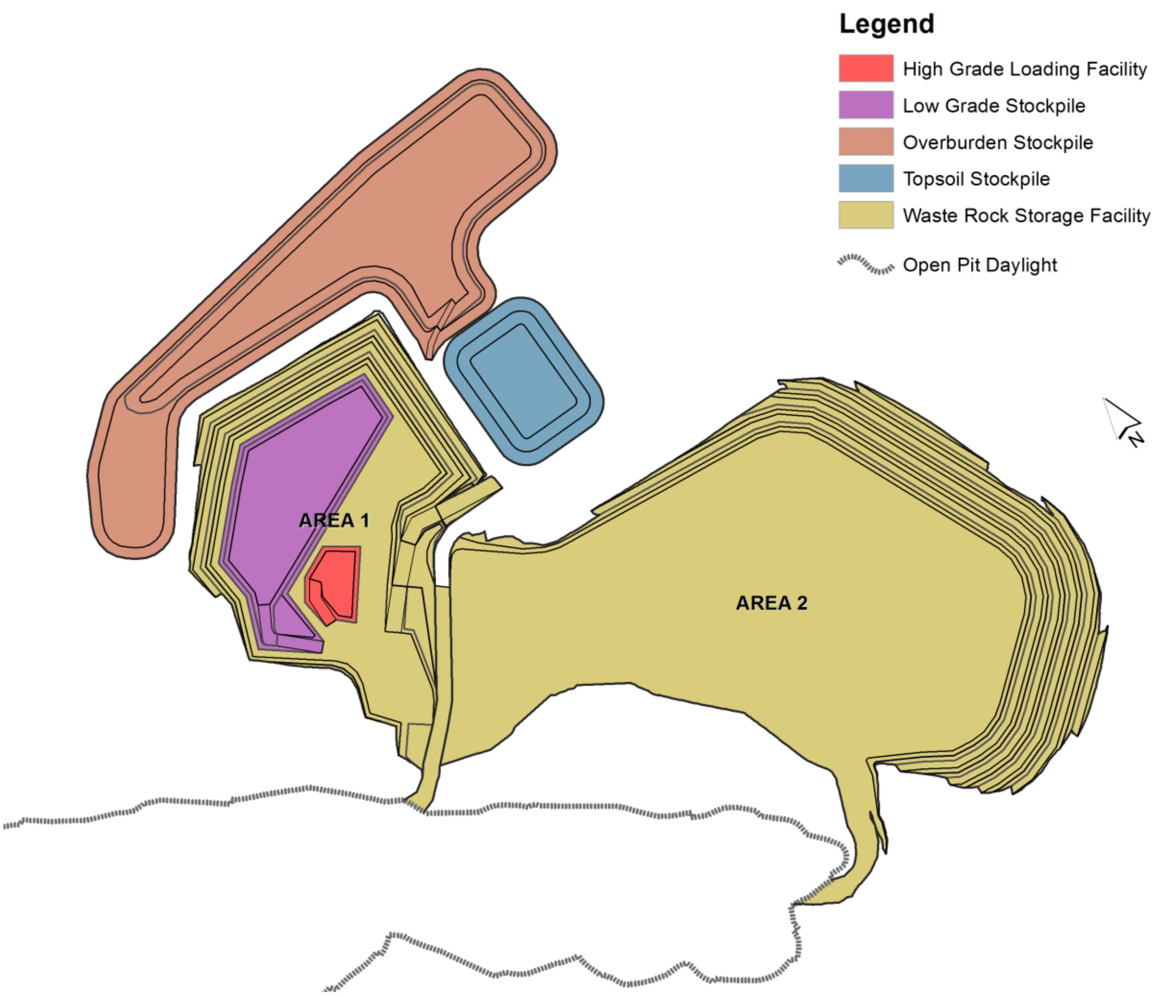
For both areas, the waste storage facility has been designed using a 10 m catch berm at every 10 m bench height using a bench face angle of 38^o. The waste storage facility has been designed with a 2.25:1 overall slope angle accordingly to the preliminary stability analysis produced by Golder Associates on May 2013.

The western part of the waste rock facility, Area 1 will be the first to be filled since its surface will be used for the low grade stockpile and the high grade loading facility. The eastern part of the waste rock facility, Area 2, will mostly be developed once Area1 will be filled.

Area 1 will be roughly 300 m by 540 m and Area 2 will be 850 m by 400 m. Both waste dumps will have space to accommodate 7.6 Mm^3 of material required during Year -1 and Year 11 inclusively. The waste from the pre-production period will mainly be used to build infrastructure such as roads, stockpile floors, and for the construction of the TSF MagSep starter berm.

The pit is divided in two parts at elevation 310. Once the eastern portion of the open pit is completed and the western portion reaches elevation 300, a part of the void created by the eastern part of the pit will be used to store 1.7 Mm^3 of waste material until the end of the mine life. This “in-pit” waste storage will limited the visual impact of the waste rock facility outside of the pit as well as it will decrease the hauling cycle time and reduce the amount of mining trucks necessary for production during Year 12 to Year 15.

Figure 20.4 - Overburden, Top Soil, Waste Dumps and Stockpiles Arrangement Plan



20.4.3.2 Stability Assessment

Stability analyses of the waste rock dump, including the high and low grade stockpiles, and the overburden storage dump were performed for 3 cross-sections using the overall deposition geometry as provided by Roche in June 2013. The cross-section locations were strategically chosen to analyse the slope stability for the most critical area based on several aspects; such as the soil stratigraphy, the ground topography, the rock depth, the water table elevation and the dump height. The general assumptions and detailed results are presented in Golder's Design Report for the Management of Ore, Waste and Overburden[50].

General Methodology

The overall stability of the waste rock dump and the overburden storage dump were assessed with conventional limit equilibrium methods using the software SLOPE/W developed by GEO-SLOPE International. Analyses were performed using a two-dimensional approach (which is a conservative simplification). The analyses were executed with the implementation of the Morgenstern-Price method, which satisfies both force and moment equilibrium. The factor of safety of several potential failure surfaces was calculated. The factor of safety is defined as the ratio of the stabilizing forces in relation to the driving forces tending to cause rupture.

The analyses were carried out for both the static and the pseudo-static conditions. The minimum factor of safety (F.S.) is dependent on the condition of the analysis and the minimum required design values are presented below:

- Static condition : F.S ≥ 1.5 ;
- Pseudo-static condition : F.S ≥ 1.1 .

For the pseudo-static analyses, the Peak Ground Acceleration (PGA) was determined for a probability of exceedance per annum of 1:1,000 years; corresponding to a value of 0.196 g. The PGA value was obtained using the seismic hazard calculator for use with the National Building Code of Canada (2010) available on Natural Resources Canada website. A horizontal seismic load having a magnitude of 50% of the PGA (0.098 g) was applied in the pseudo-static analysis.

Cross-Sections Studied

The geometry of the waste rock dump was provided by Roche (June, 2013) based on preliminary recommendations by Golder for such disposal sites. The general bench height of the waste rock dump is 10 m while the bench width is also 10 m. The bench face angle is 38 degrees and the overall slope angle is about 2.3H:1V (24 degrees). The waste rock dump has a maximal elevation of 360 m and 365 m in the zone where the ore is stockpiled. The geometry of the overburden storage dump was provided by Roche (June, 2013) with a maximum elevation of 335 m and an overall slope angle of 3H:1V (18 degrees). The locations of the 3 typical cross-sections analysed are briefly described hereafter:

- The first cross-section is located to the north of the waste rock dump with the low grade ore stockpile on top. The ground elevation of this section is taken from the topographic contour line provided by Matamec

[50] Golder Associés Ltée, 2013, Design Report for the Management of Ore, Waste and Overburden - Kipawa Project, ref.:# 027-12-1221-0034, July 2013.

while the soil stratigraphy is mainly based on test pit TE-12-10 located near the toe of the waste rock dump;

- The second cross-section is located on the northern side of the overburden storage dump. The ground elevation of this section is taken from the topographic contour line provided by Matamec while the soil stratigraphy is inferred based on the nearest test pit (TE-12-10) located south of the overburden storage dump;
- The third cross-section is located on the southeastern portion of the waste rock dump where the height of the dump is maximal. The ground elevation of this section is taken from the topographic contour line provided by Matamec while the soil stratigraphy is mainly based on test pit TE-12-13 which is located near the toe of the waste rock dump.

From the test pit and borehole observations, the water level was inferred to be at the bedrock surface in the southeastern portion of the waste rock dump and 3 m below the ground surface in the northwestern portion. Analyses were also conducted for water levels at the ground surface in order to assess the sensibility of the system to this parameter as the saturation of the foundation was identified to be the most critical element in the waste rock pile stability assessment.

Geotechnical Properties

The geotechnical properties used for the analyses were based on data from the literature and upon the description of the soils observed in the test pits and boreholes. The properties used are presented in Table 20.2.

Table 20.2 - Geotechnical Properties of the Materials used in the Stability Analysis

Material Type	**Geotechnical Properties**		
	Bulk unit Weight-γ (kN/m^3)	**Friction Angle-ϕ (º)**	**Cohesion-Cu (kPa)**
Waste rock	**20**	37	0
Overburden	**16.5**	30	0
Silty sand (loose to compact)	**17.5**	30	0
Silty sand (dense)	**19**	34	0
Bedrock	**Impenetrable**		

Results

The detailed results and cross-section illustrations of each stability analyses are presented in Golder's Design Report for the Management of Ore, Waste and Overburden[51]. Table 20.3 presents a summary of the factors of safety obtained for each stability analysis performed.

[51] Golder Associés Ltée, 2013, Design Report for the Management of Ore, Waste and Overburden - Kipawa Project, ref.:# 027-12-1221-0034, July 2013.

Table 20.3 - Factors of Safety for the Waste Rock Dump and Overburden Storage Dump

Cross-section location	Condition	Water level	F.S
North of the waste rock dump with the low grade ore stockpile on top	Static	3 m below ground surface	1.58
		At the ground surface	1.58
	Pseudo-static	3 m below ground surface	1.26
Northern side of the overburden storage dump	Static	3 m below ground surface	1.75
		At the ground surface	1.71
	Pseudo-static	3 m below ground surface	1.30
Southeastern portion of the waste rock dump	Static	Bedrock surface	1.57
		At the ground surface	1.57
	Pseudo-static	Bedrock surface	1.25

The calculated factors of safety meet the minimum design requirements. For the waste rock dump, only failure going through 2 benches or more were considered. In general, slip-surfaces are contained within the waste rock material and typically do not extend through the foundation material. Increasing the water level at the ground surface has no significant impact on the stability of the waste rock dump and the overburden storage dump.

As described in Section 20.4.1, the foundation of the waste rock piles consists mainly of silty sand of variable thicknesses. Based on the in-situ standard penetration tests performed in the three boreholes in the area, it is reasonable to expect the silty sand layer under the waste rock piles will be of dense to very dense compacticy. Silty sand deposits with this type of compacity usually have very low liquefaction potential. During the detailed design phase, some additional in situ testing under the footprint of the waste rock piles will be carried out to confirm these results.

20.4.4 Overburden Management

The overburden and the top soil removal result from site preparation at these following locations:

- Road construction to powder magazine;
- Road construction from the open pit leading to the garage;
- Road access construction between the pit and the waste rock storage Area 2;
- Mining preparation covering the open pit area.

All the overburden and the top soil will be removed at the pre-production period (Year -1). The overburden and the top soil tonnage have been evaluated to 1,328,480 tonnes and 130,760 tonnes, respectively. The top soil has been evaluated using an average thickness of 20 cm. The total expected loose volume required for the construction of the overburden and the top soil piles are 759,000 m^3 and 90,200 m^3, respectively.

As shown in Figure 20.4, the overburden removed will be stored to the North West side of the waste storage Area 1 and the garage. The north side of the overburden location will be partially outside of the waste rock drainage area, but the area is well constrained by roads allowing the water runoff to be easily redirected and connected to it

As shown in Figure 20.4, the top soil pile will be constrained between the main mining road, the waste rock storage Area 1, and the overburden pile. The top soil will be stored separately from the overburden and will be located closer to the main access road which will allow using it for concurrent reclamation purposes.

20.4.5 ORE MANAGEMENT

20.4.5.1 Ore Stockpiles Configuration and Sequencing

The low grade stockpile is needed to accumulate the marginal economical ore to be processed at the end of the mine life. The high grade stockpile is required to rehandle the ore via other smaller trucks up to the crusher at 10 kilometres away. Both the low grade and high grade rehandling piles will be built on top of the waste rock storage Area 1. The low grade stockpile and the high grade rehandling pile are shown in Figure 20.4. For convenience, both piles will be located closer to the main access road. The floor pads for the low grade and the rehandling facility will be partially built in pre-production year to get ready receiving both materials in the first year of production. In the beginning of the production, as the waste storage builds up towards the north, it will increase the low grade stockpile area. The mining trucks will bring the material from the south ramp closer to the pit and the low grade or high grade material will be dumped in distinct piles accordingly. In order to avoid interaction between mine equipment and hauler trucks that will transport the high grade ore to the crusher, a second designed ramp will be developed on the north side to get access to the rehandling zone. This second ramp will start straight from the main access road, close to the garage and will results in more efficient and safer operations.

20.4.6 GROUNDWATER PROTECTION ASSESSMENT

A numerical modelling study of groundwater flow and solute transport was completed to assess the impact of ore and waste rock piles facilities on groundwater in accordance with the regulatory framework outlined in Directive 019[49]. A two-dimensional cross-sectional model was constructed using FEFLOW (Finite Element Subsurface Flow System) Version 6.1[52]. The model was constructed based upon the data presented in the Golder factual hydrogeological and geotechnical investigation report[48], the Golder geomechanical investigation report[53], the ore and waste piles configuration proposed by Roche and on the geochemical characterization results presented above. The methodology and the results of this modelling study are presented in the report[54] for the management of ore, waste and overburden.

Site geology in the ore and waste piles area consists of silt to silty sand layer on bedrock. Based on the available test pit log information, overburden thickness varies from 1.9 to more than 5.5 m. Along the selected cross-section, the groundwater flow direction is toward the east in the direction of Lake 9. It is expected that a portion of the seepage water coming from the ore and waste piles would flow toward the pit.

Lake 9, located about 400 m downgradient of the ore and waste piles, and the pit, located 130 m from the ore and waste piles are considered the main receptors. The MDDEFP criteria for groundwater discharging to surface water (RESIE) therefore apply. Drinking water wells are not present in the area. The identification of the chemical species of interest for the contaminant transport simulations was completed by comparing the MDDEFP RESIE criteria to the average concentration (geometric mean) of parameters considered as leachable according to

[52] DHI-WASY GmbH, 2012. FEFLOW v6.1 Finite Element Subsurface Flow and Transport Simulation System, DHI-WASY GmbH, Berlin, Germany.

[53] Golder Associés Ltd. (2013c). *Factual Report: Geomechanics*. Report prepared for Matamec Explorations Inc. Ref. # 005-12-1221-0034. May 2013.

[54] Golder Associés Ltée, 2013, Design Report for the Management of Ore, Waste and Overburden - Kipawa Project, Report prepared for Matamec Explorations Inc. ref. # 027-12-1221-0034, July 2013.

Directive 019[49] in SPLP and CTEU-9 test leachates. Based on this comparison, the chemical species of interest in seepage water from the ore pile are lead, zinc and selenium. In the waste rock, the chemical species of interest are lead and zinc. This comparison should be reviewed following completion of the water quality modelling. According to Battele[55], the mobility of zinc and selenium is low to moderate (K_d of 12.7 and 5.9 L/kg) and the mobility of lead is very low (K_d of 234 L/kg). Leachate from ore and waste piles is not expected to be radioactive based on the Directive 019[49] criteria and this aspect was not considered in the contaminant transport simulations.

The modelling results show that the daily seepage rate per unit surface from the ore and waste piles facility would be 0.9 $L/m^2/d$, which is lower than the Directive 019[49] criteria (3.3 $L/m^2/d$). The modelling results show that selenium, lead and zinc concentrations in groundwater do not exceed the RESIE criteria at a short distance (i.e. less than 30 m) downgradient of the ore and waste rock pile. The low mobility of zinc and lead in groundwater explains this result. In comparison, the ore and waste rock piles are located 400 and 130 metres from Lake 9 and the pit, respectively.

20.5 Tailings Management

The ore treatment at the Kipawa project consists of two (2) different successive processes. Since the waste generated by these two processes has different physical and geochemical characteristics, the tailings management of the two streams has been assumed, from the early beginning of the project, to be conducted separately.

The first stream, generated by the magnetic separation process, is referred to as the MagSep tailings, or simply MagSep. The MagSep represents approximately 55% of the total waste tonnage generated by the process. The MagSep disposal management strategy is described in Golder's Design Report for the Magnetic Separation Tailings Management Facility[56] and its main features are summarized in Section 20.5.1.

The concentrate produced from the magnetic separation process is to be directed to the hydrometallurgical process plant for further recovery treatments. Following the hydrometallurgical process, the second tailings product is to be referred as the Hydromet tailings, or simply Hydromet. Hydromet represents approximately 45% of the total waste tonnage generated by the process. The Hydromet disposal management strategy is described in Golder's Design Report for the Hydrometallurgical Tailings Management Facility[57]. Its general features are summarized in Section 20.5.2.

The assessment and selection of the tailings management area locations for both MagSep and Hydromet were performed according to the Guidelines for the Assessment of Alternatives for Mine Waste Disposal[58] (Environment Canada, 2011). In order to assess the different sites and applicable technologies for the tailings management, a detailed study was carried out with respect to the potential environmental and social impacts as well as the economic and technical development. Methodology and detailed results of the analysis leading to the selection of both tailings management areas are described in Golder's Draft Site Selection Report[59]. According to the results of this study, the MagSep tailings management facility will be located adjacent to the proposed process plant area

[55] Battelle Memorial Institute, 1989. Chemical Database for the Multimedia Environmental Pollutant Assessment System (MEPAS), Version 1. December 1989

[56] Golder Associés Ltée, 2013, *Design Report for the Magnetic Separation Tailings Management Facility - Kipawa Project,* ref.: 025-12-1221-0034, July 2013.

[57] Golder Associés Ltée, 2013, *Design Report for the Hydrometallurgical Tailings Management Facility - Kipawa Project,* ref.: 026-12-1221-0034, July 2013.

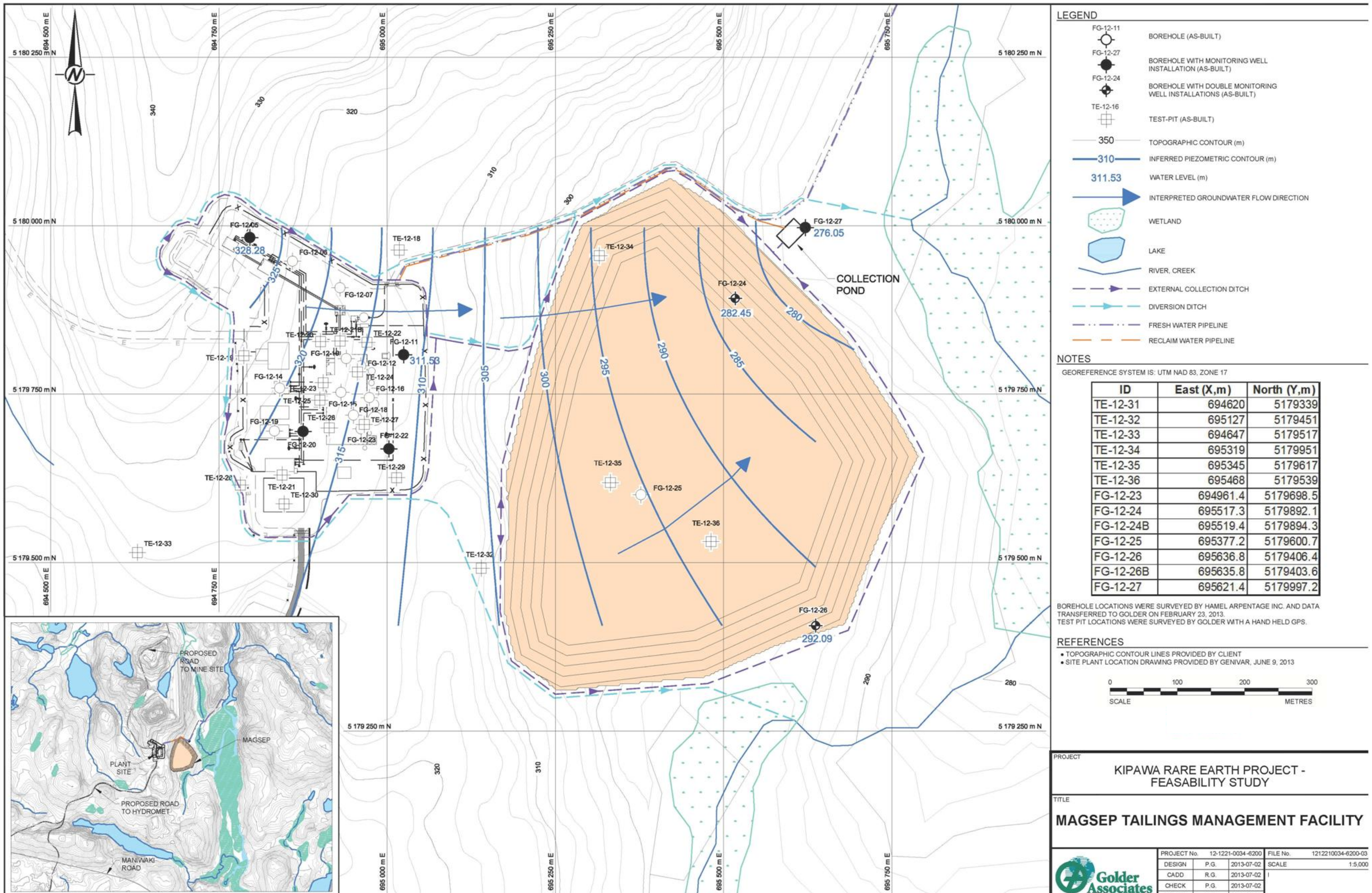
[58] Environment Canada, 2011, Mining and Processing Division, *Guidelines for the Assessment of Alternatives for Mine Waste Disposal*, September 2011.

[59] Golder Associés Ltée, 2013, Rapport préliminaire - *Étude de selection de sites - Gestion des rejets des procédés,* ref. : 008-12-1221-0034, December 2012.

and the Hydromet tailings and water management facility will be located along the south side of Maniwaki Road; north of Bell and Venne Lakes.

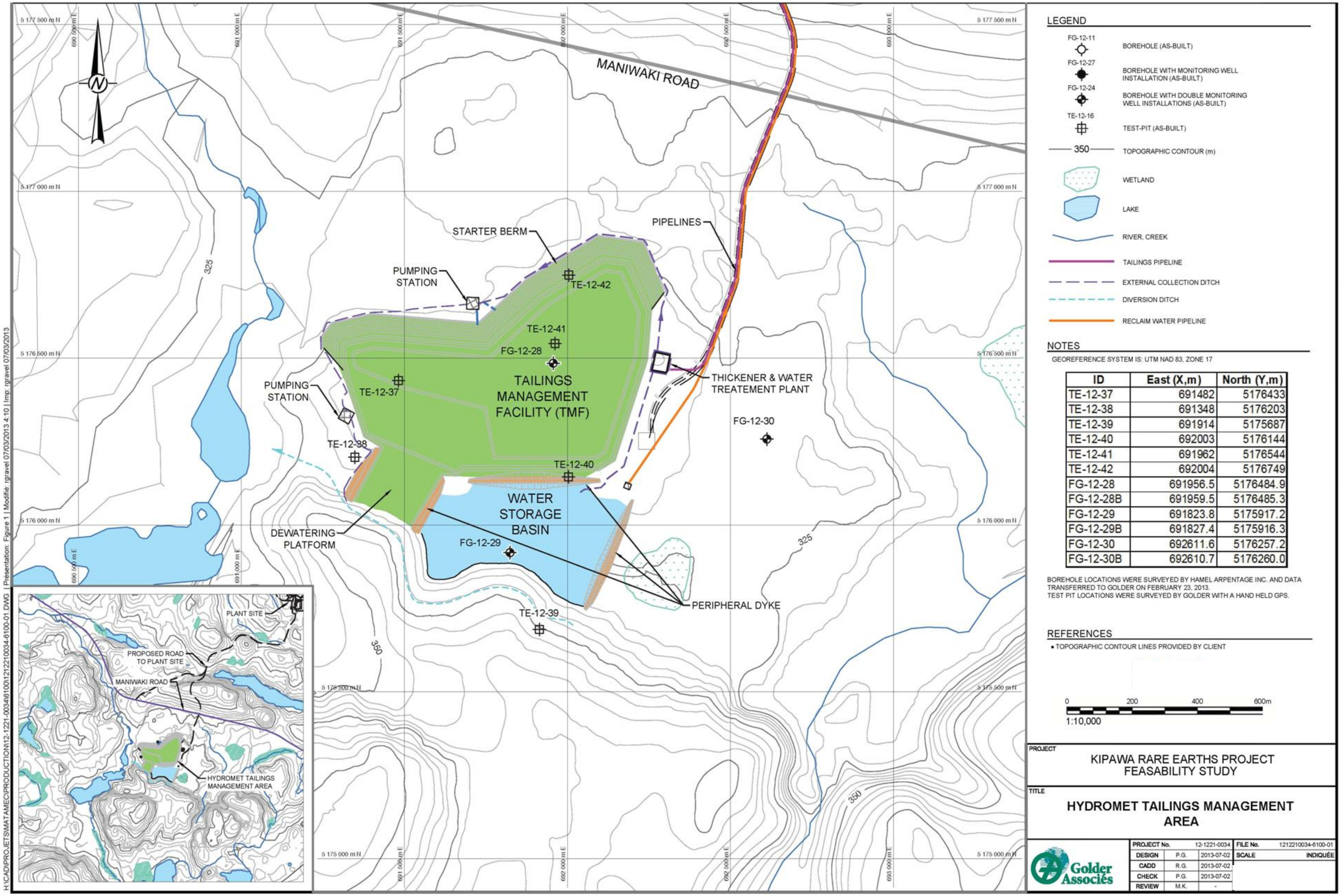
Figure 20.5 presents the MagSep Tailings Management Facility (TMF) location, as well as the boreholes and test pits carried out in the area during the geotechnical and hydrogeological site investigation. Figure 20.6 presents details of the Hydromet Tailings Management Facility (TMF) location and associated infrastructure, as well as the boreholes and test pits carried out in the area during the geotechnical and hydrogeological site investigation.

Figure 20.5 - MagSep Tailings Management Facility



ID	East (X,m)	North (Y,m)
TE-12-31	694620	5179339
TE-12-32	695127	5179451
TE-12-33	694647	5179517
TE-12-34	695319	5179951
TE-12-35	695345	5179617
TE-12-36	695468	5179539
FG-12-23	694961.4	5179698.5
FG-12-24	695517.3	5179892.1
FG-12-24B	695519.4	5179894.3
FG-12-25	695377.2	5179600.7
FG-12-26	695636.8	5179406.4
FG-12-26B	695635.8	5179403.6
FG-12-27	695621.4	5179997.2

Figure 20.6 - Hydromet Tailings Management Facility



ID	East (X,m)	North (Y,m)
TE-12-37	691482	5176433
TE-12-38	691348	5176203
TE-12-39	691914	5175687
TE-12-40	692003	5176144
TE-12-41	691962	5176544
TE-12-42	692004	5176749
FG-12-28	691956.5	5176484.9
FG-12-28B	691959.5	5176485.3
FG-12-29	691823.8	5175917.2
FG-12-29B	691827.4	5175916.3
FG-12-30	692611.6	5176257.2
FG-12-30B	692610.7	5176260.0

20.5.1 MAGNETIC SEPARATION TAILINGS MANAGEMENT FACILITY

20.5.1.1 Introduction and Location

The MagSep TMF is located near the process plant location, as shown in Figure 20.5. The footprint of the MagSep TMF, including the successive lateral and vertical expansions, has been designed to accommodate all of the tailings expected to be produced during the planned 15.2 year mining operations. The MagSep tailings production, and ultimately the need for storage, will be relatively constant throughout the mine operations. With daily production of 2,007 tonnes, the MagSep storage area should cumulate up to 10.88 Mt by the end of the Life of Mine (LOM).

The MagSep is a blended material consisting of 85% non-magnetic tailings and 15% weakly magnetic tailings. As tests and analyses have shown, the MagSep process generates tailings that are expected to be coarse material with grain size distribution allowing for easy dewatering. MagSep tailings will be dewatered and filtered at the mill to approximately 86% solids by weight content (geotechnical water content of 16.3%). Transportation to the storage facility will be done by trucking operated all year round. With an estimated dry density of 1.45 t/m^3, the total capacity of the MagSep TMF is estimated to be 7.5 Mm^3.

The MagSep TMF does not require water containment. All bleed water from the tailings, expected to be very low to none, and runoff water will either rapidly drain into the external water collection system (collection ditches) or will be diverted where possible (natural runoff only). At this stage, it is anticipated that MagSep tailings will only require groundwater protection assessment (Directive 019[60]).

The MagSep operational data and calculated or measured values based on the MagSep testing carried out at Golder's laboratory are presented in the Golder Design Report for the Magnetic Separation Tailings Management Facility[56].

20.5.1.2 Geotechnical and Hydrogeological Field Investigation Summary

Geotechnical and hydrogeological data that have been collected at the MagSep TMF sector corroborate with the conditions observed at the northwest adjacent process plant area. The information gathered for the process plant area is described in Section 17.0. The detailed results for the MagSep TMF sector, including the process plant area, are presented in Golder's factual field investigation report[61].

The foundation conditions at the actual MagSep TMF were assessed by conducting a geotechnical site investigation consisting of 4 boreholes and 4 test pits. The investigation locations were selected to cover the footprint of the proposed disposal area and to provide sufficient information on the existing natural ground. The field results and subsequent laboratory testing on selected samples were used to determine the geotechnical properties, the bedrock depth and the hydrogeological conditions.

In general, there is little variability in the subsurface layers over the entire area. The surface soil stratigraphy is generally composed, from top to bottom, of a 0.1-m to 0.3-m organic cover overlying a dense to compact silty sand or silt layers. Scattered gravel was also observed in some of the boreholes and test pits. The overburden thickness fairly increases from the southwest (highest ground elevation) to the northeast (lowest ground elevation) with

[60] Ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2012, Directive 019 sur l'industrie minière - version mars 2012, Gouvernement du Québec.

[61] Golder Associés, 2013, *Rapport factuel d'investigation géotechnique et hydrogéologique - Projet Kipawa*, ref.: 018-12-1221-0034-4000, May 2013.

bedrock summit observed at depths varying between 0.9 m and 10.14 m. The locations of boreholes and test pits are shown in Figure 20.5 (MagSep Tailings Management Facility, fig. 15.1).

At the bedrock interface, a 0.45 m-thick sand and gravel layer and a 1.14 m-thick gravelly sand layer were observed in two boreholes located in the northeastern and southeastern-most boundaries of the MagSep TMF. A 0.3-m-thick layer of organic silt was also observed under the organic cover in one of the borehole located in the middle of the MagSep TMF.

A total of 5 observation wells were installed in the boreholes to assess the general hydrogeological conditions in the area of the MagSep TMF. The piezometry and the estimated flow direction are in accordance with the topography of the MagSep and the adjacent process plant area. The elevation of the measured water table varies between 328.28 m (northwest of the process plant area) and 276.05 m (northeast of the MagSep area). The underground water is inferred to flow from west to east toward the eastern wetlands and the adjacent Des Jardins River (Figure 20.5). Two hydraulic conductivity tests were performed in the sand and silt horizon observed in the northeastern part of the MagSep TMF area. The measured in-situ hydraulic conductivities for this surficial deposit are $1*10^{-5}$ m/s and $6*10^{-6}$ m/s. Two tests were also performed in the bedrock horizon; one on the northeastern part of the MagSep TMF with a measured hydraulic conductivity of $4*10^{-6}$ m/s and one on the southeastern part with a measured hydraulic conductivity of $5*10^{-6}$ m/s. From the measured groundwater elevation and the inferred piezometric contour lines, the average calculated horizontal hydraulic gradient was established to be 0.058 m/m for the entire area, including the process plant area.

20.5.1.3 Geotechnical Conditions

The general soil stratigraphy encountered in the test pits and boreholes performed at the MagSep and adjacent Plant sites were reasonably similar, with slight variations in soil constituents and lithological unit thicknesses. The soil and rock boundaries have been inferred from *in-situ* soil testing and visual observations. Laboratory testing provided more information on the existing foundation material. The preliminary field program provided some important information on the *in-situ* material condition, such as the soil constituents, density, water content, etc.

The water table was measured at various depths between the bedrock interface and a few metres below the ground surface. The foundation material consists of silty and sandy deposits over bedrock with fair rock quality designation (RQD) on surface to excellent at depth beyond 2 m.

Based on the *in situ* standard penetration tests performed in the boreholes in the area, it is reasonable to expect the silty to sandy layer under the MagSep TMF will be of compact to dense compacity. Silty sand deposits with this type of compacity usually have low liquefaction potential. From a geotechnical point of view, the compacity of the foundation, the estimated water table elevation and the gentle overall topographic slopes are elements providing favourable long-term safety factors against slope failure and have low potential for liquefaction. Indeed, in the context of the project area, i.e. high seismic ground acceleration, liquefaction might become the most important design condition. All infrastructure has to demonstrate the ability to resist seismic loads and liquefaction. During the detailed design phase, some additional *in situ* testing under the footprint of the MagSep TMF will be carried out to confirm these results. A preliminary assessment of the susceptibility to liquefaction of the foundation was done as well as preliminary stability analyses. Results are presented in Section 20.5.1.6.

20.5.1.4 Geochemistry Assessment Summary

The MagSep tailings were geochemically characterized to evaluate the risk for radioactivity, acid rock drainage and metal leaching. The results from this characterization were used to: (1) classify the magnetic separation tailings according to Quebec Directive 019[62] providing environmental design guidelines for the tailings storage facilities; and (2) identify constituents of potential environmental concern for mine waste and water management planning. The samples were analyzed for the same set of parameters as waste rock and ore, as described in Section 20.4.2.

Tailings from the two streams were analyzed: (1) magnetic rejects from the low magnetic field representing 15% of the magnetic separation tailings and (2) non-magnetic rejects from the high magnetic field representing 85% of the magnetic separation tailings.

Magnetic separation tailings streams are non-acid generating. The magnetic rejects from the low magnetic field are classified as leachable for lead, selenium and zinc, but the non-magnetic rejects from the high magnetic field are classified as leachable only for lead. Considering that the latter represents the majority of the magnetic separation tailings, the two streams combined should be only leachable for lead. Both streams and their leachates do not classify as radioactive materials according to Directive 019, nor are they classified as high risk waste. Both streams exceed NORM criteria and leachates from TCLP and CTEU-9 tests also exceed NORM criteria implying that a worker dose assessment should be carried out.

Results of the MagSep tailings analyses indicate that they will require an assessment of the level of groundwater protection measures that may need to be implemented. Additional tests will be carried out as the project continues, including more representative kinetic weathering tests, to better define the likely metal releases from MagSep material exposure to the environment.

Detailed results are presented in the Golder 2013 geochemical characterization report.[63]

20.5.1.5 Configuration and Sequencing

The general arrangement and basic geometry of the proposed MagSep TMF are presented in Figure 20.7 along with starter berm and raised benches. The peripheral berms, constructed from clean waste rock, are designed to provide efficient drainage and initial containment of the MagSep tailings. Surface runoff and seepage will be collected in the collection pond located at the northeast side of the TMF. An additional buried underdrain, installed at the low point in the centre of the TMF, will allow collection of drainage water from the tailings. This underdrain will also convey the drainage water into the collection pond. Seepage and runoff contact water from the pond will be recirculated to the process as described in Section 20.6. No discharge to the environment is planned at this location.

The initial construction phase of the MagSep facilities consists of the installation of the starter berms, the construction of the collection pond, the internal buried underdrain, the external and diversion ditches as well as the required reclaim and fresh water pipelines. The MagSep TMF development sequence was designed to allow for progressive closure and revegetation of the tailings within the TMF, while reducing as much as possible the up-front capital costs. The footprint itself has been divided into three sectors - North, East and West, which will be exploited in that order.

The filling scheme was broken down into 4 consecutive phases called steps. In general, each step is consistent with a vertical raise and/or a lateral expansion of the MagSep TMF. A detailed breakdown of the different activities required during the development of the MagSep site is presented in the following Table 20.4.

[62] Ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2012, Directive 019 sur l'industrie minière - version mars 2012, Gouvernement du Québec.

[63] Golder Associés Ltée, 2013, *Rapport de caractérisation géochimiques des roches stériles et des résidus - Projet Kipawa*, Report prepared for Mamatec Explorations Inc. ref:# 0003-12-1221-0100, May 2013.

Table 20.4 - MagSep TMF Construction and Filling Sequence

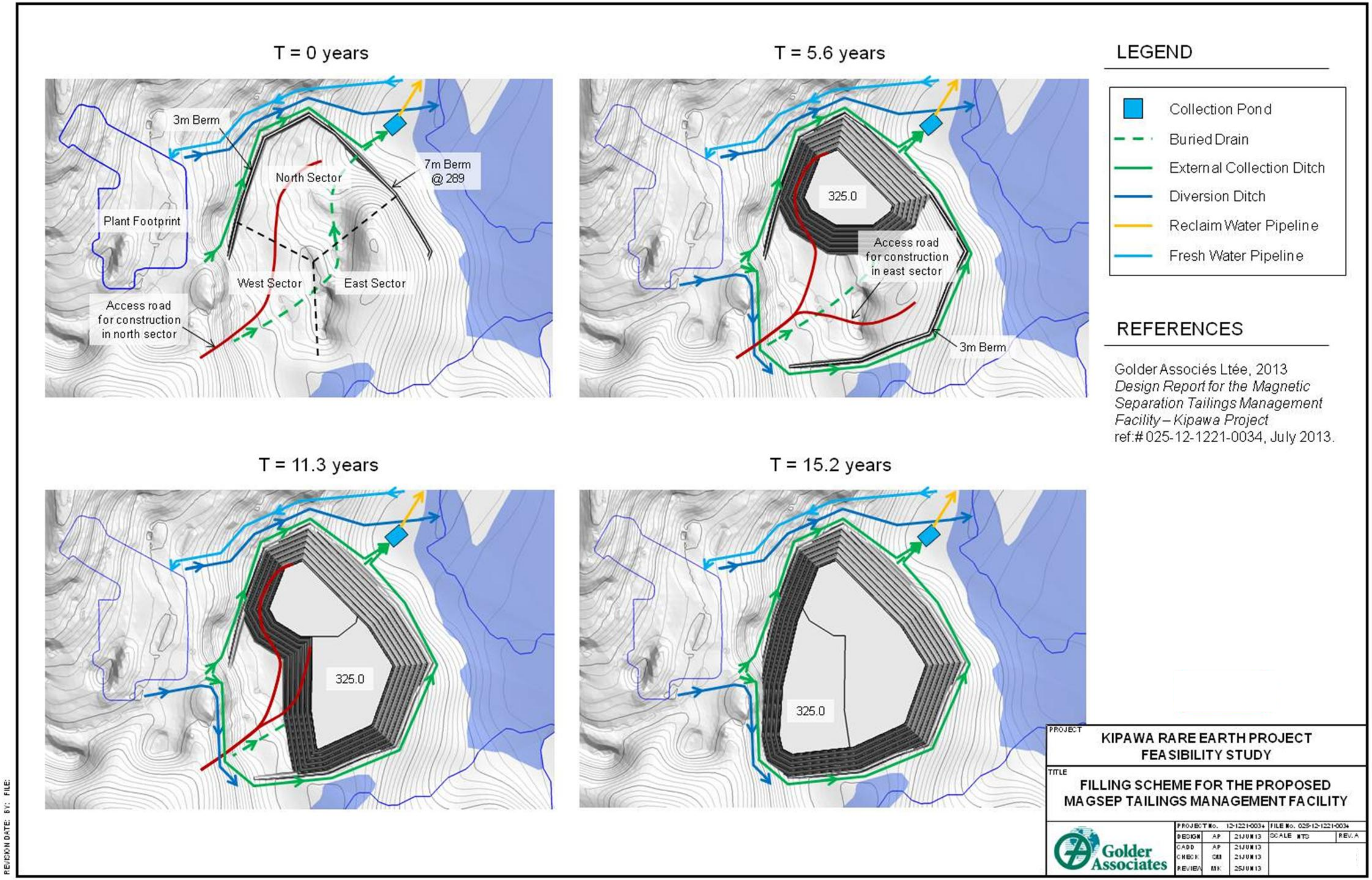
Phase	Construction and Deposition Activities	Approximate Completion (years)	Cumulative Tailings Tonnage (tons)
Step 0	• Stripping and preparing the footprint of the North sector • Building the access road, central drain and starter berm made of clean waste rock material • Implementing the construction of the external collection ditch, buried drain, pipelines and collection pond	t = 0	0
Step 1	• Initiating the MagSep tailings deposition in the North Sector • Raising the starter berm and construction of the benches (to El. 325 m) built with controlled compacted MagSep tailings • Raising the access roads and building the access road to the East Sector • Extending the starter berm with constant thickness (3 m) • Continuing the MagSep tailings deposition	t = 5.6	4,002,000
Step 2	• Closure and revegetation of the TMF (North sector) • Initiating the MagSep tailings deposition in the East Sector • Raising the benches (to El. 325 m) with controlled compacted MagSep tailings • Raising the access roads • Continuing the MagSep tailings deposition	t = 11.3	8,097,000
Step 3	• Closure and revegetation of the TMF (East sector) • Initiating the MagSep tailings deposition in the West Sector • Raising the benches (to El. 325 m) built with controlled compacted MagSep tailings • Completion the MagSep tailings deposition • Completing the closure and the revegetation of the TMF	T = 15.2	10,879,000

Detailed results are presented in the Golder Design Report for the Magnetic Separation Tailings Management Facility[56].

20.5.1.6 Stability Assessment

Stability analyses of the MagSep TMF were performed for 2 cross-sections using the overall design geometry as presented in Golder's Design Report for the Magnetic Separation Tailings Management Facility[56]. The cross-section locations were strategically chosen to assess the slope stability for the most critical area based on several aspects such as the soil stratigraphy, the ground topography, the rock depth, the water table elevation and the MagSep TMF height. The general assumptions and detailed results are also presented in Golder's Design Report[56].

Figure 20.7 - Filling Scheme for the Proposed MagSep Tailings Management Facility



General Methodology

The overall stability of the MagSep TMF was assessed with conventional limit equilibrium methods using the software SLOPE/W developed by GEO-SLOPE International. Analyses were performed using a two-dimensional approach (which is a conservative simplification). The analyses were executed using the Morgenstern-Price method, which satisfies both force and moment equilibrium. The factor of safety of several potential failure surfaces was calculated. The factor of safety is defined as the ratio of the stabilizing forces in relation to the driving forces tending to cause rupture.

The analyses were carried out for both the static and the pseudo-static conditions. The minimum factor of safety (F.S) is dependent on the condition of the analysis and the minimum required design values are presented below:

Static (long term) condition : F.S ≥ 1.5 ;

Pseudo-static condition : F.S ≥ 1.1 ;

For the pseudo-static analyses, the Peak Ground Acceleration (PGA) was determined for a probability of exceedance per annum of 1:1,000 years; corresponding to a value of 0.196 g. The PGA value was obtained using the seismic hazard calculator for use with the National Building Code of Canada (2010) available on the Natural Resources Canada website. A horizontal seismic load having a magnitude of 50% of the PGA (0.098 g) was applied in the pseudo-static analysis.

Cross-Sections

The design of the MagSep TMF consists of a starter berm made of clean waste rock having a maximal height of 7 m and a slope angle of 2.0H:1V. The starter berm is then raised with compacted tailings benches up to a maximum elevation of 325 m. The compacted tailings benches are typically 5 m high and 2.5 m wide with a bench face angle of 2.5H:1V. The locations of the 2 typical cross-sections analysed are briefly described hereafter:

- The first cross-section is located at the northeastern side of the MagSep TMF. The ground elevation at this location is taken from the topographic contour lines provided by Matamec while the soil stratigraphy is mainly based on boreholes FG-12-27 and FG-12-24 where the starter berm is 7 m high and the MagSep pile is at its maximum (42 m thick);
- The second cross-section is located on the southeast side of the MagSep TMF. The ground elevation at this location is taken from the topographic contour lines provided by Matamec while the soil stratigraphy is mainly based on borehole FG-12-26 located near the toe of MagSep TMF where the starter berm is 3 m high.

The water levels observed in boreholes FG-12-24, FG-12-26 and FG-12-27 were used to establish the piezometric level in the analyses. The water level for both sections is located within the overburden material at varying depths between the bedrock and few metres below the ground elevation.

Geotechnical Properties

The geotechnical properties used for the analyses were based on data from literature, upon the description of the soils observed in the test pits and boreholes and correlation from the Standard Penetration Test (SPT) values. The unit weight of the compacted MagSep tailings was taken as the optimal unit weight from a Proctor compaction test on the tailings. The properties implemented to perform the stability analyses are presented in Table 20.5.

Table 20.5 - Geotechnical Properties of the Materials Used in the Stability Analysis

Material Type	Geotechnical Properties		
	Unit Weight-γ (kN/m^3)	Friction Angle-ϕ (º)	Cohesion-Cu (kPa)
Tailings	15	30	0
Compacted tailings	16	30	0
Clean Waste Rock	20	37	0
Silty sand (loose to compact)	17.5	30	0
Silty sand (dense)	19	34	0
Bedrock	Impenetrable		

Results

The detailed results of the stability assessment are presented in the Golder Design Report for the Magnetic Separation Tailings Management Facility[56]. Table 20.6 presents a summary of the factors of safety obtained for each stability analysis performed.

Table 20.6 - Factors of Safety for the MagSep TMF

Cross-section location	Condition	F.S
Northeast of the MagSep TMF	Static	1.61
	Pseudo-static	1.29
Southeast of the MagSep TMF	Static	1.51
	Pseudo-static	1.22

The calculated factors of safety meet the design requirements. In general, the slip-surfaces are contained within either the starter berm material or the controlled compacted tailings and typically do not extend through the foundation material.

Liquefaction Potential Assessment

In the context of the project area, i.e. high seismic ground acceleration and overburden characteristics, it was identified that liquefaction might become the most important design condition.

Given the MagSep grain size and the very low Air Entry Value of the material, as obtained from Golder laboratory testing, it is anticipated that MagSep tailings would retain very little to no water. It is also anticipated, according to the proposed design and based on MagSep characteristics, that its compaction level will be high. In the absence of water retention and with fairly well compacted material, liquefaction within the MagSep pile is not expected to develop. Design features, such as the rock fill berm and the underdrain, are incorporated in order to further provide rapid drainage in case unexpectedly high rates of infiltration or saturation occur.

The foundation of the MagSep facility, however, consists mainly of sandy soil deposits. This type of foundation is often associated with liquefaction and requires an assessment of its susceptibility to liquefy.

The characteristic earthquake magnitudes for the assessment of foundation liquefaction potential were based on site-specific de-aggregation results computed by the Geological Survey of Canada (GSC) and the implemented natural ground properties as defined following the site investigation and laboratory testings. According to the 2010 National building Code of Canada (NBCC), the following earthquake conditions corresponding to a 1,000-year return period (exceedance rate of 5% in 50 years) was used for the assessment of the potential of liquefaction:

- Peak Ground Acceleration (PGA): 0.196 g;
- Characteristic Earthquake Magnitude: M 5.82.

The potential of liquefaction of granular soils encountered on site was evaluated according to the method proposed by Youd & al. (2001)[64] and based on the standard penetration tests performed into the boreholes FG-12-24, FG-12-26 and FG-12-27. The liquefaction analyses were performed on silts and silty sands ranging from the soil surface and extending through to a depth of approximately 9.0 m as in borehole FG-12-27.

The implemented detailed values and results of potential liquefaction assessment are presented in Golder's Design Report for the Magnetic Separation Tailings Management Facility[56]. The first analyses indicate that the silty and fine sands encountered at the proposed site are not liquefiable under the analyzed seismic conditions. Although liquefaction analyses performed for the MagSep site showed that the risk of soil liquefaction is not currently anticipated, according to the information from boreholes FG-12-24, FG-12-26, and FG-12-27, a geotechnical investigation along the future dyke alignments and MagSep TMF footprint will be performed at the detailed design phase in order to confirm the hypothesis.

20.5.1.7 Groundwater Protection Assessment

A numerical modelling study of groundwater flow and solute transport was completed to assess the impact of MagSep facility on groundwater in accordance with the regulatory framework outlined in Directive 019[60]. A two-dimensional cross-sectional model was constructed using FEFLOW (Finite Element Subsurface Flow System) Version 6.1[65]. The model was constructed based upon the data presented in the factual hydrogeological and geotechnical investigation report[61], the MagSep pile design prepared by Golder and on the geochemical characterization result presented above. The methodology and the results of this modelling study are presented in the design report[56] for the magnetic separation tailings management facility.

As presented in Section 20.5.1.2, site geology in the MagSep area consists of silt to silty sand layer on bedrock. Overburden thickness varies between 0.9 and 10.14 m and hydraulic conductivity vary between $2x10^{-6}$ and $1x10^{-5}$ m/s. Based on the available data the groundwater flow direction along the selected cross-section is toward the east.

The Des Jardins River is located about 450 m downgradient of the MagSep facility and is considered the main receptor. The MDDEFP criteria for groundwater discharging to surface water (RESIE) are therefore applicable. Drinking water wells are not present in the area. The identification of the chemical species of interest for the contaminant transport simulations was completed by comparing to the MDDEFP RESIE criteria the average

64 Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils" by Youd et al., published in Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No.10, October 2001, pp. 817-833 using LiquefyPro, a commercial software developed by CivilTech.

65 DHI-WASY GmbH, 2012. FEFLOW v6.1 Finite Element Subsurface Flow and Transport Simulation System, DHI-WASY GmbH, Berlin, Germany.

concentration (geometric mean) of parameters considered as leachable according to the Directive 019[60] in SPLP and CTEU-9 test leachates. Based on this comparison, the chemical species of interest in seepage water from the MagSep facility are lead and zinc. This comparison should be reviewed once the water quality modelling is complete. According to Battele (1989)[66], the mobility of zinc is low to moderate (Kd of 12.7 L/kg) and the mobility of lead is very low (Kd of 234 L/kg). Leachate coming from the MagSep facility is not expected to be radioactive based on the Directive 019[60] criteria and this aspect was not considered in the simulations.

The modelling results show that the daily seepage rate per unit surface from the MagSep facility would be 0.9 L/m^2/d, which is lower than the Directive 019[60] criteria (3.3 L/m^2/d). The modelling results show that lead and zinc concentration in groundwater should not exceed the RESIE criteria at a distance of 50 m downgradient of the MagSep facility. The low mobility of zinc and lead in groundwater explains this result. In comparison and as mentioned earlier, the Des Jardins River is located at 450 m downgradient of the MagSep facility.

20.5.2 Hydrometallurgical Separation (Hydromet) Tailings Management

20.5.2.1 Introduction and Location

The different elements of the Hydromet tailings management area include a Tailings Management Facility (TMF), a waste water storage basin (WSB) and an adjacent dewatering platform. These facilities will allow the Hydromet tailings and the waste water to be managed in contiguous but hydraulically separate containment structures. These facilities are located along the south side of Maniwaki Road, north of Bell and Venne Lakes. The layout of the proposed Hydromet facilities is shown in Figure 20.6.

The final footprint of the Hydromet TMF, including the successive lateral and vertical expansions, was designed to accommodate the tailings that will be produced during 15.2 years of continuous operation. It is assumed that the Hydromet production, and ultimately the need for solid waste and water storage, will be fairly constant year after year. With daily production of 1,707 tons, Hydromet TMF should cumulate up to 9.25 Mt by the end of the Life of Mine (LOM). With an estimated dry density of 1.51 t/m^3, the total capacity of the Hydromet TMF is estimated to be 6.1 Mm^3.

Although finer than the MagSep, tests and analyses show that the Hydromet tailings have particle grain-size distribution coarse enough to enable some sort of dewatering process and close to dry storage operations. From the process plant, the Hydromet tailings will be pumped through a pipeline as a slurry (approximately 30% solids by weight content) to a thickener plant adjacent to the Hydromet TMF where the solid content will be raised up to 50%. Then, it will be dewatered at the dewatering platform to an anticipated solids content of approximately 75%. The selected dewatering options, a combination of geotubes and drying beds, assume that the current geochemical characterisation of the solids and the pore water will require a groundwater protection assessment (Directive 019[67]) with limited protection measures. Handling and transportation to the storage facility will be done by trucking operated all year round.

Similar to the MagSep, the Hydromet TMF does not require water containment. All bleed water from the tailings, expected to be relatively moderate, and contact runoff water will either rapidly drain into a few internal, as well as the main external, water collection systems (collection ditches and pumping stations). External runoff will be

[66] Battelle Memorial Institute, 1989. Chemical Database for the Multimedia Environmental Pollutant Assessment System (MEPAS), Version 1. December 1989

[67] Ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2012, Directive 019 sur l'industrie minière - version mars 2012, Gouvernement du Québec.

diverted where possible (natural runoff only). The water from the collection system will be pumped to the WSB or discharged by gravity to/from the adjacent platform. The WSB is to be designed to accommodate a water storage capacity of approximately 463,000 m^3 (refer to Section 20.6).

The Hydromet operational data and calculated or measured values based on the Hydromet tailings testing carried out at Golder's laboratory are presented in Golder's Design Report for the Hydrometallurgical Tailings Management Facility[68].

20.5.2.2 Geotechnical and hydrogeological Field Investigation Summary

The foundation conditions at the Hydromet TMF and the WSB were assessed by conducting a geotechnical site investigation consisting of 3 boreholes and 6 test pits. The investigation locations were selected to generally cover the global area of the proposed facilities and to provide general information on the existing natural ground. The field results and subsequent laboratory testing on selected samples were used to determine some geotechnical properties, the bedrock depth and the prevailing hydrogeological conditions.

Little variability was observed in the subsurface layers over the entire area based on the collected information. The superficial soil stratigraphy is generally composed, from top to bottom, of an organic cover layer, less than 0.2 m thick, overlying a dense to compact silty sand layer. The underlying bedrock was observed at depths varying between 3.80 m and 16.45 m. Scattered coarse grain-size particles were identified in the majority of the boreholes and test pits. Observations made in some test pits and boreholes showed or suggested the presence of coarse gravel and many cobbles and blocks.

The area to the north of the Hydromet TMF seems to be covered with saturated peatlands with a high water table. The planned test pits in that area had to be abandoned either following wall instability or difficult access due to low-bearing capacity of the ground.

A total of six (6) observation wells were installed in the boreholes to assess the general hydrogeological conditions at the Hydromet TMF and the WSB. Some water levels were measured in those wells with water elevations varying between 320.29 m (central valley of the TMF) and 323.67 m (downstream of the WSB). Two hydraulic conductivity tests were performed in the sand and silt horizon observed in the central valley of the Hydromet TMF and downstream of the WSB. The measured in-situ hydraulic conductivities for this surficial deposit are $2*10^{-6}$ m/s and $7*10^{-7}$ m/s, respectively. One test was also performed in the bedrock horizon with a measured hydraulic conductivity of $1*10^{-7}$ m/s. Further field measurements, combined with additional field work, are planned and will be performed to be able to determine the underground water flow direction and more precise overall hydrogeological conditions in the area.

20.5.2.3 Geotechnical Conditions

The general soil stratigraphy encountered in the test pits and boreholes performed at the Hydromet sites shows similarities across the area with variation in soil type and lithological unit thicknesses. Laboratory testing provided information on the existing foundation material at the borehole locations. The preliminary field program provided some important information on the in situ material condition, such as the soil type, density, water content, etc.

The water table was generally measured close to ground surface and visual observations indicate that the water table might be artesian, however with low anticipated vertical pressure, in the southern portion of the site. The

[68] Golder Associés Ltée, 2013, Design Report for the Hydrometallurgical Tailings Management Facility - Kipawa Project, Report prepared for Matamec Explorations Inc. ref. # 026-12-1221-0034, July 2013.

foundation material consists of silty sand deposits over bedrock with poor rock quality designation on the surface to excellent at depths beyond 1 m.

From a geotechnical point of view, the dense to compact density of the foundation beneath the top material and the gentle overall topographic slopes are elements providing favourable long-term safety factors against slope failure.

The presence of peatlands in the northern portion of the Hydromet TMF requires provision for construction measures so as to remove the organics, dewater the area and ensure that the ground is suitable for construction.

In the context of the project area, i.e. high seismic ground acceleration, liquefaction should be considered as a potential design condition. As some low-density granular material was observed in some areas and the requirement for relatively restrictive seismic acceleration for the WSB infrastructure, ground improvement measures are to be considered. These measures, such as dynamic compaction, will ensure that the infrastructure will resist the required project seismic loads and will prevent potential ground liquefaction. During the detailed design phase, some additional in situ testing under the footprint of the hydromet TMF and WSB will be carried out to confirm these results; especially along the dyke alignments.

A preliminary assessment of the susceptibility to liquefaction of the foundation was done as well as preliminary stability analyses. The implemented detailed values and results are presented in Section 20.5.2.6.

20.5.2.4 Geochemistry Assessment Summary

The tailings from the proposed hydrometallurgical process will represent 45% of the tailings to be generated by the mining project. A suite of samples from the multiple steps of a trial hydrometallurgical process were retained for geochemical analysis to evaluate the risk for radioactivity, acid rock drainage and metal leaching from these wastes. The results were used to: (1) classify the hydrometallurgical tailings according to Quebec Directive 019, which establishes the environmental design guidelines for the tailings facilities; and (2) identify constituents of potential environmental interest for mine waste and water management planning. The samples were analyzed for the same set of parameters as waste rock and ore described in Section 20.4.2.

One sample combining the major streams of the hydrometallurgical process was analyzed. However, this combined sample does not include the final neutralization step of the process which was ongoing at the time of analysis. A small quantity of final hydrometallurgical tailings sample was later made available for a limited number of geochemical analyses. The available quantity allowed for the following analyses: extractible metals, leaching tests (SPLP and CTEU-9 only), acid-generating potential and radiogenic potential.

Analyses show that the sample has a high sulphur content but that sulphur is in the form of sulphate rather than sulphide. Sulphide is the key element in acid generation from mineral oxidation, while sulphate is already present in an oxidized form and will not oxidize further to release acid. The sulphide content of the sample is very low. Thus, although the sample has high sulphur and a low neutralization potential (and a low neutralization potential ratio (NPR) which, according to Directive 019, would classify the samples as potentially acid-generating), the actual long-term acid generation potential is expected to be minimal given the absence of sulphide.

The combined sample exhibits a low paste pH (2.5) and a low leach test pH (e.g., 2.5 for CTEU-9 test). In these conditions the sample releases metals. The final neutralized hydrometallurgical sample has a high sulphur content (3.22%, although 3.13% is as sulphate and only 0.09% is as sulphide) and a low neutralization potential ratio, and pH (3.1), but leachate metals are low with many below detection limits. Though the Hydromet tailings currently classifies as potentially acid-generating, based on its total sulphur content, the long-term oxidation and acidification potential of this material is expected to be low given the small quantity of sulfur present as reactive sulphide. Given the hydrometallurgical process is still in development, final process tailings may differ from the ones evaluated as part of this study. Further development of the hydrometallurgical process is planned as the project moves forward, from which additional samples will be collected and characterized. Additional testing will be completed on the hydrometallurgical residue, including more representative kinetic weathering tests that will aim to refine the geochemical properties of the material.

The combined sample of the major hydrometallurgical streams (not neutralized) is classified as leachable for fluoride, lead and selenium. This sample is not classified as a high risk waste. The tailings solids are classified as radioactive waste but not its leachate. The combined major streams sample and its leachate from the three leaching tests exceed NORM criteria, thus implying that a worker dose assessment must be carried out. The final Hydromet sample classification could not be completed because the sample's quantity was insufficient to carry out analyses for the classification for leachability (TCLP test was not carried out). Further refinement of the hydrometallurgical process will generate new tailings that will be analyzed to refine their classification according to Directive 019 and to evaluate more realistic leaching properties through the use of kinetic weathering tests.

Detailed results are presented in Golder's 2013 geochemical characterization report.[69]

20.5.2.5 Management Options and Configuration

A thickening plant will be constructed next to the TMF in order to increase the solids content of the 30% solids slurry arriving from the mill up to 50%. Following the thickening, dewatering operations will take place at the Dewatering Platform, which will be equipped with a geomembrane liner covered by granular drainage layer, both installed over the entire surface. The installation will enable the drained process water to flow by gravity directly into the WSB.

During the winter months, geotubes will be installed on the granular material to dewater the thickened slurry. During the warmer season, the slurry will be dewatered using geotextiles and granular drying beds. The tailings will be pumped directly into the trenches where some residence time will be allowed. The drainage water will flow by gravity through the granular materials directly towards the WSB. The drying beds will be equipped with layer of geotextile to prevent the fine particle migration. The geotextile will be constantly replaced while the beds themselves will require periodic reshaping and replacement of the granular drainage layer. It is assumed that tailings will dewater once deposited in the drying beds without any further loading during the extended summer period. Geotubes will remain available during this period as contingency in case weather is unfavorable during some years. Once the tailings have been dewatered, either using the drying beds or the geotubes, they will be excavated and deposited in the TMF using hydraulic shovels and haul trucks.

The TMF will be unlined and delimited by moderate starter berms constructed using rip-rap and gravel. A densification and preparation of the access roads will be required on the tailings to ensure the safe movement of the haul trucks.

The WSB footprint was optimized during the design project, and consists of a 463,000 m^3 capacity pond. As the foundation was assessed to be unsuitable for water retention, i.e. consisting mainly of sandy silty deposits with hydraulic conductivity in the order of $10^{-6}/10^{-7}$ m/s, the WSB is planned to be lined with a geomembrane.

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[69] Golder Associés Ltée, 2013, *Rapport de caractérisation géochimiques des roches stériles et des résidus - Projet Kipawa*, Report prepared for Mamatec Explorations Inc. ref:# 0003-12-1221-0100, May 2013.

The initial construction phase of the Hydromet facilities consists of the installation of the TMF starter berms, the installation of the thickening and water treatment plants, pumping station, collection ponds, and all of the necessary pipelines, drains and ditches as well as the complete WSB construction and the preparation of the dewatering platform. The construction sequence was designed to allow for progressive closure and revegetation of the tailings within the TMF, while reducing as much as possible the up-front capital costs. Closure of the TMF will consist of the profiling of the dewatered tailings to ensure surface water run-off at the final surface, and the installation of a low-permeability protective soil layer on top of the reprofiled tailings so that the surface will be apt to vegetation. Seeding will then be applied to encourage revegetation.

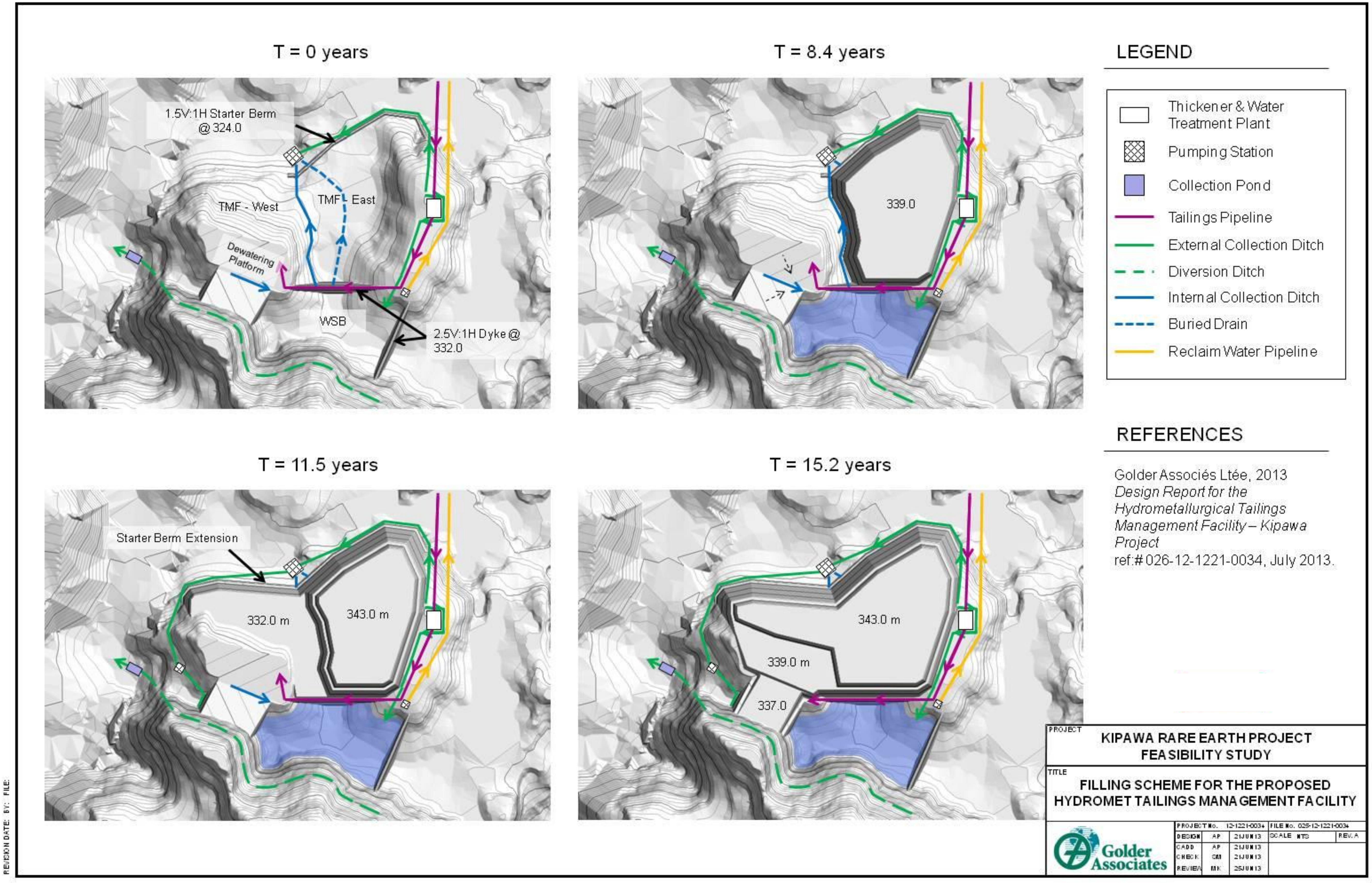
A detailed breakdown of the different activities required during the development of the Hydromet TMF is presented in Table 20.7. General arrangement of the proposed facilities is presented in Figure 20.8.

Table 20.7 - Hydromet TMF Construction and Filling Sequence

Phase	Construction and Deposition Activities	Approximate Completion (years)	Cumulative Tailings Tonnage (tons)
Step 0	• Stripping and preparing the footprint of the TMF (east side), the Dewatering platform and the WSB • Building the TMF (east side) starter berm to elevation 324 m • Building the WSB peripheral dykes to elevation 332 m, and lining the facility; including granular puncture protection layers • Implementing the construction of the Thickener and Water Treatment Plants, the pumping (north) station, tailings pipelines, external collection ditches, internal drain, collection pond and reclaim water pipeline • Building the Dewatering Platform; including the geosynthetic liners (geotextile and geomembrane) and the granular layers for drainage and puncture protection	t = 0	0
Step 1	• Initiating the Hydromet tailings deposition in the east side • Dewatered Hydromet tailings placement up to elevation 339 m • Discharging water to the WSB • Reclaiming water from the WSB • Treating water before release, if necessary	t = 8.4	3,356,000
Step 2	• Continuing dewatered Hydromet tailings placement up to elevation 343 m • Stripping and preparing the footprint of the TMF (west side) • Extending TMF (east side) starter berm to the west (at elevation 324 m) • Extending the construction of the drainage and collection system to the west • Closure and revegetation of the TMF (east side) • Continuing dewatered Hydromet tailings placement, on the west side, up to elevation 332 m • Continuing discharging water to and reclaiming water from the WSB Treating water before release, if necessary	t = 11.5	6,998,000
Step 3	• Continuing dewatered Hydromet tailings placement, on the west side, up to elevation 343 m • Continuing discharging water to and reclaiming water from the WSB • Beginning the closure and the revegetation of the TMF (west side) • Beginning the dewatered Hydromet tailings placement over the Dewatering Platform (north section) up to elevation 339 m • Completing the closure and the revegetation of the TMF • Completing the dewatered Hydromet tailings placement at the Dewatering Platform (south section) up to elevation 337 m • Completing the closure and the revegetation of the Dewatering platform • Decommissioning	T = 15.2	9,250,000

Detailed results are presented in the Golder Design Report for the Hydrometallurgical Tailings Management Facility[68].

Figure 20.8 - Filling Scheme for the Proposed Hydromet Tailings Management Facility



20.5.2.6 Preliminary Stability Assessment

Stability analyses of the Hydromet TMF were performed for 4 cross-sections using the overall design geometry as presented in Golder's Design Report for the Hydrometallurgical Tailings Management Facility[68]. The cross-section locations were strategically chosen to assess the slope stability for the most critical area based on several aspects; such as the available soil stratigraphy, the ground topography, the anticipated rock depth, the available measurements of ground water elevation, the planned Hydromet TMF height and various project flood elevations at the WSB. The general assumptions and detailed results are presented in the Golder Design Report[68].

20.5.2.7 General Methodology

The overall stability of the Hydromet TMF and the WSB was assessed with conventional limit equilibrium methods using the software SLOPE/W developed by GEO-SLOPE International. Analyses were performed using a two-dimensional approach (which is a conservative simplification). The analyses were executed using the Morgenstern-Price method, which satisfies both force and moment equilibrium. The factor of safety of several potential failure surfaces was calculated. The factor of safety is defined as the ratio of the stabilizing forces in relation to the driving forces tending to cause rupture.

The analyses were carried out for both the static and the pseudo-static conditions. The minimum factor of safety (F.S) is dependent on the condition of the analysis and the minimum required design values are presented below:

- Static condition (long-term) : F.S ≥ 1.5 ;
- Pseudo-static condition : F.S ≥ 1.1 ;

For the pseudo-static analyses of the Hydromet TMF (classified as a structure with no water retention according to Directive 019), the Peak Ground Acceleration (PGA) was determined for a probability of exceedance per annum of 1:1,000 years; corresponding to a value of 0.196 g. For the WSB (classified as a structure with water retention according to Directive 019), the PGA was determined for a probability of exceedance per annum of 1:2,475 years; corresponding to a value of 0.324 g. The PGA values were obtained using the seismic hazard calculator for use with the National Building Code of Canada (2010) available on Natural Resources Canada website. A horizontal seismic load having a magnitude of 50 % of the PGA (0.098 g or 0.162 g) was applied in the pseudo-static analysis.

For a water retention structure such as the WSB, Directive 019 suggests performing an additional rapid-drawdown stability analysis. In the case of the WSB, this condition is not considered applicable as the upstream face of the retention structures will be lined with a geomembrane. Thus, the body of the dykes is not saturated. Rapid drawdown, provoked by a catastrophic breach or failure, will not affect the main body of the dykes or the liner as none retains water within its matrix.

<u>Cross-Sections</u>

The locations of the 4 typical cross-sections analysed with the stability assessment are briefly described below:

- The first cross-section is located at the toe of the starter berm on the northern side of the Hydromet TMF. The ground elevation at this location is taken from the topographic contour lines provided by Matamec while the soil stratigraphy is mainly based on test pit TE-12-42 and the nearest borehole FG-12-28. The starter berm has a slope angle of 1.5H:1V and is 3 m high. The starter berm is raised with dry tailings that have a slope angle of 4H:1V up to a maximum elevation of 343 m;

- The second cross-section is located at the WSB; transversely to the eastern dyke centre line. The ground elevation at this location is taken from the topographic contour lines provided by Matamec while the soil stratigraphy is mainly based on the nearest borehole FG-12-29. The slope angle on both sides of the dyke is 2.5H:1V and the maximum height is 7 m;
- The third section is located across the dyke limiting the WSB containment to the north. The ground elevation at this location is taken from the topographic contour lines provided by Matamec while the soil stratigraphy is mainly based on the nearest borehole FG-12-29. The slope angle on both sides of the dyke is 2.5H:1V and the maximum height is 9 m. As this dyke is also separating the WSB from the Hydromet TMF, on the downstream side of the dyke, the tailings slope is 4H:1V with one intermediate bench;
- The fourth cross-section goes through the dewatering platform and the western dyke of the WSB. The ground elevation at this location is taken from the topographic contour lines provided by Matamec while the soil stratigraphy is mainly based on test pit TE-12-38 and the nearest borehole FG-12-29. The slope angle on both sides of the dyke is 2.5H:1V and the maximum height is 8 m. Leaning against the downstream side of the dyke, the compacted granular fill material (from the overburden reshaping) is placed with a finish slope of 2.5H:1V. The model includes a 1 m-thick layer of Hydromet tailings placed above the dewatering platform with a 4H:1V slope.

The water levels observed in the test pits and the boreholes suggest that the water level is near the ground surface elevation in the area of the Hydromet (possibly artesian condition). In the analyses, the water level was set to 0.5 m below the ground surface elevation to take into account the effect of the drainage ditches that will be installed. During the detailed design phase, further analyses will be performed, together with additional data collection, to assess the sensitivity of the system to water level fluctuations.

Geotechnical Properties

The geotechnical properties used for the analyses were based on data from the literature, upon the description of the soils observed in the test pits and boreholes and correlation from the Standard Penetration Test (SPT) values. The properties for all material types are presented in Table 20.8.

Table 20.8 - Geotechnical properties of the materials used in the stability analysis

Material Type	Geotechnical Properties		
	Bulk unit Weight-γ (kN/m^3)	Friction Angle-ϕ (º)	Cohesion-Cu (kPa)
Tailings	15	30	0
Crushed Rocks	20	37	0
Compacted granular material (overburden)	19	34	0
Silty sand (loose to compact)	17.5	30	0
Silty sand (dense)	19	34	0
Bedrock	Impenetrable		

Results

The detailed results and cross-section illustrations of the stability assessment are presented in Golder's Design Report for the Hydrometallurgical Tailings Management Facility[68]. Table 20.9 presents a summary of the factors of safety obtained for each stability analysis performed.

Table 20.9 - Factors of safety for the Hydromet TMF and WSB

Cross-section location	Side	Condition	F.S. (with berm)
North of the Hydromet TMF	Downstream	Static	1.53
		Pseudo-static (1/1000 yr)	1.27
East of the WSB	Downstream	Static	1.85
		Pseudo-static (1/2475 yr)	1.22
	Upstream	Static	2.04
		Pseudo-static (1/2475 yr)	1.1
Interface between Hydromet TMF and WSB	Downstream	Static	1.78
	Upstream	Static	2.16
		Pseudo-static (1/2475 yr)	1.1
West of the WSB	Upstream	Static	2.1
		Pseudo-static (1/2475 yr)	1.1
West of the dewatering platform	Downstream	Static	1.74
		Pseudo-static (1/2475 yr)	1.1

With the adjustment of the slope geometry and the addition of berms along some infrastructure, the calculated factors of safety meet the design requirements. In general, the slip-surfaces are contained within either the starter berm material or the controlled compacted tailings and typically do not extent through the foundation material.

20.5.2.8 Liquefaction Potential Assessment

As mentioned in Section 20.5.1.6 (Liquefaction Potential Assessment), the high seismic ground acceleration calculated for the project area and the overburden material characteristics suggest that liquefaction of the foundation and/or the tailings themselves might be an important design condition.

Hydromet tailings are a fine grained material with particles ranging from clay-size to medium sand-size. Based on laboratory measured hydraulic permeability of $1.9*10^{-8}$ m/s and Air-Entry Value (AEV) in the order of 100 kPa, it is reasonable to expect Hydromet tailings would retain some water. Design features allowing rapid dissipation of the pore pressure during seismic event and increasing the degree of compaction will be provided in order to control this condition within the tailings body. More particularly, these consist of an underdrain system, draining the toe berm and a contingency plan consisting of horizontal wick drains within the body of the tailings. The latter consists of simple geosynthetic tubes being rolled on the surface of the tailings every few lifts. These will allow for quick preferential draining and dissipation of water pressure within the impoundment.

The foundation of the Hydromet facilities consists mainly of sandy soil deposits. This type of foundation is often associated with liquefaction and requires an assessment of its susceptibility to liquefy.

The characteristic earthquake magnitudes for the assessment of liquefaction potential of the site were based on site-specific de-aggregation results computed by the Geological Survey of Canada (GSC) and the implemented natural ground properties as defined following the site investigation and laboratory testings. According to the 2010 NBCC, the following earthquake conditions corresponding to a 2,475-year return period (exceedance rate of 2% in 50 years) was used for the assessment of the potential of liquefaction for the WSB:

- Peak Ground Acceleration (PGA): 0.324 g;
- Characteristic Earthquake Magnitude: M 5.95.

For the Hydromet TMF, falling in the same category as the MagSep TMF (no retention water infrastructure), the PGA value (0.196) and the earthquake magnitude (5.82) for a return period of 1:1,000 year (5% Exceedance in 50 years) have been used.

The potential of liquefaction of granular soils encountered on site was evaluated according to the method proposed by Youd & al. (2001)[70] and based on the standard penetration test performed into the boreholes FG-12-28 and FG-12-29. The liquefaction analyses were performed on sandy silts and silty sands ranging from the soil surface and extending through approximately 9.8-m depth as in borehole FG-12-28.

The implemented detailed values and results of potential liquefaction assessment are presented in Golder's Design Report for the Hydrometallurgical Tailings Management Facility[68]. Based on the preliminary investigation results, it is expected that the sandy silts and silty sands encountered at the proposed site are susceptible to liquefaction under the analyzed seismic conditions. Thus, provisions for the implementation of ground improvement measures (e.g. rapid dynamic compaction, stone column construction, etc.) are required at the footprint of the dykes and under the impoundment to some limited extent. A geotechnical investigation along the future WSB dyke alignments, the TMF starter berm and the overall footprint will be performed at the detailed design phase in order to confirm the hypothesis and to select the most appropriate ground improvement measures.

20.5.2.9 Preliminary Groundwater Protection Assessment

Water management is one of the key elements of the project. It is estimated that effort to reduce the Hydromet water content before disposal will provide better control on the seepage water quality to groundwater. As a first measure to reduce tailings water content, Matamec is planning on building a thickening plant with the objective to increase the solids content of the slurry up to 50%. The second measure is to further dewater the tailings using the combination of geotubes and drying beds. The drying area will be equipped with a geomembrane liner and the water extracted from the tailings will flow directed by gravity toward a lined water storage basin (WSB). Once the tailings have been dewatered, they will be excavated and deposited in the TMF. At the end of the dewatering process, the solids content of the slurry is expected to be as high as 75% by weight, which means that a significant portion of the tailings pore water will be removed prior to placement in the TMF and thus the amount of available water for seepage is expected to be low. At closure, the surface grading of the dewatered tailings and the installation of a low-permeability protective soil layer on top of the graded tailings should minimize infiltration of

[70] Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils" by Youd et al., published in Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No.10, October 2001, pp. 817-833 using LiquefyPro, a commercial software developed by CivilTech.

water into the tailings. Considering the water management measures described above and the expected low permeability of the tailings, seepage of tailings pore water to groundwater is expected to be low.

Some geochemical evaluation of the Hydromet tailings has been completed and additional testing has been recommended (see Section 20.5.2.4). The assessment of the Hydromet tailings has not been fully completed. From the available results, suggesting the tailings storage requires groundwater protection assessment, it has been concluded that Hydromet TMF will require groundwater modelling studies to quantify the infiltration rate to groundwater and to demonstrate that groundwater protection objectives are satisfied. This study should be performed once the geochemical evaluation is completed and the expected chemical concentrations in Hydromet tailings pore water are known.

20.6 Site Water Management

The purpose of the Kipawa Site Water Management is to control contact water at the site and thereby limit the risk of adverse effects from contact water on the natural environment. The plan includes the management of all surface runoff from the developed portions of the site, management of some natural area runoff at the site, management of select process flows, and feasibility-level design of management structures.

20.6.1 Models

Two methods were used to provide the basis for the feasibility-level design of the water management system; a site water balance model (which was used to estimate required storage volumes, pumping rates, and treatment rates), and a hydrologic/hydraulic model (which was used to size overland flow features).

20.6.1.1 Water Balance Model

A water balance model for the site was created using GoldSim software. This model was created to estimate the flow volumes for the site water management during the 15.2 year operation of the site. Historic climate data was used to generate 2,000 "realizations[71]" of the 15.2 year climate record; these were then applied to the water balance model and the results were used to estimate the size of site water management structures and the required pumping and treatment rates. The basic flow chart of the water balance model is shown on Figure 20.9.

20.6.1.2 Hydrologic and Hydraulic Model

A hydrologic and hydraulic model of portions of the water management system was created using SWMM5 software. The model was used to evaluate runoff to and capacity of the ditches at the site. These include both contact water ditches and natural area diversion ditches.

Water management criteria and infrastructure for the three sites (Mine, MagSep and Hydromet) are presented in the following Sections (20.6.2 to 20.6.4). Table 20.10 summarizes the information on pond sizing for the three sites and Table 20.11 presents details on the pumping rates to and from the different water management infrastructure. The water management infrastructure for the Kipawa Project includes:

- Seven ponds distributed amongst three sites (Mine, MagSep and Hydromet), with pond active volumes ranging from 1,300 m^3 (Hydromet west collection pond) to 463,000 m^3 (Hydromet water storage basin);

[71] A "realization" is a single simulation run representing a particular "future" (i.e., one possible path the system may follow through time). When running probabilistic simulations, multiple realizations are carried out in order to simulate a large number of possible futures. Each realization of the 15.2 year climate record is a new "synthetic" record with similar statistics to the measured record

- A total of 13.7 km of contact water ditches, 50% of which are located at the mine site;
- A total of 4.5 km of diversion ditches (non-contact water), located at the MagSep and Hydromet sites;
- Ditches with slopes ranging from 0.2% to 29.4%;
- Two water treatment plants, one located at the Mine site and the other at the Hydromet site, with peak inflows to treatment of 3,600 m^3/day (Mine site) and 3,300 m^3/day (Hydromet site);
- Average yearly volumes of water treated: 781,000 m^3 (Mine site) and 688,400 m^3 (Hydromet site)
- Two release points to the environment: one located at the Mine site, and one at the Hydromet site (not including emergency overflow spillways).

Table 20.10 - Pond Sizing Information

	Mine Site North Collection Pond	Mine Site South Collection Pond	Mine Site Pit Collection Pond	MagSep Collection Pond	Hydromet North Collection Pond	Hydromet West Collection Pond	Hydromet Water Storage Basin
Active volume(1) (m^3)	38,000	203,000	-	80,000	85,300	1,300	463,000
Total pond volume(2) (m^3)	74,400	345,000	-	158,000	168,000	2,600	697,000
Effective area at crest(3) (m^2)	18,700	66,300	-	37,000	39,000	1,300	163,000
Permanent pool depth (sediment storage + pumping) (m)	1.5	1.5	-	1.5	1.5	1.5	1.5
Spillway invert elevation (m)	4	5	-	4	4	4	6
Freeboard above spillway invert (m)	1	1	-	1	1	1	1.5
Pond shape	rectangular cropped pyramid	rectangular cropped pyramid	irregular	rectangular cropped pyramid	rectangular cropped pyramid	rectangular cropped pyramid	irregular
Base length (m)	150	310	-	230	240	8	-
Base width (m)	75	160	-	115	120	4	-
Top length (m)	190	365	-	270	280	50	-
Top width (m)	100	180	-	135	140	25	-
Total depth of pond (m)	5	6	-	5	5	5	7.5
Lateral slopes (m/m)	3H:1V	3H:1V	-	3H:1V	3H:1V	3H:1V	2.5H:1V

(1) Active volume : between the permanent pool and the spillway invert

(2) Total pond volume: including permanent pool, active volume and freeboard

(3) Effective area: Area at top crest

Figure 20.9 - Water Balance Flow Diagram

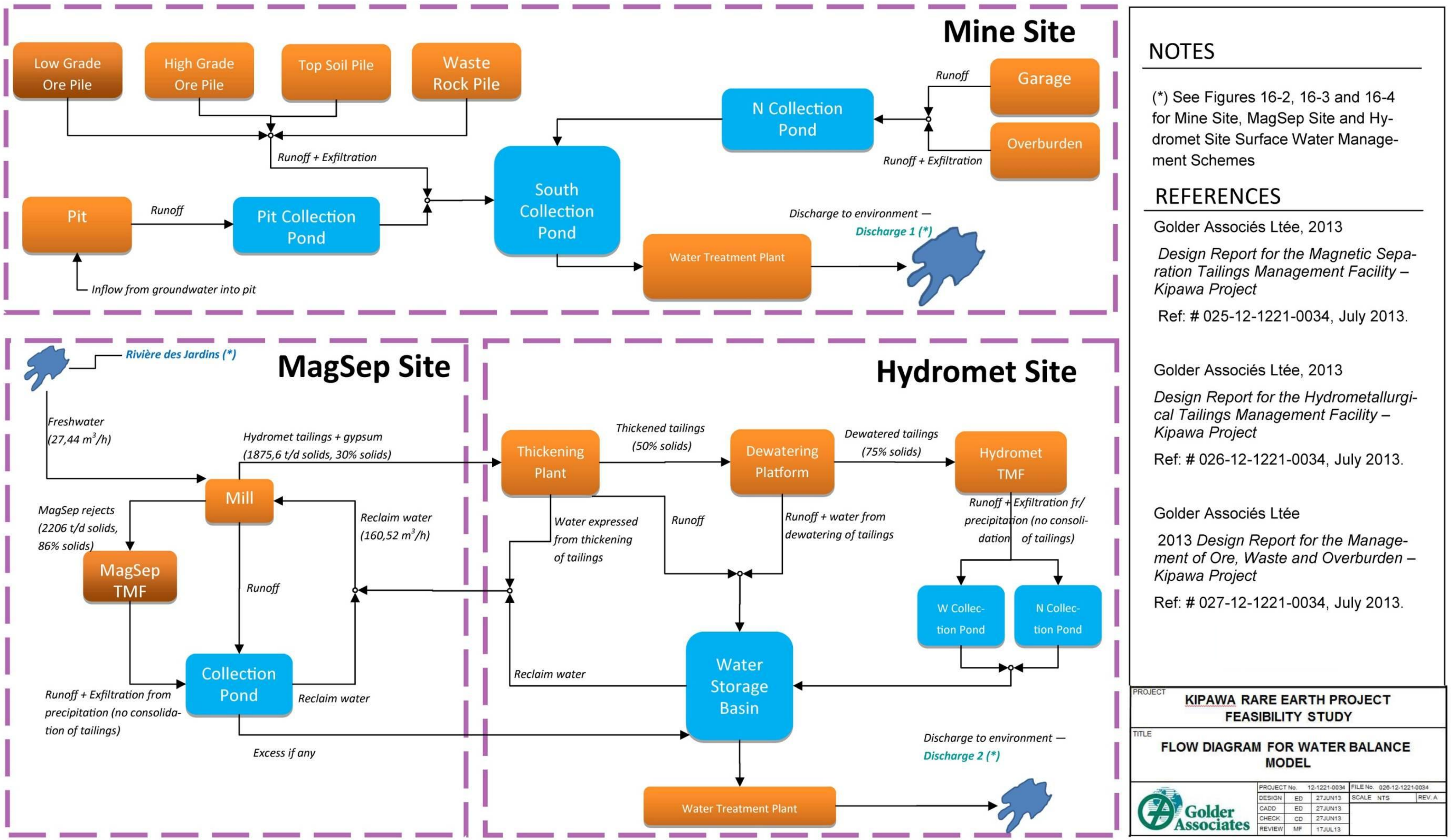


Table 20.11 - Maximum Daily and Average Yearly Pumping Rates

			Pumping Rates	
	Pumping from	**Pumping to**	**Max daily (m^3/day)**	**Average yearly (m^3/yr)**
Mine Site	North Collection Pond	South Collection Pond	800	98,000
	Pit Collection Pond	South Collection Pond	900	258,000
	South Collection Pond	Receiving environment	3,600	781,000
MagSep	Collection Pond	Mill	3,850	295,000
	Collection Pond	Excess water to Hydromet Water Storage Basin	1,360	27,000 (1st year only)
Hydromet	North Collection Pond	Water Storage Basin	1,000	155,000
	West Collection Pond	Water Storage Basin	45	4,500
	Thickening Plant Overflow (Thickening Plant not designed by Golder)	Mill	2,500	833,000
	Water Storage Basin	Mill	1,360	270,000
	Water Storage Basin	Receiving environment	3,300	688,000

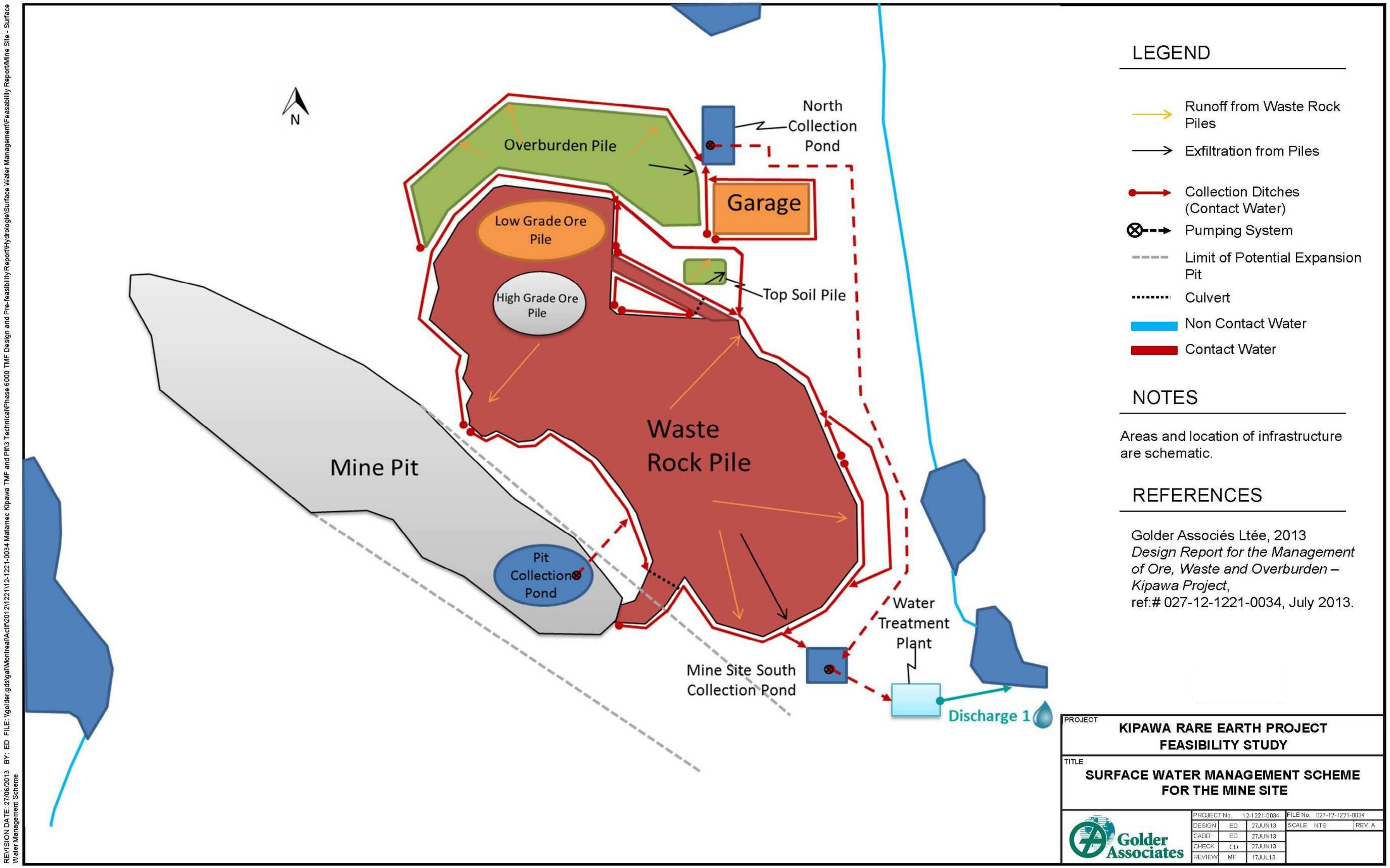
20.6.2 Water Management - Mine Site

Runoff and exfiltration from the piles at the mine site are captured by 6,530 m of contact water ditching as shown in Figure 20.10. Information on ditch sizing is presented in Table 20.12. Generally, flows in the ditches are routed by gravity towards the mine site south collection pond; the area around the overburden stockpile and the garage area are routed to the north collection pond, with water pumped from this pond to the south collection pond. The ditches are trapezoidal with lateral slopes between 0.2% and 12%. Due to high velocities in the ditches, all ditches will be lined with riprap. The modeled peak runoff flow in the ditches during the 100-yr storm is 19.3 m^3/s at the pond inlet.

Table 20.12 - Mine Site Ditch Sizing Information

Mine Site											
Type of ditch	**Length (m)**	**Peak runoff flow 100 yr storm at pond inlet (m^3/s)**	**Shape**	**Base width (m)**	**Depth**		**Side slopes**	**Lateral Slopes**		**Riprap lining length (m)**	**Rock check dams (m)**
					Min	**Max**		**Min**	**Max**		
Contact	6,530	19.3	trapezoidal	2	1	2	3H:1V	0.2%	12%	6,530	0
Non-Contact (diversion)	none										

Figure 20.10 - Mine Site Surface Water Management



The mine site north collection pond is designed to contain the 1:100 yr design storm. The pond includes an overflow spillway with a spillway crest above the expected 1:100 year water level in the pond. The spillway is designed to pass the peak PMP storm flow without overtopping the berm.

The mine site south collection pond is designed to contain the 1:100 yr design storm. The pond includes an overflow spillway located above the expected 1:100 year water level in the pond. The spillway is designed to pass the peak PMP storm flow without overtopping the berm. The mine site south pond receives water collected in the pit sump via a pumping system. In order to manage extreme events (events with return periods exceeding 100 years), the pumping from the pit sump to the mine site south collection pond is stopped when the mine site south collection pond is more than half full. This occurs on average five days a year. Water is pumped from the pond to be treated and discharged to the nearby creek (Figure 20.10). Since the discharge exceeds an annual average of 1,000 m^3/day (Table 20.11), Directive 019[72] requires continuous flow and pH monitoring upstream of the mine site treatment discharge. Furthermore, Directive 019[72] states that the impact in terms of flow on the receiving creek must be minimised. In order to quantify this impact, follow-up monitoring of flows on the receiving creek upstream of the discharge point is also recommended.

At the time of writing, the water quality modelling had not been completed. The results of this modelling may indicate runoff from the waste rock pile is adequate for direct release to the environment. In this case, a separate collection pond for the ore piles alone would be desirable. Water from this pond would require treatment, but at much smaller volumes than if both the ore piles and the waste rock pile runoff require treatment. The waste rock pile occupying the majority of the area (over 60%) draining to the mine south collection pond, the impact on the volume of water to be treated would be significant. This need for an ore pile collection pond will be further evaluated in subsequent phases of the project, once the water quality model is completed.

20.6.3 Water Management - Plant Site (including MagSep)

Runoff from upstream natural areas north and west of the mill and MagSep reject pile are captured by two non-contact water ditches (with a total length of 3,240 m) as shown in Figure 20.11. Flows in the ditches are routed by gravity towards two discharge points (north and south) into existing natural channels. The ditches have lateral slopes ranging between 0.5% and 8.7%. To protect the ditches against erosion, some sections must be lined with riprap, while the remaining sections will have rock check dams. Table 20.13 summarizes the characteristics of the ditches.

[72] Ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2012, Directive 019 sur l'industrie minière - version mars 2012, Gouvernement du Québec.

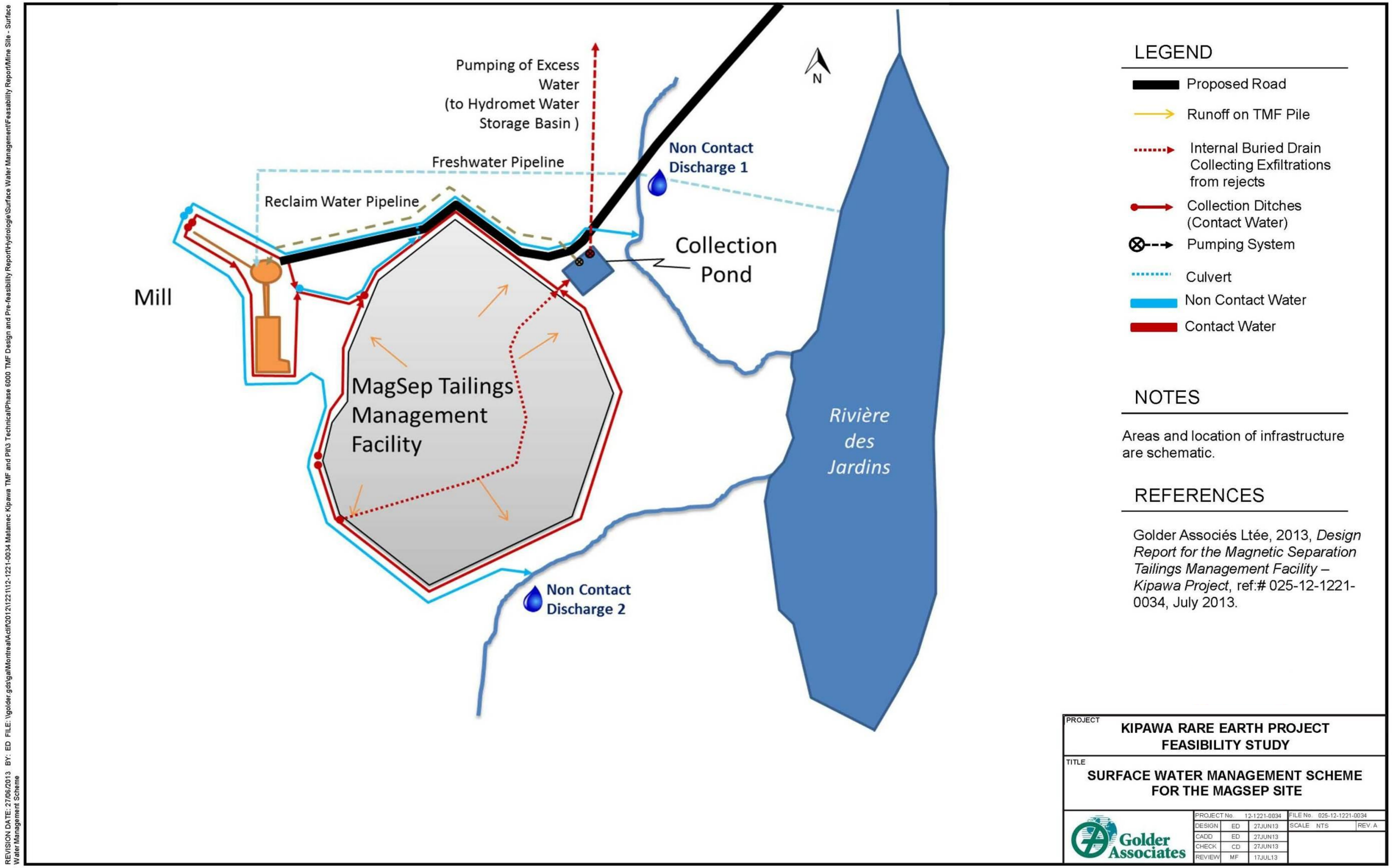
Table 20.13 - MagSep Site Ditch Design Information

MagSep Site											
Type of ditch	**Length (m)**	**Design Flow (peak runoff from 100 yr storm at pond inlet [m^3/s])**	**Shape**	**Base width (m)**	**Depth**		**Side slopes**	**Lateral Slopes**		**Riprap lining length (m)**	**Rock check dams (m)**
					Min	**Max**		**Min**	**Max**		
Contact	4050	13.7	trapezoidal	1	1	2	3H:1V	0.7%	8.9%	4050	0
Non-Contact (diversion)	3240	2.9 (northern diversion ditch) 2.1 (southern diversion ditch)	trapezoidal	1	1	2	3H:1V	0.5%	8.7%	400	2840

Runoff from the mill site and the road, as well as runoff and exfiltration from the MagSep TMF, are captured by 4,050 m of contact water ditching as shown in Figure 20.11. Flows in the ditches are routed by gravity towards the MagSep collection pond. The ditches have lateral slopes ranging between 0.7% and 8.9%. All contact water ditches will be lined with riprap to protect against erosion. The modeled peak runoff flow in the ditches during the 100-yr storm was 13.7 m^3/s.

The MagSep collection pond is designed to contain the 1:1,000 year design storm (as per Directive 019[72]). The pond includes an overflow with its invert at the expected 1:1000 year pond water level (as per Directive 019[72]), with the spillway designed to pass the peak PMP storm flow without overtopping the berm. Water is pumped from the pond to the mill for use in the process. Any excess water from the MagSep pond is pumped to the Hydromet water storage basin. Pumping rates are presented in Table 20.11 (above).

Figure 20.11 - MagSep Site Surface Water Management



20.6.4 WATER MANAGEMENT - HYDROMET SITE

Runoff from the natural area south of the Hydromet site is captured by 1,250 m of non-contact water ditching as shown in Figure 20.12. Flows in the ditch are routed by gravity towards a discharge into the existing channel to the west. The ditches have lateral slopes ranging from 0.5% to 21%. To protect the ditches from erosion, some sections of the ditch will be lined with riprap or will have rock check dams. The modeled peak runoff flow in the ditches during the 100-yr storm was 2.2 m^3/s. Table 20.14 presents detailed information on ditch design for the Hydromet site.

Table 20.14 - Hydromet Site Ditch Design Information

Hydromet Site											
Type of ditch	**Length (m)**	**Peak runoff flow 100 yr storm at pond inlet (m^3/s)**	**Shape**	**Base width (m)**	**Depth**		**Side slopes**	**Lateral Slopes**		**Riprap lining length (m)**	**Rock check dams (m)**
					Min	**Max**		**Min**	**Max**		
Contact	3150	2 (to water storage basin) 7.5 (to N Collection Pond) 0.2 (to W Collection Pond)	trapezoidal	1	1	2	3H:1V	0.1%	29.4%	2190	0
Non-Contact (diversion)	1250	2.2	trapezoidal	1	1	1	3H:1V	1%	21%	178	1070

Runoff and exfiltration from the Hydromet tailings and the tailings dewatering platform are generally routed towards the Hydromet water storage basin (to the southeast of the TMF), the north collection pond (north of the TMF), and the west collection pond (west of the dewatering platform). Runoff from the tailings around the periphery (which due to slope cannot be graded towards the water storage basin) are captured by 3,150 m of contact water ditching as shown in Figure 20.12. The ditches have slopes ranging from 0.1% to 29.4%. To protect the ditches from erosion, all of the contact water ditches must be lined with riprap. The modeled peak runoff flow in the ditches during the 100-yr storm is 2.0 m^3/s (to the Hydromet water storage basin), 7.5 m^3/s (to the Hydromet north collection pond) and 0.2 m^3/s (to the west collection pond).

All ponds at the Hydromet site are designed to contain the 1:2,000 year design flow (as per Directive 019[72]). All ponds have an overflow spillway, set at the expected 1:2,000 year water level in the pond, with the spillway designed to pass the peak PMP storm flow without overtopping the berm.

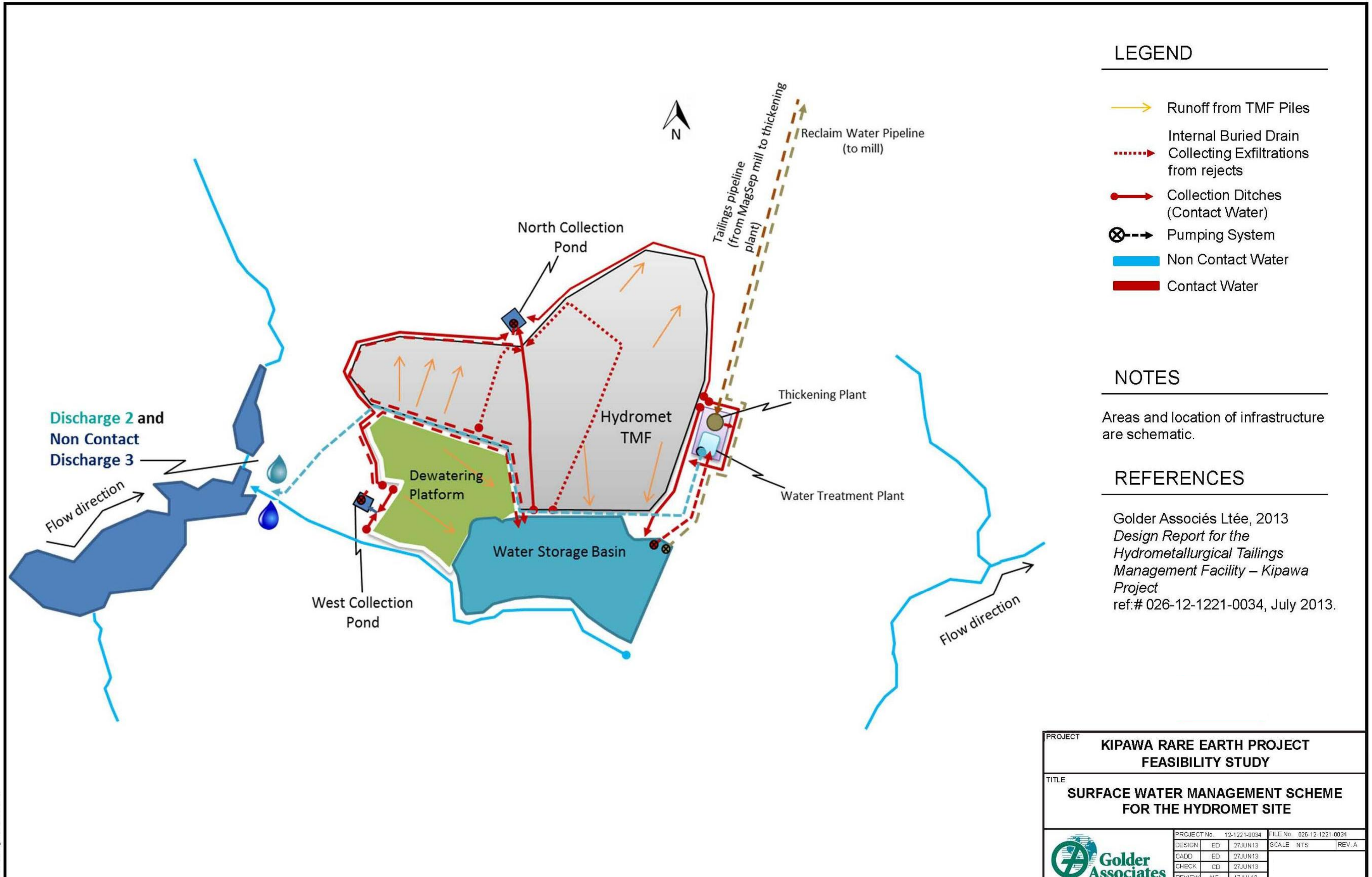
Runoff and exfiltration from the tailings that cannot be directly routed to the Hydromet water storage basin are first captured in either the west or the north collection pond. The water is then pumped from these ponds to the water storage basin.

The Hydromet water storage basin is the biggest pond at all three sites, with an active volume of 463,000 m^3. Water from this basin is pumped to the mill (located at the MagSep site) for use in the process. Water that is not pumped to the mill is instead pumped to a water treatment plant before discharge to the nearby creek (Figure

20.12) at a maximum daily rate of 3,300 m^3/day. The discharge point is in the creek west of the TMF, so as to return the water to its original watershed and thereby limit impacts to original creek flows. Since the discharge exceeds an annual average of 1,000 m^3/day (Table 20.11), Directive 019[72] requires continuous flow and pH monitoring upstream of the Hydromet treatment discharge. Furthermore, Directive 019[72] states that the impact in terms of flow on the receiving creek must be minimised. In order to quantify this impact, follow-up monitoring of flows on the receiving creek upstream of the discharge point is also recommended.

Process water that is extracted from the Hydromet tailings at the thickening plant on the Hydromet site (Figure 20.12) will be pumped back to the mill at a constant rate of 2,500 m^3/day for use in the process.

Figure 20.12 - Hydromet Site Surface Water Management



20.6.5 COLLECTION POND DESIGN AND CONSTRUCTION

The proposed collection ponds are integrated with the mine waste facilities. They are designed to collect all runoff and seepage from each site and the water is then clarified prior to use in process or release to the environment. The general assumptions, calculations and detailed results are presented in separate Golder's Design Reports[73,74,75] associated with the Mine, the MagSep TMF and the Hydromet TMF sites. The Water Storage Basin is also introduced in Section 20.5.2(Hydromet Tailings Management Facility).

The collection ponds are purposely located at low-topographic elevations to collect either the water flows that are routed by gravity from the ditches or the end-discharged water from the pipeline recirculation system. Depending on the local topography, the pond consists of a layout of cut and fill materials combined with the use of geosynthetic liners to contain water. The ponds will be constructed according to the proposed geometry and sizing as described in Table 20.10.

The collection ponds are designed to:

- Retain water.
- Meet or exceed required factors of safety (F.S) for embankment stability under both seismic (F.S ≥ 1.1) and long term static (F.S ≥ 1.5) conditions.
- Consider all aspects of constructability, stability, seepage and resistance to external and internal erosion forces.

Standard construction activities involve removing the organics from the surface before reshaping the overburden material in order to build the collection pond foundation or to raise the perimeter embankment, if required. The construction sequencing will include the following items:

- Implementation of water control works to manage water and to control the release of sediment during construction.
- Clearing, stripping and excavation: the collection pond excavation footprint is stripped, top soil is stockpiled for reclamation and, if suitable, all excavated materials are re-used as random backfill for the perimeter embankment construction.
- Placement of granular fill material for embankment construction and compaction in layers and then pulling back at slopes of 3H:1V; both upstream and downstream slopes.
- Bedding preparation: placement of a transition layer made of compacted sand material at the base of the pond up to the upstream crest of the embankment. The finished surface will be competent; free from any deleterious materials and any important protrusion from any exposed aggregates.
- Waterproofing of the collection ponds will come from the installation of a high density polyethylene (HDPE) geomembrane liner covering the base and anchored at the top of the perimeter embankment. The HDPE geomembrane is overlain by a geotextile used for puncture protection and against the activation of the polymer degradation process caused by ultra-violet sun-ray.

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73 Golder Associés Ltée, 2013, *Design Report for the Hydrometallurgical Tailings Management Facility - Kipawa Project,* ref.: 026-12-1221-0034, July 2013

74 Golder Associés Ltée, 2013, *Design Report for the Management of Ore, Waste and Overburden - Kipawa Project,* ref.: 027-12-1221-0034, July 2013

75 Golder Associés Ltée, 2013, *Design Report for the Magnetic Separation Tailings Management Facility - Kipawa Project,* ref.: 025-12-1221-0034, July 2013.

- Placement of granular fill material above the geotextile to preserve the underlying material integrity, to protect against ice formation and to prevent bio-intrusions.
- Implementation of a leak detection program to control the containment system integrity: the water puddle system or the dipole technique will be performed accordingly on the exposed and covered geomebrane liner.
- A seepage collection system is installed at downstream toe of the embankment to monitor the quantity and quality of seepage, if any, through the embankment and foundation.

20.7 Mine Closure

A conceptual closure plan will be prepared with respect to the "Guidelines for preparing a mining site rehabilitation plan and general mining site rehabilitation requirements" and the Québec *Mining Act*. The conceptual plan will be presented to the Ministère des Ressources naturelles (Ministry of Natural Resources) for approval before the beginning of the mining activities. The document will present a description of the mining activities, mine site, accumulation areas, rehabilitation program, emergency plan, monitoring program, closure cost, work schedule and description of the financial security.

Closure costs include engineering and permitting for all planned rehabilitation work, the removal of all infrastructure and buildings, rehabilitation of road surfaces and pads, open pit securement, the rehabilitation of all accumulation areas and, finally, post-closure monitoring.

The calculation of the financial security to be paid is based on the estimated rehabilitation costs of the accumulation areas, namely, the two tailings management facilities (MagSep and Hydromet) and the waste rock dump at the mine site. Over the course of the 15.2 years of mining activities, the project will have produced a total of 18.6 Mt (9.3 Mm^3) of waste rock, 10.9 Mt (7.5 Mm^3) of tailings from the magnetic separation process and 9.25 Mt (6.1 Mm^3) of tailings from the hydrometallurgical process.

The choice of a tailings management technology based on the dewatering of tailings was aimed at avoiding the management of water bodies during and at the end of the mine operation. Thus, the dewatered tailings stacked at each location can be progressively reclaimed and efforts could be made to continuously improve the closure strategy. Overall, once all mining activities have ceased; two piles of dewatered tailings and one waste rock dump will remain on site. The geochemical assessment of both tailings streams and the waste rock do not suggest rehabilitation should include works other than stabilizing the surface, controlling the erosion and providing for adequate surface water management.

The rehabilitation concepts of the accumulation areas are expected to be as follows:

20.7.1 Waste Rock Dump

The mining of the open pit will produce a total of 9.3 Mm^3 of waste rock and most of this volume (7.6 Mm^3) will be stored in a dump located at the north-east side of the open pit. Of the total 9.3 Mm^3 of waste rock, 1.7 Mm^3 will be returned in the eastern portion of the open pit and a small amount will be used for construction.

The horizontal bench surfaces of the waste rock dump will be re-profiled so that surface water can run off freely towards the edge of the waste rock pile. The waste rock dump will then be covered with thin organic layer and be vegetated. A progressive rehabilitation program will be implemented in order to lower the environmental impact during the project. Each time three lifts (approximately) of the dump are completed, vegetation of the benches will be carried out. At the end of the mining activities, the final surface of the waste rock dump will be re-profiled to ensure there is no accumulation of water and that surfaces will be covered with organics and vegetated.

20.7.2 MagSep Tailings

As a result of the magnetic separation process, a total of 7.5 Mm^3 of MagSep tailings will be produced. The entire volume will be stored at the south-east end of the process plant. All horizontal and slope surfaces of the MagSep tailings pile will be revegetated. In this case, the progressive rehabilitation program is divided in 3 phases. Vegetation will be carried out after 5.2 years of operation, then at the 11.3-year mark, and, finally, at the end of the mining activities. It is anticipated that the re-vegetation will be done with hydraulic means on the slope. The surface of the pile, as completed for each of the stages, will be re-profiled by creating a natural surface runoff pattern, covered with thin organics layer and vegetated. The first stage is intended to serve as a testing pad in order to determine the best vegetating strategies for this type of material.

20.7.3 Hydromet Tailings

As a result of the hydrometallurgical process, a total of 6.1 Mm^3 of Hydromet tailings will be produced. The entire volume will be stored in a tailings management facility located south of the Maniwaki road at Kilometre 50. The Hydromet tailings are finer and are expected to retain some water. In order to control the rising of the water table within the impoundment itself, it is planned to limit the infiltration of surface water to the impoundment. All horizontal and slope surfaces will be covered with a thin low permeability layer consisting of natural or, if available, man-made materials. The final surface will be reshaped in order to allow natural runoff patterns to form and will then be vegetated.

Similarly to the MagSep tailings management facility rehabilitation, the progressive rehabilitation program is divided in 3 phases. The installation of the low permeability layer and the revegatation will be carried out after 10.1 years of operation, then at the 10.6 year mark, and, finally, at the end of the mining activities.

20.7.4 Water Management Structures

At the end of the mining operations, the sediments found in the footprint of the water storage basin will be characterized and disposed of, in compliance with the applicable laws. The liner will be removed, the surface vegetated and the peripheral dyke will be breached to restore natural water flow. The same rehabilitation steps will be implemented for all smaller ponds or basins.

According to the available information, the estimated rehabilitation cost for of the Matamec project after 15.2 years of operation is 23.1 million dollars. Out of this total, the amount associated with the accumulation areas alone is 15.4 million dollars. A contingency of 15% has been applied to the estimate.

20.8 Environmental and Social Impact Assessment

The Environmental and Social Impact Assessment (ESIA) of the Project is currently underway, but not completed; only the main expected issues are presented in this section. Positive and negative impacts identified below are listed from experience of similar projects and only with a preliminary understanding of the interactions between the surrounding environment and the characteristics of the Project.

20.8.1 Environmental Assessment Approach

The ESIA has three main objectives:

- To identify the potential impacts of the project during the planning stage so that the project design could be enhanced to avoid or reduce potential impacts;
- To propose, if needed, mitigation measures to reduce the potential impacts of the project on the physical, biological and social environments; and
- To prepare a report for regulatory authorities and the public explaining the residual impacts of the project (i.e., the impacts predicted to occur once mitigation measures have been applied).

The impacts on the environment are generated by sources that can be defined as the project elements (i.e., infrastructure, works or activities) planned and likely to affect, directly or indirectly, a component of the physical, biological or social environment. The identification of potential impacts is based on the technical characteristics of the project, the knowledge of the surrounding environment and experience from similar projects.

The interrelation between the environmental and social components and the sources of impacts are evaluated to identify the impacts. Then, the significance of each impact is evaluated through a series of criteria, namely: the geographic extent, the magnitude and the duration of the potential impact. Mitigation measures or project improvements are integrated to lessen the impact identified. Finally, compensation measures can also be defined, if needed. The management of the residual impacts is addressed through an environmental monitoring and follow-up program.

As the ESIA is not yet completed, the assessment presented below is qualitative and only presents a preliminary identification of the main potential impacts based on the interactions between the project and the surrounding environment. These impacts will be assessed in more detail during the preparation of the ESIA.

20.8.2 Preliminary Identification of Potential Impacts

Potential impacts will mainly be triggered by:

- The construction of the Project infrastructure (including many works such as clear-cutting, blasting, excavating, building, etc.);
- The operation of the Project infrastructure (including mining, ore processing, handling of waste and tailings, water management, etc.);
- The closure of the mine and its related infrastructure.

20.8.2.1 Physical Environment

The main potential impacts anticipated for the physical environment are briefly described below.

<u>Effects on surface water quality and hydrology</u>

The surface water quality could be affected by potential higher suspended solids associated with subsidence and erosion, potential contamination by effluents and leachate from waste rock and ore piles, MagSep and tailings facilities, and potential spills of petroleum products or other chemicals. The surface water quality has a direct interaction on the ecosystem (fish and waterfowl for example) and people using the territory for recreational purposes. The effluents will have to meet the Metal Mining Effluent Regulations (MMER) requirements, pursuant to the Fisheries Act as well as the provincial requirements (Effluent Discharge Objectives and Directive 019).

The numerical modelling study of groundwater flow and solute transport shows that the contaminants transported from ore and waste rock piles and the MagSep facilities will not reach the surrounding lakes and rivers. Runoff from the ore and waste rock piles, the MagSep and the tailings facilities will be collected by a network of ditches. Settlement ponds will be implemented to limit the suspended solids release to the water. For the tailings, Matamec is planning on building a thickening plant to reduce the tailings water content. In addition, the tailings will be dewatered on a granular drying pad in summer and in geotubes during winter. A geochemical evaluation of the tailings is currently underway. Other mitigation measures may be applied if necessary.

Local contamination of water could potentially be caused by accidental spillage of petroleum products and other contaminants or dust generated by the mining activities. Measures will be implemented to reduce the risk of accidents and an emergency response plan as well as an environmental management plan will also be in place to minimize the consequences in the event of an accident.

Any change in the volume of flow or distribution pattern of the water can cause disturbances to an ecosystem. Clear-cutting and the construction and presence of infrastructure will modify some characteristics of the drainage system naturally in place. The hydrological dynamics of water courses can be modified by the water intake and effluent outlets. The impacts have not yet been assessed, but to minimize the need for fresh water, tailings drainage water and tailings thickener overflow will be reused as process water in the process plant. Other mitigation measures can be put in place as necessary.

Drawdown of groundwater near the pit and effects on groundwater quality

The open mine activities will require the dewatering and will potentially drawdown the water-table near the pit. It is not expected that the water-table drawdown zone will reach a lake or a stream. The most likely scenario from modelling works estimates a groundwater inflow into the pit at 300 m^3/day.

Groundwater quality could be impacted through leaching or dissolution of metals as well as accidental spills or equipment failure. As previously mentioned, an emergency response plan as well as an environmental management plan will also be in place to minimize the consequences in the event of an accidental spill.

Effect on soil quality

Local contamination of soil could potentially be caused by accidental spillage of petroleum products and other contaminants. Security measures will be implemented to reduce the risk of accident.

Changes in air quality

The local air quality will potentially be affected by contaminants and dust during the mine construction and operation. Atmospheric emission from exhaust of generators, engines, vehicles and heavy equipment will be the main sources of contaminants.

Dust will be generated from a multitude of sources including vegetation clearing, erosion during the creation of new roads and the placement of installations, the movements of vehicles, loading, unloading of material, mining, blasting, crushing, processing or wind removal from waste rock and tailings.

An air-dispersion modelling will be completed to assist in evaluating the effect of the project on the air quality as well as dust falls. The emissions will have to meet the Clean Air Regulation requirements that establish, notably, emission standards and monitoring measures to prevent, eliminate, or reduce the emission of contaminants into the atmosphere. The atmospheric quality standards (Clean Air Regulation) and criteria (Environment Quality Act) were designed to protect human health and minimize nuisances and impacts on ecosystems.

Local changes in noise and vibrations

The project will change the noise and vibration level in the areas surrounding the mining infrastructure. Sources of noise during the mine construction and operation include the use of machinery, vehicles, drilling, blasting and crushing of the ore. Matamec will keep a register of data related to blasting to comply with the provincial requirements (Directive 019; MDDEP, 2012). Noise modelling will be conducted to assess the geographical extent of this impact.

20.8.2.2 Biological Environment

The main potential impacts anticipated for the biological environment are briefly described below.

Local loss of vegetation and wetlands

Vegetation and wetlands will be lost by clear-cutting and the implementation of new infrastructure at the mining site, the process plant site, the tailings storage facility site, the access road and other infrastructure.

Most of the vegetation lost will be from forest land (mixed stands). Wetlands will also be affected by the project, mostly at the tailings site where a large proportion of the project footprint consists of wetland communities.

Clear-cutting will be limited to the pre-defined sectors and, as much as possible, disturbed areas will be used to implement the infrastructure and minimize habitat loss. The project design will avoid the wetland areas for the road construction to the greatest extent possible. Other mitigation measures will also be put in place to minimize the impacts on the vegetation and wetlands.

Local loss and alteration of habitats for terrestrial fauna and birds

The clear-cutting and implementation of infrastructure will locally reduce the available habitats for mammals, reptiles, amphibians, and birds. However, it is not anticipated that sensitive or rare habitat will be affected by the project. Most of the affected habitat types are common in the surrounding area of the project sites. Mitigation measures will be put in place to minimize the impacts.

Perturbation and displacement of fauna resulting from noise and activities during construction and operation

Drilling, blasting, excavation and backfilling, and traffic of heavy machinery and vehicles are possible sources of noise within the project sites. The increase of noise and the presence of workers will potentially change the use of the territory by fauna. Some species will avoid the sectors, notably because of noise and intensity of light.

Blasting can have a potential negative impact on fish health and fish habitat, notably by causing damages to the internal organs, mortality of fish eggs and disturbance of spawning grounds (Wright and Hopky, 1998). The weight of the charge used for the construction of the mine infrastructure and mining operation, as well as the time delay between explosions will be selected in order to respect the Department of Fisheries and Oceans (DFO) guidelines for usage of explosives in or near fish habitats. Consequently, the blasting impact is not anticipated to cause any fish health issues or damage to fish spawning grounds. Moreover, as previously mentioned, Matamec will keep a register of data related to blasting to comply with the provincial requirements (Directive 019; MDDEP, 2012).

Loss and modification of some fish habitats due to the installation of the project infrastructure, changes in hydrology, hydraulics and water quality

As described previously, the water quality and hydrology could potentially be affected by the effluent releases and effects associated with drainage and erosion. Consequently, fish habitat quality will potentially be affected, especially the spawning grounds that could be altered by sedimentation. The potential effect of sedimentation on spawning ground for walleye (Sander vitreus), lake trout (Salvelinus namaycush) and brook trout (Salvelinus fontinalis) found in lakes and water courses around the project sites will be assessed during the ESIA.

Some fish habitat will potentially be lost from the installation of the infrastructure. However, it is expected that the loss of habitat will be minor. This impact will be assessed in detail during the ESIA. Mitigation and compensation measures will also be implemented, as required.

20.8.2.3 Social Environment

The main potential impacts anticipated for the social environment are briefly described below.

<u>Local modifications of land and resource use</u>

Public land leases for camps and cottages are common in the area. The clear-cutting and the implementation of new infrastructure will modify land and resource use within the project footprint. A few seasonal camps and cottages within this footprint may need to be resettled.

The proposed project sites are located within the Restigo controlled harvesting zone (ZEC) where hunting and fishing activities are conducted. However, the project footprint covers a very small portion of the ZEC territory. Land based activities that could be somehow impacted within the project site include trapping and canoeing in addition to hunting and fishing. For Non-Aboriginals, these activities are recreational while for Aboriginals they are considered as part of their culture.

<u>Potential disturbance of archaeological sites</u>

The study of the archeological potential identified 25 sites with medium or high archeological potential within a 150 km² in the project site. The clear-cutting and the implementation of new infrastructure will affect the land within the project footprint. No site with archeological potential is located within the proposed infrastructure footprint; however, two potential archeological sites are located fairly close to the proposed tailings site. Before any of the planned development work takes place on these two potential archeological sites, an archeological inventory shall be conducted. Any artefact discovered during the inventory would be preserved, assessed by an archaeologist and reported to the responsible public agency according to existing regulation.

<u>Visual modification of the landscape</u>

The actual landscape of the project area is characterized by hills and forest cover. The clear-cutting, the implementation of new infrastructure and the development of the mining pit will create new open spaces, modify the topography and change the landscape in the project footprint. The visual impacts will depend in particular on the height of the infrastructure, the resistance to change of the different landscape units in the project surroundings and the location of the observers. A visual impact assessment will be conducted at a later stage.

Economic opportunities

The Témiscamingue RCM is heavily dependent on the forest industry and lacks economic diversity. The lack of economic diversity and unemployment explains in part the decreasing population both at a local and a regional level. The project operation will take place over a period of about 15 years and up to 250 workers will be employed for the project during the construction phase. Once in operation, the project will employ around 230 people. The development and operation of the mine will directly and indirectly have positive impacts on employment, training, and investment opportunities, at the local and regional levels. These socio-economic benefits could extend to neighbouring Ontario.

Traffic increase

From Témiscaming, access to the project site is currently done through national road 101, Kipawa Road and a forest road. Logging companies are the main users of the access road. A significant number of their trucks travel on this road. The road is also used by hunters, fishermen, camp and cottage owners, and recreational visitors in the area. During the construction phase, up to 15 trucks will travel daily between Témiscaming and the project site. Once in operation, it is expected that around 10 trucks will travel daily on this road. Workers transportation to the project site will add to this traffic. Therefore, the development and operation of the mine will increase traffic in the project site.

In addition, some material and products required for the development and operation of the mine may come from Ontario by truck. There is already important traffic between the two provinces, notably between Témiscaming and North Bay. Therefore, the project should have limited impact on the increase of inter-provincial traffic between Québec and Ontario. However, potential risk of spilling of chemical product during transportation will apply to roads in both provinces. Security measures will be implemented to reduce the risk of accidents and an emergency response plan as well as an environmental management plan will be in place to minimize the consequences in the event of an accident.

Pressure on public health and social services

In a 45-km radius of the project site, the total population is estimated at 3,350 people. Health and social services for this population are located in Témiscaming. They are designed in accordance with actual population figures; with ten beds and four doctors, the hospital provides basic health services. Under an agreement with North Bay hospital, patients needing specialized health services are referred by Témiscaming's hospital to North Bay.

During its construction phase and its 15 years operation phase, the project will hire up to 250 workers. If not already living in the project site, it is likely that some of these workers and their family will settle in Témiscaming or Kipawa. It is expected that additional families will settle in the area through the indirect employment that the project will generate. The project will entail a population increase which will put pressure on public health and social services in Témiscaming and in North Bay.

Quality of life

As noted, the total population in a 45-km radius of the project is less than 3,500 people. This population is centralized mostly in Témiscaming and Kipawa. Algonquin represents nearly 15% of the population. At a local level, social acceptability of the project concerns these people who feel they might be affected by the project. Both during construction and operation phase, the project will entail some modifications in the biophysical and the social environment. Aboriginal and non-Aboriginal local and regional populations and institutions, as well as other stakeholders, have some concerns in regard to these modifications. Addressing these concerns within the project design and an environmental management plan will contribute to achieving social acceptability of the project.

As noted, the total population in a 45-km radius of the project is less than 3,500 people of which around 15% are Aboriginal. This population is centralized mostly in Témiscaming and Kipawa. Quality of Life is important for these 3,500 people and is a subjective issue that refers to people's perception of their well-being. Some elements contributing to quality of life for the concerned population have been identified on a preliminary basis. They include elements such as youth employment, public safety, beauty of the surroundings, great outdoor activities, sense of belonging to a community living in a pristine environment.

Both during the construction and operation phases, the project will entail some modifications in the biophysical and the social environment. Aboriginal and non-Aboriginal populations, as well as other stakeholders, have some concerns in regard to these modifications which could impact their quality of life. In addition to the mitigation measures that will be applied to the biophysical and social components, relaying proper information to the stakeholders will contribute to developing a project that will maintain or even enhance the quality of life of the population.

20.8.3 Monitoring and Follow-up Programs

The objective of the environmental monitoring program is to ensure that the project will meet all relevant and applicable legislation and regulatory requirements, and the conditions to be set out in the governmental decree. The program also aims to ensure that the commitments and mitigation measures presented in the ESIA are fulfilled and optimized, if necessary or possible.

The objective of the environmental follow-up program is to verify the accuracy of predictions presented in the ESIA and to ensure the effectiveness of the mitigation and improvement measures. If required, corrective measures can also be proposed and applied during the environmental follow-up program, to meet the environmental standards and to ensure the protection of the environmental components within the study area.

Details of the environmental monitoring and follow-up programs will be developed as project details are finalized and regulatory approval requirements are clarified.

21.0 CAPITAL AND OPERATING COSTS

21.1 Capital Cost Estimate

Capital Cost Estimate section of the feasibility study report covers initial and sustaining capital cost estimate.

21.1.1 INITIAL CAPITAL COST ESTIMATE

The Initial Capital Cost estimate (CAPEX) presents the capital spending required during the pre-production period. The CAPEX is broken down into two (2) categories: Direct Costs and Indirect Costs.

A summary of the Initial Capital Cost Estimate for Matamec Kipawa Project feasibility study is presented in Table 21.1 below.

Table 21.1 - Initial Capital Cost Estimate Summary (CAPEX)

Capital Cost Item	Cost ($)
Direct Costs	**257,992,730**
Off-Site Installations	9,762,799
Mine Site	41,922,429
Inter-Site Services	13,352,349
Hydromet Plant Site	192,955,152
Indirect Costs & Contingency	**116,389,345**
Construction Indirects	53,116,900
Owner's Costs	14,440,000
Contingency	48,832,445
Total Capital Cost	**374,382,075**

The Direct Costs include the cost of installed equipment, materials, and labour directly involved in the physical construction of the project.

The Indirect Costs include all costs which do not become a physical part of the final installation, but that are required for the orderly completion of the project. They include but are not limited to the detailed engineering, procurement, construction, and project management, temporary site facilities, insurance, owner's costs, etc. For Matamec Kipawa project feasibility study, a contingency is included in the Indirect Costs portion of the CAPEX.

The summary of the Direct and Indirect Costs are presented in Appendix 8.1 . The CAPEX is presented per sub-project and area in the tables below. Direct costs are presented by sub-project in Table 21.2 to Table 21.5, whereas Indirect costs and contingencies are presented in Table 21.6.

Table 21.2 - Direct Costs, Sub-Project 11 - Off Site Installations CAPEX

SUB-PROJECT 11 - OFF-SITE INSTALLATIONS (5 km RADIUS OF TEMISCAMING)	Total Cost ($)
AREA 210 - MAIN SUB-STATION (Temiscaming - 120 kV)	3,573,998
AREA 215 - HYDRO-QUÉBEC 2 km 120 kV POWER LINE	5,540,000
AREA 305 - PARKING AT TEMISCAMING	648,801
Total Sub-Project 11 -- Off-Site Installations	**9,762,799**

Table 21.3 - Direct Costs, Sub-Project 10 - Mine Site CAPEX

SUB-PROJECT 10 - MINE SITE (KIPAWA)	Total Cost ($)
AREA 110 - MINING EQUIPMENT	13,519,084
AREA 115 - MINE ROADS	412,975
AREA 120 - MINE DEWATERING	71,880
AREA 130 - MINE PRE-PRODUCTION	10,117,634
AREA 150 - MINE EXPLOSIVE STORAGE	180,315
AREA 310 - ACCESS ROADS (Mine Site - Plant Site)	9,729,747
AREA 330 - MINE MAINTENANCE SHOP (Garage)	7,541,910
AREA 334 - MINE SITE FUEL STORAGE	348,886
Total Sub-Project 10 - Mine Site	**41,922,429**

Table 21.4 - Sub-Project 14 - Inter-Site Services CAPEX

SUB-PROJECT 14 - INTER-SITE SERVICES	Total Cost ($)
AREA 220 - POWER LINES (120 kV Sub-Station - Plant Site)	9,457,278
AREA 225 - COMMUNICATIONS	1,642,207
AREA 310 - ACCESS ROAD (Maniwaki Road - Plant Site)	2,252,864
Total Sub-Project 14	**13,352,349**

Table 21.5 - Sub-Project 18 - Hydromet Plant Site CAPEX

SUB-PROJECT 18 - HYDROMET PLANT SITE	Total Cost ($)
AREA 230 - MAIN SUB-STATION (Hydromet Site)	5,898,361
AREA 310 - ACCESS ROAD (Bypass Road Plant Site)	152,089
AREA 320 - GENERAL PLANT SITE PREPARATION	5,934,004
AREA 336 - PLANT SITE FUEL STORAGE	286,914
AREA 340 - ADMINISTRATION & SERVICE BUILDING	3,549,397
AREA 342 - PLANT SITE WAREHOUSE	1,323,778

Table 21.5 - Sub-Project 18 - Hydromet Plant Site CAPEX

SUB-PROJECT 18 - HYDROMET PLANT SITE	Total Cost ($)
AREA 344 - ASSAY LABORATORY	3,941,757
AREA 348 - SURFACE SUPPORT MOBILE EQUIPMENT	876,000
AREA 350 - REAGENT STORAGE (Cold Storage)	821,108
AREA 390 - SITE FIRE PROTEC., PUMP. STATION, PIPELINE	488,450
AREA 510 - CRUSHING	9,410,851
AREA 515 - ORE STORAGE	4,791,607
AREA 520 - GRINDING	4,592,570
AREA 525 - MAGNETIC SEPARATION	6,524,969
AREA 530 - MAGNETIC SEPARATION CONC. REGRIND	3,033,160
AREA 535 - MAGNETIC SEPARATION CONC. DEWATERING	1,246,849
AREA 540 - MAIN BUILDING PROCESS PLANT	48,390,525
AREA 550 - MAGNETIC SEPARATION TAILINGS DEWATERING	4,096,724
AREA 552 - ACID LEACHING	2,893,434
AREA 554 - AL TAILINGS DEWATERING	12,476,883
AREA 556 - PRE-NEUTRALIZATION	3,316,020
AREA 558 - PN RE-LEACH	4,700,076
AREA 560 - IMPURITIES REMOVAL	2,473,516
AREA 562 - RARE EARTH PRECIPITATION	724,894
AREA 564 - REP RE-LEACH	5,900,475
AREA 566 - PRECIPITATE DEWATERING & LOADOUT	3,597,766
AREA 568 - FINAL TAILINGS NEUTRALIZATION	722,547
AREA 570 - PROCESS & FRESH WATER DISTRIBUTION	2,058,492
AREA 572 - REAGENT PREPARATION & DISTRIBUTION	6,872,808
AREA 574 - COMPRESSORS ROOM & AIR DITRIBUTION	1,107,533
AREA 576 - PRIMARY ELECTRICAL ROOM	2,434,216
AREA 577 - SECONDARY ELECTRICAL ROOM	3,568,063
AREA 590 - PLANT METALLURGICAL LABORATORY	289,800
AREA 598 - PLANT TOOLS, MOBILE EQUIPMENT	1,985,015
AREA 805 - FRESH WATER PUMPING STATION and PIPELINE	4,785,824
AREA 810 - TAILINGS POND	19,403,027
AREA 820 - TAILINGS PIPELINE	2,023,995
AREA 830 - RECLAIM PUMPING STATION & PIPELINE	1,963,653
AREA 860 - EFFLUENT WATER TREATMENT (if required)	4,298,000
Total Sub-Project 18	**192,955,152**

Table 21.6 - Indirect Costs & Contingency CAPEX

INDIRECT COSTS & CONTINGENCY	Total Cost ($)
AREA 910 - CONSTRUCTION INDIRECTS	53,116,900
AREA 945 - CONSTRUCTION CONTINGENCY (15% of Direct Costs & Construction Indirect Costs)	46,666,445
AREA 950 - OWNER'S COSTS	14,440,000
AREA 995 - OWNER'S COST CONTINGENCY (15% of Owner's Costs)	2,166,000
Total Indirect Costs & Contingency	**116,389,345**

21.1.2 SUSTAINING CAPITAL COST ESTIMATE

Sustaining Cost is the capital spending required to maintain the operation once the mine will be in operation. The Sustaining Costs include but are not limited to mine fleet replacement, tailings dykes heightening, and additional tailings road work, as well as rehabilitation costs. Table 21.7 presents the summary of the sustaining capital cost. Detailed sustaining capital cost is presented in Section 22 as part of the expense schedule for the financial analysis.

Table 21.7 - Sustaining Capital Cost Estimate Summary

Sustaining Capital Cost Item	Cost ($)
Mine fleet growth & equipment replacement	12,046,729
Open pit dewatering (pumps + piping)	221,000
Tailings Management Facilities	440,000
Rehabilitation costs	20,100,518
Contingency	4,921,237
Total Sustaining Capital Cost	37,729,484

21.1.3 ESTIMATE METHODOLOGY

The estimate methodology used for the Matamec Kipawa project feasibility study was mostly a detailed unit cost approach, although a factorization method was used on occasion when detailed information was not available.

Most, if not all, of the direct cost items were estimated based on the determination of proper unit rates, equipment purchase cost, all-in labour rates, and installation costs provided in most cases by quotations from suppliers and/or local contractors.

In some cases, mostly for some indirect cost items, a stochastic method (factor) was used to estimate costs when the detailed information was not available. Cost information from previous similar mining projects was also used for estimating some indirect cost items.

The sustaining capital costs, as well as the related indirect costs, were estimated using the same estimate methodology as the CAPEX.

The Cost Breakdown Structure (CBS) described in Section 21.1.4 details how the estimate template was established.

21.1.4 COST BREAKDOWN STRUCTURE

The Matamec Kipawa project's CAPEX Cost Breakdown Structure (CBS) is based on the Cost Coding Chart document (Appendix 8.2). The purpose of the CBS is to break the total project cost into a sum of smaller individual cost items.

The estimate is divided into direct and indirect costs. The direct cost section of the estimate is divided into sub-projects, each sub-project representing a specific geographical location. Each sub-project is divided into areas representing different physical entities, be it a service, a building, a process, etc. Each area is divided by disciplines. Each discipline is responsible for evaluating the scope, quantities, and unit costs for each activity or equipment required for any given area. Each discipline breaks down their estimate sections into individual cost items (activity or equipment). The Cost Breakdown Structure example in Table 21.8 is a good representation of how each individual cost item is developed.

Table 21.8 - Cost Coding Example

Sub-Project	Area	Discipline	Activity		Sequential #
10	110	5	005	-	01

- Sub-Project 10: Mine Site;
- Area 110: Mine Equipment;
- Discipline 5: Mechanical;
- Activity 005: Wheel Loader;
- Sequential 01: Wheel Loader number 01.

All individual cost items are assigned a cost code. For each individual cost item, the quantities, as well as the unit costs for the material, equipment, and installation / labour are estimated. The CAPEX is the sum of all individual cost items. Table 21.9 presents an example of the Cost Breakdown Structure.

Table 21.9 - Example of Individual Cost Item CBS

<table>
<tr><th rowspan="2">Sub-Project</th><th rowspan="2">Area</th><th rowspan="2">Disc.</th><th rowspan="2">Activity</th><th rowspan="2">Seq.#</th><th rowspan="2">Unit</th><th rowspan="2">Qty</th><th colspan="2">Material</th><th colspan="2">Equipment</th><th colspan="4">Installation/Labour</th><th rowspan="2">Total Cost</th></tr>
<tr><th>Unit Cost</th><th>Total Cost</th><th>Unit Cost</th><th>Total Cost</th><th>Unit</th><th>Qty</th><th>Unit Cost</th><th>Total Cost</th></tr>
<tr><td>10</td><td>110</td><td>5</td><td>005</td><td>01</td><td>1</td><td>Ea.</td><td></td><td></td><td>10000</td><td>10000</td><td>Man-hours</td><td>10</td><td>120</td><td>1200</td><td>11200</td></tr>
</table>

Sections 21.1.4.1 and 21.1.4.3 describe the different Sub-Projects, Areas, Disciplines, and Activities used for the Matamec Kipawa project feasibility study CAPEX.

21.1.4.1 Direct Costs

Sub-Projects

The Matamec Kipawa Project Direct Cost estimate is divided into four (4) different sub-projects representing different geographical locations where construction will be taking place during the pre-production period: Off-Site Installations, Inter-Site Services, Mine Site, and Hydromet Plant Site.

- Sub-Project 11 - Off-Site Installations (5 km radius of Temiscaming)

  The Off-Site Installations sub-project includes all cost items that are within a 5 km radius of Temiscaming. It includes a 120 kV main electrical sub-station and a parking lot at Temiscaming for workers traveling to and from the mine site.

- Sub-Project 14 - Inter-Site Services (65 km between Temiscaming & Hydromet Plant Site)

  The Inter-site Services sub-project includes all cost items that connect the Temiscaming installations to the Hydromet Plant Site (around 65 km). It includes the main electrical power line, communications, as well as the road work to connect the existing Maniwaki road to the Hydromet Plant Site.

- Sub-Project 10 - Mine Site (10 km from Hydromet Plant Site)

  The Mine Site sub-project includes all cost items related to the mine site which is located around 10 km north of the Hydromet Plant Site. It includes mining equipment, mine roads, mine dewatering, mine pre-production work, explosive storage, mine electrical distribution & lighting, mine communications, mine secondary sub-station, access road from mine site to hydromet plant site including bridge over the Kipawa river, mine maintenance shop, and mine site fuel storage.

- Sub-Project 18 - Hydromet Plant Site

  The Hydromet Plant Site sub-project includes all cost items related to the hydromet plant site, which include but are not limited all process, tailings, and water management related activities, site power distribution, auxiliary buildings (administration office, assay laboratory, warehouse, cold storage, gate house), services and infrastructure such as fresh water pump stations and pipeline, plant site fuel storage, support mobile equipment, effluent treatment, site drainage, etc.

Areas

Areas are presented in the CAPEX Sub-Project Table 21.2 to Table 21.6 and were created to break down the cost estimate into physical entities for buildings, processes, services, etc.

Disciplines

The disciplines are composed of earthwork, concrete, structural, architectural, mechanical, piping, electrical and instrumentation, and HVAC.

Activities / Equipment

Activities and/or equipment are assigned a number based on the Cost Coding Chart (Appendix 8.2).

21.1.4.2 Indirect Costs

Indirect costs are divided in four (4) areas: Construction indirects, Construction indirects contingency, Owner's costs, and Owner's costs contingency.

21.1.4.3 Cost Information

For each individual cost item, cost data was entered for three categories: material, equipment, and installation / labour. Descriptions of the three categories are found below.

<u>Material</u>

"Material" includes all construction materials (concrete, steel, piping, electrical cables, etc.) and non-tangible items (earthworks).

<u>Equipment</u>

"Equipment" includes mechanical and HVAC equipment only. Freight and spare parts are estimated separately in the indirect costs.

<u>Installation / Labour</u>

All cost related to the man-hours required to install or perform a task is categorized as installation / labour. The purpose is to separate the installation cost, especially the required man-hours, from the material and equipment in order to assess how many workers will be needed during the construction period. The cost of construction equipment (ex: crane) is estimated separately as an indirect cost. It is important to note that for some cost items, mostly for earthworks and concrete, the installation / labour is embedded in the material unit costs.

21.1.5 Basis of Estimate

The Matamec Kipawa project is a green field Rare Earth mining project located in Abitibi-Temiscaming, Québec, Canada. The purpose of the feasibility study is to serve as the basis for a final decision to finance the development of the deposit for mineral production.

21.1.5.1 Scope of the Estimate

<u>Scope Definition</u>

The scope of the CAPEX covers all of the project management, engineering, procurement, construction, commissioning, and start-up costs of the Matamec Kipawa Project's pre-production phase.

<u>Estimate Classification</u>

The estimate is classified as being feasibility study level, which is defined by the Association for the Advancement of Cost Engineering International (AACEI) as: ' [...] a comprehensive study of a mineral deposit in which all geological, operating, economic, social, environmental and other relevant factors are considered in sufficient detail that it could reasonably serve as the basis for a final decision by a financial institution to *finance the development of the deposit for mineral production.'* A feasibility study level cost estimate is the equivalent of the AACEI Class 3 cost estimate.

Estimate Presentation

The Feasibility Study CAPEX is presented in an Excel document in one spreadsheet. A second tab presents a summary by area. It provides cost information for all sub-projects, area, disciplines, and activities/equipment.

The main contributors to the capital cost estimate are Roche-Genivar who received quotations from major equipment manufacturers and most unit prices from local contractors. Golder Associates is responsible for the Tailings, Water treatment, and Environmental Cost sections of the estimate.

21.1.5.2 Design Basis - Reference Documents

The Feasibility Study Level CAPEX is based on the engineering documents included with the Feasibility Study Report prepared by Roche-Genivar, Golder and SGS. Engineering documents produced throughout the feasibility study were used as a design basis for the estimation process. The main reference documents include, but are not limited to:

- Design Criteria
- Equipment List
- Flowsheets, Mass & Water Balance
- Project Location & Site Layout
- General Arrangements
- Single Line Diagrams
- Sub-Station Layouts
- P&ID

21.1.5.3 Units of Measure

International System (SI) units are used throughout the estimate. In some cases, imperial units might be used (ex: pipe diameter) but are converted to metric.

21.1.5.4 Currency Base Date and Exchange Rates

The base date of the cost estimate is June 1st, 2013.

The estimate is expressed in Canadian Dollars.

For reference, the currency conversions rates used during the estimate preparation are as per instructions from Matamec:

- 1 CAD = 1.00 USD (U.S. Dollar);
- 1 CAD = 0.75 EUR (Euro);
- 1 CAD = 0.65 GBP (British Sterling Pound).

For all material and installation / labour, cost information came from local vendors and/or contractors and was expressed in Canadian Dollars (CAD). Equipment quotations received came from Canada, Europe, and USA. Table 21.10 presents an approximate distribution of the equipment quotations received by currency for the feasibility study.

Table 21.10 - Quotations Currency Repartition (% of Total Process Equipment Cost)

Currency	Quotations Received
CAD	58%
EUR	26%
USD	15%
GBP	1%

21.1.5.5 Direct Costs

Direct costs cover cost that is directly attributable to the cost item and/or activity. It covers equipment supply, material costs, and installation costs (labour, contractor's supervision and management costs, contractor's travelling & living allowances, contractors/suppliers administration and profits). Direct costs were estimated by each discipline: earthworks, concrete, steel structure, architecture, mechanical, piping, electrical and instrumentation, and HVAC.

Earthworks

Unit rates have been established according to quotations received from local contractors and from expert judgments based on previous similar projects. A return period of 1/10 years has been used for rainfall and drainage design.

Quantities have been calculated using the following methods:

- Manual and hand calculations;
- AutoCAD/Civil3D modelling;
- Mensura Genius 7.0 modelling;
- Epanet 2.0 modelling.

Assumptions

The following are the main key assumptions used for earthworks estimation:

- There is a layer of 200 mm of organic matter and a layer of 300 mm of second class materials followed by bedrock.
- Earthworks design based on topographic data from Google Earth and photogrammetry 1:15000. Photogrammetry was used for the following areas:
  - Plant site;
  - Garage site;
  - Access road between the plan and garage site;
  - Tailings road between the Maniwaki road and the Thickening pad;
  - Thickening pad.
- Road between the Hydromet Plant site and the Mine Maintenance Shop was designed for Western Star 6900XD trucks.

- Road between the Maniwaki road and the Hydromet Plant site was designed for regular cars and trucks;
- At the Témiscaming Parking site, it is assumed that existing municipal infrastructure (sanitary and potable lines) are in proximity of the parking facilities. No rock drilling and excavation has been estimated for the parking site;
- Organic matter resulting from the construction of the garage site and road section between the bridge and the garage will be disposed at organic matter dump at the mine site;
- At the mine maintenance shop (garage) building, maintenance and cleaning of equipment will be made without the use of soap. Water will be sent to an oil separator and will be discharge into the drainage ditch. Water in the drainage ditch will flow to the treatment pond;
- Discharge water from the oil separators of the electrical transformers will be sent to the drainage ditch with an oil content of less than 15 ppm;
- Surface water of the plant site and the garage site will be managed and will flow to the treatment ponds;
- The existing road portion to the mine site pumping station will be rehabilitated with a layer of 300 mm of MG-20b. A provision has been estimated for additional tree clearing for the new power line;
- Earthworks estimates and units price are based on location and quantities from the report prepared by Poly-Geo February 2013. The following borrow pits will be open and used for civil constructions: D-05, D-08, D-14, and D-16.

References

The following are the main reference documents use to perform the estimate:

- Note techniques : Recherche de matériaux d'emprunt (till, sable et gravier) pour le projet minier Kipawa (Matemec explorations Inc.), Témiscaming. February 2013, Poly-Geo;[76]
- Google Earth;
- Photogrammetry 1:15000 date realized by Genivar;
- Preliminary logs realized at the plant site and garage site by Golder (2012-2013). 77

Exclusions

The estimate does not include the following items:

- Mine site potable water treatment (water bottles will be used).

21.1.5.6 Concrete and Structure

For each area of the estimate, the concrete cost comes from recent quotations from local suppliers. The cost for reinforced steel comes from recent similar mining project database and cost for forms comes from several local contractors.

[76] "Recherche de matériaux d'emprunt (till, sable, gravier) pour le projet minier Kipawa (Matamec Explorations Inc.), Témiscamingue", Poly-Geo report, February 2013

[77] Preliminary logs realized at the plant site and mine maintenance shop, Golder, 2012-2013

Assumptions

- The concrete strength used in the estimate is 30 MPa;
- Cost for steel comes from previous similar projects;
- The ground capacity used for the estimate is 150 kPa;
- A mobile crane suited for the project's construction needs will be permanently available on site during construction.

Methodology

- Area 210 - Main Sub-Station (Témiscaming 120 kV):

  Include concrete bases, containment basins, oil separator, pre-fabricated building and foundations. Quantities were estimated based on similar projects except for the foundations of the pre-fabricated building which were calculated based on the project's specifics.

- Area 220- Power Lines (between Sub-Station 120 kV and Plant Site):

  Include concrete bases, containment basins, oil separator, cable bridge and pre-fabricated building and foundations. Quantities were estimated based on similar projects except for the foundations of the pre-fabricated building which were calculated based on the project's specifics.

- Area 330 - Mine Maintenance Shop (Garage)

  The mine maintenance shop building was modeled and analyzed with the ADA software. Steel Structure quantities come from the model. The transformer base and the containment basin quantities come from previous similar projects.

- Area 334 and 336 - Mine Site and Plant Site Fuel Storage

  Include concrete bases and containment basins based on the quantities and size of reservoirs to be installed.

- Area 340 - Administration & Service Building

  Cost for pre-fabricated administration & service building comes from a supplier's quotation. Foundations were calculated based on the quotations specifications.

- Area 342, 344 and 350 - Plant Site Warehouse, Assay Laboratory and Reagent Storage

  Cost for each building comes from quotations for 'Fold Away' type pre-fabricated buildings. Foundations were calculated based on the buildings specifications.

- Area 510 - Crushing

  The building was modeled and analyzed using the ADA software. Required steel quantities come from the model. Regarding foundations, they were calculated using the results of ADA software.

- Area 515 - Ore Storage

  The concrete bases for the storage silo were calculated based on the silo's specifications.

- Area 540 - Main Building Process Plant

The main process plant building was modeled and analyzed using ADA Software. Steel quantities were provided by the software. Foundations were calculated based on the results coming from the ADA Software.

Architecture

All building are "fold-away" type when possible in order to minimize installation time and cost.

Mechanical - Equipment Procurement

Based on the engineering documents produced for the Feasibility Study, an equipment list was created for all mechanical and HVAC equipment. Similar types of equipment were regrouped in lots and datasheets were prepared in order to request for quotations from equipment suppliers. A Work Packages List (Appendix 8.3, document # 1-00-G1R1-MLST-00-015) was created to follow up with the reception of quotations. All quotations received were budgetary. Bid analyses were performed for all major equipment quotations received in order to determine, based on Roche-Genivar's experience, which suppliers had the best mix of technical and commercial offer. For minor equipment, historical data from previous similar projects and factorization of equipment size were used in order to complete the estimate. The approximate breakdown of sourcing for the equipment procurement is estimated as follows:

Table 21.11 - Breakdown of Equipment Costs

Source	Percentage
Firm Quotations	0 %
Budget Quotations	±95 %
Historical Data	±4 %
Allowances	±1 %

The freight estimate is included in the Indirect Cost (Section 21.1.5.7).

Piping

Starting from the general arrangements issued for the feasibility study and a P&ID prepared for cost estimate purposes, each pipe line was sized and attributed a length from origin to destination going through the structure's main lines for support accessibility. The overall length for each type of pipe and each diameter was determined. All valves, fittings, drains and any other accessories were taken from the P&IDs. Unit prices obtained from quotations, vendor proposals, or past projects were used to estimate the total cost.

From this total, a 25% allocation was added to overcome any underestimated piping lengths due to relocations during detailed engineering in case of conflicts with other equipment, secondary piping not shown in P&ID (drains, vents, etc.), small compressed air and instrumentation air lines, and material losses due to installation.

Electrical and Instrumentation

Budget quotations were obtained for major electrical distribution material. Unit prices for sections of MCCs and switchgears were established based on similar projects and used for cost estimates as per electrical distribution design. Cables sizing and lengths were estimated based on the feasibility study General Arrangements and were integrated to the load list to allow good estimate accuracy. Man-hours for installation of the equipment, services, grounding, cable trays, and cables were based on an estimation book edited by the Guild of master electricians of Quebec (Antoine Poggi, 2006)[78].

For the automation and instrumentation, estimates were based on a pre-design of the automation network and a P&ID prepared for cost estimate purposes. PLC cabinets, cables, and instruments costs are based on vendor quotations. For control, instrumentation, and communications, cable lengths were roughly estimated based on the feasibility study General Arrangements.

HVAC - Services

The methodology for estimating the electro-mechanical for the building (ventilation, plumbing, compressed air, outlets and electrical services) was the same for all buildings.

Major equipment cost was obtained by getting quotations from suppliers. Smaller equipment cost information was based on previous similar projects.

Construction Labour Rates

The labour rates for estimates greatly depend on what is included and is often subject to debate. The all-in rates for the Matamec Kipawa project are based on quotations from two (2) local contractors having experienced mining construction projects in the area. The contractor's quotations were validated by consulting the Quebec Construction Association (ACQ) hourly rates publication for January 2013 as well as by consulting previous similar projects. The chosen all-in rates for the feasibility study CAPEX are presented in Table 21.12.

The rates are divided in two, Iron Workers rate and General rate. The general rate is an average of all trades except for the iron workers.

Table 21.12 - All-In Labour Rates

Trades	All-In Rates 60 hr/wk ($/hour)
General (All other trades)	**122.00**
Iron Workers (Structural Steel)	**130.00**

Work Week

A 60 hour per week schedule, corresponding to 6 days a week at 10 hours per day (Monday to Saturday), is used for the estimate. This involves 40 hours per week at regular rate, and 20 hours per week double time as per Québec Construction Collective agreement for 2013.

Transportation of workers to and from the Temiscaming parking lot and the Construction Site (Hydromet Plant Site) will be provided by Matamec. As per the Quebec Construction Collective agreement for 2013 (Article 23.01, 23.02, 23.04 and 23.05) it is assumed that time spent during transportation, which is estimated at two (2) hours

[78] Guild of master electricians of Quebec (Antoine Poggi, 2006)

per day, will not be paid since the transport is offered free of charge and arranged by Matamec, and that the construction site location is the Hydromet Plant Site.

Man-Hours and Productivity

No productivity factor was included in the All-In labour rates. The productivity factor is estimated in the number of man-hours.

No productivity factor has been applied to take into account the local conditions for construction work in Abitibi-Temiscaming.

No separate productivity factor was used for outside winter work. For this estimate, it is assumed that minimal work will take place outside during the worst winter months. Winter work usually results in a lower productivity in the range of 75%.

Contractor Expenses at Site

At the Feasibility Study stage, the inclusions and exclusions of the all-in rates for contractor expenses at site are as listed below:

Items included in the All-In Labour Rates:

- Mobilization and demobilization of Contractor's personnel;
- Room and Board, living allowances and transportation cost for all personnel;
- Transportation to and from Temiscaming;
- Safety clothing and safety supplies;
- Contractor's indirect personnel (Foreman, General Foreman & Superintendent);
- Contractor's site supervision personnel;
- Contractor's head office overhead, expenses, insurance;
- Contractor's profits;
- Consumables including welding rods, sealant, adhesives and lubricants;
- Contractor's temporary facilities.

Items excluded from the All-In Labour Rates:

- Transportation between Temiscaming and Construction Site (Hydromet Plant).
- Daily pre-start safety meetings;
- Weekly tool box meetings;
- Safety induction sessions;
- Special safety trainings;
- Other time consuming activities other than real installation hours.

Excluded items are estimated separately in the number of man-hours.

Common Construction Equipment

The inclusions and exclusions of the all-in rates for common construction equipment are listed below:

Items included in the All-In Labour Rates:

- Construction's vehicles;
- Small tools and consumables;

Items excluded from the All-In Labour Rates:

- Mobilization and demobilization of crane equipment to site;
- Office trailers and lunch rooms;
- All sizes crane rental.
- Project management of complex and/or facilities;
- Construction's sanitary facilities;
- Construction's guard house and security personnel;
- First Aid Station.

These items are covered in the indirect costs.

Unit Prices

The unit prices for concrete and steel are commonly the most important cost related for infrastructure work. These unit prices can largely vary depending on the project's location and overall construction activities in the region.

21.1.5.7 Indirect Costs

Indirect Costs covers costs that are required for completion of the installation but are not directly attributable to the cost item / activity. For the Matamec Kipawa project's feasibility study, it is divided into Construction Indirects and Owner's costs. Contingencies are also included in the indirect costs.

Construction Indirects

The Construction Indirects are based on a pre-production of around 24 months for performing the detailed engineering, procurement, construction, start-up, and commissioning phases.

- Engineering & Technical Assistance

  Engineering & Technical Assistance includes detailed engineering, procurement, vendor representative assistance, quality assurance/quality control consultants (QA/QC), and other various consultation fees. The engineering & technical assistance estimate was based on experience with similar mining projects estimates and corresponds to around 8.0% of Direct Costs.

- Consultation for Studies

  Since the Feasibility Study and Environmental Impact Study are both completed and are therefore considered as sunk costs, no cost for consultation studies is included in the CAPEX.

- Construction Management

Construction Management includes the salaries for project construction personnel, site supervision consultants' fees, health & safety coordinators / consultants, health & safety supplies, traveling & lodging for project construction personnel, vehicle rentals, surveying support, and surveying equipment. Each cost item was estimated based on previous experiences. The costs were estimated on a monthly basis or as a lot when estimated for the entire construction period. These costs correspond to roughly 3.5% of Direct Costs.

- Contractor Mobilization/Demobilization

Contractor personnel mobilization and demobilization costs are included in the all-in labour rates and are computed in the Direct Cost section of the estimate under Installation / labour. Equipment mobilization and demobilization is included with the "Site Construction Equipment" below.

- Temporary Services & Facilities

Temporary Services & Facilities includes all facilities and services required during the construction period only. This includes temporary facilities, construction office, first aid & equipment, trailers for short term contractors, heat, electricity, security services & supplies, and containers.

Estimate for trailers, offices, and other temporary buildings come from a quotation from a supplier of temporary camps.

Estimate for security services & suppliers came from a quotation from a security services provider.

Estimate for heat and electricity came from the estimated heat required for the area (m2) of temporary buildings.

Generator sets requirement for temporary electricity generation and manpower required for the logistics was also estimated based on experience.

- Office Operation Expenses (During Construction)

The operating cost for the construction period is split into construction site office supplies & expenses, communication, electrical consumption (assumed to be from gensets only during construction), gasoline/fuel/oil consumption, janitorial services, trash removal, snow removal and access road maintenance, sewage disposal, computers, hardware & software, and office furniture. The cost for these items was based on the construction schedule planning and from past experiences.

- Site Construction Equipment

The site construction equipment typically includes small tools and specialized equipment for the construction site, such as cranes, forklifts, etc. For the feasibility study, the small tools cost is included in the all-in labour rates and is part of the Direct Costs. Specialized equipment was estimated based on rental or purchasing prices for lifting equipment and were estimated based on a 24 months construction period including mobilization and demobilization.

- Maintenance

Maintenance costs for the construction period includes the site general maintenance for offices and trailers, and the vehicle & mobile equipment maintenance. Maintenance estimation was based on material required to perform the maintenance and labour man-hours.

- Freight

  Freight consists of inland transportation and export packing, all forwarder costs, ocean freight, air freight, insurance, receiving port custom agent fees, and local inland freight to the project site. Duties are not included.

  Since freight cost is fairly volatile and is difficult to get accurate cost from budgetary quotations, a factor based on 4.2% of direct equipment purchase was used. This takes into account that most equipment are coming from North-America although some will come from Europe. Some of the equipment budgetary quotations included an approximate freight allocation, which was used to benchmark the factored freight cost estimation.

- Mill First Load

  The mill first load includes the cost of the first fill of reagents' reservoirs, grinding media, lubricants, etc. The cost is estimated based on the operating consumables and reagents. In this case, 1 month's supply was used to allow for the beginning of the mill's operation after which, the operating costs will cover for the production life.

- Capitalized Spare Parts

  Spare Parts required for the beginning of the operations are estimated by factorizing 2.4% of the direct equipment purchase costs.

- Start-Up

  The Start-Up cost includes the processing equipment cold commissioning, as well as cost for external contractor assistance at start-up.

Owner's Cost

- Pre-Production Activities - Owner's Cost

  During the pre-production period, the owner's construction team is involved in all aspects of the project. Items like insurance, permits and certifications, performance bonds, taxes & duties, land acquisition, pre-production salaries and benefits, training expenses, consultants, security, human resources, public relations, environmental follow-up, health & safety operations, etc. are all under the owner's direct responsibility. This involves a team and considerable cost associated with it. Owner's costs are estimated at $14.4M.

- Security

  Security at the Temiscaming parking lot is estimated at $240 K for the pre-production period.

- Head Office Support

  Support from the Head Office during the pre-production period is difficult to estimate. An allocation of $50,000 per month during an estimated period of 24 months was used to account for legal, accounting, engineering, and other related cost that will be charged under the Matamec Kipawa project by the Matamec Head Office.

Construction Indirects & Owner's Costs - Contingency (15%)

Contingency is an amount of money allowed in an estimate for costs which, based on past experience, are likely to be encountered, but are difficult or impossible to identify at the time the estimate is prepared. It is an amount which is expected to be expended during the course of the project. Contingency does not include scope changes, force majeure, labour strikes/wobbles, or labour availability.

A contingency of 15% has been applied to the Direct, Construction Indirect, and Owner's Costs. The determination of the 15% contingency was based on typical feasibility study level estimate.

21.1.5.8 Escalation

No escalation is included in the CAPEX.

21.1.5.9 Allowances

In order to complete the estimation process, allowances were used to estimate equipment or activities that were difficult to quantify and/or judged so insignificant that an error in the cost figures would not impact the total estimate in a significant way. Equipment such as bin and small fans were then attributed an allowance based on previous project's experience.

21.1.5.10 Assumptions and Qualifications

The following items are assumptions and qualifications concerning the capital cost estimate:

- There will be no major delays in the project such as those associated to environmental permitting;
- There is sufficient accommodation available in the Témiscamingue area for the manual and non-manual workers as the cost of a camp is NOT included in the estimate;
- It will be possible to insure safety without incurring significant loss of efficiency;
- Matamec will supply means of transportation between the town of Temiscaming and the construction site free of charge to the workers;
- It is assumed that the construction workers will travel one hour to, and one hour from the plant site free of charge every working day (6 days per week);
- Pre-production work will take place over a period of 24 months;
- The final product is a Total Rare Earth Elements Mix, Ex-Works (EXW).

21.1.5.11 Exclusions

The following items are not included in the capital cost estimate:

Feasibility Study

All costs incurred between the end of the Feasibility Study and the beginning of the detailed engineering phase were excluded from the Feasibility Study estimation scope and is therefore excluded from the CAPEX.

Labour

- Allowance for industrial dispute or lost time arising from industrial actions;
- Allowance for special incentives (schedule, safety, or others) was made.

Environmental and Community Relations

- Asbestos, lead paint, and any other hazardous material removal;
- Cost for removal of sheet metal with lead paint;
- Allowance for future designation of hazardous classification areas;
- Provisions for the cost of remedial actions with respect to contaminated soil, lead contaminants, and archaeological historical findings;
- Environmental studies, permitting, and mitigation beyond the tabling of the Environmental and Social Impact Assessment (ESIA);
- Costs for community relations and services;
- Plant closure and rehabilitation costs (excluded from initial CAPEX, included in Sustaining Capital Expenditure).

Legal Costs and Taxes

- Legal costs; (Head office charges)
- Force Majeure issues;
- License and Royalty fees;
- All Owner payable taxes;
- Permits / cost of permits.

Financing Costs

- Owners cost prior to project approval;
- Any requirements related to project financing;
- Financing Fees;
- Working capital;
- Sustaining or deferred capital costs (included in Economic Analysis);
- Cost changes due to currency fluctuation;
- Sunk cost;
- Resettlement / relocation costs;
- Project interest and financing cost during construction;
- Other Owner's costs not described above and not included in the CAPEX indirect costs.

Operating and Maintenance Costs

- Operating and Maintenance Costs are provided separately in the Operating Cost Estimate (OPEX);
- Any operational insurance such as business interruption insurance and machinery breakdown.

21.1.6 Accuracy Assessment

The purpose of this Feasibility Study phase is to prepare a capital cost estimate with an accuracy of ±15%. In order to obtain this level of accuracy, the following has been done:

- Obtain most equipment procurement cost based on suppliers' quotations;
- Obtain detailed all-in construction labour rates from local contractors experienced with mining projects in the region to reflect the most recent practices in Abitibi-Témiscaming;
- Validate the all-in construction labour rate quotations with Québec's Construction Collective Agreement (2010-2013) guidelines;
- Perform detailed calculations of quantities to reflect the latest engineering documents issued;
- Confirm unit prices based on collecting information from various sources including local contractors.

21.2 Operating Cost Estimate

The operating cost estimates for specific areas were estimated by the responsible consultants, compiled by Roche, and reviewed by Roche and Matamec.

The overall yearly operating cost for the Matamec Kipawa project feasibility study is estimated at $78.6M per year or $58.9 per tonne milled. A summary of the operating costs for the project is shown in Table 21.13. A summary is presented in Appendix 9.1.

Table 21.13 - Operating Cost Summary (OPEX)

Activity	Annual Cost ($/y)	Cost per tonne moved[79] ($/t)	Cost per tonne milled ($/t)	Cost per kg of TREO ($/kg)
GENERAL & ADMINISTRATION	**11,606,417**	**4.54**	**8.71**	**3.18**
MANPOWER - Administration	3,708,401	1.45	2.78	1.02
CONTRACTS	2,190,800	0.86	1.64	0.60
GENERAL	4,957,936	1.94	3.72	1.36
MARKETING	350,000	0.14	0.26	0.10
MUNICIPAL TAXES	399,280	0.16	0.30	0.11
MINING	**18,140,457**	**7.03**	**13.62**	**4.97**
MINING ORE ($/t of ore)	*10,801,078*	*8.04*	*8.11*	*2.96*
Manpower - Mining - Ore	6,745,753	5.02	5.06	1.85
Equipment & Consumables - Ore	4,055,326	3.02	3.04	1.11
MINING WASTE ($/t of waste)	*7,339,379*	*5.93*	*5.51*	*2.01*
Manpower - Mining - Waste	4,598,447	3.72	3.45	1.26
Equipment & Consumables - Waste	2,740,931	2.22	2.06	0.75
PROCESS	**48,725,000**	**19.04**	**36.57**	**13.35**
MANPOWER - Process	8,541,000	3.34	6.41	2.34
ENERGY	5,397,966	2.11	4.05	1.48
FRESH WATER	20,102	0.01	0.02	0.01
REAGENTS	22,343,520	8.73	16.77	6.12
CONSUMMABLES	6,982,786	2.73	5.24	1.91
OTHER PROCESSING	674,000	0.26	0.51	0.18
TAILINGS	4,765,000	1.86	3.58	1.31
Total OPEX Cost	**78,471,248**	**30.60**	**58.90**	**21.50**

[79] Cost per tonne mined presented in Cost per tonne of Ore mined and Cost per tonne of Waste mined for mining costs.

21.2.1 Scope and Methodology

21.2.1.1 Scope

The Operating Cost Estimate (OPEX) scope covers all costs related to the operation of the Matamec Kipawa project and includes mining, ore processing (beneficiation and hydrometallurgy), tailings management, on site water management, general and administration fees as well as infrastructure and services. The scope covers the Matamec Kipawa project yearly operation for a typical production year.

The quantities used for operating cost come from various disciplines involved in the project and result from the engineering work done throughout the feasibility study.

21.2.1.2 Methodology

The methodology used to estimate the operating cost consisted of using data from existing similar mining operations and quotations received from local contractors, as well as consultation of reference publications. Matamec's team, Roche, and Others' experience with estimating operating costs for mining projects also contributed to estimating parts of the operating costs when detailed information was limited.

21.2.2 Cost Breakdown Structure

The OPEX Cost Breakdown Structure for the feasibility study is divided in three (3) main categories: Mining, Process, and General and Administration (G&A).

21.2.2.1 Fixed and Variable Operating Costs

In order to evaluate the impact of a potential reduction of production rate on the operating cost, costs items were divided into fixed and variable operating costs.

Fixed operating costs do not vary with production rate, while variable operating costs are dependent on the production rate.

For the purpose of the feasibility study, fixed costs cover G&A operating costs and manpower costs, variable costs cover mining equipment operating cost and consumables, as well as processing and other consumables for the operation.

Lower production rates generally occur during production ramp-up at the beginning of production and at the end of the mine life as the ore supply is depleted.

Fixed and variable costs are shown in the OPEX estimate summary (Appendix 9.1). Variable operating costs are calculated on an annual basis based on tonnage moved and/or milled and are presented in the Detailed Financial Analysis (Appendix 10.1).

A detailed description of the OPEX cost breakdown structure and details for each category are presented below.

21.2.2.2 Manpower Operating Costs

A total of 229 employees are required for the Matamec Kipawa Project. This is considering a plant running 24 hours a day, 7 days a week, 52 weeks per year.

The working schedule for most yearly compensated employees will be a standard 40 hours per week, 8 hours per day, 5 days per week, Monday to Friday. Some yearly compensated employees will be working 12-hour shifts, equivalent to 84 hours per week, as part of a two-week repeating schedule; the first week working 4 days followed by 3 days off, the second week working 3 days followed by 4 days off.

The hourly workers will be working 12-hour shifts as part of the same two-week repeating schedule. Most activities require 24 hour per day operation, which is split in 4 shifts. Ore hauling between the ore rehandling stockpile and the crusher, as well as crusher operation, require 12-hour per day operation which is split in 2 shifts.

A summary of the total estimated annual manpower is presented in Table 21.14. Manpower salaries have been estimated based on existing mining operations in the Abitibi-Temiscaming area and benchmarked with the Canadian Mine Salaries, Wages and Benefits 2012 Survey results[80].

The Matamec Kipawa project manpower work group has been divided into three (3) sub-groups: Mine employees, Process Facilities employees, and Administration staff.

Table 21.14 - Manpower Costs Summary

Activity	Number of Employees	Annual Cost ($/y)	Cost per tonne milled ($/t)
Mine	109	11,344,200	8.52
Processing Facilities	89	8,541,000	6.41
Administration	31	3,708,400	2.78
Total Manpower	**229**	**23,593,600**	**17.71**

Mine Manpower Operating Costs

The mining operation and supervision group (84 employees) will be composed of a mine and maintenance superintendent, a senior general foreman, production supervisors, drill and blast supervisors, a project supervisor, a clerk, a senior geologist, a grade control and data processing technician, a mine geologist, a technical services superintendent, a senior engineer, a mine engineer, a mine technician, a chief surveyor, a production surveyor, operation labour, and equipment operators. The mine maintenance group (25 employees) is composed of an engineer planner, a maintenance foreman, mechanics, welders, electricians, electro-technicians, and equipment operators. Mine Manpower Cost is detailed in Table 21.15.

Table 21.15 - Mine Manpower Costs

Mine Employees	Annual Salary	Qty	Total Annual Cost ($/y)
Mine Operation			
STAFF:			
Mine&Maintenance Super.	175,200	1	175,200
Senior General Foreman	146,000	1	146,000
Mine Supervisor - Production	124,100	4	496,400
Mine Supervisor - Drill & Blast	124,100	2	248,200
Mine Supervisor - Project	124,100	1	124,100
Clerk	73,000	1	73,000

[80] Canadian Mine Salaries, Wages & Benefits, 2012 Survey Results, compiled by Krista Noyes Salzer, Infomine USA, Inc.

Mine Employees	Annual Salary	Qty	Total Annual Cost ($/y)
HOURLY:			
Excavator Operator - Rehandling	116,800	2	233,600
Production Loader Operator	116,800	4	467,200
Dozer Operator	94,900	6	569,400
Grader Operator	116,800	6	700,800
Mining Truck Driver	94,900	12	1,138,800
Ore Transport Truck Driver	94,900	16	1,518,400
Mine Helper - General	80,300	8	642,400
Mine Helper - Drill Doctor	80,300	2	160,600
Production Drill operator	109,500	4	438,000
Blaster Leadman	102,200	2	204,400
Blast Helper	87,600	2	175,200
TOTAL MINE OPERATION		***74***	***7,511,700***
Mine Maintenance			
STAFF:			
Engineer Planner	116,800	1	116,800
Foreman	124,100	2	248,200
HOURLY:			
Mechanic	94,900	6	569,400
Welders	102,200	4	408,800
Electrician	102,200	2	204,400
Mechanic (Trouble shooter)	109,500	4	438,000
Electro-Technician	102,200	2	204,400
Lube & Fuel Operator	94,900	4	379,600
TOTAL MINE MAINTENANCE		***25***	***2,569,600***
Geology			
STAFF:			
Senior Geologist	167,900	1	167,900
Grade Control & Data Process. Tech.	109,500	1	109,500
Mine Geologists	131,400	1	131,400
TOTAL GEOLOGY		***3***	***408,800***
Engineering (Mine)			
STAFF			
Technical Services Superintendent	175,200	1	175,200
Senior Engineer	153,300	1	153,300
Mining Engineer	131,400	1	131,400
Mine Technician	94,900	2	189,800
Surveyor - Production	94,900	1	94,900
Chief Surveyor	109,500	1	109,500
TOTAL ENGINEERING (Mine)		***7***	***854,100***
Total Mine		**109**	**11,344,200**

Processing Facilities Manpower Operating Costs

The processing facilities operation and supervision group (53 employees) is composed of a mill superintendent, metallurgists, metallurgical technicians (wet lab), a foreman, a chief chemist, lab technicians (assay lab), health and safety technicians, a mill trainer, a clerk, shift supervisors, process equipment operators, and labour. The tailings operation group (10 employees) is composed of hydromet tailings operation labour and dry tailings haul truck operators. The mill maintenance group (26 employees) is composed of mechanical and electrical foremen, planners, mechanical and electrical leaders, mechanics, electricians, instrument technicians, and helpers. Processing Facilities Manpower is detailed in Table 21.16.

Table 21.16 - Processing Facilities Manpower Costs

Process Facilities Employees	Annual Salary	Qty	Total Annual Cost ($/y)
SUPERVISION STAFF:			
Mill Superintendent	175,200	1	175,200
Senior Metallurgist	131,400	1	131,400
Metallurgist	109,500	1	109,500
Metallurgical tech. (Wet Lab)	73,000	3	219,000
General Op./Maint. Foreman	131,400	1	131,400
Chief chemist	116,800	1	116,800
Lab technicians (Assay Lab)	94,900	6	569,400
Health and Safety technician	94,900	2	189,800
Mill trainer	124,100	1	124,100
Clerk	73,000	1	73,000
OPERATION HOURLY:			
Crushing	94,900	4	379,600
Grinding and magnetic separation	94,900	4	379,600
Leach and neutralization	94,900	4	379,600
Purification (Ix, Reagent X HCL)	94,900	4	379,600
Concentrate filtration	94,900	4	379,600
Tailings/reagents	94,900	4	379,600
Shift supervisor	124,100	4	496,400
Helpers	80,300	4	321,200
Labour	73,000	3	219,000
TAILINGS (Hydromet Operation & Dry Hauling):			
Haul Truck Driver	94,900	4	379,600
Tailings Operation Labor	80,300	6	481,800
MAINTENANCE STAFF:			
Mill Mechanical foreman	124,100	1	124,100
Mill Maintenance planner	102,200	2	204,400
Electrical foreman	124,100	1	124,100
MAINTENANCE HOURLY:			
Mechanical leader (mill, surface)	94,900	2	189,800
Electrical leader (mill, surface)	94,900	2	189,800
Mechanics	94,900	8	759,200

Process Facilities Employees	Annual Salary	Qty	Total Annual Cost ($/y)
Electricians	102,200	4	408,800
Instrument Technician	102,200	2	204,400
Helpers	80,300	4	321,200
Total Process		***89***	***8,541,000***

Administration Staff Operating Costs

The Administration group (31 employees) is composed of mainly yearly salaried employees and includes staff for the following functions: general management, accounting, human resources, public relations, health and safety, training, IT services, environment, procurement, warehouse management, as well as assistants, a clerk, and a crew for general surface and logistic operations. These employees will be working a normal work schedule of day shifts. The administration staff's operating cost details are presented in Table 21.17.

Table 21.17 - Administration Staff Costs

Administration (Staff)	Annual Salary ($/y)	Qty	Total Annual Cost ($/y)
General Manager	233,600	1	233,600
Administrative Superintendent	175,200	1	175,200
Executive Assistant	160,600	1	160,600
Accountant	124,100	1	124,100
Clerk	80,300	1	80,300
Administrative Assistant	80,300	2	160,600
Human Resources Officer	131,400	2	262,800
Regional Public Relation Coordinator	131,401	1	131,400
Regional Public Relation Assistant	102,200	1	102,200
First Aid Attendant	109,500	2	219,000
Training Coordinator	124,100	1	124,100
IT Technologist	109,500	2	219,000
Health and Safety Coordinator	138,700	2	277,400
Senior Environmental Engineer	153,300	1	153,300
Environmental Monitor	102,200	2	204,400
Purchasing Officer	138,700	2	277,400
Warehouse Supervisor	146,000	2	292,000
Warehouse Deputy	80,300	2	160,600
Surface crew operator and logistic	87,600	4	350,400
Total Administration		**31**	**3,708,400**

21.2.2.3 Mining Operating Costs

The mining equipment will be owned, operated, and maintained by Matamec. Explosives will be delivered on site and, in the case of bulk explosives, delivered in the hole under the supervision of Matamec blasting staff by a third party on a contract basis. Mine operating costs cover all costs applicable to the operation of the mine facility. The scope of the mine operating costs includes drilling, blasting, loading, hauling, auxiliary, service support, maintenance, and mine and maintenance staff. Annual mine operating cost is estimated at $18.1M per year or $8.04 per tonne mined for ore, $5.93 per tonne of waste, and $7.03 per tonne mined of ore and waste combined. Table 26.6 details the costs associated with each activity for ore and waste combined.

Table 21.18 - Mining Operating Costs

Ore & Waste Mining Operation Activities	Operating & Maintenance Annual Cost ($/y)	Cost per tonne ($/t mined)
Drilling	1,513,546	0.59
Blasting	1,772,285	0.69
Loading	1,249,491	0.48
Hauling	4,853,064	1.88
Auxiliary	2,368,268	0.92
Service Support	1,072,769	0.42
Maintenance	2,420,233	0.94
Mine & Maintenance Staff	2,890,800	1.12
Total Mining - Ore + Waste	**18,140,457**	**7.03**

Table 21.19 and Table 21.20 detail the costs associated with each activity for ore and waste separately. Each cost category is further detailed and contains equipment operating costs, including consumables and maintenance supplies, as well as labour required (manpower) for each task including maintenance tasks. Ore and waste costs have been separated to demonstrate the difference between the costs of mining ore and waste due to re-handling activities.

Table 21.19 - Ore Mining Operating Costs[81]

Ore Mining Operation Activities	Operating & Maint. Annual Cost ($/y)	Manpower Annual Cost ($/y)	Sub-total Ore Annual Cost ($/y)	Cost per tonne ($/t ore)
Drilling	476,326	311,634	787,961	0.59
Blasting	725,040	197,622	922,662	0.69
Loading	370,583	476,827	847,410	0.63
Hauling	1,553,286	2,111,266	3,664,551	2.73
Auxiliary	571,660	661,273	1,232,934	0.92
Service Support	246,171	334,437	580,608	0.43
Maintenance	112,260	1,147,727	1,259,987	0.94
Mine & Maintenance Staff	0	1,504,967	1,504,967	1.12
Total Mining - Ore	**4,055,326**	**6,745,753**	**10,801,080**	**8.04**

[81] All values have been rounded to the nearest dollar or cent.

Table 21.20 - Waste Mining Operating Cost [81]

Waste Mining Operation Activities	Operating & Maint. Annual Cost ($/y)	Manpower Annual Cost ($/y)	Sub-total Waste Annual Cost ($/y)	Cost per tonne ($/t waste)
Drilling	438,620	286,966	725,586	0.59
Blasting	667,646	181,978	849,624	0.69
Loading	178,108	223,973	402,081	0.32
Hauling	642,579	545,934	1,188,513	0.96
Auxiliary	526,408	608,927	1,135,335	0.92
Service Support	184,198	307,963	492,161	0.40
Maintenance	103,373	1,056,873	1,160,246	0.94
Mine & Maintenance Staff	0	1,385,833	1,385,833	1.12
Total Mining - Waste	**2,740,931**	**4,598,447**	**7,339,379**	**5.93**

21.2.2.4 Processing Operating Costs

The processing operating costs include all costs applicable to the operation of the processing facilities and tailings management facilities. Processing operating cost's scope includes all processing activities from the crushing of ore to the TREO Mix product ready for shipment Ex-Works (EXW) hydromet plant site. It is comprised of the processing manpower, energy, fresh water, reagents, consumables, tailings disposal, and water treatment, as well as other processing costs. Yearly processing operating cost is estimated at $48.7M per year or $36.57 per tonne milled. A summary of the total estimated annual Process operating cost is presented in Table 21.21.

Table 21.21 - Process Operating Cost Summary[81]

Process Operation	Annual Cost ($/y)	Cost per tonne milled ($/t)	Cost per kg of TREO ($/kg)
MANPOWER - Process	8,541,000	6.41	2.34
ENERGY	5,397,966	4.05	1.48
FRESH WATER	20,102	0.02	0.01
REAGENTS	22,343,520	16.77	6.12
CONSUMMABLES	6,982,786	5.24	1.91
OTHER PROCESSING	674,000	0.51	0.18
TAILINGS	4,765,000	3.58	1.31
Total Process OPEX Cost	**48,725,000**	**36.57**	**13.35**

Energy Costs

Matamec Kipawa operations will be powered by the following three (3) sources of energy: electricity, diesel fuel, and gasoline. Most fixed equipment will be powered by electricity. Generators and most mobile equipment will be powered by diesel fuel. Gasoline will be kept for small pick-up trucks, small generators, and hand tools. The consumption of each energy source and the basis for operational cost evaluation is described below. Details are shown in Table 21.22.

Table 21.22 - Energy Cost Summary[81]

Energy Cost Items	Annual Cost ($/y)
Electrical Power	4,719,357
Diesel fuel	631,778
Gasoline	46,830
Total Energy Costs	**5,397,966**

Electricity Consumption

For practical reasons, the entire site electrical power consumption is based on the process plant load that represents typically 95% of the energy consumption. The electricity consumption is based on the connected and running power (kW) for the entire site. The total electrical power requirement is based on the equipment load list, which is derived from the mechanical equipment list.

Based on electrical load list, Matamec Kipawa Project's estimated electrical power consumption is 9,400 kW; which is above 5,000 kW that qualifies for Hydro-Québec's "Tarif L" program.

As of April 2013, the "Tarif L" program states that Hydro-Québec (HQ) charges $12.36 per subscribed kilowatt agreed with HQ per month and 3.04¢/kWh consumed.

To calculate the cost of demand load in relation to the $12.36 per subscribed kW agreed with HQ per month, the best estimate is to use the connected power (kW) multiplied by the mechanical load factor. This is due to the fact that HQ defines "subscribed kilowatts" as the peak load taken by the plant during the monthly billing period (even if this is for 1 hour of 1 day per month) rather than the average required power. If there are exceeded powers above the subscribed kilowatt during the reference monthly period, the prime to pay to H-Q is 21.69$ per kW. Therefore, for billing purposes, this peak load cannot be less than the subscribed power agreed in the contract with HQ.

To calculate the cost of consumption in relation to the 3.04¢/kWh, it is correct to use the subscribed power which is a product of the real power (kW) (after mechanical load factor and utilization rate), which has been partly calculated based on the projected utilization of equipment in different areas and partly estimated based on experience.

Detailed electricity consumption is presented in the Equipment Load List.

Diesel Consumption

Diesel cost per litre is established at $0.96/L and corresponds to the cost after tax credit/refund from the government. Diesel consumption for support mobile equipment (pick-up trucks, small loader, etc.) has been estimated based on 22 mobile equipment consuming 50 L/day per piece of equipment for 365 days a year. Diesel consumption for fixed equipment (emergency gensets, diesel heaters, etc.) has been estimated at 5000 L/week.

Gasoline Consumption

Gasoline cost per litre is established at $0.90/L and corresponds to the cost after tax credit/refund from the government. Gasoline consumption allowance for potential gasoline powered pick-up trucks, small generators, pumps, vibrating plates, etc. has been estimated at 1000 L/week.

Fresh Water Costs

Fresh water will come from the Des Jardins Water Reservoir for the process plant operation, and from the Sheffield water reservoir for the mine site operation. The cost for fresh water consumption comes from the Province of Quebec's Rule for water usage due royalty (Règlement sur la redevance exigible pour l'utilisation de l'eau, Ré: Loi sur (L.R.Q., c. Q-2, a. 31, 46, 109.1 et 124.1), D. 1017-2010, a. 5.). The rate is $0.07/cubic metre of fresh water used. Fresh water consumption is estimated at 36.04 cubic metres per hour, or 290 thousand cubic metres per year. The anticipated annual cost for the water royalties is $20,102.

Reagents

The annual consumption of reagents has been based on pilot plant and laboratory testing done throughout the feasibility study. The quantities have been scaled up to reflect the full scale process plant mass and water balances. Reagents unit prices came from various manufacturers and reflect annual quantities required as well as actual market price. The total annual reagent cost is $22.3M.

Consumables Costs

Consumables are divided in four sub-groups: liners, grinding media, supplies, and lubricants. Details are shown in Table 21.23.

Table 21.23 - Consumables Summary Cost

Consumables items	Annual Cost ($/y)
Liners	697,306
Grinding Media	1,445,480
Supplies	4,600,000
Lubricant	240,000
Total Consumables Costs	**6,982,786**

Liners

Liners are needed for the roll crusher, cone crushers, ball mill, and rod mill. The quantities and unit cost for the roll and cone crusher steel liners come from the equipment manufacturer's quotations. Also included in Roll and Cone crushers' liners consumption are auxiliary components presented under "Other Consumables (lot)". The mills' liners consumption is calculated using equations developed by Allis-Chalmers/Bond F.C., and is based on ore abrasion index measured in the laboratory. Unit cost for mill liners comes from mill manufacturer's quotations. Liners' annual consumption cost represents $697K.

Grinding Media

The grinding media consumption is calculated using equations developed by Allis-Chalmers/Bond F.C., and is based on ores abrasion index measured in the laboratory. Unit cost for grinding rods and balls come from mill manufacturer's quotation. Total annual grinding media costs amount to $1.45M.

Supplies

The supplies were estimated using factors of mechanical equipment, piping material, and instrumentation material and equipment costs. Total supplies cost is estimated at $4.60M per year.

Lubricants

Lubricants cost were estimated as a lump sum which was estimated by factorizing previous similar project lubricant's costs based on the feed tonnage at the plant. Total annual lubricant cost was estimated at $240K.

Other Processing Costs

Other processing costs such as mechanical, electrical, instrumentation, and piping maintenance contracts given to outside contractors, as well as wet laboratory supplies and surface equipment maintenance costs have been estimated based on Roche and Matamec experience. Total annual other processing costs are estimated at $674K per year.

Tailings Costs

Tailings costs include operating costs for the management of dry magnetic separation rejects, hydromet tailings, and general tailings related operations. It includes the handling of dry MagSep rejects, geotube operation, reconditioning of drying beds (geotextile and gravel), water storage basin treatment, excavation, transport, placement and compaction of dewatered hydromet tailings, piping displacement, inspection, and tailings road maintenance. The operating costs for the hydromet tailings management facilities have been estimated by Golder Ass. and is based on the engineering performed throughout the feasibility study. The operating cost of hauling of dry tailings between the magnetic separation process and the dry tailings dump area has been estimated based on operating cost inputs from hauling equipment manufacturer quotations. Tailings annual operating costs are estimated at 4.77M$.

General & Administration Costs

General and administration operating costs cover all costs incurred that are not directly attributable to the mining and/or processing operations. It includes all the administration staff, contracts, general cost, marketing, and municipal taxes. A summary of the total estimated annual General & Administration operating cost is presented in Table 21.24.

Table 21.24 - General & Administration Operating Cost Summary

G&A Operation	Annual Cost ($/y)	Cost per tonne milled	Cost per kg of TREO
MANPOWER - Administration	3,708,401	2.78	1.02
CONTRACTS	2,190,800	1.64	0.60
GENERAL	4,957,936	3.72	1.36
MARKETING	350,000	0.26	0.10
MUNICIPAL TAXES	399,280	0.30	0.11
Total G&A OPEX Cost	**11,606,417**	**8.71**	**3.18**

Contracts

Overall, contracts will be given for the following peripheral operations: road maintenance, man carrier, security guards, janitor services, garbage disposal, as well as other contractors. The estimates for the costs of contracts are based on quotations from local contractors, except for sewage and garbage disposal, which are allocations based on experience. Total annual contractor costs amount to $2.19M.

General Costs

General costs covers the following recurrent items: site insurance, head office back charge, public relations, environmental services, consultants, legal and accounting fees, buildings maintenance, training expenses, communication, summer students and grants, safety equipment, as well as other miscellaneous costs. Total annual general costs amount to $4.96M.

Marketing

An allocation has been created for marketing costs. This cost is for promoting the new rare earth mine operation to the world, potential clients, population, governments, sales, etc. It was agreed with Matamec that the equivalent of 2 employees' annual salary and miscellaneous expenses (traveling, etc.) was a good estimate of the cost for marketing service. The total annual marketing cost is estimated at $350 K.

Municipal Taxes, School Taxes and Mining Right

Municipal taxes have been estimated based on an approximate value of the buildings agreed with Matamec and a tax rate given by the "Municipalité Régionale de Comté" (MRC) of Temiscamingue for 2013. Approximate value of the building based on the CAPEX is $40M, and the tax rate is $0.9982 per $100 of evaluation for a total of $399K per year.

22.0 ECONOMIC ANALYSIS

22.1 Summary

The economic/financial analysis of the Kipawa project is based on price projections from the second-quarter of 2013 (Q2-2013) and cost estimates in Canadian currency. No provisions were made for the effects of inflation. An at-par exchange rate was assumed to convert the USD price projections into CAD. The evaluation was carried out on a 100%-equity basis. Current Canadian tax regulations were applied to assess the corporate tax liabilities of the project while the recently proposed regulations in Quebec (May 2013) were applied to assess the mining tax liabilities.

The project's financial indicators for base case conditions are:

Financial Indicator	Pre tax	After tax
Payback Period (years)	3.9	4.1
Net Present Value @ 10% (M $)	259.7	127.7
Internal Rate of Return (%)	21.6	16.8

A sensitivity analysis reveals that the project's viability is not significantly vulnerable to variations in capital and operating costs, within the margins of error associated with feasibility study estimates. However, the project's viability remains vulnerable to the larger uncertainty in future prices.

22.2 Methodology

The financial performance of the project is based on a cash flow model that combines the revenue and cost estimates that are documented in previous sections of this report. An annual cash flow model was constructed in which revenues were based on the annual amounts of rare earth elements produced, price forecasts, transport and refining factors, and estimates of the proportions of produced amounts sold. The operating expenses take into account the amounts of mineralization and waste extracted on an annual basis and the mill feed schedule. The initial capital expenditure, i.e. costs incurred during pre-production, consists of direct and indirect costs as well as a contingency component. The sustaining capital costs, i.e. costs incurred throughout the operating life of the project, consists of direct costs and a contingency component. For tax purposes, the indirect costs and contingency are allocated to direct costs. Revenues and costs are expressed in constant money terms (Q2-2013). No provisions have been made for the effects of inflation.

Results are presented both on a pre-tax and after-tax basis. Three levels of tax liabilities exist for mining projects in Canada. These are corporate taxes, both at the federal and provincial levels, and mining taxes at the provincial/territory level. A special corporate tax regime is applicable to mining projects which are certified as mineral resources. This is in fact the case for the Kipawa deposit, which received "Mineral Resource" status from Revenue Canada on 22 July, 2013.

22.3 Summary of Input Data

22.3.1 Economic Assumptions

The economic assumptions used in the base case are shown below (Table 22.1). The market price forecasts are documented in Section 19.5.

Apart from analysing the sensitivity of project economics to capital expenses and operating cost, the sensitivity analysis examines a range of prices 30% above and below the base case prices, all prices being varied together.

Table 22.1 - Economic Assumptions

Item	Unit	Base Case Value
Price forecasts	USD/kg	CAD
Ce_2O_3		5.90
La_2O_3		5.95
Nd_2O_3		75.00
Pr_2O_3		75.40
Sm_2O_3		6.85
Eu_2O_3		1,100.00
Gd_2O_3		59.40
Tb_2O_3		1 076.00
Dy_2O_3		713.00
Ho_2O_3		53.60
Er_2O_3		63.60
Tm_2O_3		1,200.00
Yb_2O_3		56.70
LuO_3		1,400.00
Y_2O_3		29.40
Exchange Rate	USD/CAD	1.00
Discount Rate	% per year	10.00

Apart from the base case discount rate of 10 %, variants of 8 and 12 % were used to determine the net present value of the project. These discounts rates represent possible weighted-average costs of capital to the investor.

22.3.2 Technical Assumptions

The main technical assumptions used in the base case are shown below (Table 22.2).

Table 22.2 - Technical Assumptions

Item	Unit	Base Case Value
Total Mineralization Mined	M tonnes	19.769
Average Processing Rate	Tonnes per year	1,330,000
Life of Mine	years	15.2
Magnetic Separation Process Recovery	%	85.0
Average Hydro-metallurgical Process Recovery	%	80.8
Average Mining Cost	($ / tonne milled)	13.33
Processing Cost	($ / tonne milled)	36.57
General & Administration Costs	($ / tonne milled)	8.71
Pre-production Capital Expense[82]	$M	369.2
Sustaining Capital Expenses[83]	$M	14.6
Rehabilitation Expenses[82]	$M	23.1

A reduced production rate of 883,500 tonnes of mineralization in the first production year provides for a ramp-up to the full capacity of 1,330,000 tonnes per year.

To determine the annual revenues associated with the project, the market price forecasts are converted into FOB prices using a factor that accounts for transportation and refining charges associated with the products sold. As well, it is assumed that the annual production of some of the rare earth elements cannot be entirely sold. Table 22.3 lists the transport and refining charge factors (expressed as a proportion of the price forecast), as well as the proportions of annual production sold for each rare earth element.

Table 22.3 - Market Assumptions

Element	Transport & Refining Charges (%)	Proportion Sold (%)
Ce_2O_3	30	100
La_2O_3	30	100
Nd_2O_3	30	100
Pr_2O_3	30	100
Sm_2O_3	30	100
Eu_2O_3	30	100
Gd_2O_3	30	100
Tb_2O_3	30	100

82 Includes indirect costs and contingency, but excludes first fills and capitalized spares
83 Includes contingency

Element	Transport & Refining Charges (%)	Proportion Sold (%)
Dy_2O_3	30	100
Ho_2O_3	40	100
Er_2O_3	40	74
Tm_2O_3	40	15
Yb_2O_3	40	46
LuO_3	40	40
Y_2O_3	30	100

22.4 Royalties and Taxation

22.4.1 ROYALTIES

No royalty payment agreement exists for this property.

22.4.2 TAXATION

Corporate taxes are levied both by the federal and provincial/territory governments in Canada. Generally, provincial corporate income taxes are levied on federal taxable income pro-rated to the particular province or territory. However, Alberta and Quebec have particular rules for determining taxable income that differ slightly from the federal rules. Thus, these provinces collect their own corporate taxes. In the present case however, those rules that differ in Quebec have no impact on the determination of provincial taxable income. Therefore, Quebec corporate taxes are based on federal taxable income. Details of the corporate tax system applicable to mining income (i.e. related to the extraction of "Mineral Resources"), are documented in the PricewaterhouseCoopers LLC publication "Canadian Mining Taxation", last published in 2011. The current federal and Quebec provincial corporate tax rates are 15% and 11.9%, respectively.

It is to be noted that two important changes have been announced in the March 2013 federal budget. The first concerns Mine Development expenses that are reclassified from Canadian Exploration Expenses (CEE) to Canadian Development Expenses (CDE). While CEE can be claimed as required to reduce taxable income down to zero, CDE can be depreciated at an annual rate of 30% on a declining-balance basis. This change will be phased in over a period of 4 years from taxation years 2015 to 2018.

The second change concerns the elimination of the provision for accelerated depreciation associated with class 41A assets (undepreciated class 41A assets were referred to as class 41 A-1 assets for the purpose of accelerated depreciation). While Class 41A assets can be depreciated at an annual rate of 25% on a declining-balance basis, the accelerated depreciation provision allowed the write-off of the balance as required to reduce taxable income down to zero. This change will be phased in over a period of 5 years from taxation years 2017 to 2021.

It is assumed that Quebec will follow suit with the same changes in the provincial corporate tax rules. These enacted changes have been accounted for in the present study.

The Quebec government has recently announced proposed changes to the Mining Tax regime initially adopted in the 2010 provincial budget. These proposed changes are documented in "*Un nouveau régime d'impôt minier équitable pour tous, mai 2013, Gouvernement du Québec*" and "*Révision du régime d'impôt minier, Bulletin d'information 2013-4, mai 2013, Ministère des Finances et de l'Économie*". The three most important changes concern the addition of a minimum annual tax in the form of a royalty (based on the value of production at the mine's mouth), a three-tier marginal tax rate (based on an annual profit margin, i.e. taxable income as a proportion of sales revenue), and enhancements to the processing allowance. The May 2013 proposals, along with the legislation that remains unchained from the 2010 budget, were applied in the present study. The proposed minimum mining tax rate is set to 16%, the same value as the unique rate in the 2010 budget. The two higher tax rates are 22% and 28%.

There is one issue related to the Quebec mining tax that remains uncertain at this time. This concerns the processing allowance. This is an annual allowance that applies to projects in which the material removed from the ground is further processed by the mine operator in Quebec. The annual allowance is specified as a proportion of the cost of the processing assets. For projects in which the ore is concentrated, the annual allowance is 10% (7% in 2010 budget) of the costs of the assets, and for projects in which the concentrate is further transformed, the annual allowance is 20% (13% in 2010 budget) of the cost of the assets. As the treatment of the mine product from the Kipawa deposit consists of two distinct processes, i.e. concentration and hydro-metallurgical treatment, it is possible that the latter be considered a process of further transformation. A request for clarification has been addressed to the government concerning this issue. To remain conservative, the rate of 10% was assumed in the present study.

22.5 Financing

Sources of financing are outside the scope of this study. As required in the financial assessment of investment projects, the evaluation is carried out on a so-called "100% equity" basis, i.e. the debt and equity sources of capital funds are ignored.

22.6 Financial Model and Results

The cash flow statement for the base case is given in Appendix 10.1. The statement is divided into sections documenting the project's revenues, operating expenses, capital expenses, taxes, pre- and after-tax cash flows, and financial indicators. A summary of the base case results is shown below (Table 22.4).

The capital expense section of the cash flow statement shows a breakdown of capital expenses into direct, indirect, and contingency components. This section also shows the breakdown of capital expenses once the indirect costs and contingency have been allocated proportionately to the direct costs. A capital spending schedule of 40/60 % is assumed over a 2-year pre-production period. The total pre-production capital expenditure is evaluated at CAD 369.2 M, excluding the Mill First Loads and Capitalized Spare Parts (first fills and spares) entries totalling CAD 5.2 M. The total sustaining capital requirement, excluding rehabilitation expenditures, is evaluated at CAD 14.6 M. A working capital equivalent to 3 months of total annual operating costs is maintained throughout the production period. The initial working capital outlay consists of an amount of CAD 5.2 M, representing the Mill First Loads and Capitalized Spare Parts entries, plus an additional CAD 11.2 M to achieve the 3-month operating cost level, for a total of CAD 16.3 M. Supplementary amounts are added or withdrawn annually as total annual operating costs increase or decrease, and the remaining amount is recovered at the end of mine life. A total of CAD 23.1 M is provided for rehabilitation expenses.

The operating expense section of the cash flow statement shows an annual and unit breakdown of operating expenses into general & administration, mining, and process components. The total operating costs are estimated at CAD 1,180.7 M for the life of the mine or on average CAD 59.72/tonne milled.

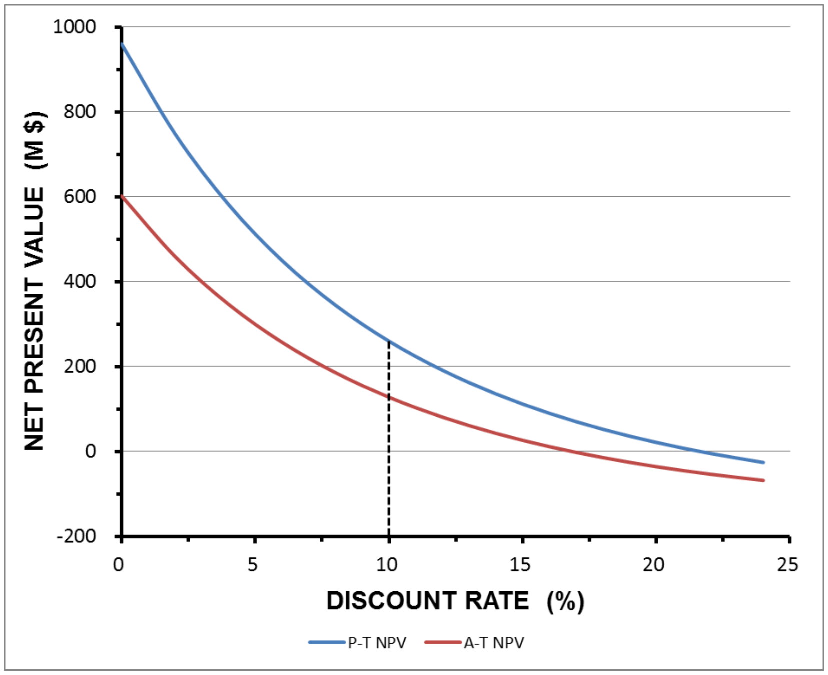
The financial results indicate a total operating profit (EBITDA) of CAD 1,367.3 M, a total pre-tax cash flow of CAD 960.4 M, a positive pre-tax Net Present Value (NPV) of CAD 259.7 M at a discount rate of 10%, a pre-tax Internal Rate of Return (IRR) of 21.6% and payback period of 3.9 years. The after-tax financial indicators are: total cash flow of CAD 602.24 M, Net Present Value of CAD 127.7 M at a discount rate of 10%, Internal Rate of Return of 16.8% and payback period of 4.1 years.

Table 22.4 - Project Evaluation Summary

Description	Base Case (M CAD)
Total At-mine Revenue	2,548.0
Pre-production Capital Expenditure (excluding first fills and spares)	369.2
Sustaining Capital Expenditure (excluding rehabilitation expenses)	14.6
Working Capital Requirement (including first fills and spares)	16.3
Rehabilitation Costs	23.1
Total Operating Costs	1,180.7
Total Operating Profit (EBITDA)	1367.3
Pre-tax Financial Indicators	
Total Cash Flow	960.4
NPV @ 10%	259.7
NPV @ 8%	344.4
NPV @ 12%	191.2
IRR (%)	21.6
Payback Period (years)	3.9
After-tax Financial Indicators	
Total Cash Flow	602.2
NPV @ 10%	127.7
NPV @ 8%	185.4
NPV @ 12%	80.8
IRR (%)	16.8
Payback Period (years)	4.1

Figure 22.1 below, illustrates how the net present value of the project varies with the discount rate, which typically represents either a weighted-average cost of capital or a minimum acceptable return on investment. At a discount rate of 0%, the net present value equals the total cash flow, and as shown, the net present value profile intersects the discount rate axis at the project's internal rate of return (21.6% on a pre-tax basis and 16.8% on an after-tax basis).

Figure 22.1 - Pre-tax and After-tax Net Present Values as a Function of Discount Rate



22.7 Sensitivity Analysis

A sensitivity analysis has been carried out on the base case scenario described above to assess the impact of changes in market prices, total pre-production capital expenditure and operating costs on the project's NPV @ 10% and IRR. Each variable is examined one-at-a-time. An interval of ±30% with increments of 10% was used for all three variables. It is noted that the margin of error for cost estimates at the feasibility study level is typically ±15%. However, the uncertainty in price forecasts usually remains significantly higher, and is a function of price volatility. The pre-tax results of the sensitivity analysis are shown below (Figure 22.2 and Figure 22.3).

Figure 22.2 indicates that the project's pre-tax viability is not significantly vulnerable to the under-estimation of capital and operating costs, taken one at-a-time. The vertical dashed lines show the typical 15% margin of error of the cost estimates. The net present value is more sensitive to variations in operating expenses than it is to capital expenditure, as shown by the steeper curve. As expected however, the net present value is most sensitive to variations in prices. An across-the-board reduction of about 24% in prices results in break-even conditions, i.e. a net present value of zero.

Figure 22.2 - Pre-Tax NPV: Sensitivity to Capital Expenditure, Operating Cost and Prices

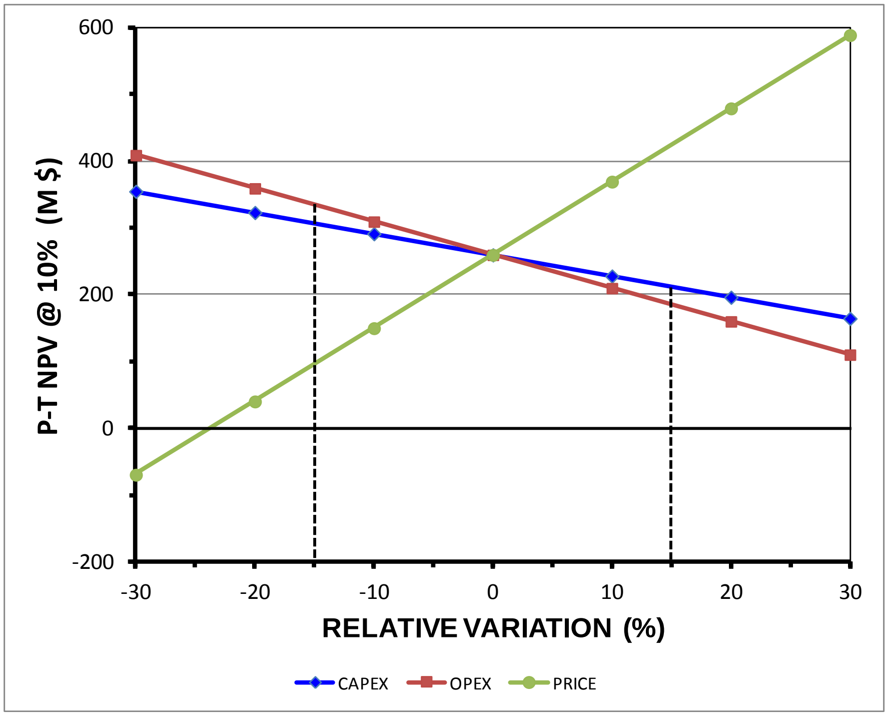
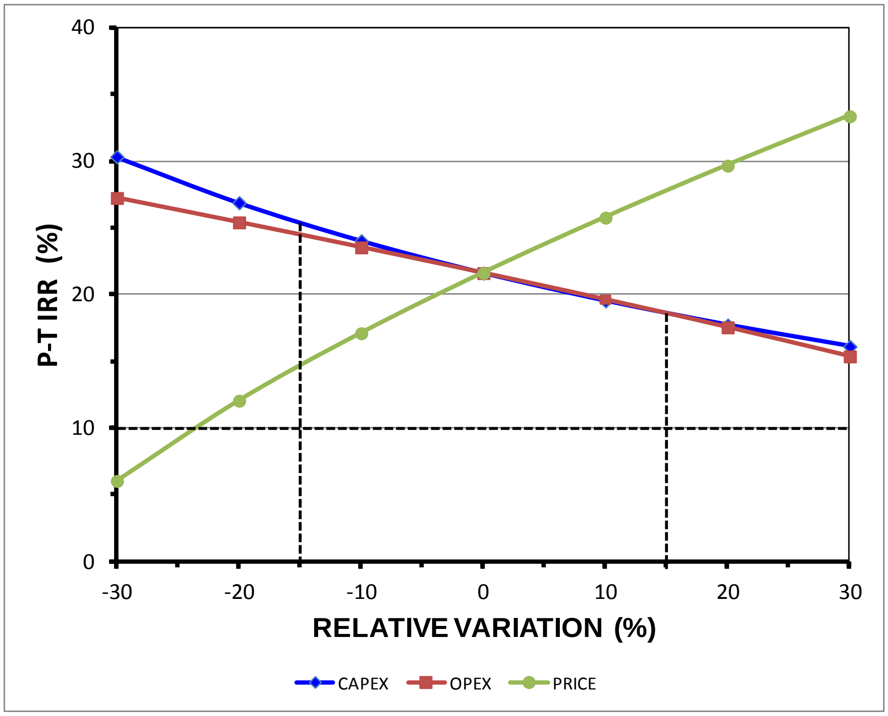


Figure 22.3, which shows variations in internal rate of return, provides similar conclusions. In contrast with Figure 22.2, which shows linear variations in net present value for the three variables studied, variations associated with internal rate of return are not linear. Due to the different timings of pre-production capital expenditure and operating costs over the mine life, the internal rate of return is more sensitive to variations in capital expenditure, especially negative variations. As was noted for the net present value, the rate of return is reduced to 10%, i.e., break-even conditions (shown by the horizontal dashed line), for an across-the-board reduction in prices of about 24%.

Figure 22.3 - Pre-Tax IRR: Sensitivity to Capital Expenditure, Operating Cost and Prices



The after-tax results of the sensitivity analysis are shown below (Figure 22.4 and Figure 22.5).

The same conclusions about the sensitivity of the project's viability to variations in capital expenditure, operating costs and prices can be drawn here. On an after-tax basis, however, break-even conditions are reached at an across-the-board reduction in prices of about 18%.

Figure 22.4 - After-Tax NPV: Sensitivity to Capital Expenditure, Operating Cost and Prices

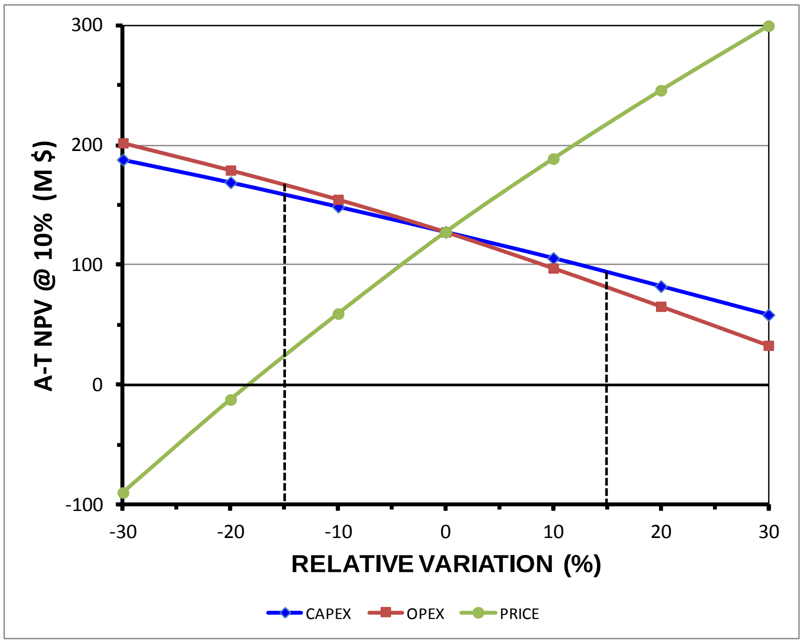
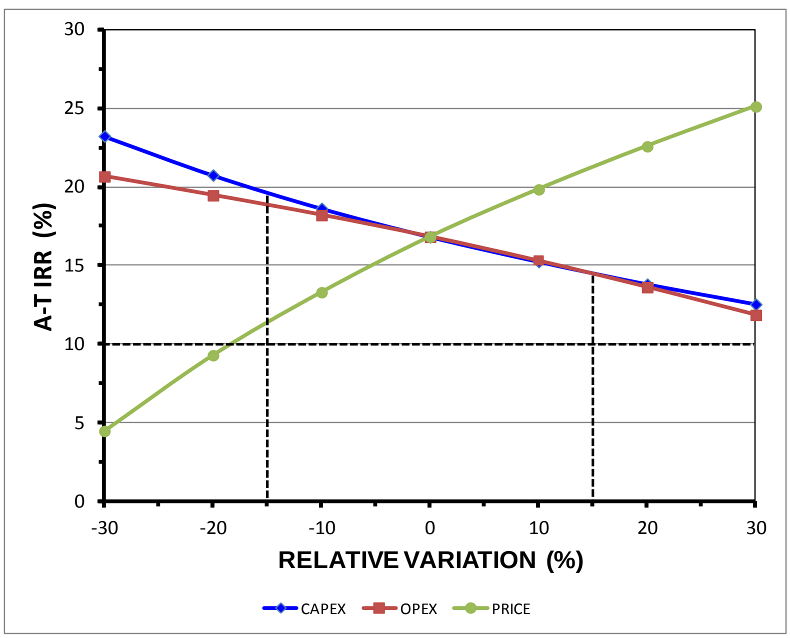


Figure 22.5 - After-Tax IRR: Sensitivity to Capital Expenditure, Operating Cost and Prices



23.0 ADJACENT PROPERTIES

Originally spurred by the uranium-gold mineralization found at Hunter's Point in 1957, exploration in the area has focused either on uranium-gold exploration (with companies like Valdez, Nuspar, Hollinger, Imperial Oil, Talisman and most recently Noront/Globex and Fieldex), gold exploration (Hecla/Aurizon) or rare-earths and yttrium mineralization (Unocal and most recently Matamec, Aurizon, Fieldex and Globex).

Most of the ground surrounding the Zeus property is currently staked by active exploration companies, including Hecla Mining Company (Hecla/Aurizon) (who recently acquired Aurizon Mines Ltd.) and Fieldex Exploration Inc. (Fieldex). Globex Mining Enterprises (Globex) optioned the Turner Falls showing and the Hunter's Point showing to Noront Resources Ltd (Noront), though the Hunter's Point showing reverted back to Globex in 2008 (Globex June 19th, 2008 press release). Exploration at the Turner Fall showing is still ongoing at this time. Forum Uranium Corp. (Forum Uranium) also optioned sections of Hecla/Aurizon property in July 2012, most notably the area between Matamec's Sheffield and McKillop claim blocks (Forum Uranium July 14th, 2012 press release).

Hecla/Aurizon owns several claims immediately north of the Zeus Property. Sulphide bearing boulders and outcrops were discovered in 2007 in the main area of interest, where four gold dispersal trains had been delineated following a till survey in 2006 (August 10th, 2007 press release). Also, Hecla/Aurizon reports radiometric anomalies (up to 1050 cpm) and two rare-earth (La, Ce, Hf) showings in that same area : the Snake showing located 5 km north of the McKillop claim group with average reported values of 0.02% U, 0.12% Y and 1.81% TREE from 29 hand samples (best values of 8.66% TREE and 1.98% Y in different samples); and the Eagle showing situated 250 m north-east of the central Sheffield claims block with average reported values of 0.06% Y and 0.51% TREE from 24 hand samples (best values of 6.06% TREE and 0.34% Y in different samples). Both showings are reported to be syenite-hosted mineralizations located on the lower contact of the Kipawa Alkaline Complex. Except for a virtual absence of associated radioactive material (7 ppm Th on average), no details on mineralogy have been given. However these showings seem comparatively more enriched in light rare earths than the Zeus property showings (November 2007 and June 2008 press release). During the summer of 2008 Aurizon completed 4 diamond drill holes on the Snake rare-earths showing (681 m total). Best intersection consisted of 38.1 m at 0.074% TREE. In 2010, Hecla/Aurizon completed a drilling program for gold (26 DDH, 6,500 m on three targets, April 13th, 2010 press release), but it did not provide sufficient encouraging results to warrant further work at the time (January 11th Activities Report). On July 14th, 2012, Hecla/Aurizon optioned off its Kipawa property to Forum Uranium (Forum Uranium July 14th, 2012 press release). In 2011, Forum ground prospecting and soil sampling outlined a prospective zone of REE-enriched boulders between Matamec's Sheffield and McKillop claim blocks (best value in the HREE-enriched samples of 3.12% TREO with 35% HREO ratio, though some of the light-enriched samples went as high as 14.24% TREO with 1.3% HREO ratio), some of which were identified as eudialyte-bearing, Kipawa-deposit type mineralization (July 17th 2012 press release). The source outcrops of these boulders could not be located in 2011. Results for their 2012 exploration campaign (announced in their August 15th, 2012 press release) are yet to be released at the time of this writing.

Ongoing targeted exploration for uranium and then rare earths is reported by Fieldex, which acquired 17 claim cells (CDC) from Ressources Minérales JDG Inc. in 2007 (Osmani 2007a). These claims, identified as the Lac Sairs property and located within a hole in Matamec's Sheffield Claim block, between Sheffield and Sairs Lakes, include the Sairs Lake showing and the Valdez-Nuspar Zone. Grab samples collected in the fall of 2006 returned up to 10 pounds per ton U_3O_8 (0.42% U). The grab samples were collected in old trenches excavated in 1977 by Valdez Resources Industries Ltd. Fieldex drilled 9 holes, totaling 2,100 m during the summer of 2007 (Osmani, 2007b). This drilling program was to be a first phase aiming at increasing the potential of the historical uranium zone delineated in 1978-1979 by Valdez Resources and Nuspar Resources, but analysis results were judged non-economic for uranium (Fieldex May 1st 2008 annual report, available on SEDAR). Fieldex later released results for 7 core samples of unspecified length from that campaign, two of them showing significant REE enrichment (August 28th, 2009 press release). Fieldex increased its land position to 56 claims in 2009 (October 8th press release) and then carried out a 4,225 m drilling campaign in 2010 (targeting the KR zone and a north-south fence of holes along Matamec's eastern claim boundary, October 25th, 2010 press release), a 15 DDH drilling campaign in 2011 (6 around a zirconium-enriched interval in their 2010 fence, 9 to the east of their claim block (September 15th 2011 press release) with no results announced to date on these 2011 DDH) and a 7 hole campaign in 2012 (in an east-west fence just north of Matamec's PS zone, September 15th 2011 and April 24th 2012 press releases), for a total of 7,646 m drilled. Best results were encountered in their 2012 east-west fence within 100 m of Matamec's claim boundaries, immediately north of Matamec's PS zone (holes LS-12-20 to 22, best values of 56.4 m @ 0.45% TREO with 40% HREO ratio, April 24th 2012 press release) and once in a single hole on the facing side of the KR zone (hole LS-10-20, 10.5 m @ 0.37% TREO, 29% HREO ratio, October 25th, 2012 press release).

Note that Matamec has also planned and carried out a 15 DDH drilling exploration program on its PS zone showing in 2012, though results have not yet been released. It is also important to note that the Valdez-Nuspar Zone lies outside of the Zeus property but within 700 m of the property limits. This zone is located south of the Kipawa River and was first sampled in 1969 by Laduboro Oil Ltd. A radiometric assay performed on an angular pink syenitic boulder gave a uranium reading of 0.105 % U and a low thorium reading of 0.004 % Th. Pits were dug in this area and high radiometric readings were obtained in boulders and sand collected from the exposed overburden. It was later drill tested by Valdez Resources Industries and Nuspar Resources. Additional exploration work conducted by Nuspar, including a scintillometer survey over the entire property, concluded that the Valdez-Nuspar Zone (identified as “Main Zone” in their report) could be extended to the west and to the east, up to a total length of about 4 km (2.5 miles). In the east direction, the extent of the anomalous zone is estimated at 1.6 km (4,500 ft), which correspond to the junction between the Kipawa River and the Des Jardins River (Rivière des Jardins) (Marchand and Robert 1979). Approximately half of this estimated extension falls within the Zeus property limits, and is a priority target for the Zeus Project. The anomalous zone was described as discontinuous, looking like stretched lenses distributed within the biotite syenite gneiss or near the contact with the syenite complex, in the hornblende syenite gneiss. Lower scintillometric anomalies are reported east of the Des Jardins River under quartzite beds. Sampling by Unocal in 1990 (Knox 1990) suggests that the Valdez-Nuspar zone has potential for REE-Zr and Nb mineralization, as well as uranium.

Noront completed in the summer of 2006 an airborne radiometric and magnetometer survey over the Hunter’s Point area, and three additional anomalous areas were delineated within the main property (Noront, press release of July 26th, 2007), where historical uranium (6.8% U) and gold values (38.4 g/t Au) from grab samples are known to have occurred in quartzite beds (Rive, 1972). Additional grab sample results for uranium (0.07% to 3.09% U), dating from 1981 onward, are also reported on Noront’s website. Their land position was expanded from 763 ha to 24 000 ha in 2007 and up to 26 000 ha in 2008. A field program was planned for 2007, consisting of prospecting, geological mapping, sampling, geochemistry, line-cutting and geophysics (Nemis 2007). Results of that program include the discovery of a new U, Au, Ag, La, Ce and Y showing named Coconut Club, theorized to connect north-south with Aurizon’s Snake-North showing. This showing shows very high values in grab samples, with best values, in different samples, for the Coconut Club showing being 0.097% U, 7.94 g/t Au, 33.1 g/t Ag, 34.5% TREO with 6% HREO ratio (Globex June 2008 and March 4th 2010 press releases). The Hunter’s Point showing then reverted back to Globex (Globex June 19th, 2008 press release).

Year 2010 saw the (re)discovery of the Turner Falls showing by Globex, located to the north-east of Matamec's main Sheffield claim block (February 1st Press Release). Globex cut 22 km of line, passed ground magnetic and radiometric surveys and did manual trenching and channel sampling in 2010 (August 19th 2010 Press Release); while 2011 saw an additional 50 km of magnetic and scintillometer survey plus some additional manual trenching (January 17th press release). The showings defined by this work, now named Old and New Turner Falls respectively, are described as being partially included in coarse grained pink pegmatites and syenitic gneisses. The Old Turner Falls showing consists of a band of pegmatite, dipping south at approximately 20-25˚, overlain by an iron formation. Grab samples have returned values up to 6.93% TREO with 46% HREO ratio and 4.77 % ZrO_2 (Globex website). The horizon is at least 95 m long by 5 m wide however, the extent of the showing in the lake is unknown. The New Turner Falls Showing consists of sporadic but locally high grade REE mineralization over an area roughly 140 m by 65 m. A pegmatite dyke with some anomalous REE values is present and likely plays a part in the mineralizing system but the highest values are contained in syenitic to granitic gneiss. The best interval from channel sampling was 2 m @ 2.4% TREO with 28% HREO ratio and 1.0 % ZrO_2 (Globex website). Globex then drilled 5 DDH in the summer of 2012. The drilling results are described as "returning anomalous results and new geological and structural information" in their February 18th, 2013 press release. They intend to go back to the property in summer 2013 to carry out more detailed mapping and sampling to guide the next round of drilling in the areas of known high grade, rare earth mineralization.

24.0 OTHER RELEVANT DATA AND INFORMATION

24.1 Project Execution Plan and Schedule

24.1.1 Introduction

24.1.1.1 Project Execution Plan (PEP) Summary

Matamec Exploration Inc. (Matamec) is a Canadian registered resource company based in Montreal, Canada. Matamec proposes developing the heavy rare earths deposit at the Kipawa site near to Témiscaming, Québec province, Canada. The Project will be built as a conventional open pit mine, at the Kipawa Alkaline Complex rare earth element mineralization. The operation has an expected production rate of 1.3 million tonnes of ore per year (Mtpy) with an estimated 15 years production life.

The PEP describes the strategy for completing all required engineering, procurement, construction, and commissioning, including the mine, tailings, and environmental activities. The PEP also ensures that the core elements of the Kipawa Alkaline Complex, regarding the inter-relationship between the Project stakeholders, community, and First Nations, are maintained from the mineral exploration stage through construction and operations stages.

This document addresses the execution of the conventional engineering driven by the Owner in a fast track construction phase EPCM. This mandate is currently to lead the Engineering (E of the EPCM); at the request of Matamec the Procurement, Construction, and Management (PCM) are not part of the mandate as they will be led by Matamec themselves.

24.1.1.2 Project Execution Planning

On March 14th, 2012, a Preliminary Economic Assessment Study for Kipawa Project (NI 43-101 Report) ("the PEA") was filed.

For the Feasibility Study, the project was divided into four (4) work packages (in relation with the CAPEX):

- Off-site installations (5 km radius of Témiscaming);
- Mine site (Kipawa);
- Inter-site services;
- Hydromet plant site (Beneficiation and Hydromet).

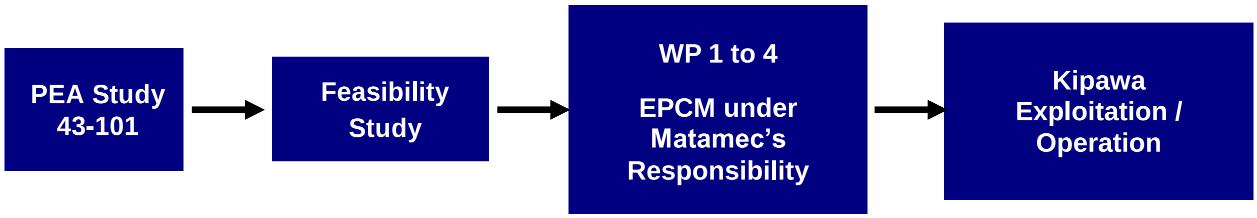
Following the PEA, a Feasibility Study was started with the following objectives:

- Perform field work required prior to the start of the engineering;
- Perform laboratory work required prior to the start of the process engineering;
- Perform tests to address the risks identified during the PEA Study and in this study;
- Prepare all Certificates of Authorization, permits, rehabilitation plans, etc. required for the work;
- Perform characterization studies of soil and mine rock;
- Perform Environment and Human Health Risk Assessment;
- Revise the cost estimate to ±15% accuracy.

Following completion of the Feasibility Study, it is planned to move immediately to the conventional engineering, driven by the Owner in a construction (Engineering driven by Matamec) EPCM phase for Work Packages 1 to 4.

The following block diagram shows all phases of the project.

Figure 24.1 - Block Diagram



24.1.1.3 Project Implementation Activities

The project implementation activities are different from those of a standard construction project due to nature of the technological process (in the Kipawa Alkaline Complex) and the type of finished product desired (rare earths-yttrium-zirconium-niobium-tantalum mineralization).

The main activities are addressed in the following sub-sections.

24.1.1.4 Engineering

Detailed engineering will be done for all the Work Packages (4). The key technical activities to be performed should be the preparation of the scopes of work for the tender process. During the preparation of these scopes of work, the execution strategy should be established, especially for the:

- Hydromet plant site;
- Management of machine safety and environment.

Procurement

As stated above, there is a very detailed process with new constructions and there are many items, pieces of equipment, and materials which need to be purchased (Canada, USA and Overseas). The main procurement activity should be the selection of one general-contractor by package and some sub-contractors. It is planned to select the sub-contractors by speciality for the Work Packages 1, 2, 3, and 4.

For Work Package No. 4 (Hydromet plant site), not all the engineering can be completed at the same time. The criteria to be used for the process are required prior to completing detailed engineering of some hydrometallurgical sectors. This work package should be divided principally into two components (Beneficiation and Hydromet).

The selection of one contractor for each work package should help in:

- Accelerating the construction by establishing the limits of their own work in each sector;
- Reducing the problem related to coordination and confusion;
- Getting participation from local contractors, if possible.

The main strategy in the preparation of the bid documents is to establish the scope and the limits of the work that allows bidders to propose action plans for the execution. The objectives are to:

- Obtain the best and lowest cost execution plan;
- Keep responsibility for the execution with the contractor in each sector.

Execution

As described above, this project mainly involves the provision of services by subcontractors at sites and the most important aspects of the conventional engineering, as well as the management of those subcontractors. The main activities should be:

- Confirming that the subcontractors' procedures are in accordance with the Health and Safety Program;
- Controlling all of the scope of work changes (documentation) with engineers and subcontractors;
- Ensuring that the subcontractors' progress reports are in accordance with the Project Management System;
- Following the progress of the works;
- Quality control.

24.1.2 Scope of Work

This PEP covers all four (4) work packages included in the Feasibility study. The scope of work for each package is as follows:

24.1.2.1 Off-site installations (5 km radius of Témiscaming)

Consists of installation of a main electric sub-station (Témiscaming 120 kV), Hydro-Québec 14 km 120 kV power line, and a parking with a guardhouse, fence, lighting and services.

24.1.2.2 Mine site (Kipawa)

Consists of the installation of access and mine roads, development of an open pit mine, loader operation, trucks and blasting equipment, pumps to drain water from mine, a building for explosive storage, electric sub-station, lighting and distribution, electrical services, and a garage and fuel storage.

24.1.2.3 Inter-site services

Consists of installing a power line (between Sub-Station 44 kV on Plant Site), communication access road (from Maniwaki Road to the plant site).

24.1.2.4 Process Plant Site

The plant is to be divided in two sections:

- Beneficiation - Physical Process
  - Crushing and screening;
  - Grinding and magnetic separation;
  - Dewatering.

- Hydromet - Chemical Process
  - Leaching / releaching;
  - Separation solid / liquid;
  - Impurities removal;
  - Neutralization / precipitation / tailings;
  - REE;
  - Option to separate rare earth element.

Additionally, it is planned to build an administration and service building, assay laboratory, fuel storage equipment, reagent storage facility, warehouse, metallurgical laboratory, offices, electrical rooms, site fire protection, access roads, potable water treatment, sewage treatment system, and pump house.

24.1.3 Approach

The Project should be executed using a reputable engineering firm (or firms): Roche Groupe-Conseil Ltée, Genivar, and Golder and Associates, to act under Matamec's authority. It is planned to move immediately from the current feasibility study to the conventional engineering, led by the Owner on construction (Engineering driven by Matamec) EPCM phase for Work Packages 1 to 4.

Services to be provided by engineering firms should include:

- Engineering management;
- Contract administration;
- Cost control;
- Schedule control;
- Procurement services;
- Site contract administration;
- Construction management;
- Health and safety compliance;
- Inspection and testing;
- Project reporting.

The Owner's team will be as indicated on the Project Organization Chart Figure 24.4.

24.1.3.1 Allocation of Responsibility

Matamec will define a responsibility matrix in the early stage of the construction project to determine the various project management functions that will be under the responsibility of the engineering parties involved in the Kipawa Project.

24.1.4 Work Breakdown Structure

The Work Breakdown Structure (WBS) is a deliverable-oriented grouping of components that organizes and defines the total scope of the project.

To facilitate the cost control, all WBS items have been regrouped by area in work packages. A Work Packages Code (WPC) has been established for each Work Packages.

<u>WPC</u>

10	Mine site (Kipawa);
11	Off-site installations (5 km radius of Témiscaming);
14	Inter-site services (power line, cell communication);
18	Hydromet plant site (Beneficiation and Hydromet).

24.1.4.1 Package Breakdown Structure

The project will be divided into execution packages to facilitate control and a Package Breakdown Structure (PBS) will be created. The project budget will be split into packages, and cost reporting will be by package, resulting in better cost forecasting and follow-up.

The schedule is to be produced by execution package, using MS-PROJECT as planning software, to facilitate the follow-up of pre-established milestones by package.

Packages should be coded as follow:

Table 24.1 - Package Codes

Sub-project	Area	Activities	Sequential
aa-	bbb-	cccc-	dd

The project deliverables identified in the WBS should be packaged into contracts. The main contracts should follow the first four of the Major Work Packages described in Section 24.1.4, and some sub-consultant and laboratory analysis contracts should also be required.

Appendix 6.1 shows the Package Breakdown Structure (PBS).

24.1.5 PROJECT CONTROL

The project control system includes not only planning and scheduling but also cost control, and various methods and forms required to facilitate project review. The cost control system and the project control budget should be developed and managed by Matamec and the Engineering Manager. The project schedule should be developed, managed and monitored by the Engineering Manager. The Project Manager should use current cost and schedule data to report on the project for decision-making purposes.

The project control budget, the project schedule, and the weekly project cost and status reports are the main tools for effective project control.

Once the overall budget has been approved by Matamec, the budgets should be assigned to the elements of the WBS and integrated into the schedule, enabling the production of cash flows. The Project Control should be under the responsibility of Matamec.

24.1.6 COST MANAGEMENT

Cost monitoring should be a continuous process in which the cost trends should be recorded and monitored. A monthly project cost control report should be issued showing original budget, scope changes and transfers, commitments to-date, forecast to complete, incurred, and period and overall variances. The Cost Management should be under the responsibility of Matamec.

A dedicated Matamec Cost Controller should be assigned to the project. He or she should interface with planning, cost engineering, procurement and construction personnel, and carry out continuous monitoring and trending to ensure that potential cost impacts are identified well in advance.

The cost control reference document should be used for cost monitoring. The reference document is integrated with:

a) The estimating reference document of the system to allow monitoring against a baseline estimate;

b) The procurement reference document to correctly record commitments and change orders;

c) The contracts administration reference document for information on contract progress.

24.1.6.1 Cost and Progress Monitoring

The methodology that should be used for the conventional engineering with the group of consultants, driven by the Owner on a fast track construction under Matamec responsibility for its own monitoring and recording of costs during project execution is as follows:

As a first step, a Work Breakdown Structure (WBS) should be developed. Each area and sub-area should be represented as a unique WBS element. Detailed elements included in the WBS should be listed.

A coding structure should be selected for the estimate elements, cost elements, commitment packages (i.e., purchase orders and construction sub-contracts), drawings and specifications. The coding structure must be able to properly support control requirements and progress and cost reporting.

24.1.6.2 Project Change Control

A request for a change to the scope of the work may originate from Matamec or any project discipline at any phase of the project. It is Matamec's Project Manager's responsibility to decide whether an initiated Project Change Notice (PCN) is within the scope of work or not

The PCN is a document that should be used by the Matamec Project Manager to obtain authorization from Matamec to perform work not already included in the scope of work and/or to control changes which affect the contract price and/or the schedule of work schedule.

PCNs may be issued for:

- Changes in design resulting in a contract change;
- Changes in design resulting in additional process equipment and/or material;
- Changes in the commercial general terms and conditions;
- Force Majeure;
- Change in the scope as requested by Matamec.

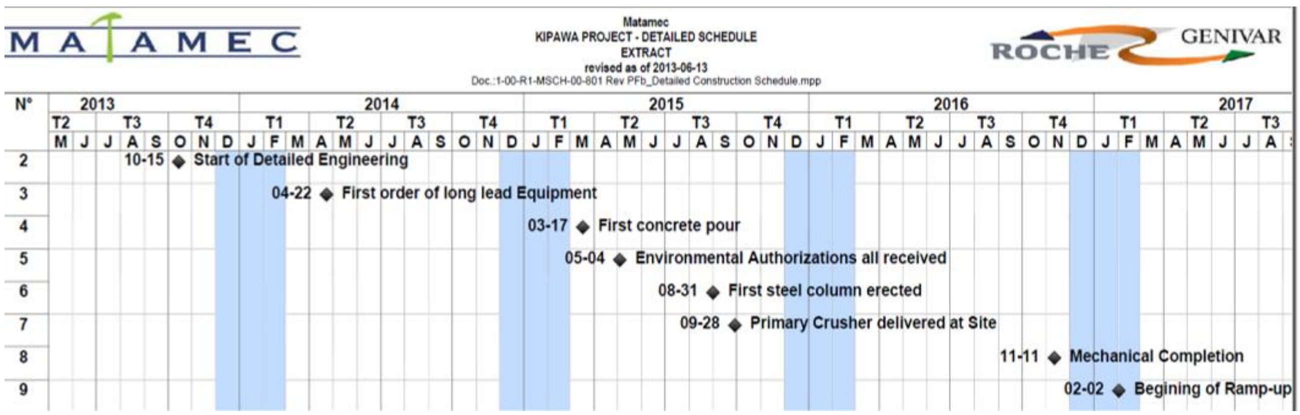
24.1.7 Planning and Scheduling

24.1.7.1 Basis of Schedule

Matamec plans to implement the Kipawa project based on the detailed project schedule found in Appendix 6.2.

Figure 24.2 illustrates the summary of project schedule with key dates and milestones.

Figure 24.2 - Project Schedule Summary



This schedule is created in MSProject 2010 as per Matamec's request. Once Matamec approved this schedule, it will be the Master Schedule which will follow all progress of the Project during the execution phase.

Basic Principles

The basic principles used to achieve the schedule integrity are as follows:

a) Project construction and start-up have to be linked with engineering and procurement activities. It is mandatory to be able to see consequences for construction and start-up if an engineering or procurement activity is delayed.

b) All activities in the schedule, except for the milestones, have to be populated with man-hours. The goal is to give a picture of the work-load, and ultimately, to match the schedule man-hours with the estimate ones.

c) No open end should exist with the exception of the following:

- Project first activity - with no predecessor;
- Project last activity - with no successor;
- Summary activities;
- Hammock activities.

Schedule Structure

The schedule document structure is built as follows:

a) Key Milestones;

b) Common activities;

c) Engineering/Procurement activities grouped into:

- Supply Packages

  Each supply package is built from a common template as shown below:

Table 24.2 - Supply Packages

Name
[Typical Supply Package] for Comments Engineering
[Typical Supply Package] Bid Engineering
[Typical Supply Package] Issued for Constr. Dwgs
[Typical Supply Package] Bid Preparation
[Typical Supply Package] Tendering Period
[Typical Supply Package] Negotiation & Award
[Typical Supply Package] Shop Drawings Preparation
[Typical Supply Package] Shop Drawing Review
[Typical Supply Package] Fabrication
[Typical Supply Package] Delivery at Site

- Construction Packages

  Each construction package follows this template:

Table 24.3 - Construction Packages

Name
[Typical Construction Package] Engineering
[Typical Construction Package] for Comments Engineering
[Typical Construction Package] Bid Engineering
[Typical Construction Package] Construction Drawings
[Typical Construction Package] Bid Preparation
[Typical Construction Package] Tendering Period
[Typical Construction Package] Negotiation & Award
[Typical Construction Package] Shop Drawings Preparation
[Typical Construction Package] Shop Drawing Review
[Typical Construction Package] Fabrication /Delivery
[Typical Construction Package] Mobilization

d) Construction Activities

Construction activities are organized into Sub-project, Areas, and then by Discipline. The goal is to assign a proper duration and work load according to the equipment to be installed in each area. The final activity sequence will be driven by the constructability review that will take place in the beginning of the next phase of the project.

e) Start-Up

Start-up is used as a general project stage including pre-commissioning, cold commissioning, hot commissioning and any related activity occurring after the "Mechanical completion" date.

Start-up phase is represented by one single line linked to all areas completion. Although the activity is shown with a relatively short duration for a simplification purpose, it is expected that start-up activities will commence as early as 6 to 9 months before the start date shown on the current schedule. The exact start date will depend on each area readiness date.

Start-up activities will be developed in the next phase of the project once the final process and equipment will have been selected.

24.1.7.2 Critical Paths

The schedule does not take in account environmental activities which could become critical if they were included.

Besides environment, there are three (3) major streams that are expected to be critical.

Construction Stream

From the information available, the present project's critical path is the construction stream. It begins with review of study documentation, and continues to:

- Confirmation of the major equipment dimension and location;
- Civil work Engineering/Procurement/Mobilization;
- Electricity, water, other services made available;
- Construction;
- Start-up and Commissioning.

Mining Stream

Along with construction activities, there will be Mining/Pre-production activities that can become critical if the preparation work requires large amount of work and machinery and pre-production contract is delayed. It begins with review of study documentation, and continues to:

- Confirmation of the mining sequencing;
- Mining work Engineering/Procurement/Mobilization;
- Access roads construction including modular bridge on Kipawa River;
- Tree cutting, ditch and water control, dump area preparation;
- Overburden removal.

Procurement Stream

From the available information, the longest "long-lead" equipment is filter with 12 month fabrication and 2 month delivery. If this equipment was delayed by 2.5 months, it would be on the critical path, overcoming Items 3 and 4 of the actual critical path.

In the other hand, if construction activities were shortened by 2.5 months, with no delay on the filters procurement, filters would still become on the critical path. It begins with review of study documentation, and continues to:

- Confirmation of the major equipment dimension and location;
- Filter procurement and delivery;
- Filters mechanical installation;
- Filters piping, electrical, instrumentation;
- Start-up.

24.1.7.3 Calendars

These are principal dates for calendar:

- Holidays are last 2 weeks of July and 2 weeks at Christmas time for construction and start-up activities. Added to these are 7 statutory holidays.
- Work weeks are 5 days of 8 hours for engineering and procurement, and 6 days of 10 hours for construction and start-up activities.
- Holidays are 2 weeks at Christmas time plus 6 statutory holidays for Engineering and Procurement activities.
- On top of the previous holidays, most civil work is based on a winter stop from mid-November to mid-March.
- Travel time from Temiscaming parking facilities to construction areas is deemed to be added to the normal 10 hours work day.

24.1.7.4 Assumptions

These are principal assumptions:

The permitting is not addressed in the schedule as it is out of the scope of this study;

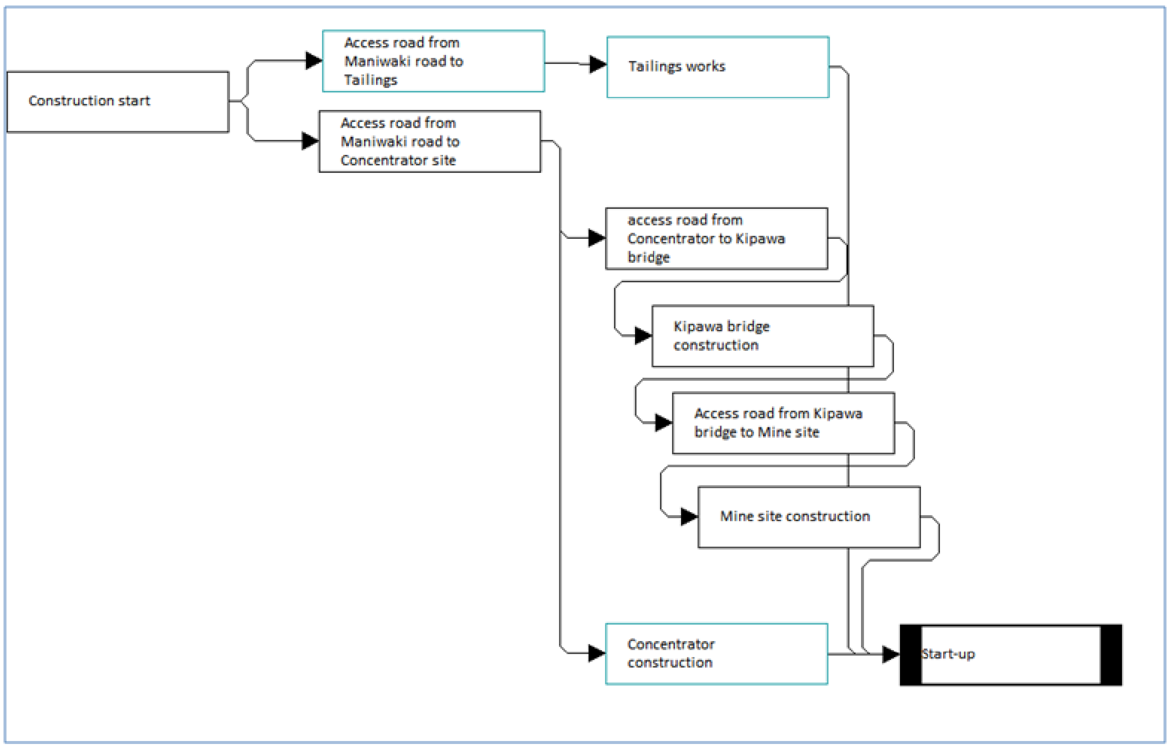
It is assumed that the concrete will come from existing facilities in Temiscaming at the beginning then a small batching plant will be setup at site to complete the initial construction;

Optimization of the project, especially related to the construction phase could be necessary to allow critical construction activities to start on-time;

Temporary power is assumed to be available from diesel generators for starting up of the project construction and later by the permanent power line from Hydro-Québec. The diesel generators will remain at site and be used as emergency power supply.

- As specified above, there is no permitting stream addressed in the present schedule, as this is out of the current scope.
- It is assumed that the concrete will come from existing facilities in Temiscaming at the beginning then a small batching plant will be setup at site to complete the initial construction.
- There has been no in-depth optimization in the project packaging, especially for the construction packages. Improvements might be necessary to allow critical construction activities to start on-time.
- Temporary power is assumed to be available from diesel generators for starting up of the project construction and later by the permanent power line from Hydro-Québec. The diesel generators will remain at site and be used as emergency power supply.
- The key logic of the project construction activities is as follow:

Figure 24.3 - Key Logic Activities



24.1.8 ENGINEERING

At the beginning of the detailed engineering phase, a Project Engineering Plan will be prepared and is to include:

- Engineering scope of work by each work packages;
- Categories of deliverables by disciplines;
- List of deliverables;
- Schedule.

24.1.8.1 Design Calculations

Design briefs consist of an orderly history of the development of design for all components of the project. They will therefore be prepared for each specific component, equipment item or system of the project and include, as applicable: design calculations, alternate studies and recommended solutions, design instructions or directives, tender evaluations, evidence of design checks and verifications.

24.1.8.2 Design Criteria

Given that the nature of the project involves open pit mining and new hydrometallurgical concentrator in a forested area, the design criteria will be governed to a large extent by environmental and safety regulations. At the beginning of the PEA, a Design Criteria Manual was prepared to provide discipline engineers with the necessary criteria they need to support their engineering work. The Feasibility Study was also based on this Design Criteria Manual, which will be updated at the beginning with the group of consultants and other providers including laboratory bench test, under Matamec's responsibility.

24.1.8.3 Standard Specifications

The standard approach for the preparation of technical specifications is set out in engineering firm standard specifications. The purpose of this procedure is to define the various categories of technical specifications and to establish a standard approach to preparing and issuing the documents.

24.1.8.4 Engineering Drawings

Design drawings will be required for all work packages. The reference document Drawing Guide Standard will be established by an engineering firm and a standard approach for the preparation and verification of engineering drawings will be created.

24.1.8.5 Equipment and Materiel

Numerous parts and types of equipment will be required for this project, specifically for the Beneficiation and Hydromet Plant. An equipment list including motor and instrumentation lists will be prepared for this task.

24.1.8.6 Equipment and Material Specifications/Data Sheet

Specifications will define equipment and material requirements and typically consist of:

- Process conditions;
- Performance and duty requirements;
- Scope of supply and exclusions;
- Specific technical requirements;
- Drawings and sketches;
- Standards and code requirements;
- Project standard specifications;
- Quality assurance requirements;
- Performance test requirements;
- Bidder and vendor data requirements.

24.1.8.7 Design and Hazard Reviews

The Design and hazard validations procedures will define the requirements for conducting design verifications on engineering work. The requirement to conduct a series of checks and reviews at three points in the development of a project will be described by engineering firm in accordance with Matamec's standard.

24.1.8.8 Vendor and Construction Contracts

Given the nature of the project, numerous engineering drawings will be produced. Furthermore, the scope of work for small item contractors' services will be the only technical document to be distributed to bidders. The scope document will include:

- The nature of work;
- The responsibility of contractors;
- The control procedure to be performed during execution;
- Exclusions;
- Others items as appropriate.

Each scope of work will be prepared by an engineer or specialist and reviewed by the appropriate Discipline Lead Engineer and the Engineering Manager.

A technical team will analyze tenders received to assess conformance with technical specifications and a bid evaluation table will be prepared to assess and compare bids

A tender evaluation and recommendation report will be issued by the Contract Administrator for each contract. The report will address conforming and non-conforming tenders, tender clarifications and overall content, and will include the recommendation of the technically preferred bidders.

Prior to the issue of contracts to preferred bidders, the technical team will verify the contracts technical conformance with specifications.

24.1.8.9 Engineering Control

Engineering quality and cost control systems will be used to control quality, time, and cost, and the Engineering Discipline Leader will be appointed for each work package and will be primarily responsible for coordinating the technical work.

24.1.8.10 Technical Document Control

All project technical documents will be handled by an engineering firm in accordance with the Document Plan and Procedure issued for the documentation process

24.1.8.11 Vendor Data

Vendor data requirements and submission dates will be defined for each procurement package in the Bid Invitation Letter included in each enquiry package.

Vendor data will be submitted to the Document Controller, who will distribute it as required and the review of vendor documents will be standardized in the Matamec's Document Plan and Procedure.

The data will be submitted in electronic pdf format and in its original format, as well as a hard copy.

All drawings and documents from vendors will receive a document control number for reference during Construction and mine life.

24.1.9 Procurement and Contracts

24.1.9.1 Procurement and Contracting Plan

At the beginning of the execution phase, a Procurement and Contracting Plan will be developed to establish an overall strategy to be followed by contract administration personnel for the execution of the project, including close-out. This plan will be prepared by Matamec during detailed engineering period.

24.1.9.2 Purchasing and Expediting Strategy

The Procurement, Construction & Management (PCM) group (created by Matamec) will provide capital equipment procurement, supplier-drawing expediting, and coordinate equipment inspection. The procurement group will manage the bidding cycle for equipment and materials to be supplied by the Owner to the contractors. Standard procurement terms and conditions approved for the Project will be utilized for all equipment and materials Purchase Orders. Suppliers will be selected based on location, quality, price, delivery, and support service.

24.1.9.3 Long Lead Items

The procedures governing the Purchase Order Terms and Conditions, General Terms and Conditions (GTC), and Professional Services Terms and Conditions will apply to all purchases of Long Lead Items. Details will be included in the Procurement and Contracting Plan. These procedures and GTC will be prepared by Matamec during detailed engineering period.

24.1.10 Construction

24.1.10.1 Early Work

The early work will be defined by Matamec in accordance with work ahead (i.e. work civil, tree cutting, access roads construction including modular bridge on Kipawa River, ditch and water control, dump area preparation, overburden, pump house and fresh water supply, explosive storage, earthworks for the crusher, and other).

24.1.10.2 Construction Management Responsibilities

The Construction Management (CM) group (created by Matamec) will be responsible for the management of the construction site. The Construction Manager will be responsible for effectively planning, organizing, and managing the construction, schedule, budget, safety, and quality.

24.1.10.3 Construction and Project Plan

Before the execution phase begins, a Project Construction Plan will be prepared that will summarize site procedures and activities, including those for:

- Staffing;
- Organization;

- Project instructions;
- Document control and filling system;
- Daily, weekly, and monthly reports;
- Schedule;
- Site offices and temporary facilities;
- Other subjects.

24.1.10.4 Site Offices and Temporary Facility

The Construction Management site office will be located in the plan on the Kipawa site. Site installation and purchasing activities will be performed by Matamec's Construction Management Team. The Construction Plan will include a detailed list of requirements to be carried out to the following before mobilization:

- Site office space (including furniture, computers and accessories, alarms detections and all telecommunication services);
- Guard house and gate;
- Lunch room;
- Wash room and toilet for workers and water treatment;
- One GA drawing to specify where and what the sub-contractor can set-up their installations

Sub-contractors will provide their own on-site offices.

24.1.10.5 Site Management

Matamec will provide the Construction Manager, the Construction Leaders, the Health and Safety Agents and the Environmental Agent. The Resident Engineers will be provided by the engineer firm and consultant.

In addition, Matamec will provide field direction, as required, to the various sub-contractors and sub-consultants and will coordinate their work on the sites.

24.1.10.6 Construction Environmental and Health and Safety

From the beginning of construction, Matamec will provide one health services construction site equipped with today's standards for a nurse to provide first aid. The first aid station will be equipped and ready to handle most emergencies. An ambulance will be present which will be able to handle the access roads to the nearest hospital.

All aspects of construction environmental issues are addressed in Section24.2.2.

24.1.10.7 Quality Control Program

Subcontractors will be responsible for their own quality control as specified in the Terms and Conditions of their contracts. However, some quality control work will be performed by third parties during execution, and subcontractors will have to wait for results of tests before continuing work.

The project team will be responsible for ensuring that subcontractors follow their quality control programs. This will be achieved through the implementation of a comprehensive field quality assurance program. As appropriate, third parties will be used as part of the field quality assurance program for on-site testing and laboratory analysis.

With the quality control program in place, the transfer of the equipment from Construction to Operation will be simplified, and easy to track.

The method of transfer used, will be the one using the demonstration that equipment run adequately with expected performance and to be stable by Construction team before to give the equipment to Operation. A technical note will be written and a copy of this will be transmitted to Document Control.

The type of reception should be:

- Mechanical reception;
- Industrial reception;
- Test.

24.1.10.8 General Contractor and Third Party Relationships

Matamec focuses its attention to labour relations on all its projects. The Construction Plan will include a section regarding the labour relations, including:

- Instructions to Subcontractors;
- Site Regulations;
- Strikes and Workouts;
- Work Stoppages;
- Confidentiality.

24.1.11 Pre-Operational Verification

According to the internal review process (IRP's), each equipment must have Pre-Operational Verification (POV) and undergo an audit by discipline (checklist) and interdisciplinary.

Each POV should comply with the security procedure Health Safety and Security (HSS) and Matamec's Quality Control. Each checklist will be submitted to Document Control for traceability.

24.1.11.1 POV Objectives

Ensure that the scope of the POV is consistent with regulatory guidance and licensee commitments

24.1.11.2 POV Requirements

Review regulatory and applicable law, code and registration applicable. Verify that the POV have informatics addresses to answer adequately requirements and licensee commitments.

Verify that the licensee has a test procedure written, reviewed, and approved for each of the required systems/areas.

24.1.11.3 POV Guidance

The emphasis of this inspection procedure should be to ensure that a POV procedure has been written, reviewed, and approved in each of the required areas.

The team/inspector should ensure that the primal test procedures not specifically reviewed are included in this inspection procedure.

24.1.12 Risk Management

During the Preliminary Economic Assessment Study for Kipawa Project (PEA), a risk assessment was carried out following the Matamec's Risk Management Process. The assessment was updated during the Feasibility Study.

The project team will review all aspects of the Project throughout the developmental stage, inclusive of environmental, technical, health and safety, community, business, and project delivery issues. These reviews will identify the relevant risks and or opportunities associated with this Project, assess those risks and opportunities against the outcome objectives and determine mitigation strategies.

Section 24.3 covers the major risk identified during different phases of the project, and the best ways to mitigate or control those risks or take advantage of opportunities that may present themselves.

A project execution risk assessment will also be made before the start of the execution phase and a Risk Management Plan will be developed based on the results of the assessment.

24.1.13 Quality Assurance/Quality Control

Quality Assurance / Quality Control (QA/QC) will be applied to all levels of the Project. Quality assurance refers to the practice and application of standard processes, while quality control refers to the analysis of the results of those standards and the resolution of any issues that may arise.

All designs shall conform to the codes and standards applicable for the province, acts and organizations, with priority given to the more stringent requirements often in place within organizations.

24.1.13.1 Quality Plan

A Project Quality Plan will be developed by Matamec and by the engineering firm during detailed engineering to provide confidence through the establishment and implementation of systems and procedures, quality reviews, quality surveillance and audits of project quality functions. The Project Quality Plan will specify responsibilities and activities to be performed, according to Matamec's QA/QC reference documents.

The Project Quality Plan will cover all aspects of the project including:

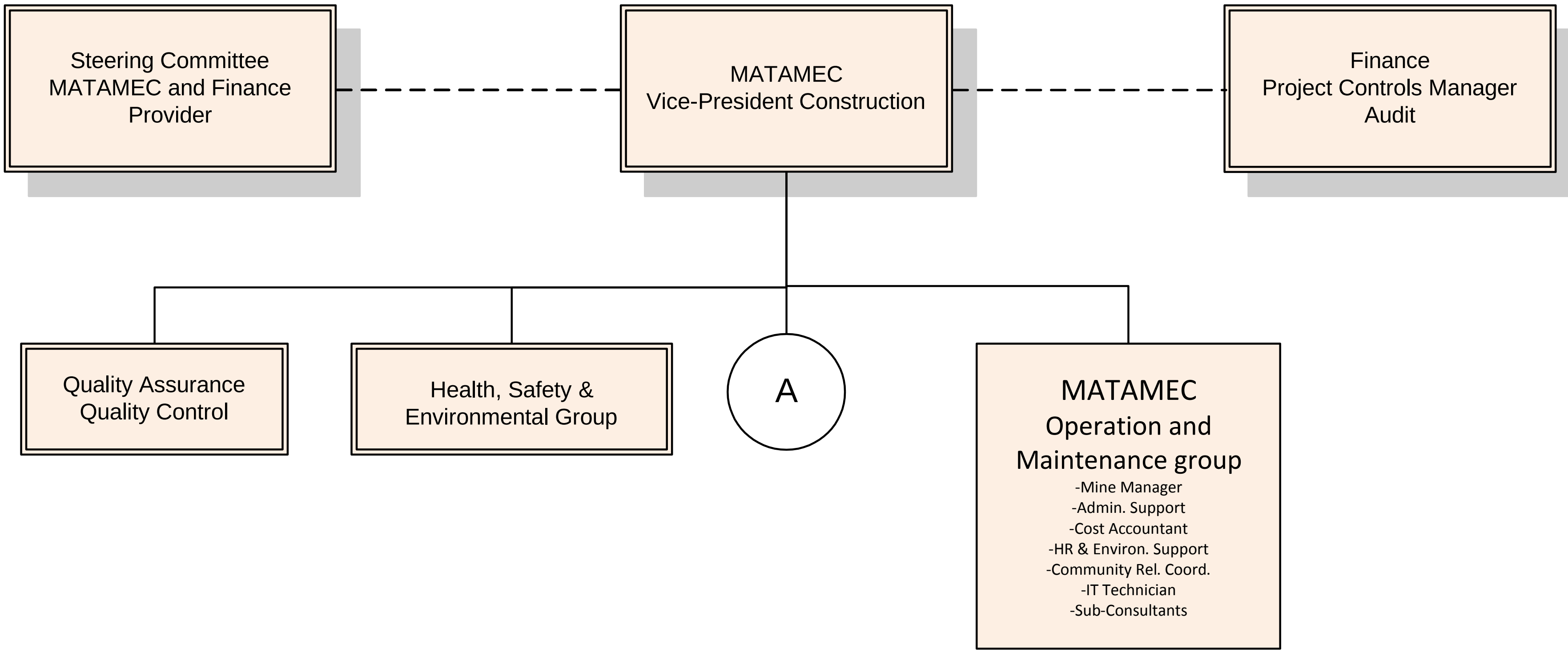
- Project Management and Controls;
- Planning and Scheduling;
- Cost Estimating;
- Cost Control;
- Cost Accounting;
- Document Control;
- Quality Assurance;
- Engineering;
- Procurement Management;
- Construction;
- Project Closure.

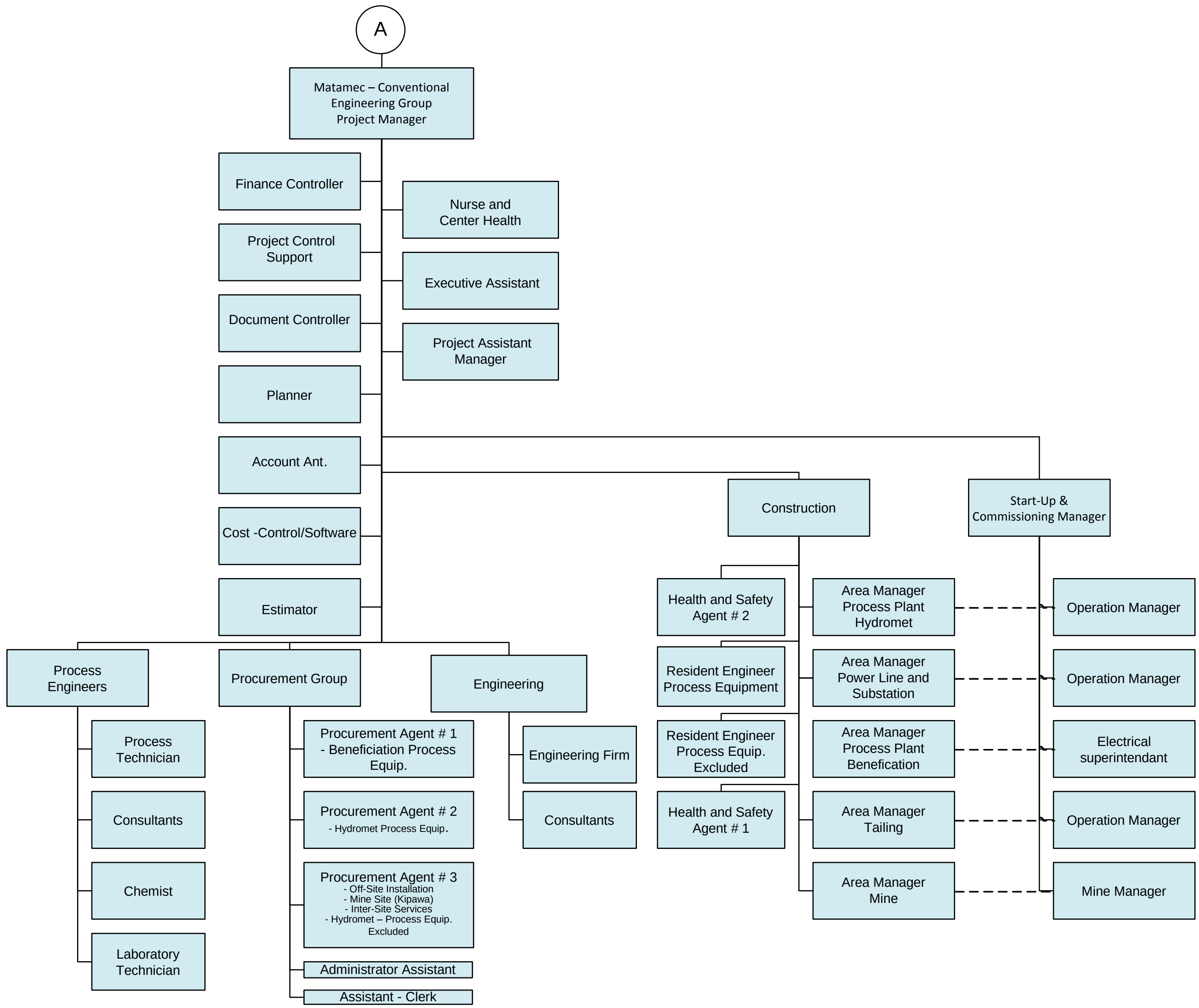
24.1.14 Project Organization

24.1.14.1 Organization Planning

The proposed Project Organization Charts are presented below. Matamec is the overall project manager team to assist the engineering firm during the engineering and construction phase. (see Appendix 6.3)

Figure 24.4 - Project Construction Management Organization Chart




A
Matamec – Conventional Engineering Group Project Manager
Finance Controller
Project Control Support
Document Controller
Planner
Account Ant.
Cost -Control/Software
Estimator
Nurse and Center Health
Executive Assistant
Project Assistant Manager
Construction
Start-Up & Commissioning Manager
Health and Safety Agent # 2
Resident Engineer Process Equipment
Resident Engineer Process Equip. Excluded
Health and Safety Agent # 1
Area Manager Process Plant Hydromet
Area Manager Power Line and Substation
Area Manager Process Plant Benefication
Area Manager Tailing
Area Manager Mine
Operation Manager
Operation Manager
Electrical superintendant
Operation Manager
Mine Manager
Process Engineers
Process Technician
Consultants
Chemist
Laboratory Technician
Procurement Group
Procurement Agent # 1 - Beneficiation Process Equip.
Procurement Agent # 2 - Hydromet Process Equip.
Procurement Agent # 3 - Off-Site Installation - Mine Site (Kipawa) - Inter-Site Services - Hydromet – Process Equip. Excluded
Administrator Assistant
Assistant - Clerk
Engineering
Engineering Firm
Consultants

24.2 Operating Plan and Human Resources

24.2.1 Human Resources

24.2.1.1 Organization Model

The overall organization will be constituted of three (3) main areas: mine, process plant, and administration. A General Manager will be at the head of the Kipawa operations and the people reporting to this person will be as follows:

- Mine & Maintenance Superintendent;
- Mine Technical Superintendent;
- Mill Superintendent;
- Administrative Superintendent;
- Human Resources Officer;
- Senior Environmental Engineer;
- Regional Public Relation Coordinator;
- Health and Safety Coordinators;
- Training Coordinator;
- Executive Assistant.

The mine department will include operations, maintenance, geology, and mine engineering. The process plant will involve both operations and maintenance, and will also have resources in health and safety as well as training. The assay laboratory will be part of this department. Site management, accounting, purchasing, warehousing, information technology services, surface crew operation and logistic, human resources, health and safety, environment and public relations will be part of the administrative sector.

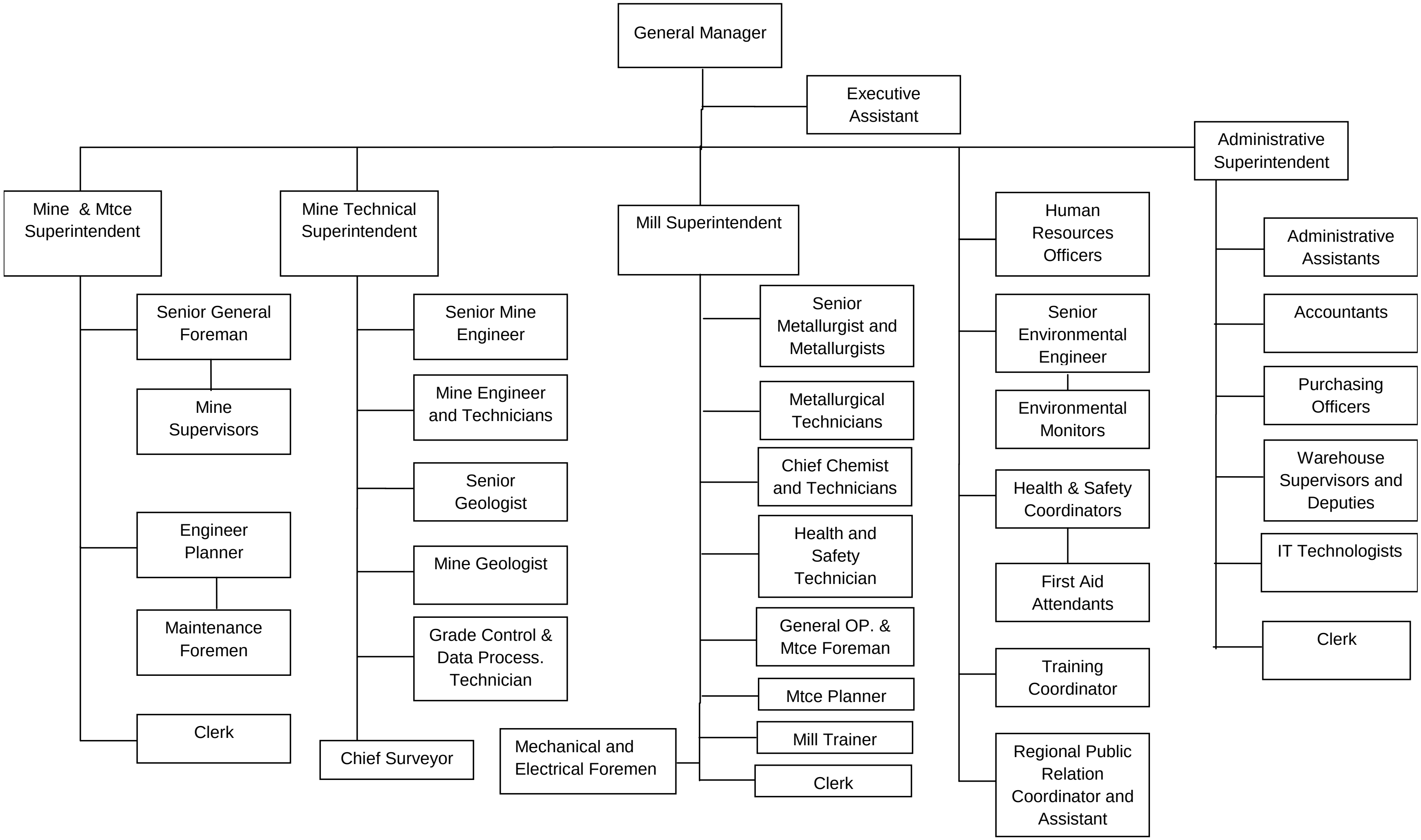
The organizational chart is presented on Figure 24.5.

The total workforce will include 229 employees. Table 24.4 below presents the manpower breakdown in the various departments.

Table 24.4 - Total Manpower

Departments	Staff	Hourly	Total
Mine:			
Operation	10	64	74
Maintenance	3	22	25
Geology	3		3
Mine Engineering	7		7
Sub-total	*23*	*86*	*109*
Process Plant:			
Operation	18	45	63
Maintenance	4	22	26
Sub-total	*22*	*67*	*89*
Administration	31		31
Total	**76**	**153**	**229**

Figure 24.5 - Organizational Chart



24.2.1.2 Recruitment and Training

Recruitment

Matamec will engage in a thorough recruitment and selection process in order to appoint the right people to the right jobs. It is very important to hire high quality employees because they can achieve the goals of the Company, and effective recruitment is beneficial to the organization because vacancies are filled quickly and performance is maintained.

First, through job analysis, Matamec will collect, analyse, and set out information about the content of jobs in order to provide the basis for a job description and data for recruitment.

This will involve job description, person specifications, and terms and conditions of employment. The job description will be a list of tasks, duties, and responsibilities that a job will entail. This will focus on the job purpose and duties, tools and equipment used, level of supervision, and how much the person supervises others or participation in team work. It will also include the job specifications like the knowledge, skills, abilities, and other characteristics required for a person to be qualified to perform the job successfully.

Person specification will also be an important part of the job analysis because it will aim at trying to find someone that will fit in the organisation, having the required competencies.

Finally, terms and conditions will also be part of the job analysis and this refers to the effort-reward relationship, and includes details on the hours to be worked, method of payment, job entitlements (holidays, allowances, etc.) as well as any other benefits.

Care will be taken to ensure criteria for hiring employees are in compliance with human rights legislation.

External recruitment will be the process used to hire people for the new mining operation of Kipawa and this will be done mainly via newspapers, internet (Company's own web page and commercial web sites) and recruitment agencies. Once Kipawa will be in operation, Matamec believes that building and maintaining a strong internal recruitment will help its organization to keep the best talents and allow employees to have a chance to apply for a new job position and change their career path when possible.

Training

Matamec recognizes that staff training will be a major priority for its Kipawa operations. The objectives of training and development are to ensure that all employees are given the necessary help and support to develop the knowledge, skills, and attitudes that they require to carry out their jobs efficiently, and to provide employees with every opportunity for career development. The organization carries out training both to satisfy its requirements as identified by management, and to fulfil the needs of the individual.

The responsibility of training will lie with all members of the management and supervisory team, who will be provided with the appropriate training in instructional techniques and coaching.

Formal appraisals will be conducted on a regular basis, at least once a year, to assess performance and potential for promotion and identify training needs. Each such appraisal will involve a face-to-face interview and discussion with the manager or supervisor. Job succession planning will be carried out and appropriate training given to develop potential before or immediately following promotion. Training records will be maintained to indicate the achievement of objectives and to assist in the identification of further training needs.

Induction training will be given to all new employees to familiarize them with the organization and indicate their place within it. The induction plan could include the following topics:

- Health and safety, hygiene and environment;
- Fire safety;
- Quality management system and quality policy;
- Skills needs assessment;
- Terms and conditions of employment;
- Job and place of work details.

For maintenance and development purposes, training will be provided on a regular basis to reinforce and update the understanding of the organization's objectives, policies and procedures. Where practicable, to encourage job satisfaction and maintain efficiency, staff will be trained in a variety of skills to achieve flexibility within departments and teams. All employees will be trained in health, safety, hygiene, and environment for the protection of the individual and to meet both the needs of the business and legal requirements.

Strategic training and development will be addressed by the senior team who will identify, on a yearly basis, the training that is needed to help the organization meet its goals and targets. This will be reviewed in line with the goals and targets on an ongoing basis.

Personal development will also be taken into account as further education for job-related items will be considered an important element. The use of external facilities, which could include colleges, universities, and correspondence courses, will be encouraged.

The organization's training program will prioritize maintenance training first, strategic second, and personal development third.

24.2.1.3 Employees and Labour Relations

The Kipawa operation will be non-unionized. Within that environment, Matamec will develop human resources policies and practices to maintain harmonious working relationships between departments, managers, and individuals. This will include employee communications, managing organization change, absenteeism, sexual harassment, as well as employment equity and diversity.

Recognizing that its employees are its most valuable resource and are entitled to quality internal communications, Matamec will keep employees informed and up-to-date about the Company's initiatives, departmental plans and progress, human resource developments, and overall Company's progress through a comprehensive internal communication process. Communication will aim to create a climate of understanding, commitment, and support that will contribute to the success and effectiveness of the organization's HR program and activities.

The organization will strive to put in place an equitable employment system that will be fair for all, that will operate on merit, and that will avoid situations, policies and/or practices which will unfairly exclude members of designated groups (women, visible minorities, First Nations persons, and persons with disabilities) in the workplace. Barriers like sexism, racism, prejudices, lack of access to education or training, lack of awareness of cross-cultural issues (particularly in communications), etc., will be eliminated.

Furthermore, through employment diversity, Matamec will recognize the contributions that individuals from diverse groups can bring to the organization. This will facilitate the exchange of new perspectives, improve problem solving by inviting different ideas, and create a respectful, accepting work environment. A diverse workforce will also help productivity and creativity.

24.2.1.4 Compensation Plan

A well-designed compensation plan will be put in place with the objective of motivating employees, controlling compensation costs, and ensure equity in this increasingly competitive environment.

To ensure both internal (within the organization) and external equity (on the market), Matamec will establish an effective compensation administration program and will conduct:

- Job analysis that will analyze and describe each job in the organization;
- Job evaluation that will determine what jobs are worth on an absolute basis and relative to other jobs in the organization;
- Job pricing that will determine rate ranges, minimum, midpoint and maximum dollar values for each labor grade.

Meaningful benefits that help in recruiting and retaining employees will be provided to employees. Strategic planning will focus on the following activities to build a competitive benefits package:

- Evaluation of benefits offered by other employers on the market;
- Identification of Matamec's corporate objectives;
- Coordination of benefit strategies with the other compensation and human resources programs;
- Design a communication plan.

A variable compensation plan will be developed and will be based upon group/team performance related to objectives to achieve for production, health and safety, environmental control, etc. The details of this plan remain to be determined and provisions are included in the operating costs through the fringe benefits.

24.2.2 Health, Safety and Environment

24.2.2.1 Introduction

Matamec is committed to protecting the health and safety of workers and the public, as well as safeguarding the environment influenced by Matamec's activities for its Kipawa project. Matamec considers that these areas are of paramount importance and believes that excellence in health, safety, and environmental practices is essential to the well-being of Matamec' organization.

24.2.3 HSE Risk Identification, Assessment and Management

At the outset of the feasibility study for its Kipawa project, Matamec undertook a thorough risk assessment to identify, understand, evaluate, and eventually mitigate or control risks when in operations. The objective is to ensure sustainability to Matamec' activities right from the beginning of the project.

Matamec will keep maintaining procedures to identify systematically the hazards and effects which may affect or arise from its activities, and from the materials which are used or encountered in them. The identification should include consideration of:

- Planning, construction and commissioning;
- Routine and non-routine operating conditions, including shut-down, maintenance, and start-up;
- Incidents and potential emergency situations;
- Decommissioning, dismantling, and disposal;
- Potential hazards and effects associated with past activities.

Procedures will be implemented to assess risks and effects from identified hazards, taking into account the probabilities of occurrence and severity of consequences for people, environment, and assets.

Matamec will maintain procedures to document hazards and effects identified as significant in relation to health, safety, and environment, outlining the measures in place to reduce them and identifying the relevant HSE critical systems and procedures.

Various measures to reduce risks and effects will be selected, evaluated, and implemented.

24.2.3.1 HSE Engineering and Design Considerations

One of the best ways to prevent occupational injuries, illnesses, and fatalities, as well as environmental hazards, is to eliminate hazards and minimize risks early in the design or redesign process, and incorporate methods of safe design into all phases of hazard and risk mitigation. Therefore, Matamec's objective is to include prevention considerations in all designs that impact the workers, the public, and the environment by:

- Eliminating hazards and controlling risks to an acceptable level at the source or as early as possible in the life cycle of equipment, products, or workplaces;
- Including design, redesign, and retrofit of new and existing work premises, structures, tools, facilities, equipment, machinery, products, chemicals, work processes, and organization of work;
- Including prevention methods in all designs.

24.2.3.2 Change Management

Change management will be implemented according to the following four steps:

- Motivate change in creating awareness and willingness to change:
  - Matamec will create awareness on the problems and opportunities in the organization and get people convinced of the necessity to change and to establish a sense of urgency;
- Organize the transition in creating commitment to change:
  - A commitment to change will be put in place throughout the organization as a concrete plan will be produced with the different steps to follow in order to get to the desired change;
- Implement change in developing the ability to change:
  - Employees will be supported during the change process as stakeholders should get confident and have faith that the change can and will be done;

- Consolidate change in putting in place new approaches:
  - – The change progress will be monitored as well as the people's attitude and behaviour in order to determine if the organization is going in the right direction towards the vision. The new achievements will be followed up, shared with people and successes will be celebrated.

24.2.3.3 Health, Safety and Environment Management

Construction

To properly prepare for the construction phase, the bid package will include a detailed description of Matamec's health and safety requirements for all contractors and subcontractors. Including these requirements in the bid package will ensure that the contractors are aware of them and will also show how Matamec is serious about them.

The pre-bid documents will include items such as:

- Requests for clearance certificates, liability insurance, and health and safety records;
- Written confirmation that the contractors will comply with Matamec's health and safety programs;
- Copies of contractors' health and safety programs;
- Designation of competent supervision;
- Request to conduct inspections, investigations, orientations (specified times);
- A description of the lines of communication;
- Penalties for non-compliance;
- Any other items that will be deemed necessary.

Before or at the beginning of construction, Matamec will ensure that:

- There is clear emergency routes and that the general public is protected from the site hazards;
- The work areas have adequate lighting;
- Workers go through site orientation sessions;
- Workers have easy access to documents like:
  - – Various manuals;
  - – Manufacturers' instructions;
  - – Engineering reports;
  - – Safe operation procedures;
  - – Hazards assessments;
  - – Site-specific procedures.

As construction proceeds, Matamec will:

- Conduct both scheduled and unannounced inspections;
- Review accident/incident investigation reports;

- Ensure corrective action is taken for any problems;
- Monitor and measure both progress and results.

Matamec will ensure that everyone working on-site will have - at the very least - the minimum mandatory training necessary, which includes both Matamec's and contractors' employees. The company site supervisors will ask for records of training or any other proof from contractors or subcontractors.

Matamec site supervisors will be provided with resources and will be assisted with their health and safety responsibilities. They will be helped to ensure and/or enforce workers' compliance with Matamec's health and safety policy.

Operation

For its operations, Matamec will meet or exceed the requirements of the Environmental and Occupational Health and Safety legislation, and therefore will:

- Implement and maintain effective health, safety, and environmental management systems that drive continuous improvement by:
  - Training employees to carry out their jobs safely and productively. No employees will be permitted to commence a job without the required training;
  - Maintaining a high degree of emergency preparedness;
  - Requiring that contractors and suppliers comply with all health, safety, and environmental standards;
  - Investigating the causes of accident and incidents, and developing effective and immediate preventative and remedial action;
  - Measuring safety, health, and environmental performances, and making improvements as warranted.
- Maintain transparent, consultative relationships with all stakeholders through proper communication channels.

Matamec will also put in place procedures to establish HSE objectives and performance criteria at relevant levels as well as plans to achieve these objectives and criteria. A system of records will be maintained in order to demonstrate the extent of compliance with the HSE policy and its requirements, and to record the extent to which planned objectives and performance criteria will have been met. Matamec will define the responsibility and authority for initiating investigation and corrective action in the event of non-compliance with specified requirements, its operation or its results.

The Kipawa deposit contains some thorium and uranium based radioactivity. Such materials are termed NORM (Naturally Occurring Radioactive Material) and established guidelines for handling and for limiting exposure of radioactivity to people, exist. As a result, a radiation protection plan will be developed and implemented for the Kipawa site. Furthermore, measures will be taken to protect people and the environment from dispersion of and exposure to radioactive ores, concentrates, and wastes. These measures will use proven technologies. A report was prepared on this issue by SENES Consultants Ltd, ''Evaluation and Management of Radioactivity for the Kipawa Rare Earth Project'', December 2012.

24.2.3.4 Emergency Response Plan

Matamec's Emergency Response Plan will be an operation's guide to all procedures and courses of action that should be followed in the case of a mine site emergency or emergency on access road to the mine site. It will identify those responsible for taking action immediately after the discovery of and during the response to an emergency, as well as their respective duties.

Development of the plan will require a firm commitment to pre-planning on behalf of management, preparation of a plan and training of personnel. The contents of the plan will include procedures and information on equipment, training, and personnel, and some of the items that will be addressed are as follows:

- Policy directive;
- Mine Emergency Response Plan coordinator and planning group;
- Emergency identification, prevention, and protection;
- Emergency operation centre;
- Duties and responsibilities of personnel;
- Action plans;
- Evacuation plan and map of escape routes;
- Mutual aid agreement with other operations;
- Communication services;
- Training plan;
- Practice session plan;
- Plan for review and updating;
- Costs.

24.2.4 Conditions of Employment

Matamec will put in place a policy on conditions of employment which will provide direction to all departments that will ensure the equitable, accurate, consistent, transparent, and timely application of conditions of employment across the organization.

Human resources people will ensure that the organization structure, resources, systems, and controls are in place to provide adequate and effective administration in accordance with the appropriate authorities. The supervisors will make sure that the appropriate documentation is conveyed to the human resources department and that the information is also properly distributed to the employees relative to their conditions of employment.

The main items covered by the policy will be as follows:

- Remuneration
  - Entitlement;
  - Rate of pay;
  - Revision to pay rates;
  - Pay increments;
  - Hours of work;
  - Overtime.
- Pay Administration
  - Bi-weekly pay;
  - Direct Deposit.
- Temporary and Permanent Employment
  - Vacations;
  - Bereavement leave;
  - Sick leave.

24.2.5 Supply and Logistics

The operation of the Kipawa site will require the utilization and consumption of various energy and chemical products, as well as other types of consumables, most of which will be delivered in bulk to the operating site.

A minimum level of logistics will be required to ensure continuous and effective operation of the Kipawa site throughout the entire mine life. Most of these products and consumables needed for the operation of the site will be transported over long distances and therefore the implementation of appropriate logistics will be very important.

First, procurement logistics will be in place and will consist of market research, operation requirements planning, suppliers' management, ordering, and order controlling. The objective will be to maintain the autonomy of the operation and minimizing procurement costs while maximizing security within the supply process.

Production logistics will ensure that each operating unit will be supplied with the right products and consumables in the right quantity and quality at the right time. The ultimate objective will be to streamline and control the flow through value - adding processes and eliminate non-value adding processes.

A proper warehouse management system will also be set up in order to adapt to any situation that can arise by making a last-minute decision based on current activity and operation status.

24.2.6 Operations Cycle

A total of 229 employees are required for the Matamec Kipawa Project. This is considering the mine and the plant running 24 hours a day, 7 days a week, 52 weeks per year. The detailed number of employees and position sub-groups: Mine employees, Process Facilities employees, and Administration staff are presented in Section 21.2.2.2 of the report.

The working schedule for most yearly compensated employees will be a standard 40 hours per week, 8 hours per day, 5 days per week, Monday to Friday. Some yearly compensated employees will be on the same working schedule as the hourly workers (84 hours per 2 weeks).

The hourly workers will be working 12-hour shifts as part of a two-week repeating schedule; the first week working 4 days followed by 3 days off, the second week working 3 days followed by 4 days off.

Activities that require 24 hour per day operation will be split in 4 shifts of workers working 12-hour shift. These activities are the mine operation, process facilities operation, tailings operation and the assay lab.

Mine maintenance, ore hauling between HGF and the crusher, and crusher operation require 12 hour per day operation, which is split in 2 shifts of workers working 12-hour shifts. Mine maintenance will be ensured 24/7 by two 12-hour shift mechanics.

24.3 Risk Assessment and Management

24.3.1 Introduction

Risk assessment is the process of identifying, describing, and evaluating the potential risks that can affect the project at any phase, which can be either threats (negative impact) or opportunities (positive impacts). Risk management involves risk assessment and prioritizing and managing risks, as well as assigning ownership of the risk to an involved party, and the selection of a management strategy. Risk management is a continual process performed throughout the different phases of the project. The purpose of risk assessment and management is to decrease the likelihood and impact of threats that can affect the project, as well as to maximize the potential opportunities. This process guides and maximizes the performance of an organization and the performance of the people working to ensure its success.

24.3.2 Scope

The scope of the risk management process for Matamec includes all risks which might arise throughout the full life-cycle of the project; from feasibility study to mine closure. The scope is comprised of credible risks (both threats and opportunities) concerning the process, execution, and financing, as well as the Owner's risks.

The Risk Analysis for this Project was performed by Roche and Matamec. The Risk Register (Appendix 7.1) was created with the contribution of experts from several professional service firms (Genivar, Golder, SGS Geostat, and Senes). The Risk Register was developed in order to be used continuously throughout the life of the project, and includes risks that can occur at any phase of the project.

Seventy-one (71) risks have been evaluated in this Study, with mitigation plans created for eight (8) risks of varying importance and areas of impact. In future phases of the project, the Risk Register will be expanded and the remaining risks will be developed and managed.

24.3.3 Methodology

24.3.3.1 Risk Identification

Risk Identification is the process of examining all aspects of the project and identifying all possible threats and opportunities for the project. This process was carried out with the contributions from professionals from the following: Matamec, TRECan, Roche, Genivar, Golder, SGS Geostat, and Senes; all of whom have an overall understanding of the Project and also an insight into one or more of its technical and managerial aspects.

Risks were identified for the current phase of the project, as well as for all subsequent phases of the Project: (1) Engineering and Permitting, (2) Engineering, Procurement, and Construction, (3) Mine Operation, and (4) Mine Closure and thereafter. For the risk identification performed during this phase of the project, the risks were classified into the categories shown in Table 24.5, and abbreviations were used to number the individual risks. Risks were assigned to more than one category depending on how they were considered (for example, a chemical spill could be an operational risk, people risk, reputation risk, legal risk, etc.)

A Workshop was held in Montreal on October 23rd, 2012, with the aforementioned contributors present. Prior to the workshop, the risk identifications forms were completed by the participants and used to create the Risk Register (Appendix 7.2, 7.3 and 7.4). The Risk Register was expanded during the workshop (Appendix 7.5), and some risks were evaluated and described. The objective of the meeting was to share information, explanations, and suggestions on risks, their causes, and their impacts, as well as to assess some risks, to discuss means to manage them, and to brainstorm idea and new risks.

Table 24.5 - Risk Classification Categories with Abbreviations

Category	Abbreviation
Commercial (clients, market, competition, etc.)	COM
Communications (stakeholders, governments, communities, etc.)	COMM
Environmental (weather, earthquake, etc.)	ENV
Financial (credit, exchange rates, financing)	FIN
International relations (relationships among countries, intercultural issues, etc.)	INT
Legal (contracts, laws, suit etc.)	LEG
Operations (plant operation, construction, closure, admin., damages to environment, etc.)	OPS
People (human resources, citizens, communities)	PEO
Political (variety of government levels and authorities involved)	POL
Regulations	REG
Reputation (Matamec, Toyota, TRECan, managers, mining industry, project, etc.)	REP
Other (multiple origins or impacts)	ALL

A condensed version of the Risk Register will be explained and presented in Section 24.3.4, Table 24.10 (Appendix 7.6).

Risk Identification, Assessment, and Management is a continuous process which will continue throughout the life of the project. All information presented in this report is valid for this stage of the process, but can change and be developed as the project progresses.

24.3.3.2 Risk Evaluation and Assessment

Risk evaluation is performed in order to assign values to each risk, and ultimately to categorize and prioritize the risks. Risks were evaluated according the following criteria:

- The Financial Impact - the financial cost or benefit that the risk can cause
- The Likelihood - the probability that the risk impacts the Project
- The Detectability - the capability to see a risk that can impact the Project

For each risk evaluated, an assessment rating was determined for each criterion based on experience. The assessment ratings for each criterion as determined by Matamec and Roche can be seen in Table 24.6, Table 24.7, and Table 24.8 for Financial Impact, Occurring Probability, and Detection Facility, respectively.

The Risk Value was calculated as the product of the three aforementioned criteria ratings:

Financial Impact X **Occurring Probability** X **Detection Facility** = **Risk Value**

For example, Risk XYZ could have (A) Financial Impact of between 10-25 million dollars (moderate), giving it a rating of 3; (B) Very low chance that it occurs, giving it a occurring probability rating of 1.5; (C) Detectability rating of 5 because it is undetectable; and finally (D) the Risk Value is therefore: 3 x 1.5 x 5 = 22.5

Table 24.6 - Financial Impact Assessment Ratings

Financial Impact: Financial Cost or Benefit if the Risk Occurs		**Rating**
Very High	Over $50 million	5
High	$25 million to $50 million	4
Moderate	$10 million to $25 million	3
Low	$3 million to $10 million	2
Very Low	Less than $3 million	1.5

Table 24.7 - Occurring Probability Assessment Ratings

Occurring Probability: A chance that the risk impacts the Project		**Rating**
Very High	Over 50% chance	5
High	50% chance	4
Moderate	25% to 50%	3
Low	2 to 25%	2
Very Low	Less than 2%	1.5

Table 24.8 - Detection Facility Assessment Ratings

Detection Facility: Capability to identify see the risk coming		**Rating**
Undetectable	No way to see it coming	5
Hard	Poor access to information	4
Moderate	Good access to information	3
Easy	Very good access to information	2
Very easy	Rigorous follow ups	1.5

A Committee ("the Committee") composed of experts from Matamec and Roche was created to carry out the description, evaluation, and management of the risks. The Committee evaluated 71 of the risks identified, with the remaining risks to be evaluated in the following phases of the project (Appendix 7.7, 7.8 and 7.9). The selection of the 71 risks was performed by Matamec based on the following criteria: (1) the nature and the issues of the current phase in the overall Project; (2) the availability of time; (3) the availability of human resources; and (4) the elimination of duplicate risks.

Each of the 71 risks identified was reviewed by the Committee. Risk descriptions were developed, describing why the risks can occur. The timing of each risk was identified; where each risk could occur during one or more of the following phases: (1) Before end of the Feasibility Study, (2) Engineering and Permitting; (3) Engineering, Procurement, and Construction; (4) Mine Operation; and (5) Mine Closure and Thereafter. The risks were then evaluated with the procedure described above, with justifications for each assessment rating.

24.3.3.3 Risk Prioritization and Importance

The evaluation described in Section 24.3.3.2 was used to illustrate the four (4) Risk Priority zones of the project at this moment:

- High;
- Important;
- Medium;
- Low.

Risks are assigned to a Risk Priority Zone (or Importance) based on the Risk Priority Matrix shown in Table 24.9. The horizontal and vertical axes of the matrix represents the Risk Value and the occurring probability, respectively. Risk Values are grouped into two groups depending on their score, values from 0 to 24 and values from 25 to 125. Risks Occurring Probabilities are also grouped into two groups depending on their score, 1.5 and 2 in one group and 3 to 5 in another group. Thus, four (4) quadrants representing the Risk Priority in which all risks are positioned are obtained.

Table 24.9 - Risk Priority Matrix

		Risk Value	
		[0 - 24]	[25 - 125]
Occurrence	[3 - 5]	Medium	High
	[1.5 - 2]	Low	Important

Section 24.3.5 shows the distribution of all 71 evaluated Risks in the Risk Priority Matrix with an illustration of the financial impacts of the Risks, as well as Risk Priority Matrices of the original Risks Categories regrouped into 4 categories: (1) Operational Risks; (2) Financial and Commercial Risks; (3) People and Communication Risks; and (4) Legal, Regulations, Political and Other Risks.

24.3.3.4 *Risk Ownership and Management*

The Risk Owner is a person or a group of people responsible for the Risk with the authority to manage it.

The current Executive Manager of Matamec has been assigned as Owner to all 71 risks except for two which will eventually be owned by the Mine Manager when aboard. In many cases, people or professional services firms were identified to collaborate with the Owner for the management of the Risk. In other cases, the Owner will determine later to whom he could delegate some responsibilities and ask for collaboration where required.

Risk management strategies include: to mitigate, to transfer, or to accept. For the current phase of the project, the Committee decided that eight (8) of the 71 risks could not be left unmanaged, with the remaining risks to be managed in future phases of the project. The eight (8) risks were chosen to be mitigated based on their timing and significance for this phase of the project, rather than the Risk Priority explained in the previous sub-section. The remaining risks will be managed in another phase of the study.

First level mitigation action plans were outlined for each of the eight (8) selected risks them as showed in Section 24.3.5. The selected risks are composed of four (4) high priority risks, one (1) important priority risk, zero (0) medium priority risks and three (3) low priority risks.

24.3.4 RISK REGISTERS

The following table, Table 24.10, shows the risk register, containing the 71 evaluated risks, their Risk ID, as well as their importance. The Risk ID is the identification number given to the risks in the early stages of risk identification, including the category abbreviation as described in Section 24.3.3.1 and Table 24.5. The Importance listed in Table 24.10 refer to the Risk Priority Zones as explained in Section 24.3.3.3 and in the Risk Priority Matrix, Table 24.9

Table 24.10 - Risk Register of the 71 Evaluated Risks, with their Importance

Risk ID	Risk	Importance
Commercial Risks		
COM01	Major decrease in demand of final product in the long term (quantity) (REE)	Important
COM01A	Major increase in demand of final product in the long term (quantity) (REE)	High
COM01B	Increase in the global supply of the final product in the long term (quantity) (REE)	Medium
COM02	Change in final product specification (quality)	Low
COM03	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)	High
COM07	Matamec - TRECan (Toyota Rare Earth Canada) partnership broken and no off-take agreement with Toyota Tsusho before construction	Medium
COM07A	Partner takes only select REEs (-)	Low
COM07B	Partner takes only select REEs and Matamec invests to further separate the REEs	Low
COM09	Substitutes to replace REE for magnets and other products during the life of mine	Low
COM10	Market is taken by other producers before start-up	High
Communication Risks		
COMM01	Social non-acceptability in regard of radioactivity	Low
COMM02	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	High
COMM04	Focus on opponents and neglect the favourable stakeholders	Low
COMM07	Bad media coverage before construction	High
COMM05	Interpretation of technical information/data/documents distributed to all stakeholders	Low
Financial Risks		
FIN01	Project Financing - availability of investors (other than offtaker)	Medium
FIN02	Changes in capital allowances	Low
FIN03	Exchange rate fluctuations	Low
FIN08	Matamec bought-out by a rival REE project	Low
FIN09	Over evaluation of CAPEX	Low
FIN09A	Under evaluation of CAPEX	Low
FIN10	Over evaluation of OPEX	Low
FIN10A	Under evaluation of OPEX	Low
FIN11	Project financing delayed by 2 years	High
Legal Risks		
LEG01	Delay in signature of Impact and Benefit Agreement with First Nations	Low
Operational Risks		
OPS03	Acid/Chemical Spills	Low
OPS06	Loss of electrical power (less than a week)	Low
OPS06A	Availability of electrical power	Low
OPS15	Contamination, Ground water	Low
OPS16	Contamination, Radioactivity	Low
OPS17	Contamination, Surface water	Low
OPS21	Damages to environment due to dust	Low
OPS22	Delays in equipment delivery (more than 2 weeks than the anticipated delivery date)	Low
OPS33	Major failure in open pit (wall failure)	Low

Risk ID	Risk	Importance
OPS35	Delay to obtain permits	Low
OPS37	Final flowsheet needs major modifications after pilot plant has run	Low
OPS38	Major fire impacting the operation for several weeks (fuel, conveyors, electrical room, etc.)	Low
OPS39	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations	Low
OPS40	Geotechnical evaluation is insufficient; causing improper wall angle	Low
OPS41	Grade control process in the mine is insufficient	Low
OPS42	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill	Low
OPS44	Ore silica content variations might cause gypsum filtration problems (Process)	Low
OPS46	Head grade variation which can cause ore recovery variation	Low
OPS48	High amount of fines generated from grinding which can cause higher mass recovery than expected in the beneficiation process	Low
OPS49	High radionuclide emission at the waste rock dump	Low
OPS50	Higher radioactivity in the process plant tailings than anticipated	Low
OPS58	Long term legacies after closure	Low
OPS60	Hydrometallurgical plant recovery lower than expected	Low
OPS61	Beneficiation plant recovery is not as expected	Low
OPS62	Mill efficiency affected by geological variability	Low
OPS69	Ore reserve calculation (ore tonnage and/or grade are lower than expected)	Low
OPS72	Piping failure from mills to tailings	Low
OPS72A	Other piping failures	Low
OPS97	Tailings dams leaks (minor)	Low
OPS97A	Tailings dams break (major)	Low
OPS102	Traffic Accident on access road	Low
OPS111	All worker injury, fatality or disability	Medium
OPS112	Visitor injury, fatality or disability	Low
People Risks		
PEO01	First Nations experts review the ESIA report	Low
PEO02	Availability of personnel, skilled people, qualified labor	Low
PEO04	Departure (loss) of key Matamec people during project preparation	Low
PEO07	First Nation socio-economic and land use assessment	Low
PEO10	Negotiation with local First Nations	Low
PEO14	Bad Perception of the community concerning Uranium/Thorium	Low
PEO16	Project to be rejected by local communities	Low
PEO18	Public pressure to have “Gold-Plated” waste management	Low
Political Risks		
POL01	Increase in municipal taxation	Low
POL02	Changes in laws (mining, environmental, etc.)	Medium
POL04	Election in the First Nations communities	Low
Regulation Risks		
REG01	Changes in regulations (mining, environmental, etc.)	Medium
Other Risks		
ALL03	Location of infrastructures and facilities including hydromet plant apart from beneficiation plant or not.	Low

24.3.5 Mitigation Actions and Risk Priority

24.3.5.1 Mitigation Actions

In this phase of the project, eight (8) risks could not be left unmanaged. As mentioned in Section 24.3.3.4, mitigation actions have been developed for the eight (8) risks to be managed presently. Table 24.11 shows the mitigation plans developed for the risks identified as being the most critical in the current and subsequent phase of the Project (Appendix 7.10).

The eight (8) risks are composed of four (4) high priority risks, one (1) important priority risk, zero (0) medium priority risks and three (3) low priority risks. Furthermore, the eight (8) risks are classified as follows: four (4) Commercial Risks, two (2) Financial Risks, one (1) Operation Risk, and one (1) People Risk.

Mitigation actions will be developed for the remaining risks in further phases of the project.

24.3.5.2 Risk Priority

Charts have been created to give a visual representation for the 71 risks evaluated in this study superimposed on top of the Risk Priority Matrix as seen in Table 24.9, Section 24.3.3.3. The charts show Risk Value versus Occurrence Probability with the size of each point being proportional Financial Impact. The background indicates the Risk Priority: Red, Yellow, Green, and White are High, Important, Medium, and Low priority, respectively.

The risks have been broken up into four charts. Note that there are many points that overlap, thus the points have been made transparent.

Table 24.11 - Mitigation Actions for the Eight Selected Risks

Risks		Mitigation Actions
HIGH PRIORITY RISKS		
(1) COM03	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)	Have Matamec management do the following: 1. Work with well-recognized firms in order to obtain best possible projections of REE prices 2. Verify REE price predictions with client(s) on a continual basis 3. Stay fully informed of changes in the metal market by every available means
(2) COM10	Market is taken by other producers before start-up	Avoid delay in Project by having Matamec management do the following: 1. Develop financing and commercial agreements with TRECan 2. Develop continuous relationships with other potential investors 3. Keep constant good relationships with local communities 4. Continuously inform all level of governmental authorities about the Kipawa Project 5. Finalize permit applications and maintain constant follow ups with government authorities
(3) COMM02	Conflict between stakeholders (communities, First Nations, ZEC) and promoter (Matamec)	Have Matamec management and representatives do the following: 1. Keep constant presence locally to inform citizens about the Project and about new important developments that can impact them, and to be informed about and to feel the reactions to the Project 2. Maintain constant negotiations with First Nations representatives in order to finalize appropriate agreements regarding progress of the Project 3. Participate in and initiate as much as possible educational and awareness activities regarding environmental issues and management 4. Whenever feasible, take local representatives to visit similar operations in order to better understand the nature of the Project

Risks		Mitigation Actions
(4) FIN11	Project financing delayed by 2 years	Have Matamec management do the following: 1. Work intensively on the completion of the offtake agreement with client(s) 2. Finalize the documentation for permit applications until November 2013 3. Communicate continuously with local communities
IMPORTANT RISKS		
(5) COM01	Major decrease in demand of final product in the long term (quantity) (REE)	Have Matamec management do the following: 1. Negotiate offtake agreement with client(s) including clauses that protects Matamec for a number of years against potential drops in demand of REE 2. Stay aware of technological developments that can impact demand of final product 3. Keep contacts with potential new clients 4. Optimize operating cost with talented key people recruited to lead the operation 5. Demonstrate REE mining can be as clean as any other responsible mining operation 6. Develop a first class health and safety programs for the people working on site and for the population 7. Develop first class environmental controls that will minimize any impact on workers, population, and environment 8. Establish a sound communication program for people working on site and for the population in order to inform them and raise their awareness concerning the nature of a mining operation in 2015
LOW PRIORITY RISKS		
(6) FIN09A	Under evaluation of CAPEX	Have Matamec management do the following: 1. Finalize agreement with major equipment suppliers as soon as possible and before March 2014, with a letter of intent signed by both parties 2. Increase geotechnical field investigation in order to secure concepts and costs related to civil works, to be done by the engineering firm that will perform the detailed engineering studies (May or June 2014)
(7) OPS50	Higher radioactivity in the process plant tailings than anticipated	Have Matamec management do the following: 1. Perform all proper characterization test work on the process plant tailings 2. Establish a double check program on the primary test work and on the sampling method to confirm first results showing a very low level of radioactivity and a low difficulty of managing it 3. Hire a specialist in radioactivity to analyse the test work results and compare them to other mining operations which deal with radioactive elements 4. Establish proper radioactivity management with a specialist
(8) PEO14	Bad Perception of the community concerning Uranium/Thorium	Have Matamec management do the following: 1. Finalize studies regarding U/Th in order to obtain real analysis result numbers 2. Communicate to the citizen with the right pedagogy the information regarding U/Th final analysis results, assuring their proper understanding of the low or non-existing radioactivity contamination risk (since it is a rare earth project, not an Uranium project) 3. Assign a communication firm to establish a communication program, test it with a pilot group, and then disseminate it

Figure 24.6 - Operational Risks Evaluated in this Study

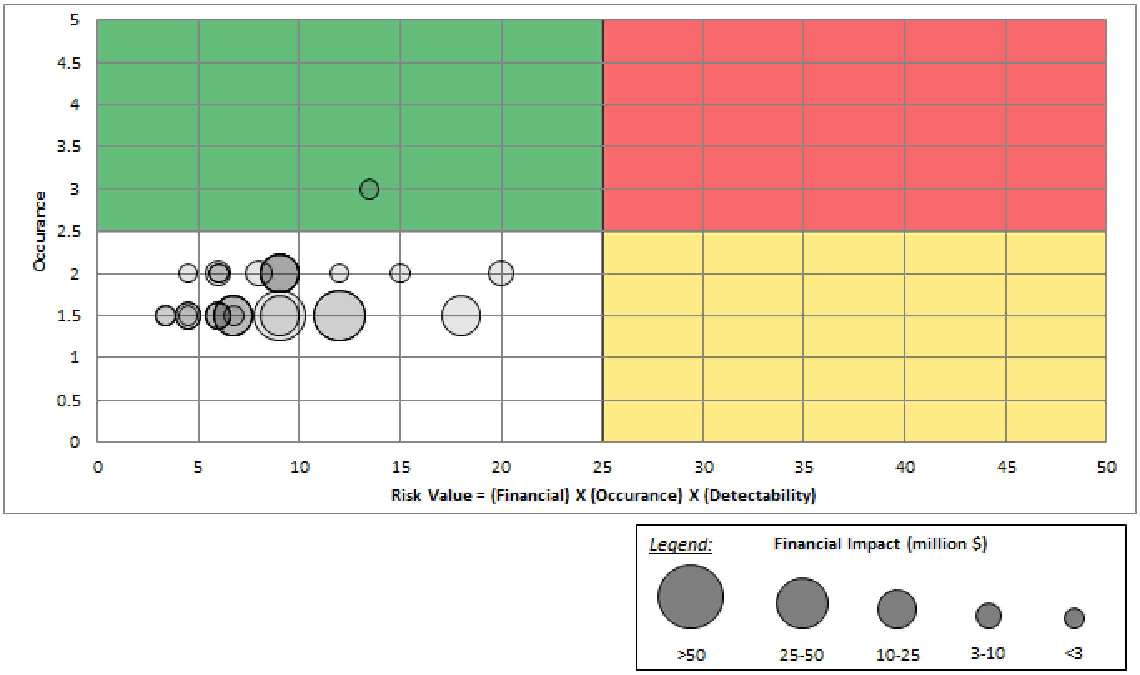


Figure 24.7 - Financial and Commercial Risks Evaluated in this Study

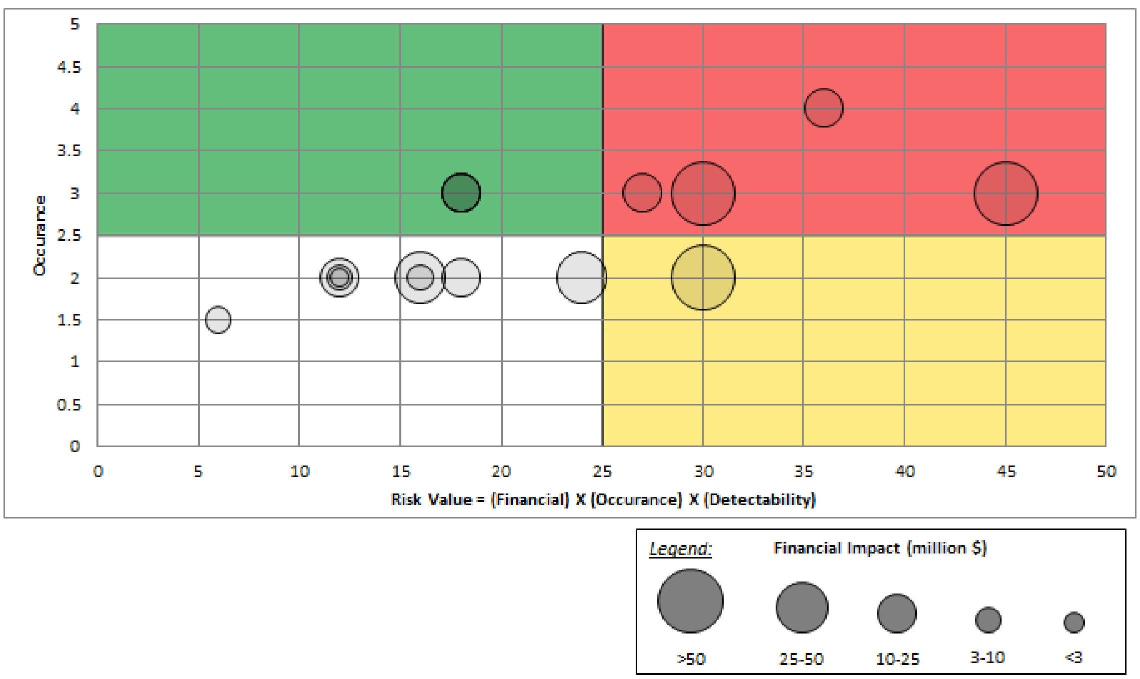


Figure 24.8 - People and Communications Risks Evaluated in this Study

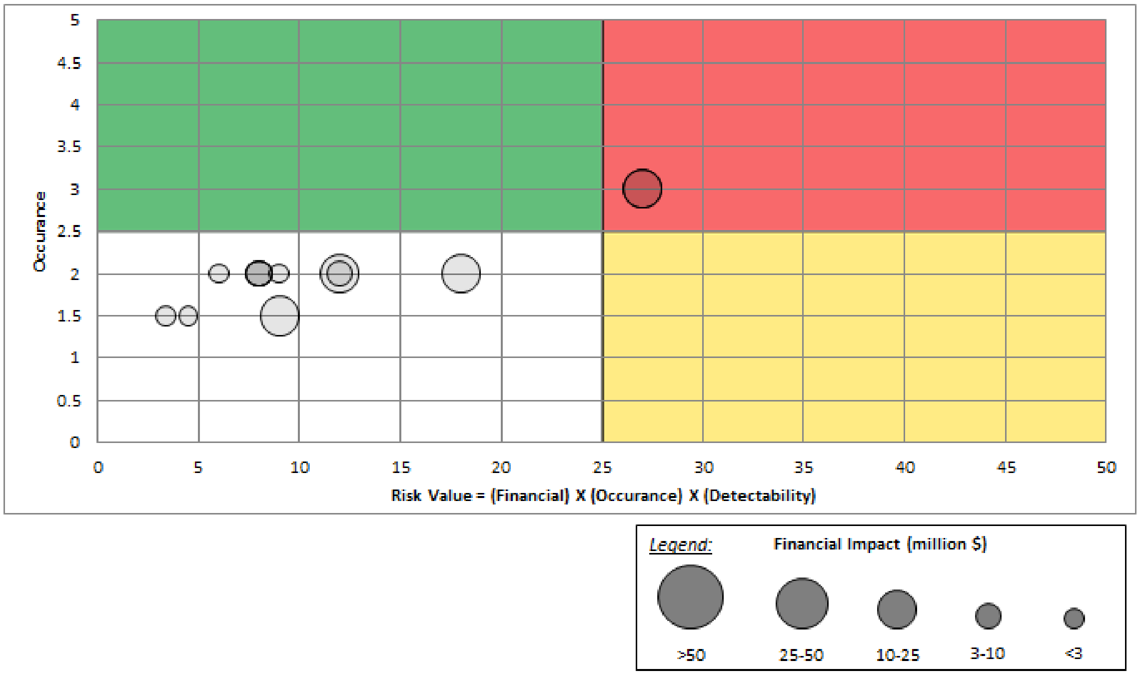


Figure 24.9 - Legal, Regulation, Political, and Other Risks Evaluated in this Study

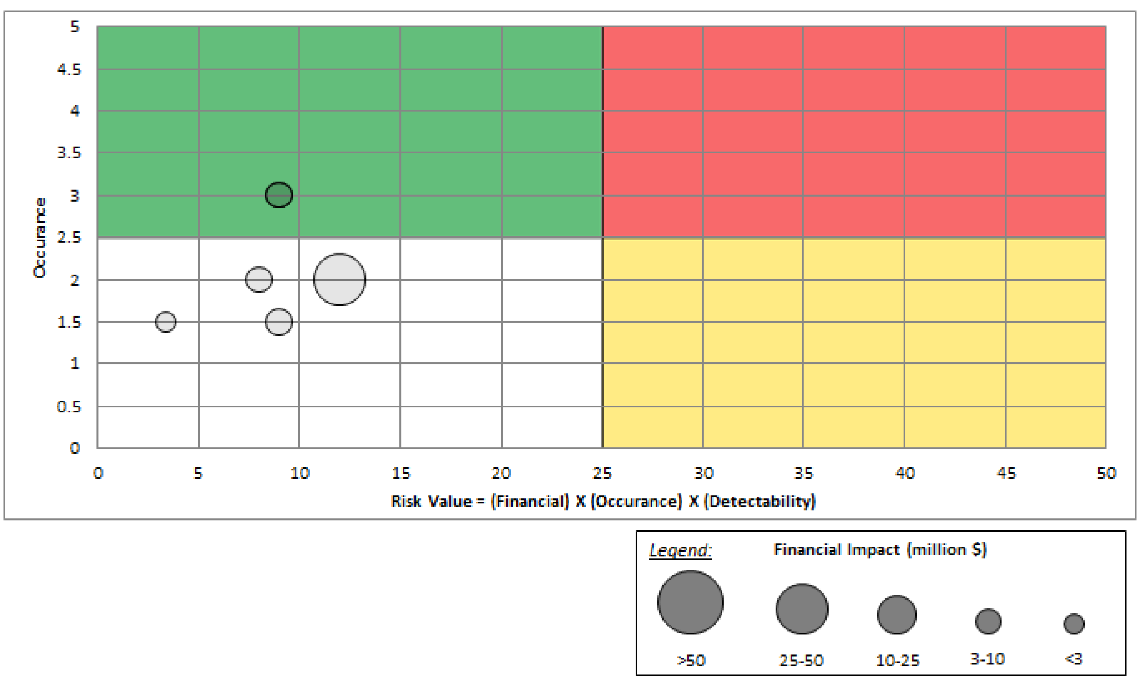
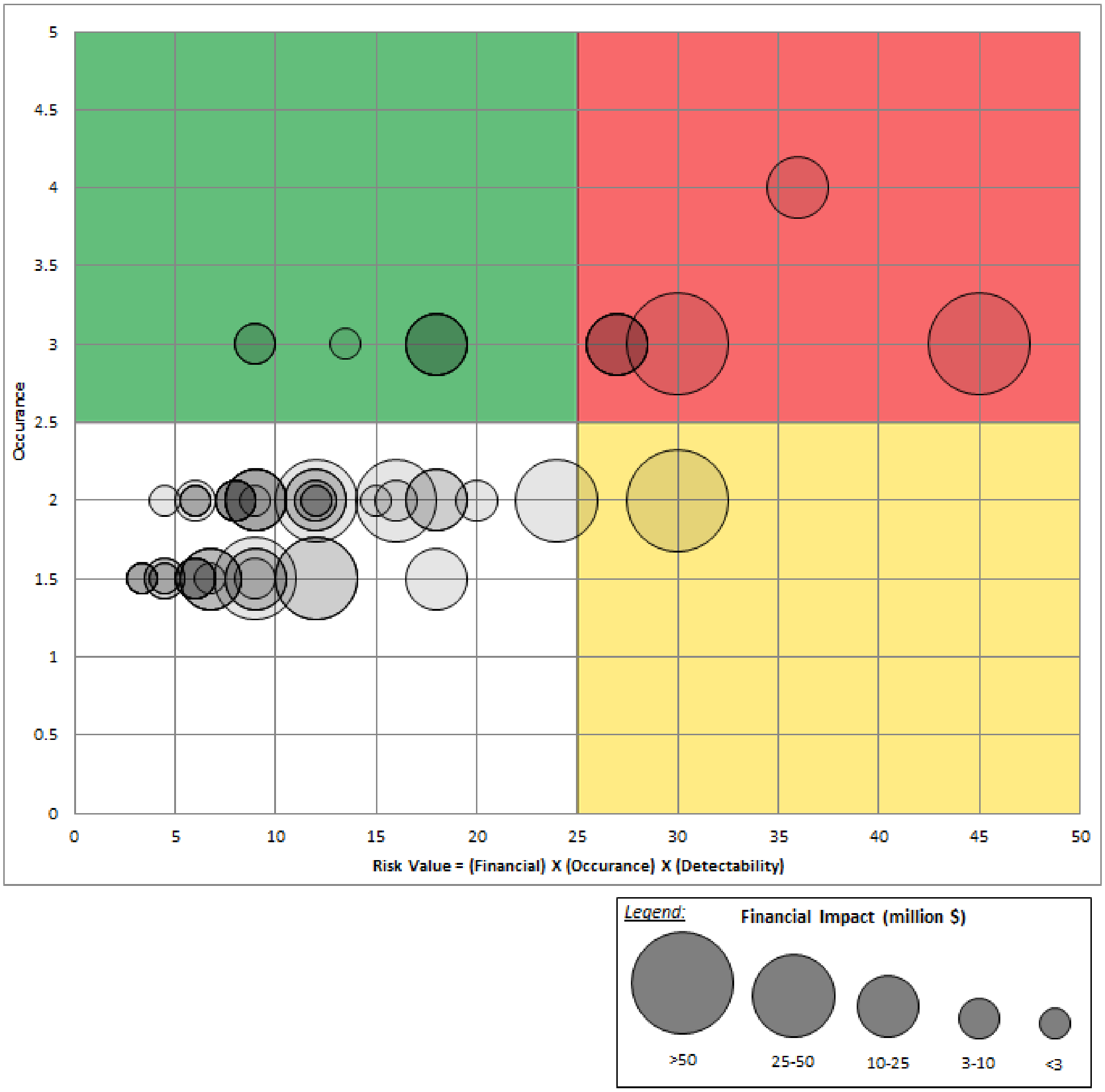


Figure 24.10 - All Risks Evaluated in this Study.



24.3.6 THREAT OF CAPEX UNDER-EVALUATION

The under evaluation of CAPEX is evaluated as a Low Priority Risk, thus not a major threat to the achievement of the Project even though its potential financial impact is High ($25 to $50 M).

The main reasons justifying this Low Priority evaluation is that the Probability that the Risk occurs is low or has less than 25% chance to occur. This is because the CAPEX estimates were done conservatively with a high level of detail and with a 15% contingency on the Project.

Mitigation strategies will be implemented for the most important factors that can possibly threat the precision of the CAPEX estimates (namely the acquisition of equipment and civil engineering works). Actions to be accomplished in these strategies:

- Finalization of the agreement with major equipment suppliers as soon as possible and before March 2014, with a letter of intent signed by both parties;
- Increase geotechnical field of investigation in order to secure concepts and costs related to civil works; this to be done by the engineering firm that will perform the detailed engineering studies (May or June 2014).

24.3.7 THREAT OF OPEX UNDER-EVALUATION

The under evaluation of OPEX is evaluated as a Low Priority Risk thus not a major threat to the achievement of the Project.

This risk has a Low Probability of Occurrence based on precise technical data and lab-tests that concluded in relevant quantity of reagents and power required for the operations upon which the suppliers relied to submit their quotes. Also, if this Risk occurs its Financial Impact is low i.e. between 3M$ and 10M$ due to trust in data used and relevant quotes.

The owner of this Risk is Matamec with the collaboration of Roche and Others. The development of a strategy to mitigate the Risk will take place later at a moment determined in the following phase of the Project.

24.3.8 OPPORTUNITIES

Although many of the uncertain events or risks considered in this Study could be analysed and strategized in terms of their positive or their negative impacts on the achievement of the Project, the emphasis was put on threats considering the timing and resources available.

Among those opportunities, two have a significant Priority and a potential Very High Financial Impact on the Project. They relate to Commercial events that could substantially increase mining operations, sales, and profitability. They require a strategic market watch and actions to promote the attractiveness and reputation of Matamec on all of its fronts.

- Major increase in demand of final product in the long term (REE) (COM01A)
- Change in final product value not as expected for the life of mine in feasibility evaluation (COM03)

One of these Risks, “Change in final product value not as expected for the life of mine in feasibility evaluation (COM03)”, is considered to potentially have such an important financial impact positive or negative on the Project that it has been selected amongst the risks for which a mitigation action plan has been planned.

24.3.9 RISK ANALYSIS

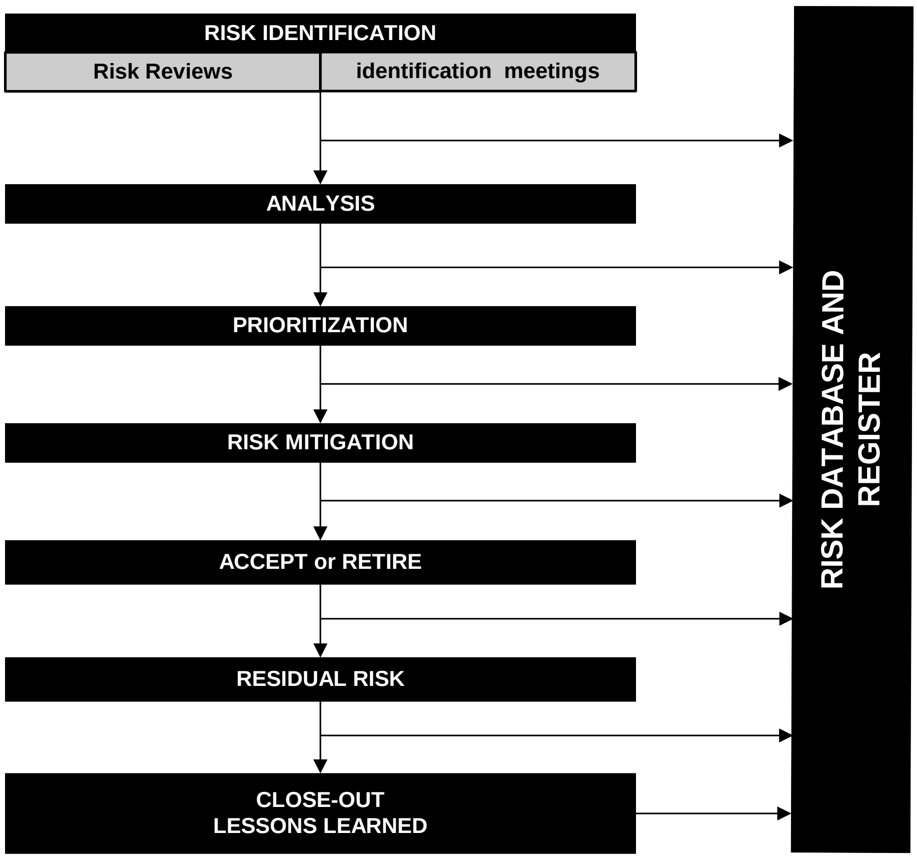
The risk management approach is one that promotes a culture where risks can be openly discussed and effectively managed. The quantification of project risks will:

- Help understand impact of risks on total project;
- Help understand the magnitude of uncertainty in order to apply appropriate risk management strategies;
- Ensure that the project resources are allocated to the right tasks at the right time;
- Help develop reasonable, realistic, and defendable forecasts for project costs;
- Develop and execute appropriate risk response plans.

Risks review meetings were held on November 25, 2012.

The approach used for risk management is illustrated in the following diagram:

Figure 24.11 - Risk Management Process



Risk identification is the process of examining the various project areas and each critical process to identify and document any associated potential risks. During the life cycle of the project, the project team continuously identifies risks through periodic and event-driven risk identification meetings.

Furthermore, Risk Analysis is part of an overall Risk Management process that includes:

- The understanding of the context in which it is accomplished (the purpose and the needs for its achievement, the size of the organization, its mission, and its resources);
- The assessment of risks which includes their analysis and their evaluation;
- The choice of a strategy to manage them (make upside risks happen, mitigate, transfer, accept, avoid downside risks);
- The monitoring and control of actions taken and their results and the emergence of new risks.

This process guides and maximises the performance of an organization and the performance of the people working to ensure its success.

At Matamec, Risk Management and Risk Analysis accomplished in the Feasibility Study for Kipawa Project was an important first step towards a structured plan of action that should take place in the following phase of the Project and thereafter in all subsequent phases; first for the eight selected Risks, and then for further Risks.

24.3.10 Insurance

The only action considered in the discussions regarding the means to strategize the management of the Risks under study is the mitigation of circumstances relevant to the probability of their occurrence, their detectability, and their financial impact on the Project. Transfer of a part of or of the total financial burden of Risks to insurance companies was not a strategy discussed.

24.3.11 Emergency Response Plan

The emergency response plan is specifically concerned with the open pit mine, the concentrator, mine residues facilities and holding pond, chemical spills on site and on the road to the mine, and the general worker safety on site. The emergency response plan has prevention, preparedness, response, and recovery elements.

The emergency response plan will be written to meet the following:

- Regulations, standards and Canadian best practices;
- The National Fire Association Codes and the Quebec Regulation on Safety and Health in Mines;
- The Canadian Fire code;
- FM Data Sheets;
- The CSA Z731-03 Standard on Industrial Emergency Planning;
- The Regulation on Transport of Hazardous Goods;
- The Quebec Environmental Quality Act;
- The Canadian Environmental Protection Act; and
- The Environmental Emergency Regulation.

The emergency response plan will include: an organization structure, on site resources, alert and evacuation procedure, specific response procedures for work accident, road accident, chemical spills and holding pond dam breach, and a training program.

24.3.12 Risk Summary and Conclusions

Risk Identification, Assessment, and Management is an on-going process which will continue throughout the life of the project. All information presented in this report is valid for this stage of the process, but will change and be developed as the project evolves. Many risks have been identified, with 71 risks evaluated, and mitigation plans drawn up for eight (8) risks.

The risk analysis has been performed with the participation of various delegates. Risks were identified for the current phase of the project, as well as for all subsequent phases of the Project. Comprehensive mitigation plans will be developed for the remaining risks in further stages of the project. This is to be expected at this level of study.

In summary, the interesting aspects of the risk analysis are listed below:

- Eight (8) Low Priority Risks have a potential Financial Impact of 25 to 50 M$, their Occurring Probability is 25% or less and their Detectability is moderate (2), easy (4) or very easy (2);
- All six (6) Medium Priority Risks have a potential Financial Impact of less than 25M$, their Occurring Probability is 25 to 50%, their Detectability is moderate (1), easy (3) or very easy (2);
- The Important Priority Risk has a potential Financial Impact of 50M$ or more, its Occurring Probability is less than 25% and its Detectability is moderate;
- One (1) out of the six (6) High Priority Risks (COM01A) has a potential positive Financial Impact of 50M$ or more, an Occurring Probability of 25 to 50% and is moderately detectable;
- One (1) out of the six (6) High Priority Risks (COM10) has a potential negative Financial Impact of 50M$ or more, an Occurring Probability of 25 to 50% and is easily detectable;
- One (1) out of the six (6) High Priority Risks (COM03) has a potential positive or negative Financial Impact of 10 to 25M$, an Occurring Probability of 50/50 and is moderately detectable.

25.0 INTERPRETATION AND CONCLUSIONS

This Report was prepared by Roche Ltd., Consulting Group and GENIVAR Inc. and supported by SGS Geostat and Golder & Associates. The results show that the Project is technically and economically feasible.

The total pre-production capital expenditure is evaluated at CAD 369.2 M, excluding the Mill First Loads and Capitalized Spare Parts entries totalling CAD 5.2 M (Total CAD 374.4 M). The total sustaining capital requirement, including rehabilitation expenditures, is evaluated at CAD 37.7 M. The result is a total capital expenditure for the life of the project of CAD 412.1 M.

A working capital equivalent to 3 months of total annual operating costs is maintained throughout the production period which totals CAD 16.3 M. Supplementary amounts are added or withdrawn annually as total annual operating costs increase or decrease, and the remaining amount is recovered at the end of mine life.

The total operating costs are estimated at CAD 1,180.7 M for the life of the mine or on average CAD 59.72/tonne milled. The annual operating cost for a typical full production year is CAD 78.5 M.

Cost estimates were prepared based on design and quantities coming from the engineering performed throughout the feasibility study, and by getting most cost data from suppliers' quotations. There is confidence that the level of detail presented in the estimates results in project's estimates within the ±15% accuracy target.

The economic/financial analysis of the Kipawa project is based on price projections from the second-quarter of 2013 (Q2-2013) and cost estimates in Canadian currency. No provisions were made for the effects of inflation. An at-par exchange rate was assumed to convert the USD price projections into CAD. There is no royalty payment agreement for this project. The evaluation was carried out on a 100%-equity basis. Current Canadian tax regulations were applied to assess the corporate tax liabilities of the project while the recently proposed regulations in Quebec (May 2013) were applied to assess the mining tax liabilities.

The project's financial indicators for base case conditions are:

Financial Indicator	Pre tax	After tax
Payback Period (years)	3.9	4.1
Net Present Value @ 10% (M $)	259.7	127.7
Internal Rate f Return (%)	21.6	16.8

A sensitivity analysis reveals that the project's viability is not significantly vulnerable to variations in capital and operating costs, within the margins of error associated with feasibility study estimates. However, the project's viability remains vulnerable to the larger uncertainty in future prices.

25.1 Public, First Nations and Regulatory Engagement

Since 2009, Matamec has invested a great deal of effort in conducting consultation activities and meetings with the public, First Nations and regulatory authorities. This has been achieved notably through the creation of a Harmonization Table as well as the holding of information and consultation meetings. A lot of people attended these information and consultation meetings. Matamec also opened an office in Témiscaming to consolidate its presence in the area, and has been in regular contact with the federal and provincial authorities.

One of the goals of these activities is to identify and address the issues raised by the stakeholders. The potential risk of environmental deterioration, the impacts on water bodies and wildlife and the impacts on recreational and traditional activities caused by the Project's mining activities are amongst the chief issues and concerns raised to date. However, the potential employment opportunities and economic benefits for the surrounding communities is also an important consideration for the stakeholders. These issues and concerns are common in the context of mining project development. The issues and concerns expressed during the information and consultation activities will be assessed during the ESIA. When needed, mitigation measures will be proposed to avoid or lessen the negative impact and enhance the positive effects.

Matamec is committed to work in partnership with the First Nations even though, to date, no recognition of First Nations treaty rights apply within the Project site. Very recently (January 2013), a Statement of Assertion of Aboriginal Rights and Title to traditional territories, which includes the Project area, was presented to the Government of Canada by Algonquin Nations. The purpose of the Statement of Assertion is to establish basis for a consultation and accommodation process regarding any development in a very extensive area which includes the Project site. However, in any event, Matamec has already committed itself to a consultation and accommodation process with two First Nations communities. Their involvement with the Project has been formalized with the signing of a "Memorandum of Understanding", which specifies the terms of collaboration between the two communities and Matamec in the preparation of the Project. As the Project progresses, Matamec will also initiate discussions with First Nations to negotiate an Impact Benefit Agreement.

25.2 Environmental Approvals and Permitting

To move forward with the Project, Matamec is required to submit an ESIA of the Project to the Canadian Environmental Assessment Agency for acceptance. No formal ESIA is currently needed under provincial regulations. However, a certificate of authorization request will need to be submitted, which will include an analysis of potential impacts. Moreover, federal and provincial laws and regulations also govern the obligation of obtaining permits, licences or authorizations.

The ESIA process is currently underway and began with the submission of the project description and the issue of Final Environmental Impact Statement Guidelines by the Canadian Environmental Assessment Agency (May 31, 2013).

Typically, mining projects have the potential of affecting the surrounding social and biophysical environments. With careful planning, these potential effects can usually be mitigated to render the Project acceptable to the regulatory agencies.

25.3 Geology, Mineral Resource, and Mineral Reserves

The terms "mineral resource" and "mineral reserve" are defined by the Canadian Institute of Mining, Metallurgy and Petroleum as the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM council.

25.3.1 Mineral Resources

The Kipawa Deposit resource are 10,478,000 tonnes at 0.46% TREO in the measured category, 13,379,000 tonnes at 0.36% TREO in the indicated category and 3,268,000 tonnes at 0.31% TREO in the inferred category. The total of measured and indicated resource now stands at 23,857,000 tonnes at 0.41% TREO representing 88% of the total resource. These results are at a 0.2% TREO cut-off and are not limited by an open pit. The overall total tonnage is about 10% greater than the last resource (see press releases dated June 30 and July 7, 2011).

The Kipawa deposit's mineral resource estimates were updated in January 2013 by SGS Canada - Geostat. The drilling done since the 2011 PEA (see press release dated January 30, 2011) totaling 14,293 m was included and permitted to outline some measured resources for the first time in the history of the project. The database now totals 293 drill holes totaling 24,571 and 13 trenches totalling 631 m. Historical Unocal holes are not in the count and were not used for the estimates. The mineralized zones were interpreted on vertical sections and meshed into volumes as per industry standards. Ordinary kriging was used to estimate the block model with block size set at 10 m x 5 m x 5 m. The measured and indicated resources required drill grids of 25 m and 50 m respectively. Resources extrapolated beyond 30 m of those drill grids are considered inferred.

The deposit is open in both ends and at depth and recommendations are mentioned in Section 26.0 for additional drilling to potentially increase tonnages.

25.3.2 Mineral Reserves

Any variation of the commodity prices, operational costs, and recoveries found during this feasibility study may require an update of the Mineral Reserves.

The optimized pit shell was generated using the Lerchs-Grossmann pit optimization algorithm using the cost and financial parameters estimated.

The current Kipawa mineral reserve estimate is based on rare earth oxide prices issued by the Client in the first half of 2013 (H1-2013) and provided to Roche for mineral reserve assessments. Due to the substantial price differences between each element (Section 19.0), the mineral reserves were estimated using a combined cut-off value based on the grade, recovery, and price of each REO, as opposed to the combined rare earth oxide grade (Section 16.0).

The mineral reserves were estimated using Gemcom Gems software at a cut-off value of $48.96/t for a total diluted proven and probable reserve estimate of 19.769 million tonnes at $141.56/t or 0.4105% of TREO. Tonnage estimates for mineral reserves are dry tonnage with no account for moisture.

25.4 Geotechnical

25.4.1 Geotechnical Parameters

A geotechnical and hydrogeological investigation program was conducted by Golder during August 2012. The program consisted of surface mapping, geotechnical core logging of five inclined and oriented boreholes, hydrogeological testing of the boreholes, selection of samples for laboratory testing, and point load testing of the rock core. The information from the field investigation was used to characterize the rock mass, evaluate the structural fabric of the project area and assess the hydrogeological characteristics of the site. This information was used to support feasibility-level pit designs.

25.4.2 Regional Stress

There are no in-situ stress measurements for the Kipawa project. The project site is located on the top of a hill. Regional stresses are considered gravitational, with horizontal forces considered equivalent to the vertical gravitational loading in all directions.

25.4.3 Engineering Geology

For purposes of analysis, the rock mass was simplified into four (4) basic rock types, which can be described as follows:

- Syenite (SY), representing the Kipawa Alkalic Complex, and host of the mineralization at the site;
- Calc-Silicate Complex (CAL-SIL), usually observed as lenses within the SY unit;
- Gneiss (GN), located below the SY unit;
- Phlogopite (PH), occurring as bands within the calc-silicate complex; while limited in extent, these bands may be associated with local stability problems within the proposed pit, depending on location.

For the rock mass at Kipawa, the CAL-SIL unit occurs as discontinuous lenses within the SY unit, and the PH unit as pods or blebs within the CAL-SIL unit

Based on the geometry of the deposit and the test results, the rock mass was grouped into two geotechnical domains: the Syenite (SY) containing all the syenite variants and the calc-silicate zones, as well as the mineralization; and the Granite Gneiss (GN).

The rock quality designations for the SY and GN are high (98% and 99%, respectively). Rock mass classification using RMR 76 classification system (Bieniawski, 1976) for these units indicates that both units are Very Good. The mineralized zones at the Kipawa site are all located within the SY geotechnical domain; the GN domain represents the waste rock in the footwall of the deposit.

25.4.4 Major Structures and Discontinuities

No major structures were identified at the deposit scale. Because the rock mass is not divided by any major structures, and the structural orientations are similar between the SY and GN geotechnical domains, the rock mass is considered one structural domain for analyses purposes.

Review of the discontinuity populations indicates a flat-lying foliation dipping south, discontinuity sets dipping subvertically to the northeast and steeply to the north, with a few random joint orientations observed. The joints were widely spaced with limited persistence.

25.4.5 Hydrogeological Considerations and Modelling

The hydrogeological conditions in the vicinity of the pit were defined based on the fieldwork conducted at the site in August 2012 and February 2013. The pit is situated close to the boundary of the watershed between Sheffield Lake to the west and the smaller Lakes 7, 8 and 9 to the east. The site is overlain by a shallow veneer of overburden (between 2.5 and 6.5 m) composed primarily of silty sand. Hydraulic conductivity within the overburden is estimated at 3×10^{-6} m/s, measured in one observation well. The first packer test interval in each borehole was started at the approximate elevation of the water table. The depth to the water table was closer to ground surface at the bottom of the slope, and greatest near the crest of the hill.

The phreatic surface at the site is situated in the bedrock, and the flow of groundwater in the vicinity of the pit is to the west, in the direction of Sheffield Lake.

25.4.6 Open Pit Predicted Water Inflow

To estimate the potential inflow of water into the pit, the rock was modelled using the software FEFLOW (Version 6.1), developed by the firm WASY Ltd. This model uses the finite element method to solve the equations of groundwater flow. Modelling was performed using a representative section of the pit, oriented southwest-northeast. The model considered a pit 300 m wide at its widest point, with a depth of 100 m, which correspond to the maximum dimensions of the proposed pit.

The rock mass was subdivided into four distinct units, based on hydraulic conductivity. Based on the different simulations that were performed, the infiltration of groundwater into the pit is estimated at between 200 m^3/day and 600 m^3/day. The most likely scenario, however, is groundwater inflow into the pit at an estimated rate of 300 m^3/day.

25.4.7 Open Pit Slope Assessment

Pit slope design recommendations were provided for the Feasibility Study in the Golder (2012a) report for 10 m bench heights. These recommendations were refined for 5 m bench heights in the Golder (2012b) technical memorandum. This section summarizes the rock slope stability analysis results and the recommended bench configurations that were provided to the project.

The Kipawa pit will be excavated in competent rock with a combination of flat-lying joints dipping to the southwest, and steeply dipping sets to the northwest and northeast. Because of the competence of the rock mass and the shallow pit depth, the slope stability within the rock slopes of the pit will be controlled by the orientation of the pit walls relative to the discontinuities. The pit design must be such that the benches retain rock debris from the pit slopes and that the inter-ramp angles limit the potential for breakback and debris.

25.4.8 Overburden

The Kipawa pit is located on a ridge slope covered with a thin veneer of overburden (3 to 5 m, typical from current investigation). Consequently, a slope design in overburden slopes was not performed.

25.4.9 Slope Design Recommendations

The rock mass was assigned a single structural fabric domain and divided into five design sectors based on wall orientation, and kinematic assessments were determined for each sector. The slope designs for the Kipawa pit are summarized in Section 16.0 of this Report in Table 16.4, and the design sectors are shown in Figure 16.8. Schematics showing the designs for the slopes for each sector are shown in Figure 16.9.

25.5 Open Pit Mining

The mining optimization results, reserves, design, long and short term plans are only valid for the commodity prices, operational costs, and recoveries found during this feasibility study. Any variations of these values may require an update of the Mining design and plans presented in the Section 16.0.

25.5.1 Mining Methods

A conventional truck-and-shovel open pit mine has been considered to be the most appropriate mining method. One (1) front wheel loader with a bucket size of 5.25 m^3 will be used for production. The selected front wheel loader will load three (3) 55-tonne mine trucks.

At the high grade ore loading facility located at the mine site, an excavator with a 6.5 m^3 bucket size will re-handle the ore and load eight (8) 40-tonne road haulers. There will be the auxiliary excavator available with the capacity to load the haulage trucks when there is preventive maintenance or unexpected downtime for the main loading equipment. Mining ramps and roads will have a width of 20.7 m and a maximum gradient of 10% which respects regulations for 2-lane traffic in all seasons.

25.5.2 Mine Design

The open pit mine is designed to be mined with a double benching arrangement and includes a 14 m bench for every 60 m of vertical height which does not intersect the ramp. The mining will take place between elevation 370 and 245 on 5 m benches to minimize the dilution and to maximise the mining recovery. The dilution and the ore loss per block were estimated at 5% and 4.76%, respectively. This level of dilution and ore loss is consistent with the North American mining industry.

25.5.3 Mine Plans

The mining plan completed by Roche includes 19.769 million tonnes of ore at 0.4105% of TREO and requires the removal of 1.3 million tonnes of overburden and 18.7 million tonnes of waste rock resulting in a life-of-mine stripping ratio (W:O) of 0.94 to 1. It is anticipated to remove all of the overburden during the pre-production period.

The mining plan will produce 55,500 tonnes of TREO for the entire mine life averaging more than 3,650 tpd of TREO during the full production years (Years 2 to 14). The main revenue contributors are dysprosium oxide, followed by neodymium oxide, yttrium oxide, and terbium oxide.

After pre-production overburden stripping, the first production phase will consist of mining higher grade ore in order to reduce the payback period. The second and final phase will consist of mining the remaining ore while focusing on completing the eastern pit, so it can be used to store 1.7 Mm^3 of waste material until the end of the mine life.

In regards to ore handling, the grade higher than the break even cut-off value of $60.70/t will be sent first to the mill and the low grade ore with a value between $48.96/t and $60.70/t will be processed after mine depletion. The mine plan is designed for an average of 3,650 tpd or 1,332,250 tpy operation, except for the first year. The ramp up production for the first year has been considered at 66% of the average annual production tonnage.

The operating mine life is 15.2 years not including the pre-production year.

25.5.4 Mine Selection and Optimization

For this study, mining estimates were generated from the pit optimization process while costs and revenues were not yet fully defined. The input data, provided by the Client to date, entered in the optimization process was conservative and yielded an economically viable open pit solution. This process has shown that variations in product prices have a minimal impact on the pit selection.

25.5.5 Mining Opportunities

During the detailed engineering phase, it is recommended that a new pit design and selection be prepared to obtain an optimized and improved mining solution.

While the economics contained in the Feasibility Study are robust, ongoing development works leading to several mining optimization opportunities have been identified and are as follows:

- Develop alternative materials handling scenarios to reduce the amount of rehandling between the mine and the crusher;
- Investigate the potential of setting aside the marginal waste rock close to the marginal cut-off grade stockpile in a context of future increase in RE prices;
- Optimize the usage of mine haulers between the mine and the crusher
- Investigate alternative mining method scenarios using contractor mining ventures.

25.6 Mineral Processing

25.6.1 Beneficiation Section

Given the objective to produce a final grind P_{80} around 850 microns, with minimal fines and the relatively low ore impact strength, it seemed unnecessary to consider two stages of grinding. Instead the focus was on utilizing crushing and screening as much as possible, with one stage of grinding. The simulations of 4 main options indicate that a 2- or 3-stage crushing circuit followed by a rod mill provides the best option, expected to deliver the maximum product yield in the target size range.

Magnetic separation tests was performed in May 2012 at both Eriez and Outotec installation on each size fraction individually as well as mixed together. The SLon magnetic separation supply by Outotec shows much more promise and produces a better separation than Eriez Wet High Intensity Magnetic Separator (WHIMS). Results show that the fines fraction does not recover as well as the middle and coarse fraction. The coarse and middle size fractions show a recovery of over 90% but fines (-75um) are at only 70%. For the SLon magnetic wet separation, the process recommended by Outotec is a low gauss rougher, followed by a cleaning of the magnetics. The cleaned highly magnetic stream is the magnetic wastes. The Low gauss tail is directed to the second pass high gauss magnetic separation. The magnetic portion from this second pass is the RE mineral concentrates. Outotec recommends the following operating condition with their SLon separators:

- Stage 1: 0.2 to 0.3 Tesla, 300 pulse/min, 3 mm matrix;
- Stage 2: 1 Tesla, 25 pulse/min, 3 mm matrix.

Beneficiation pilot plant was operated at SGS Mineral Services at Lakefield in May-June 2012. An overall recovery of 77.4% Y was achieved in 40.8% of the mass, including the fines. Recoveries were gradually increasing towards the end of the operation, and the best separation achieved was 83.6% Y recovery in the same 40.8% mass.

By end of 2012, more testwork on Magnetic separation was performed on variability sample and global composite. Dry, WHIMS and SLon magnetic separation were performed, with the objective of comparing all 3 methods side-by-side with the same material. Overall, 79% Y recovery in 40% of the mass was obtained with the global composite for dry testing. In comparison, only 72% in 40% of the mass was obtained with the WHIMS testwork on global composite. SLon provided the best recovery out of the three with 80% Y recovery in 40% of the mass.

The global composite was tested with varying magnetic intensity and pulse rate on the SLon separator. It was found that a 0.3 T and 300 rpm pulse rate provides the best rejection of magnetic materials as a first pass. With the materials generated from the first pass, the high intensity second pass was tested again with varying conditions.

The optimum condition for the second pass is found to be 1 T and 25 rpm. The SLon results are then plotted on a curve to determine correlations between head grade, mass pull and overall recovery of the 2 SLon passes. From the Recovery vs. Grade curve, the head grade has minimal effect on the Y recovery through the SLon separator. The correlation is much more pronounced between the Recovery and the Mass Pull. With the curves, it is possible to conclude that with a head grade of 0.075% Y, which is similar to the Global composite and to the average life of mine ore, a recovery of 82.5% Y in 45% mass is achievable with the SLon.

Testwork were conducted at Outotec with a SLon unit on the magnetic separation tails collected from the first stage low intensity separator contains as high as 5.5% REE losses in 11% of the mass rejected. The cleaning SLon unit was operated at 0.4 T intensity and 300 rpm pulsation using a 3 mm matrix. In spite of the result being based on limited tests and is un-optimised, it shows a positive recovery in recovering the lost REE. By allowing the recovered stream to be combined with the low intensity non-mag stream, and then process them together into the high intensity magnetic separation, an improvement of 3.2% recovery can be achieved with an additional 2.3% mass. In doing so, the overall recovery of the beneficiation circuit can be increased to 85% in 45% mass.

Recommendations are presented in Section 26.0 for additional testwork.

25.6.2 HYDROMETALLURGICAL SECTION

25.6.2.1 Results from the 1st Pilot Plant

Following the completion of the beneficiation pilot plant, the hydrometallurgical pilot plant was operated at SGS Mineral Services in Lakefield during July 2012. The main objectives of the pilot plant were to:

1) Validate the process developed from the bench scale in a larger, continuous operation;
2) Understand the Solid-Liquid-Separation behaviour of various slurries;
3) Generate a bulk rare earth product, such that the characteristics and impurities content can be known, and further development work can be done to purify this bulk product.

For the first step of the hydrometallurgical process, the leaching of the mineral concentrate, results from the pilot plant showed an extraction rate of the LREE, HREE and total REE of 84%, 93% and 88% extraction respectively.

The pilot plant then showed for the Pre-Neutralization (PN) that the addition of hydrogen peroxide was needed to allow sufficient iron oxidation. The pH was calibrated to allows for good rejection of impurities such as iron, zirconium, and thorium, while lowering the precipitation of REE into the neutralized PN cake. Calculations showed that approximately 13% of the HREE and 32% of the LREE were precipitated at the PN.

The releach was optimized by a kinetic test during the pilot plant. Results determined that the optimal residence time for releach is around 10-15 minutes in order to maximize REE extraction and to minimize extraction of impurities such as Zr and Fe.

There are high amounts of colloidal silica in the pregnant leach solution (PLS), which causes filtration difficulties with the Pre-Neutralization discharge slurry. A small reagent X treatment circuit was included in the pilot plant operations, immediately after the PLS has been Pre-Neutralized. The circuit worked smoothly without issues, and the silica level after treatment was consistently around 100-150 ppm. Only a negligible amount of REE were found in the reagent X residue, indicating no losses were incurred in this step. In addition, 80% of the Th, 50% of the Fe, and 80% of the Zr were also found to be precipitated and removed during this step of the pilot plant.

In order to remove uranium, the solution is then fed into the ion exchange columns. The feed solution contains on average 10 ppm U and less than 1 ppm Th. As shown, assays revealed 99% uranium removal and negligible REE loading onto the resins. The discharge consistently contains < 0.1 ppm of uranium. The data also showed a 4% loss of REE into the resin; however it is shown by the assays of the final resin that the rare earths were displaced by uranium once the resins were loaded completely.

The REE precipitation circuit, the last step of the hydrometallurgical process, operated without issue during the pilot plant, with well over 99% precipitation of all REE at pH 7.5.

The overall achieved recovery from the pilot plant was 53% for LREE and 78% for HREE without accounting for releach. Assuming a 50% releach extraction, where the liquor is recycled back into the process, the overall recovery would increase to 65% and 84%, respectively.

25.6.2.2 Process Optimisation Following the Pilot Plant and Variability Testing Sample Selection

Following this first pilot plant campaign, a few area of weaknesses in the process flowsheet were identified and additional testworks were conduct to address them.

For the hydrometallurgical pilot plant, the two key issues were also highlighted, namely the slow filtration on the Pre-Neutralization discharge, and the high REE losses into the PN cake. A testwork program was initiated in Q4 of 2012 to revisit the Pre-Neutralization circuit in an attempt to find parameters that allows for better filterability.

Also, in order to increase the confidence of the process design in handling feed material across the entire mineral deposit a variability testwork program was conduct using a total of eight (8) samples taken from areas of different mineralogy, lithology, and grade, which represent the variation of feed ore throughout the life of mine. This testing allowed to revisit each step of the hydrometallurgical process.

Leach results from the variability samples were lower than expected, at around low to mid 80% RE extraction. In order to increase the REE extraction, a conventional 2-stage counter-current leach methodology was tested. Results showed an improvement over the 1-stage leach, and hence were adapted into the flowsheet.

Due to the new precipitation curve and the change from 1-stage leach to 2-stage leach, it was decided to keep the PN circuit as a 1-stage process. It was found that significantly less REE were precipitated at PN. At pH at 3.85, less than 10% of the LREE and less than 5% of HREE were precipitated. Iron precipitation remains at > 95%. The much reduced REE precipitation along with good rejection of Fe highlighted the advantages of this 2-stage leach, 1-stage PN flowsheet.

Releach is then optimised with this new flowsheet. Besides recovering REE, one of the key purposes of the releach is to reject impurities, to avoid a build-up in the circuit. The new releach condition showed a high REE extraction and low Fe extraction on this new cake.

Uranium ion exchange test was carried on the new solution. Results are as expected with over 99% uranium removal. Some REE were removed, which is similar to what was found during the pilot plant. It is expected that the rare earth will be replaced by uranium when the resins are completely loaded.

Finally, Rare Earth Precipitation was tested to confirm the precipitation pH for carrying out rare earth precipitation. It was shown that a pH of 7.5 would precipitate near 100% of the REE in solution. This pH confirms with the pilot plant findings, selected as the target pH for REP. Recommendations are presented in Section26.0 for additional testwork.

25.7 Process Plant

25.7.1 Process Equipment

The bulk material conveyed by trucks from the open pit will be discharged at the primary crushing area. The crushing system will be an open loop type, with a primary and a secondary crusher. The storage silo will have a storage capacity of 18 hours at a production rate of 3,650 tonnes per day.

The crushed ore will be conveyed to the process plant directly in the grinding circuit. The grinding circuit will have one rod mill, classifier, a set of cyclones and two pumps (one in operation and one spare) to feed the cyclones. The magnetic separation area will be located next to the grinding circuit and will include five (5) magnetic separators.

In another area of the building, there will be tanks for leaching, re-pulping, neutralization and precipitation, filters, a thickener, the required pumps and sump pumps. Reservoirs will also be there for reagents storage and distribution. Outside the building there will be thickeners, fresh and process water tanks as well as reagent storage (limestone, lime, sulfuric acid, sodium carbonate, etc.).

25.7.2 Fresh and Process Water Distribution

An exterior tank will be installed to provide the process plant with fresh water for different applications including potable water treatment plant, fire protection, and process water. The total capacity of the tank will be 1,835 m^3. Part of the storage tank will be dedicated to fire protection.

25.8 On-Site Infrastructure

25.8.1 Power

A 44 kV Substation will be installed near the process plant for electrical distribution. Three (3) transformers will distribute power to the process plant main electrical room. Three (3) 750 kW diesel generators will also be installed on-site to deal with emergencies and will feed the 44 kV network with a step-up transformer. The cost of power is estimated at 5.97 ¢/kWh.

25.8.2 Process and Fresh Water

A pumping station will pump fresh water to the garage from Sheffield Lake. The water fed to the mine will not be treated. Therefore, potable water will be provided through water fountains.

The plant site fresh water will be provided by a pumping station located on the shore of the Des Jardins River. The potable water to the plant site (administration building, process plant, etc.) will be treated in a modular system installed in a container before being consumed.

For both mine site and process plant fresh water tanks, there will be water capacity allocated to fire protection. Tailings water drainage will be captured in a settling pond and tailings thickener overflow will be stored in a tank before being pumped to be reused as process water in the process plant.

25.8.3 Site Roads and Surface Pads

The on-site roads will give access to the following areas:

- Process plant facility & surrounding buildings;
- Open pit;
- Garage;
- Pumping stations;
- Tailings disposal area;
- Magnetic separation rejects disposal.

25.8.4 Solid Waste, Water Treatment and Management

At the mine site, waste water will be treated (from domestic usage only) through a BIONEST standard system. For the plant site, this will be done via a BIONEST - KODIAK turnkey system, located in a container which will allow for disinfection and phosphate removal before being returned to the environment.

Solid waste will be removed from the site by a contractor on a regular basis.

25.8.5 Fuel Storage and Distribution System

Fuel storage facilities will be in place at both plant and mine sites. Both will have a concrete slab for the vehicle filling area, concrete blocks to protect the installation and a membrane to recover any spill in the storage area.

25.8.6 Fence, Roads and Parking at Témiscaming and Plant Site

A fence will be put in place at both mine and plant sites. Access road between these sites will not be fenced. A parking lot will be available near Témiscaming and from there, employees will be transported by bus to both plant and mine sites.

25.8.7 Security and Telecommunications

The security officers, who will control the site access, will be located in a gatehouse that will be part of the administration building. There will be an alarm system for fire protection as well as a surveillance system for the site via cameras.

25.8.8 Buildings

25.8.8.1 Plant Site

The administration building will include office spaces, conference rooms, dry, first aid and mine rescue. The gatehouse will be part of that building.

A building will be used as a warehouse and there will be some room inside to park the ambulance vehicle. A cold shed will be located next to the warehouse building.

The assay laboratory will be located in a separate building.

25.8.8.2 Mine Site

The garage building will have washing, lubrication, welding, and repair areas for the large mine vehicles. There will be also a repair area for small vehicles and another one for miscellaneous jobs.

25.9 Off-Site Infrastructure

25.9.1 Main Access Road

The access road to the process plant has a total distance of 62 km, starting from the town of Témiscaming, using the existing Maniwaki Road for the first segment. This will be followed by 4.8 km of new road to be constructed. This new segment will be 9 meter wide to allow two-way traffic.

25.9.2 Power Line and 120 kV Substation

The power will be provided by Hydro-Québec via a 120 kV power line that will be put in place specifically for the project. Hydro-Québec will be in charge of designing, supplying and installing the 120 kV line, around 1.9 km long. A 120 kV substation, owned and maintained by Matamec, will be located near the town of Témiscaming. Power will be delivered to the plant site substation at 44 kV via a 64 km overhead line following the Maniwaki Road and the process plant main access road.

The total connected power will be 18 MW and the real power requirement will amount to 10 MW.

25.10 Ore, Waste Rock and Overburden Management

25.10.1 Geotechnical and Hydrogeological Field Investigation Summary

The foundation conditions at the mine site were assessed by conducting a geotechnical site investigation, consisting of 3 boreholes and 8 test pits, in order to determine the geotechnical properties, the bedrock depth and the hydrogeological conditions. In general, there is little variability in the subsurface layer constituents but rather noticeable differences in the overburden layer thicknesses over the entire area. The superficial soil stratigraphy is generally composed, from top to bottom, of a 0.1 m to 0.3 m organic cover overlying a dense to compact silty sand layer. The bedrock underneath the superficial deposit was observed at depths varying between 0.30 m and 29.30 m.

A total of 3 observation wells were installed in the boreholes to assess the general hydrogeological conditions. The performed investigation and collected measurements allowed for the determination of an average horizontal calculated hydraulic gradient of 0.159 m/m. A hydraulic conductivity test was performed in the sand and silt horizon and in the bedrock, at one location. The calculated hydraulic vertical gradient at this location was established to be 0.63 m/m.

25.10.2 Geochemical Characterization Summary

The ore and waste rock to be generated by the mining operations were geochemically characterized to evaluate the risk for radioactivity, acid rock drainage and metal leaching and to classify these wastes according to Quebec Directive 019. Also, Radioactivity results were compared to the standards set in the Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM).

The geochemical testing results show that none of the waste rock or ore samples are classified as potentially acid generating. Some samples are classified as leachable for lead, and, to a lesser extent, for zinc. None of the waste rock samples are classified as high risk and only one of the ten ore samples is classified as high risk. Most waste rock samples are not radioactive and that most of the ore is classified as radioactive according to the Directive 019 classification system. Leachates, analyzed on select samples, do not exceed the limit for ionizing emissions. Some of the waste rock other than granitic gneiss and bazal monzonitic gneiss exceed the NORM criteria, and most of the ore samples exceed the NORM criteria as well.

These results imply that a worker dose assessment should be carried out on the waste rock from the lithologies that exceed the NORM criteria. Also, it is anticipated that the bulk of the ore material would require an evaluation of groundwater protection measures to be designed for the ore stockpile facility. A groundwater protection assessment will be required to define the appropriate measures for protection for the waste rock material as portions of it are classified as leachable under Directive 019.

Further testing of the ore material will be carried out in later stages of the project to verify the classification of the ore and the waste rock material, as well as to better qualify the probable metal releases from these materials.

25.10.3 Waste Rock Management

To minimize the visual impact of the waste and considering drainage, rock storage is separated into two distinct areas. Drainage ditches have been designed all around the rock storage facilities and a sedimentation pond will be made at the lowest elevation. Both waste dumps will have space to accommodate 7.6 Mm^3 of materials. Once the eastern portion of the open pit is completed, the “in-pit” waste storage area will be used and will contribute to limit the visual impact, decrease the hauling cycle time, and reduce the amount of mining trucks during Year 12 to Year 15. The "in-pit" waste storage will have a capacity of 1.7 Mm^3 of waste material until the end of the mine life

Stability analyses of the waste rock dump were performed for 3 cross-sections of the design geometry. The overall stability was analysed using conventional limit equilibrium methods which satisfies both force and moment equilibrium. Results showed that the calculated factors of safety meet the minimum design requirements. Also, increasing the water level at the ground surface has no significant impact on the stability. Based on the in-situ standard penetration tests performed in the three boreholes in the area, it is reasonable to expect that the foundation of the waste rock piles will have very low liquefaction potential. During the detailed design phase, some additional in-situ testing under the footprint of the waste rock piles will be carried out to confirm these results.

25.10.4 Overburden Management

The overburden and the top soil removal from site preparation are evaluated at 1,328,480 tonnes and 130,760 tonnes, respectively. All the overburden and the top soil will be removed at the pre-production period (Year -1). The overburden removed will be stored to the North West side of the waste storage Area 1 and the garage, and the top soil pile will be constrained between the main mining road, the waste rock storage Area 1, and the overburden pile.

25.10.5 Ore Management

The low grade stockpile is needed to accumulate the marginal economical ore to be processed at the end of the mine life. The high grade stockpile (high grade rehandling pile) is required to rehandle the ore via other smaller trucks up to the crusher at 10 kilometres away. Both the low grade and high grade rehandling piles will be built on top of the waste rock storage Area 1, closer to the main access road. A second designed ramp will be developed on the north side to get access to the rehandling zone which will allow for more efficient and safer operations. During detailed design phase, the location of the stockpile may be reviewed depending of the level of groundwater protection required.

25.10.6 Groundwater Protection Assessment

A numerical modelling study of groundwater flow and solute transport was completed, using FEFLOW Version 6.1 software, to assess the impact of ore and waste rock piles facilities on groundwater. The chemical species of interest in seepage water are lead, zinc, and selenium from the ore pile, and lead and zinc from the waste rock. Leachate from ore and waste piles is not expected to be radioactive according to Directive 019 criteria and this aspect was not considered in the contaminant transport simulations. The modelling results show that the daily seepage rate per unit surface is lower than the Directive 019 criteria for level A groundwater protection. The modelling results show that selenium, lead, and zinc concentrations in groundwater do not exceed the RESIE criteria at a short distance.

25.11 Tailings Management

The ore treatment at the Kipawa project consists of two different successive processes generating waste with different physical and geochemical characteristics. The tailings management of the two streams has been assumed to be conducted separately.

The first stream, generated by the magnetic separation process, is referred to as the MagSep tailing. The concentrate produced from the magnetic separation process is to be directed to the hydrometallurgical process plant which will generate the second stream to be referred as the Hydromet tailing. Each stream represents approximately 55% and 45%, respectively, of the total waste tonnage generated.

The assessment and selection of the tailings management area locations for both MagSep and Hydromet were performed according to the Guidelines for the Assessment of Alternatives for Mine Waste Disposal (Environment Canada, 2011). In order to assess the different sites and applicable technologies for the tailings management, a detailed study was carried out with respect to the potential environmental and social impacts as well as the economic and technical development. According to the results of this study, the MagSep tailings management facility will be located adjacent to the proposed process plant area and the Hydromet tailings and water management facility will be located along the south side of Maniwaki Road; north of Bell and Venne Lakes.

25.11.1 Magnetic Separation Tailings Management Facility

25.11.1.1 Geotechnical and Hydrogeological Field Investigation Summary

The foundation conditions at the actual MagSep TMF were assessed by conducting a geotechnical site investigation consisting of 4 boreholes and 4 test pits, in order to determine the geotechnical properties, the bedrock depth and the hydrogeological conditions. In general, there is little variability in the subsurface layers over the entire area.

A total of 5 observation wells were installed in the boreholes to assess the general hydrogeological conditions.

25.11.1.2 Geotechnical Conditions

The general soil stratigraphy encountered in the test pits and boreholes were reasonably similar. The water table was measured at various depths between the bedrock interface and a few metres below the ground surface. The foundation material consists of silty and sandy deposits over bedrock with fair rock quality designation (RQD) on surface to excellent at depth beyond 2 m. It is reasonable to expect the silty to sandy layer under the MagSep TMF will be of compact to dense compacity which usually have low liquefaction potential.

From a geotechnical point of view, the compacity of the foundation, the estimated water table elevation, and the gentle overall topographic slopes are elements providing favourable long-term safety factors against slope failure and have low potential for liquefaction, one of the most important design condition. During the detailed design phase, some additional in-situ testing under the footprint of the MagSep TMF will be carried out to confirm these results.

25.11.1.3 Geochemistry Assessment Summary

The MagSep tailings were geochemically characterized to evaluate the risk for radioactivity, acid rock drainage and metal leaching. The results were used to classify the MagSep tailings according to Quebec Directive 019 and to identify constituents of potential environmental concern. Tailings' samples from the two streams were analyzed (low and high magnetic field tailings).

Magnetic separation tailings streams are non-acid generating. The magnetic rejects from the low magnetic field are classified as leachable for lead, selenium and zinc, but the non-magnetic rejects from the high magnetic field are classified as leachable only for lead. The two streams combined should be predominately leachable for lead. Both streams and their leachates do not classify as radioactive materials according to Directive 019, nor are they classified as high risk waste. Both streams exceed NORM criteria and leachates from TCLP and CTEU-9 tests also exceed NORM criteria implying that a worker dose assessment should be carried out. Results of the MagSep tailings analyses indicate that they will require an assessment of the level of groundwater protection measures that may need to be implemented.

25.11.1.4 Configuration and Sequencing

The peripheral berms, constructed from clean waste rock, are designed to provide efficient drainage and initial containment of the MagSep tailings. Surface runoff and seepage will be collected in the collection pond located at the northeast side of the TMF. An additional buried underdrain will allow collection of drainage water from the tailings into the collection pond. No discharge to the environment is planned at this location.

The MagSep TMF development sequence was designed to allow for progressive closure and revegetation of the tailings within the TMF, while reducing as much as possible the up-front capital costs. The filling scheme was broken down into 4 consecutive phases called steps. In general, each step is consistent with a vertical raise and/or a lateral expansion of the MagSep TMF.

25.11.1.5 Stability Assessment

Stability analyses of the MagSep TMF were performed for 2 cross-sections using the overall design geometry. The overall stability was analysed using conventional limit equilibrium methods which satisfies both force and moment equilibrium. Results showed that the calculated factors of safety meet the design requirements.

It was identified that liquefaction might become the most important design condition. It is anticipated that MagSep tailings would retain very little to no water and compaction level will be high, therefore liquefaction within the MagSep pile is not expected to develop. Design features, such as the rock fill berm and the underdrain, are incorporated in order to further provide rapid drainage in case unexpectedly high rates of infiltration or saturation occur. The foundation of the MagSep facility, however, consists mainly of sandy soil deposits which is often associated with liquefaction. The first analyses indicate that the silty and fine sands encountered at the proposed site are not liquefiable under the analyzed seismic conditions. A geotechnical investigation along the future dyke alignments and MagSep TMF footprint will be performed at the detailed design phase in order to confirm the hypothesis.

25.11.1.6 Groundwater Protection Assessment

A numerical modelling study of groundwater flow and solute transport was completed to assess the impact of MagSep facility on groundwater in accordance with the regulatory framework outlined in Directive 019. It is determined that the chemical species of interest in seepage water from the MagSep facility are lead and zinc, which mobility is very low and low to moderate respectively. Leachate coming from the MagSep facility is not expected to be radioactive based on the Directive 019 criteria and this aspect was not considered in the simulations. The modelling results show that the daily seepage rate per unit surface from the MagSep facility would be lower than the Directive 019 criteria. The modelling results show that lead and zinc concentration in groundwater should not exceed the RESIE criteria at a distance of 50 m downgradient of the MagSep facility.

25.11.2 Hydrometallurgical Separation (Hydromet) Tailings Management

25.11.2.1 Introduction and Location

The different elements of the Hydromet tailings management area include a Tailings Management Facility (TMF), a waste water storage basin (WSB) and an adjacent dewatering platform.

25.11.2.2 Geotechnical and hydrogeological Field Investigation Summary

The foundation conditions at the Hydromet TMF and the WSB were assessed by conducting a geotechnical site investigation consisting of 3 boreholes and 6 test pits, in order to determine geotechnical properties, the bedrock depth and the prevailing hydrogeological conditions.

Little variability was observed in the subsurface layers over the entire area based on the collected information.

A total of six (6) observation wells were installed in the boreholes to assess the general hydrogeological conditions. Further field measurements will be performed to be able to determine the underground water flow direction and more precise overall hydrogeological conditions in the area.

25.11.2.3 Geotechnical Conditions

The general soil stratigraphy encountered shows similarities across the area with variation in soil type and lithological unit thicknesses. The water table was generally measured close to ground surface. The foundation material consists of silty sand deposits over bedrock with poor rock quality designation on the surface to excellent at depths beyond 1 m which are elements providing favourable long-term safety factors against slope failure.

In the present context, liquefaction should be considered as a potential design condition. As some low-density granular material was observed ground improvement measures, such as dynamic compaction, are to be considered to ensure that the infrastructure will resist the required project seismic loads and will prevent potential ground liquefaction. During the detailed design phase, additional in-situ testing will be carried out to confirm these results.

25.11.2.4 Geochemistry Assessment Summary

A suite of samples from the multiple steps of a trial hydrometallurgical process were retained for geochemical analysis to evaluate the risk for radioactivity, acid rock drainage and metal leaching of the Hydromet tailing. The results were used to classify the Hydromet tailings according to Quebec Directive 019 and to identify constituents of potential environmental concern.

One sample combining the major streams of the hydrometallurgical process was analyzed. However, this combined sample does not include the final neutralization step of the process which was ongoing at the time of analysis.

The sample had high sulphur content; however, the actual long-term acid generation potential is expected to be minimal given the absence of sulphide. This sample is classified as leachable for fluoride, lead, and selenium and it is not classified as a high risk waste. The tailings solids are classified as radioactive waste but not its leachate. The combined major streams sample and its leachate from the three leaching tests exceed NORM criteria, thus implying that a worker dose assessment must be carried out. Sample size was insufficient to carry out analyses for the classification for leachability. Given the hydrometallurgical process is still in development, final process tailings may differ and additional testing will be carried out to refine their classification.

25.11.2.5 Management Options and Configuration

A thickening plant will be constructed in order to increase the solids content to up to 50%. Following the thickening, dewatering operations will take place at the Dewatering Platform, which will be equipped with a geomembrane liner covered by granular drainage layer. The installation will enable the drained process water to flow by gravity directly into the WSB. During the winter months, geotubes will be installed on the granular material to dewater the thickened slurry. During the warmer season, the slurry will be dewatered using geotextiles and granular drying beds. Once the tailings have been dewatered they will be excavated and deposited in the TMF using hydraulic shovels and haul trucks. The WSB footprint consists of a 463,000 m^3 capacity pond and it is planned to be lined with a geomembrane.

The different activities required during the development of the Hydromet TMF is divided into 4 steps over the life of the mine. The construction sequence was designed to allow for progressive closure and revegetation of the tailings within the TMF, while reducing as much as possible the up-front capital costs. Closure of the TMF will consist of the profiling of the dewatered tailings to ensure surface water run-off at the final surface, and the installation of a low-permeability protective soil layer on top of the reprofiled tailings so that the surface will be apt to vegetation.

25.11.2.6 Preliminary Stability Assessment

Stability analyses of the Hydromet TMF were performed for 4 cross-sections using the overall design geometry. The overall stability was analysed using conventional limit equilibrium methods which satisfies both force and moment equilibrium. With the adjustment of the slope geometry and the addition of berms along some infrastructure, the calculated factors of safety meet the design requirements. In general, the slip-surfaces are contained within either the starter berm material or the controlled compacted tailings and typically do not extent through the foundation material.

It is expected that the sandy silts and silty sands encountered at the proposed site are susceptible to liquefaction under the analyzed seismic conditions. Thus, provisions for the implementation of ground improvement measures are required at the footprint of the dykes and under the impoundment to some limited extent. A geotechnical investigation along the future WSB dyke alignments, the TMF starter berm and the overall footprint will be performed at the detailed design phase in order to confirm the hypothesis and to select the most appropriate ground improvement measures.

25.11.2.7 Preliminary Groundwater Protection Assessment

Water management is one of the key elements of the project. It is estimated that effort to reduce the Hydromet water content before disposal will provide better control on the seepage water quality to groundwater. Using a thickening plant and a dewatering process, the solids content of the slurry is expected to be as high as 75% by weight. Considering that a significant portion of the tailings pore water will be removed and the installation of a low-permeability protective soil layer, seepage of tailings pore water to groundwater is expected to be low.

Additional testing has been recommended. The assessment of the Hydromet tailings has not been fully completed and, based on the results so far, it has been concluded that Hydromet TMF will require groundwater modelling studies to quantify the infiltration rate to groundwater and to demonstrate that groundwater protection objectives are satisfied.

25.12 Site Water Management

The purpose of the Kipawa Site Water Management is to control contact water at the site and thereby limit the risk of adverse effects from contact water on the natural environment.

25.12.1 Models

Two methods were used to provide the basis for the feasibility-level design of the water management system: a site water balance and a hydrologic/hydraulic model.

A water balance model was created, using GoldSim software and historic climate data, in order to estimate the flow volumes for the site water management during the 15.2 year operation of the site. The results were used to estimate the size of site water management structures and the required pumping and treatment rates. A hydrologic and hydraulic model of portions of the water management system was created using SWMM5 software in order to evaluate runoff to and capacity of the ditches at the site. Those results were used to determine the water management criteria and infrastructure for the three sites (Mine, MagSep and Hydromet).

The water management infrastructure for the Kipawa Project includes: seven ponds with active volumes ranging from 1,300 m^3 to 463,000 m^3, 13.7 km of contact water ditches, 4.5 km of diversion ditches with slopes ranging from 0.2% to 29.4%, two water treatment plants (Mine and Hydromet site) with peak inflows of 3,600 m^3/day and 3,300 m^3/day and average yearly volumes of water treated of 781,000 m^3 and 688,400 m^3, respectively, and two release points to the environment (Mine and Hydromet site).

25.12.2 Water Management - Mine Site

At the mine site, runoff, and exfiltration are captured by 6,530 m of contact water ditching, where flows are routed by gravity towards the south and north collection pond, with water pumped from latter to the former. All ditches will be lined with riprap. These collection ponds are designed to contain the 1:100 yr design storm and are equipped with spillways to pass the peak PMP storm flow.

The mine site south pond receives water collected in the pit sump via a pumping system. In order to manage extreme events, the pumping is stopped when the collection pond is more than half full. Water is then pumped to be treated and discharged to the nearby creek.

Directive 019 requires continuous flow and pH monitoring upstream of the mine site treatment discharge and that the impact in terms of flow on the receiving creek must be minimised. Follow-up monitoring of flows on the receiving creek upstream of the discharge point is then recommended.

At the time of writing, the water quality modelling had not been completed. The results of this modelling may indicate runoff from the waste rock pile is adequate for direct release to the environment which could reduce the volume of water to be treated. This will be further evaluated in subsequent phases of the project, once the water quality model is completed.

25.12.3 Water Management - Plant Site (including MagSep)

At the plant site, runoff from upstream natural areas north and west of the mill and MagSep reject pile are captured by two non-contact water ditches (total length of 3,240 m) to route the water towards two existing natural channels. Runoff from the mill site and the road, as well as runoff and exfiltration from the MagSep TSF, are captured by 4,050 m of contact water ditching to route the water towards the MagSep collection pond. To protect the ditches against erosion, sections will either be lined with riprap or have rock check dams.

The collection pond is designed to contain the 1:1,000 yr design storm and is equipped with a spillway to pass the peak PMP storm flow. Water is pumped from the pond to the mill for use in the process. Any excess water from the MagSep pond is pumped to the Hydromet water storage basin.

25.12.4 Water Management - Hydromet Site

At the Hydromet site, runoff from the natural south area south is captured by 1,250 m of non-contact water ditching to route the water towards a discharge into the existing channel to the west. To protect the ditches against erosion, sections will either be lined with riprap or have rock check dams. Runoff and exfiltration from the Hydromet tailings and the tailings dewatering platform are generally routed towards the Hydromet WSB, the north and west collection pond. Runoffs from the tailings around the periphery are captured by 3,150 m of contact water ditching. To protect the ditches from erosion, the ditches must be lined with riprap. All ponds at the Hydromet site are designed to contain the 1:2000 yr design storm and is equipped with a spillway to pass the peak PMP storm flow. Runoff and exfiltration from the tailings are captured in either the west or the north collection pond and then pumped to the Hydromet WSB.

The Hydromet water storage basin has an active volume of 463,000 m^3. Water from this basin is pumped either to the mill for use in the process or to a water treatment plant before discharge to the nearby creek. Directive 019 requires continuous flow and pH monitoring upstream of the Hydromet treatment discharge and that the impact in terms of flow on the receiving creek must be minimized. Follow-up monitoring of flows on the receiving creek upstream of the discharge point is then recommended.

Process water that is extracted from the Hydromet tailings at the thickening plant on the Hydromet site will be pumped back to the mill at a constant rate of 2,500 m^3/day for use in the process.

25.12.5 Collection Pond Design and Construction

The proposed collection ponds are designed to collect all runoff and seepage from each site and the water is then clarified prior to use in process or release to the environment. Depending on the local topography, the pond consists of a layout of cut and fill materials, combined with the use of geosynthetic liners to contain water. The collection ponds are designed to: retain water, meet or exceed required factors of safety (F.S) for embankment stability and consider all aspects of constructability, stability, seepage and resistance to external and internal erosion forces.

25.13 Mine Closure

A conceptual closure plan will be prepared with respect to the "Guidelines for preparing a mining site rehabilitation plan and general mining site rehabilitation requirements" and the Québec *Mining Act*. The conceptual plan will be presented to the Ministère des Ressources naturelles (Ministry of Natural Resources) for approval before the beginning of the mining activities.

Over the course of the 15.2 years of mining activities, the project will have produced a total of 18.6 Mt (9.3 Mm^3) of waste rock, 10.9 Mt (7.5 Mm^3) of tailings from the magnetic separation process and 9.25 Mt (6.1 Mm^3) of tailings from the hydrometallurgical process. Overall, once all mining activities have ceased; two piles of dewatered tailings and one waste rock dump will remain on site. The geochemical assessment does not suggest rehabilitation works other than stabilizing the surface, controlling the erosion and providing for adequate surface water management.

A progressive rehabilitation program will be implemented in order to lower the environmental impact during the project. In general, surfaces will be reshaped in order to allow natural runoff patterns to form and will then be vegetated. At the end of the mining operations, the sediments found in the footprint of the water storage basin will be characterized and disposed of, in compliance with the applicable laws. The estimated rehabilitation cost for of the Matamec project after 15.2 years of operation is $23.1 M.

25.14 Project Execution Plan and Schedule

The approach chosen for Matamec is completely adapted to the situation of the development of rare earth mine in the Quebec context. For this level of study, all work packages, "battery limits" for each area, and cost control strategies were identified.

Key dates, milestones, and the critical path were identified in the Project Schedule (Appendix 6.2). In order to meet the Client's time frame, the detailed engineering phase should commence Q4-2013. Experienced resources (engineering, procurement, contract management, health and safety, quality control, environmental, human resources, administration, etc.) are currently available and can be grouped under the direction of the Client.

Risks relating to the PEP and schedule were considered and evaluated in Section 24.3, and will be reassessed in further phases of the project.

The project structure, planning, construction organization, health and safety, and environmental considerations have been evaluated to be feasible for this level of study.

25.15 Operating Plan and Human Resources

25.15.1 Organizational Model

The overall organization will be constituted of three (3) main areas: mine, process plant, and administration. The mine department will include operations, maintenance, geology, and mine engineering. The process plant will involve both operations and maintenance, and will also have resources in health and safety as well as training. The assay laboratory will be part of this department. Site management, accounting, purchasing, warehousing, information technology services, surface crew operation and logistic, human resources, health and safety, environment and public relations will be part of the administrative sector. The total workforce will include 229 employees.

25.15.2 Health, Safety and Environment

Matamec is committed to protecting the health and safety of workers and the public as well as safeguarding the environment influenced by the Company's activities for its Kipawa project. At the outset of the feasibility study for its Kipawa project, Matamec undertook a thorough risk assessment to identify, understand, evaluate, and eventually mitigate or control risks when in operations. The Company will keep maintaining procedures to identify systematically the hazards and effects, which may affect or arise from its activities, and from the materials which are used or encountered in them. Matamec's objective is to include prevention considerations in all designs that impact the workers, the public, and the environment.

Change management will also be implemented throughout the organization.

To properly prepare for the construction phase, the bid package will include a detailed description of Matamec's health and safety requirements for all contractors and subcontractors. Including these requirements in the bid package will ensure that the contractors are aware of them and will also show how Matamec is serious about them. During construction, Matamec will ensure that everyone working on-site will have - at the very least - the minimum mandatory training necessary, which includes both Company's and contractors' employees.

For its operations, Matamec will meet or exceed the requirements of the Environmental and Occupational Health and Safety legislation, and therefore will implement and maintain effective health, safety, and environmental management systems that drive continuous improvement and will maintain transparent, consultative relationships with all stakeholders through proper communication channels.

Procedures will be put in place to establish HSE objectives and performance criteria at relevant levels as well as plans to achieve these objectives and criteria.

The Kipawa deposit contains some thorium and uranium based radioactivity. A radiation protection plan will be developed and implemented for the Kipawa site. Furthermore, measures will be taken to protect people and the environment from dispersion of and exposure to radioactive ores, concentrates, and wastes.

Matamec's Emergency Response Plan will be an operation's guide to all procedures and courses of action that should be followed in the case of a mine site emergency or emergency on access road to the mine site. It will identify those responsible for taking action immediately after the discovery of and during the response to an emergency, as well as their respective duties.

25.15.3 Supply and Logistics

The operation of the Kipawa site will require the utilization and consumption of various energy and chemical products, as well as other types of consumables, most of which will be delivered in bulk to the operating site. A minimum level of logistics will be required to ensure continuous and effective operation of the Kipawa site throughout the entire mine life. A procurement logistics will be in place and will consist of market research, operation requirements planning, suppliers' management, ordering, and order controlling. Production logistics will ensure that each operating unit will be supplied with the right products and consumables in the right quantity and quality at the right time. A proper warehouse management system will also be set up in order to adapt to any situation that can arise by making a last-minute decision based on current activity and operation status.

25.16 Environmental and Social Impact Assessment

All potential impacts will be assessed during the ESIA, which is currently underway. A preliminary assessment has revealed that the Project's main potential impacts that have been anticipated are related to water quality (surface and groundwater), loss of natural habitat, potential risks associated with the presence of radioactive substances in the rare earths and social changes (e.g. modification of land and resource use, and quality of life).

Although beneficial spinoffs (including economic opportunity) are slated to be generated by the Project, Aboriginal local, non-Aboriginal local, regional populations and institutions have expressed some concerns with respect to the Project's environmental and social impacts. Addressing these concerns within the Project design and in the environmental management plan (to be included in the ESIA report) will contribute to achieving the Project's social acceptability.

25.17 Marketing Plan

In the future, Matamec would continue to participate in key industry trade shows and conferences. The company's role at these events would evolve from a company that was for many years primarily an exploration company to that of a key supplier in the field of heavy rare earth products.

Concurrently, key milestones pursued which will advance the project to produce a saleable series of products, these milestones would include:

- Securing financing for the development stage before the construction phase begins;
- Complete the planned second pilot plant with the goal to further optimize the metallurgy;
- Completion of an off-take agreement with Toyota Tsusho Corporation;
- Acceptance of social license to operate through standard environmental and social evaluation process;
- Start of construction subsequent to receipt of permits in 2014 and project commissioning starting Q4 2016.

At the end of 2016, the company will be one of the first heavy rare earth producers outside of China; this will position the company to forge key business relationships with major end users of rare earth elements around the world. This would support further development of the property which could produce addition output that would be available to the marketplace. The economics of this would be evaluated in the interim.

Over the last several decades China has not just held the position of being a rare earth ore producer, but they are the dominant force in the separation of the ore into the individual rare earth oxides and the manufacturing of alloys and magnetic materials. It is these downstream operations that require development outside of China, which will free the many multinational organizations from their dependence on the current Chinese production of these types of products. The company would evaluate technologies that could be developed to increase its contribution to the value chain.

25.18 Risk Assessment and Management

Risk Identification, Assessment, and Management is an on-going process which will continue throughout the life of the project. All information presented in this report is valid for this stage of the process, but will change and be developed as the project evolves. Many risks have been identified, with 71 risks evaluated, and mitigation plans drawn up for eight (8) risks.

The risk analysis has been performed with the participation of various delegates. Risks were identified for the current phase of the project, as well as for all subsequent phases of the Project. Comprehensive mitigation plans will be developed for the remaining risks in further stages of the project. This is to be expected at this level of study.

25.19 Conclusions

After conducting a review of the information and after completing the present feasibility study, the authors concluded that the Kipawa Heavy Rare Earth project is technically and economically feasible. The FS shows a pre-tax NPV (10%) of 260M$ with an Internal Rate of Return of 21.6%.

Some risks have been identified as well as mitigation plans to minimise or neutralise their impacts. On the other hand, upside opportunities have been recognized and recommendations have been proposed to optimise some aspects of the project.

26.0 RECOMMENDATIONS

26.1 Introduction

Matamec is developing its Kipawa Rare Earth Elements (REE) - Yttrium - Zirconium deposit located 50 km east of Temiscaming in North Western Quebec. The site is accessible by road and logistical conditions are favourable for mine development and ore concentration with easy access to the Quebec and Ontario roads and railroads. The power line grid is currently not available at the site, but a request to Hydro-Quebec could be made, who provides of some of the most affordable electrical power in North America. The area surrounding deposit is used by forestry and most importantly by pulp and paper industries, which apply chemical processes and handle various types of chemicals. The area does not have a mining history aside from sand and gravel quarries. As the forestry industry is in decline, the local population is eager to attract projects to create new employment in the area.

The development of applications using REE in products that are in strong demand would increase in the future, fuels the search for resources that will be available at a low cost and competitive price without commercial barriers for domestic uses and exports. Applications of REE include high intensity magnets, catalysts, metal alloys, polishing, glass, LED, and others; some of which will be facing increased demand, and others will experience stable demand. The actual suppliers of REE oxides, being almost entirely located in China, will limit and reduce their exports to focus on domestic transformation and use. New and old projects are being brought into production, but will lack some of the heavier REE to fill the market demand.

The marketing survey performed indicates that in the years to come, it is expected that there will be an increased demand for HREE especially for terbium and dysprosium. The Kipawa deposit contains a variety of REE, including terbium, dysprosium, and other HREE, which is remarkable.

However, even if the project is very well advanced, the Feasibility Study shows that additional studies for certain aspect should be performed before entering the detailed engineering phase in order to optimize and improve the project and these aspects are presented in this section.

26.1.1 Geology and Resources Estimation, Exploration Potential

The deposit is currently considered open both laterally and at depth, though to varying degrees and present potential for increasing tonnage.

At depth: After Matamec's 2012 campaign, the deposit's extension at depth is fairly well defined. Eight sections do remain open at the 0.22% TREO (0.05% Y_2O_3) level and are considered worthy of further exploration holes. It should be noted though, that with the possible exception of sections 2340 to 2407 to the east, open sections seem to present only moderate opportunities to increase tonnage as they are bounded on each side by sections that are themselves closed off.

The possibility remains of finding other REE lenses similar to the Kipawa deposit, and the possibility at depth should not be discounted. It is unlikely that the only spot where the right conditions for REE precipitation occurred just happened to be at surface where it was needed. More likely is that these favourable conditions occurred in many places and that the Kipawa deposit was discovered because it was the only one that was outcropping at this point in time, not the only one in existence in the region (indeed, it is known from boulders of Kipawa-style mineralization at the PB and PS zone that at least one other lens existed at one time). That said, no geophysical method has presently been found to detect Kipawa-type mineralization at depth and depth exploration would therefore have to rely on a regular "blind/Wildcat" drilling grid. Such a grid is in the planning stages in Matamec's offices.

North-West extension: Prospects for this area were greatly increased with the discovery of eudialyte mineralization in one of Matamec's 2011 mechanical trenches (see Figure 10.1 and July 28th press release), 220 m north-west of Unocal's last trench (which only contained mineralization in the Mosandrite Zone). Extent of this mineralization and continuity with existing resource blocks are to be a focus point in Matamec's next drilling effort.

South-East extension: The immediate south-east seems to be fairly blocked by the unmineralized trench T-9. Trenching efforts in this area in 2010 and 2011 encountered either very modest grades (2010) or relatively thick overburden (more than 3m) which prevented mechanical trenching (2011).

However, based on thickness and grade two adjacent sections remain consistently and strongly open at depth in the area preceding Trench 9. Furthermore, this area is located at the edge of the hill. There is also strong evidence of Kipawa-style REE mineralization 2 km further south-east, found in the boulders of the PB and PS showings. A fold, a slight change in dip (combined with the change in topographic surface) or the beginning of an *en echelon* secondary lens to the south would be consistent with a barren trench 9 and those open sections. Further above-ground exploration of this prospective area is therefore fully warranted and strongly recommended.

A provisional budget is presented below in Section 26.2. Matamec would have the option to conduct this exploration program prior to the detailed engineering phase to potentially increase the tonnage. This could provide more flexibility in the development of the mining plan.

26.1.2 METALLURGY

The process has been tested and is proven except for the removal of one impurity in the final purification. This is due to the fact that the required testwork results were not available before the closure of the Feasibility Study. The final purification still has to confirm the removal of a few hundred ppm of aluminium from the concentrates in order to meet the buyers' specifications.

Nevertheless, the testwork program showed that few minor improvements can be significant for the project:

- For the process beneficiation (physical separation), investigate reverse flotation and heavy media separation to see if the recovery can be improved at beneficiation. If the results are favorable, a trade off study is recommended to determine whether or not it is worth integrating into the process.
- For the hydrometallurgical process, the filtration of leach residue has been proven with press filters; however it might be worth determining whether or not a CCD circuit along with belt filters would improve the process and/or reduce the CAPEX.
- Perform a second pilot plant for beneficiation and hydrometallurgical concentration in order to further confirm the process and reagent selection as well as optimizing process parameters such as recoveries. The second pilot plant would confirm the sizing of the process equipment, which are currently oversized, as well as improve solution recirculation to minimize reagents consumption. Finally, the second pilot plant would be performed with samples representing at least the first 5 or 6 years of operation to optimize process parameters and to improve design criteria sufficient to support a detailed design.
- Proceed with the piloting of the purification circuit using the carbonate concentrate generated by the second pilot plant. This would allow to confirm performance and equipment sizing for the purification

circuit and to support detailed engineering. This testwork would further validate recycling and regeneration circuits for reagent used in the purification circuit.

- Alternative impurity removal methods could prove to be an improvement and should be investigated.
- The potential to separate specific components from the bulk mixed REE product at the Hydrometallurgical Plant should be investigated briefly before the next phase of the project.
- Potential to further separate into mixed LREE, MREE and HREE products with separation plant.
- The potential for recovering Zirconium and other by-products should be investigated later after the project is in operation.

A provisional budget is presented below in Section 26.2.

26.1.3 MINING

The geotechnical study has been developed based on a review of the actual diamond drill borehole cores provided from the drilling campaign. Geotechnical mapping to define the structural characteristics of the rock mass along with geotechnical drilling and logging to characterize rock mass parameters have been performed to optimize open pit slope wall angle. The mining plan has been developed based on overall wall angles of 50 and 52 degrees and geotechnical data.

In addition to geotechnical investigations, hydrological conditions should be addressed with aquifer pump testing, packer testing or geophysical borehole surveys to validate the long-term slope stability of the pit.

The waste storage facility has been located and developed using a visual and photogrammetric approach as well as fieldwork at this early stage development. Prior to final waste storage facility design, it is recommended to further investigate the geotechnical slope stability particularly foundation conditions.

The dilution has been estimated based on similar projects, and is controlled by the optimization of the mining practices. It is recommended to further assess the geological and geotechnical conditions in order to minimize the dilution.

During the pre-production year, it is recommended to perform test blasts in order to understand the blast movements and loading practices. This will provide data for improved grade control practices during production.

Based on the construction of similar projects, the rental cost of construction equipment is expected to be high. It is recommended to perform a cost comparison to confirm if it is beneficial to purchase, lease, or rent-to-buy the equipment.

Some parameters, such as milling recoveries, are expected to be adjusted during the detailed engineering phase and will affect the pit optimization and design. As parameters change, a new pit optimization and mine design must be carried out.

During the course of the detailed engineering phase, it is, thus, recommended to conduct the following studies to better optimise the design:

- Hydrological conditions with aquifer pump testing, packer testing or geophysical borehole surveys;
- Slope stability investigation including foundation conditions;
- Geological and Geotechnical assessments on dilution;
- New pit optimization and mine design based on the latest results.

26.1.4 Environmental Aspects and Permitting

The collection of field data to establish the baseline study started in 2010. The collection of data has been completed in Q2 2013 and the complete baseline study is planned to be completed by Q3 2013.

In parallel to the baseline, a complete Environmental and Social Impact Assessment (ESIA) is being concluded as well and should become available during winter 2014.

At the Federal level, a project notice has been sent to the Canadian Agency of Environmental Evaluation (CAEE) last January. The Agency responded at the end of March stating that the project will be submitted to a complete Environmental Impact Assessment, which was expected. In June 2013, the Agency provided complete guidelines to follow in order to complete the require documentation, allowing Agency to perform their evaluation of the project. The required documentation is planned to be provided to the CAEE by early 2014.

At the provincial level, it is necessary to apply for a "Certificate of Authorization" to operate a mine and it is to be delivered by the "Ministère du Développement Durable, Environnement, Faune et Parc" (MDDEFP). The guidelines to fill out the permit application are already available; however, EISA needs to be completed in order to complete the application. It is planned to send the CA application at winter 2014 to the MDDEFP.

It is recommended to complete the EISA and finalize the permits applications as per schedule in order to not delay the construction of the project.

A provisional budget is presented below in Section 26.2.

26.1.5 Plant Sites and Tailings

It was recommended in the PEA study to perform a trade-off study in order to evaluate the advantages and disadvantages of having the concentrator and the hydrometallurgical plant located on one or two different sites. The study has been performed and the results showed that it is more advantageous to put the concentrator (beneficiation plant) and the hydrometallurgical plant together in one location even if this location is 10 km south of the mine. The location has been established to take in account the populations concerns about having chemical reagents travelling across the Kipawa River.

No budget is required since the trade-off study is completed, but the optimisation of the process plant location with local topography is recommended for the detailed engineering phase.

26.2 Future Works

A preliminary evaluation of the costs involved to further optimisation of the project before the beginning of the detailed engineering has been done and is presented below. These costs will have to be re-evaluated as the project progresses.

26.2.1 GEOLOGY AND RESOURCES – COST ESTIMATION (OPTIONAL)

26.2.1.1 Verification of ore Deposit Extension

Exploration at depth (19 DDH, 1800 m - high priority) :	$320,000
Exploration north-west extension (9 DDH, 850 m - high priority):	$150,000
Regional exploration (20 DDH, 2000 m - low priority) :	$350,000
Wilcat Grid – 400m spacing (35 DDH, 5000 m - low priority):	$875,000
Total Exploration:	**$1,695,000**

26.2.2 METALLURGY – COST ESTIMATION

26.2.2.1 Testwork prior to Detailed Engineering

Optimization testwork - short term :	$50,000
Pilot Plant #2 (Beneficiation and Hydromet):	$1,660,000
Pilot Plant for purification circuit :	$600,000
Complementary testwork at equipment supplier facilities and others:	$310,000
Total Metallurgy:	**$2,620,000**

26.2.3 ENVIRONMENTAL ASPECT AND PERMITTING – COST ESTIMATION

26.2.3.1 Environmental and Permitting

a)	Redaction of the Federal EIS and permit application:	$900,000
d)	Completion of the Provincial Certificate of Authorization application:	$105,000
e)	Completion of the baseline study:	$136,000
f)	Kinetic Column testwork, results analysis and reporting:	$132,000
g)	Completion of Geotechnical drilling for dam and water basin design:	$150,000
h)	Advance dam and water basin design for permitting purpose:	$185,000
i)	Water Quality modelling:	$ 45,000
j)	Dust modelling:	$125,000
k)	Follow-up during permitting process:	$250,000
l)	Contingency:	$ 90,000
	Total Environmental and Permitting:	**$2,118,000**

26.2.4 Communication and Social Awareness

Public Engagement Sessions with the First Nations communities as well as with the local population and the government(s) and local authorities.

Engagement Projects with the First Nations communities and the local population.

Total Communication and Projects: **$1,500,000**

26.2.5 Engineering and Economical Studies

Review the marketing, market study, and strategy. Complete an off-take agreement with TTC prior to detail engineering phase.

26.2.6 Total Future Works Cost

The total future works cost prior to detailed engineering phase will be in the amount of **$6,238,000 CAD** and not including the exploration program and Matamec's administration fees.

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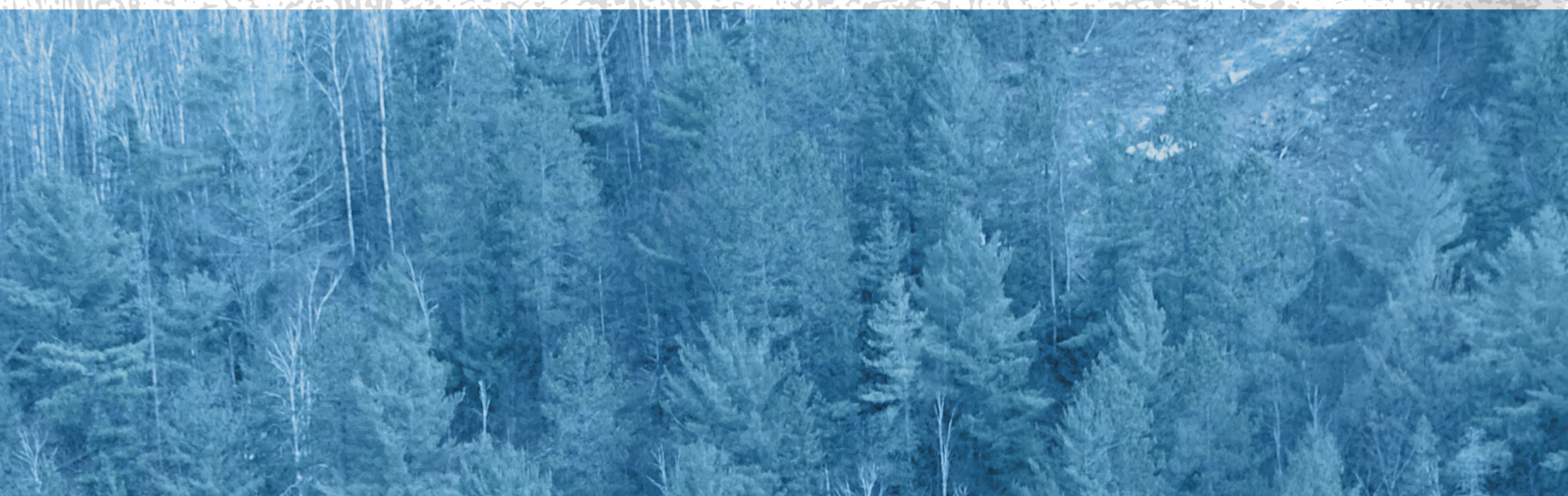
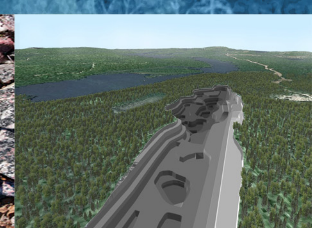
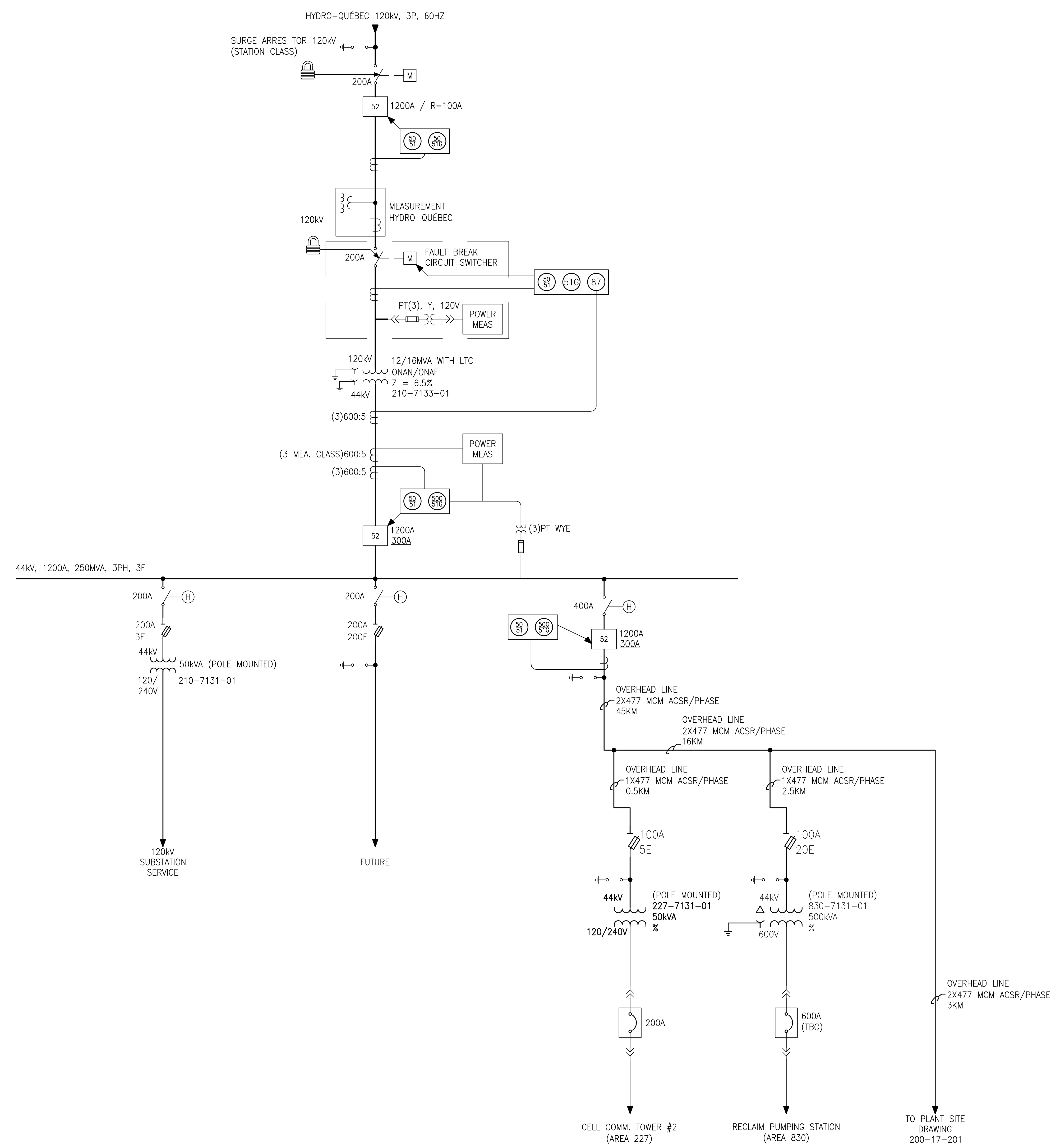




APPENDIX 1- Drawings

ROCHE GENIVAR SGS Golder Associates



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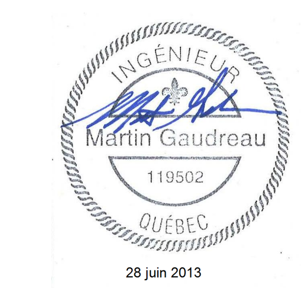

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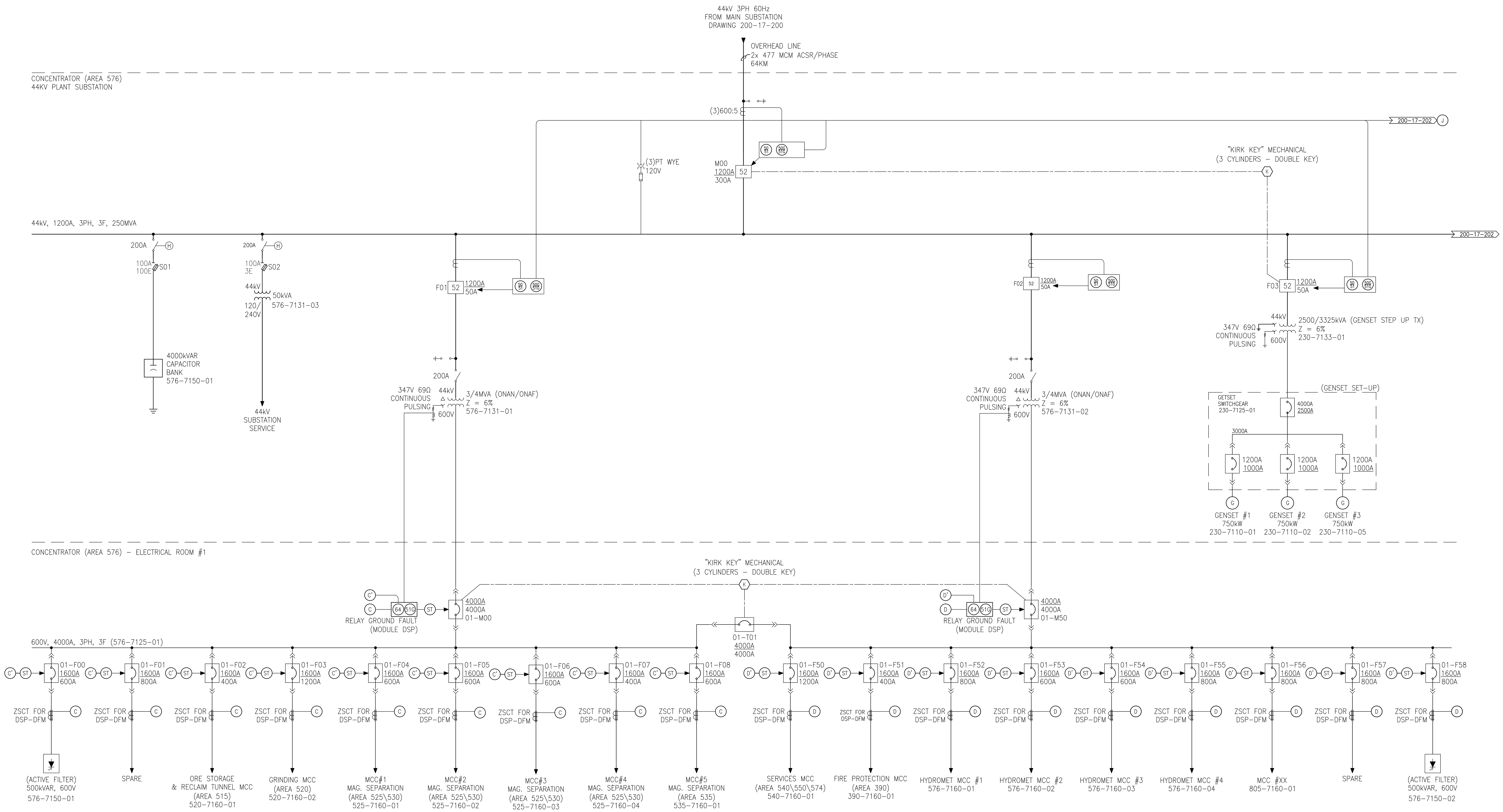

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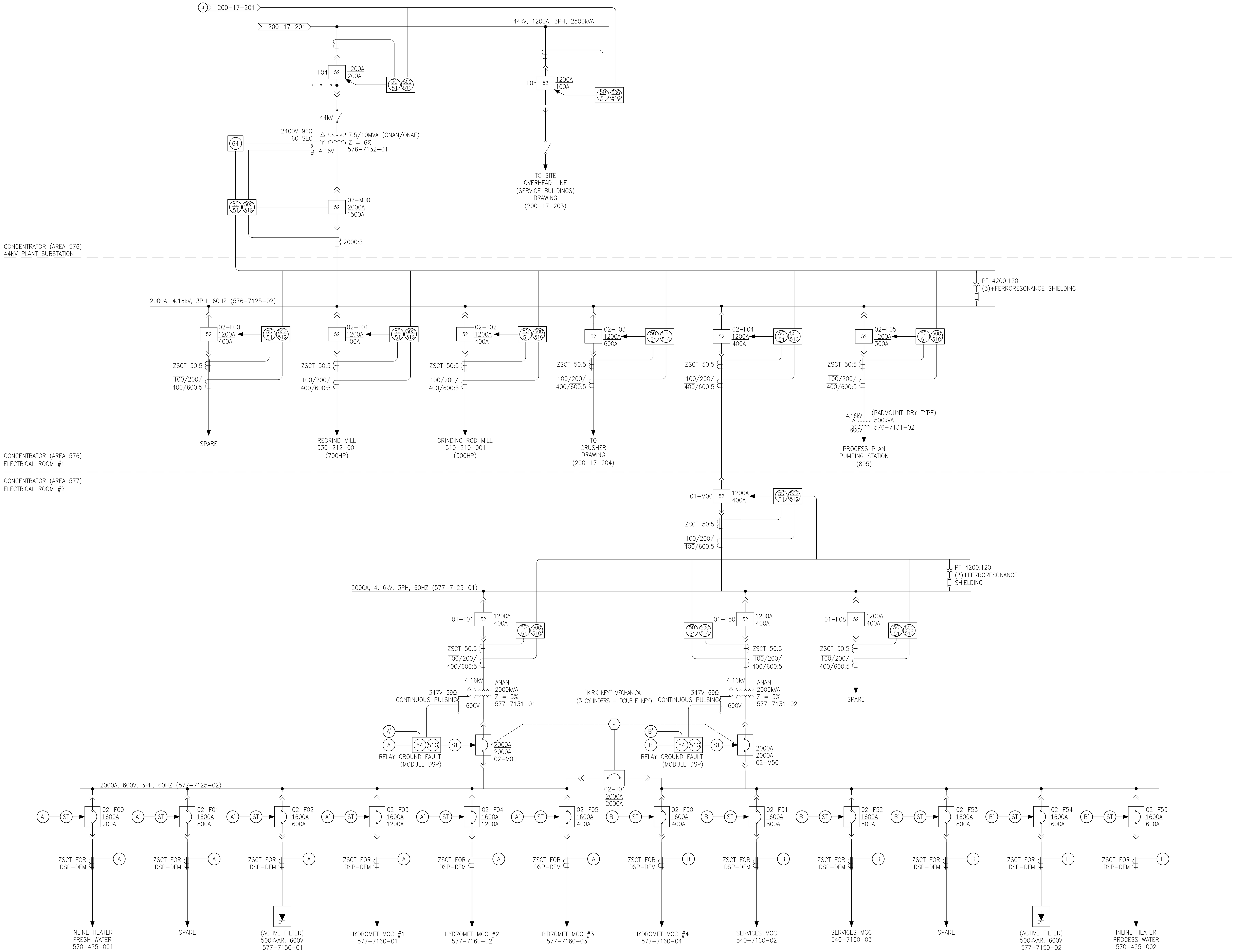

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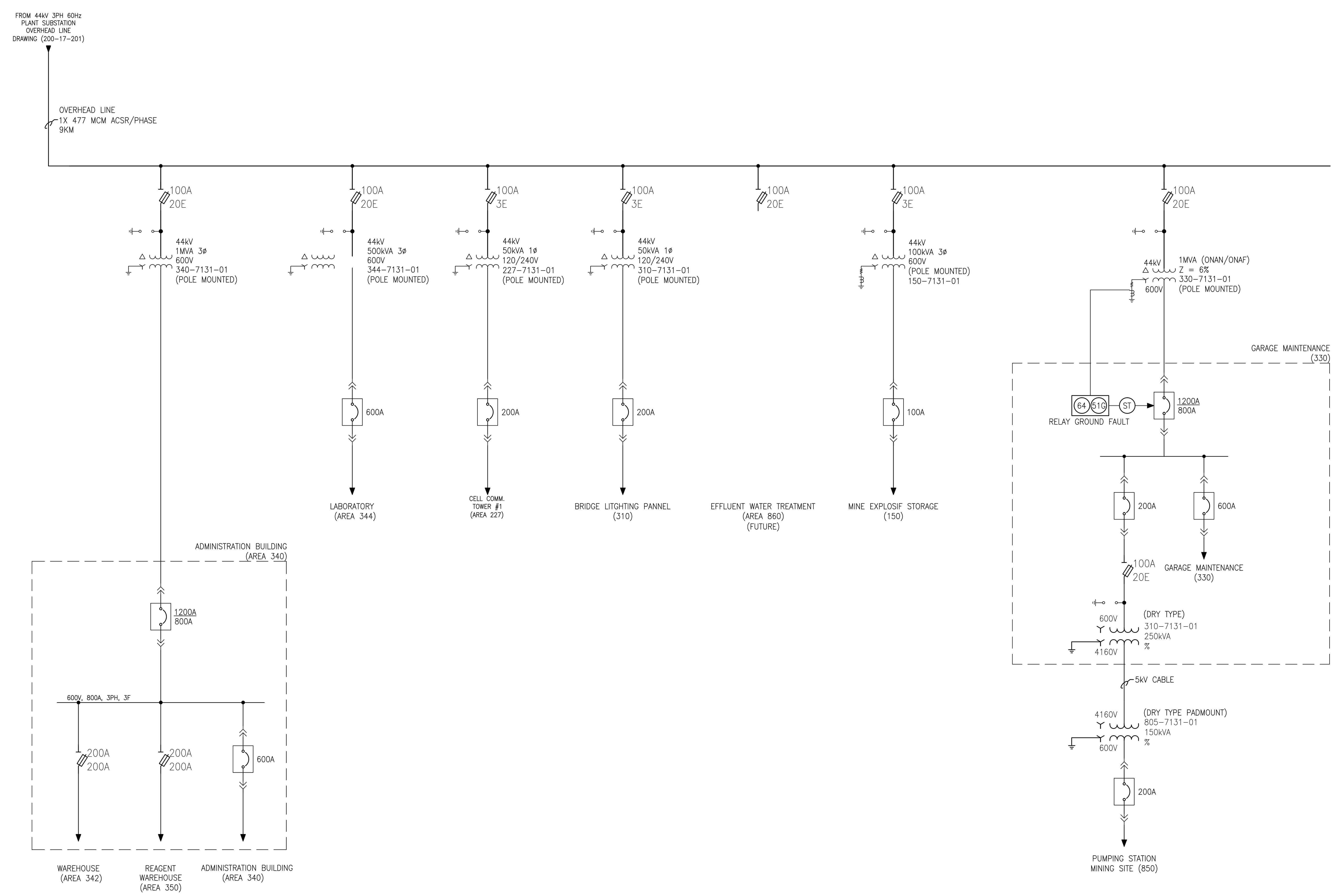

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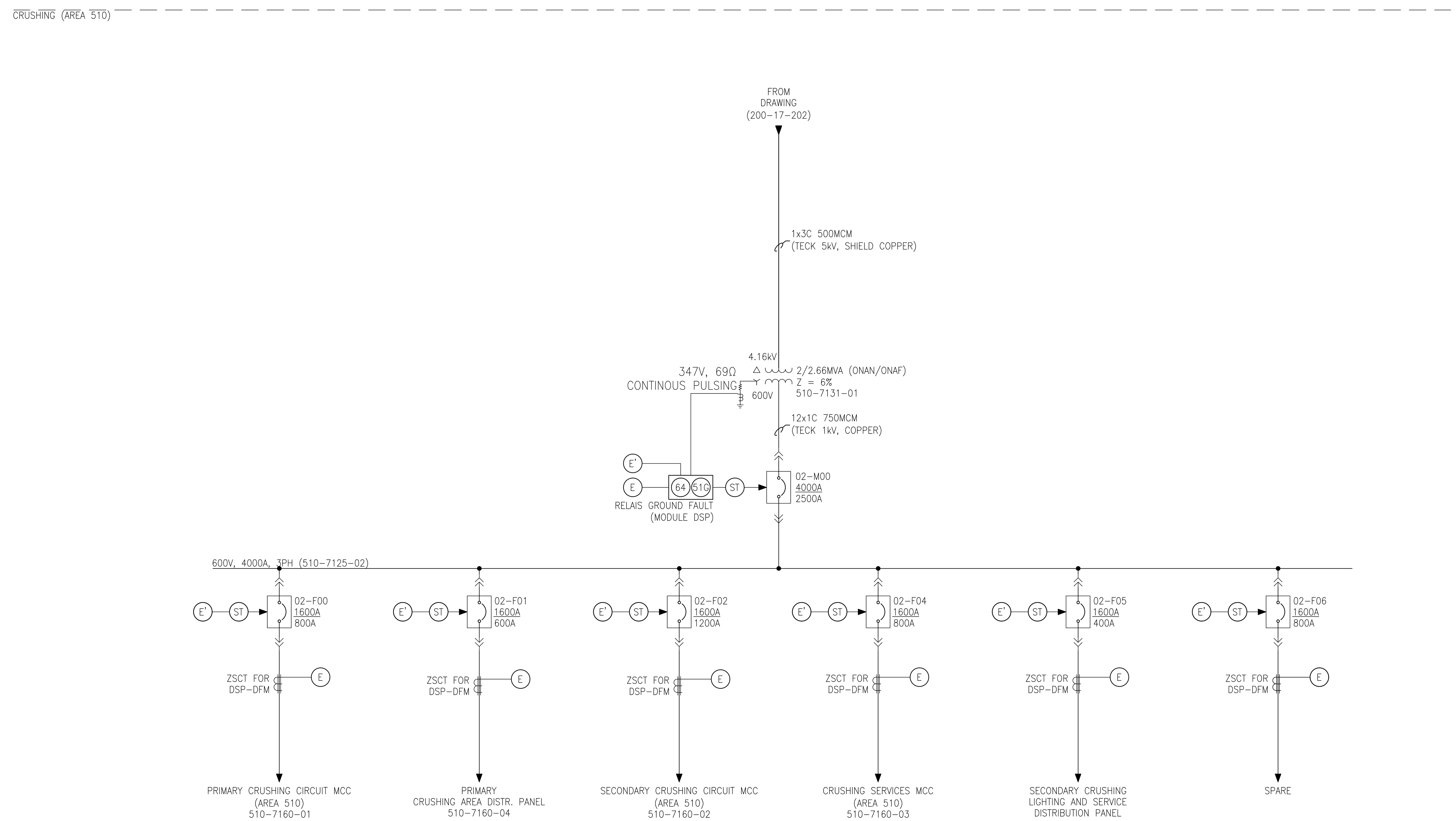

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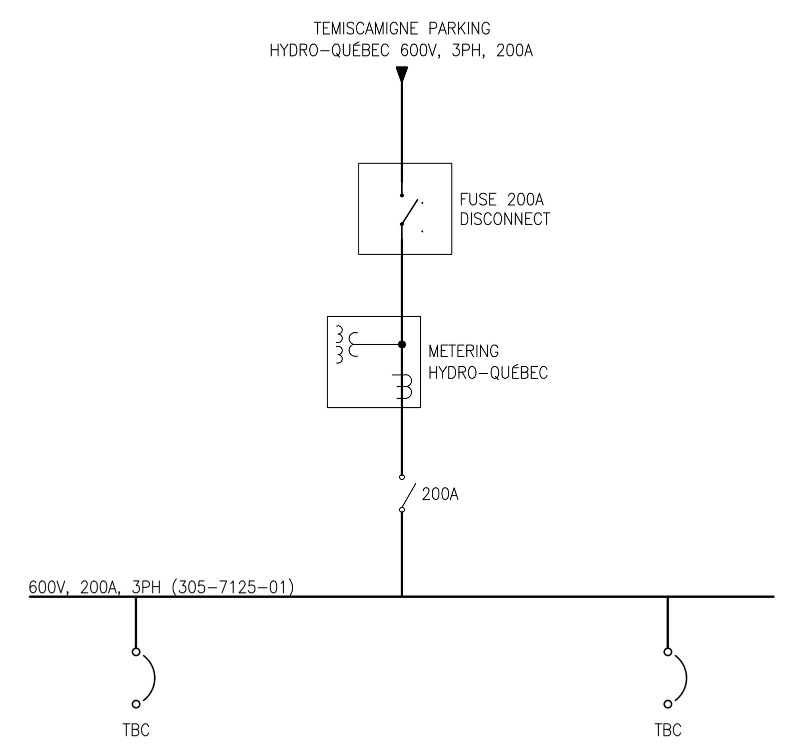

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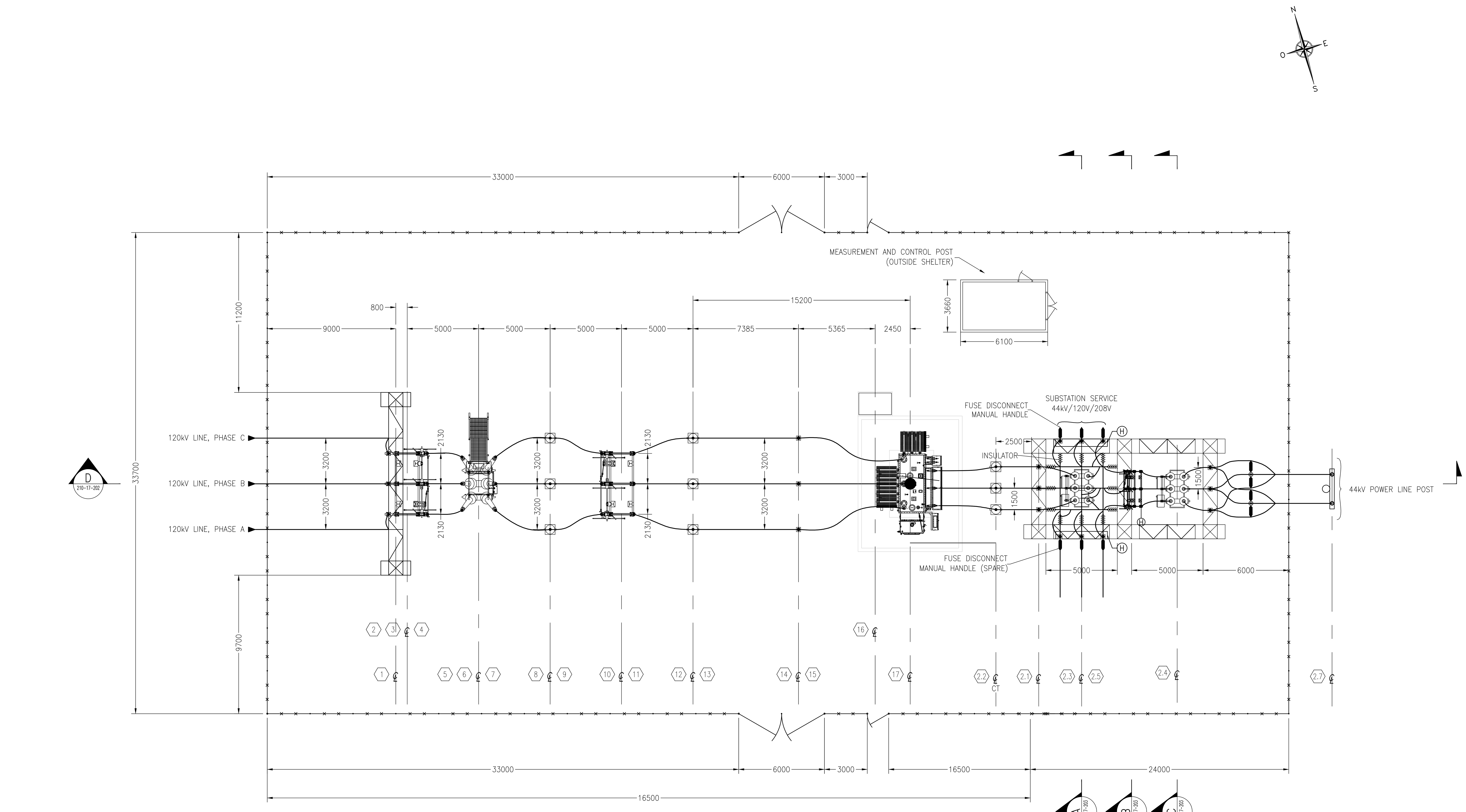


PLAN VIEW – 120KV POST

EQUIPEMENT LOCATION 120kV POST

SCALE: 1:150

NOTES:

1 PORTAL STRUCTURE

2 3 4 LIGHTNING ARRESTER AND BREAKER

5 6 7 CIRCUIT BREAKER

8 9 HYDRO-QUÉBEC METERING

10 11 BREAKER

12 13 OWNER METERING

14 15 INSULATOR POST

16 RES. GROUND

17 BREAKER

2.1 44kV SUBSTATION GANTRY STRUCTURE C/W 44kV INSULATOR, CONDUCTORS AND LITGHTNING ARRESTORS

2.2 CURRENT TRANSFORMERS (600:5) CW STRUCTURAL

2.3 44kV BREAKER C/W STRUCTURE, CONTROL CABINET, CT'S (600:5) AND PT'S 44kV/120V FOR MEASUREMENT

2.4 44kV BREAKER C/W STRUCTURE, CONTROL CABINET, CT'S (600:5)

2.5 44kV 200A FUSE DISCONNECT C/W MANUAL MECHANISM HANDLE

2.6 44kV 400A FUSE DISCONNECT C/W MANUAL MECHANISM HANDLE

2.7 SUBSTATION TO LINE TRANSITION POLE

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL: Martin Gaudreau 119502 QUÉBEC 15 juillet 2013

CLIENT / CLIENT: MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT: KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-07-15	ISSUED FOR FEASIBILITY STUDY
0E	2013-05-27	ISSUED FOR INFORMATION

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013/02/22

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"

CONÇU PAR / DESIGNED BY: MARTIN GAUDREAU, ENG

DESSINÉ PAR / DRAWN BY: JUAN PABLO ESCOBAR

VÉRIFIÉ PAR / CHECKED BY: ÉRIC POIRIER, ENG

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE: 120kV ELECTRICAL SUBSTATION PLAN VIEW

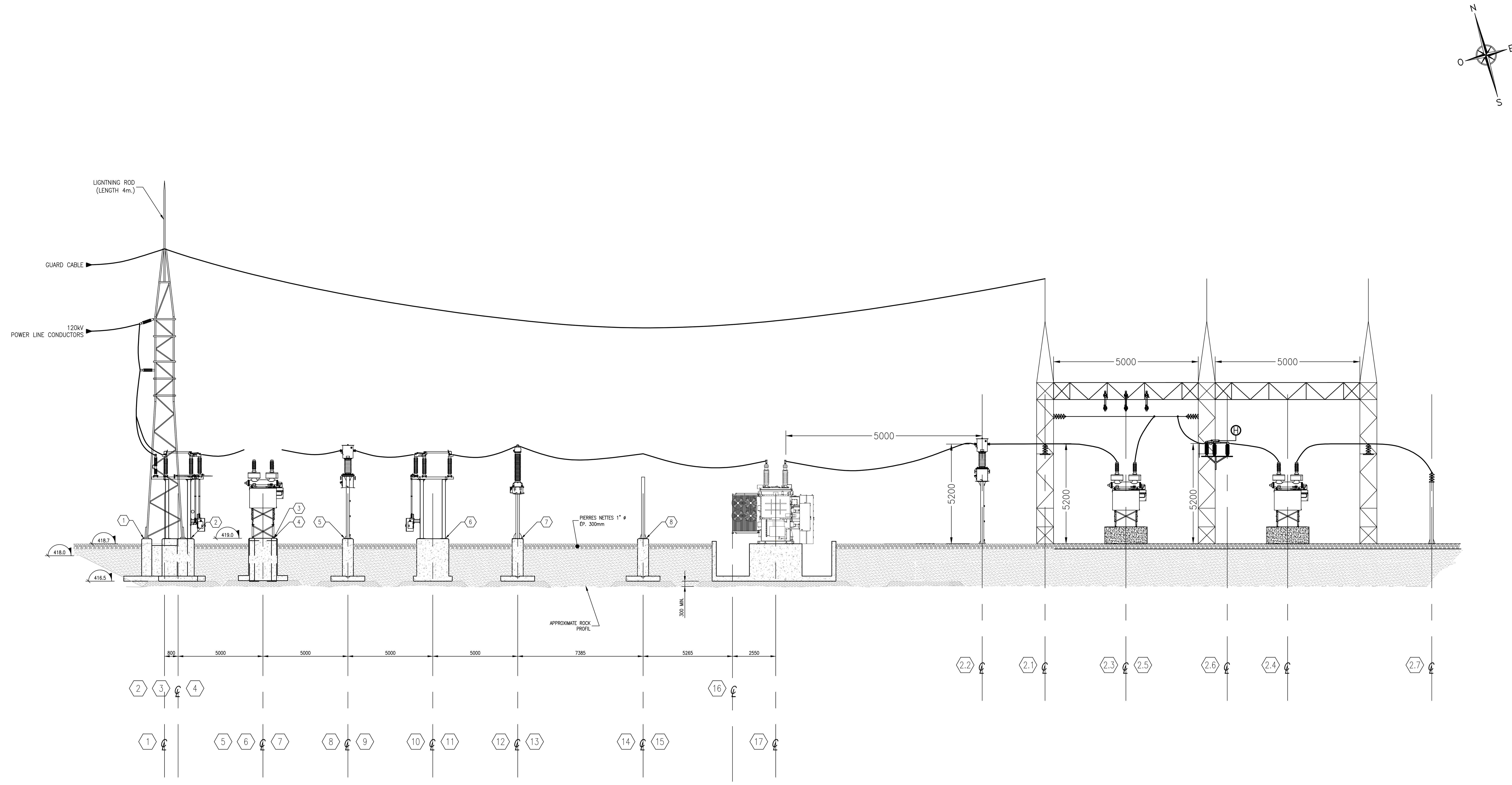
NUMÉRO DU FEUILLET / SHEET NUMBER: 210-17-201

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

RV./RV. #: 00

EN DATE DU / DATE OF: 2013-06-14



SIDE VIEW – 120kV POST (D 210-17-201)
EQUIPMENT LOCATION 120kV POST
SCALE: 1:150

NOTES:

- (1) PORTAL STRUCTURE
- (2)(3)(4) LIGHTNING ARRESTER AND BREAKER
- (5)(6)(7) CIRCUIT BREAKER
- (8)(9) HYDRO-QUÉBEC METERING
- (10)(11) BREAKER
- (12)(13) OWNER METERING
- (14)(15) INSULATOR POST
- (16) RES. GROUND
- (17) BREAKER
- (2.1) 44kV SUBSTATION GANTRY STRUCTURE C/W 44kV INSULATOR, CONDUCTORS AND LITGHTNING ARRESTORS
- (2.2) CURRENT TRANSFORMERS (600:5) CW STRUCTURAL
- (2.3) 44kV BREAKER C/W STRUCTURE, CONTROL CABINET, CT'S (600:5) AND PT'S 44kV/120V FOR MEASUREMENT
- (2.4) 44kV BREAKER C/W STRUCTURE, CONTROL CABINET, CT'S (600:5)
- (2.5) 44kV 200A FUSE DISCONNECT C/W MANUAL MECHANISM HANDLE
- (2.6) 44kV 400A FUSE DISCONNECT C/W MANUAL MECHANISM HANDLE
- (2.7) SUBSTATION TO LINE TRANSITION POLE

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR Martin Gaudreau 119502 QUÉBEC
15 juillet 2013

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-07-15	ISSUED FOR FEASIBILITY STUDY
0E		2013-05-27	ISSUED FOR INFORMATION

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013/02/22
ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS
CONÇU PAR / DESIGNED BY: MARTIN GAUDREAU, ENG
DESSINÉ PAR / DRAWN BY: JUAN PABLO ESCOBAR
VÉRIFIÉ PAR / CHECKED BY: ÉRIC POIRIER, ENG

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

120kV SUBSTATION
SIDE VIEW

NUMÉRO DU FEUILLET / SHEET NUMBER: 210-17-202
FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
RV./RV. #: 00
EN DATE DU / DATE OF: 2013-02-24

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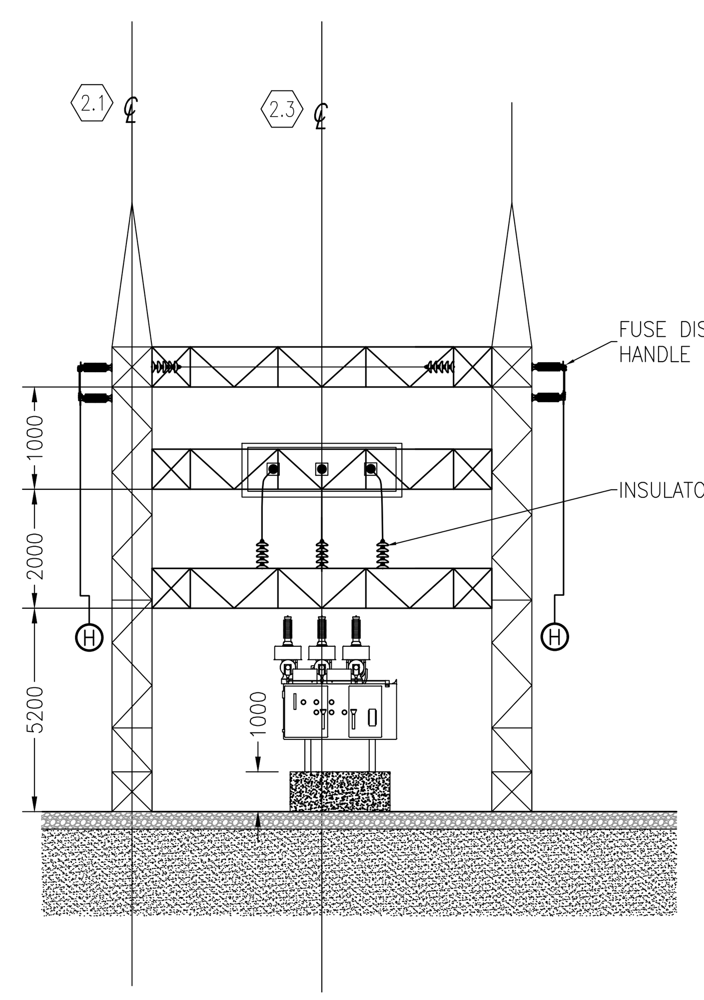
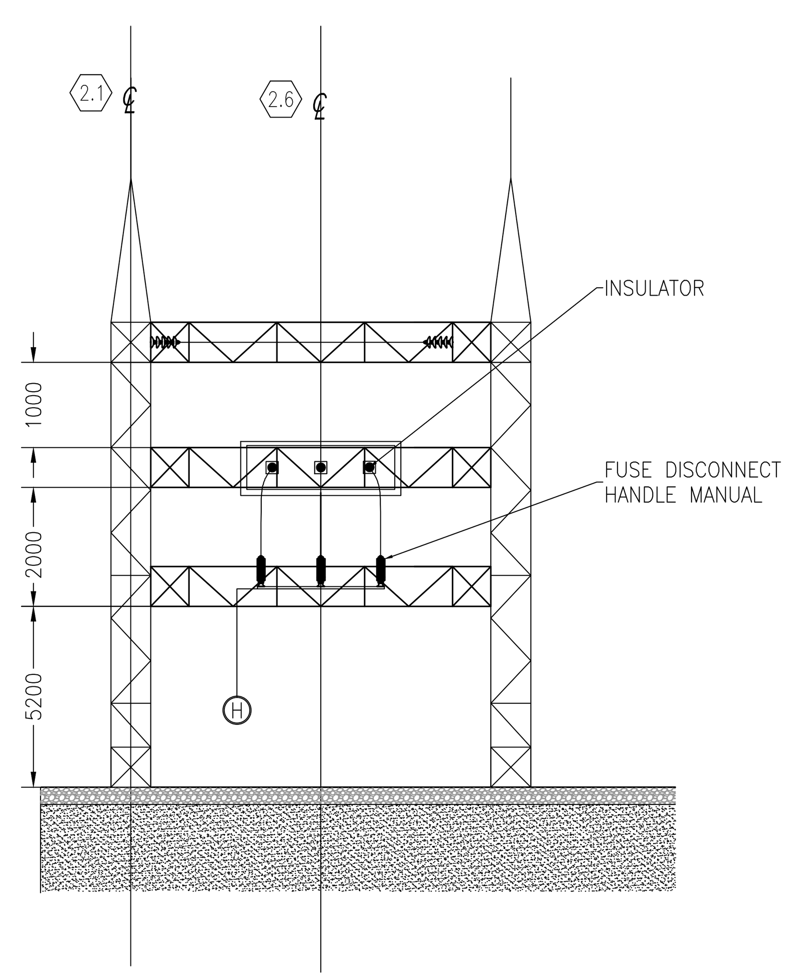
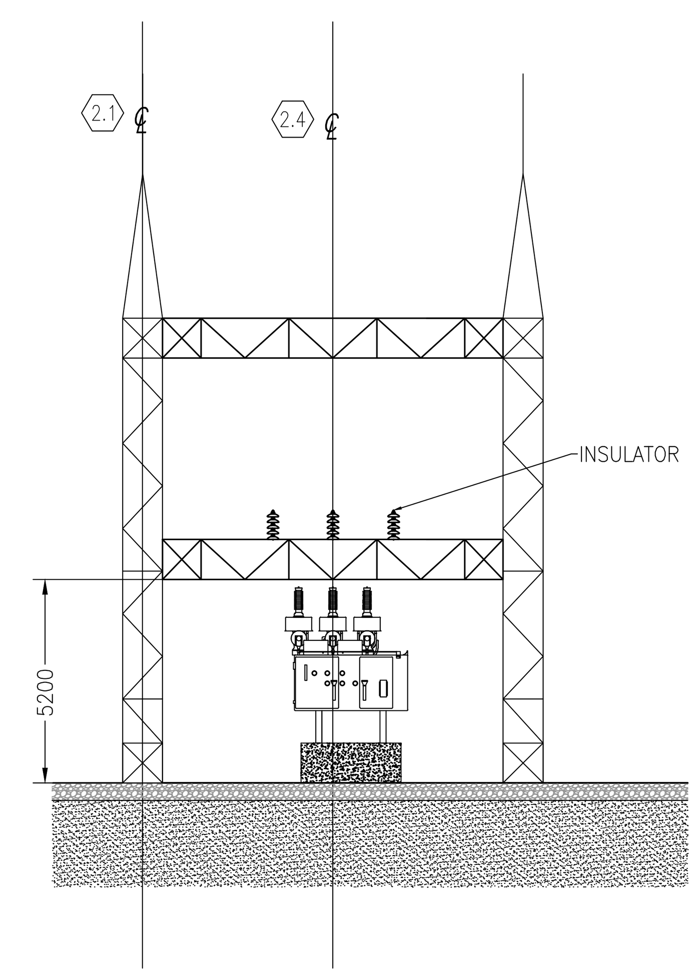


LEFT VIEW – 120kV POST A 210-17-201
EQUIPMENT LOCATION 120kV POST
SCALE: 1:150



CENTER VIEW – 120kV POST B 210-17-201
EQUIPMENT LOCATION 120kV POST
SCALE: 1:150



RIGHT VIEW – 120kV POST C 210-17-201
EQUIPMENT LOCATION 120kV POST
SCALE: 1:150

NOTES:

- (2.1) 44kV SUBSTATION GANTRY STRUCTURE C/W 44kV INSULATOR, CONDUCTORS AND LITGHTNING ARRESTORS
- (2.2) CURRENT TRANSFORMERS (600:5) CW STRUCTURAL
- (2.3) 44kV BREAKER C/W STRUCTURE, CONTROL CABINET, CT'S (600:5) AND PT'S 44kV/120V FOR MEASUREMENT
- (2.4) 44kV BREAKER C/W STRUCTURE, CONTROL CABINET, CT'S (600:5)
- (2.5) 44kV 200A FUSE DISCONNECT C/W MANUAL MECHANISM HANDLE
- (2.6) 44kV 400A FUSE DISCONNECT C/W MANUAL MECHANISM HANDLE
- (2.7) SUBSTATION TO LINE TRANSITION POLE

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR
Martin Gaudreau
119502
QUÉBEC
15 juillet 2013

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-07-15	ISSUED FOR FEASIBILITY STUDY
0E		2013-15-27	ISSUED FOR INFORMATION

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013/02/22

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

CONÇU PAR / DESIGNED BY: MARTIN GAUDREAU, ENG

DESSINÉ PAR / DRAWN BY: JUAN PABLO ESCOBAR

VÉRIFIÉ PAR / CHECKED BY: ÉRIC POIRIER, ENG

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

120kV SUBSTATION
PORTAL VIEW

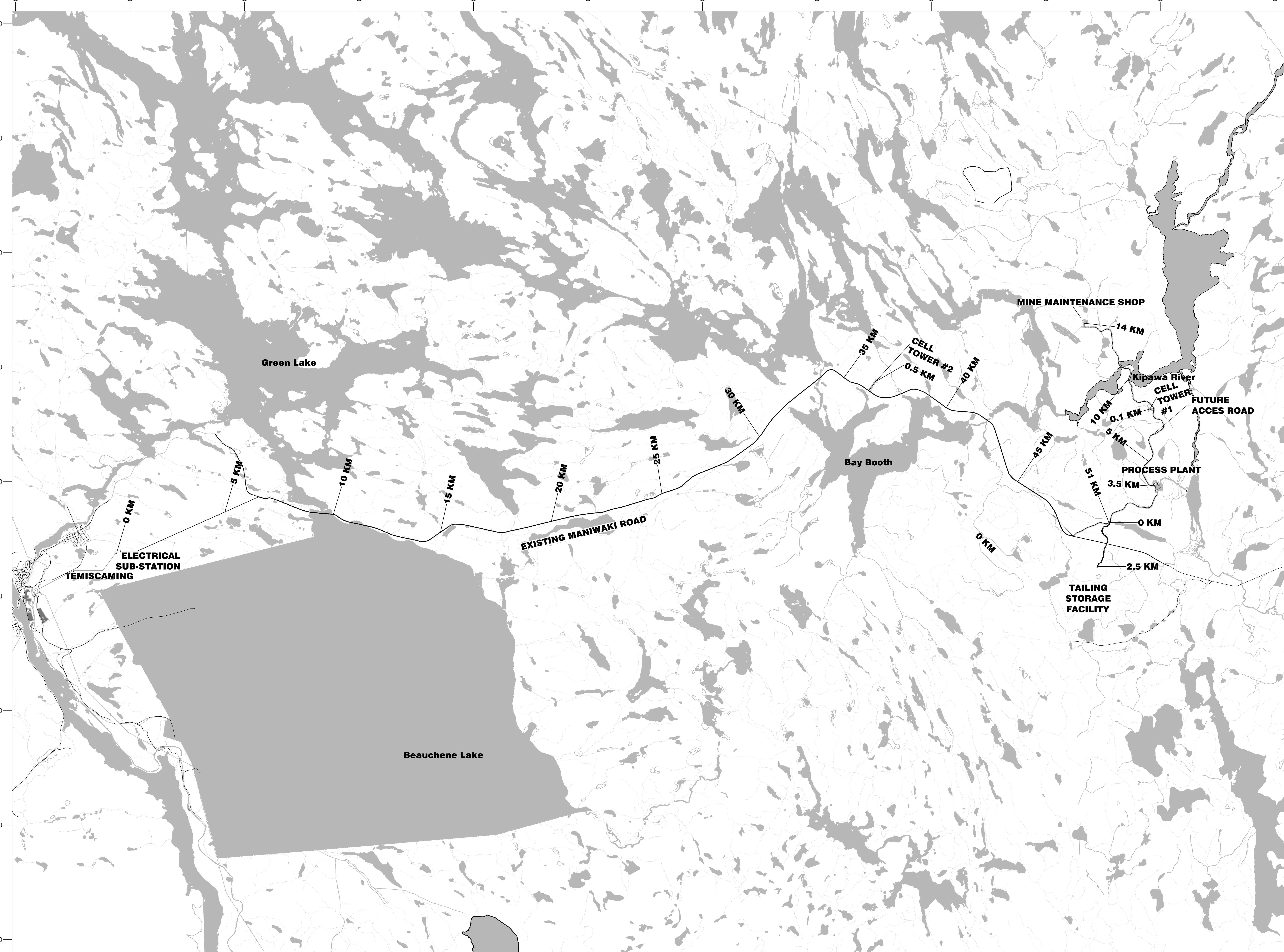
NUMÉRO DU FEUILLET / SHEET NUMBER: 210-17-203

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-02-24

RV./RV. #: 00



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR Martin Gaudreau 119502 QUÉBEC

28 juin 2013

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

COORDONNÉE NAD 83 UTM17

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-06-28	ISSUED FOR FEASIBILITY STUDY
0A		2013-02-27	ISSUED FOR QUOTATION

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 27 FEV 2013

ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:75 000

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: MARTIN GAUDREAU, ing.

DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE

VÉRIFIÉ PAR / CHECKED BY: MARTIN GAUDREAU, ing.

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

44 kV POWER LINE BETWEEN TEMISCAMING AND KIPAWA SITE

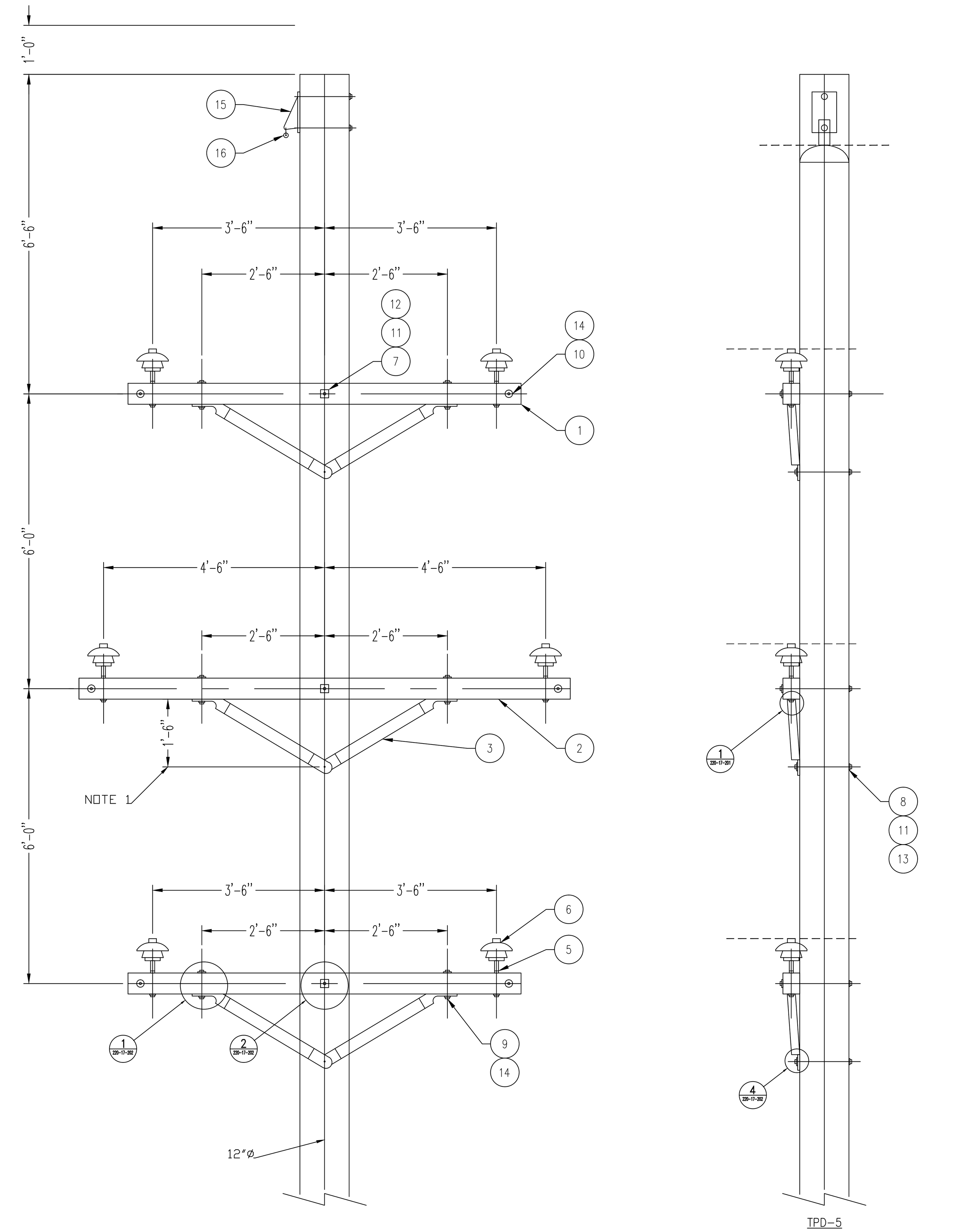
NUMÉRO DU FEUILLET / SHEET NUMBER: 220-17-101

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-28

RV./RV. #: 00

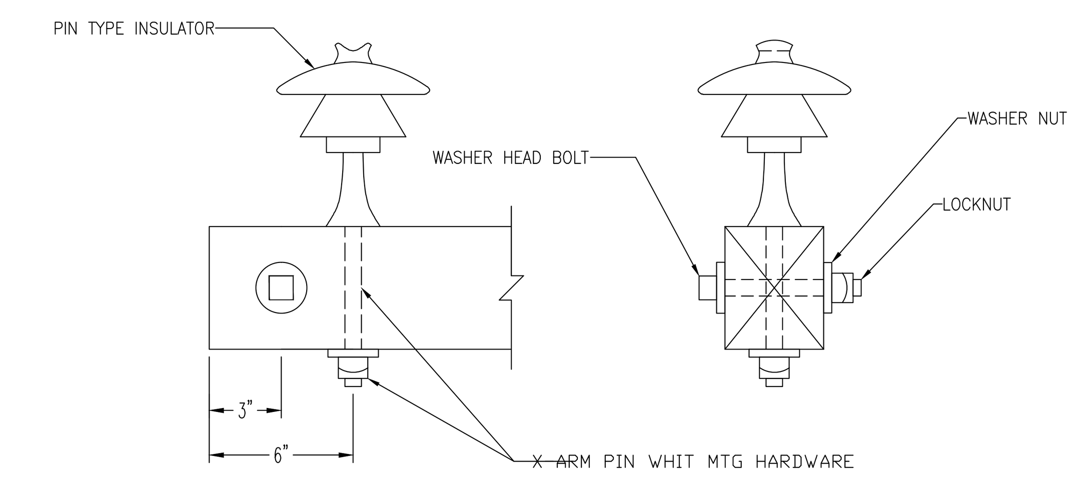


TRANSMISSION LINE STRUCTURE

DOUBLE CIRCUIT- TANGENT PINT TYPE INSULATOR
46kV MAXIMUM
SCALE: NONE

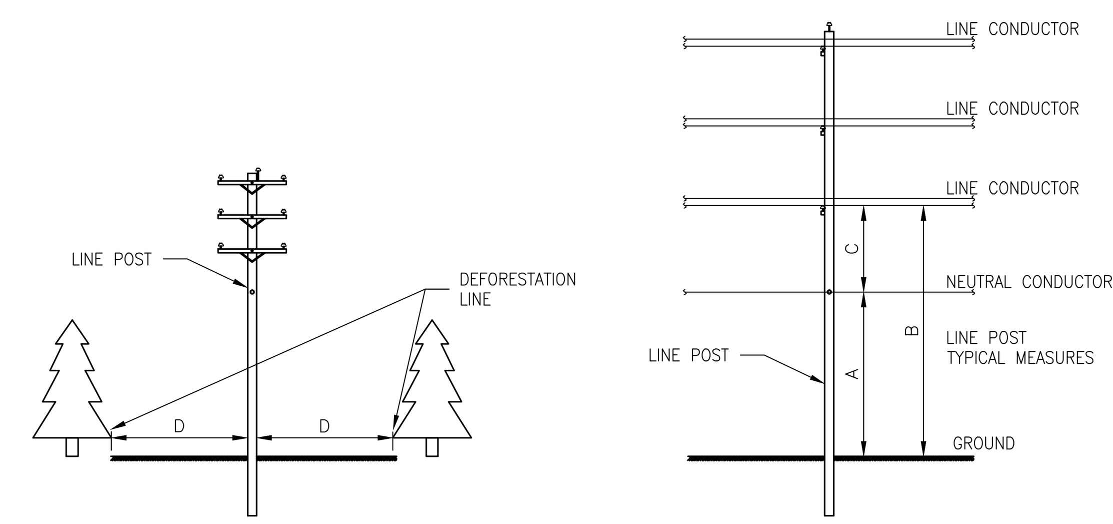
	TPD-	DESCRIPTION			
No	5	DESCRIPTION	ITEM	DE T.	CODE No
1	2	X-ARM, 4-1/8" X 5-1/8" X 8'-0", #12		TCD-6	
2	1	X-ARM, 4-1/8" X 5-1/8" X 10'-0", #21		TCD-10	
3	3pr.	BRACE, X-ARM, 60"-1/8"	cu		
4	–	PLATE, DOUBLE ARMING, 24" X 4" X 12"	ct		
5	6	PIN, X-ARM, LONG SHANK, W/mtg, HDWR	f		
6	6	INSULATOR, PIN TYPE	a		
7	3	3/4" BOLT, MACHINE, BY REQ'D LENGTH	c		
8	3	5/8" BOLT, MACHINE, BY REQ'D LENGTH	c		
9	12	1/2" BOLT, WASHER HEAD, BY REQ'D LENGTH	c		
10	6	1/2" BOLT, WASHER HEAD, W/WASHER NUT	c		
11	9	WASHER, FLAT, 2-1/4" SQ. X 3/16", 13/16"H.	a		
12	3	3/4" LOCKNUT, MF TYPE	ek		
13	3	5/8" LOCKNUT, MF TYPE	ek		
14	12	1/2" LOCKNUT, MF TYPE	ek		
15	1	OHWG SUPPORT ASSEMBLY	–	TM-6	
16	1	OHWG SUPPORT, TANGENT	–	TM-4	

NOTES:
1. FIELD DRILLED HOLES SHALL BE THOROUGHLY TREATED
2. AT LINE ANGLES, MOUNT THE OHGW SUPPORT ASSEMBLY ON THE INTERIOR ANGLE SIDE OF THE POLE
3. THE FOLLOWING MATERIALS ARE TO BE SPECIFIED SEPARATELY ON A PLAN AND PROFILE DRAWINGS AND STAKING SHEETS: POLES GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS



DETAILS 1-PIN INSULATOR MOUNTINGS TD-1A

SCALE : NONE



ID	EQUIPMENT	SPECIFICATIONS	REMARKS
1	LINE CONDUCTOR	2x3 477 AWG	
2	NEUTRAL CONDUCTOR	2x3 477 AWG	
3	LINE-LINE VOLTAGE	44kV	
4	NEUTRAL-LINE VOLTAGE	25.4kV	
5	SPAN BETWEEN POSTS	TYPICAL 60M	
6	EQUIPMENT POST	50', CLASS 3 (MINIMUM)	TREATED WOOD POST
7	LINE POST	50', CLASS 4 (MINIMUM)	TREATED WOOD POST

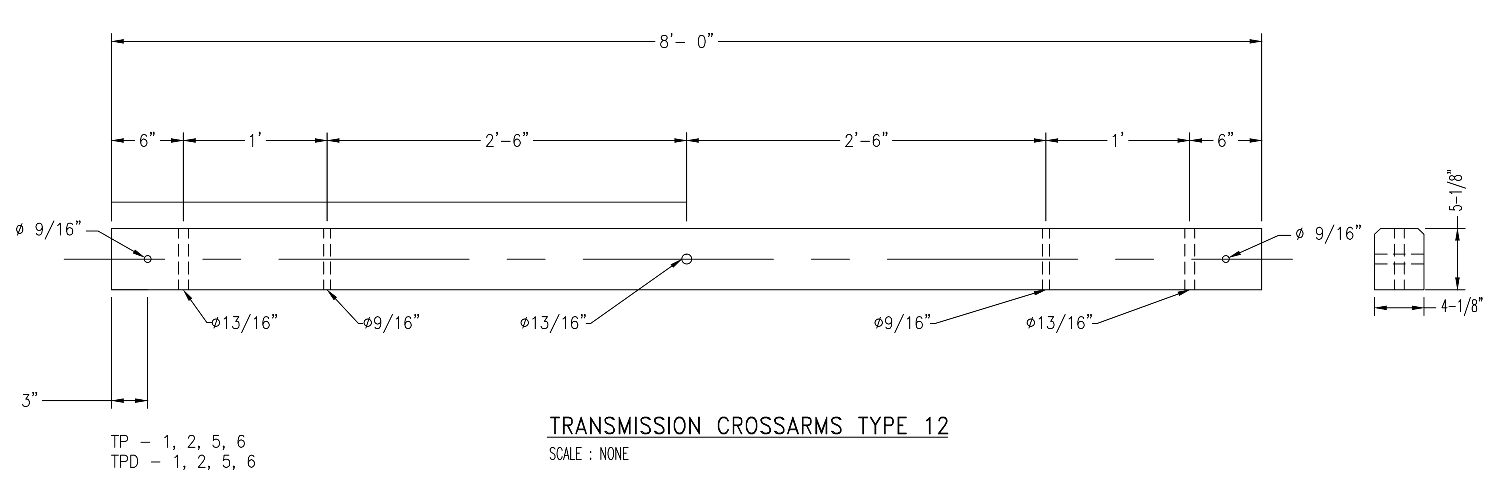
NOTES :
1. ALL LINE EQUIPMENT TO BE DESIGNED FOR VOLTAGE INDICATED ABOVE
2. ALL LINE EQUIPMENT TO BE NEW OR REFURBISHED

POST TYPICAL IMPLANTATION					
ZONE	A	B	C	D	REMARKS
TYPICAL FIELD	MIN. 6.838m	MIN. 8.838m	MIN. 2.000m	MIN. 4.500m	
ALONG THE BOAD	MIN. 6.838m	MIN. 8.838m	MIN. 2.000m	MIN. 4.500m	
ACROSS THE BOAD	MIN. 8.838m	MIN. 10.838m	MIN. 2.000m	–	
ACROSS OF WATER COURSES	MIN. 8.838m	MIN. 10.838m	MIN. 2.000m	–	

NOTES :
1. ADD 2000mm BETWEEN NEUTRAL CONDUCTOR AND LINES CONDUCTOR TO PROVIDE SPACING INSTALATION OF A TRANSFORMER;
2. TYPICAL CONDUCTOR HEIGHT TO BE CONFIRM IF ACROSS WATERWAY;

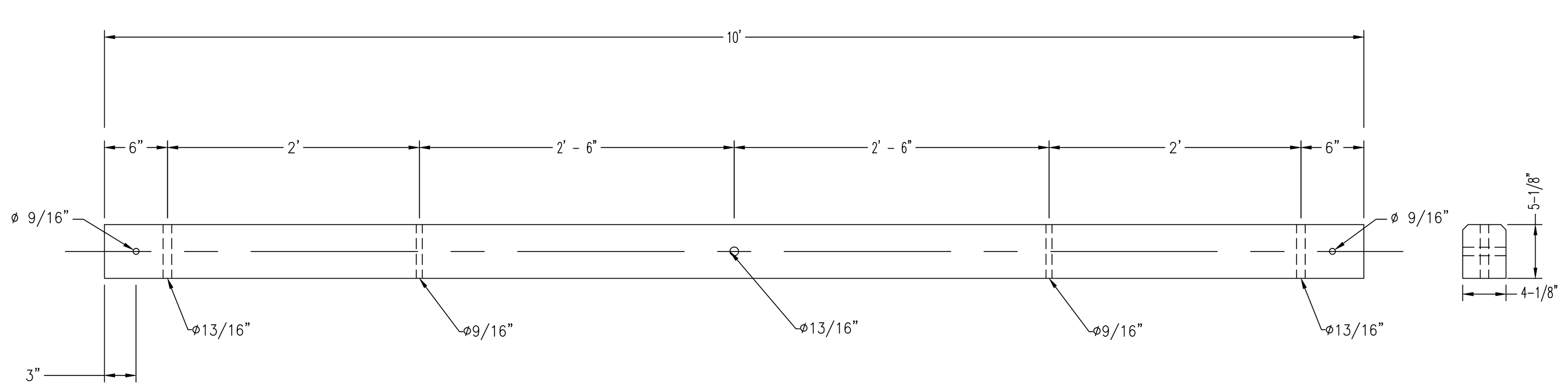
TYPICAL INSTALATION DETAIL

SCALE : NONE



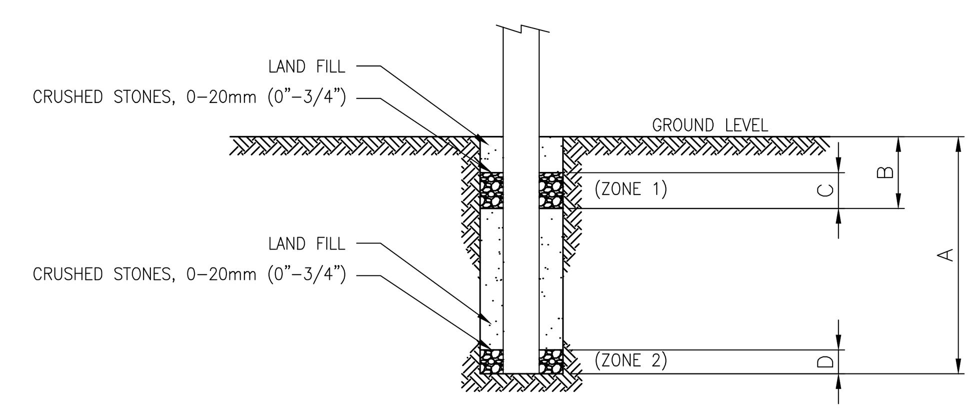
TRANSMISSION CROSSARMS TYPE 12

SCALE : NONE



TRANSMISSION CROSSARMS TYPE 21

SCALE : NONE

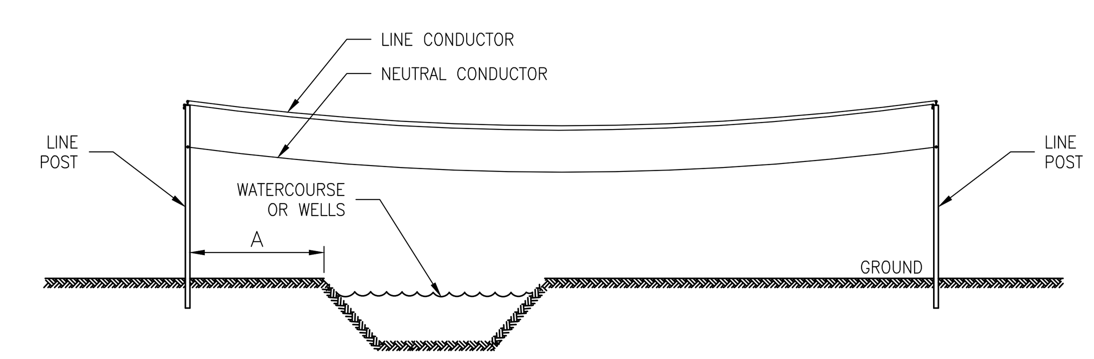


REQUIRED MINIMUM DEPTH (mm)					
ZONE	A	B	C	D	REMARKS
35 FT POST	1830	600	300	300	
40 FT POST	1830	600	300	300	
45 FT POST	1980	600	300	300	
50 FT POST	2130	600	300	300	
55 FT POST	2280	600	300	300	
60 FT POST	2440	600	300	300	

NOTES :
1. REFERENCES COME FROM H.Q. B.41.11 STANDARDS;
2. ZONES 1 AND 2 TO BE FILLED WHIT LAND FILL IF QUANTITY OF STONES IF ARE SUFICIENT;
3. COMPACT MECHANICALLY LAND FILL IN ALL 150mm IN ORDER TO IMPROVE POST STABILITY ;
4. REFER TO H.Q. B.41.11 FOR OTHER SOIL TYPES.

CLASS 2 OF 5 INGROUND POST IMPLANTATION

SCALE : NONE



REQUIRED MINIMUM SPAGING (mm)		
ZONE	A	REMARKS
WATERCOURSES	6000	
DITCH	3000	
WELLS	50000	EXEPT UNTREATED CEDAR POST

NOTES :
1. REFERENCES COME FROME H.Q. B.41.11 STANDARDS;
2. ;

REQUIRED INITIAL DEFLECTION HEIGHT

SCALE : NONE

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-06-28	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013/02/22

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: MARTIN GAUDREAU, ENG

DESSINÉ PAR / DRAWN BY: JUAN PABLO ESCOBAR

VÉRIFIÉ PAR / CHECKED BY: ÉRIC POIRIER, ENG

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

44kV POWER LINE
TRANSMISSION LINE STRUCTURE
DETAILS

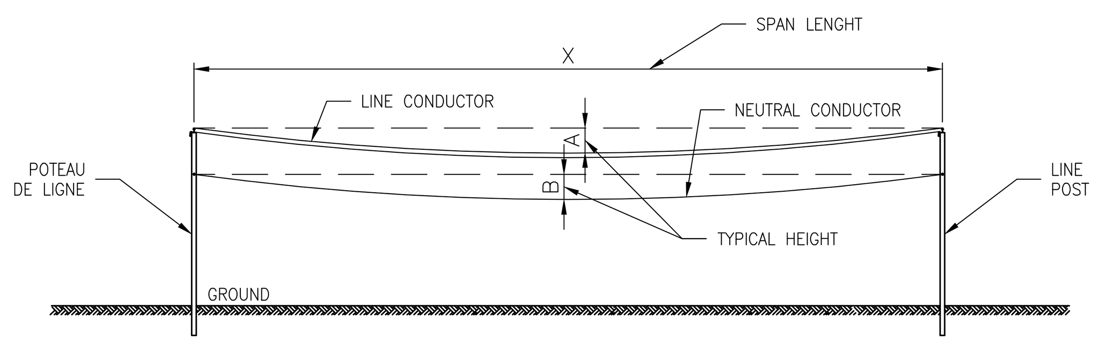
NUMÉRO DU FEUILLET / SHEET NUMBER: 220-17-201

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-28

RV./RV. #: 00

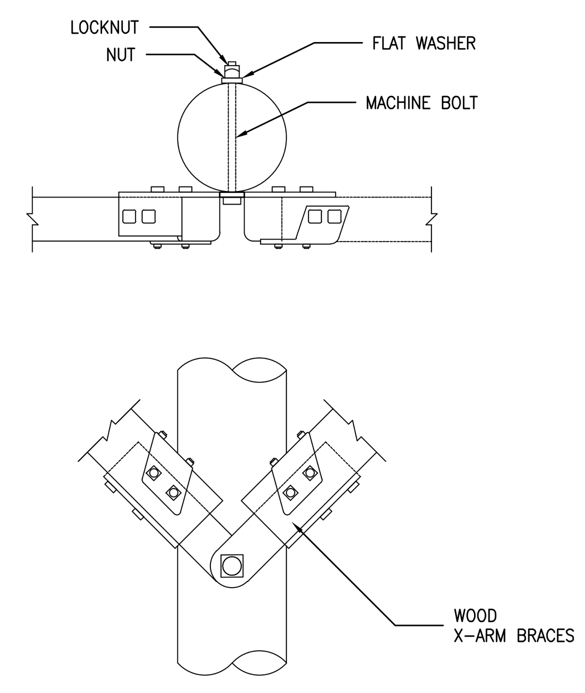


LOOSE SPAN REQUIRED INITIAL DEFLECTION HEIGHT 447 KCMIL, AL CONDUCTOR								
TEMPERATURE OF CONDUCTOR (°C)	MECHANICAL TENSION (N)	SPAN (X)						
		11m	13m	14m	15m	16m	17m	18m
NEW CONDUCTOR		INITIAL DEFLECTION mm (A) ET (B)						
−40	200	470	580	710	840	990	1140	1310
−30	220	480	590	710	850	1000	1160	1330
−20	220	480	600	720	860	1010	1170	1340
−15	220	490	600	730	870	1020	1180	1360
−10	220	500	610	740	880	1030	1200	1380
−5	220	500	610	740	880	1030	1200	1380
0	210	500	620	750	890	1040	1210	1390
5	210	500	620	750	890	1040	1210	1390
10	210	510	630	760	900	1060	1230	1410
15	210	510	630	760	900	1060	1230	1410
20	210	510	630	760	910	1070	1240	1420
30	210	520	640	770	920	1080	1250	1440
40	200	520	650	780	930	1090	1270	1450

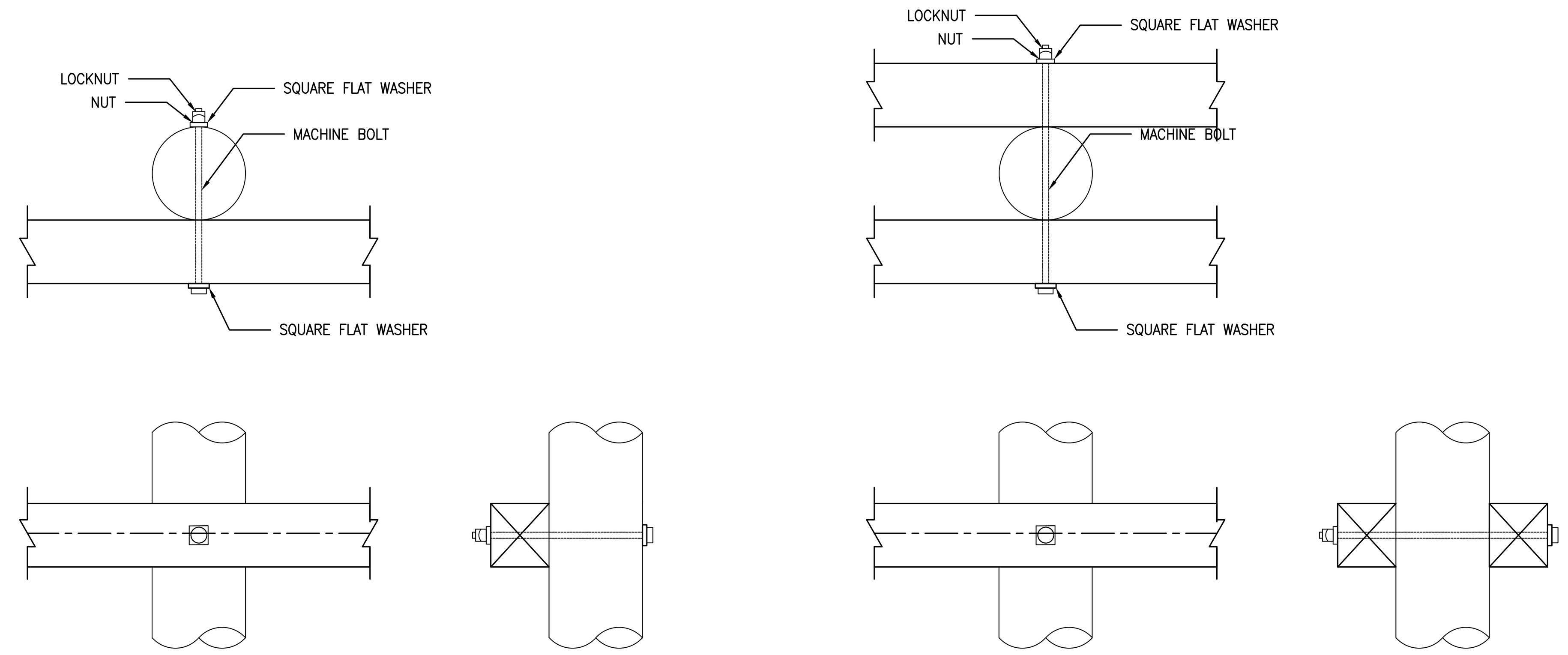
LOOSE SPAN REQUIRED INITIAL DEFLECTION HEIGHT 447 KCMIL, AL CONDUCTOR								
TEMPERATURE OF CONDUCTOR (°C)	MECHANICAL TENSION (N)	SPAN (X)						
		45m	50m	55m	60m	65m	70m	75m
NEW CONDUCTOR		INITIAL DEFLECTION mm (A) ET (B)						
−40	4400	380	470	560	670	790	910	1050
−30	3610	460	570	690	820	960	1120	1280
−20	3080	540	670	810	960	1130	1310	1500
−15	2870	580	720	870	1030	1210	1400	1610
−10	2700	610	760	920	1090	1280	1480	1700
−5	2560	650	800	970	1150	1350	1570	1800
0	2430	680	840	1020	1210	1420	1650	1890
5	2320	710	880	1070	1270	1490	1730	1980
10	2230	750	920	1120	1330	1560	1810	2080
15	2140	780	960	1160	1380	1620	1880	2160
20	2060	800	990	1200	1430	1680	19500	2230
30	1930	860	1060	1290	1530	1800	2080	2390
40	1820	920	1130	1370	1630	1910	2220	2550

NOTES :
1. REFERENCES DATA COMING FROM: 477 KCMIL AL CONDUCTOR H.Q. B.41.11 STANDARD.

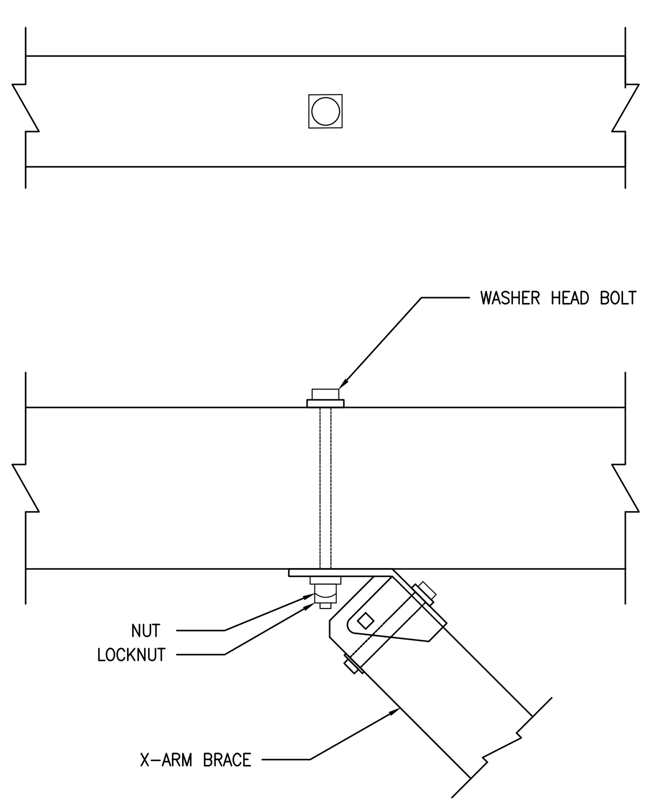
TREQUIRED INITIAL DEFLECTION HEIGHT
SCALE : NONE



DETAIL 4-FROM DRAWING 220-17-201
CROSSARM TO POLE
SCALE : NONE



DETAIL 2-FROM DRAWING 220-17-201
CROSSARM TO POLE
SCALE : NONE



DETAIL 1-FROM DRAWING 220-17-201
BRACE TO ARM CONNECTIONS
SCALE : NONE

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

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ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-06-28	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013/02/22

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: MARTIN GAUDREAU, ENG

DESSINÉ PAR / DRAWN BY: JUAN PABLO ESCOBAR

VÉRIFIÉ PAR / CHECKED BY: ÉRIC POIRER, ENG

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

44kV POWER LINE
TRANSMISSION LINE STRUCTURE
DETAILS

NUMÉRO DU FEUILLET / SHEET NUMBER: 220-17-202

FEUILLET / SHEET #: 1 DE / OF 1

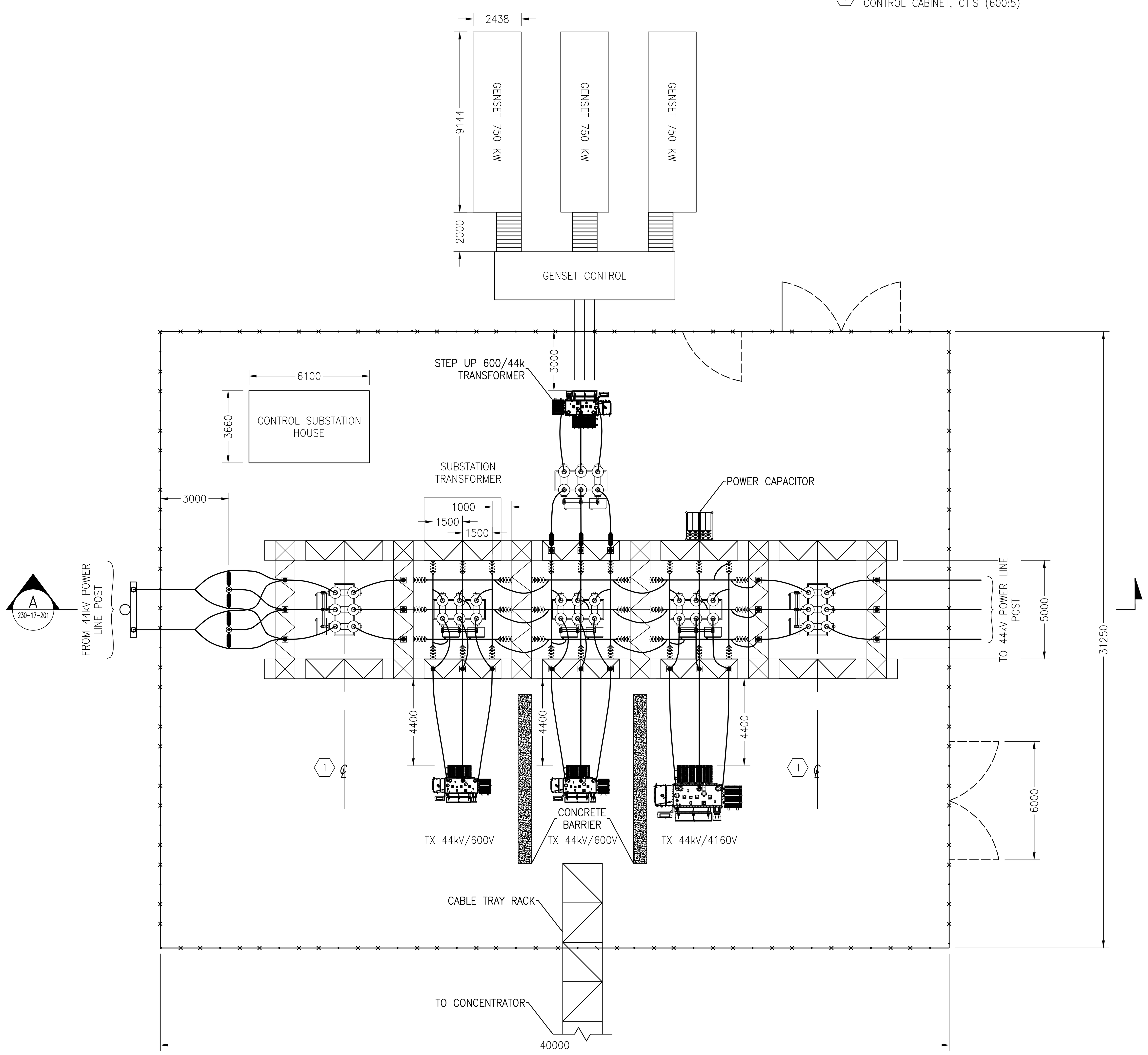
ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-28

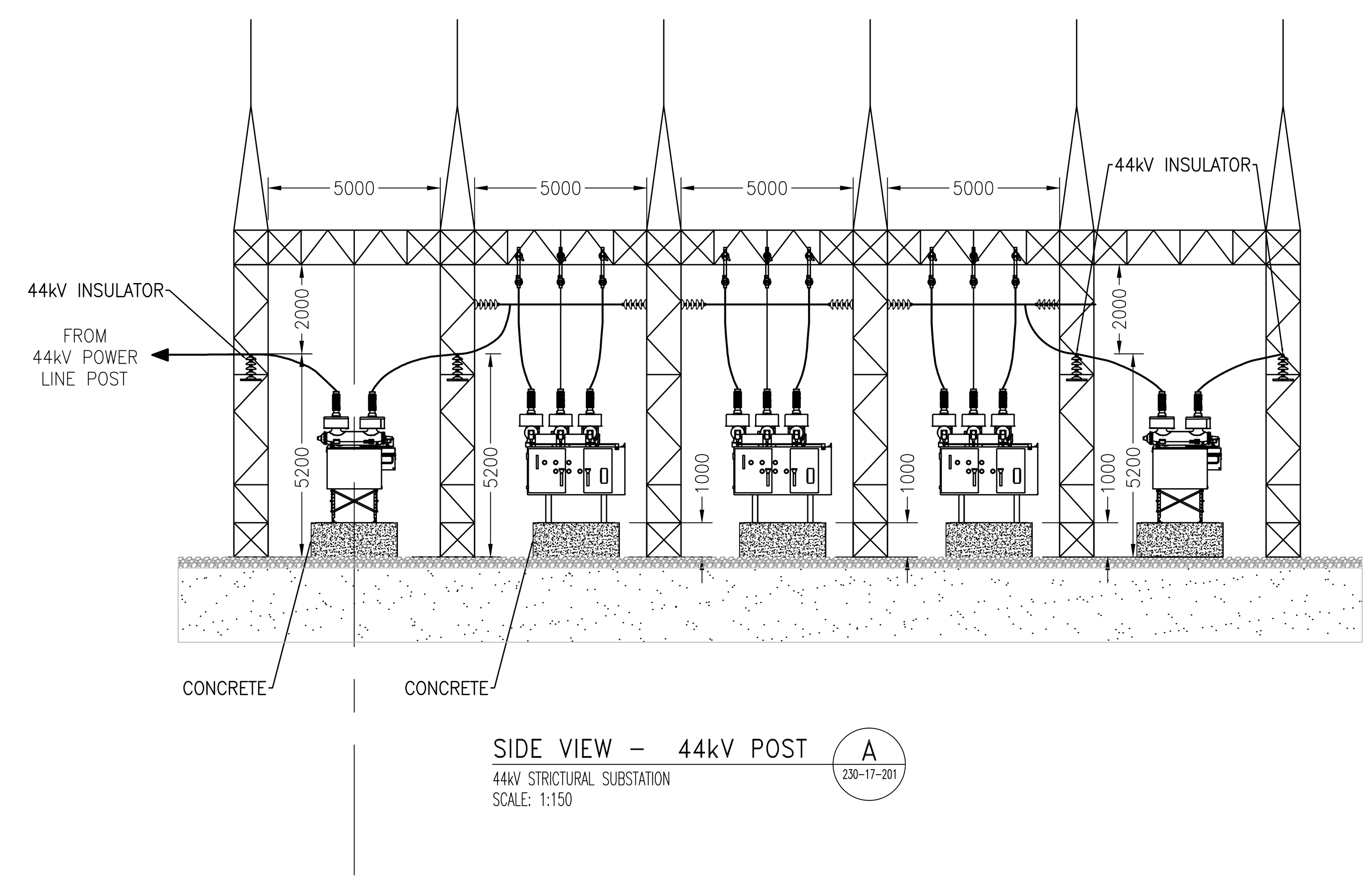
RV./RV. #: 00

NOTES:

1. 44kV BREAKER C/W STRUCTURE, CONTROL CABINET, CT'S (600:5)



44kV SUBSTATION–TOP VIEW
SCALE 1:150



SIDE VIEW – 44kV POST (A, 230-17-201)
44kV STRICTURAL SUBSTATION
SCALE: 1:150

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR Martin Gaudreau 119502 QUÉBEC
28 juin 2013

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-06-28	ISSUED FOR FEASIBILITY STUDY
OF	2013-06-03	ISSUED FOR INFORMATION

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013/02/22
ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS
CONÇU PAR / DESIGNED BY: MARTIN GAUDREAU, ENG
DESSINÉ PAR / DRAWN BY: JUAN PABLO ESCOBAR
VÉRIFIÉ PAR / CHECKED BY: ÉRIC POIRIER, ENG

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

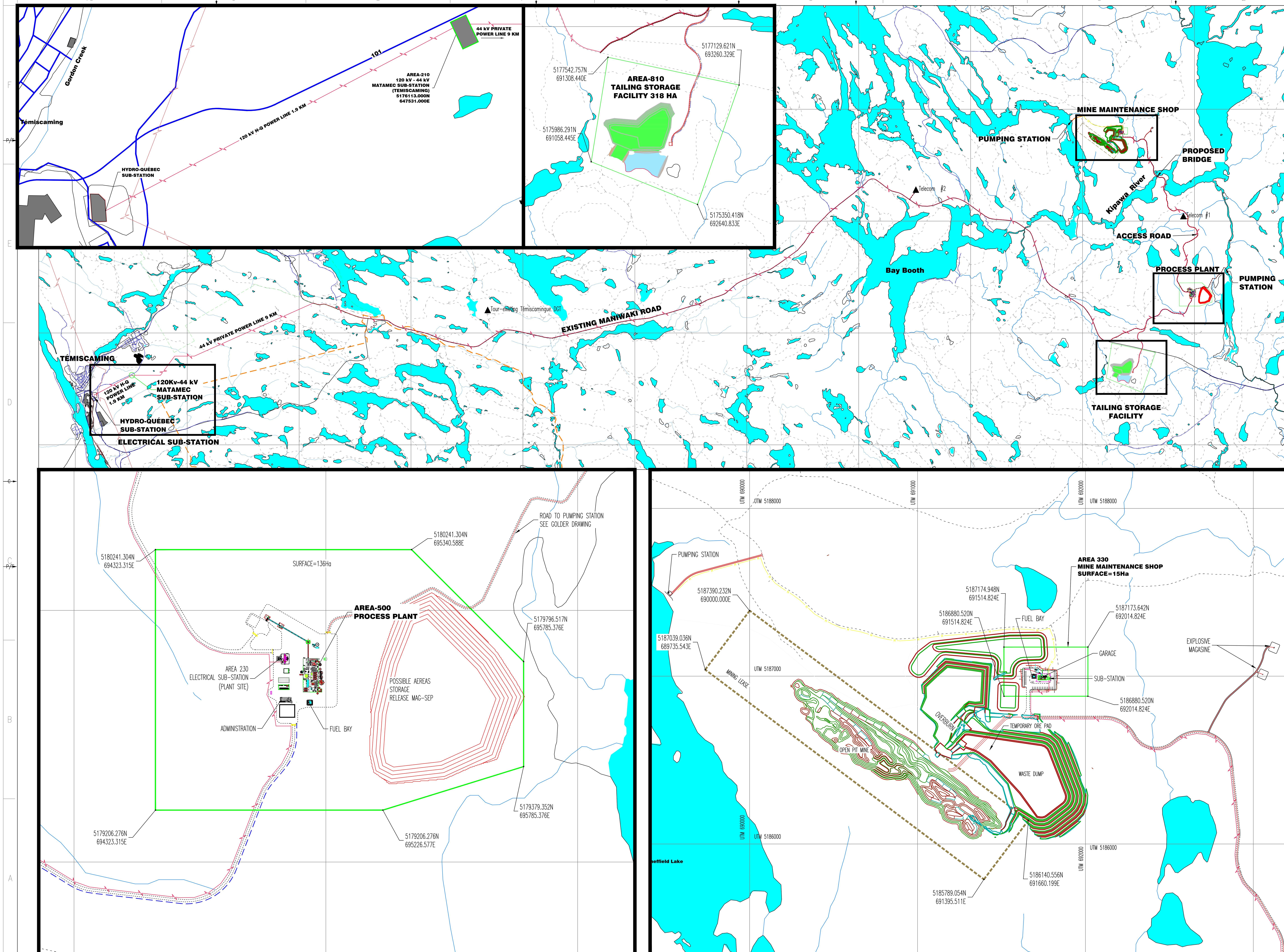
DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

POWER PLANT DISTRIBUTION
44kV SUBSTATION
PLAN & SIDE VIEW

NUMÉRO DU FEUILLET / SHEET NUMBER: 230-17-201
FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
RV./RV. #: 00
EN DATE DU / DATE OF: 2013-06-28



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

COORDONNÉE NAD 83 UTM17

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013/07/11	ISSUED FOR FEASIBILITY STUDY
	0C	2013/06/06	ISSUED FOR FINAL REVIEW
	0B	2013/05/27	ISSUED FOR COORDINATION
0A		2013/03/26	ISSUED FOR COORDINATION

NO PROJET / PROJECT NO: 121–18716–00

DATE / DATE: 2012/11/22

ÉCHELLE ORIGINALE / ORIGINAL SCALE: N.T.S.

CONÇU PAR / DESIGNED BY: MARTIN DROUIN, ing.

DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE

VÉRIFIÉ PAR / CHECKED BY: REJEAN FOURNIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL

TITRE / TITLE: GENERAL ARRANGEMENT

NUMÉRO DU FEUILLET / SHEET NUMBER: 300–00–101

FEUILLET / SHEET #: -- DE / OF --

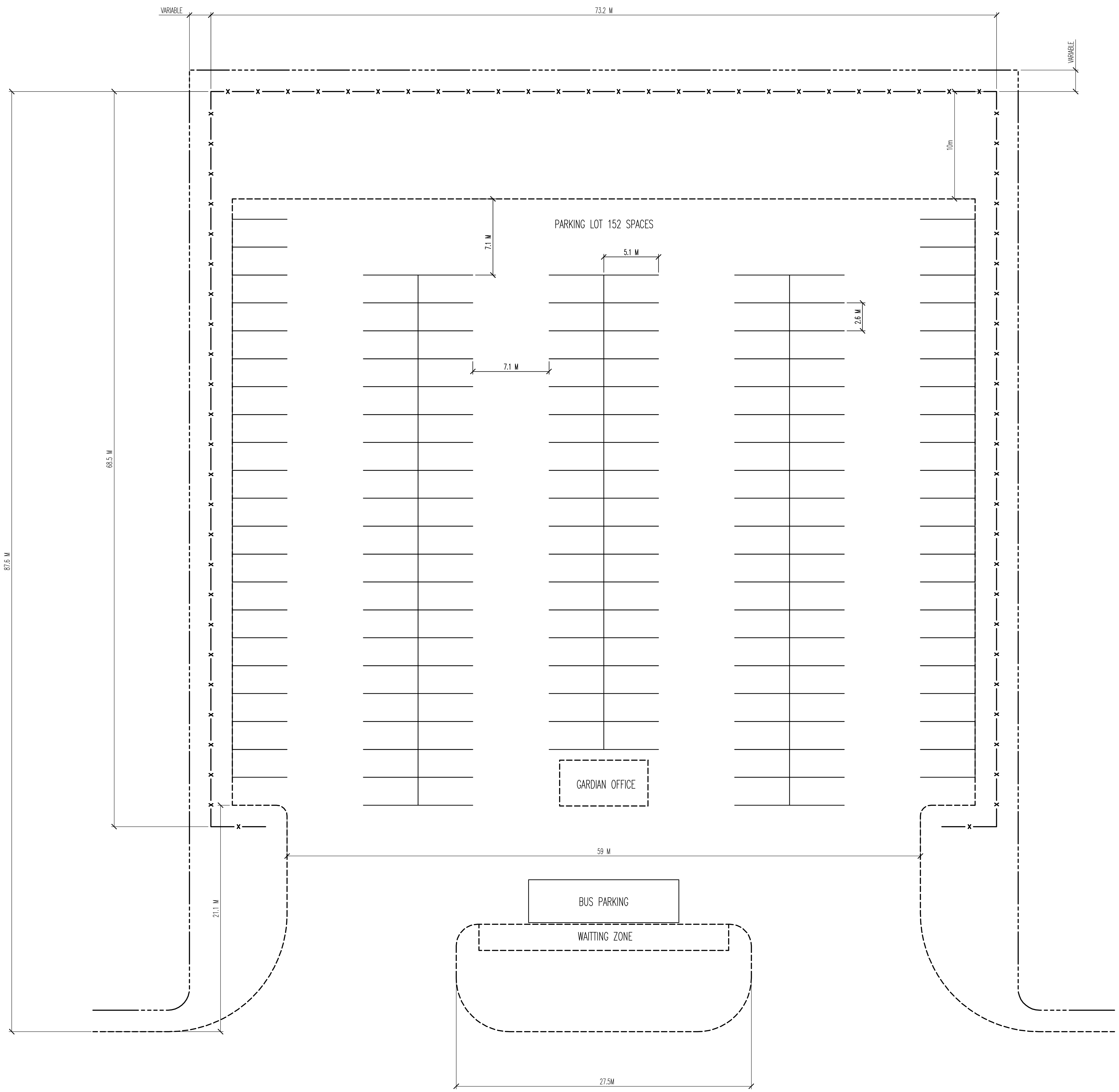
ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013/07/11

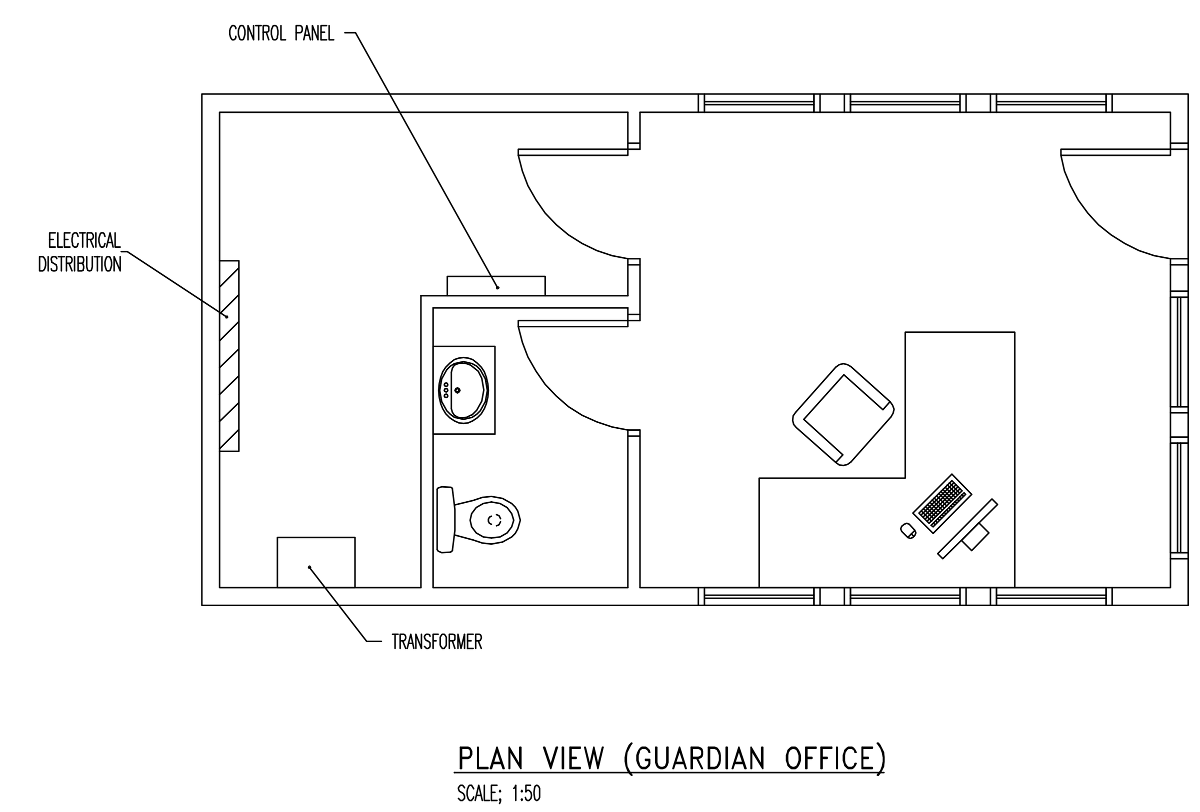
RV./RV. #: 00

Arch D, P:_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Emis\300-00-101_00.dwg, 2013-07-11 16:58:40

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



PLAN VIEW
SCALE: 1:200



PLAN VIEW (GUARDIAN OFFICE)
SCALE: 1:50

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Alexandre Hudon 128475 2013-07-15

Cédric Lalande 131277 2013-07-15

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA
FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-07-15	ISSUED FOR FEASABILITY STUDY
	0B	2013-02-22	ISSUED FOR FEASABILITY STUDY
0A		2013-01-04	ISSUED FOR COMMENTS

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 29-01-2013

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: ALEXANDRE HUDON, ing.

DESSINÉ PAR / DRAWN BY: CINDY LABREQUE

VÉRIFIÉ PAR / CHECKED BY: CÉDRIC LALANDE, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: CIVIL WORKS

TITRE / TITLE:

PARKING AT TEMISCAMING
GENERAL ARRANGEMENT

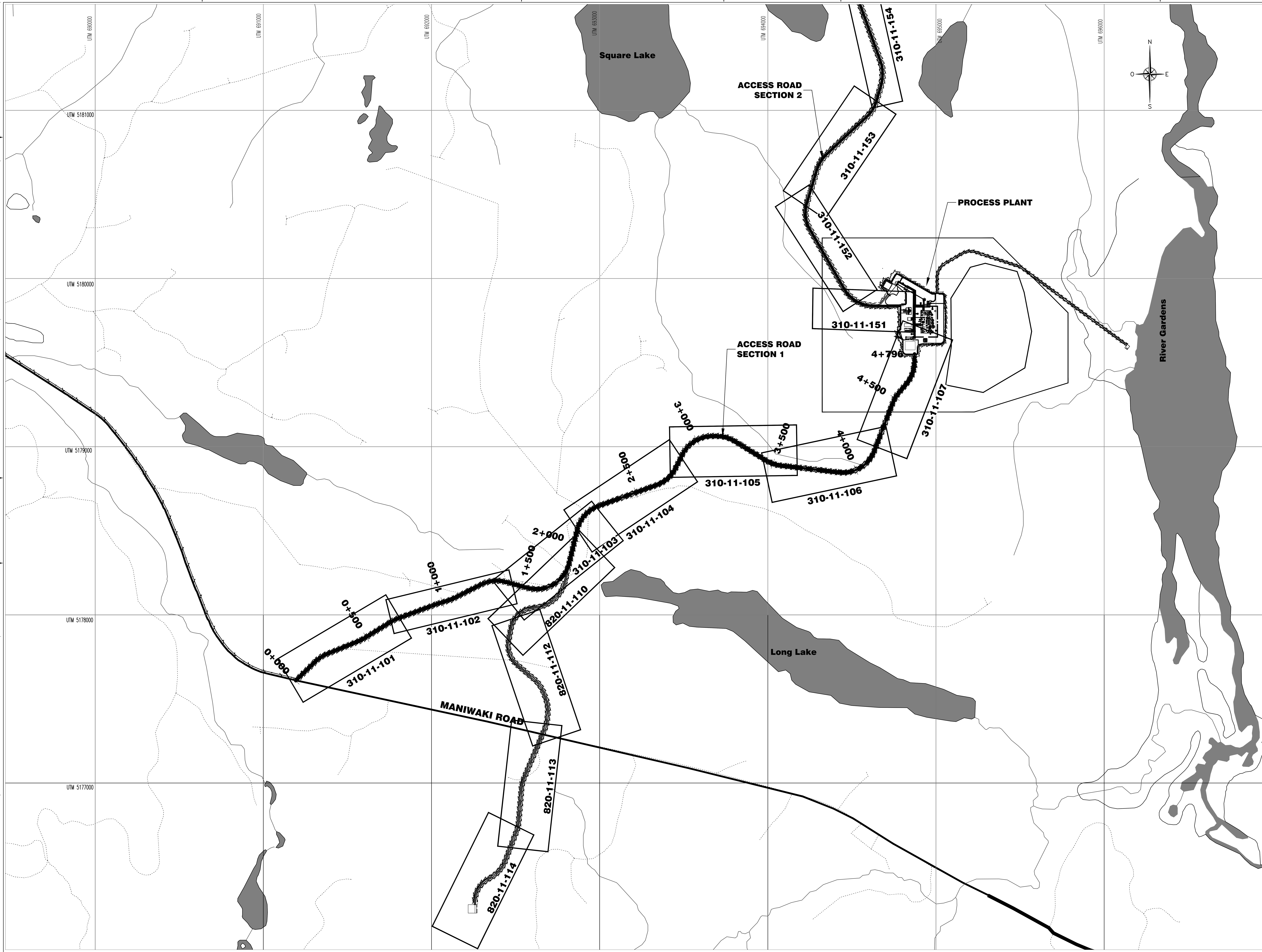
NUMÉRO DU FEUILLET / SHEET NUMBER: 305-11-100

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

RV./RV. #: 00

EN DATE DU / DATE OF: 2013-07-15



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA
FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013/06/26	ISSUED FOR FEASIBILITY STUDY–FINAL
	0B	2013/04/03	ISSUED FOR FEASIBILITY STUDY
0A		2012/11/27	ISSUED FOR COMMENTS

NO PROJET / PROJECT NO: 121–18716–00

DATE / DATE: 2012/11/22

ÉCHELLE ORIGINALE / ORIGINAL SCALE: N.T.S.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: MARTIN DROUIN, ing.

DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE

VÉRIFIÉ PAR / CHECKED BY: REJEAN FOURNIER, ing.

DISCIPLINE / DISCIPLINE: CIVIL WORKS

TITRE / TITLE:

OFF SITE INFRASTRUCTURE
ACCESS ROAD/SECTION 1
PLAN

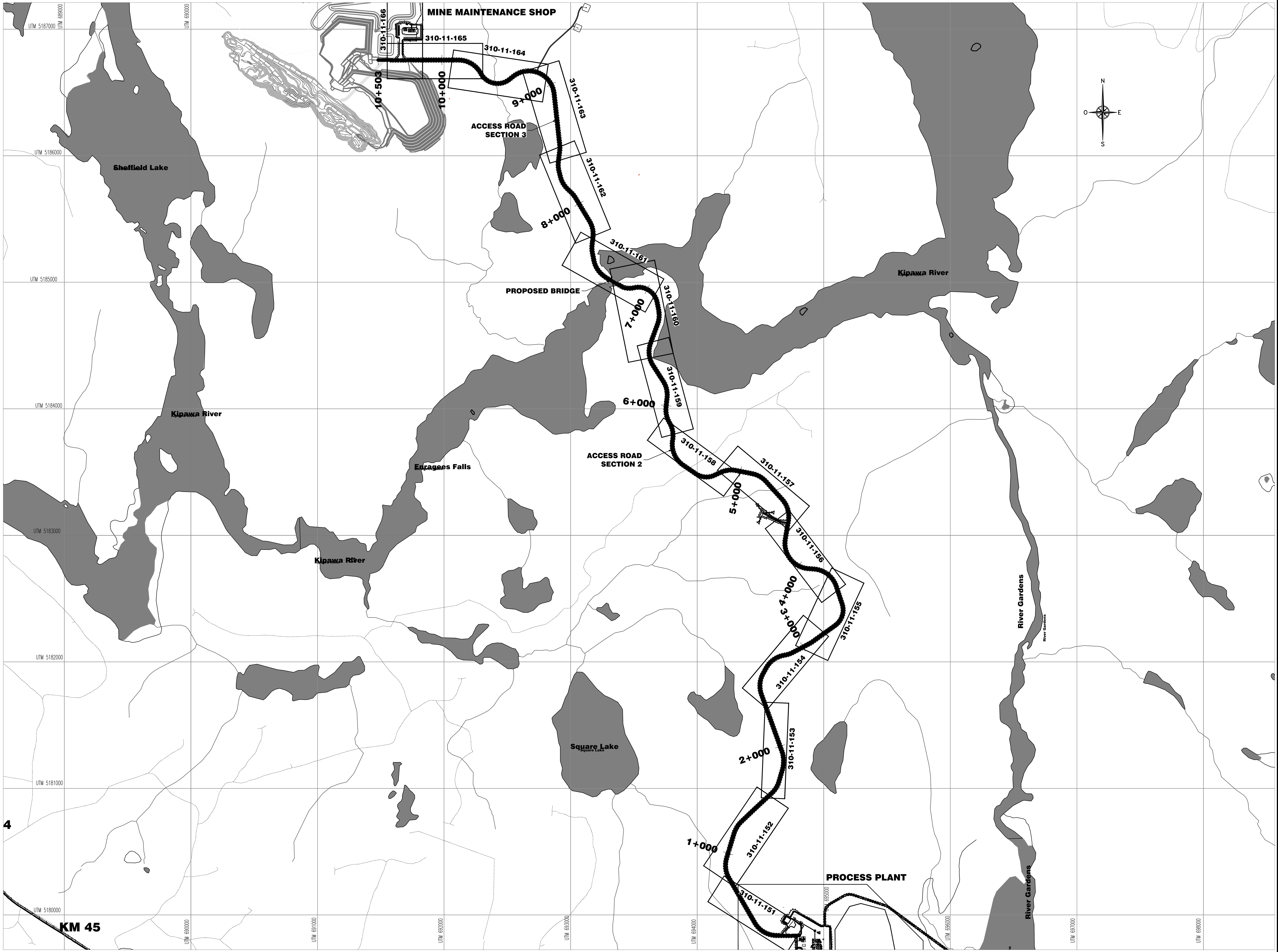
NUMÉRO DU FEUILLET / SHEET NUMBER: 310–11–100

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY–FINAL

RV./RV. #: 00

EN DATE DU / DATE OF: 2013/06/26



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

Réjean Fournier

CLIENT / CLIENT:

MATAMEC

REF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013/06/26	ISSUED FOR FEASIBILITY STUDY–FINAL
	0B	2013/04/03	ISSUED FOR FEASIBILITY STUDY
0A		2012/11/27	ISSUED FOR COMMENTS

NO PROJET / PROJECT NO: 121–18716–00

DATE / DATE: 2012/11/22

ÉCHELLE ORIGINALE / ORIGINAL SCALE: N.T.S.

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE

VÉRIFIÉ PAR / CHECKED BY: REJEAN FOURNIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: CIVIL WORKS

TITRE / TITLE:

OFF SITE INFRASTRUCTURE
ACCESS ROAD/SECTION 2–3
PLAN

NUMÉRO DU FEUILLET / SHEET NUMBER: 310–11–150

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY–FINAL

RV./RV. #: 00

EN DATE DU / DATE OF: 2013/06/26

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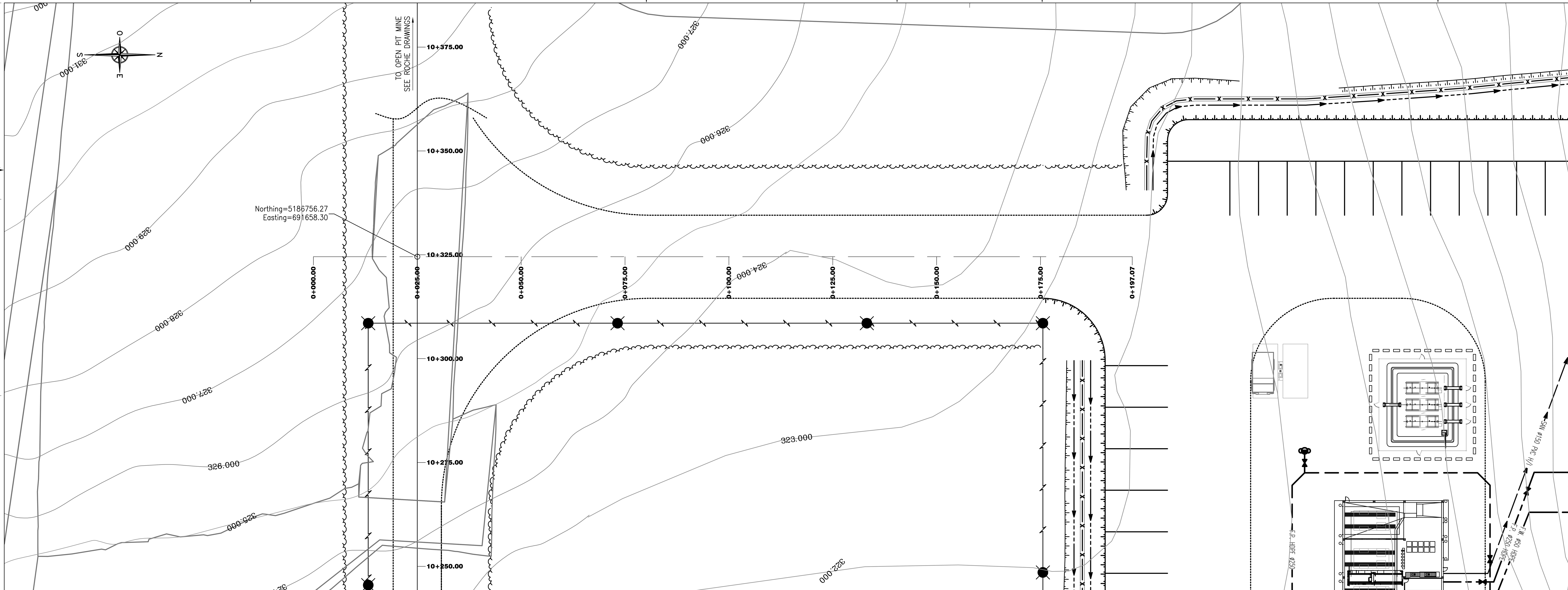
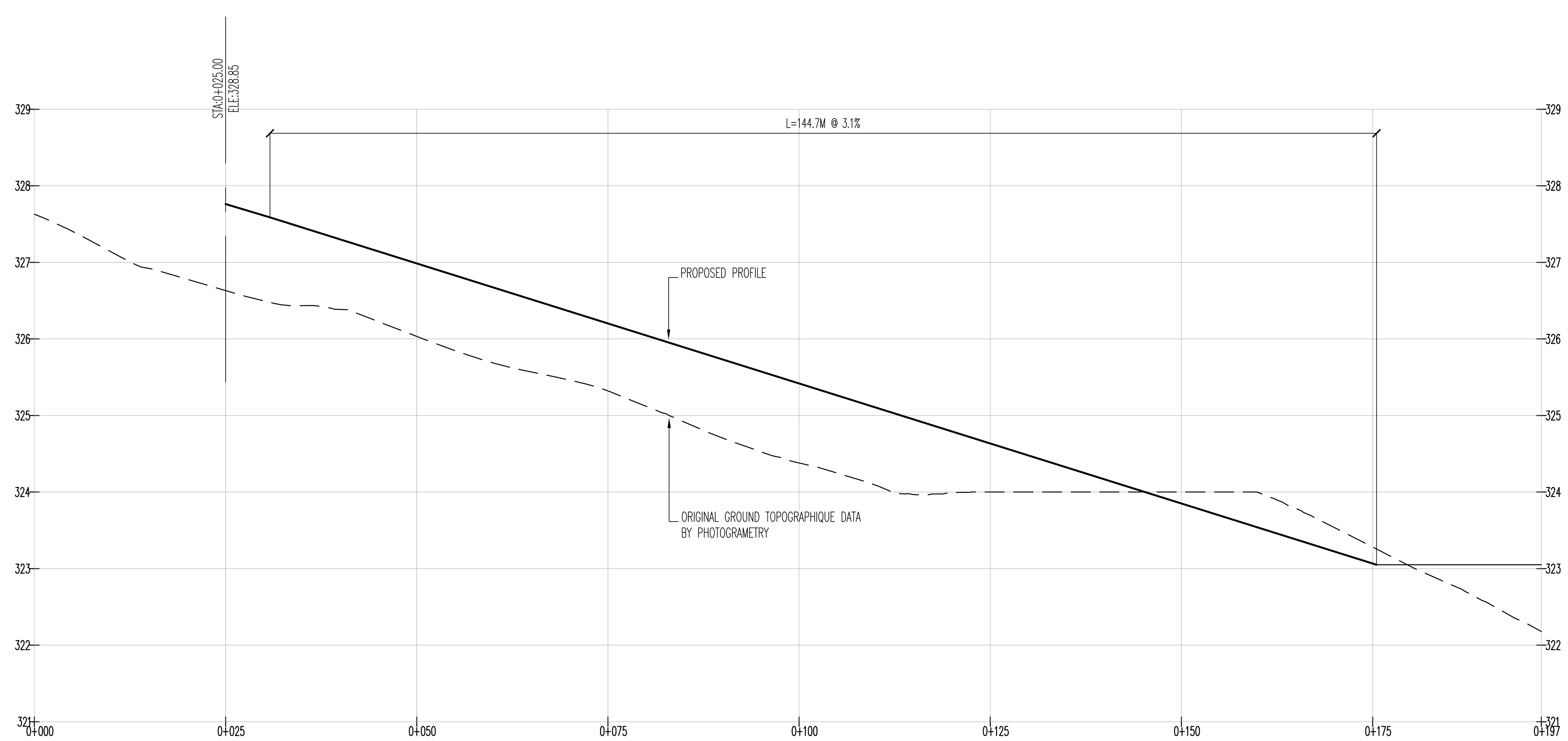




ACCESS ROAD TO MINE MAINTENANCE SHOP – 0+000 @ 0+197
ECH.HOR:500
ECH.VER:50

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA
FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013/06/26	ISSUED FOR FEASIBILITY STUDY–FINAL
0A		2013/04/03	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2012/11/22
ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:500
CONÇU PAR / DESIGNED BY: MARTIN DROUIN,ing.
DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE
VÉRIFIÉ PAR / CHECKED BY: RÉJEAN FOURNIER, ing.

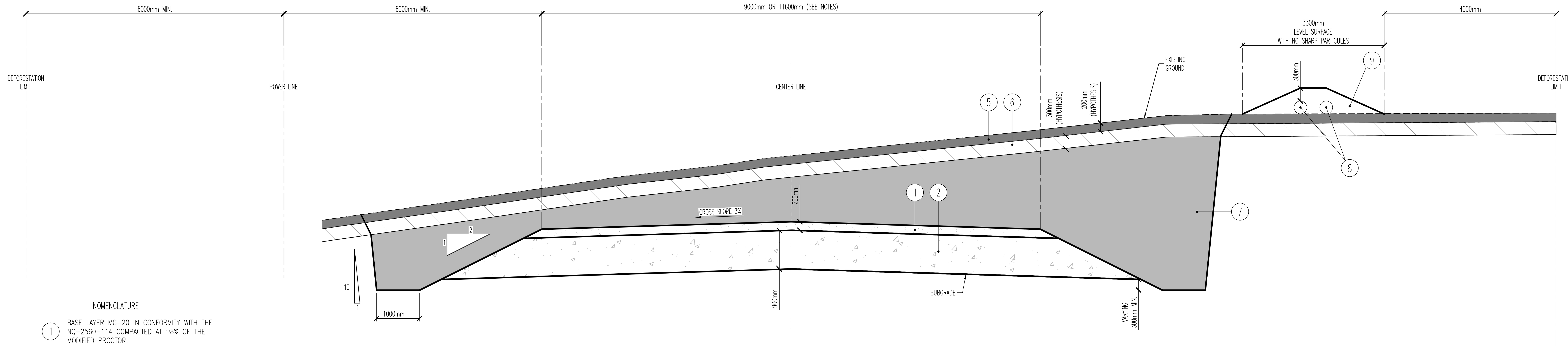
SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: CIVIL WORKS

TITRE / TITLE:

OFF SITE INFRASTRUCTURE
ACCESS ROAD
TO MINE MAINTENANCE SHOP
PLAN AND PROFILE

NUMÉRO DU FEUILLET / SHEET NUMBER: 310-11-166
FEUILLET / SHEET #: -- DE / OF --
ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY–FINAL
RV./RV. #: 00
EN DATE DU / DATE OF: 2013/06/26



TYPICAL EXCAVATED CROSS SECTION

SCALE 1:50

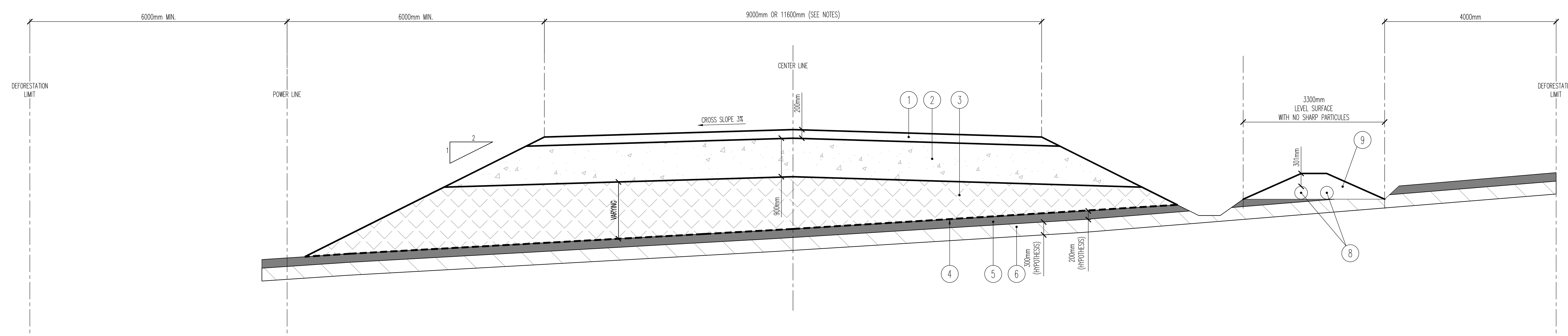
NOMENCLATURE

1. BASE LAYER MG-20 IN CONFORMITY WITH THE NQ-2560-114 COMPACTED AT 98% OF THE MODIFIED PROCTOR.
2. SUB-BASE MG-112mm IN CONFORMITY WITH THE NQ-2560-114 COMPACTED AT 90% OF THE MODIFIED PROCTOR. BY LAYERS OF 300mm AND 95% FOR THE FINAL LAYER.
3. BACKFILL WITH SECOND CLASS MATERIALS COMPACTED AT 90% OF THE MODIFIED PROCTOR BY LAYERS OF 300mm
4. FIBROUS MATERIALS LAID ON THE GROUD IN A ODERLY FASHION ACCORDING TO WORK SITE CONDITIONS AND THE ENGINEER RECOMMENDATIONS
5. EXISTING LAYER OF FIBROUS MATERIALS
6. EXISTING LAYER OF SECOND CLASS MATERIALS
7. EXISTING ROCK LAYER
8. -HDPE TAILING LINE (FROM MILL TO POND)
   DOUBLE WALL PIPE: 10"DR9(INSIDE), 12"DR21(OUTSIDE) FOR 2100M
   8"DR11(INSIDE), 10"DR21(OUTSIDE) FOR 1100M
   8"DR17(INSIDE), 10"DR21(OUTSIDE) FOR 2170M

   -HDPE RECLAIM LINE (FROM POND TO MILL)
   SINGLE WALL PIPE: 10"DR9, FOR 2670M
   8"DR11, FOR 2000M
   8"DR17, FOR 700M
   REFERENCE:MECHANICAL DESIGN SHEET 121-18716-00-CALCULS TUYAUTERIE HDPE-2013-07-02
9. RESTRAINING BERM, CG-14 IN CONFORMITY WITH THE NQ-2560-114. COMPACTED AT 92% OF THE MODIFIED PROTOR
   BERMS ARE 3M LONG EVERY 15M

NOTE:

- EXISTING GROUND LAYERS AND LAYERS THICHNESS ARE PRELIMINARY. TO BE CONFIRMED FOLLOWING GEOTHECHNICAL INVESTIGATIONS
- ROAD WIDTH BETWEEN THE MANIWAKI ROAD AND THE PLANT SITE IS 9M
- ROAD WIDTH BETWEEN THE PLANT SITE AND THE GARAGE SITE IS 11.6M
- HDPE LINES WILL ONLY BE INSTALLED ON A PORTION OF THE ROAD BETWEEN THE PLANT SITE AND MANIWAKI ROAD



TYPICAL BACKFILL CROSS SECTION

SCALE 1:50

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

Martin Drouin 5009960 QUÉBEC 2013-07-05

CLIENT / CLIENT:

MATAMEC

REF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA
FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS./RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
01	2013/07/04	ISSUED FOR FEASIBILITY STUDY-FINAL
00	2013/06/26	ISSUED FOR FEASIBILITY STUDY-FINAL
0A	2013-05-14	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-02-06

ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:50

CONÇU PAR / DESIGNED BY: MARTIN DROUIN, ing.

DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE

VÉRIFIÉ PAR / CHECKED BY: REJEAN FOURNIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: CIVIL WORKS

TITRE / TITLE:

OFF SITE INFRASTRUCTURE
ACCESS ROAD / TYPICAL CROSS SECTIONS

NUMÉRO DU FEUILLET / SHEET NUMBER: 310-11-300

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY-FINAL

RV./RV. #: 01

EN DATE DU / DATE OF: 2013/07/04

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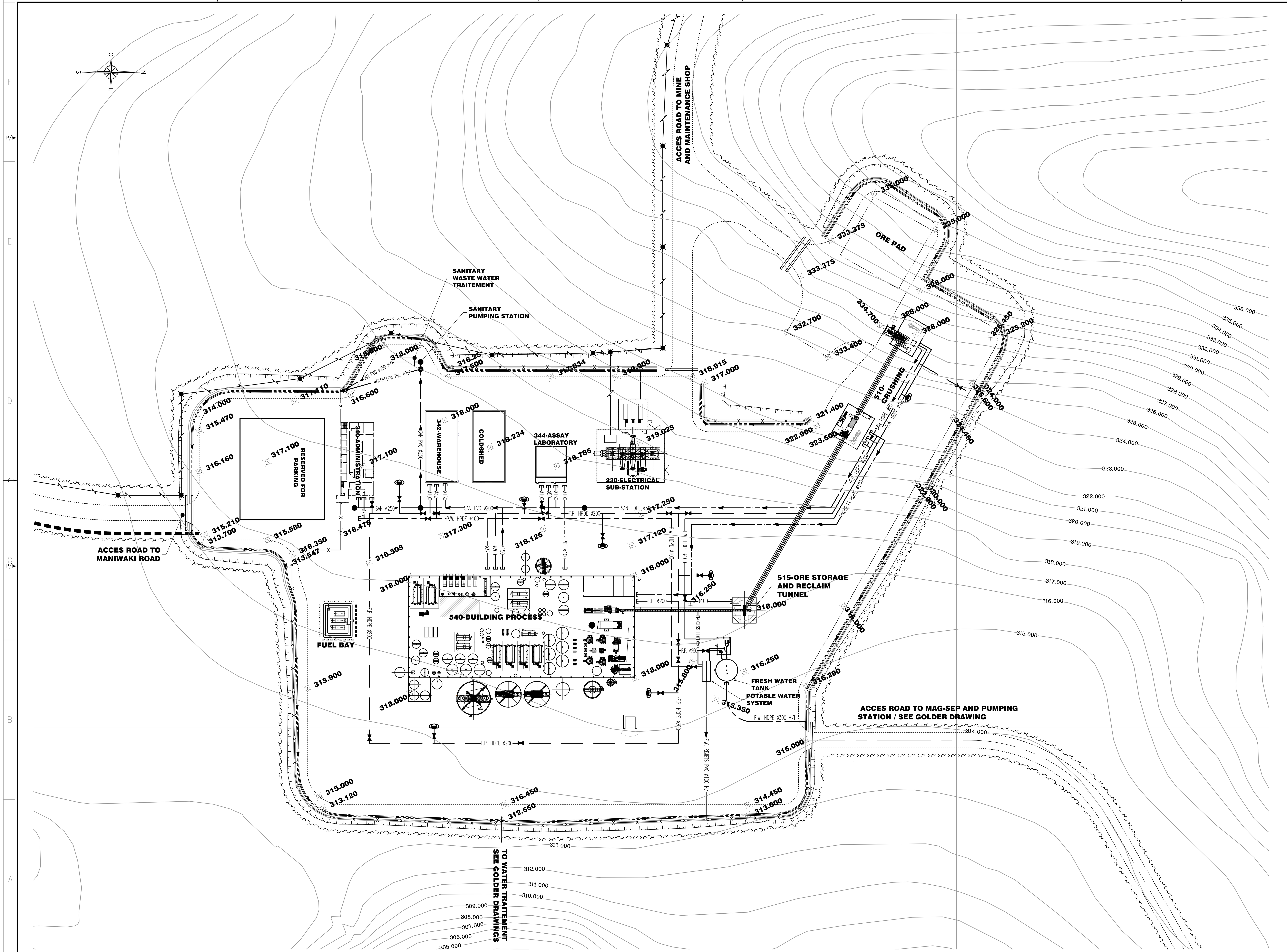


ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

REF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA
FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013/06/26	ISSUED FOR FEASIBILITY STUDY
	0B	2013/06/06	ISSUED FOR COORDINATION
0A		2013/03/28	ISSUED FOR COORDINATION

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: --

ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:1000

CONÇU PAR / DESIGNED BY: MARTIN DROUIN, ing.

DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE

VÉRIFIÉ PAR / CHECKED BY: REJEAN FOURNIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: CIVIL WORKS

TITRE / TITLE:

ON SITE INFRASTRUCTURE
GENERAL PLANT SITE
PLAN VIEW

NUMÉRO DU FEUILLET / SHEET NUMBER: 320-11-100

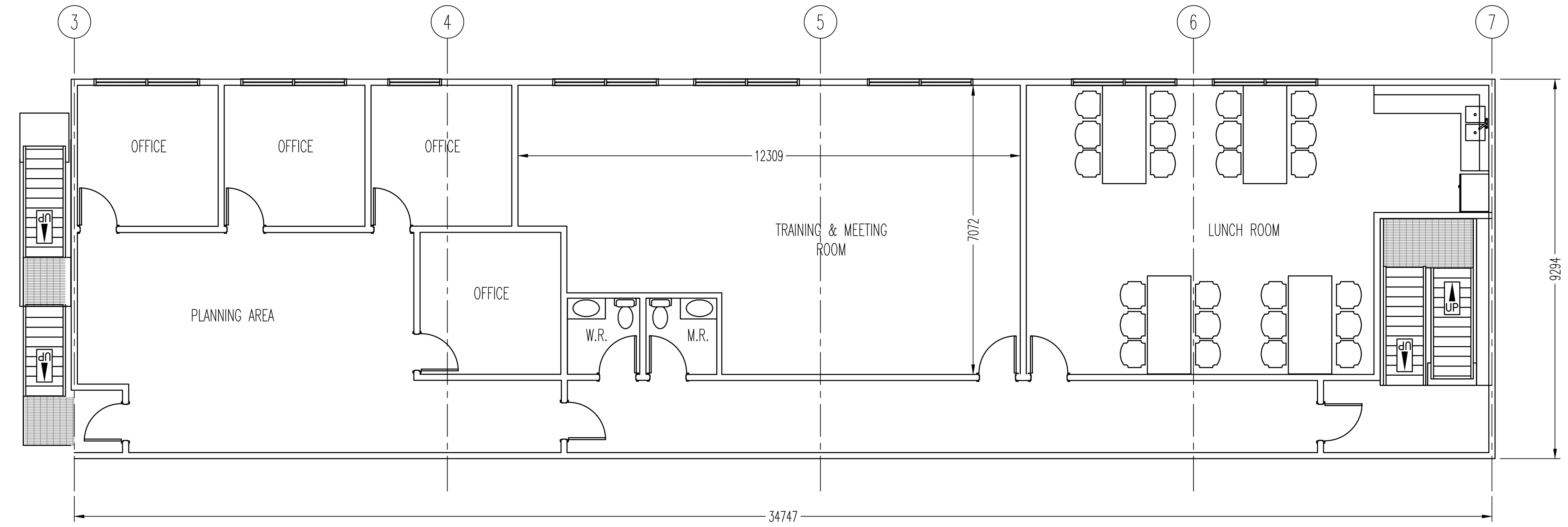
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

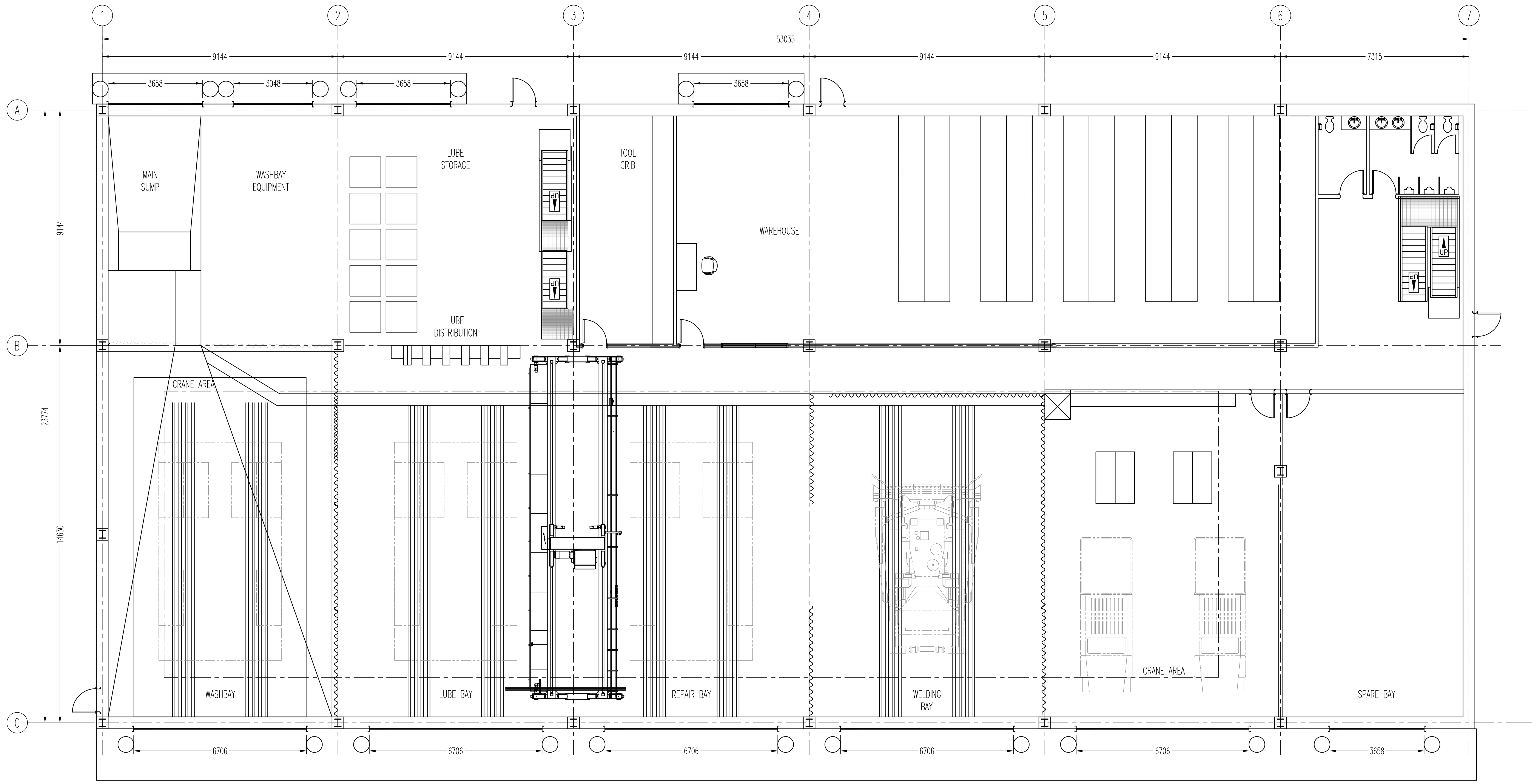
EN DATE DU / DATE OF: 2013/06/26

RV./RV. #: 00

Arch D, P:_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Emis\320-11-100_00.dwg, 2013-06-26 19:27:54



OFFICE FLOOR (MEZZANINE)



GROUND FLOOR

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-30

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: ERIC BLONDIN

DESSINÉ PAR / DRAWN BY: ERIC BLONDIN

VÉRIFIÉ PAR / CHECKED BY: ERIC POIRIER, ing.

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

GARAGE
GENERAL VIEW
GROUND FLOOR

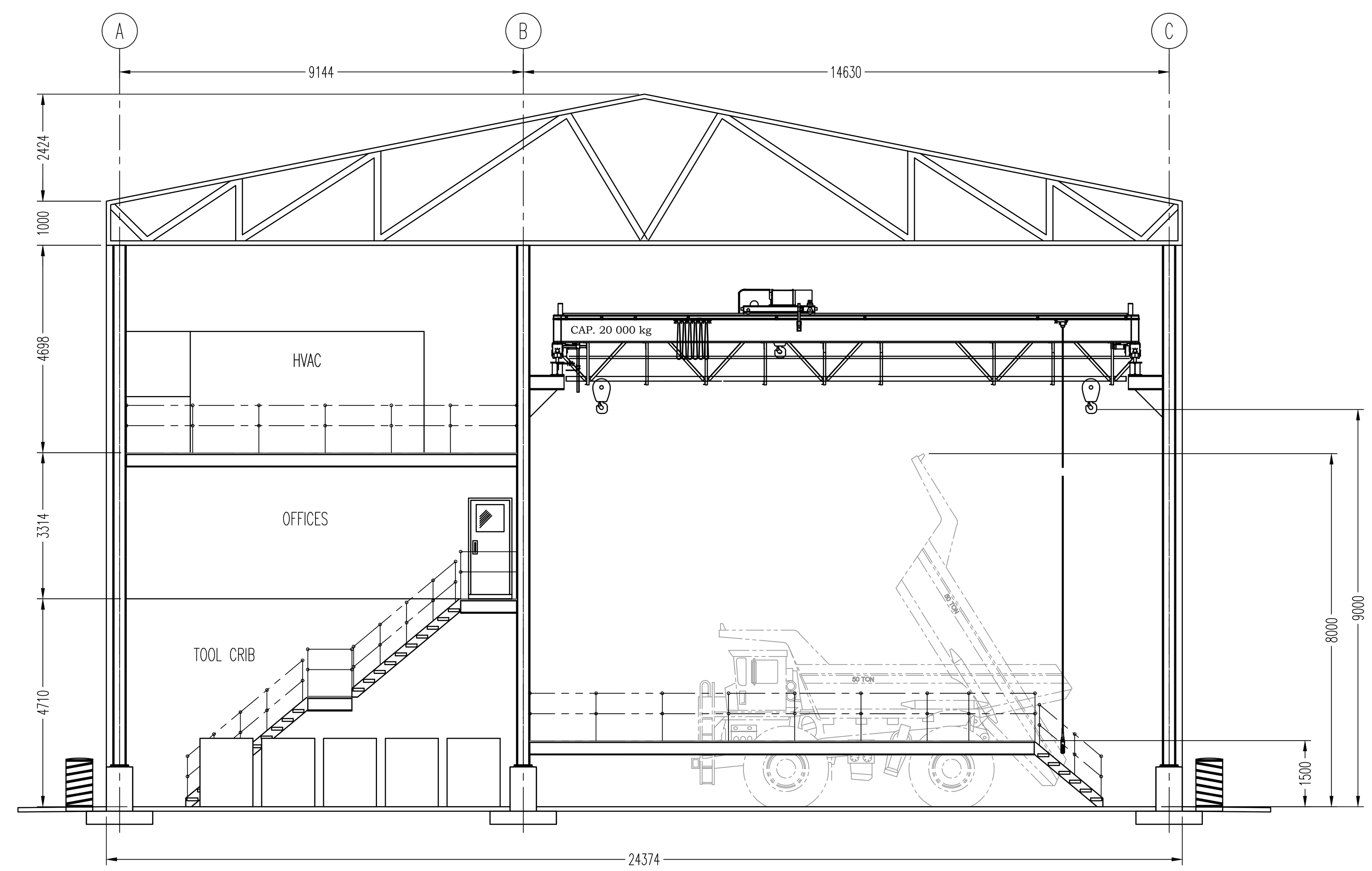
NUMÉRO DU FEUILLET / SHEET NUMBER: 330-00-100

FEUILLET / SHEET #: 1 DE / OF 1

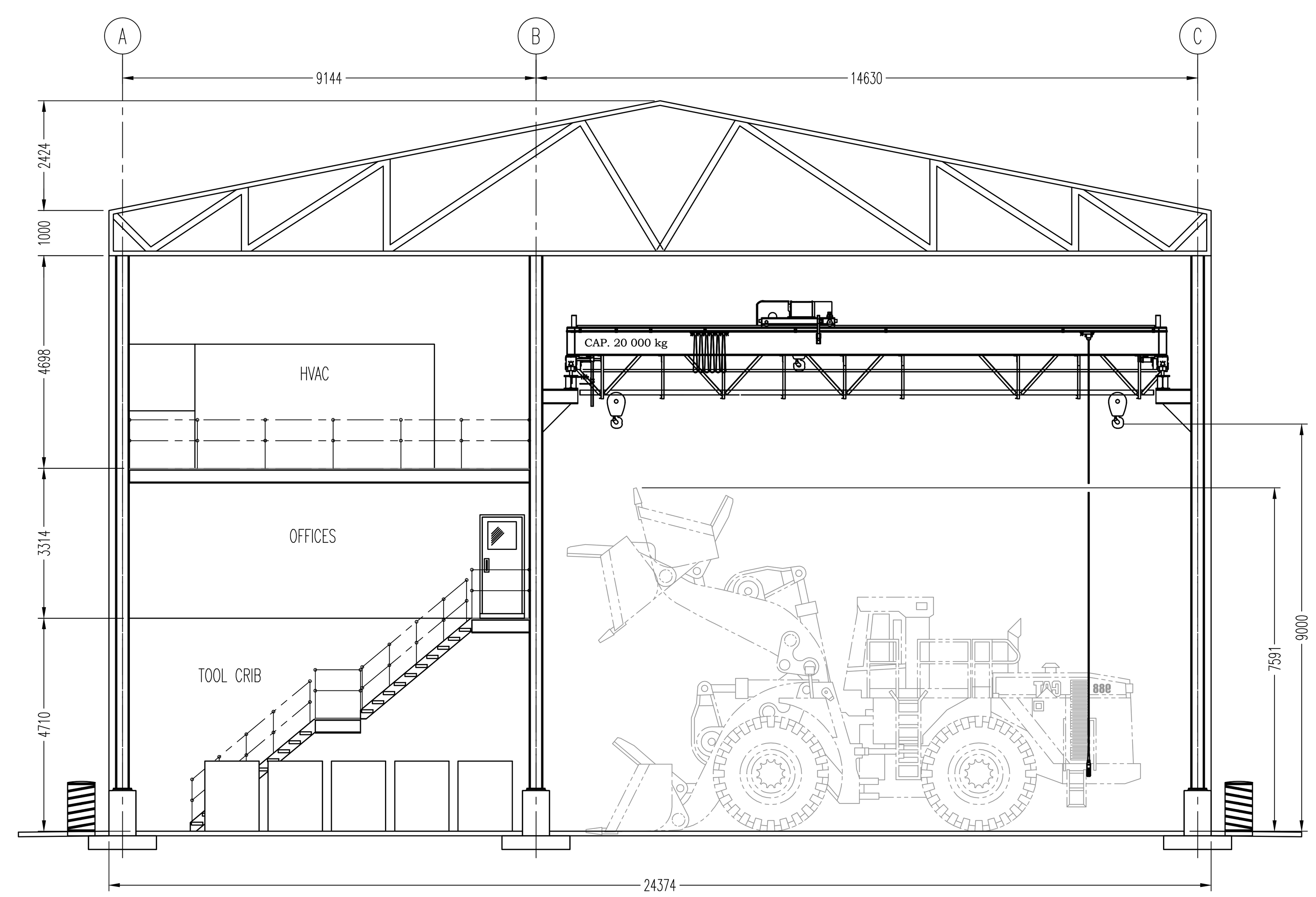
ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

RV./RV. #: 00

EN DATE DU / DATE OF: 2013-06-21



WASH BAY VIEW



LUBE BAY VIEW

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR Eric Poirier 120063 QUÉBEC

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

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ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-30

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: ERIC BLONDIN

DESSINÉ PAR / DRAWN BY: ERIC BLONDIN

VÉRIFIÉ PAR / CHECKED BY: ERIC POIRIER, ing.

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

GARAGE
GENERAL VIEW
ELEVATION

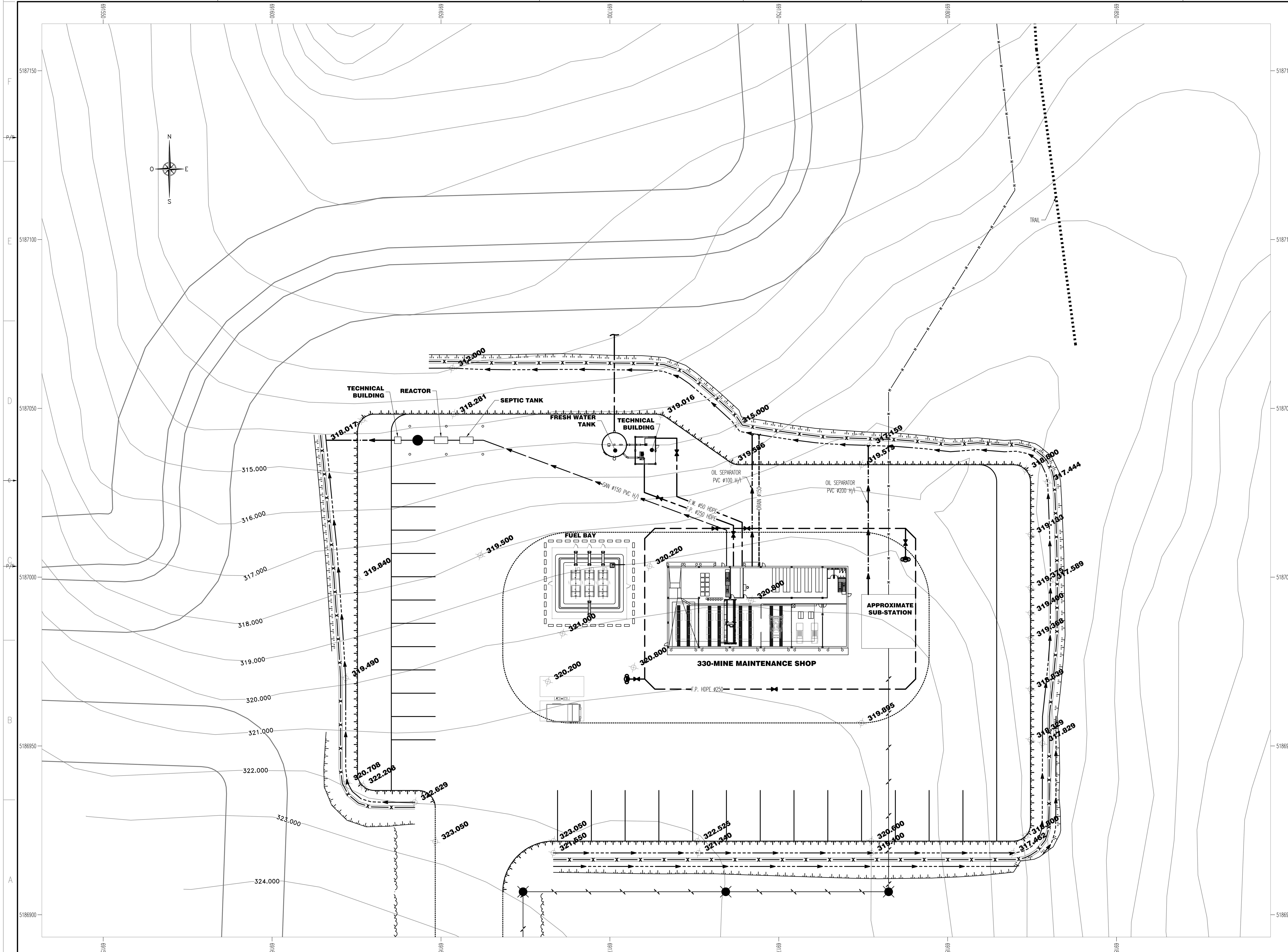
NUMÉRO DU FEUILLET / SHEET NUMBER: 330-00-200

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-21

RV./RV. #: 00



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

Réjean Fournier

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013/06/26	ISSUED FOR FEASIBILITY STUDY
0A		2013/03/28	ISSUED FOR COORDINATION

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013/02/15

ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:500

CONÇU PAR / DESIGNED BY: MARTIN DROUIN, ing.

DESSINÉ PAR / DRAWN BY: CINDY LABRECQUE

VÉRIFIÉ PAR / CHECKED BY: RÉJEAN FOURNIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: CIVIL WORKS

TITRE / TITLE:

ON SITE INFRASTRUCTURE
MINE MAINTENANCE SHOP
PLAN VIEW

NUMÉRO DU FEUILLET / SHEET NUMBER: 330-11-100

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

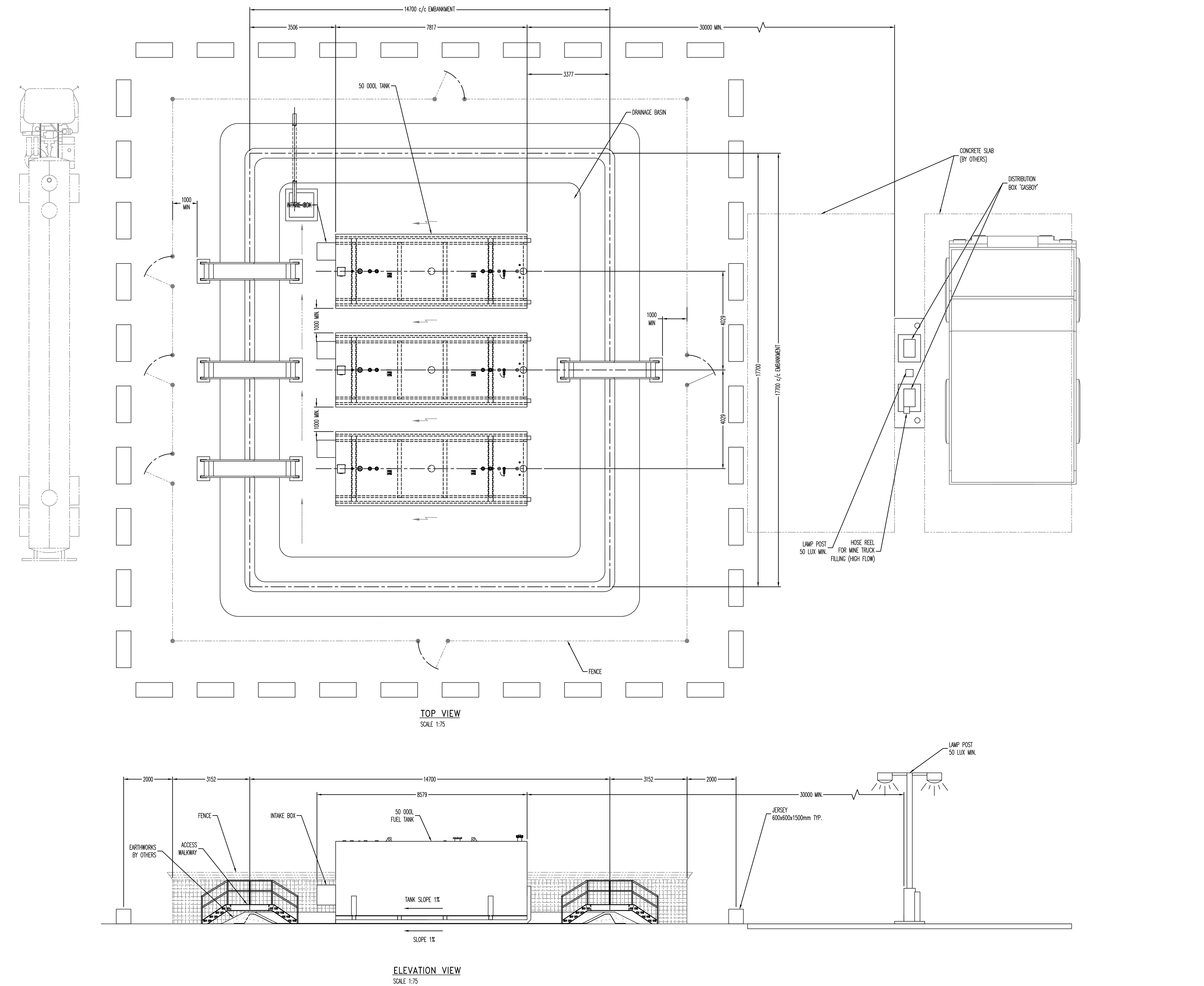
EN DATE DU / DATE OF: 2013/06/26

RV./RV. #: 00

Arch D, P:_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Emis\330-11-100_00.dwg, 2013-06-26 19:29:39

NOTES:

1. REFER TO THE PROCESS FLOW DIAGRAM #334-17-201 FOR TECHNICAL DETAILS.



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR · ENGINEER
Bertrand Fortin
129024
2013-06-26

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
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--	00	2013/06/26	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2012-12-10
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"
CONÇU PAR / DESIGNED BY: STEVE THERRIAULT GINGRAS	
DESSINÉ PAR / DRAWN BY: DANNY LARIVIÈRE	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN	

DISCIPLINE / DISCIPLINE:

GENERAL ARRANGEMENT

TITRE / TITLE:

MINE SITE FUEL DEPOT GENERAL ARRANGEMENT

NUMÉRO DU FEUILLET / SHEET NUMBER:

334-00-201

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE:

ISSUED FOR FEASABILITY STUDY

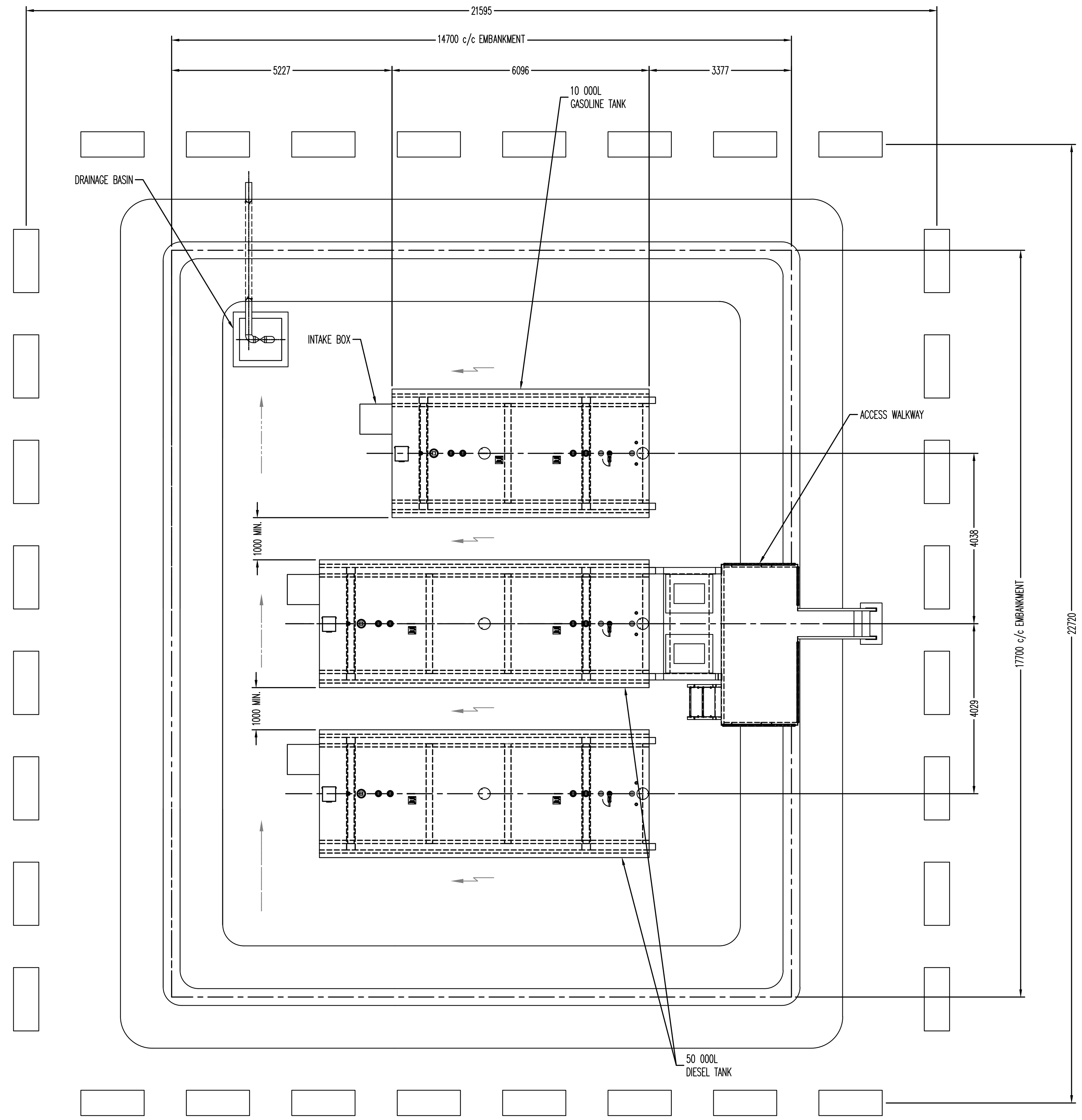
EN DATE DU / DATE OF: 2013/06/26

RV./RV. #: 00

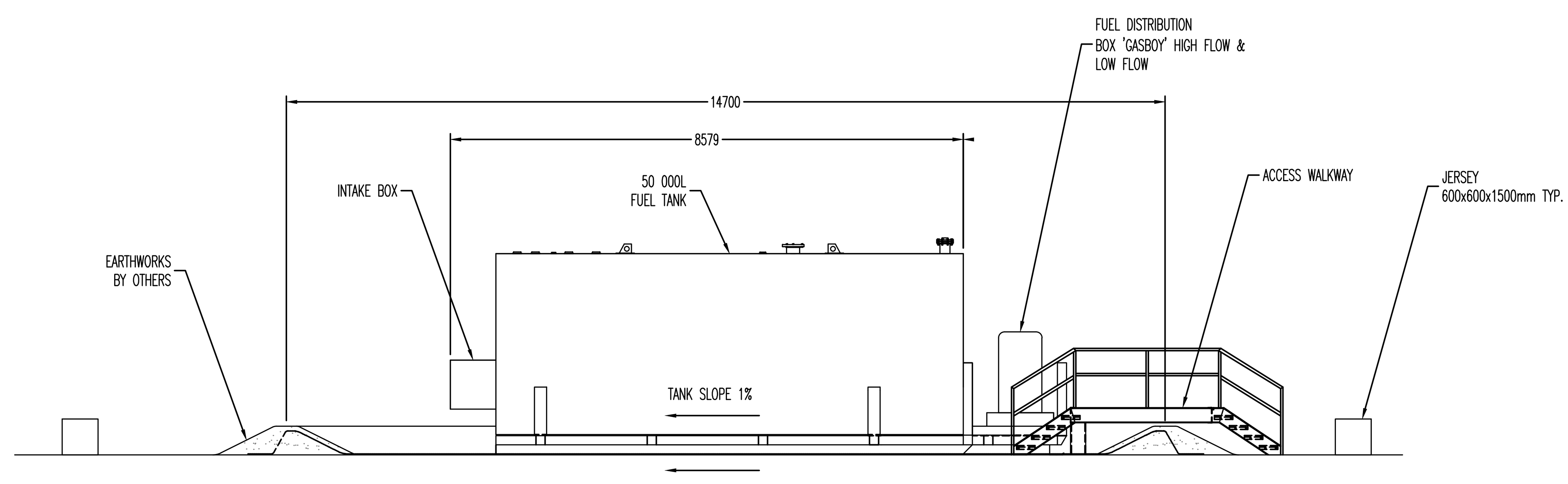
\\sv076data02\projet_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Emis\350-00-100_0B.dwg, 2012-11-16 09:31:46

NOTES:

1. REFER TO THE PROCESS FLOW DIAGRAM #334-17-201 FOR TECHNICAL DETAILS.



TOP VIEW
SCALE 1:75



ELEVATION VIEW
SCALE 1:75

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR · ENGINEER Bertrand Fortin 129024 2013-06-26

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--			
--			
--			
--			
--			
--	00	2013/06/26	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2012-12-10
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: DANNY LARIVIÈRE
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

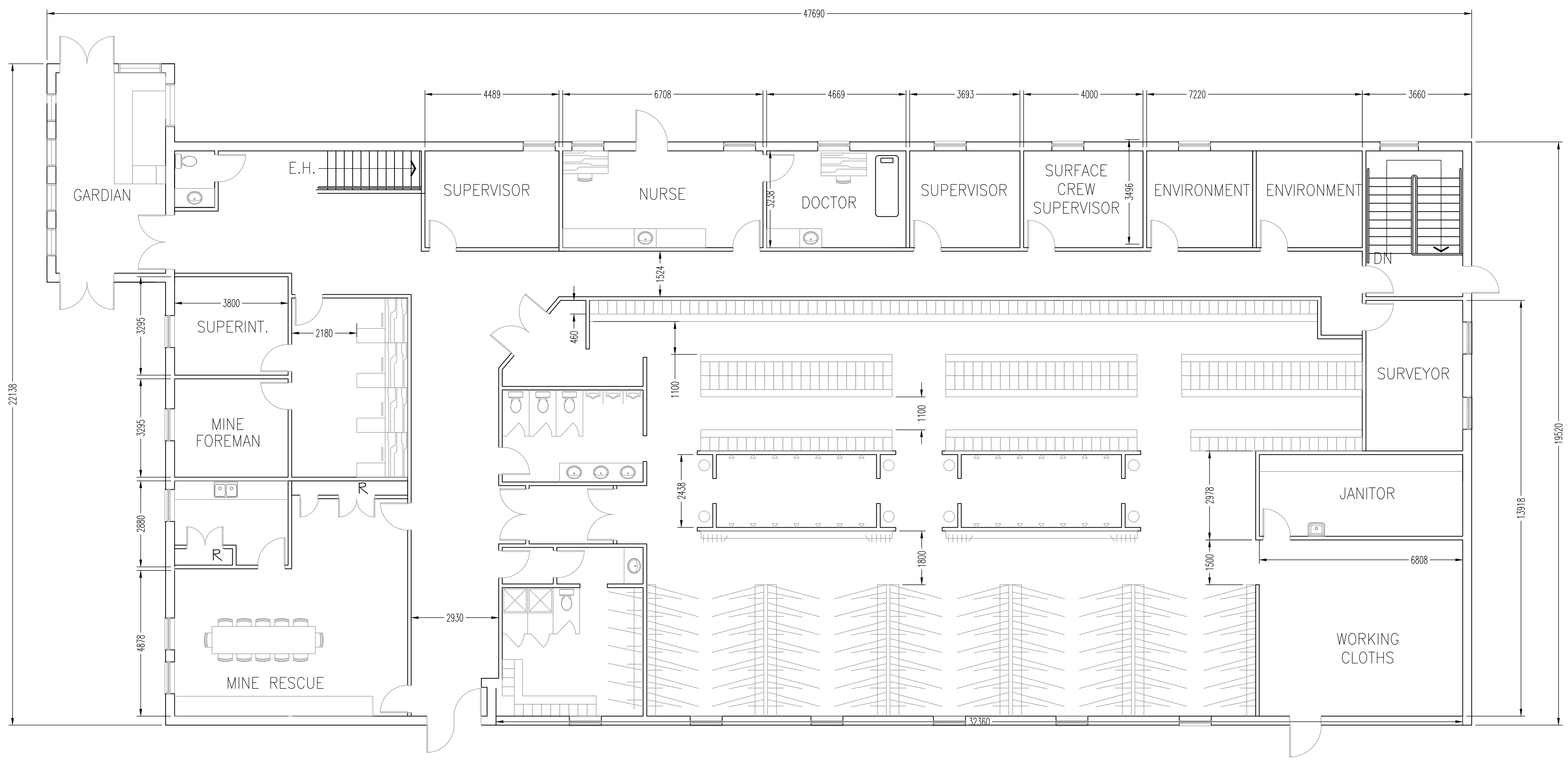
TITRE / TITLE:

PROCESS PLANT
FUEL BAY
GENERAL ARRANGEMENT

NUMÉRO DU FEUILLET / SHEET NUMBER: 336-00-201
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY
RV./RV. #: 00
EN DATE DU / DATE OF: 2013/03/15

Arch: D, \\sv076data02\projet_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Emis\350-00-100_08.dwg, 2012-11-16 09:31:46



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR Eric Poirier 120063 QUÉBEC

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-10

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

CONÇU PAR / DESIGNED BY: ERIC BLONDIN

DESSINÉ PAR / DRAWN BY: ERIC BLONDIN

VÉRIFIÉ PAR / CHECKED BY: ERIC POIRIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

ADMINISTRATION BUILDING
GENERAL VIEW
GROUND FLOOR

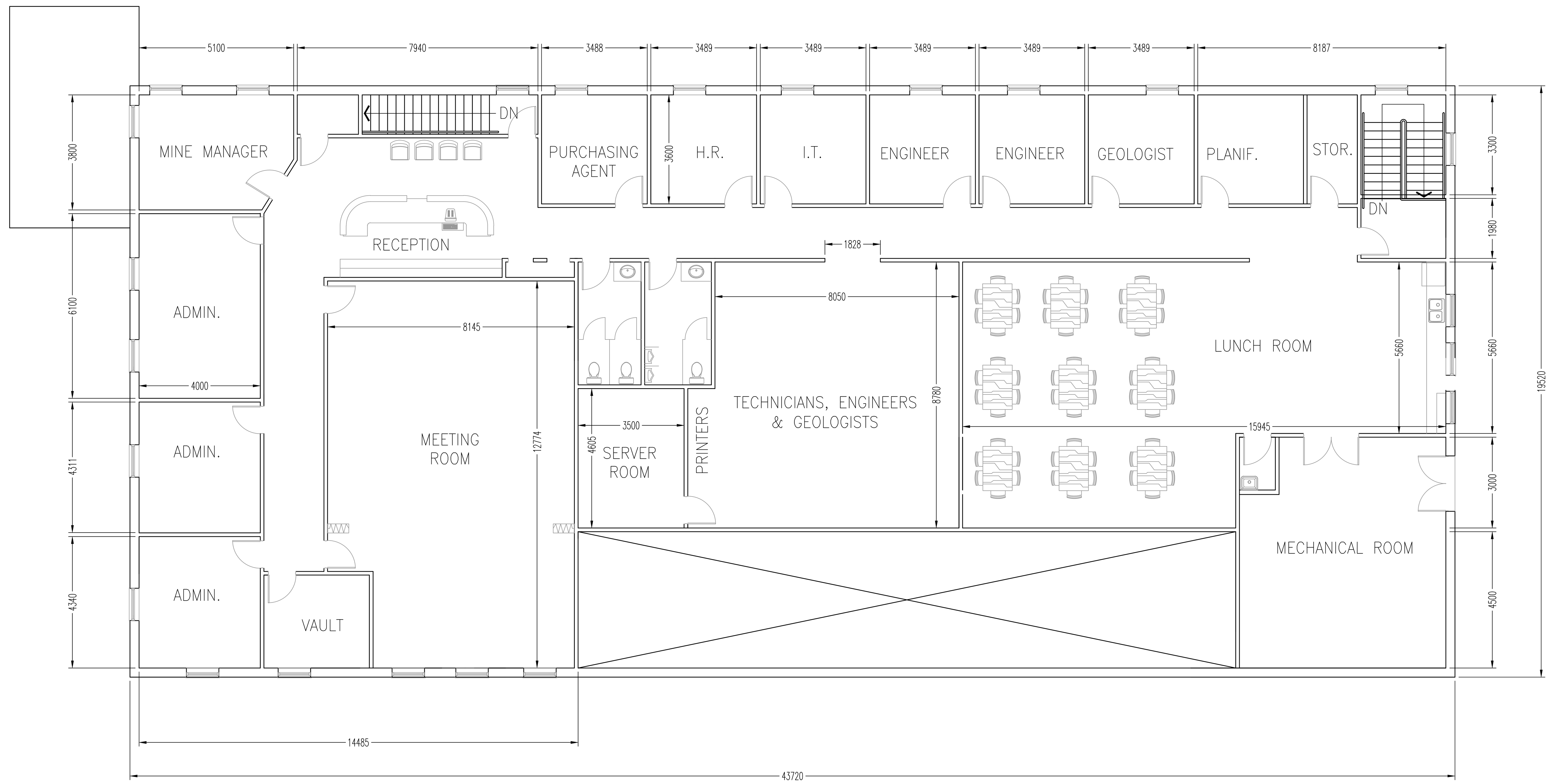
NUMÉRO DU FEUILLET / SHEET NUMBER: 340-00-100

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-21

RV./RV. #: 00



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR Eric Poirier 120063 QUÉBEC

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-10

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

CONÇU PAR / DESIGNED BY: ERIC BLONDIN

DESSINÉ PAR / DRAWN BY: ERIC BLONDIN

VÉRIFIÉ PAR / CHECKED BY: ERIC POIRIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

ADMINISTRATION BUILDING
GENERAL VIEW
FIRST FLOOR

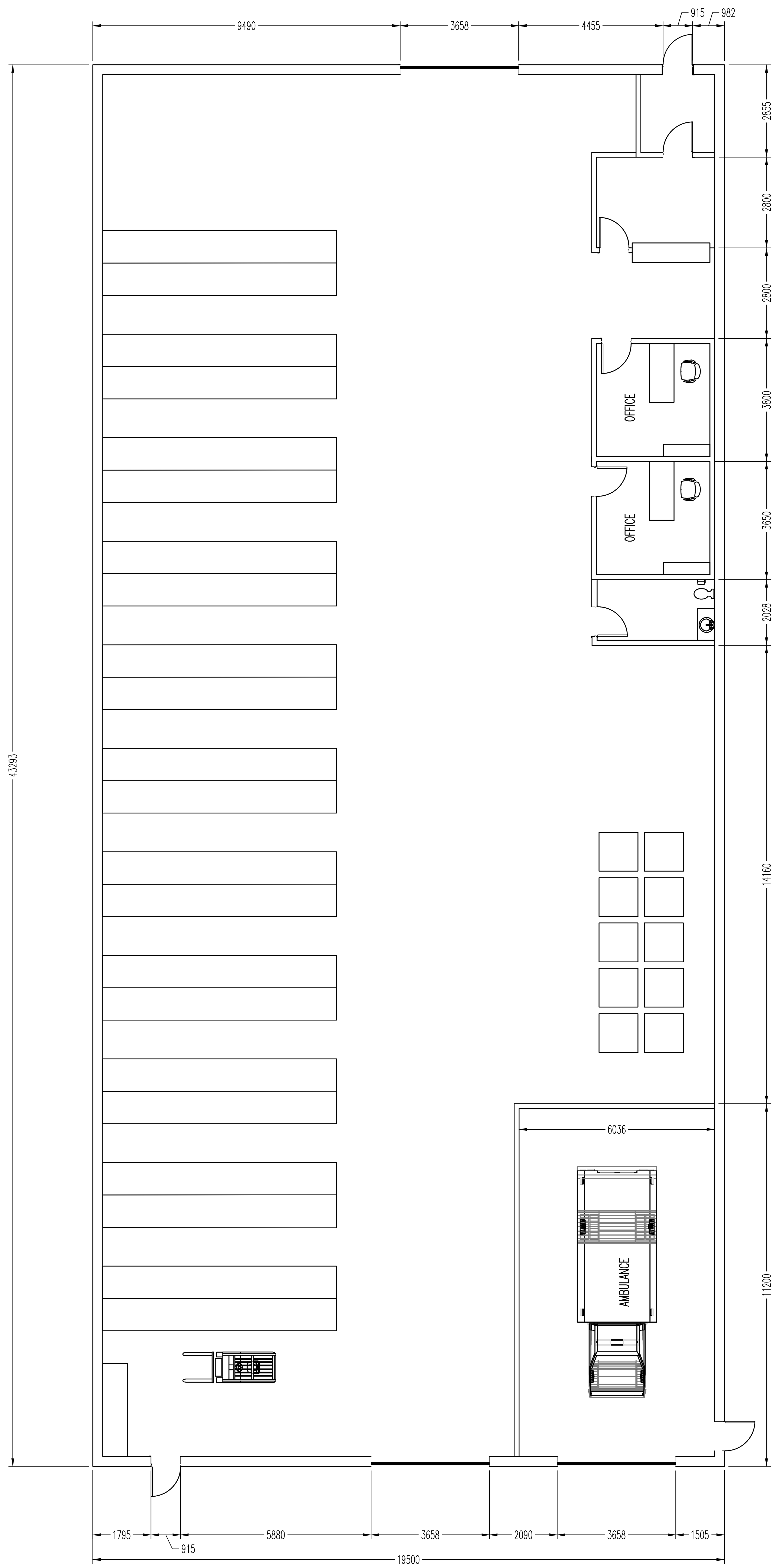
NUMÉRO DU FEUILLET / SHEET NUMBER: 340-00-101

FEUILLET / SHEET #: 1 DE / OF 1

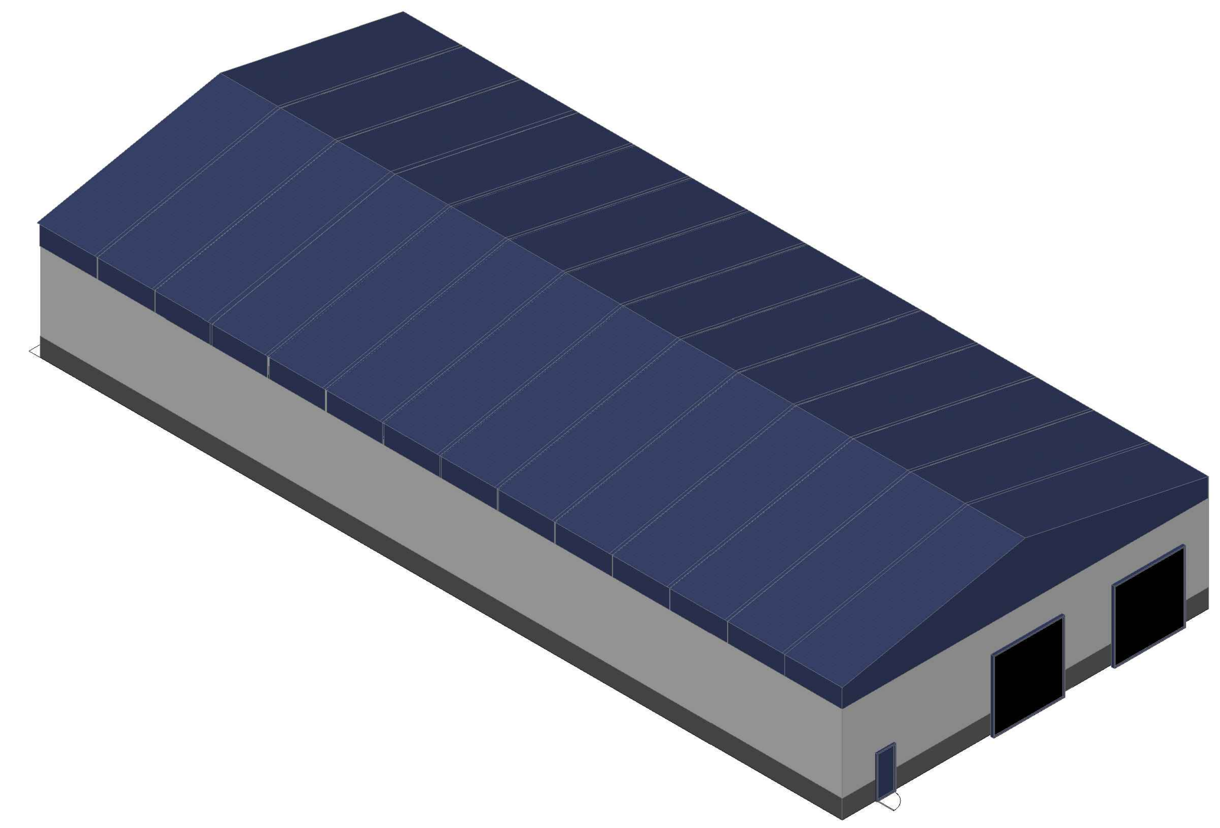
ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-21

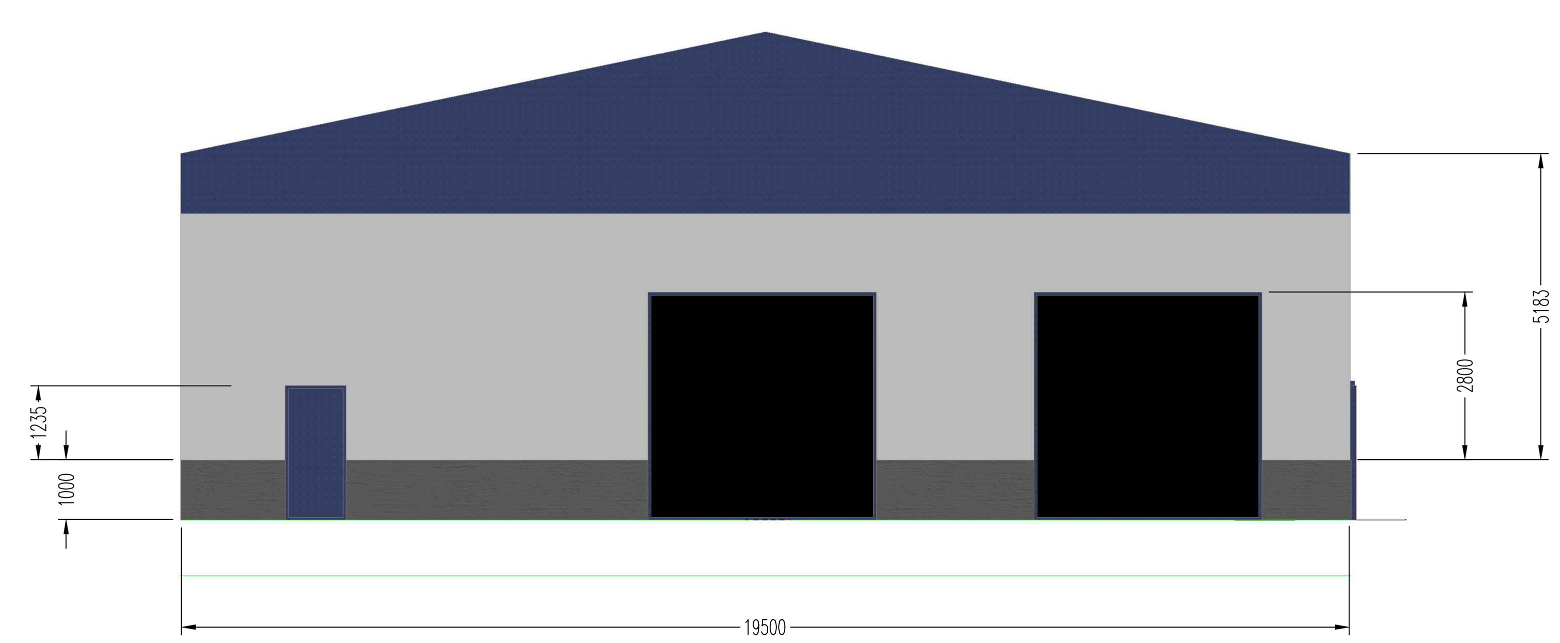
RV./RV. # 00



PLAN VIEW
SCALE: 1:100



ISO VIEW WAREHOUSE
SCALE: N/A



FRONT VIEW
SCALE: NTS

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR Eric Poirier 120063 QUÉBEC

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-10

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

CONÇU PAR / DESIGNED BY: ERIC BLONDIN

DESSINÉ PAR / DRAWN BY: ERIC BLONDIN

VÉRIFIÉ PAR / CHECKED BY: ERIC POIRIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

WAREHOUSE BUILDING
GENERAL VIEW
GROUND FLOOR

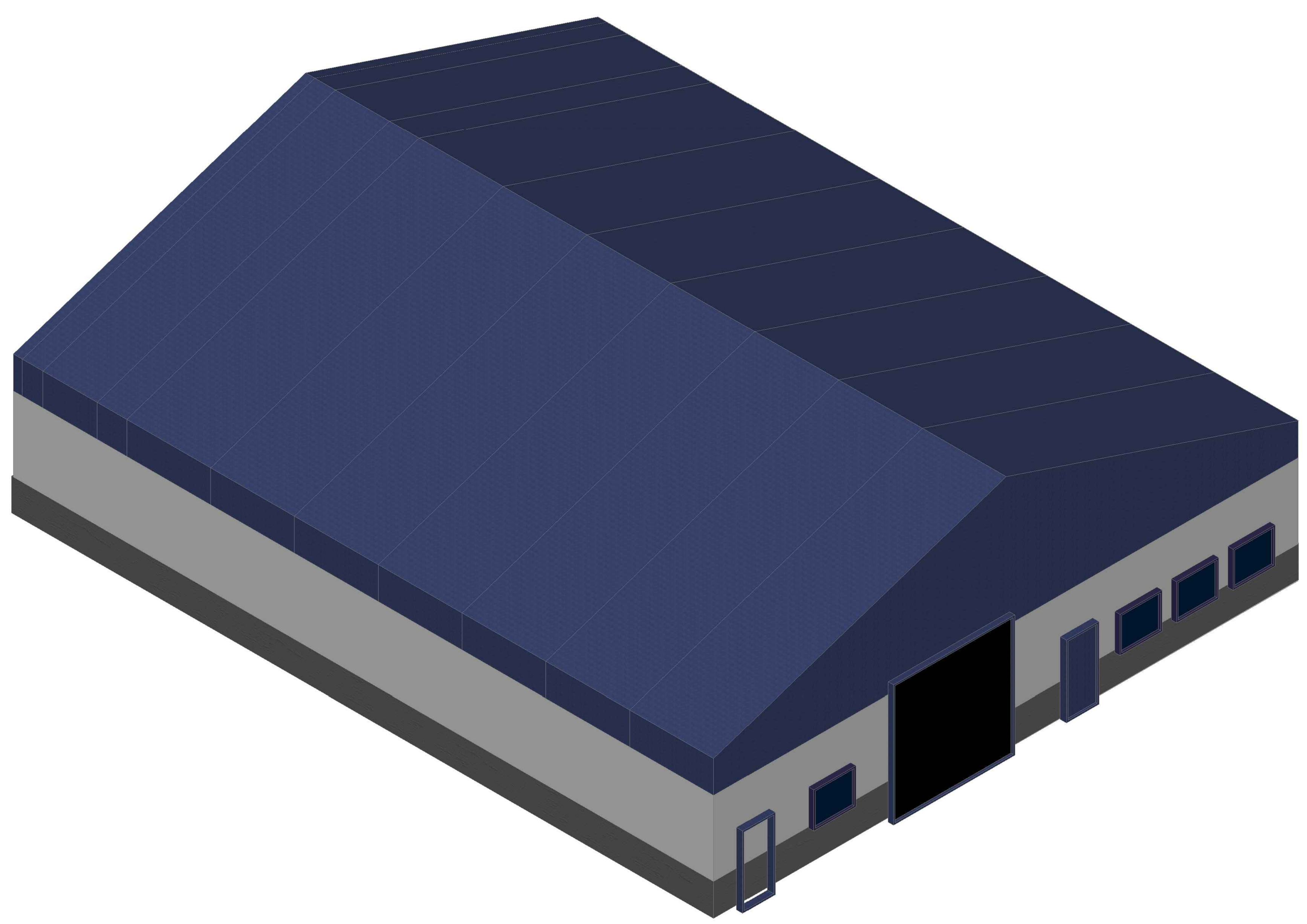
NUMÉRO DU FEUILLET / SHEET NUMBER: 342-00-100

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

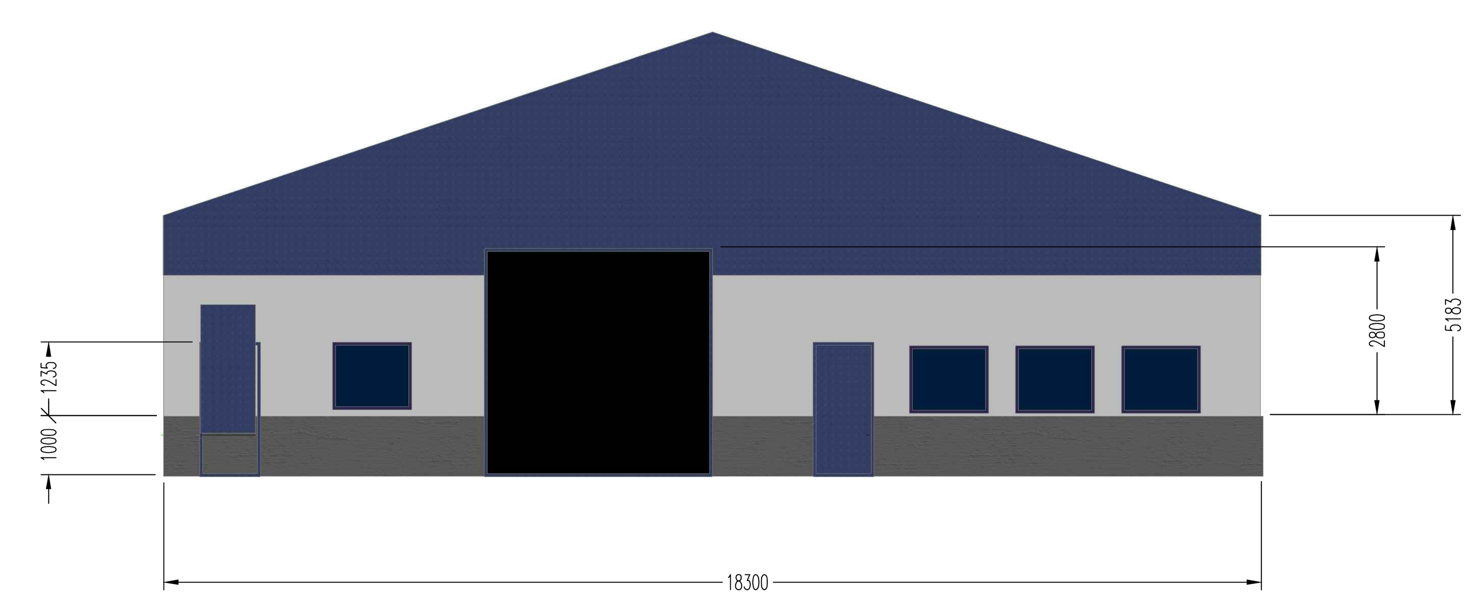
EN DATE DU / DATE OF: 2013-06-21

RV./RV. #: 00



ISOMETRIC VIEW

SCALE: N/A



FRONT VIEW

SCALE: NTS

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR Eric Poirier 120063 QUÉBEC

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-30

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

CONÇU PAR / DESIGNED BY: ERIC BLONDIN

DESSINÉ PAR / DRAWN BY: ERIC BLONDIN

VÉRIFIÉ PAR / CHECKED BY: ERIC POIRIER, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

ASSAY LAB
GENERAL VIEW
GROUND FLOOR

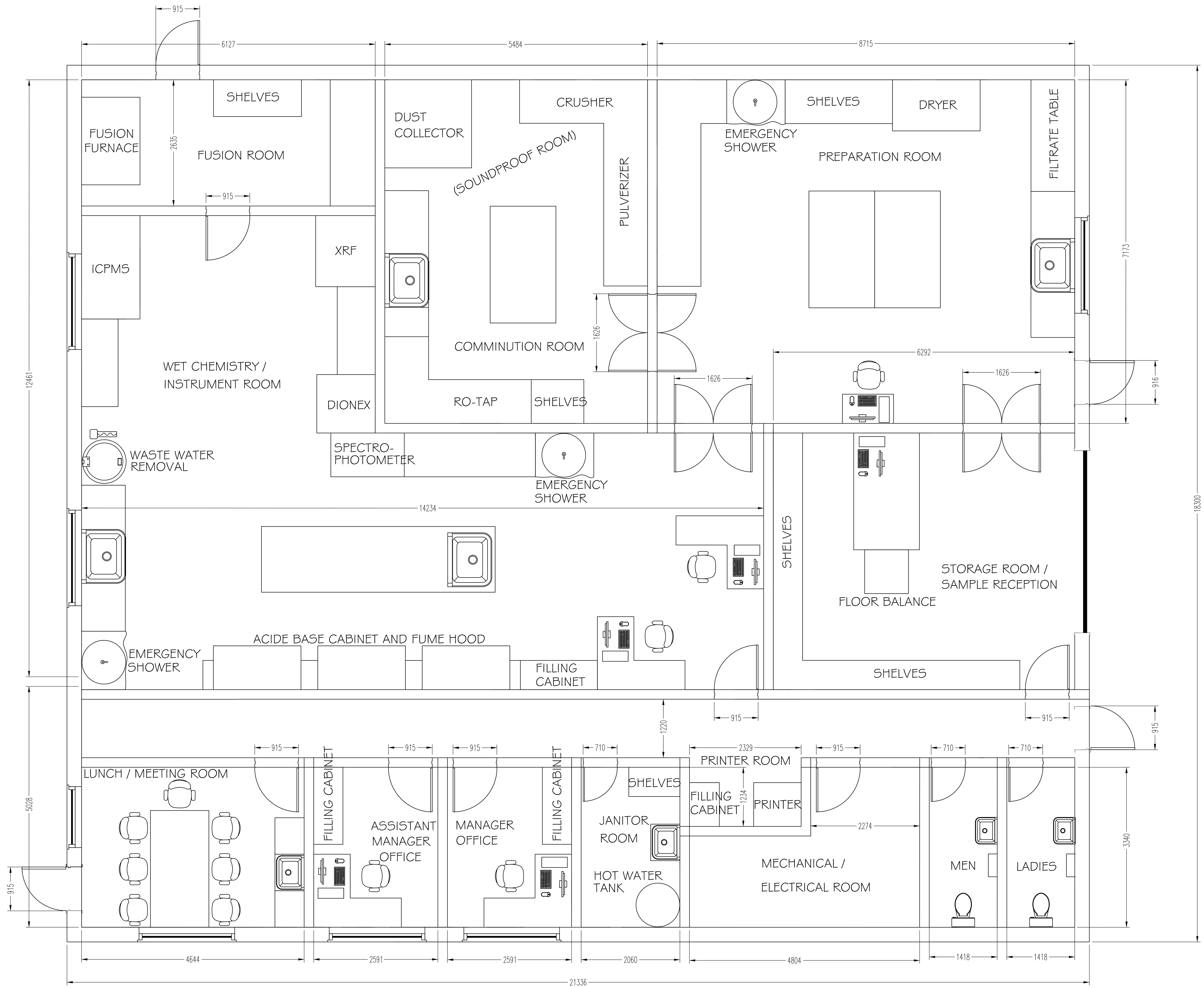
NUMÉRO DU FEUILLET / SHEET NUMBER: 344-00-100

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

RV./RV. #: 00

EN DATE DU / DATE OF: 2013-06-21



PLAN VIEW

SCALE: 1:40

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-11	ISSUED FOR FAISIBILITY STUDY
--	0E	2013-01-30	ISSUED FOR CAPEX
--	0D	2012-12-20	ISSUED FOR CAPEX
--	0C	2012-12-03	ISSUED FOR COMMENTS
--	0B		NOT ISSUED
--	0A		NOT ISSUED

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-30

ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:40

CONÇU PAR / DESIGNED BY: KARL CÔTÉ-LAFRENIÈRE

DESSINÉ PAR / DRAWN BY: KARL CÔTÉ-LAFRENIÈRE

VÉRIFIÉ PAR / CHECKED BY: ANNIE LAVOIE

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

ASSAY LAB
GROUND FLOOR
GENERAL ARRANGEMENT

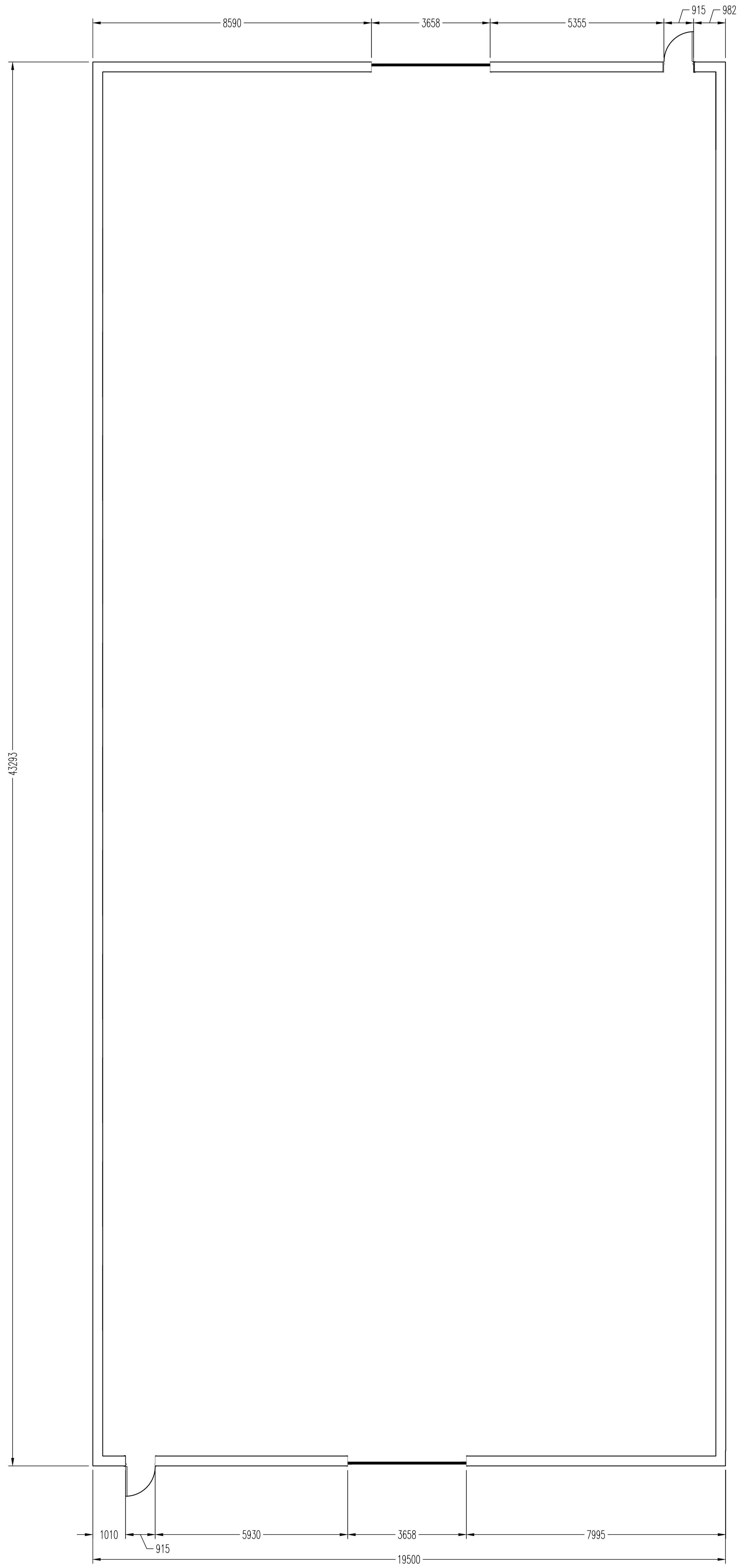
NUMÉRO DU FEUILLET / SHEET NUMBER: 344-00-101

FEUILLET / SHEET #: -- DE / OF --

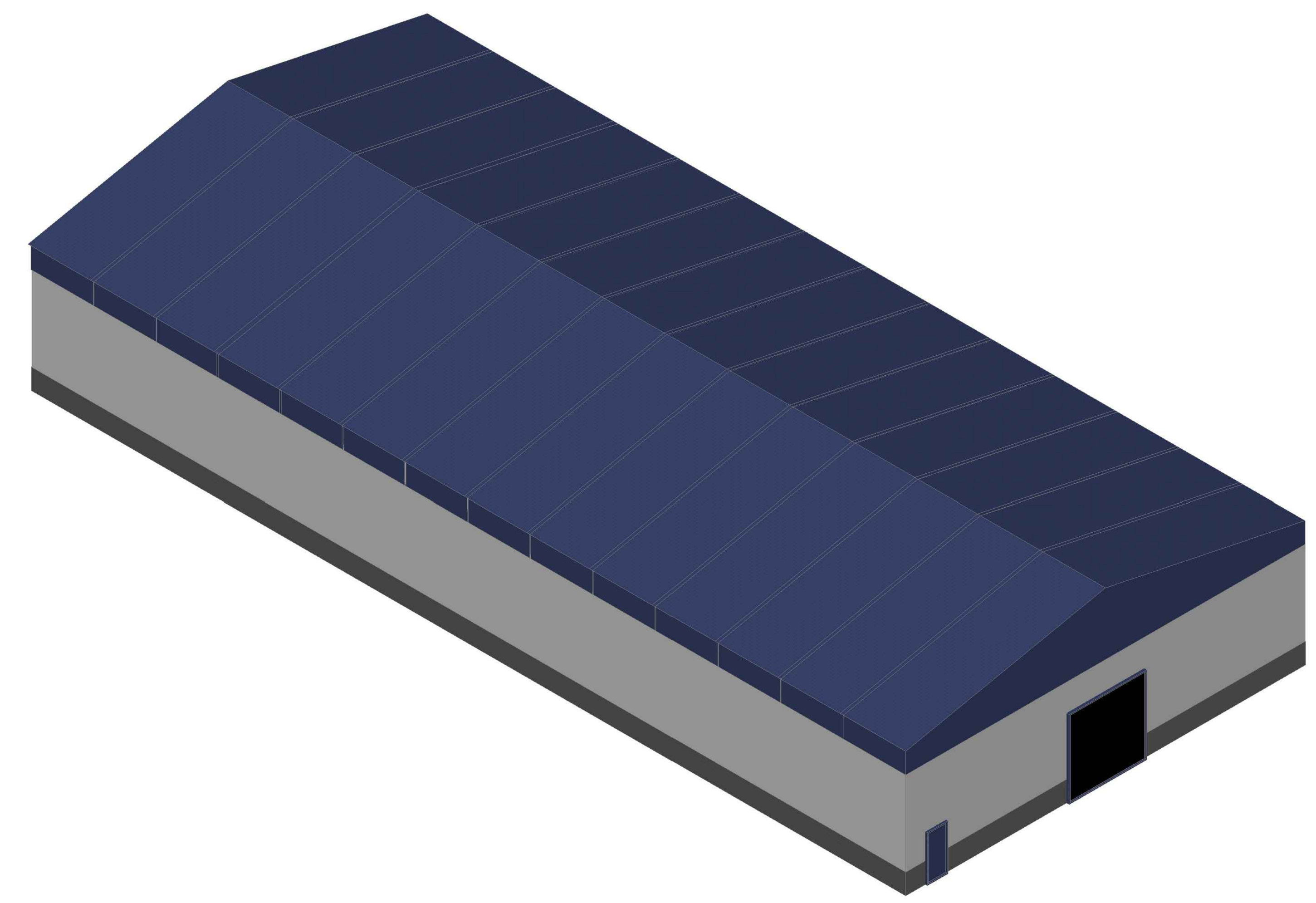
ÉMISSION / ISSUE: ISSUED FOR FAISIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-11

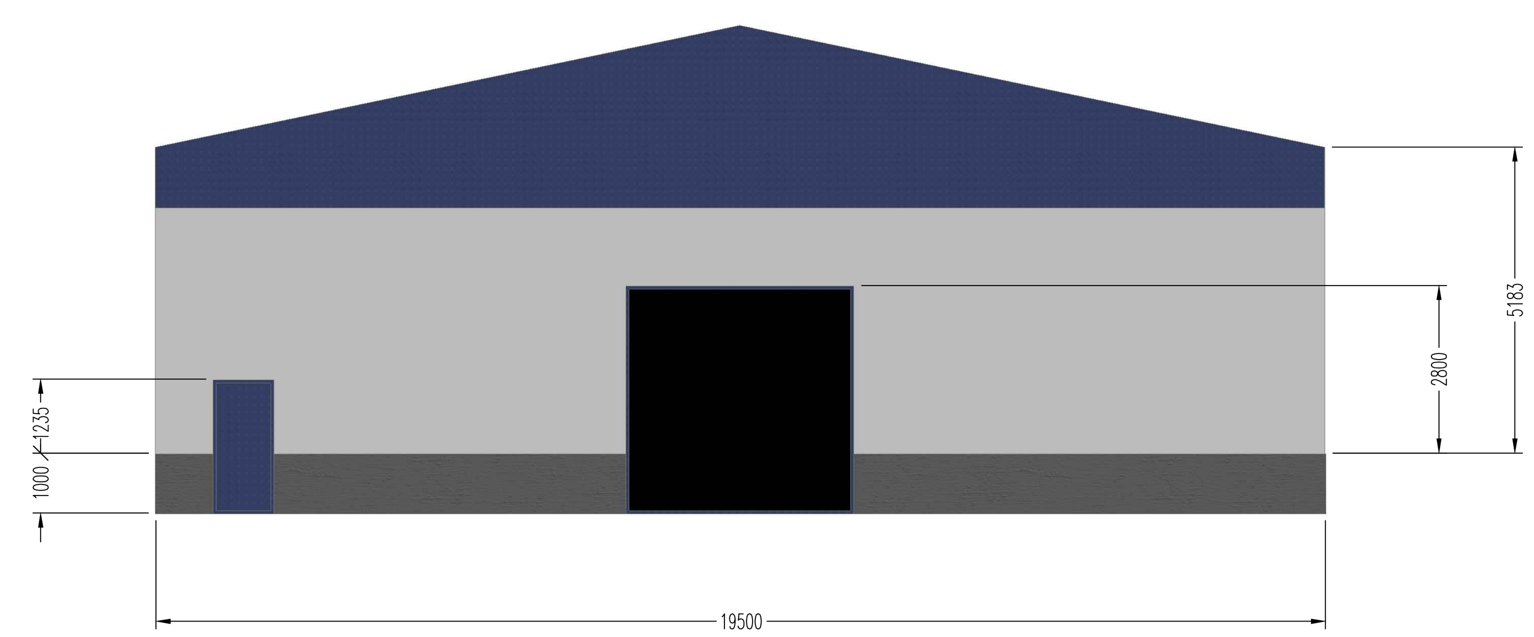
RV./RV. #: 00



PLAN VIEW
SCALE: 1:100



ISO VIEW COLD SHED
SCALE: N/A



FRONT VIEW
SCALE: NTS

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR
Eric Poirier
120063
QUÉBEC

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-10

ÉCHELLE ORIGINALE / ORIGINAL SCALE: NTS

CONÇU PAR / DESIGNED BY: ERIC BLONDIN

DESSINÉ PAR / DRAWN BY: ERIC BLONDIN

VÉRIFIÉ PAR / CHECKED BY: ERIC POIRIER, ing

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

COLD SHED
GENERAL VIEW
GROUND FLOOR

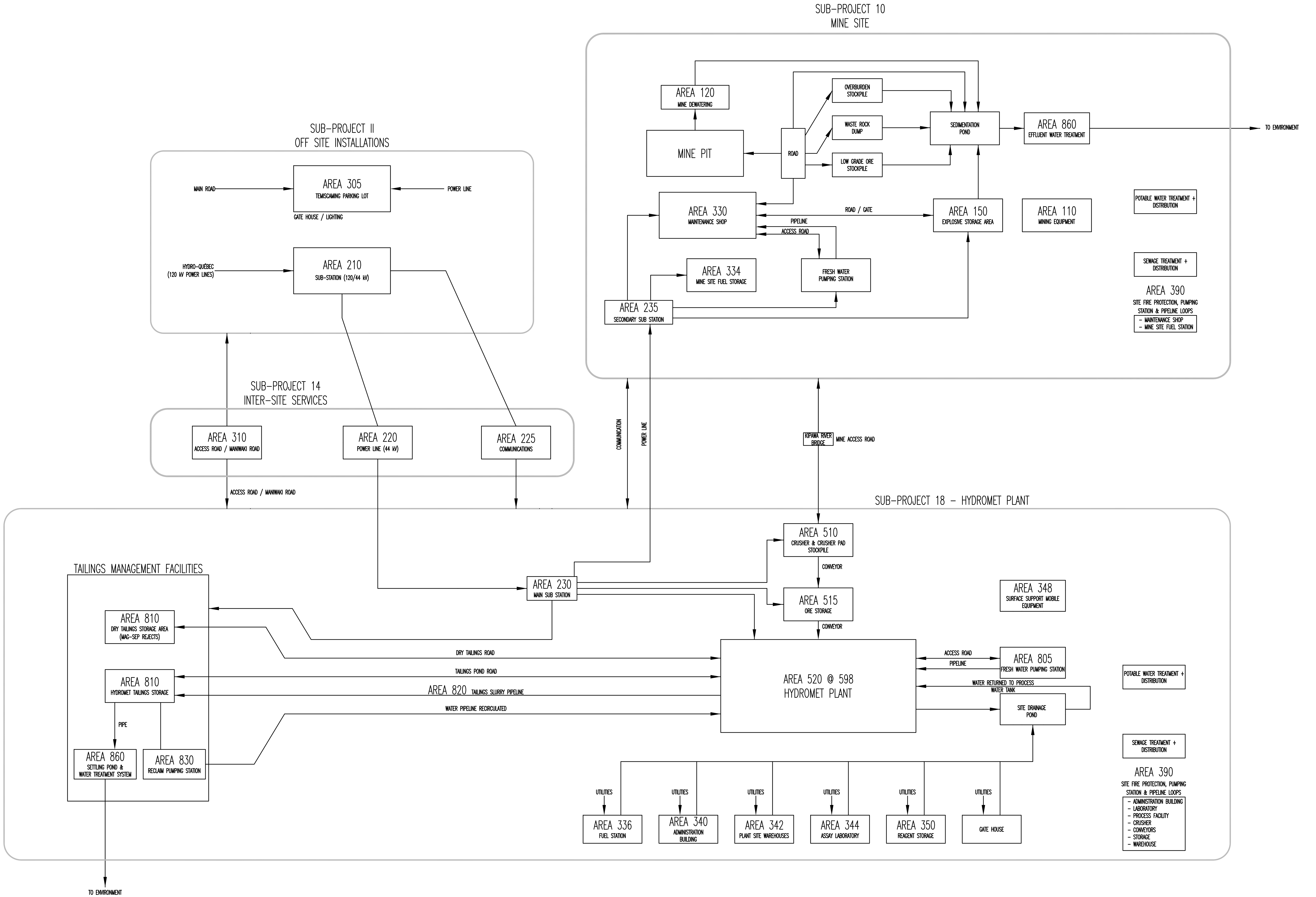
NUMÉRO DU FEUILLET / SHEET NUMBER: 350-00-100

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-21

RV./RV. #: 00



NO. DESSIN / DRAWING NO.	TITRE / TITLE	NO.	DESCRIPTION / DESCRIPTION	J/D	M/M	A/Y	PAR/BY	APP
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-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	
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-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	
-	-	0A	ISSUED FOR FEASIBILITY STUDY	05	08	13	W.L.	
-	-	A1	ISSUED FOR DISCUSSION	29	01	13	P.G.G.	

REFERENCES / REFERENCES — REVISIONS / REVISIONS

CONSULTANT DWG # 1-10-500-R1-EDRA-05-200
CONSULTANT CONTRACT # 061623.002

	NOM / NAME	INIT	J/D	M/M	A/Y
DESSINE / DRAW	P.-G. GAGNON		09	01	13
VERIFIE / CHECKED	W. LECLERC		09	01	13
EXAMINE / EXAMINES	-		-	-	-
APPROBATION / APPROVAL					
INGENIEUR / ENGINEER	W. LECLERC		09	01	13
INGENIEUR / ENGINEER	-		-	-	-

ECHELLE / SCALE NTS

SCEAU / SEAL

ROCHE GENIVAR

NOTE: UNE COTE MARQUEE D'UN ASTERISQUE* INDIQUE QU'IL FAUT LA MESURER OU LA VERIFIER AU CHANTIER.

NOTE: A DIMENSION MARKED WITH AN ASTERISK * INDICATES THAT IT NEEDS TO BE MEASURED OR VERIFIED ON SITE.

L'ENTREPRENEUR DEVRA AVANT DE COMMENCER A EXECUTER TOUT TRAVAIL, PRENDRE ET VERIFIER SUR PLACE TOUTES LES MESURES ET DIMENSIONS ET CELA SOUS SA SEULE RESPONSABILITE SAUF INDICATION CONTRAIRE.

BEFORE PERFORMING ANY WORK, THE CONTRACTOR IS RESPONSIBLE TO TAKE AND VERIFY ALL MEASUREMENTS AND DIMENSIONS UNLESS OTHERWISE SPECIFIED.

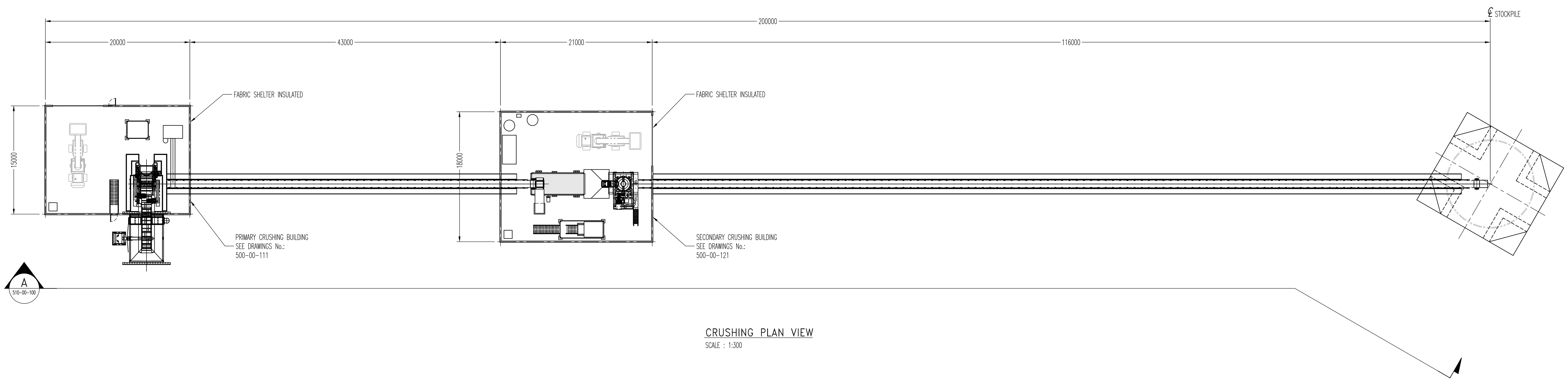
MATAMEC

MATAMEC - KIPAWA PROJECT

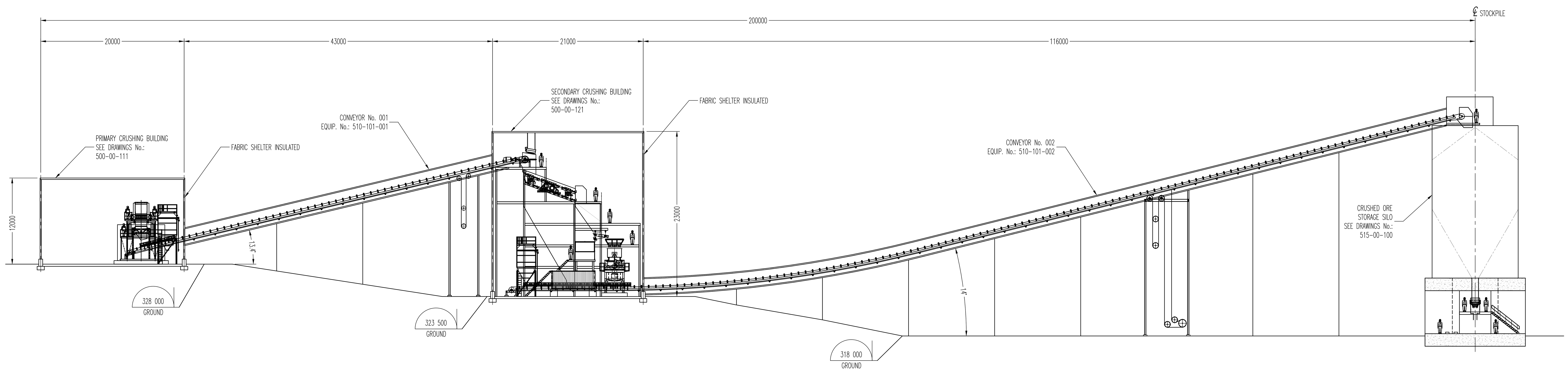
FEASIBILITY STUDY
AREA 570
BLOCK DIAGRAM
-

NO. CONTRAT / CONTRACT NO.	NO. DESSIN / DRAWING	REV.	FOR.
-	500-05-200	0A	A1

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



CRUSHING PLAN VIEW
SCALE : 1:300



SECTION A
SCALE : 1:300
510-00-100

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER
Bertrand Fortin
129024
2013-06-21

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-11

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: SÉBASTIEN ST-LOUIS

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD PRIMARY & SECONDARY CRUSHING GENERAL VIEW

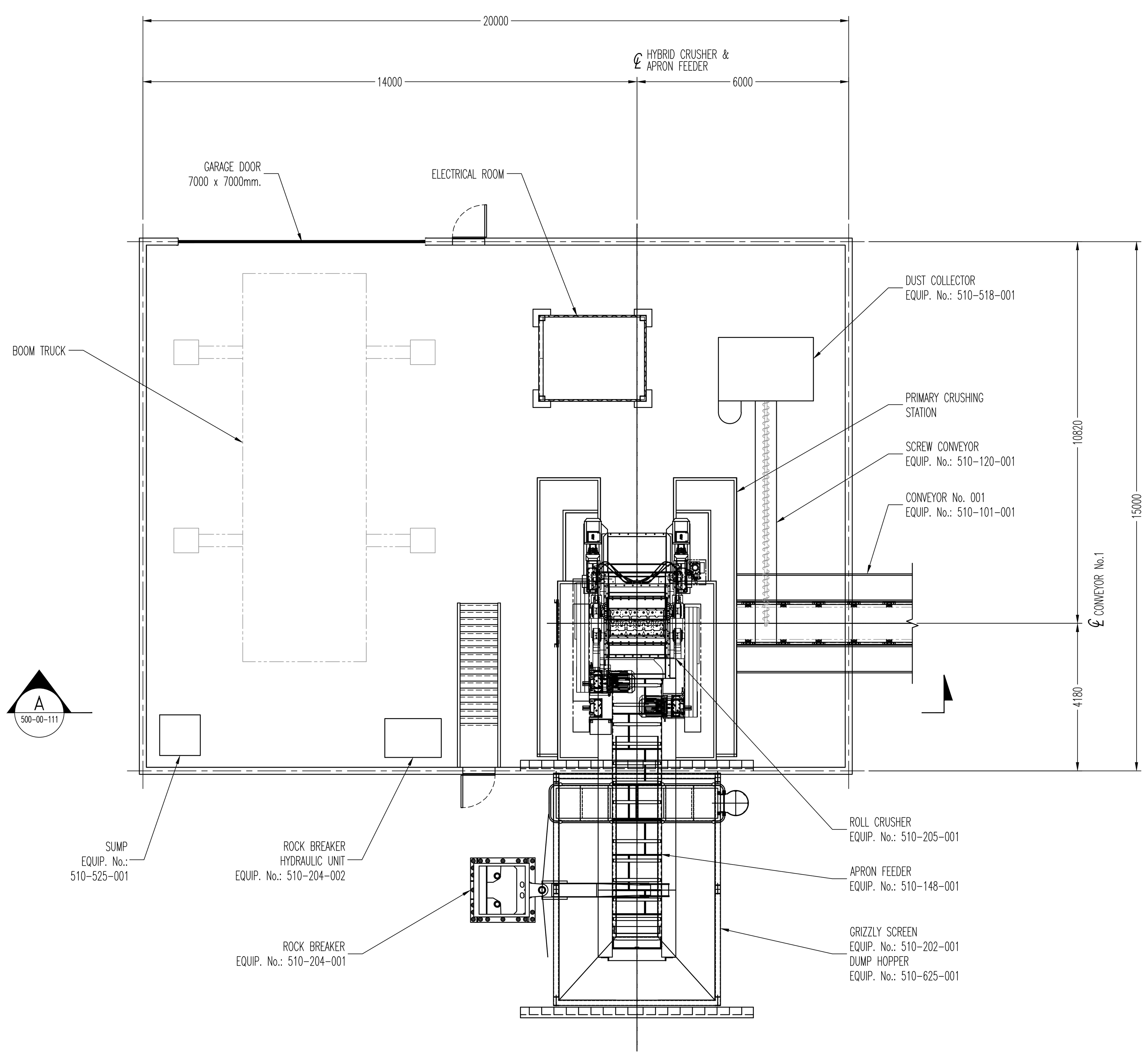
NUMÉRO DU FEUILLET / SHEET NUMBER: 510-00-100

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

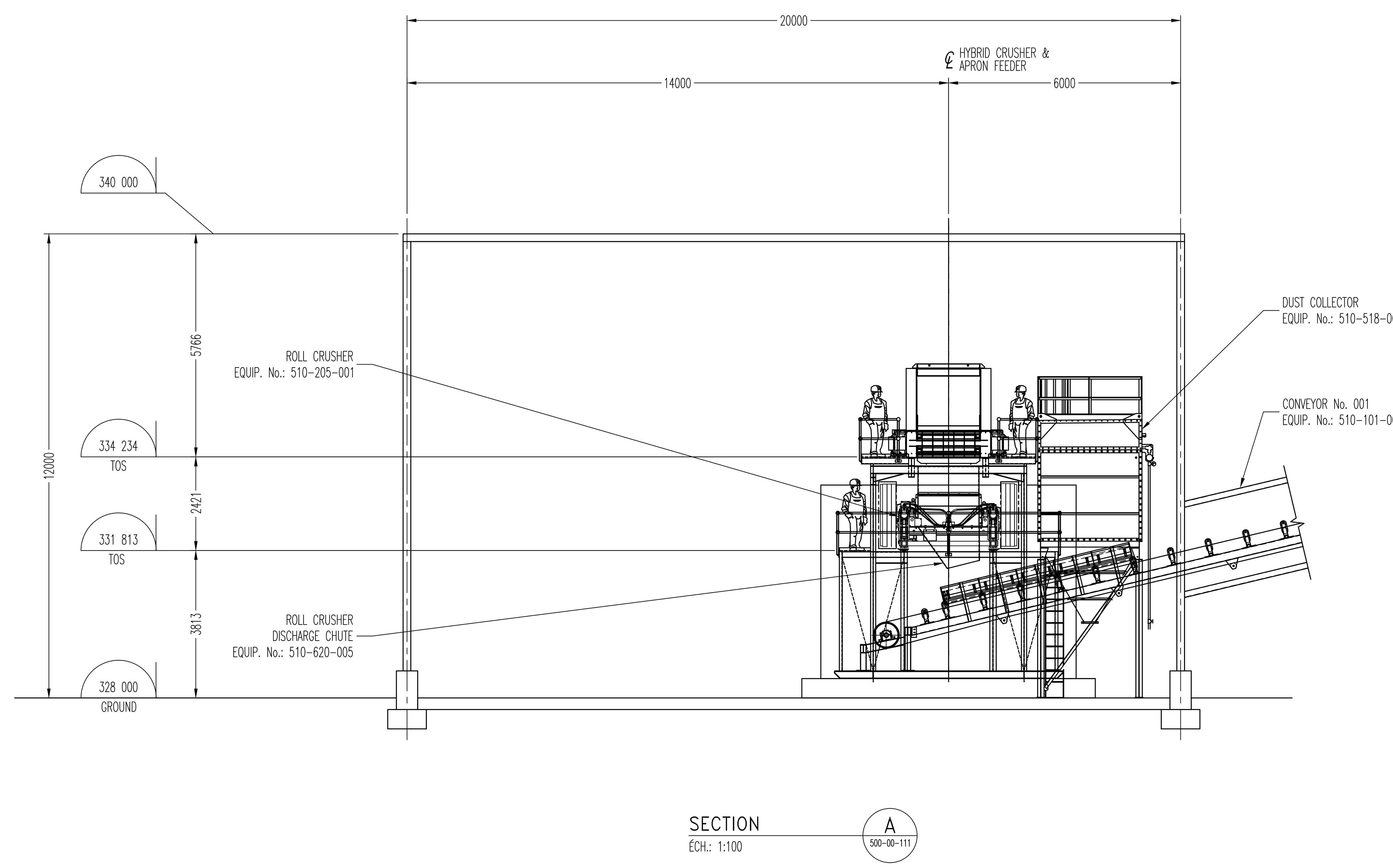
EN DATE DU / DATE OF: 2013-06-21

RV./RV. #: 00



PRIMARY CRUSHING – PLAN VIEW

SCALE : 1:100



SECTION A (500-00-111)

ÉCH.: 1:100

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER Bertrand Fortin 129024 2013-06-21

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-01-18

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: SÉBASTIEN ST-LOUIS

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
PRIMARY CRUSHING BUILDING
PLAN & ELEVATION VIEWS

NUMÉRO DU FEUILLET / SHEET NUMBER: 510-00-111

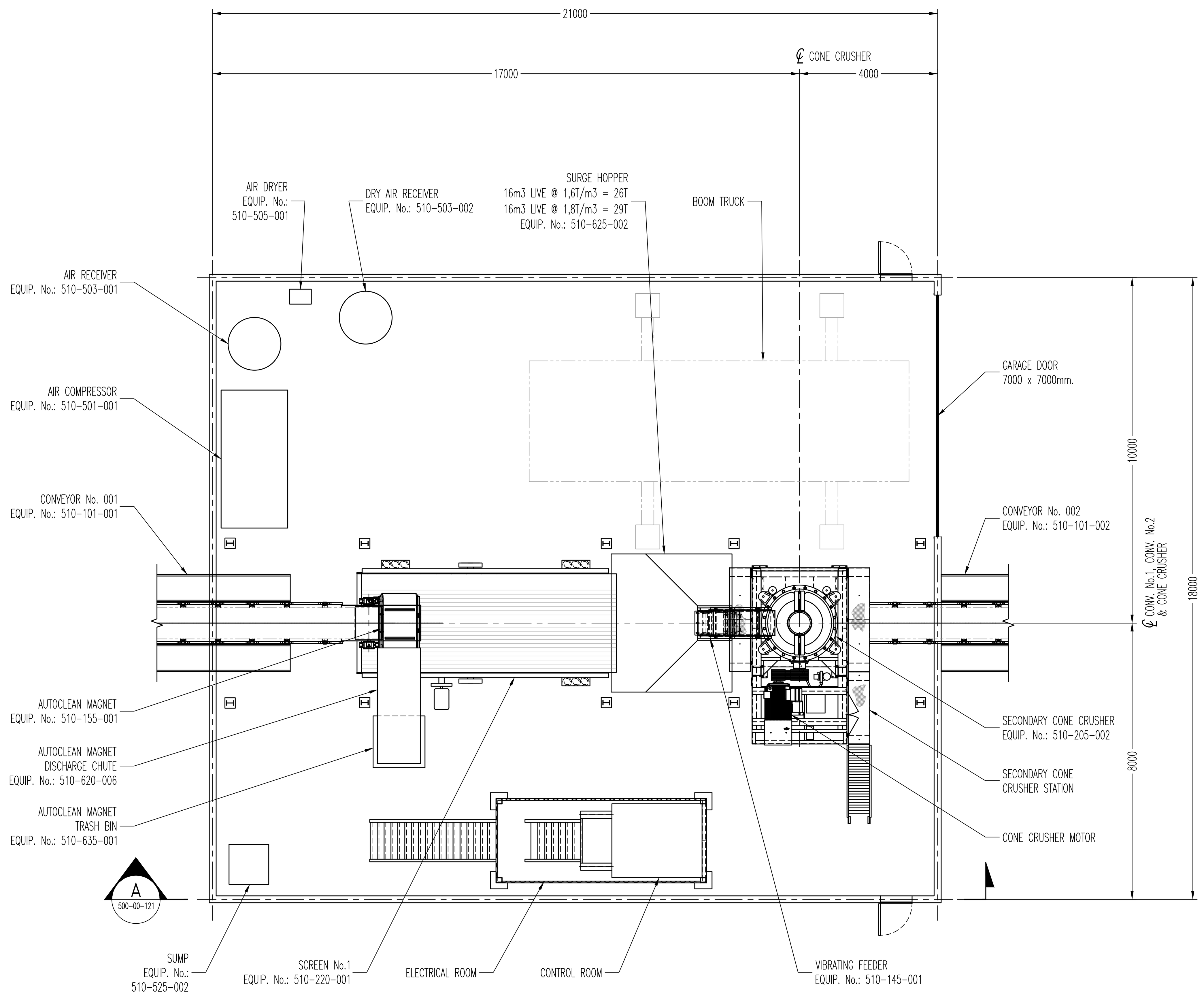
FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

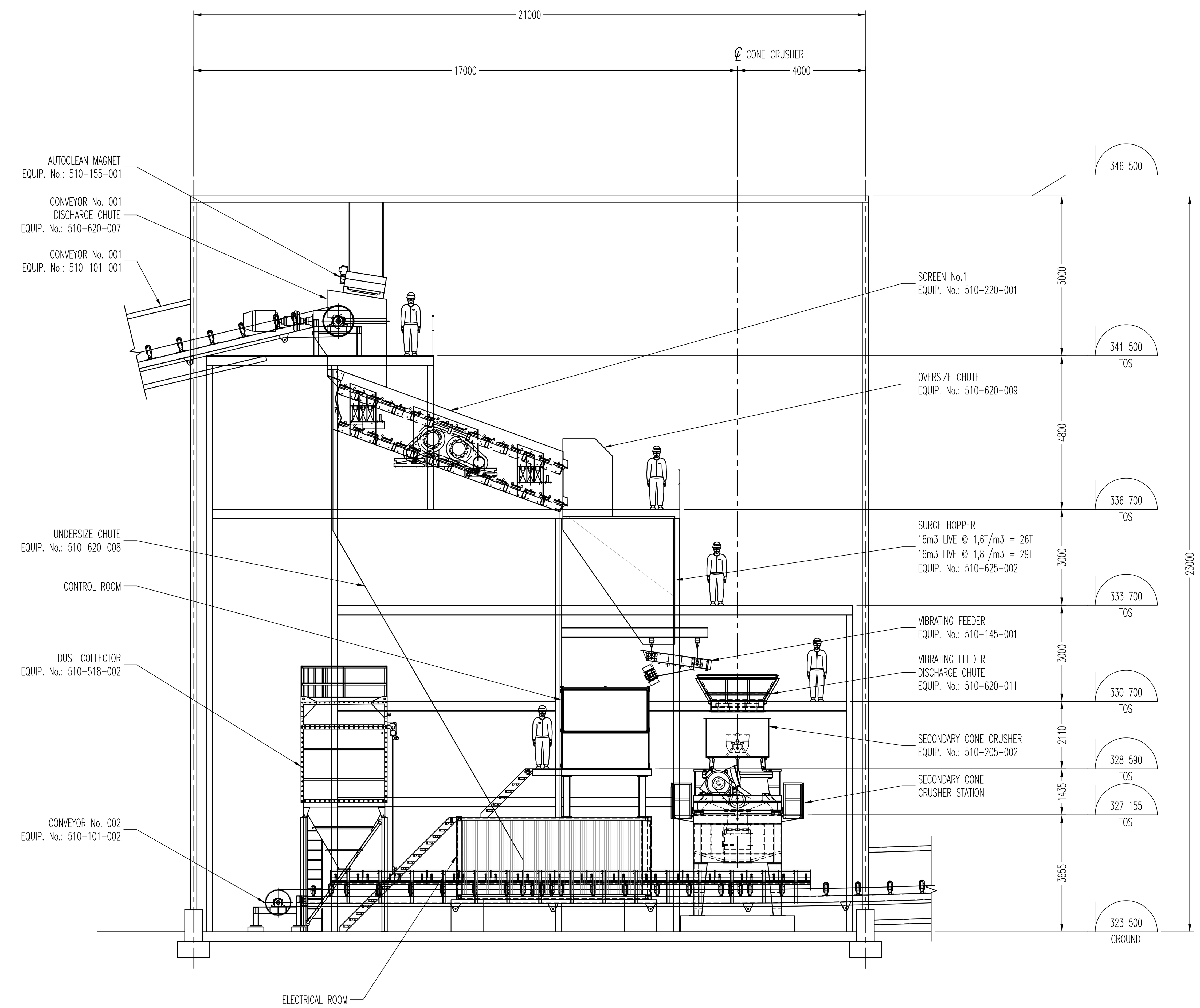
EN DATE DU / DATE OF: 2013-06-21

RV./RV. #: 00

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



SECONDARY CRUSHING – PLAN VIEW
SCALE : 1:100



SECTION A
ÉCH.: 1:100
500-00-121

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER
Bertrand Fortin
129024
2013-06-21

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2012-12-18
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: SÉBASTIEN ST-LOUIS
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

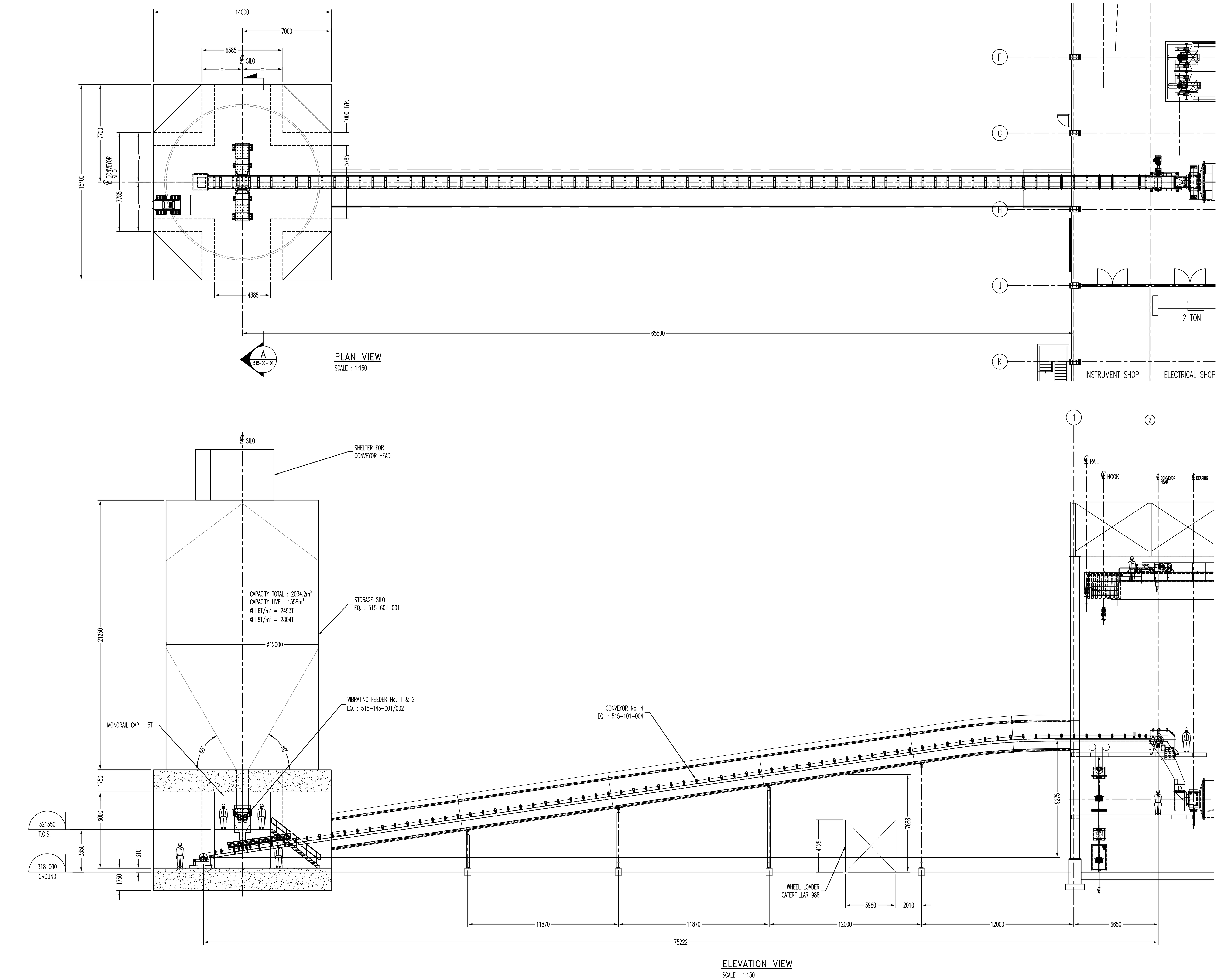
DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECONDARY CRUSHING BUILDING
PLAN & ELEVATIONS VIEWS

NUMÉRO DU FEUILLET / SHEET NUMBER: 510-00-121
FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
EN DATE DU / DATE OF: 2013-06-21
RV./RV. #: 00



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

SCEAU / SEAL:

INGÉNIEUR - ENGINEER
Bertrand Fortin
129024
QUÉBEC
2013-06-26

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-06-26	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-11-24

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
ORE STORAGE & RECLAIM TUNNEL
PLAN & ELEVATION VIEWS

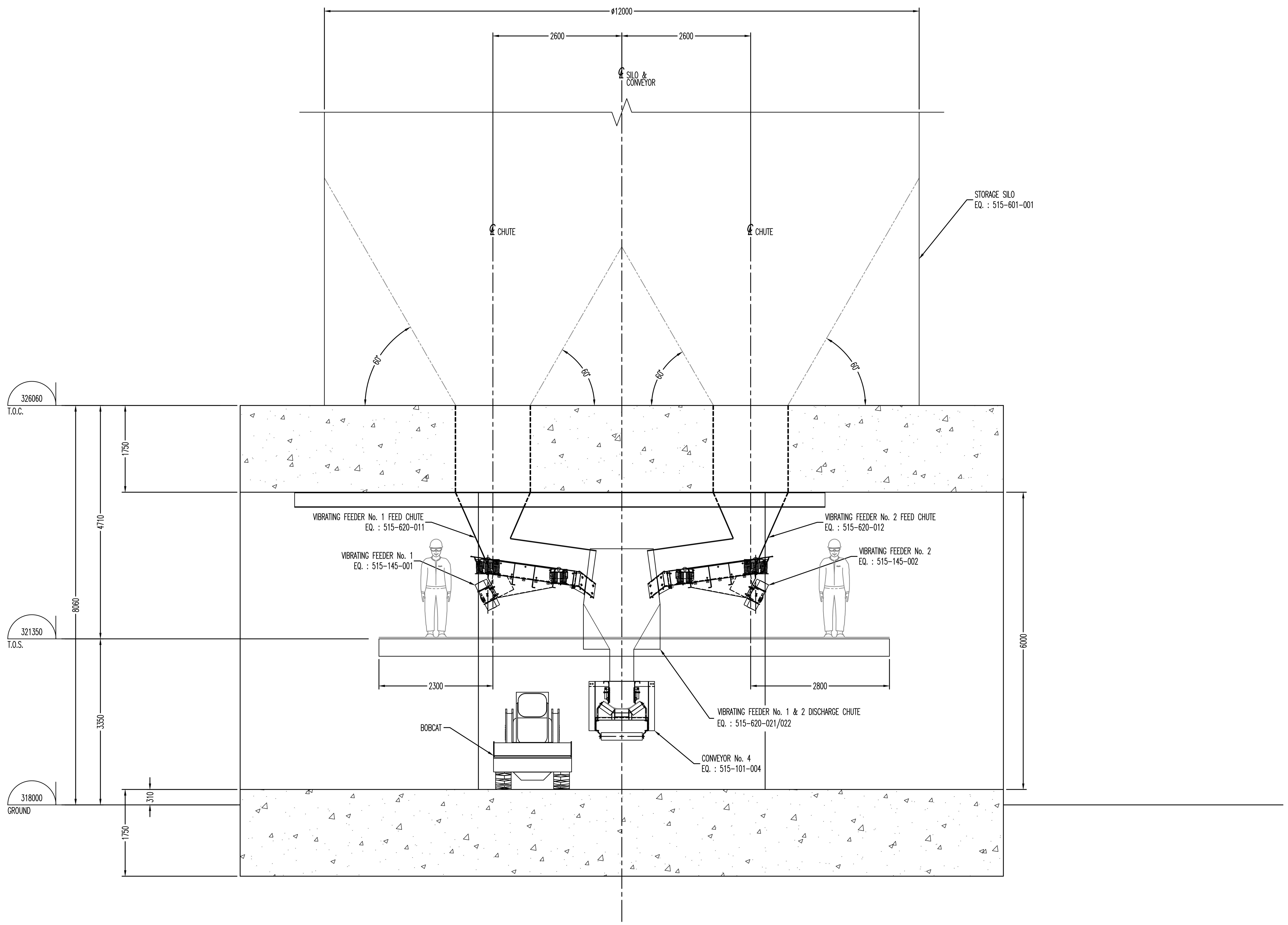
NUMÉRO DU FEUILLET / SHEET NUMBER: 515-00-100

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

RV./RV. #: 00

EN DATE DU / DATE OF: 2013-06-26



SECTION A
SCALE : 1:50
515-00-100

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024 — INGÉNIEUR · ENGINEER — 2013-06-26

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-06-26	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-11-24

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
ORE STORAGE
SECTION VIEW

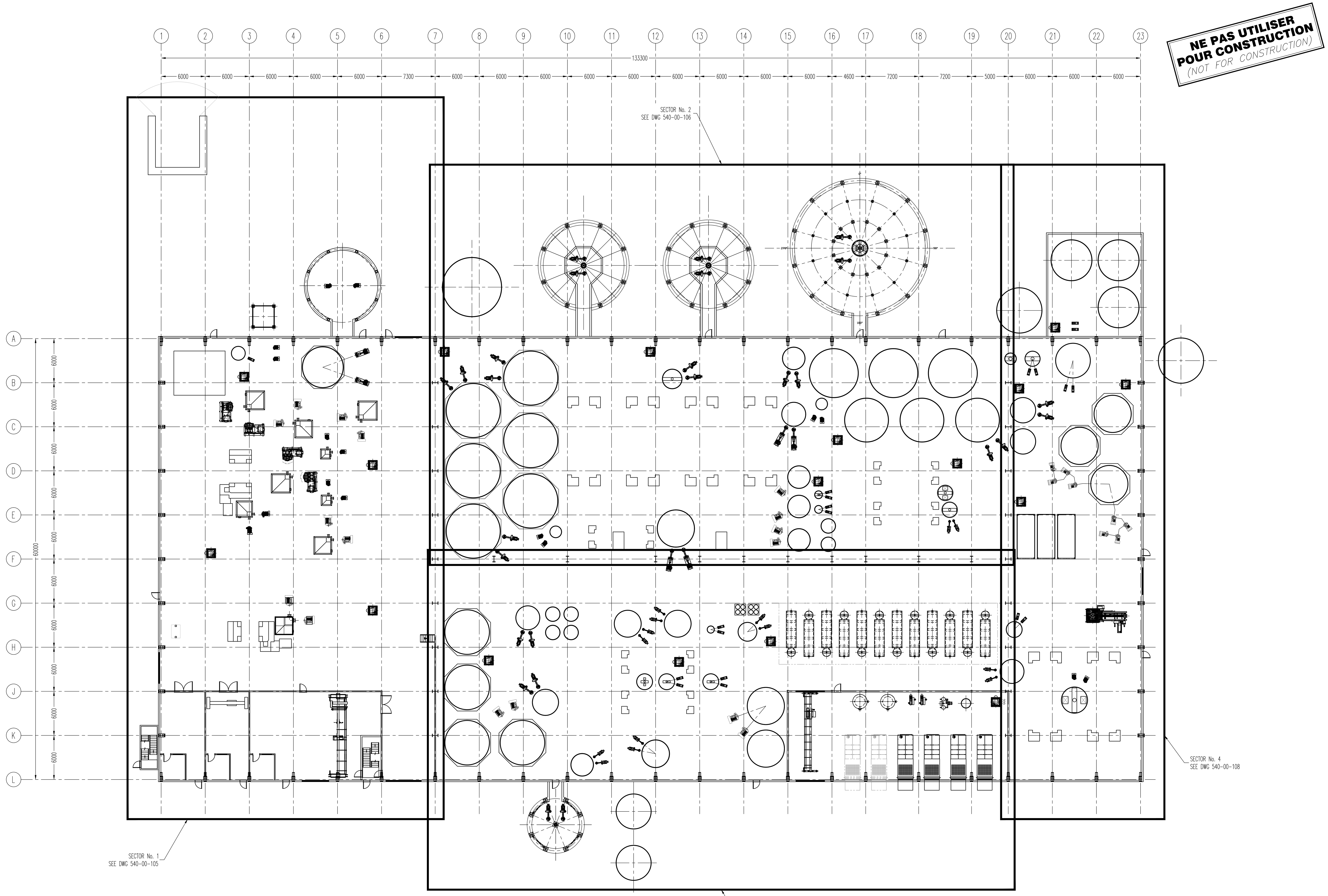
NUMÉRO DU FEUILLET / SHEET NUMBER: 515-00-101

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-06-26

RV./RV. #: 00



PLAN VIEW – 318000 LEVEL

SCALE : 1:250

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR - ENGINEER
Bertrand Fortin
129024
QUÉBEC
NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)
2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2012-08-07
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"
CONÇU PAR / DESIGNED BY: GENIVAR	
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.	

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
PLAN VIEW
GROUND FLOOR

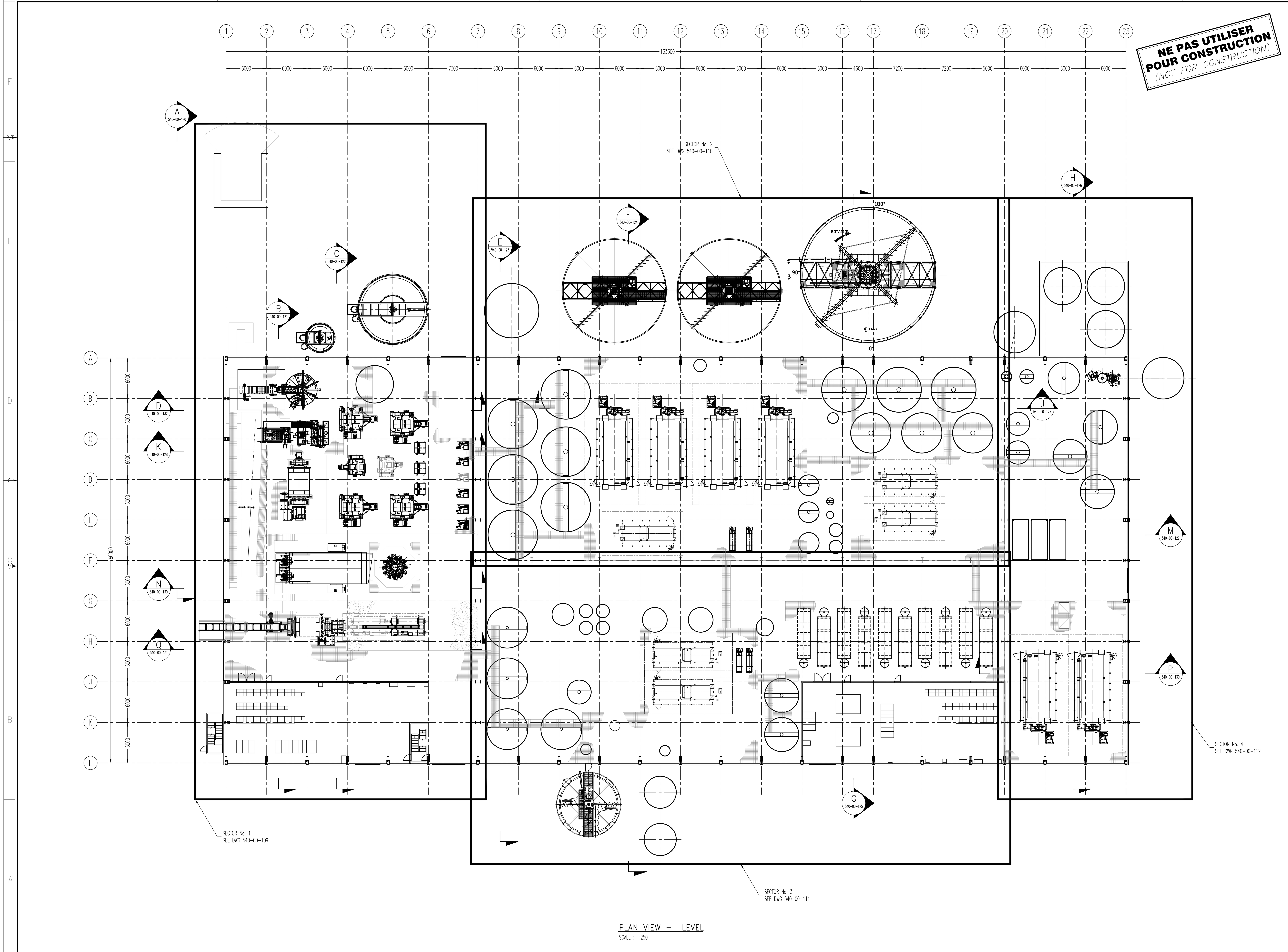
NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-100

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. #: 00



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-08-07

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
OPERATING FLOOR
PLAN VIEW

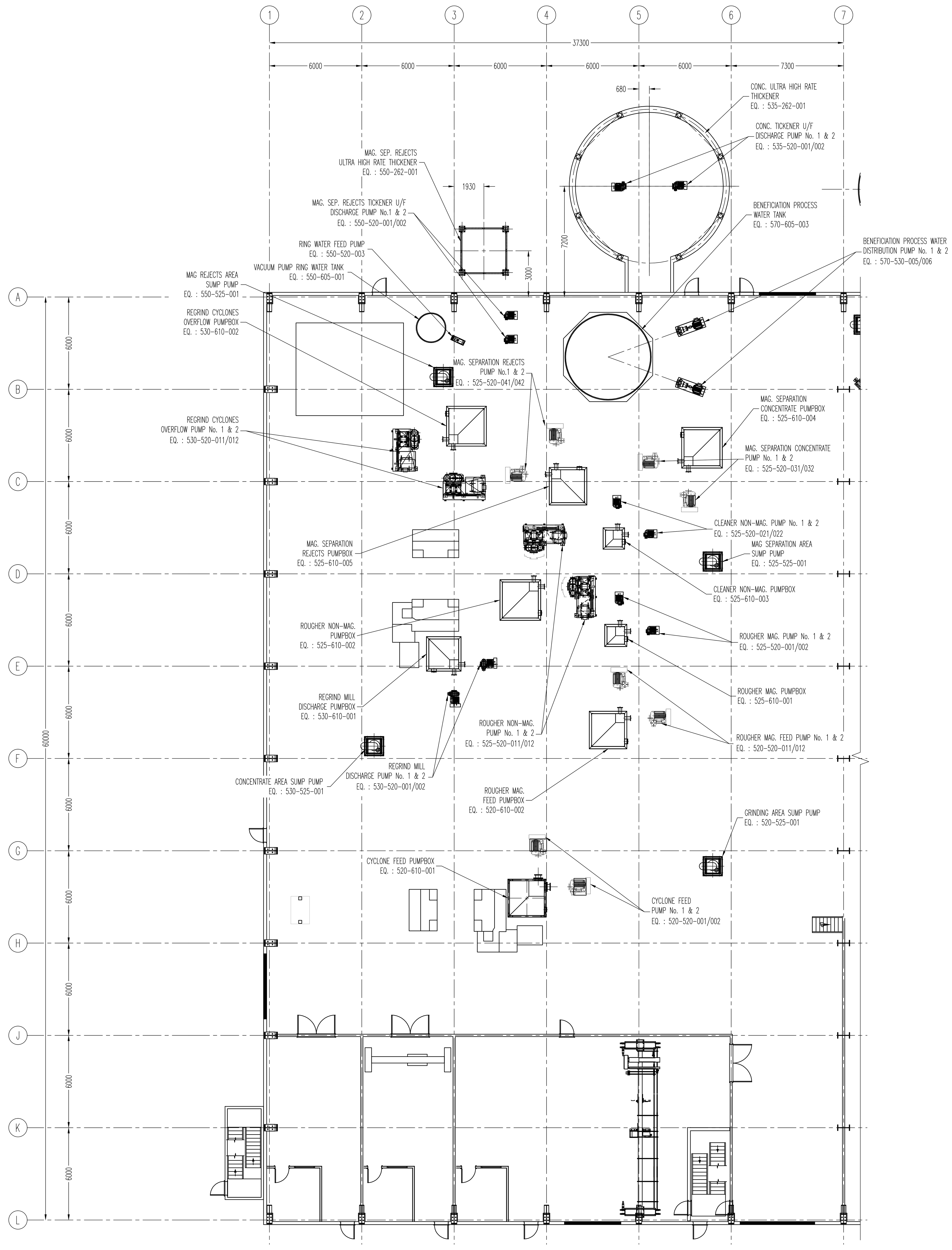
NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-101

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. #: 00



SECTOR No. 1 - 318000 LEVEL

SCALE : 1:150

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024 — NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION) — 2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABLITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2013-04-23
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"
CONÇU PAR / DESIGNED BY: GENIVAR	
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.	

DISCIPLINE / DISCIPLINE:

GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
PLAN VIEW
GROUND FLOOR
SECTOR No. 1

NUMÉRO DU FEUILLET / SHEET NUMBER:

540-00-105

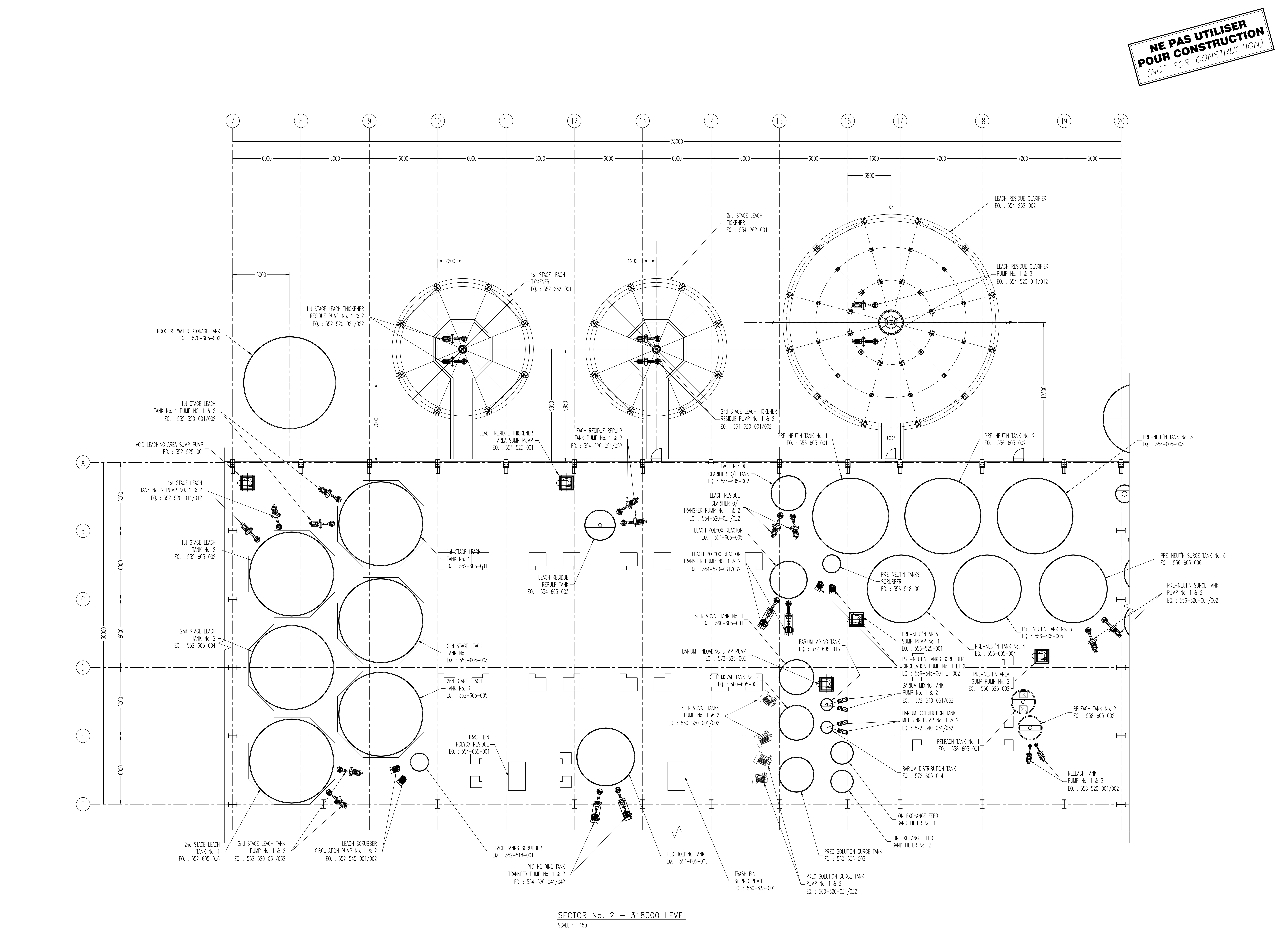
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. #: 00

-COMM\Envoyé\0_MATAMEC\GEN-MAT-121-18716-00-114 (GA Issued For Feasability Study)\540-00-105_00.dwg, 2013-07-12 09:05:49



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2013-04-23
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"
CONÇU PAR / DESIGNED BY: GENIVAR	
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.	

DISCIPLINE / DISCIPLINE:
GENERAL ARRANGEMENT

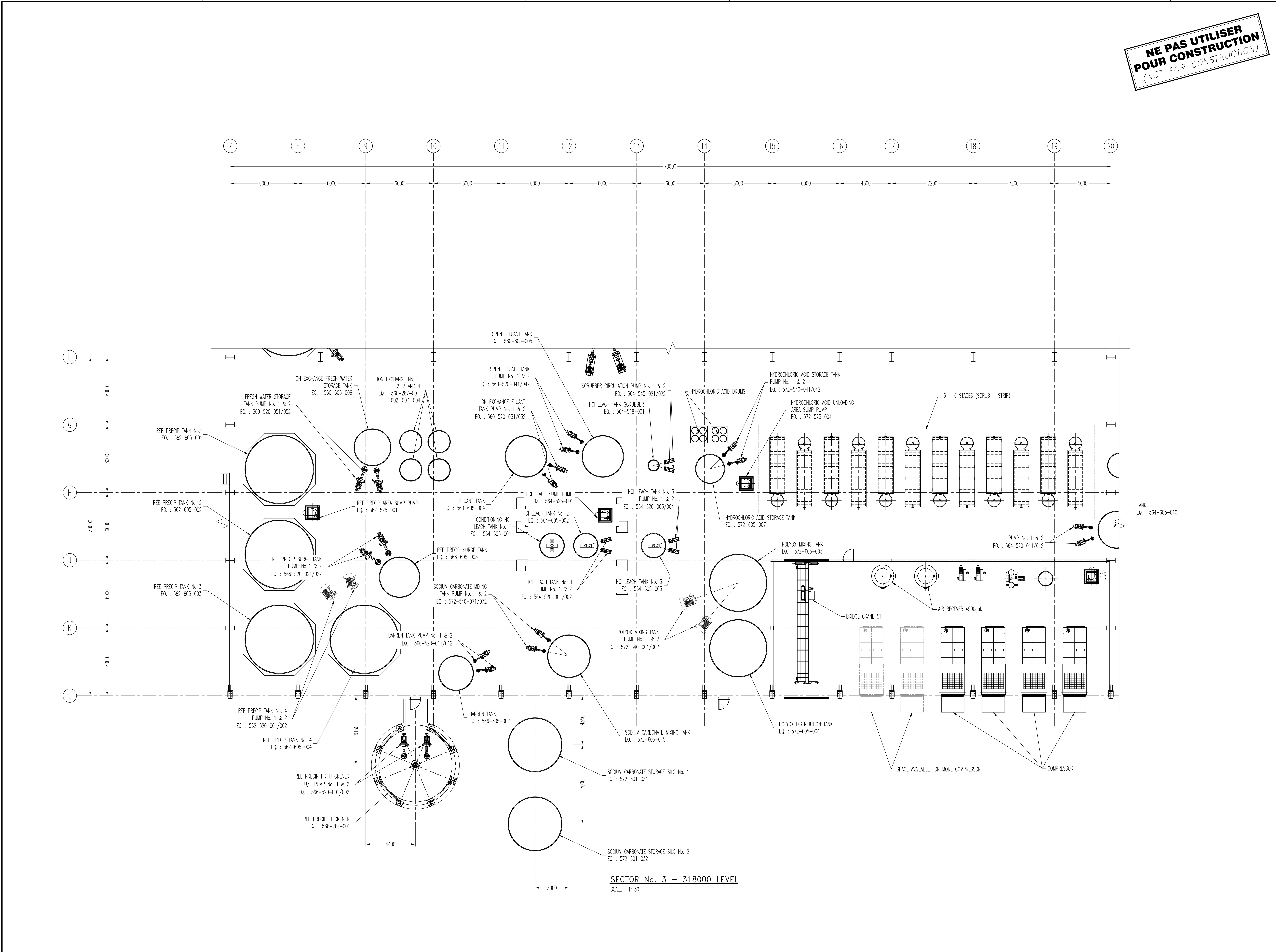
TITRE / TITLE:

PROCESS PLANT 4000 TPD
PLAN VIEW
GROUND FLOOR
SECTOR No. 2

NUMÉRO DU FEUILLET / SHEET NUMBER:
540-00-106

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY
EN DATE DU / DATE OF: 2013-07-12
RV./RV. #: 00



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-04-23

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
PLAN VIEW
GROUND FLOOR
SECTOR No. 3

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-107

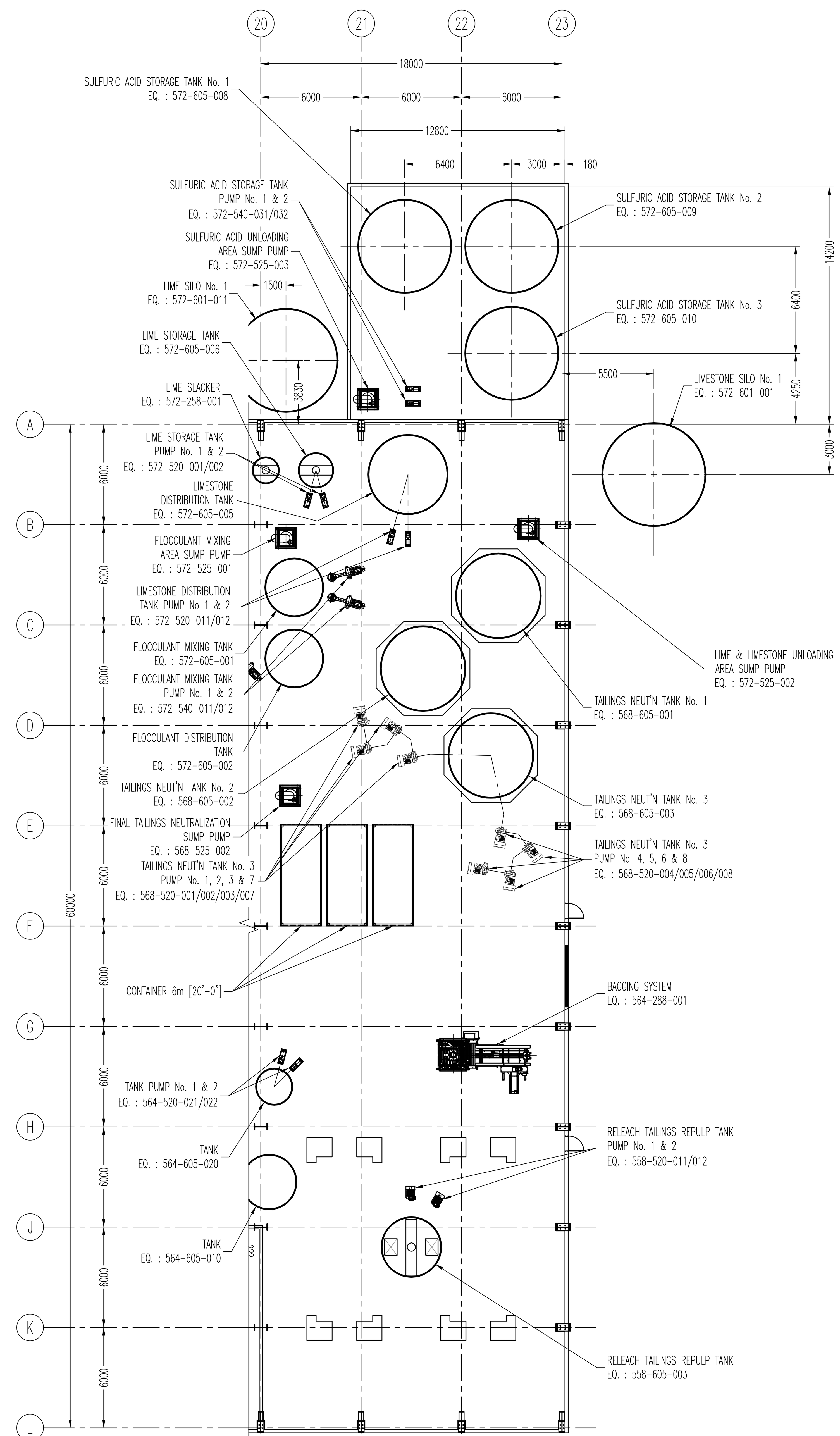
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASSABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. # 00

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



SECTOR No. 4 – 318000 LEVEL

SCALE : 1:200

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER
Bertrand Fortin
129024
QUÉBEC

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-04-23

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
PLAN VIEW
GROUND FLOOR
SECTOR No. 4

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-108

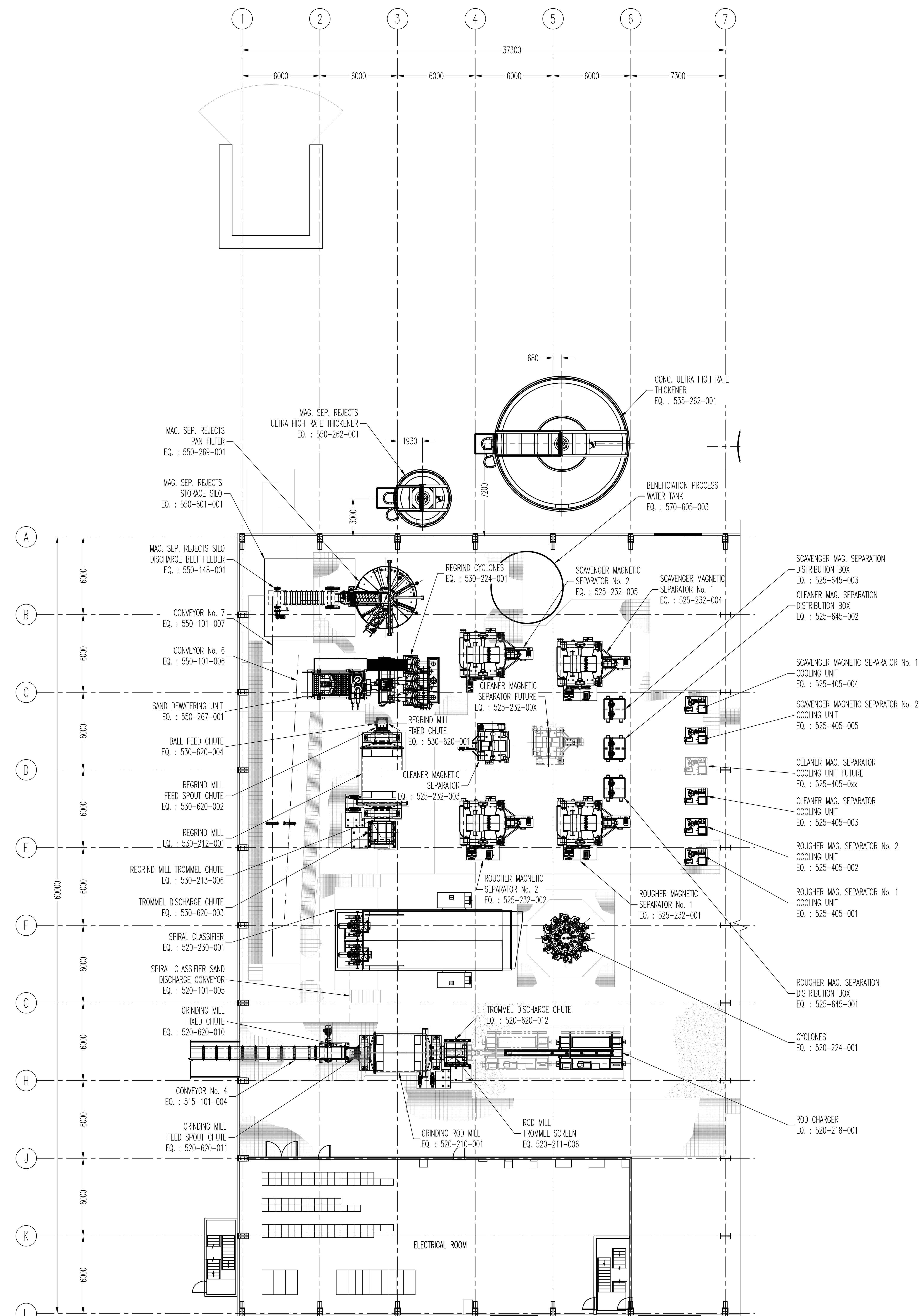
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. 00

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



SECTOR No. 1 – OPERATION FLOOR

SCALE : 1:200

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER Bertrand Fortin 129024 QUÉBEC

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-04-23

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
OPERATING FLOOR
PLAN VIEW
SECTOR No. 1

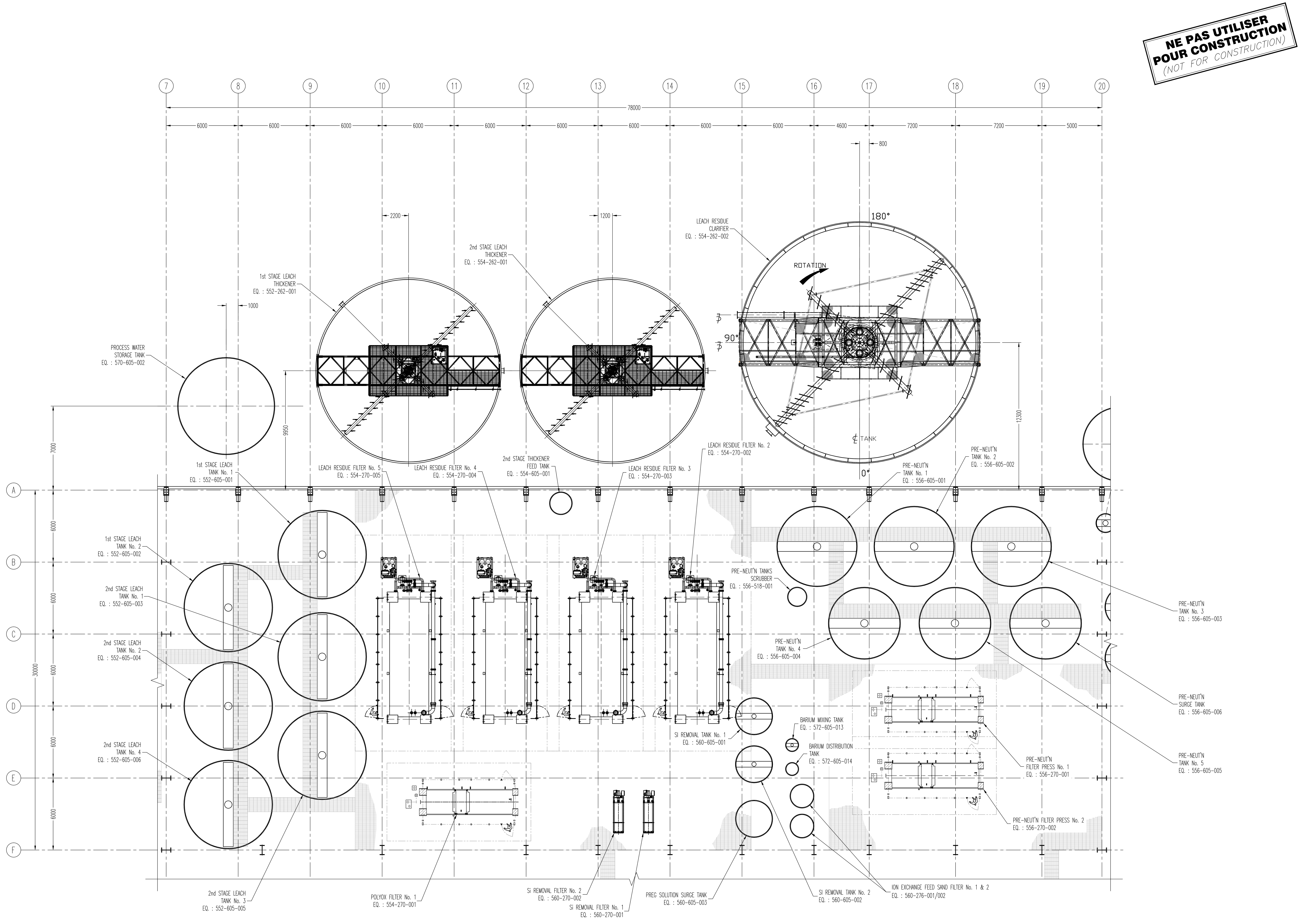
NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-109

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

RV./RV. # 00

EN DATE DU / DATE OF: 2013-07-12



SECTOR No. 2 – OPERATION FLOOR

SCALE : 1:150

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-07-12	ISSUED FRO FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013-04-23
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

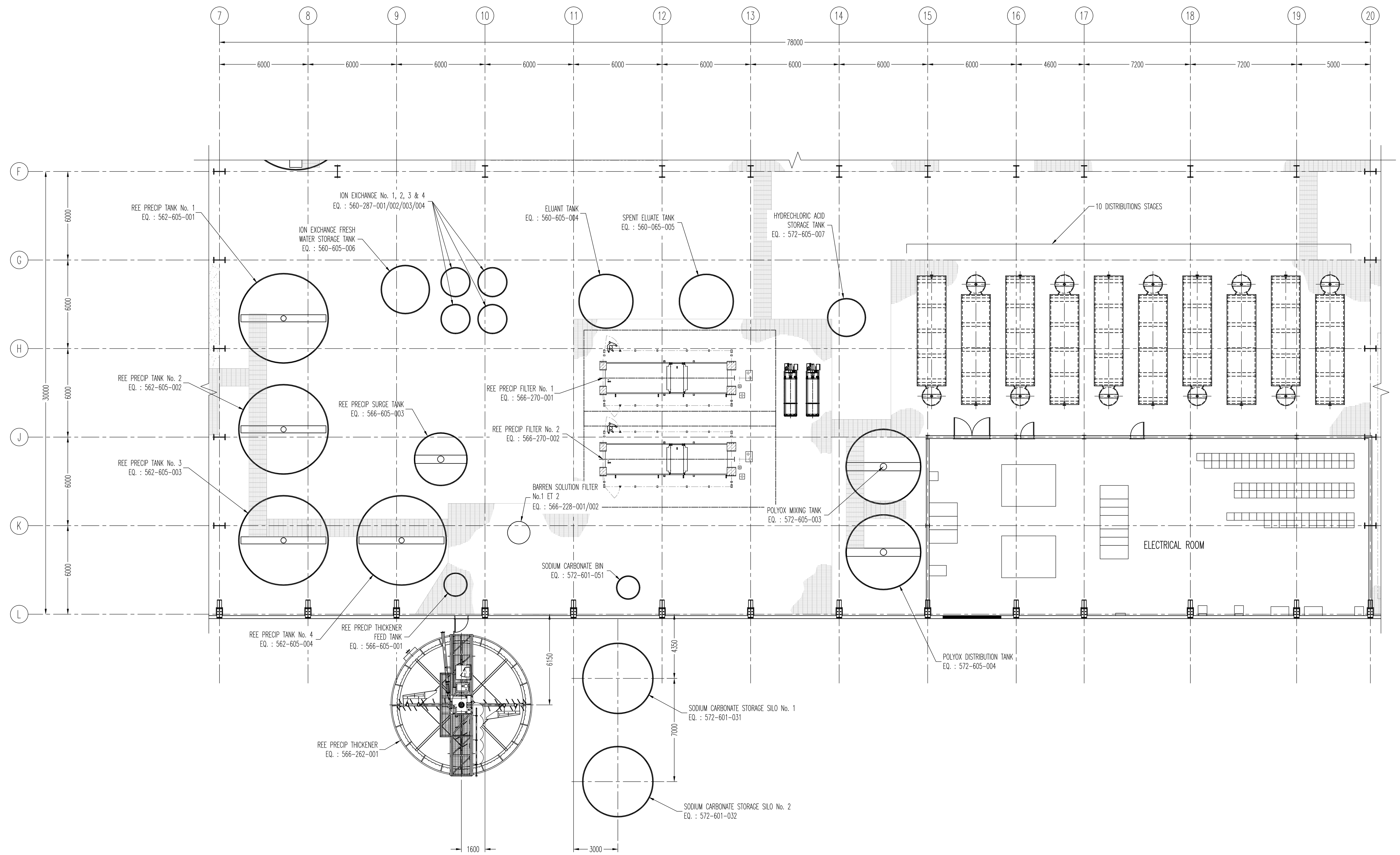
PROCESS PLANT 4000 TPD
OPERATING FLOOR
PLAN VIEW
SECTOR No. 2

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-110

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY
EN DATE DU / DATE OF: 2013-07-12
RV./RV. #: 00

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



SECTOR No. 3 – OPERATION FLOOR
SCALE : 1:150

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024 — NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION) 2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013-04-23
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

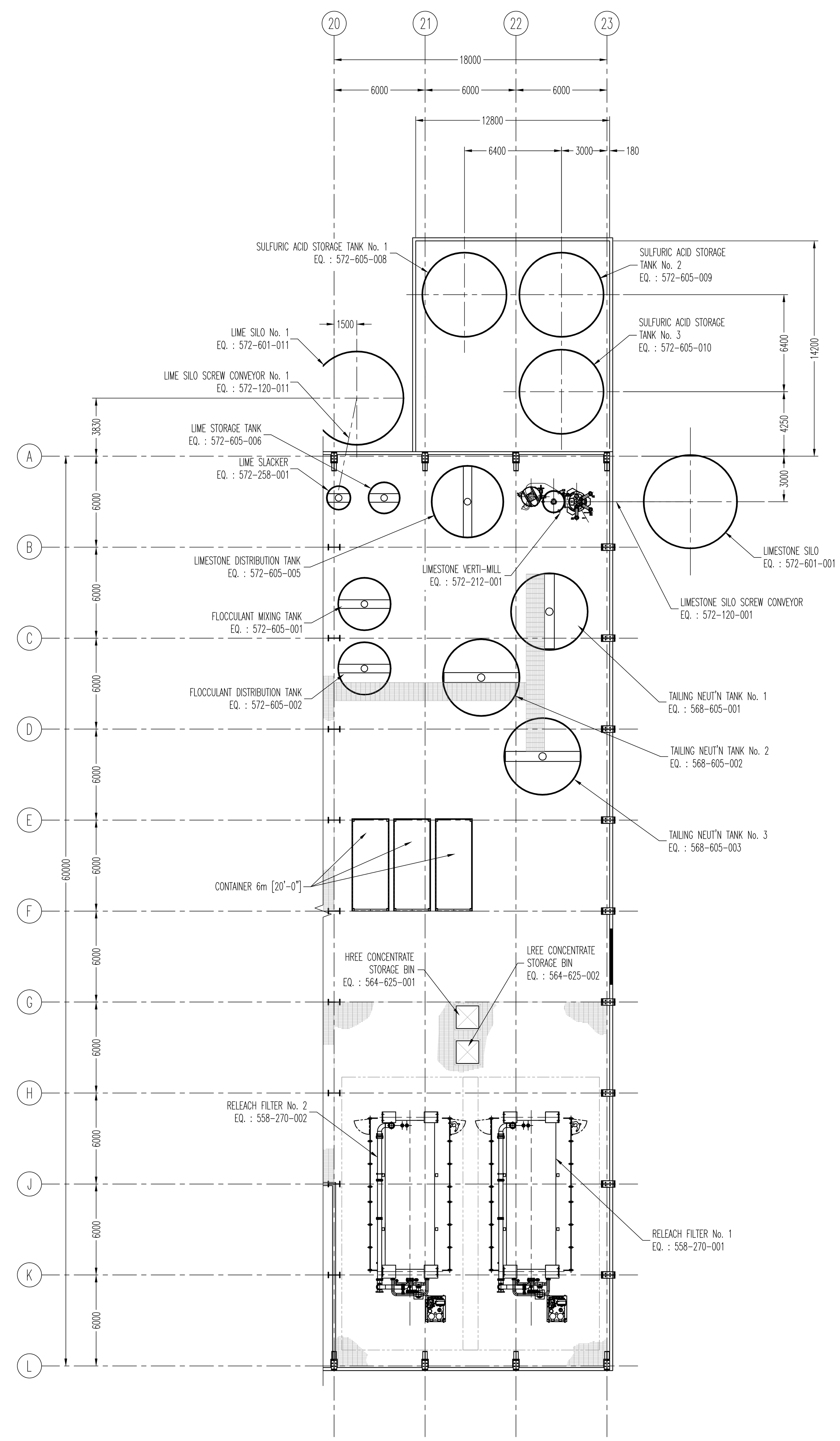
PROCESS PLANT 4000 TPD
OPERATING FLOOR
PLAN VIEW
SECTOR No. 3

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-111
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEAASABILITY STUDY
EN DATE DU / DATE OF: 2013-07-12
RV./RV. # 00

Arch D, P:_12X-XXXX-XX\121-18716-00\01-COMM\Envoyé\0_MATAMEC\GEN-MAT-121-18716-00-114 (GA Issued For Feasability Study)\540-00-111_00.dwg, 2013-07-12 09:16:28

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



SECTOR No 4 – OPERATION FLOOR

SCALE : 1:200

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin
129024
NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)
2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-04-23

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
OPERATING FLOOR
PLAN VIEW
SECTOR No. 4

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-112

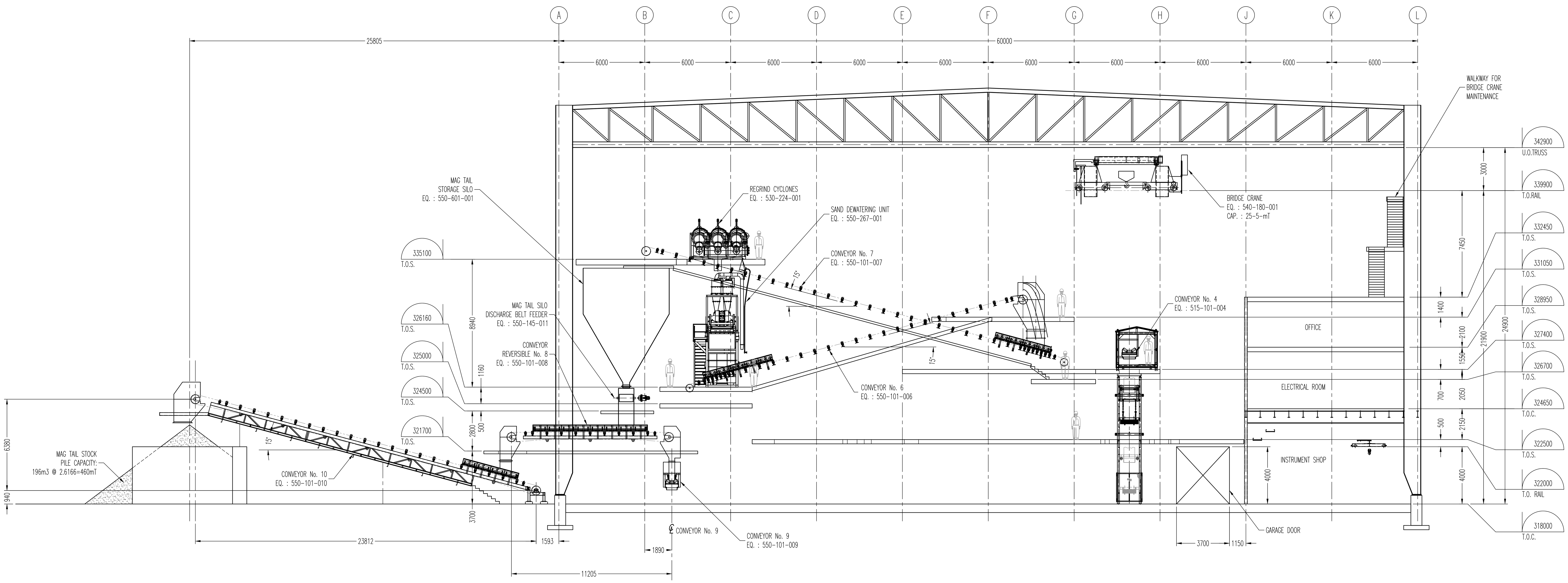
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

RV./RV. # 00

EN DATE DU / DATE OF: 2013-07-12

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



VIEW A
SCALE : 1:150
540-00-101

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR - ENGINEER
Bertrand Fortin
129024
QUÉBEC
NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)
2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00		2013-07-12	ISSUED FRO FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2012-08-07
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

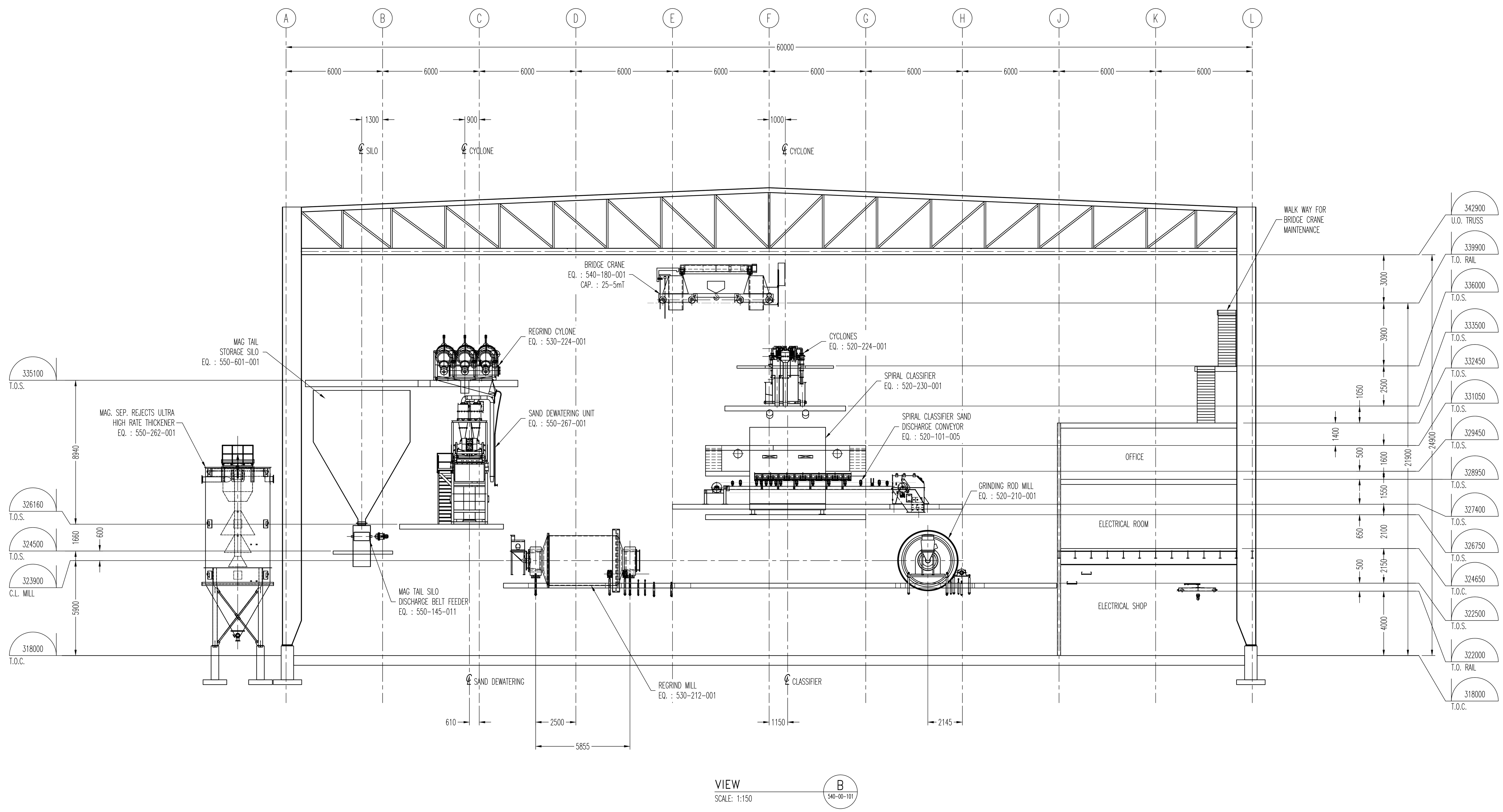
DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW A

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-120
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY
RV./RV. #: 00
EN DATE DU / DATE OF: 2013-07-12



GENIVAR
ROCHE

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024
NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)
2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2013-03-19
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"
CONÇU PAR / DESIGNED BY: GENIVAR	
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.	

DISCIPLINE / DISCIPLINE:
GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW B

NUMÉRO DU FEUILLET / SHEET NUMBER:
540-00-121

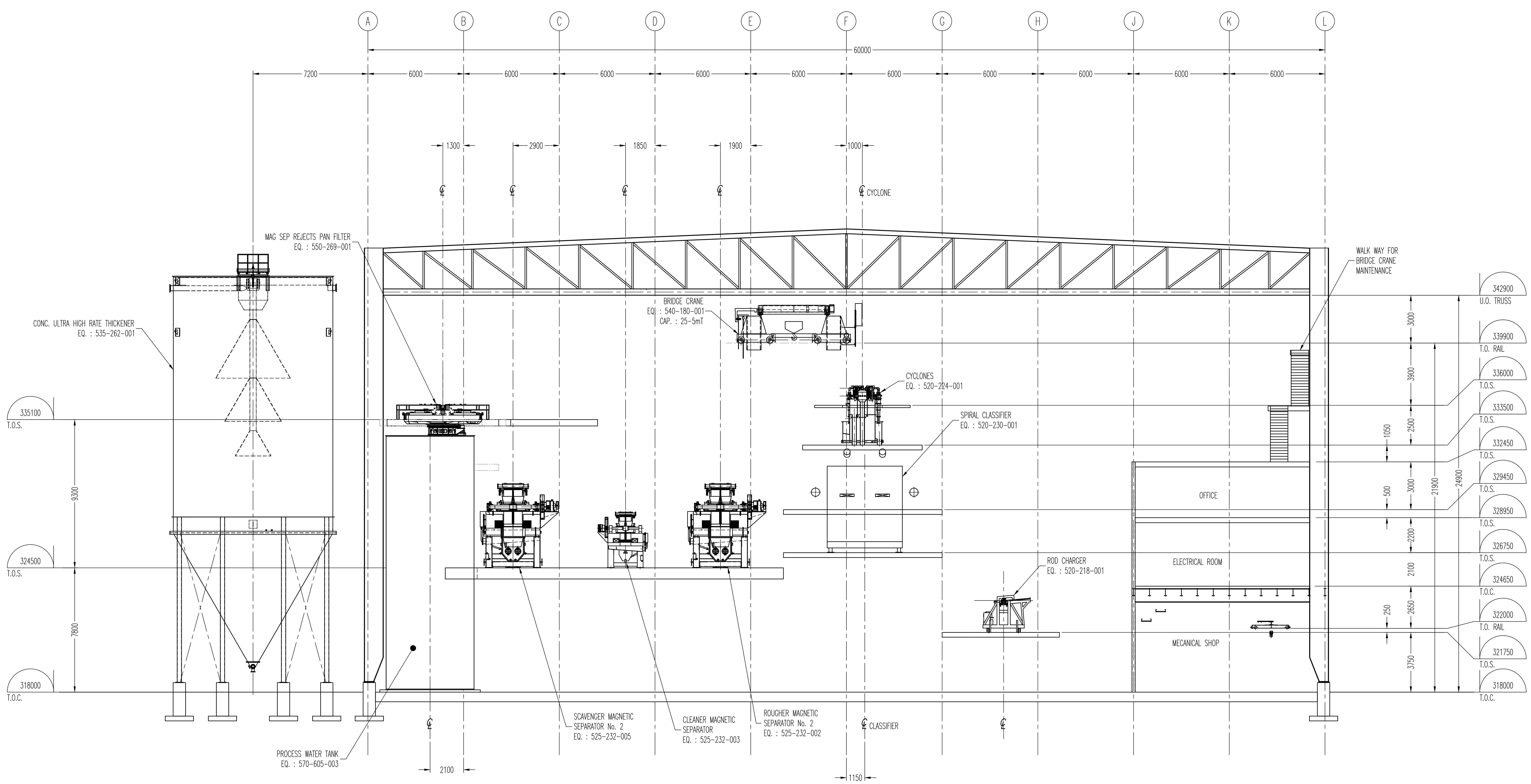
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE:
ISSUED FOR FEASABILITY STUDY
EN DATE DU / DATE OF: 2013-07-12

RV./RV.
00

Arch D, P:_12X-XXXX-XX\121-18716-00\01-COMM\Envoyé\0_MATAMEC\GEN-MAT-121-18716-00-114 (GA Issued For Feasability Study)\540-00-121_00.dwg, 2013-07-11 16:56:56

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)



VIEW C
SCALE: 1:150
540-00-101

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER
Bertrand Fortin
129024
QUÉBEC
NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)
2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013-03-19
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

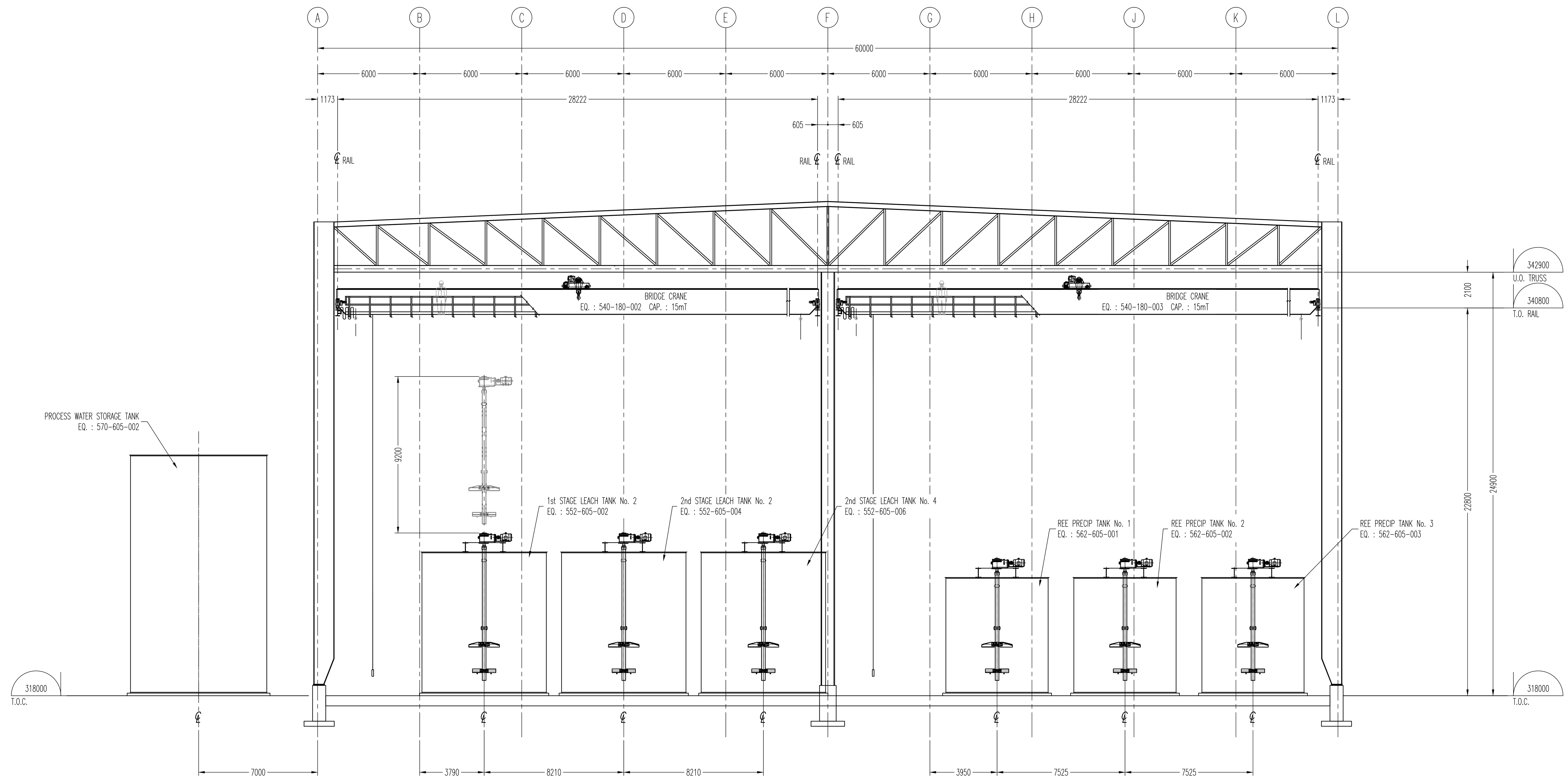
DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW C

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-122
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY
EN DATE DU / DATE OF: 2013-07-12
RV./RV. # 00



VIEW E
SCALE : 1:150
540-00-101

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024 — 2013-07-12 — NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-19

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW E

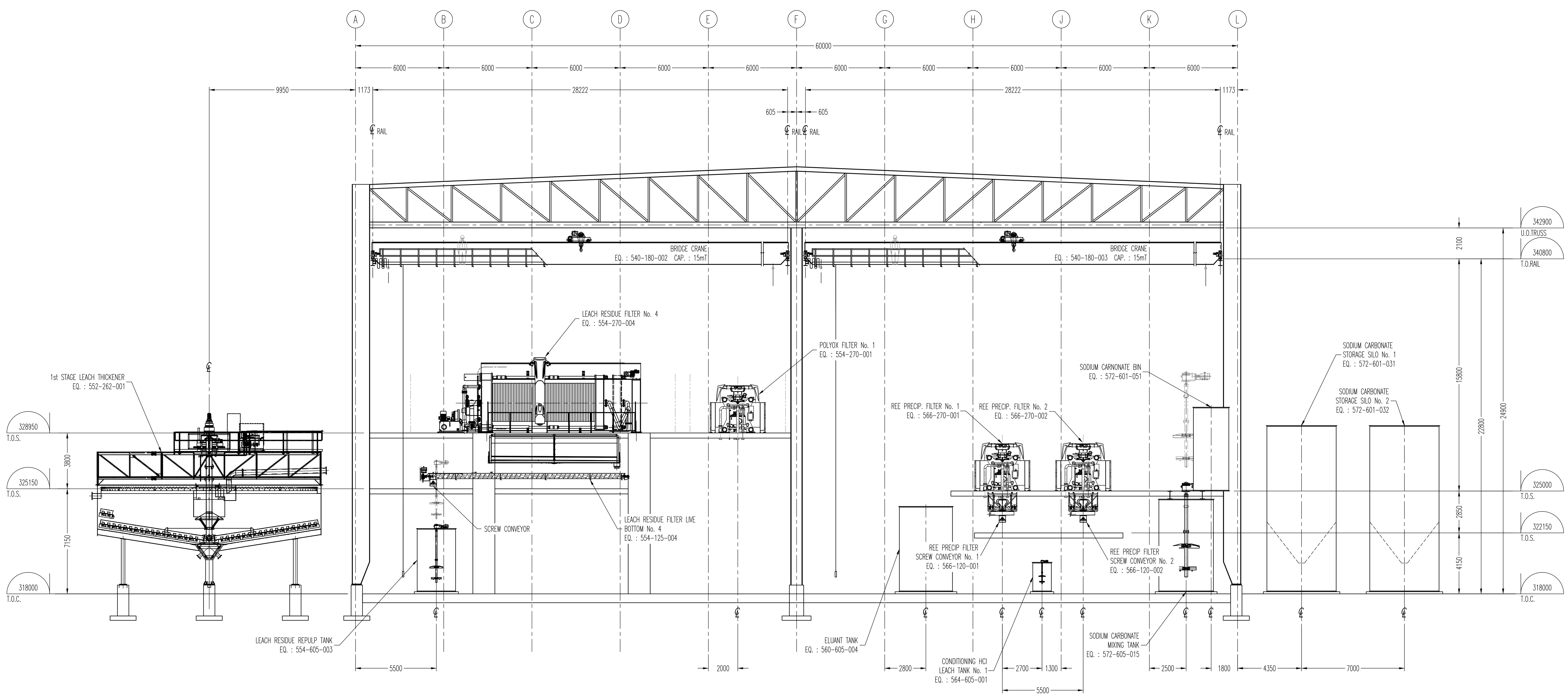
NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-123

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

RV./RV. #: 00

EN DATE DU / DATE OF: 2013-07-12



VIEW F
SCALE : 1:150
540-00-101

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-19

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

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1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW F

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-124

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASSABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. #: 00

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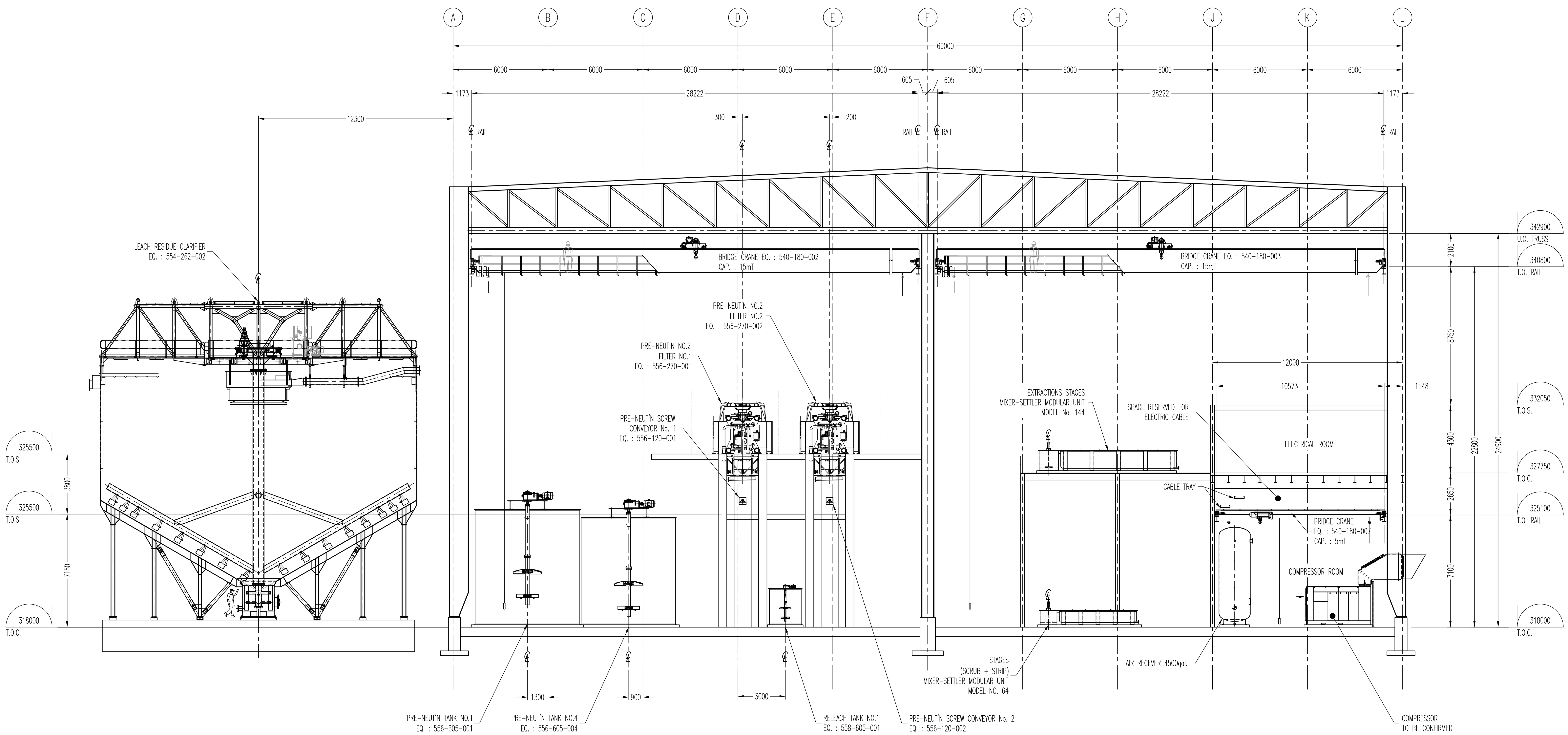

VIEW G
SCALE : 1:150
540-00-101

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024 — NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION) — 2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013-03-19
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
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1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW G

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-125

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY
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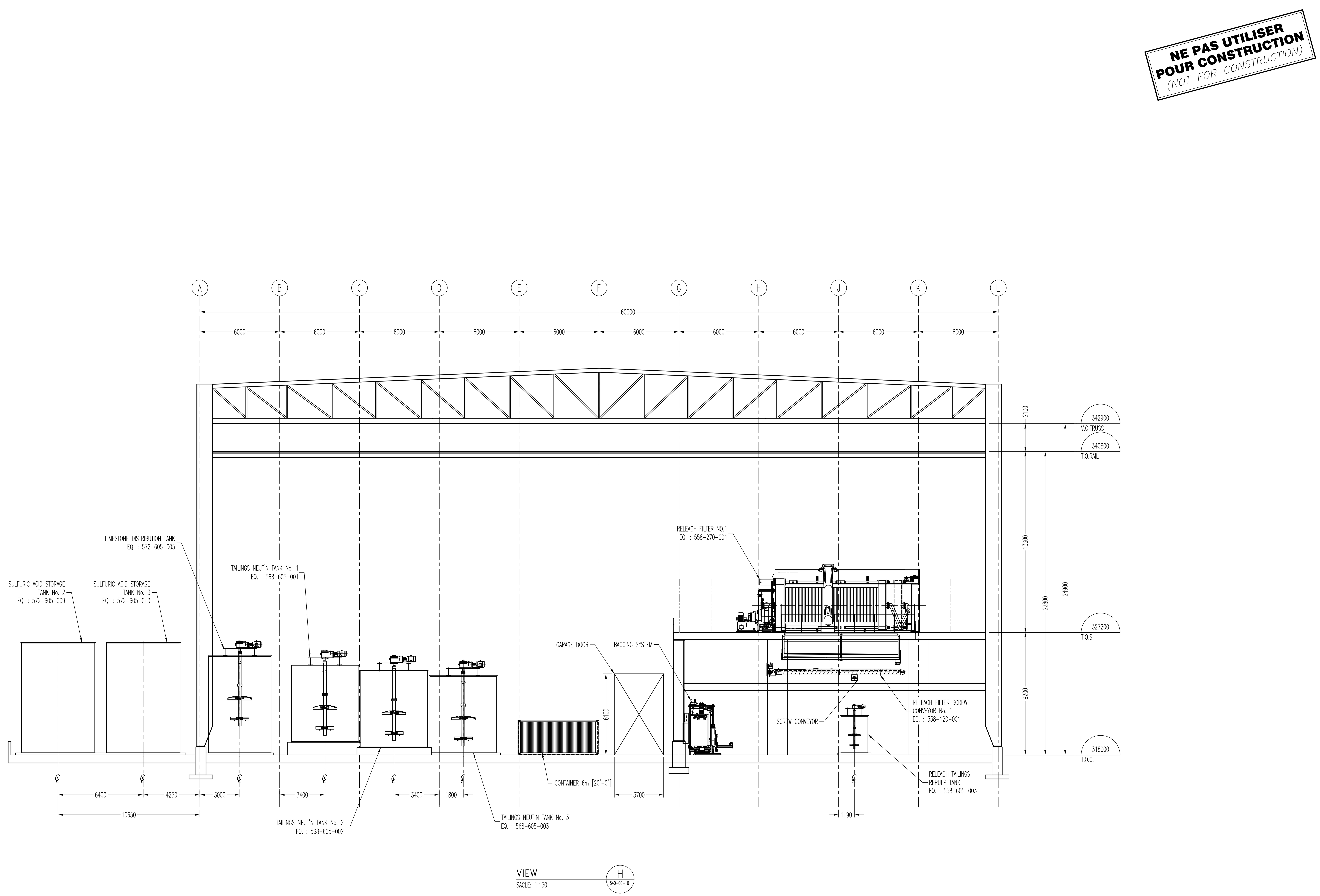
EN DATE DU / DATE OF: 2013-07-12



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER Bertrand Fortin 129024 QUÉBEC

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-19

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW H

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-126

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. #: 00

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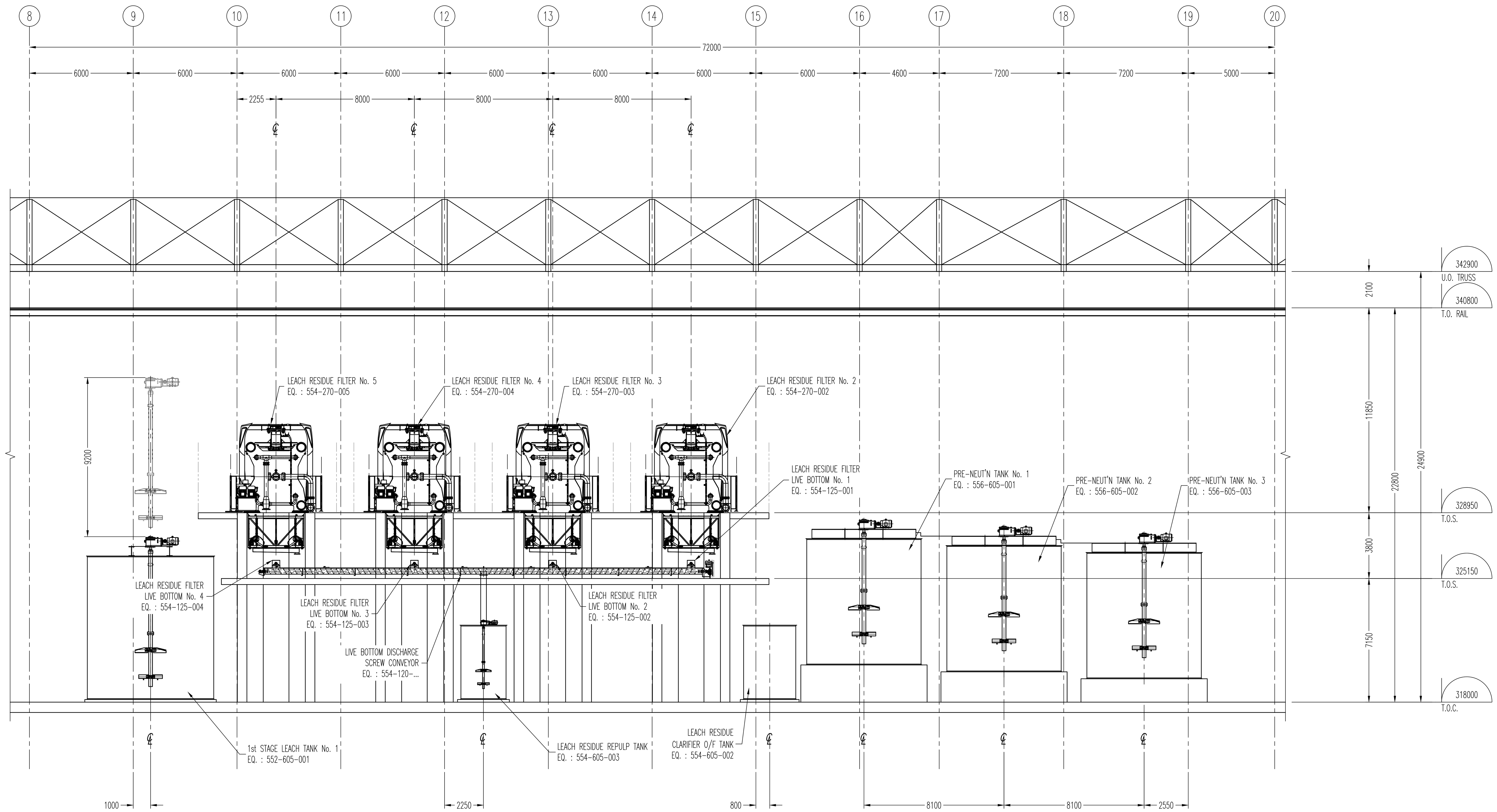

VIEW J
SCALE: 1:150
540-00-101

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024 2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-19

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW J

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-127

FEUILLET / SHEET #: -- DE / OF --

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EN DATE DU / DATE OF: 2013-07-12

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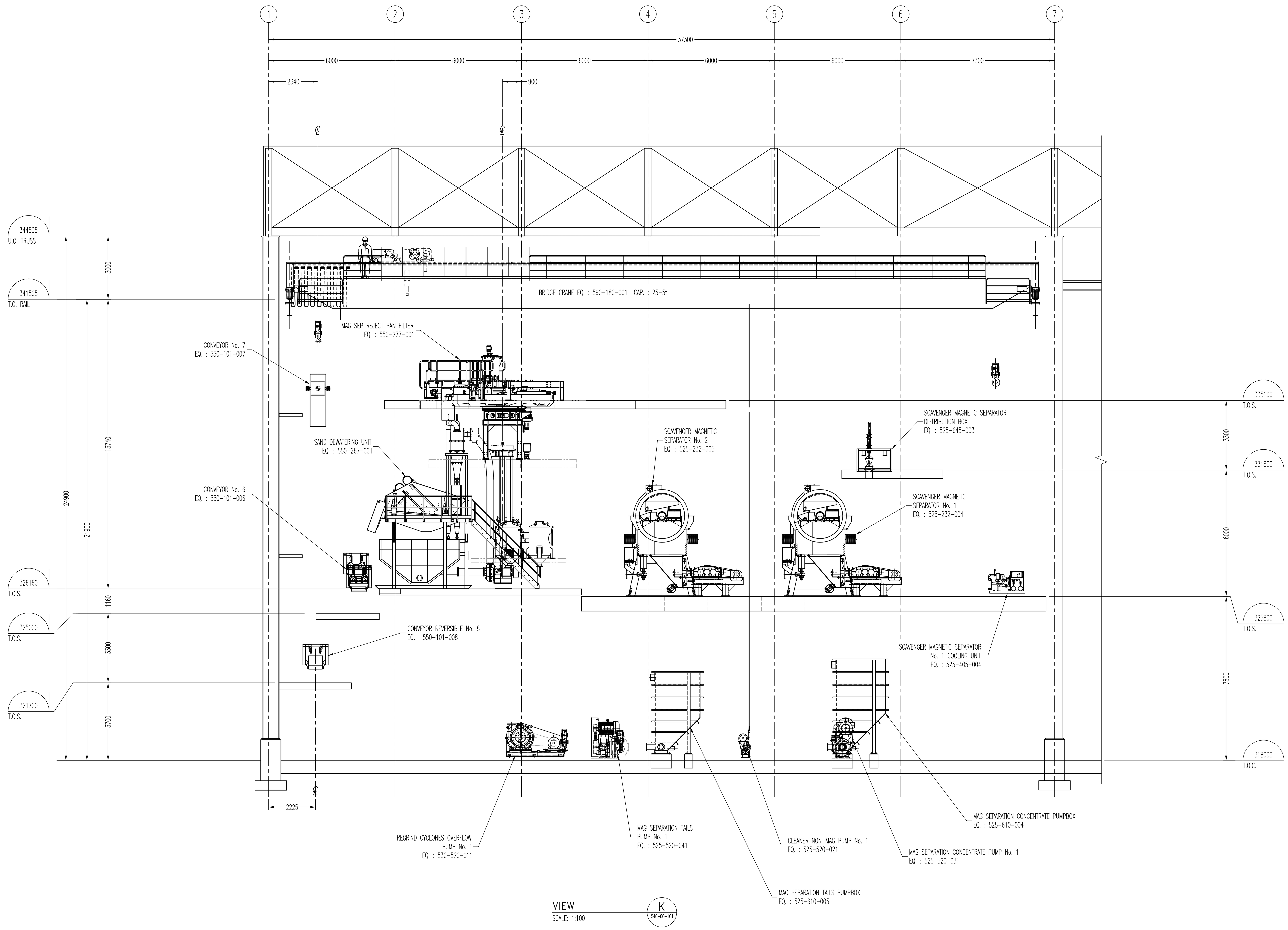

VIEW K
SCALE: 1:100
540-00-101

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-19

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW K

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-128

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. # 00

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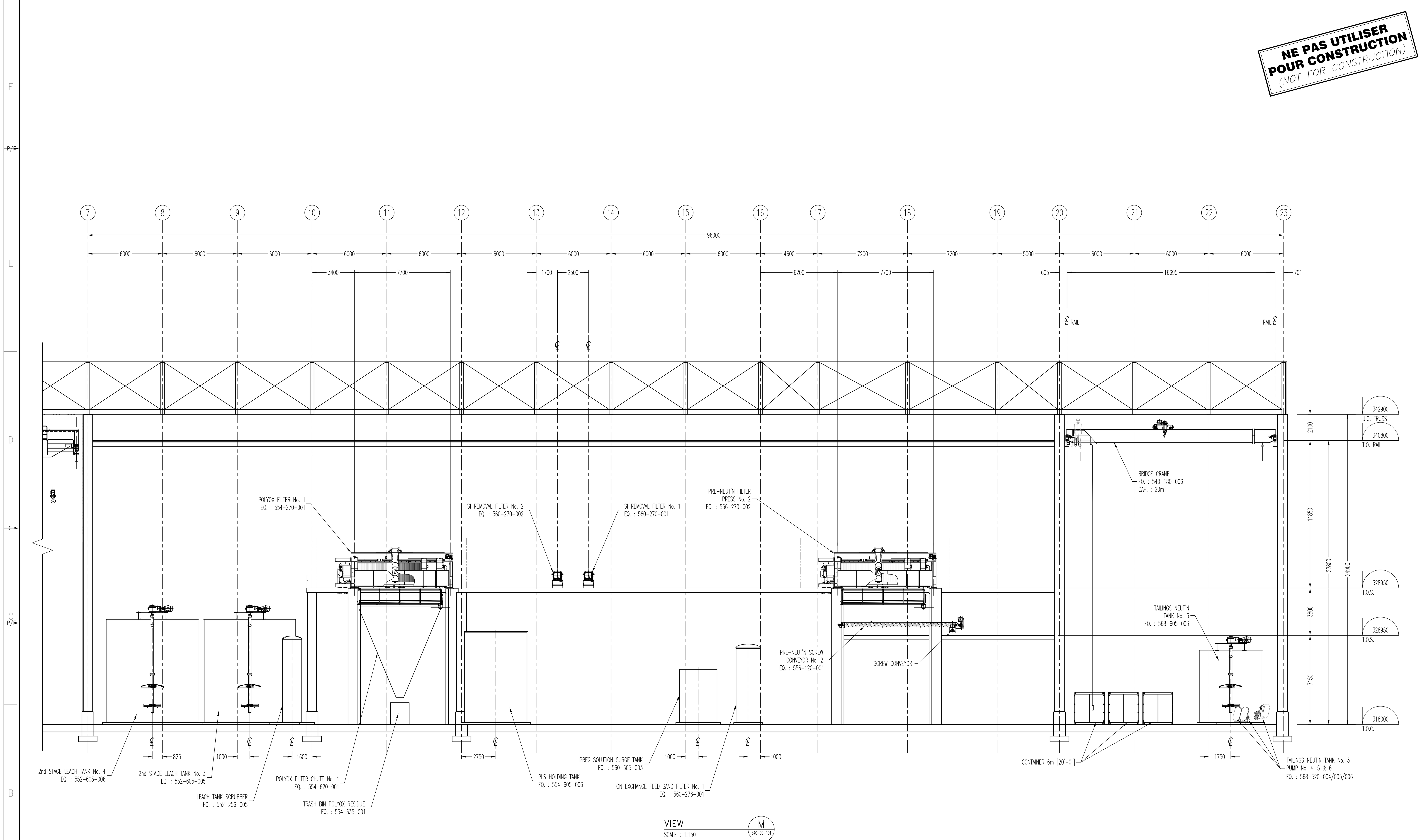

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-19

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW M

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-129

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

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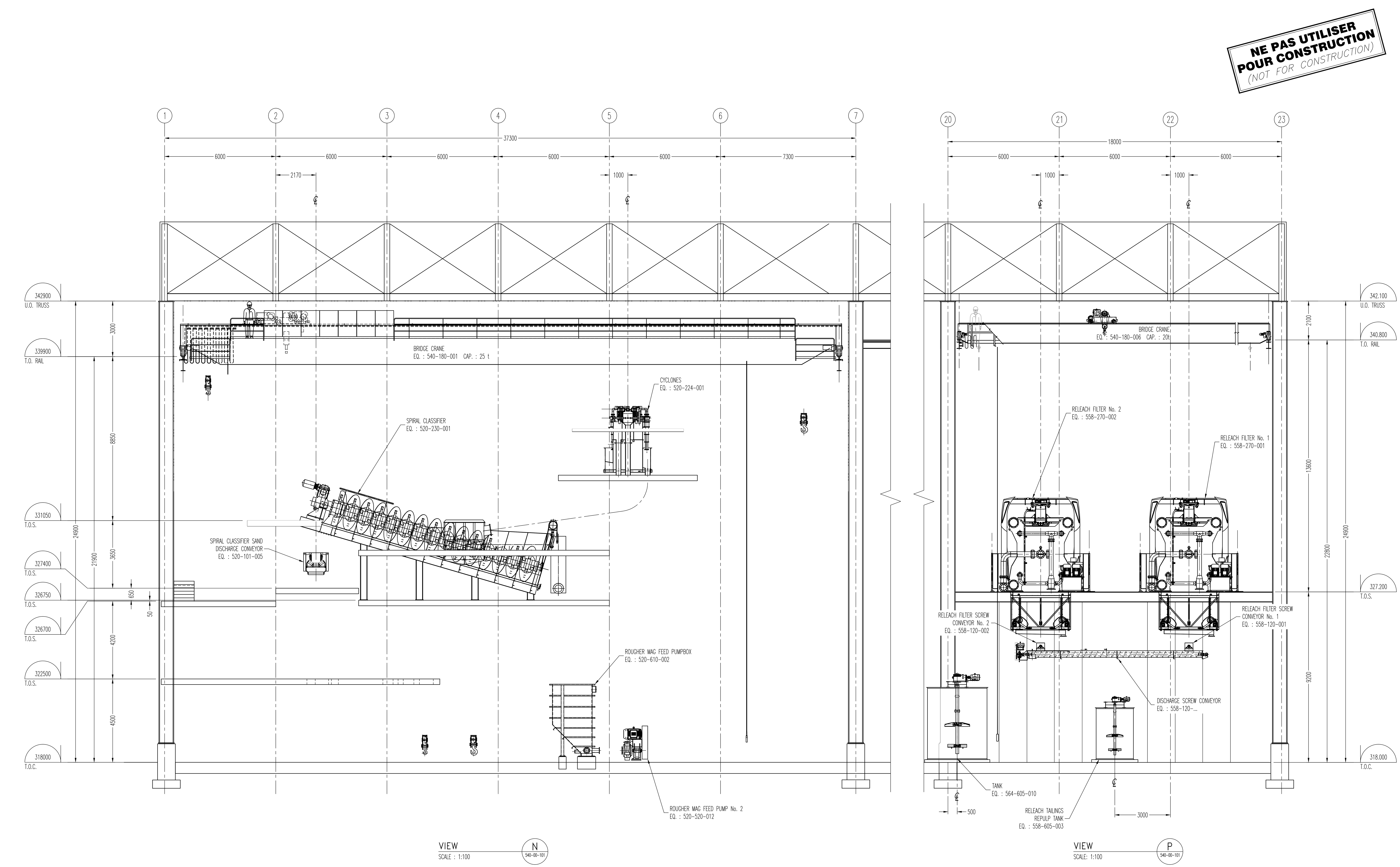

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

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ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2013-03-19
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"
CONÇU PAR / DESIGNED BY: GENIVAR	
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.	

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW N
SECTION VIEW P

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-130

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

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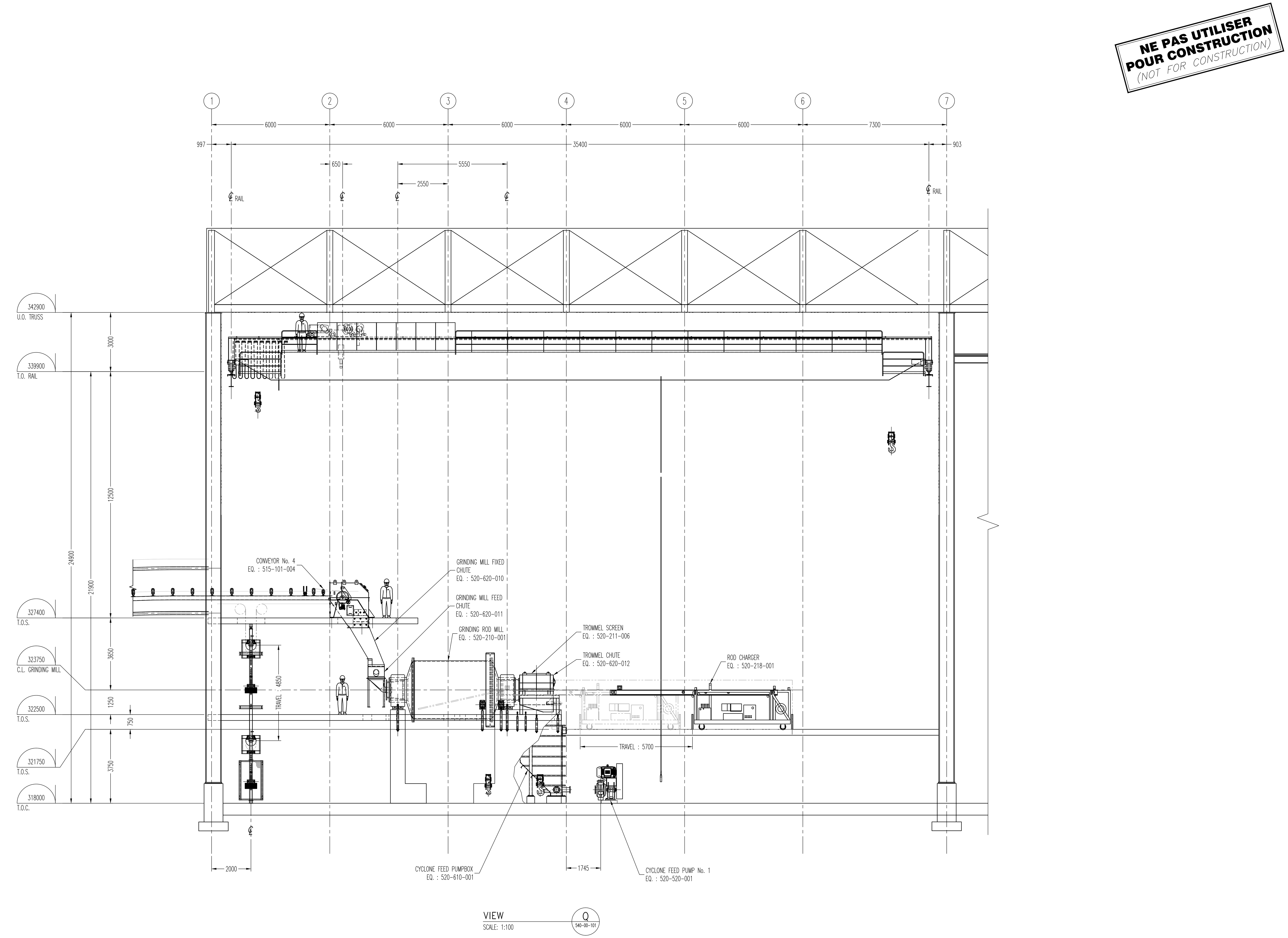

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 129024 — NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION) 2013-07-12

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-19

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

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1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

PROCESS PLANT 4000 TPD
SECTION VIEW Q

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-131

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY

EN DATE DU / DATE OF: 2013-07-12

RV./RV. # 00

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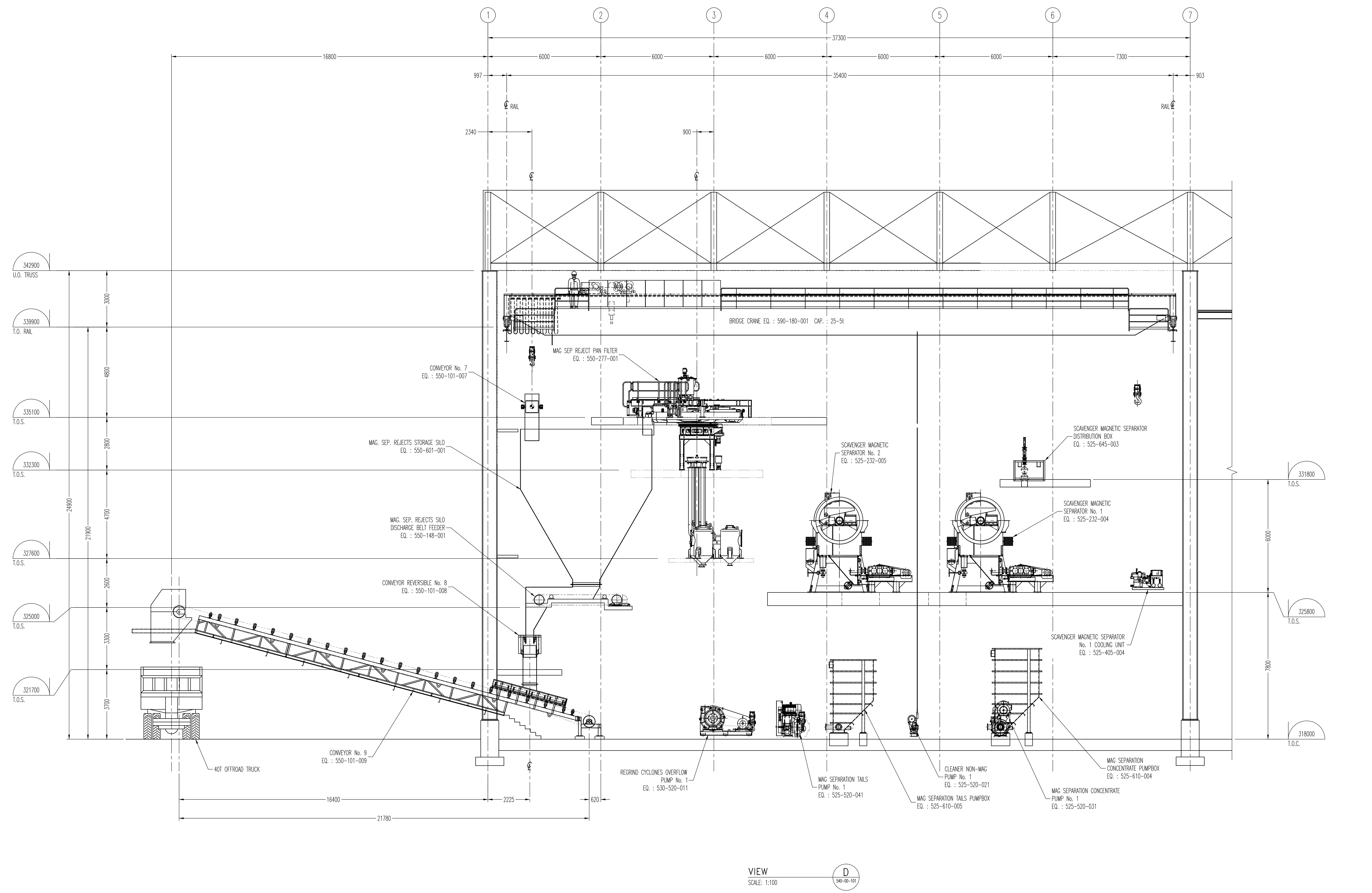


CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT: KIPAWA PROJET

PLAN CLÉ / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS. RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
00	2013-07-12	ISSUED FOR FEASABILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2013-04-30
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
CONÇU PAR / DESIGNED BY: GENIVAR	
DESSINÉ PAR / DRAWN BY: MICHEL BESSETTE	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.	

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

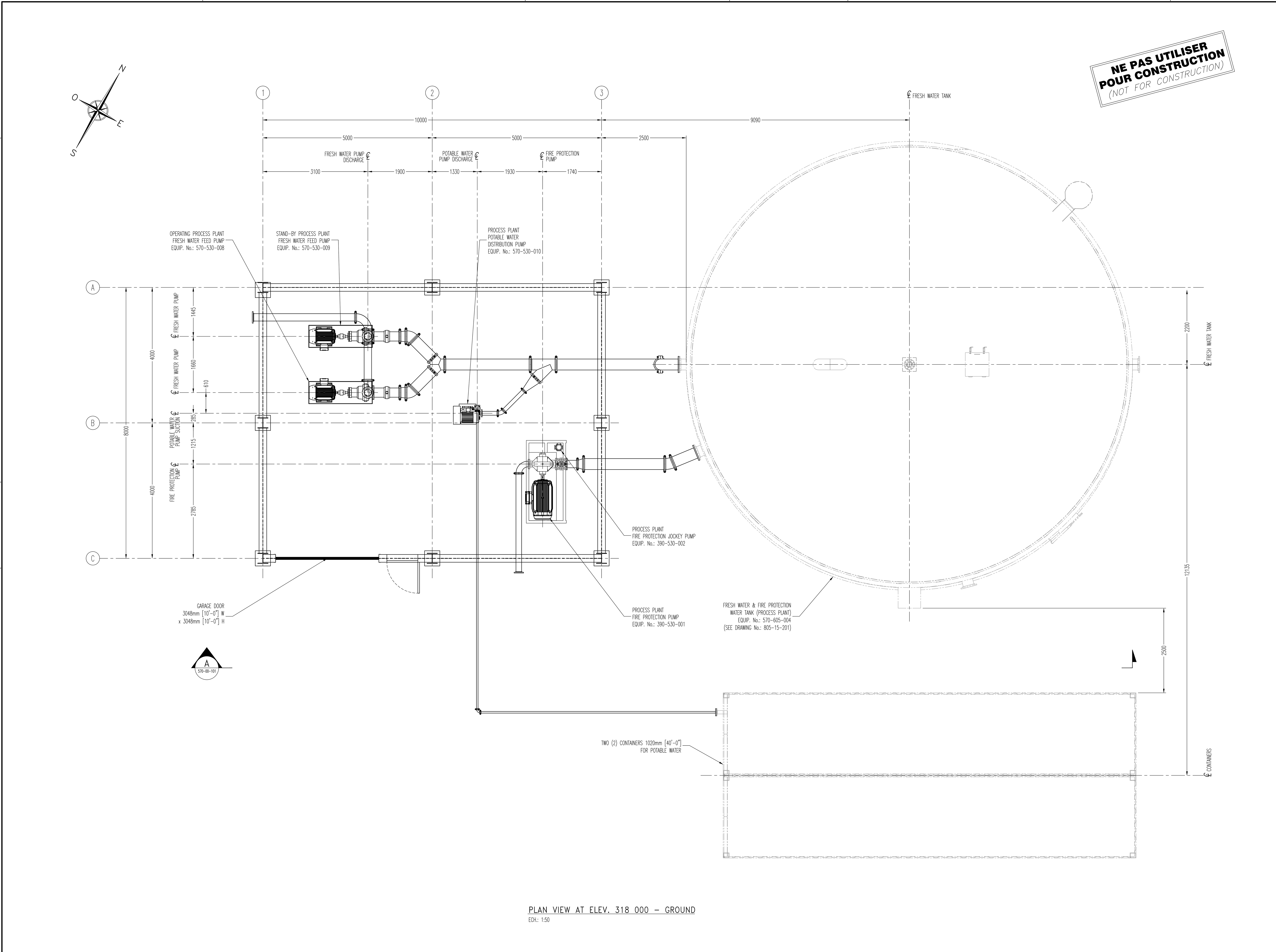
PROCESS PLANT 4000 TPD
SECTION VIEW D

NUMÉRO DU FEUILLET / SHEET NUMBER: 540-00-132

FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASABILITY STUDY — # RV./RV. # 00

EN DATE DU / DATE OF: 2013-07-12



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER
Bertrand Fortin
129024
QUÉBEC
2013-06-21

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013-02-26
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: SÉBASTIEN ST-LOUIS
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

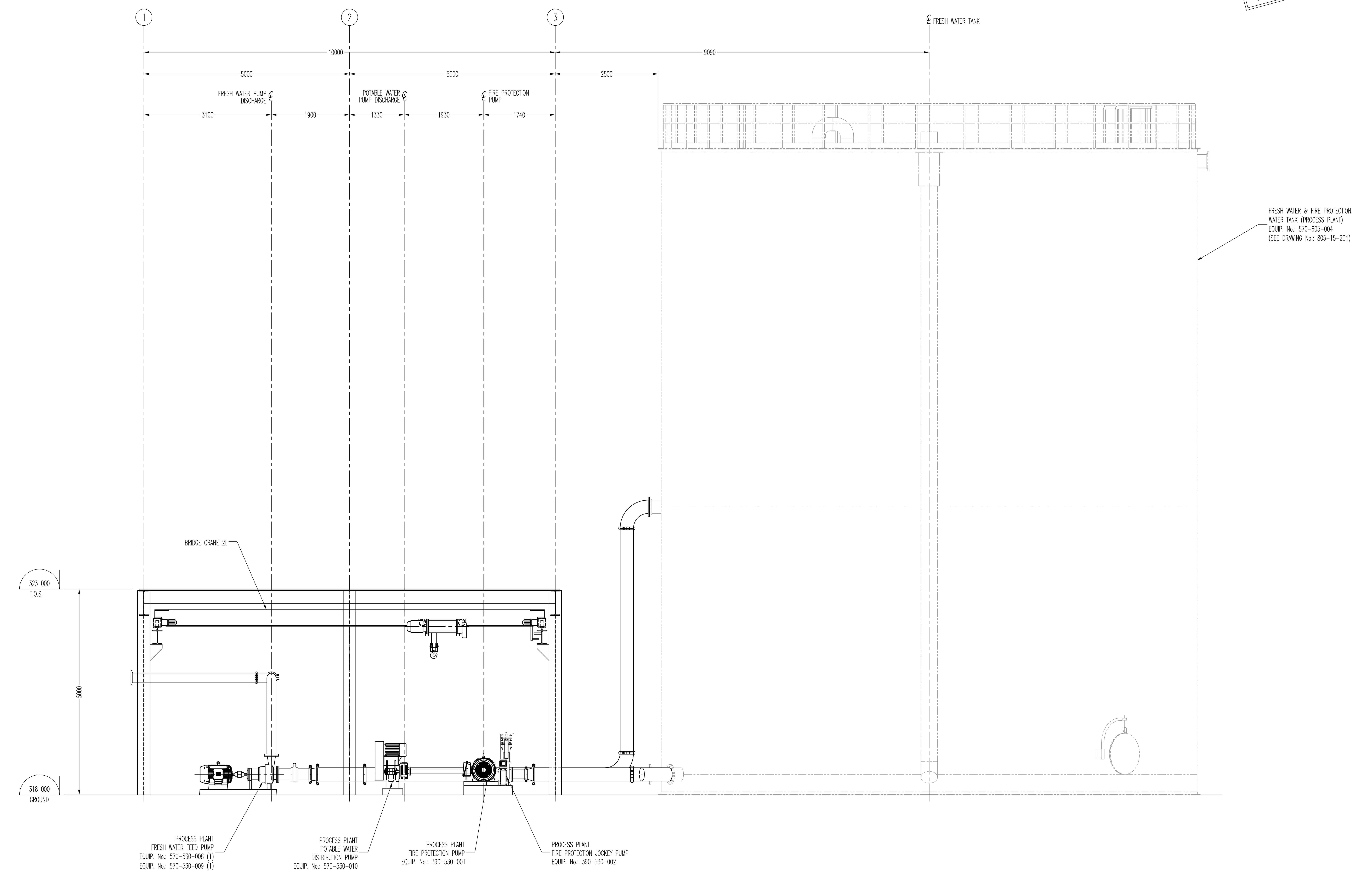
TITRE / TITLE:

PROCESS & FRESH WATER DISTRIBUTION PUMPING STATION FOR PROCESS PLANT PLAN VIEW

NUMÉRO DU FEUILLET / SHEET NUMBER: 570-00-100

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
EN DATE DU / DATE OF: 2013-06-21
RV./RV. #: 00



SECTION A
ÉCH: 1:50
570-00-100

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR - ENGINEER
Bertrand Fortin
129024
2013-06-21

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013-02-26
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: SÉBASTIEN ST-LOUIS
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

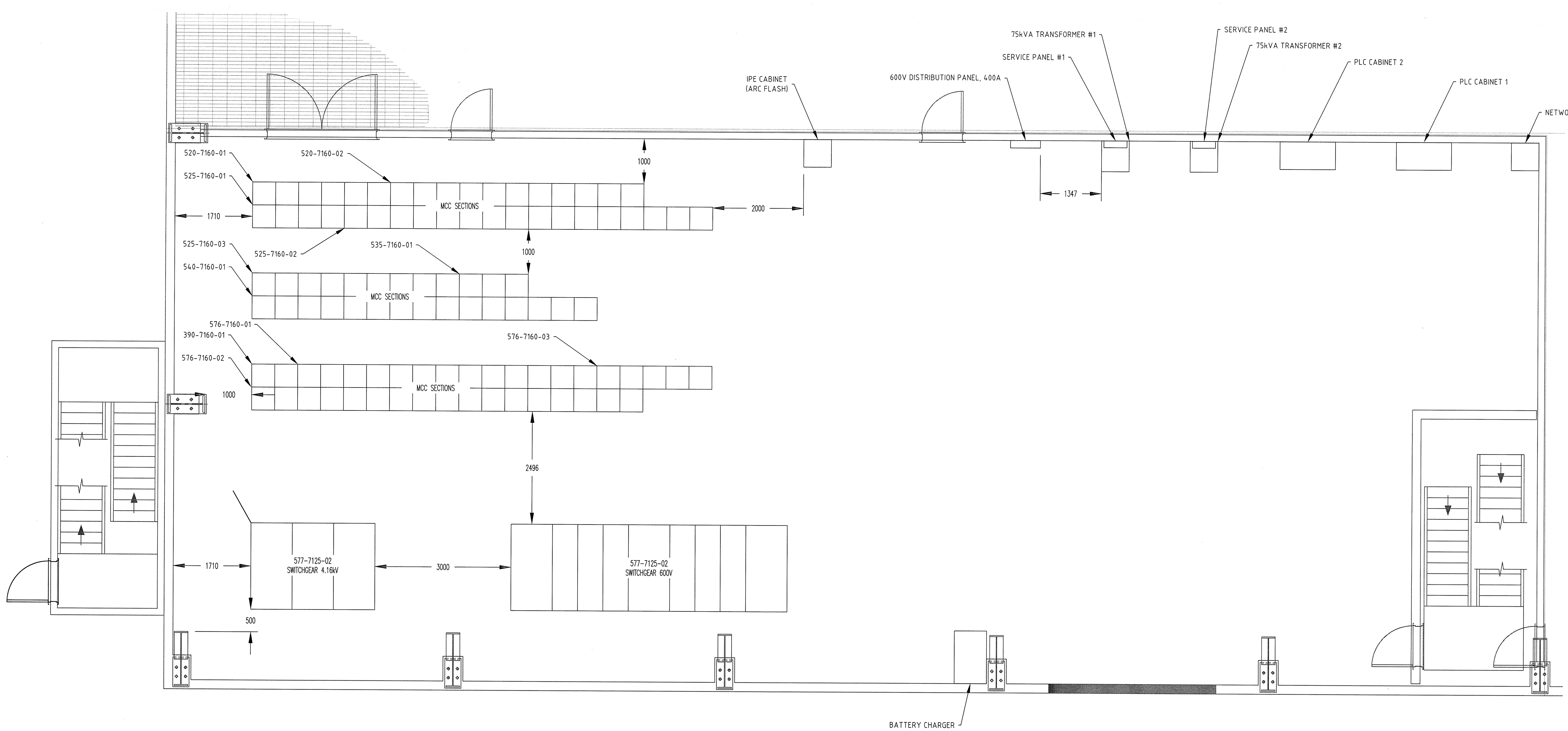
PROCESS & FRESH WATER DISTRIBUTION PUMPING STATION FOR PROCESS PLANT SECTION A

NUMÉRO DU FEUILLET / SHEET NUMBER: 570-00-101

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
EN DATE DU / DATE OF: 2013-06-21
RV./RV. #: 00

NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Louis De Carufel 140090 QUÉBEC

12 juillet 2013

CLIENT / CLIENT:

MATAMEC

REF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
J.D.	00	2013-07-12	ISSUED FOR FEASIBILITY STUDY
J.P.E	0A	2012-09-27	ISSUED FOR COMMENTS

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-27

ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:50

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

CONÇU PAR / DESIGNED BY: LOUIS de CARUFEL, ENG.

DESSINÉ PAR / DRAWN BY: JÉRÉMIE DUGAS

VÉRIFIÉ PAR / CHECKED BY: LOUIS de CARUFEL, ENG.

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

MAIN ELECTRICAL ROOM
PROCESS PLANT
KIPAWA

NUMÉRO DU FEUILLET / SHEET NUMBER: 576-17-101

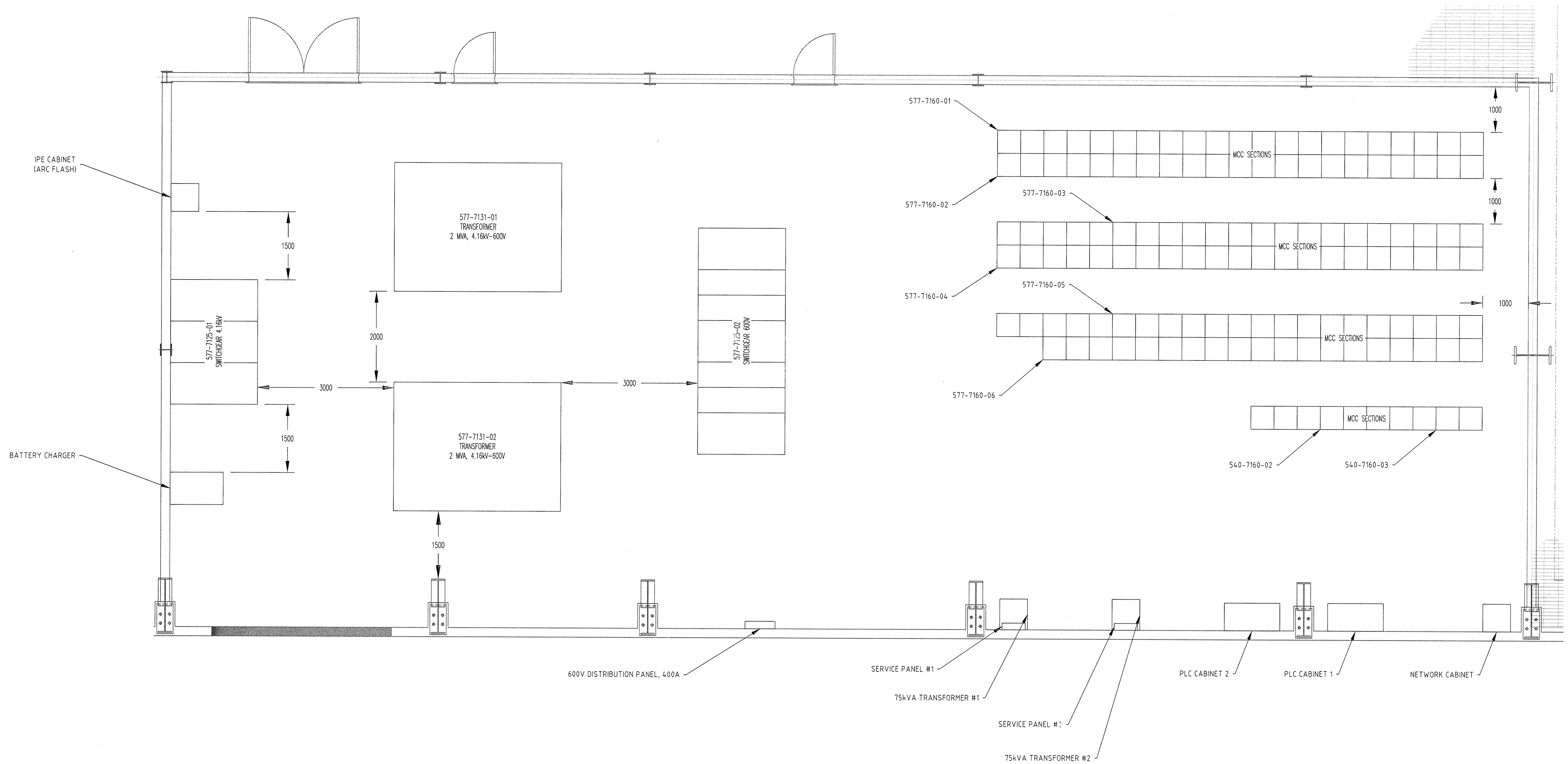
FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

RV./RV. #: 00

EN DATE DU / DATE OF: 2013-07-12

Arch D, P:_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Progres\576-17-101_00.dwg, 2013-06-11 15:07:01



ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

16 JUILLET 2013

CLIENT / CLIENT:

MATAMEC

REF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA FEASIBILITY STUDY

PLAN CLE / KEY PLAN:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
M.O	01	2013-07-16	ISSUED FOR FEASIBILITY STUDY_FINAL
J.D.	00	2013-07-12	ISSUED FOR FEASIBILITY STUDY
J.P.E	0A		ISSUED FOR COMMENTS

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2012-09-27

ÉCHELLE ORIGINALE / ORIGINAL SCALE: 1:50

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

CONÇU PAR / DESIGNED BY: LOUIS de CARUFEL, ENG.

DESSINÉ PAR / DRAWN BY: JÉRÉMIE DUGAS

VÉRIFIÉ PAR / CHECKED BY: LOUIS de CARUFEL, ENG.

DISCIPLINE / DISCIPLINE: ELECTRICAL

TITRE / TITLE:

SECONDARY ELECTRICAL ROOM
PROCESS PLANT
KIPAWA

NUMÉRO DU FEUILLET / SHEET NUMBER: 577-17-101

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY_FINAL

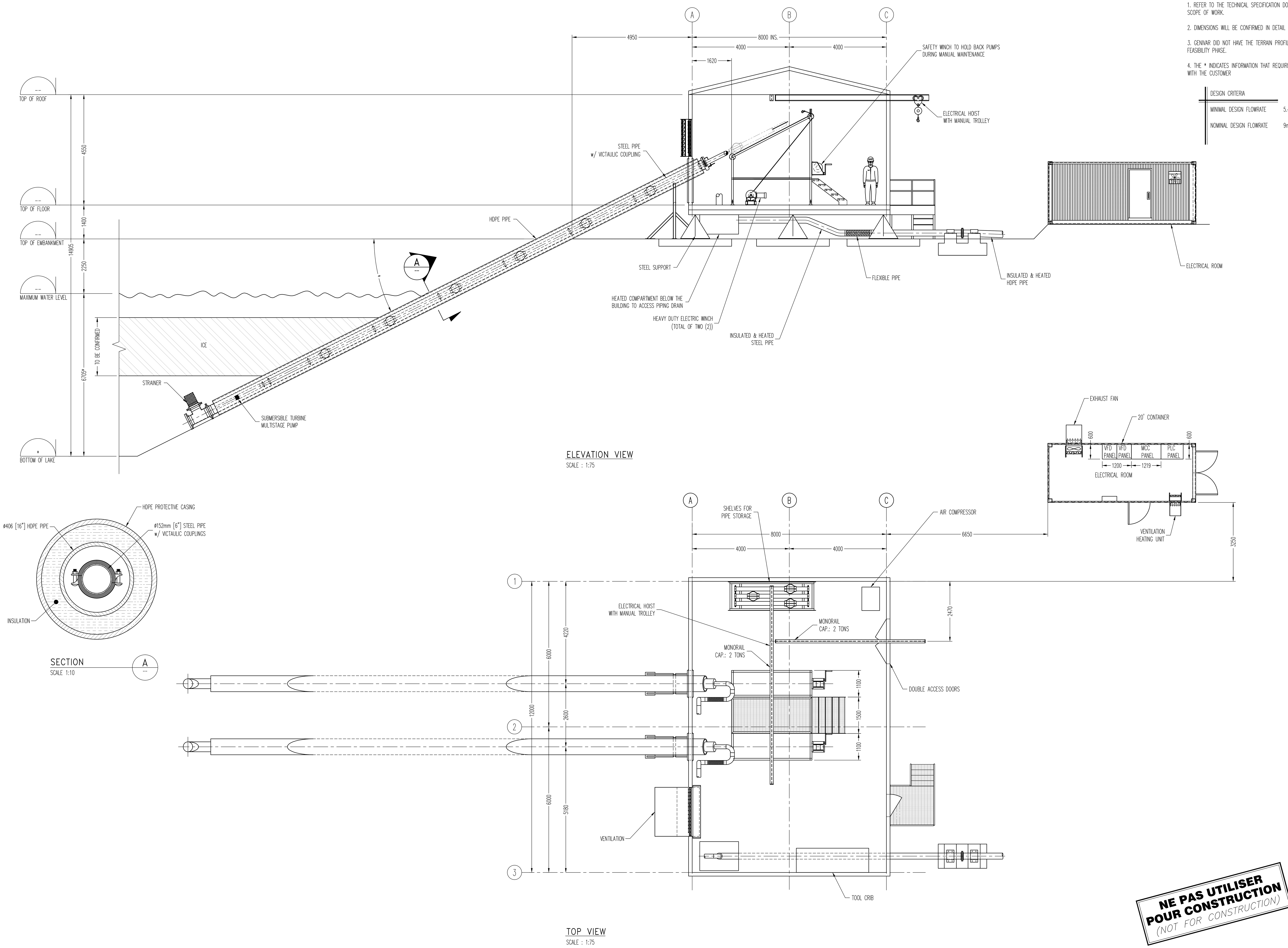
RV./RV. #: 01

EN DATE DU / DATE OF: 2013-07-12

NOTES:

1. REFER TO THE TECHNICAL SPECIFICATION DOCUMENT FOR SCOPE OF WORK.
2. DIMENSIONS WILL BE CONFIRMED IN DETAIL ENGINEERING.
3. GENIVAR DID NOT HAVE THE TERRAIN PROFILE DURING FEASIBILITY PHASE.
4. THE * INDICATES INFORMATION THAT REQUIRES VERIFICATION WITH THE CUSTOMER

DESIGN CRITERIA	
MINIMAL DESIGN FLOWRATE	5.4m³/h
NOMINAL DESIGN FLOWRATE	9m³/h



NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

INGÉNIEUR · ENGINEER Bertrand Fortin 129024 2013-06-21

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-04

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: DANNY LARIVIERE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

MINE SITE PUMPING STATION
GENERAL ARRANGEMENT
PLAN & ELEVATION

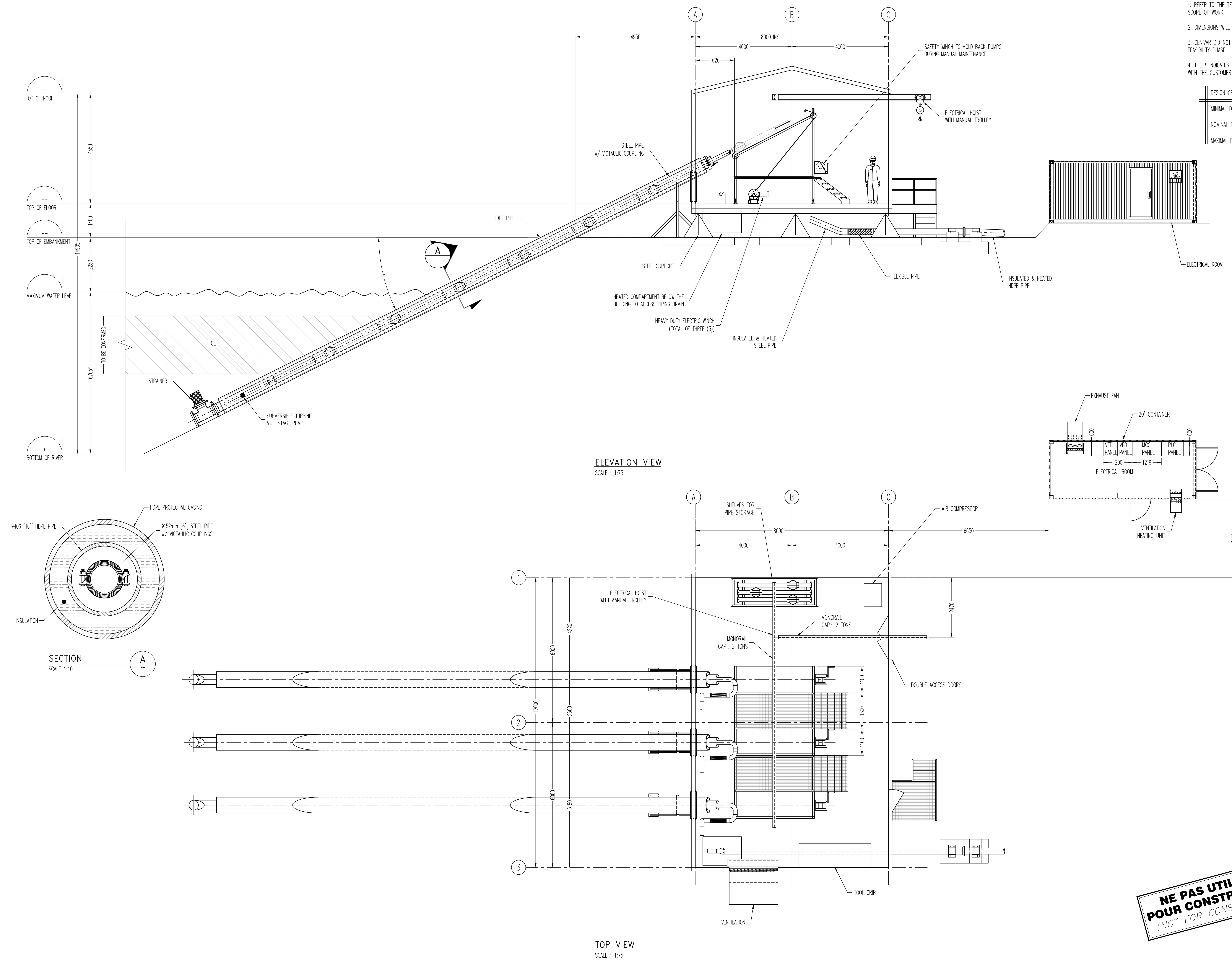
NUMÉRO DU FEUILLET / SHEET NUMBER: 805-00-202

FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-21

RV./RV. # 00



NOTES:

1. REFER TO THE TECHNICAL SPECIFICATION DOCUMENT FOR SCOPE OF WORK.
2. DIMENSIONS WILL BE CONFIRMED IN DETAIL ENGINEERING.
3. GENIVAR DID NOT HAVE THE TERRAIN PROFILE DURING FEASIBILITY PHASE.
4. THE * INDICATES INFORMATION THAT REQUIRES VERIFICATION WITH THE CUSTOMER

DESIGN CRITERIA	
MINIMAL DESIGN FLOWRATE	54m³/h
NOMINAL DESIGN FLOWRATE	180m³/h
MAXIMAL DESIGN FLOWRATE	290m³/h

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL: INGÉNIEUR · ENGINEER Bertrand Fortin 129024 2013-06-21

CLIENT / CLIENT: MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT: KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013-03-04
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: DANNY LARIVIERE
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

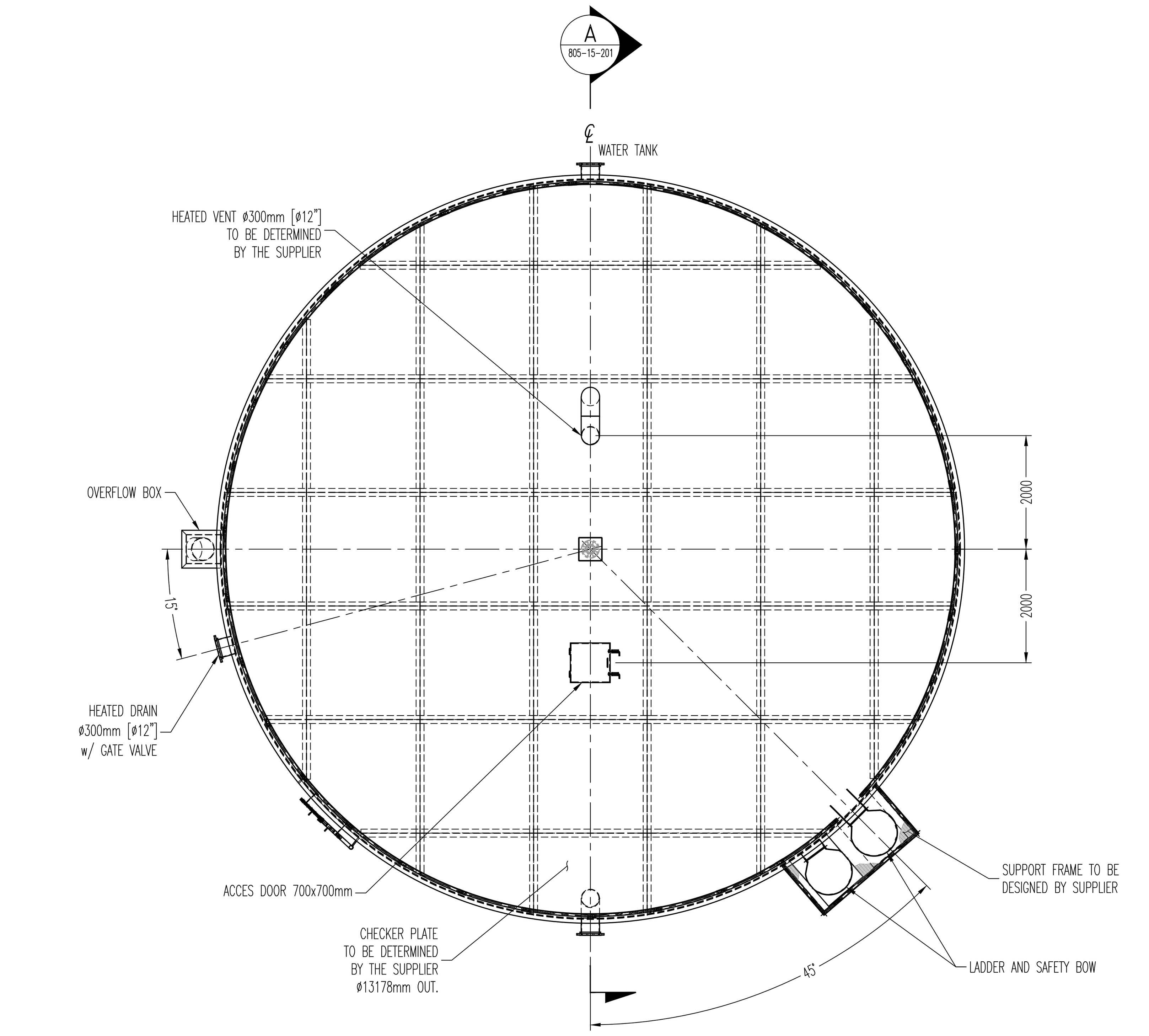
FRESH WATER PUMPING STATION
GENERAL ARRANGEMENT
PLAN & ELEVATION

NUMÉRO DU FEUILLET / SHEET NUMBER: 805-00-204

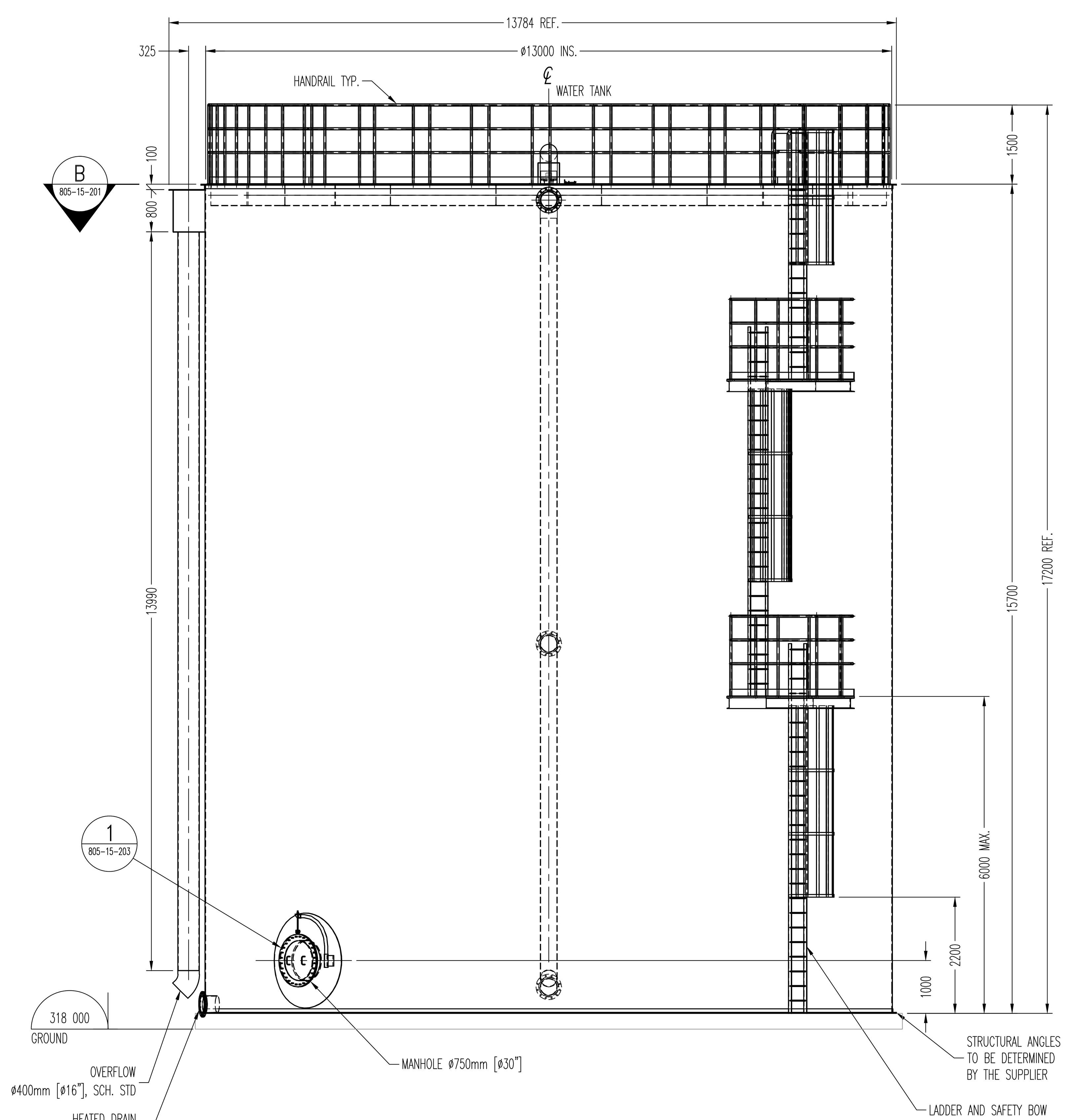
FEUILLET / SHEET #: 1 DE / OF 1

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
EN DATE DU / DATE OF: 2013-06-21
RV./RV. #: 00

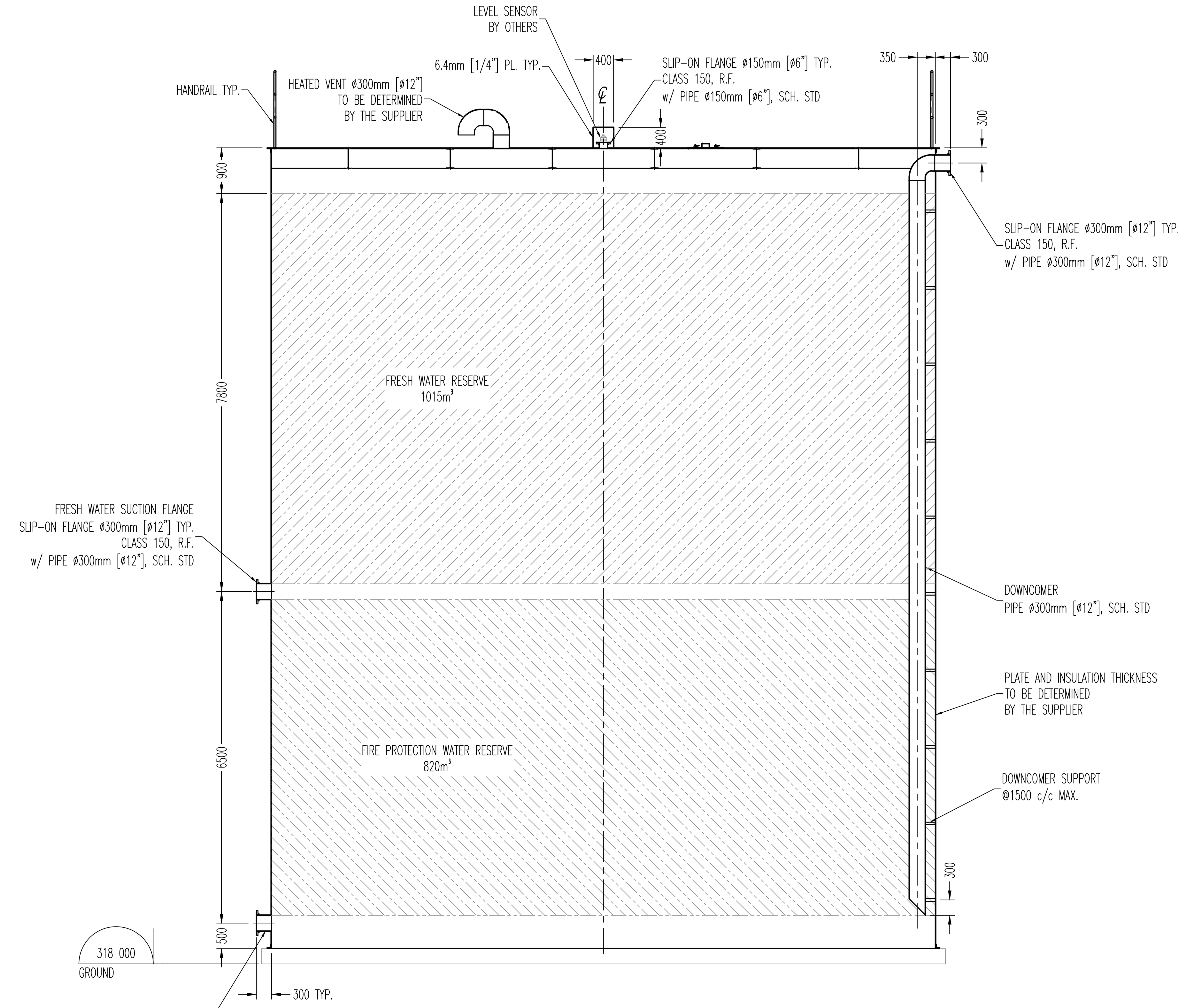
NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



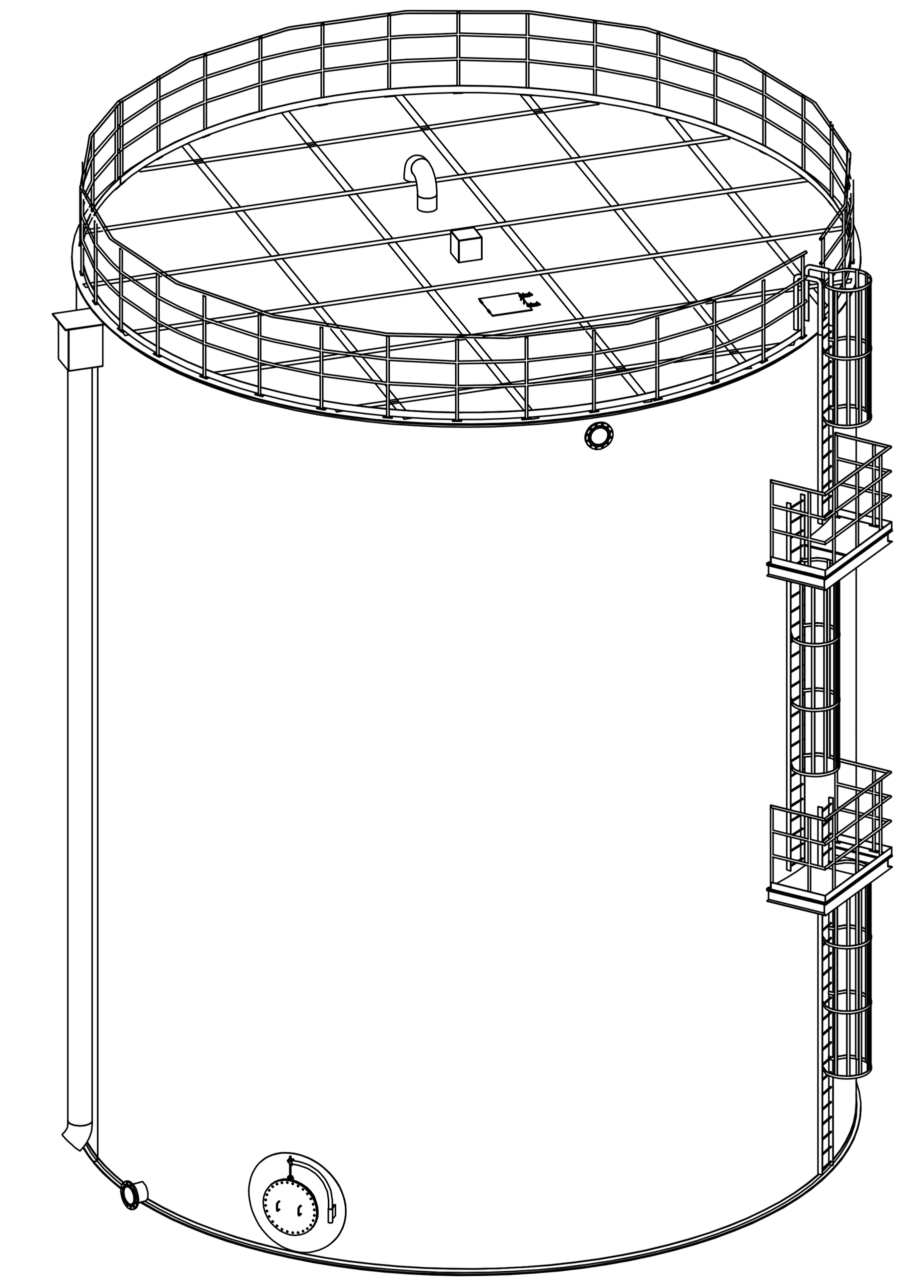
TOP VIEW
SCALE: 1:75



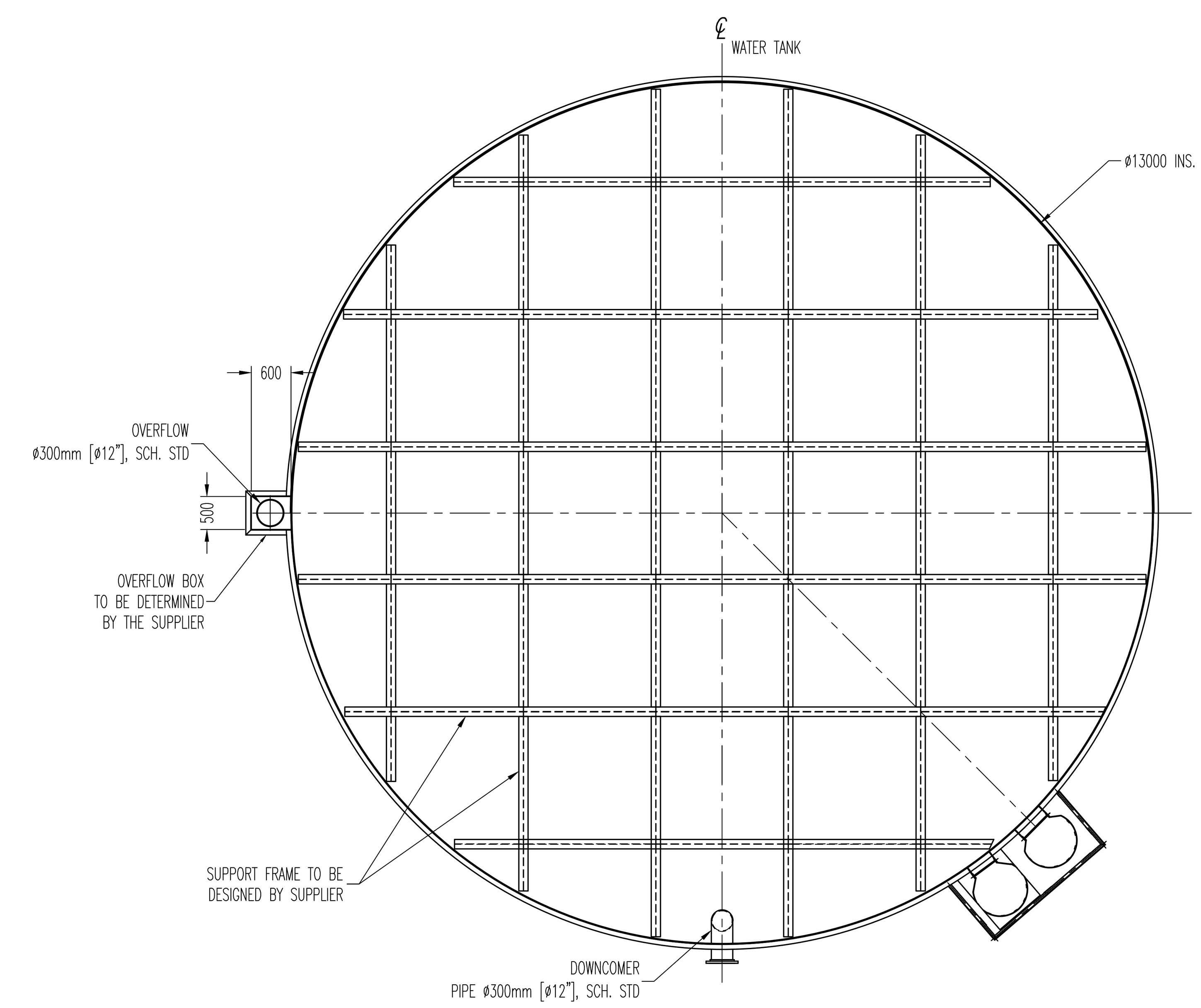
PROCESS PLANT FRESH WATER TANK – ELEVATION
SCALE: 1:75



SECTION A
SCALE: 1:75
805-15-201



ISOMETRIC VIEW
SCALE: N.T.S.



SECTION B
SCALE: 1:75
805-15-201

NOTES:

- THE TANK IS INSTALLED OUTSIDE, REFER TO THE DOCUMENT 1-00-G1-ESTU-00-001_SITE CONDITION_REV 02 FOR THE DESIGN.
- THE TANK SHALL BE INSULATED. IF HEATING IS NECESSARY, PLEASE PROVIDE US WITH THE PRICE AS AN OPTIONS IN YOUR PROPOSAL.

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

Bertrand Fortin 2013-07-15 — NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-07-15	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013/02/26
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: ÉRIC BOISSONNEAULT
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: MECHANICAL

TITRE / TITLE:
PROCESS PLANT FRESH WATER AND FIRE PROTECTION TANK
EQ. 805-5605-01
ASSEMBLY AND SECTIONS

NUMÉRO DU FEUILLET / SHEET NUMBER: 805-15-201
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
EN DATE DU / DATE OF: 2013-07-15
RV./RV. #: 00

Arch D, P:_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Transit\805-15-201_00.dwg, 2013-07-15 16:00:32

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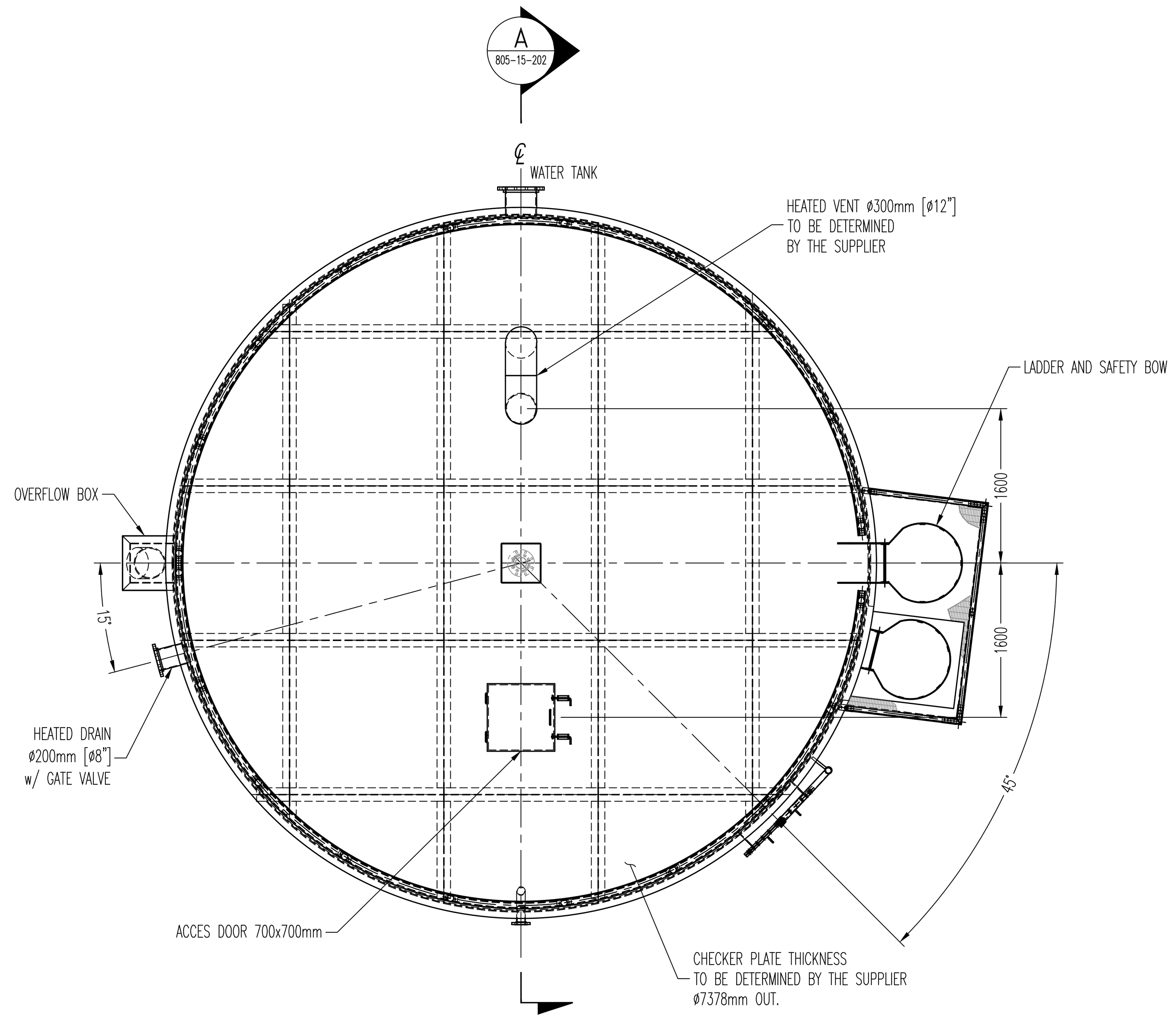
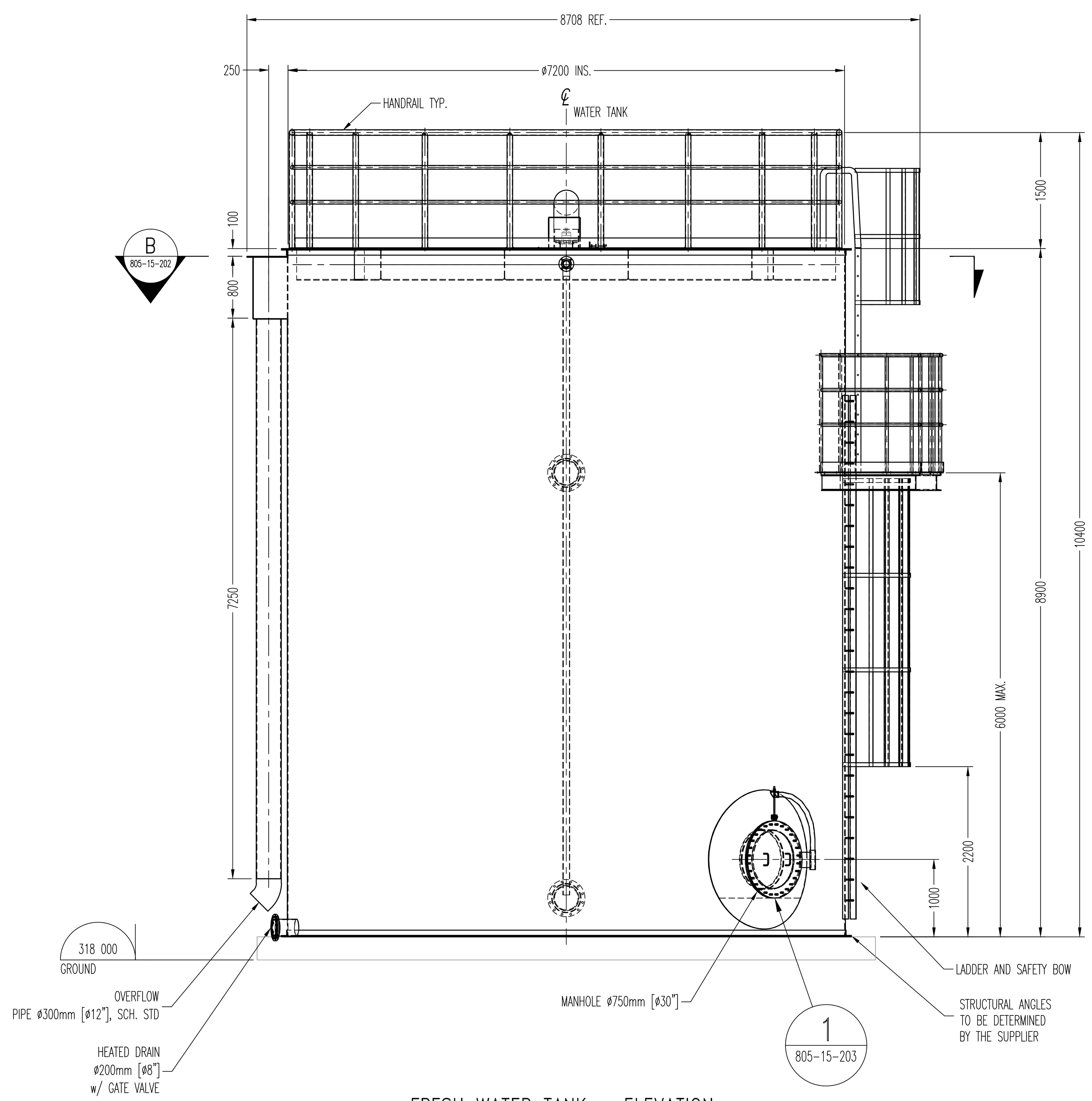
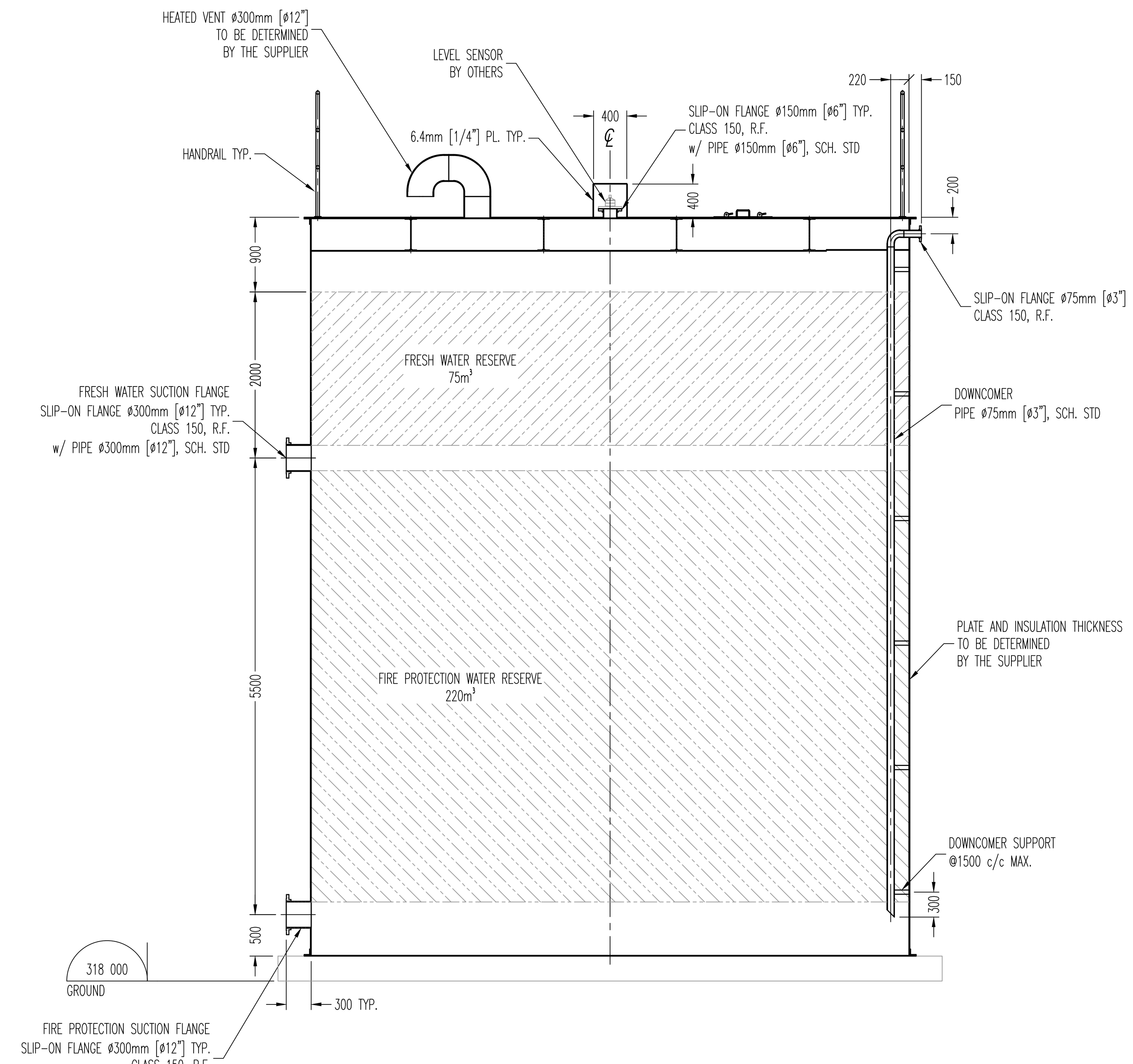


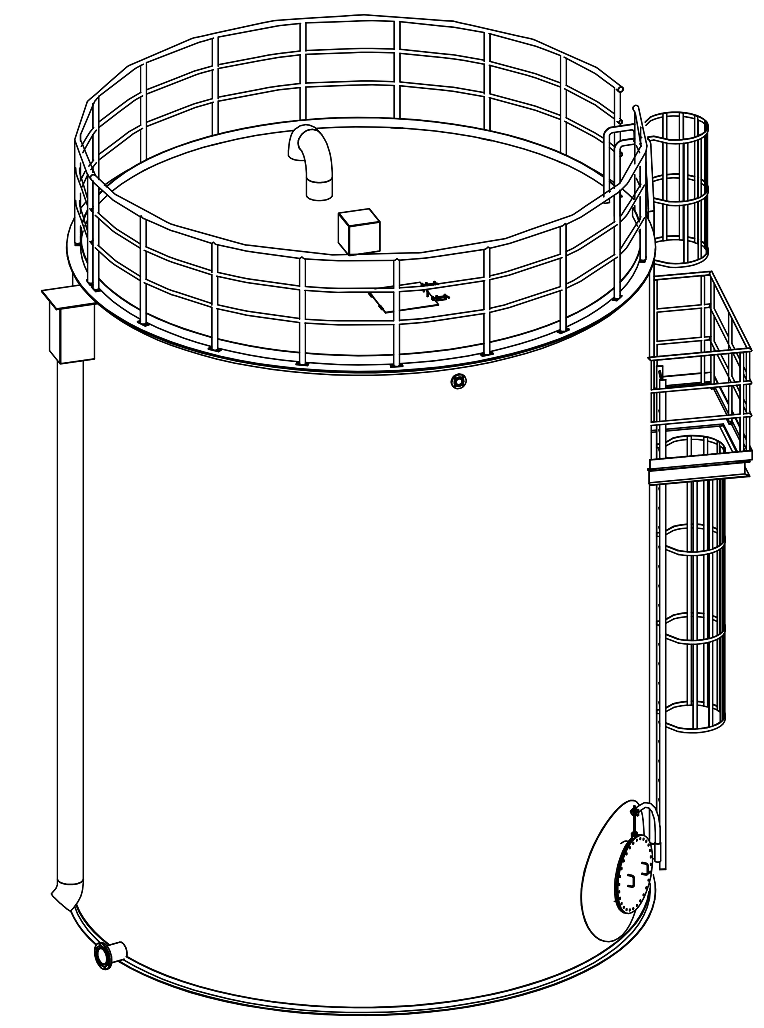
TOP VIEW
SCALE: 1:50



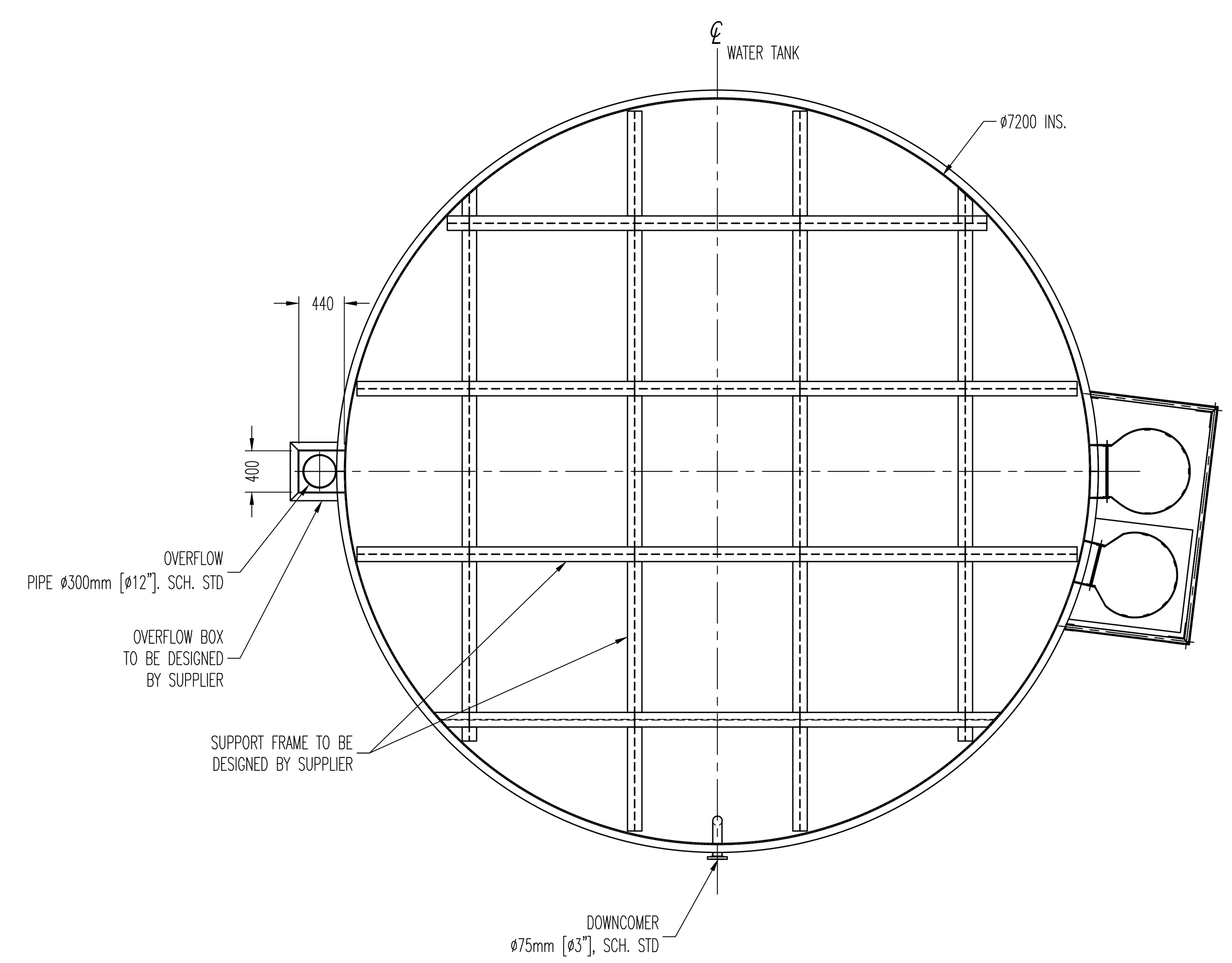
FRESH WATER TANK – ELEVATION
SCALE: 1:50



SECTION A 805-15-202
SCALE: 1:50



ISOMETRIC VIEW
SCALE: N.T.S.



SECTION B 805-15-202
SCALE: 1:50

NOTES:

- THE TANK IS INSTALLED OUTSIDE, REFER TO THE DOCUMENT 1-00-G1-ESTU-00-001_SITE CONDITION_REV 02 FOR THE DESIGN.
- THE TANK SHALL BE INSULATED. IF HEATING IS NECCESSARY, PLEASE PROVIDE US WITH THE PRICE IAS AN OPTIONS IN YOUR PROPOSAL.

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-07-15	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00	DATE / DATE: 2013/02/25
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN	SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE. IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE. 1"
CONÇU PAR / DESIGNED BY: GENIVAR	
DESSINÉ PAR / DRAWN BY: ÉRIC BOISSONNEAULT	
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.	

DISCIPLINE / DISCIPLINE: MECHANICAL

TITRE / TITLE:

MINE SITE FRESH WATER AND FIRE PROTECTION TANK
EQ. 805-5605-02
ASSEMBLY & SECTIONS

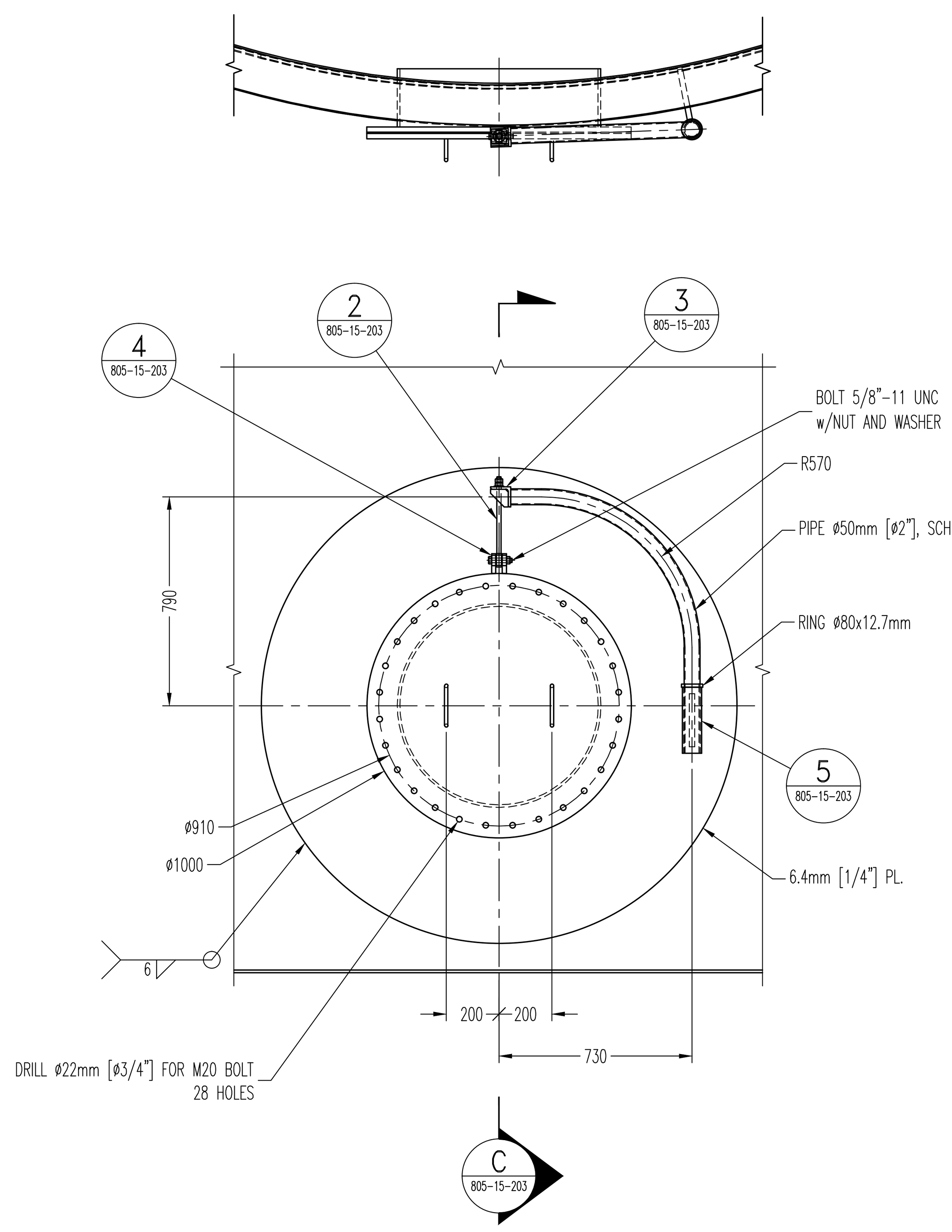
NUMÉRO DU FEUILLET / SHEET NUMBER: 805-15-202

FEUILLET / SHEET #: -- DE / OF --

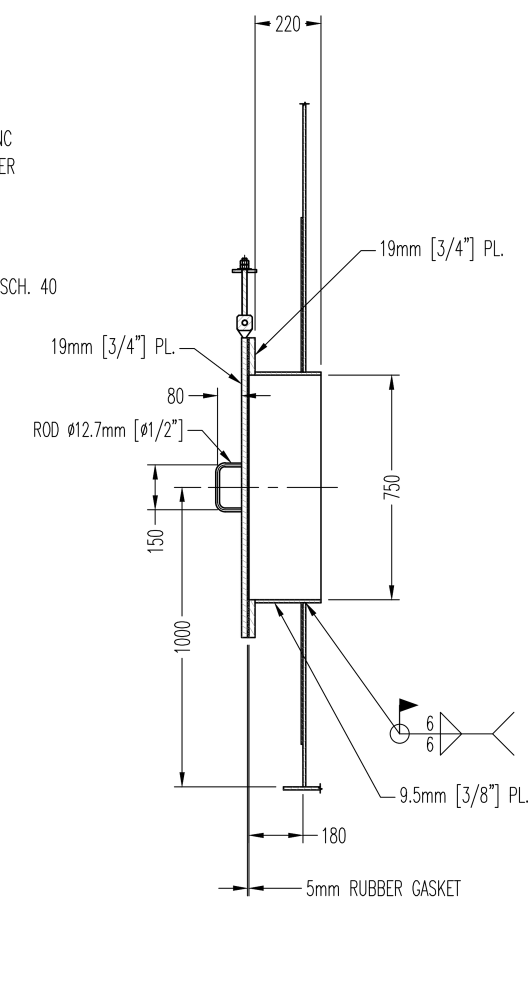
ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
EN DATE DU / DATE OF: 2013-07-15
RV./RV. #: 00

Arch D, P:_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Transit\805-15-202_00.dwg, 2013-07-15 15:59:48

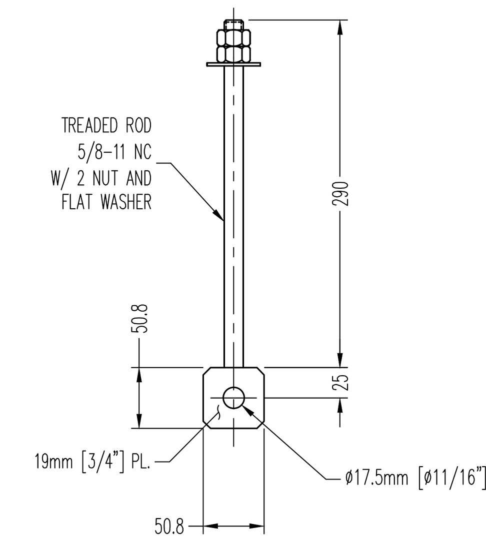
NE PAS UTILISER POUR CONSTRUCTION
(NOT FOR CONSTRUCTION)



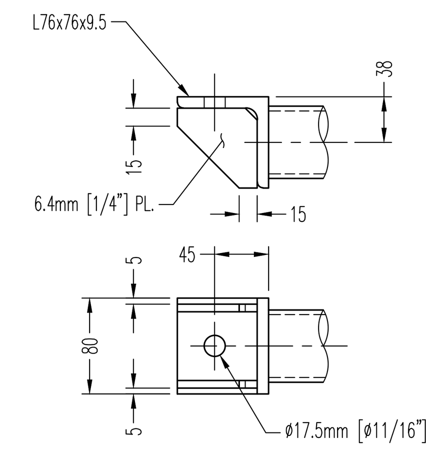
DETAIL 1 (805-15-201)
SCALE: 1:20
QTÉ:



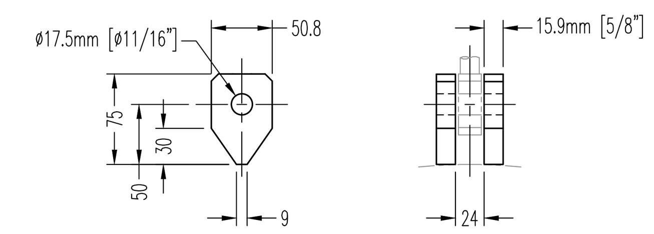
SECTION C (805-15-203)
SCALE: 1:20



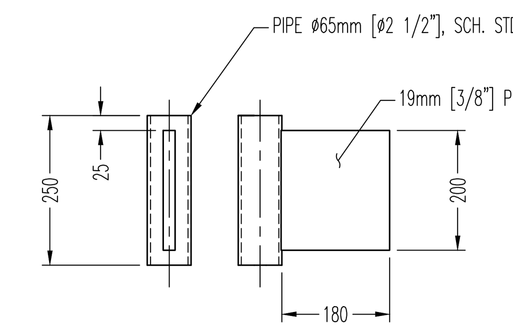
DETAIL 2 (805-15-203)
SCALE: 1:5



DETAIL 3 (805-15-203)
SCALE: 1:5



DETAIL 4 (805-15-203)
SCALE: 1:5

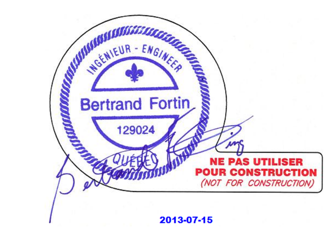


DETAIL 5 (805-15-203)
SCALE: 1:10

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:



CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #: --

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

AVERTISSEMENT / DISCLAIMER: COPYRIGHT / COPYRIGHT:

ÉMISSION - RÉVISION / ISSUED FOR - REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
	00	2013/07/15	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00
DATE / DATE: 2013/02/28
ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN
CONÇU PAR / DESIGNED BY: GENIVAR
DESSINÉ PAR / DRAWN BY: ÉRIC BOISSONNEAULT
VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.
IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.
1"

DISCIPLINE / DISCIPLINE: MECHANICAL

TITRE / TITLE:

FRESH WATER AND FIRE PROTECTION TANK SECTIONS AND DETAILS

NUMÉRO DU FEUILLET / SHEET NUMBER: 805-15-203
FEUILLET / SHEET #: -- DE / OF --

ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY
EN DATE DU / DATE OF: 2013/07-15
RV./RV. #: 00

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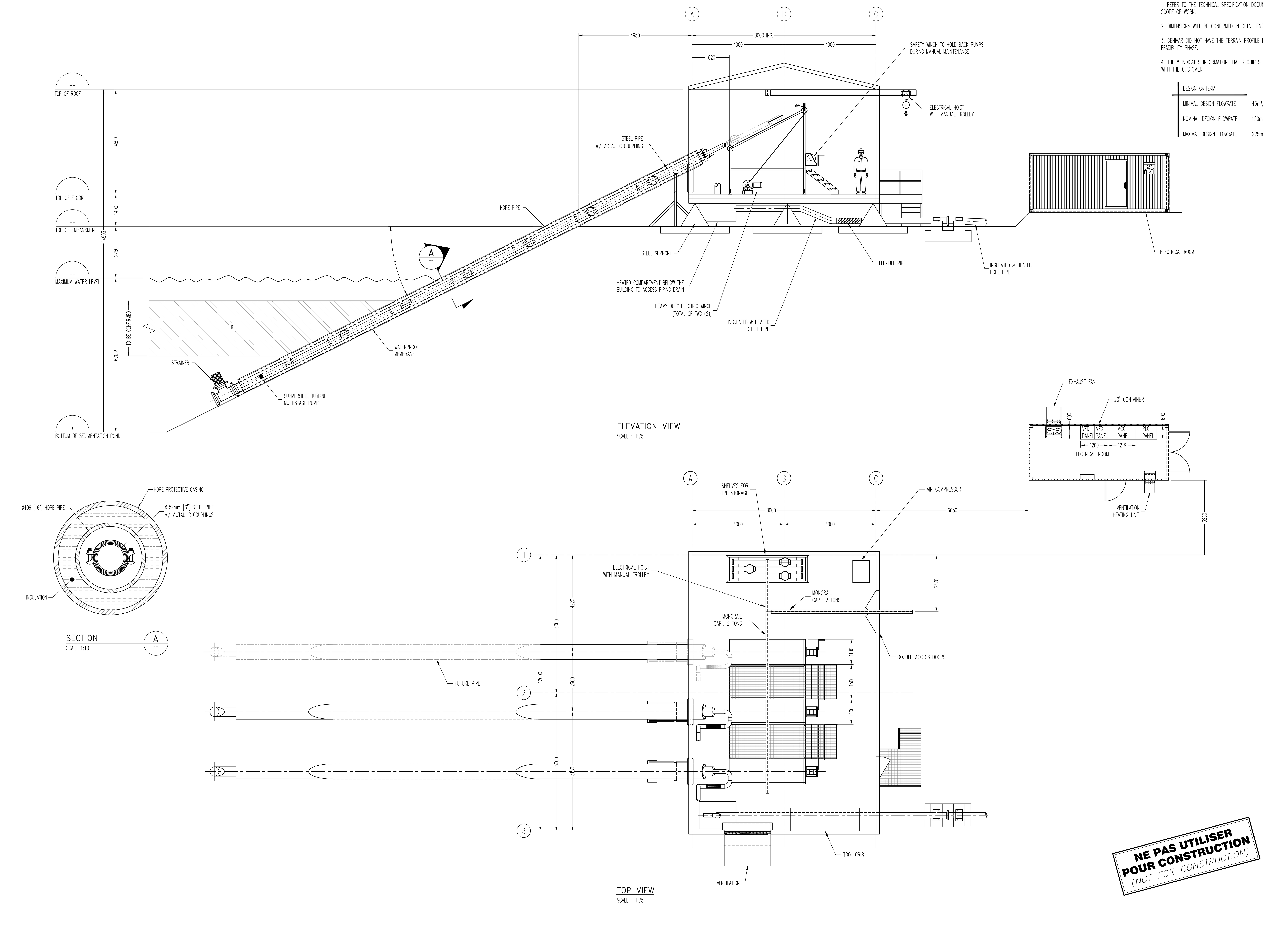


NOTES:

1. REFER TO THE TECHNICAL SPECIFICATION DOCUMENT FOR SCOPE OF WORK.

2. DIMENSIONS WILL BE CONFIRMED IN DETAIL ENGINEERING.

3. GENIVAR DID NOT HAVE THE TERRAIN PROFILE DURING FEASIBILITY PHASE.

4. THE * INDICATES INFORMATION THAT REQUIRES VERIFICATION WITH THE CUSTOMER

DESIGN CRITERIA	
MINIMAL DESIGN FLOWRATE	$45 m^3/h$
NOMINAL DESIGN FLOWRATE	$150 m^3/h$
MAXIMAL DESIGN FLOWRATE	$225 m^3/h$

ROCHE GENIVAR

CONSULTANT / CONSULTANT:

SCEAU / SEAL:

CLIENT / CLIENT:

MATAMEC

RÉF. CLIENT / CLIENT REF. #:

PROJET / PROJECT:

KIPAWA PROJECT

PLAN CLÉ / KEY PLAN:

ÉMISSION – RÉVISION / ISSUED FOR – REVISION:

ÉM./IS.	RV./RV.	DATE / DATE	DESCRIPTION / DESCRIPTION
--	00	2013-06-21	ISSUED FOR FEASIBILITY STUDY

NO PROJET / PROJECT NO: 121-18716-00

DATE / DATE: 2013-03-04

ÉCHELLE ORIGINALE / ORIGINAL SCALE: AS SHOWN

CONÇU PAR / DESIGNED BY: GENIVAR

DESSINÉ PAR / DRAWN BY: DANNY LARIVIERE

VÉRIFIÉ PAR / CHECKED BY: BERTRAND FORTIN, ing.

SI CETTE BARRE NE MESURE PAS 1", AJUSTER VOTRE ÉCHELLE DE TRAÇAGE.

IF THIS BAR IS NOT 1" LONG, ADJUST YOUR PLOTTING SCALE.

1"

DISCIPLINE / DISCIPLINE: GENERAL ARRANGEMENT

TITRE / TITLE:

RECLAIM WATER PUMPING STATION
GENERAL ARRANGEMENT
PLAN & ELEVATION

NUMÉRO DU FEUILLET / SHEET NUMBER: 830-00-201

FEUILLET / SHEET #: 1 DE / OF 1

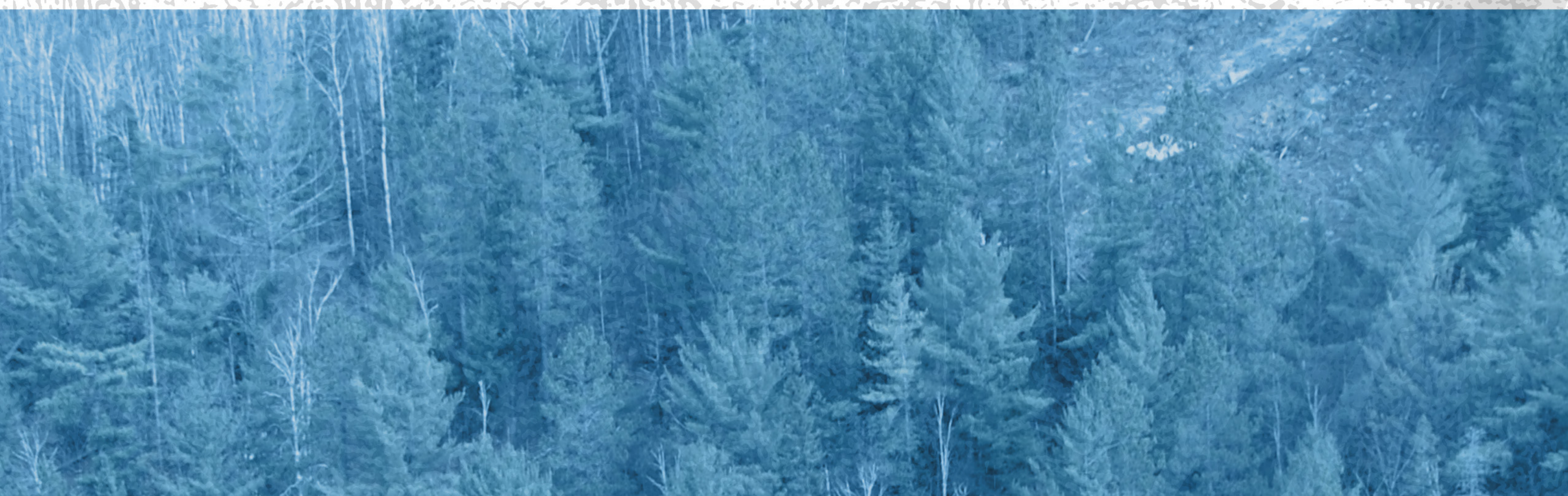
ÉMISSION / ISSUE: ISSUED FOR FEASIBILITY STUDY

EN DATE DU / DATE OF: 2013-06-21

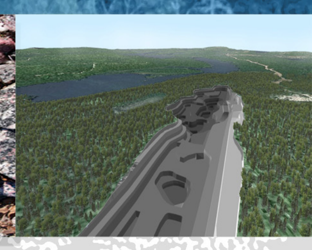
RV./RV. #: 00

\\sv076data02\projet_12X-XXXX-XX\121-18716-00\03-TECH_ORANGE\Dessin\Dessin_Emis\350-00-100_0B.dwg, 2012-11-16 09:31:46

MATAMEC







APPENDIX 2- Legal

ROCHE GENIVAR SGS Golder Associates

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032609	31L16	58,93	8	1	2001-12-19	2015-06-06	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2020790	31L16	58,91	10	3	2006-07-17	2014-07-16	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2020791	31L16	58,91	10	5	2006-07-17	2014-07-16	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2020793	31L16	58,91	10	4	2006-07-17	2014-07-16	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2027195	31L15	58,94	6	60	2006-10-02	2014-10-01	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2027196	31L15	58,94	6	59	2006-10-02	2014-10-01	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2027199	31L15	58,92	9	59	2006-10-02	2014-10-01	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2027200	31L15	58,92	9	60	2006-10-02	2014-10-01	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2027202	31L15	58,92	9	58	2006-10-02	2014-10-01	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2027264	31L16	58,93	8	3	2006-10-02	2014-10-01	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2027268	31L16	58,92	9	1	2006-10-02	2014-10-01	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2182305	31L16	58,93	8	4	2009-04-15	2015-04-14	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2182307	31L16	58,92	9	3	2009-04-15	2015-04-14	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	2182308	31L16	58,92	9	4	2009-04-15	2015-04-14	Active
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032605	31L16	58,94	6	1	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032606	31L16	58,94	6	2	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032607	31L16	58,93	7	1	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032608	31L16	58,93	7	2	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032610	31L15	58,93	7	59	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032611	31L15	58,93	7	60	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032612	31L15	58,92	8	59	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc 75 % Toyotsu Rare Earth Canada, Inc. 25 %	1032613	31L15	58,93	8	60	2001-12-19	2015-06-06	Suspended
Matamec Explorations Inc	96612	31L16	58,96	5	10	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96613	31L16	58,95	6	10	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96614	31L16	58,95	6	11	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96615	31L16	58,94	7	10	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96616	31L16	58,94	7	11	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96617	31L16	58,93	8	10	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96618	31L16	58,93	8	11	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96620	31L16	58,88	13	12	2005-09-29	2015-09-28	Active
Matamec Explorations Inc	96621	31L16	58,88	13	13	2005-09-29	2015-09-28	Active
Matamec Explorations Inc	96622	31L15	58,91	9	55	2005-09-29	2015-09-28	Active
Matamec Explorations Inc	96623	31L15	58,91	9	56	2005-09-29	2015-09-28	Active
Matamec Explorations Inc	96624	31L15	58,91	10	55	2005-09-29	2015-09-28	Active
Matamec Explorations Inc	96625	31L15	58,91	10	56	2005-09-29	2015-09-28	Active
Matamec Explorations Inc	96626	31L15	58,88	13	49	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96627	31L15	58,88	13	50	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96628	31L15	58,87	14	49	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	96629	31L15	58,87	14	50	2005-09-29	2013-09-28	Active
Matamec Explorations Inc	1022343	31L16	58,96	5	8	2001-06-27	2015-06-26	Active
Matamec Explorations Inc	1022344	31L16	58,96	5	9	2001-06-27	2015-06-26	Active

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
Matamec Explorations Inc	1024601	31L16	58,96	4	8	2001-07-17	2015-07-16	Active
Matamec Explorations Inc	1024602	31L16	58,95	6	8	2001-07-17	2015-07-16	Active
Matamec Explorations Inc	1024605	31L16	58,94	7	6	2001-07-17	2015-07-16	Active
Matamec Explorations Inc	1024606	31L16	58,94	7	7	2001-07-17	2015-07-16	Active
Matamec Explorations Inc	1024607	31L16	58,94	7	8	2001-07-17	2015-07-16	Active
Matamec Explorations Inc	1032603	31L16	58,95	5	4	2001-12-19	2015-08-03	Active
Matamec Explorations Inc	1032604	31L16	58,95	5	5	2001-12-19	2015-08-03	Active
Matamec Explorations Inc	1124062	31L16	58,96	4	9	2003-05-13	2015-05-12	Active
Matamec Explorations Inc	1124063	31L16	58,96	4	10	2003-05-13	2015-05-12	Active
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Matamec Explorations Inc	2020782	31L15	58,9	11	59	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020783	31L15	58,89	12	60	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020784	31L15	58,89	12	59	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020785	31L15	58,88	13	58	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020786	31L15	58,88	13	60	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020787	31L15	58,88	13	59	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020788	31L16	58,91	10	1	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020789	31L16	58,91	10	2	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020792	31L16	58,91	10	6	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020794	31L16	58,9	11	1	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020795	31L16	58,9	11	2	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020796	31L16	58,9	11	3	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020797	31L16	58,9	11	4	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020798	31L16	58,9	11	5	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020799	31L16	58,9	11	6	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020800	31L16	58,89	12	2	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020801	31L16	58,89	12	3	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020802	31L16	58,89	12	4	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020803	31L16	58,89	12	5	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020804	31L16	58,89	12	6	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020805	31L16	58,89	12	1	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2020806	31L16	58,88	13	1	2006-07-17	2014-07-16	Active
Matamec Explorations Inc	2027190	31L15	58,96	4	60	2006-10-02	2014-10-01	Active
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Matamec Explorations Inc	2027192	31L15	58,95	5	59	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027193	31L15	58,95	5	60	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027194	31L15	58,94	6	57	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027197	31L15	58,93	7	57	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027198	31L15	58,92	8	56	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027201	31L15	58,92	8	57	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027203	31L15	58,92	9	57	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027204	31L15	58,91	9	54	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027205	31L15	58,91	10	57	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027206	31L15	58,91	10	58	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027207	31L15	58,91	10	59	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027208	31L15	58,91	10	60	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027209	31L15	58,9	11	56	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027210	31L15	58,9	11	57	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027211	31L15	58,9	11	58	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027212	31L15	58,89	12	50	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027213	31L15	58,88	13	53	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027214	31L15	58,87	14	48	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027215	31L15	58,86	15	48	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027216	31L15	58,85	16	48	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027217	31L15	58,85	16	49	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027218	31L15	58,84	17	47	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027219	31L15	58,84	17	48	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027220	31L15	58,84	17	49	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027221	31L15	58,83	18	47	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027222	31L15	58,83	18	48	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027229	31L16	58,99	1	4	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027230	31L16	58,99	1	5	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027231	31L16	58,99	1	6	2006-10-02	2014-10-01	Active

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
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Matamec Explorations Inc	2027234	31L16	58,98	2	4	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027235	31L16	58,98	2	5	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027236	31L16	58,98	2	7	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027237	31L16	58,98	2	6	2006-10-02	2014-10-01	Active
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Matamec Explorations Inc	2027239	31L16	58,97	3	3	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027240	31L16	58,97	3	4	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027241	31L16	58,97	3	9	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027242	31L16	58,97	3	10	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027243	31L16	58,97	3	11	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027244	31L16	58,97	4	11	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027245	31L16	58,97	3	1	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027246	31L16	58,96	4	1	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027247	31L16	58,96	4	2	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027248	31L16	58,96	4	3	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027249	31L16	58,96	4	4	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027250	31L16	58,96	5	12	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027251	31L16	58,96	5	11	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027252	31L16	58,95	5	1	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027253	31L16	58,95	5	2	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027254	31L16	58,95	5	3	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027255	31L16	58,95	6	12	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027256	31L16	58,95	6	13	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027257	31L16	58,94	7	12	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027258	31L16	58,94	7	13	2006-10-02	2014-10-01	Active
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Matamec Explorations Inc	2027260	31L16	58,94	7	14	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027261	31L16	58,93	8	6	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027262	31L16	58,93	8	7	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027263	31L16	58,93	8	12	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027265	31L16	58,92	9	2	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027266	31L16	58,92	9	5	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027267	31L16	58,92	9	6	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027401	31L16	58,93	8	13	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027403	31L16	58,93	8	16	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027404	31L16	58,93	8	15	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027405	31L16	58,92	9	13	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027406	31L16	58,92	9	14	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027407	31L16	58,92	9	15	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027408	31L16	58,92	9	16	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027409	31L16	58,92	9	17	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027410	31L16	58,92	9	18	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027411	31L16	58,91	10	13	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027412	31L16	58,91	10	14	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027413	31L16	58,91	10	15	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027414	31L16	58,91	10	16	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027415	31L16	58,91	10	18	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027416	31L16	58,91	10	19	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027417	31L16	58,91	10	17	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027418	31L16	58,9	11	13	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027419	31L16	58,9	11	14	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027420	31L16	58,9	12	17	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027421	31L16	58,9	12	18	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027422	31L16	58,9	12	19	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027423	31L16	58,89	13	17	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027424	31L16	58,89	13	18	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027425	31L16	58,88	13	4	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027427	31L16	58,88	13	5	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027429	31L16	58,88	13	6	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027431	31L16	58,88	13	7	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027433	31L16	58,88	13	8	2006-10-02	2014-10-01	Active

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
Matamec Explorations Inc	2027434	31L16	58,88	13	10	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027435	31L16	58,88	13	11	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027436	31L16	58,88	13	9	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027437	31L16	58,87	14	4	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027438	31L16	58,87	14	5	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027439	31L16	58,87	14	6	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027440	31L16	58,86	16	6	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027441	31L16	58,86	16	7	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027442	31L16	58,86	15	4	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027443	31L16	58,86	15	5	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2027444	31L16	58,86	15	6	2006-10-02	2014-10-01	Active
Matamec Explorations Inc	2028336	31L16	58,87	14	7	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2028337	31L16	58,87	14	8	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2028338	31L16	58,87	14	9	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2028339	31L16	58,87	15	9	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2028340	31L16	58,86	16	8	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2028341	31L16	58,86	16	9	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2028342	31L16	58,86	15	7	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2028343	31L16	58,86	15	8	2006-10-10	2014-10-09	Active
Matamec Explorations Inc	2047009	31L15	58,81	20	47	2007-01-11	2015-01-10	Active
Matamec Explorations Inc	2056515	31L16	58,97	3	12	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056516	31L16	58,98	3	13	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056517	31L16	58,97	4	12	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056518	31L16	58,97	4	13	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056519	31L16	58,96	5	13	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056520	31L16	58,96	5	14	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056521	31L16	58,95	6	14	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056522	31L16	58,95	6	15	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056523	31L16	58,94	7	16	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056524	31L16	58,94	7	17	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056525	31L16	58,93	8	17	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056526	31L16	58,93	8	18	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056527	31L16	58,92	9	19	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056528	31L16	58,91	10	20	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056529	31L16	58,91	11	19	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056530	31L16	58,91	11	20	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056531	31L16	58,9	12	20	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056532	31L16	58,89	13	19	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056533	31L16	58,89	13	20	2007-02-21	2015-02-20	Active
Matamec Explorations Inc	2056753	31L16	58,95	6	9	2007-02-22	2015-02-21	Active
Matamec Explorations Inc	2056755	31L16	58,93	8	8	2007-02-22	2015-02-21	Active
Matamec Explorations Inc	2169500	31L16	58,98	3	14	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169501	31L16	58,98	3	15	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169502	31L16	58,98	3	16	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169503	31L16	58,97	4	14	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169504	31L16	58,97	4	15	2008-08-06	2014-08-05	Active
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Matamec Explorations Inc	2169508	31L16	58,95	6	16	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169509	31L16	58,95	6	17	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169510	31L16	58,94	7	18	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169511	31L16	58,94	7	19	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169512	31L16	58,94	7	20	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169513	31L16	58,94	7	21	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169514	31L16	58,93	8	19	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169515	31L16	58,93	8	20	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169516	31L16	58,93	8	21	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169517	31L16	58,92	9	20	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169518	31L16	58,92	9	21	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169519	31L16	58,92	9	22	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169520	31L16	58,91	10	21	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169521	31L16	58,92	10	22	2008-08-06	2014-08-05	Active

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
Matamec Explorations Inc	2169522	31L16	58,91	11	21	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2169523	31L16	58,91	11	22	2008-08-06	2014-08-05	Active
Matamec Explorations Inc	2182300	31L15	58,97	3	59	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182301	31L15	58,96	4	58	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182302	31L15	58,94	6	56	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182303	31L15	58,93	7	56	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182304	31L15	58,92	8	55	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182306	31L16	58,93	8	5	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182309	31L16	58,92	9	7	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182310	31L16	58,92	9	11	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182311	31L16	58,92	9	12	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182312	31L16	58,91	10	7	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182313	31L16	58,91	10	11	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182314	31L16	58,91	10	12	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182315	31L16	58,9	11	7	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182316	31L16	58,9	11	12	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182317	31L16	58,89	12	7	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182318	31L16	58,89	12	9	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182319	31L16	58,89	12	10	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182320	31L16	58,89	12	11	2009-04-15	2015-04-14	Active
Matamec Explorations Inc	2182321	31L16	58,89	12	12	2009-04-15	2015-04-14	Active
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Matamec Explorations Inc	2188249	31L15	58,96	4	59	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188250	31L15	58,92	8	54	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188251	31L15	58,91	9	53	2009-09-10	2013-09-09	Active
Matamec Explorations Inc	2188252	31L16	58,98	2	1	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188253	31L16	58,98	2	3	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188254	31L16	58,97	3	8	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188255	31L16	58,93	8	14	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188256	31L16	58,92	9	8	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188257	31L16	58,92	9	10	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188258	31L16	58,91	10	8	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188259	31L16	58,9	11	8	2009-09-10	2015-09-09	Active
Matamec Explorations Inc	2188260	31L16	58,9	11	11	2009-09-10	2015-09-09	Active
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Matamec Explorations Inc	2188734	31L15	58,93	7	58	2009-09-16	2015-09-15	Active
Matamec Explorations Inc	2188735	31L15	58,92	8	58	2009-09-16	2015-09-15	Active
Matamec Explorations Inc	2190399	31L15	58,97	3	56	2009-09-30	2013-09-29	Active
Matamec Explorations Inc	2190400	31L15	58,97	3	57	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190401	31L15	58,97	3	58	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190402	31L15	58,96	4	54	2009-09-30	2013-09-29	Active
Matamec Explorations Inc	2190403	31L15	58,96	4	55	2009-09-30	2013-09-29	Active
Matamec Explorations Inc	2190404	31L15	58,96	4	56	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190405	31L15	58,96	4	57	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190406	31L15	58,95	5	54	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190407	31L15	58,95	5	55	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190408	31L15	58,95	5	56	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190409	31L15	58,95	5	57	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190410	31L15	58,94	6	54	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190411	31L15	58,94	6	55	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190412	31L15	58,93	7	54	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190413	31L15	58,93	7	55	2009-09-30	2015-09-29	Active
Matamec Explorations Inc	2190414	31L16	58,99	1	1	2009-09-30	2013-09-29	Active
Matamec Explorations Inc	2190415	31L16	58,99	1	2	2009-09-30	2013-09-29	Active
Matamec Explorations Inc	2190416	31L16	58,99	1	3	2009-09-30	2013-09-29	Active
Matamec Explorations Inc	2194864	31L15	58,99	1	55	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194865	31L15	58,99	1	56	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194866	31L15	58,99	1	57	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194867	31L15	58,99	1	58	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194868	31L15	58,99	1	59	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194869	31L15	58,99	1	60	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194870	31L15	58,98	2	55	2009-11-19	2013-11-18	Active

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
Matamec Explorations Inc	2194871	31L15	58,98	2	56	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194872	31L15	58,98	2	57	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194873	31L15	58,98	2	58	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2194874	31L15	58,98	2	59	2009-11-19	2015-11-18	Active
Matamec Explorations Inc	2194875	31L15	58,98	2	60	2009-11-19	2015-11-18	Active
Matamec Explorations Inc	2194876	31L15	58,97	3	55	2009-11-19	2013-11-18	Active
Matamec Explorations Inc	2247352	31L16	58,91	11	27	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247353	31L16	58,91	11	28	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247354	31L16	58,91	11	29	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247355	31L16	58,91	11	30	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247356	31L16	58,91	11	31	2010-08-24	2014-08-23	Active
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Matamec Explorations Inc	2247358	31L16	58,9	12	28	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247359	31L16	58,9	12	29	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247360	31L16	58,9	12	30	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247361	31L16	58,9	12	31	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247362	31L16	58,89	13	24	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247363	31L16	58,89	13	25	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247364	31L16	58,89	13	26	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247365	31L16	58,89	13	27	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247366	31L16	58,89	13	28	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247367	31L16	58,89	13	29	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247368	31L16	58,89	13	30	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247369	31L16	58,89	13	31	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247370	31L16	58,88	14	23	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247371	31L16	58,88	14	24	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247372	31L16	58,88	14	25	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247373	31L16	58,88	14	26	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247374	31L16	58,88	14	27	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247375	31L16	58,88	14	28	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247376	31L16	58,88	14	29	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247377	31L16	58,88	14	30	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247378	31L16	58,88	14	31	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247379	31L16	58,87	15	23	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247380	31L16	58,87	15	24	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247381	31L16	58,87	15	25	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247382	31L16	58,87	15	26	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247383	31L16	58,87	15	27	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247384	31L16	58,87	15	28	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247385	31L16	58,87	15	29	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247386	31L16	58,87	15	30	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247387	31L16	58,87	15	31	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247388	31L16	58,86	16	23	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247389	31L16	58,86	16	24	2010-08-24	2014-08-23	Active
Matamec Explorations Inc	2247921	31L16	58,98	3	19	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247922	31L16	58,98	3	20	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247923	31L16	58,98	3	21	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247924	31L16	58,98	3	22	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247925	31L16	58,97	4	19	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247926	31L16	58,97	4	20	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247927	31L16	58,97	4	21	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247928	31L16	58,97	4	22	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247929	31L16	58,97	4	23	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247930	31L16	58,96	5	24	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247931	31L16	58,96	5	25	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247932	31L16	58,96	5	26	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247933	31L16	58,96	5	27	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247934	31L16	58,96	5	28	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247935	31L16	58,95	6	24	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247936	31L16	58,95	6	25	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247937	31L16	58,95	6	26	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247938	31L16	58,95	6	27	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247939	31L16	58,95	6	28	2010-08-30	2014-08-29	Active

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
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Matamec Explorations Inc	2247942	31L16	58,94	7	26	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247943	31L16	58,94	7	27	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247944	31L16	58,94	7	28	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247945	31L16	58,93	8	24	2010-08-30	2014-08-29	Active
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Matamec Explorations Inc	2247947	31L16	58,93	8	26	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247948	31L16	58,94	8	27	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247949	31L16	58,94	8	28	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247950	31L16	58,93	9	27	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247951	31L16	58,93	9	28	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247952	31L16	58,93	9	29	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247953	31L16	58,93	9	30	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247954	31L16	58,93	9	31	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247955	31L16	58,92	10	27	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247956	31L16	58,92	10	28	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247957	31L16	58,92	10	29	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247958	31L16	58,92	10	30	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2247959	31L16	58,92	10	31	2010-08-30	2014-08-29	Active
Matamec Explorations Inc	2248176	31L16	58,94	8	34	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248177	31L16	58,95	6	29	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248178	31L16	58,95	6	30	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248179	31L16	58,95	6	31	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248180	31L16	58,96	6	32	2010-08-31	2014-08-30	Active
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Matamec Explorations Inc	2248185	31L16	58,95	7	31	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248186	31L16	58,95	7	32	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248187	31L16	58,95	7	33	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248188	31L16	58,95	7	34	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248189	31L16	58,94	8	29	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248190	31L16	58,94	8	30	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248191	31L16	58,94	8	31	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248192	31L16	58,94	8	32	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248193	31L16	58,94	8	33	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248194	31L16	58,93	9	32	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248195	31L16	58,93	9	33	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248196	31L16	58,93	9	34	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248197	31L16	58,92	10	32	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248198	31L16	58,92	10	33	2010-08-31	2014-08-30	Active
Matamec Explorations Inc	2248199	31L16	58,92	10	34	2010-08-31	2014-08-30	Active
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Matamec Explorations Inc	2248213	31L16	58,87	15	33	2010-08-31	2014-08-30	Active
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Matamec Explorations Inc	2355846	31L09	59,07	22	13	2012-07-23	2014-07-22	Active
Matamec Explorations Inc	2355847	31L09	59,07	22	14	2012-07-23	2014-07-22	Active
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Matamec Explorations Inc	2355867	31L09	59,05	24	6	2012-07-23	2014-07-22	Active
Matamec Explorations Inc	2355868	31L09	59,05	24	7	2012-07-23	2014-07-22	Active
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Matamec Explorations Inc	2355871	31L09	59,06	24	14	2012-07-23	2014-07-22	Active
Matamec Explorations Inc	2355872	31L09	59,06	24	15	2012-07-23	2014-07-22	Active
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Matamec Explorations Inc	2355874	31L09	59,06	24	17	2012-07-23	2014-07-22	Active
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Matamec Explorations Inc	2355876	31L09	59,04	25	2	2012-07-23	2014-07-22	Active
Matamec Explorations Inc	2355877	31L09	59,04	25	3	2012-07-23	2014-07-22	Active
Matamec Explorations Inc	2355878	31L09	59,04	25	4	2012-07-23	2014-07-22	Active
Matamec Explorations Inc	2355879	31L09	59,04	25	5	2012-07-23	2014-07-22	Active
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Matamec Explorations Inc	2355882	31L09	59,05	25	12	2012-07-23	2014-07-22	Active
Matamec Explorations Inc	2355883	31L09	59,05	25	13	2012-07-23	2014-07-22	Active
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Matamec Explorations Inc	2360097	31L09	59,02	28	6	2012-08-06	2014-08-05	Active
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Matamec Explorations Inc	2360099	31L09	59,02	28	8	2012-08-06	2014-08-05	Active
Matamec Explorations Inc	2360100	31L09	59,01	29	9	2012-08-06	2014-08-05	Active
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Matamec Explorations Inc	2360103	31L09	59	30	9	2012-08-06	2014-08-05	Active
Matamec Explorations Inc	2360104	31L09	59	30	10	2012-08-06	2014-08-05	Active
Matamec Explorations Inc	2360105	31L09	59	30	11	2012-08-06	2014-08-05	Active
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Matamec Explorations Inc	2375923	31L09	59,02	28	22	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375924	31L09	59,01	29	19	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375925	31L09	59,01	29	20	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375926	31L09	59,01	29	21	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375927	31L09	59,01	29	22	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375928	31L09	59	30	19	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375929	31L09	59	30	20	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375930	31L09	59,01	30	21	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375931	31L09	59,01	30	22	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375932	31L16	59	1	19	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375933	31L16	59	1	20	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375934	31L16	59	1	21	2013-01-18	2015-01-17	Active

Owner	Claim CDC #	NTS	Surface (ha)	Row	Column	Registry Date	Expiry Date	Status
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Matamec Explorations Inc	2375936	31L16	58,99	2	20	2013-01-18	2015-01-17	Active
Matamec Explorations Inc	2375937	31L16	58,99	2	21	2013-01-18	2015-01-17	Active
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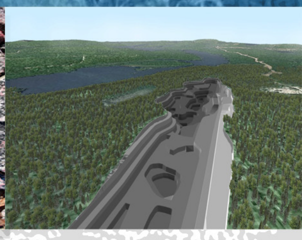
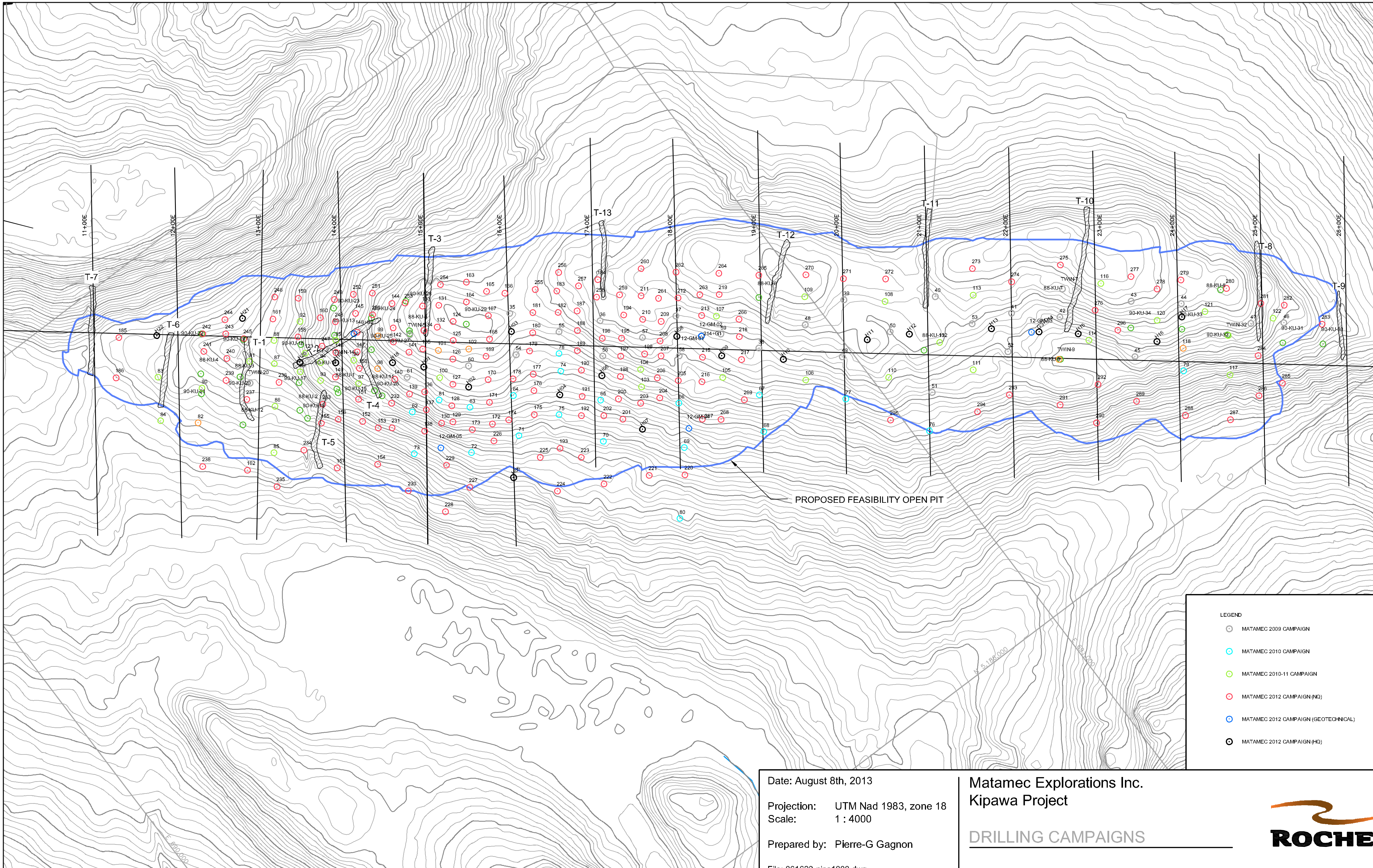


APPENDIX 3- Geology



Date: August 8th, 2013

Projection: UTM Nad 1983, zone 18

Scale: 1 : 4000

Prepared by: Pierre-G Gagnon

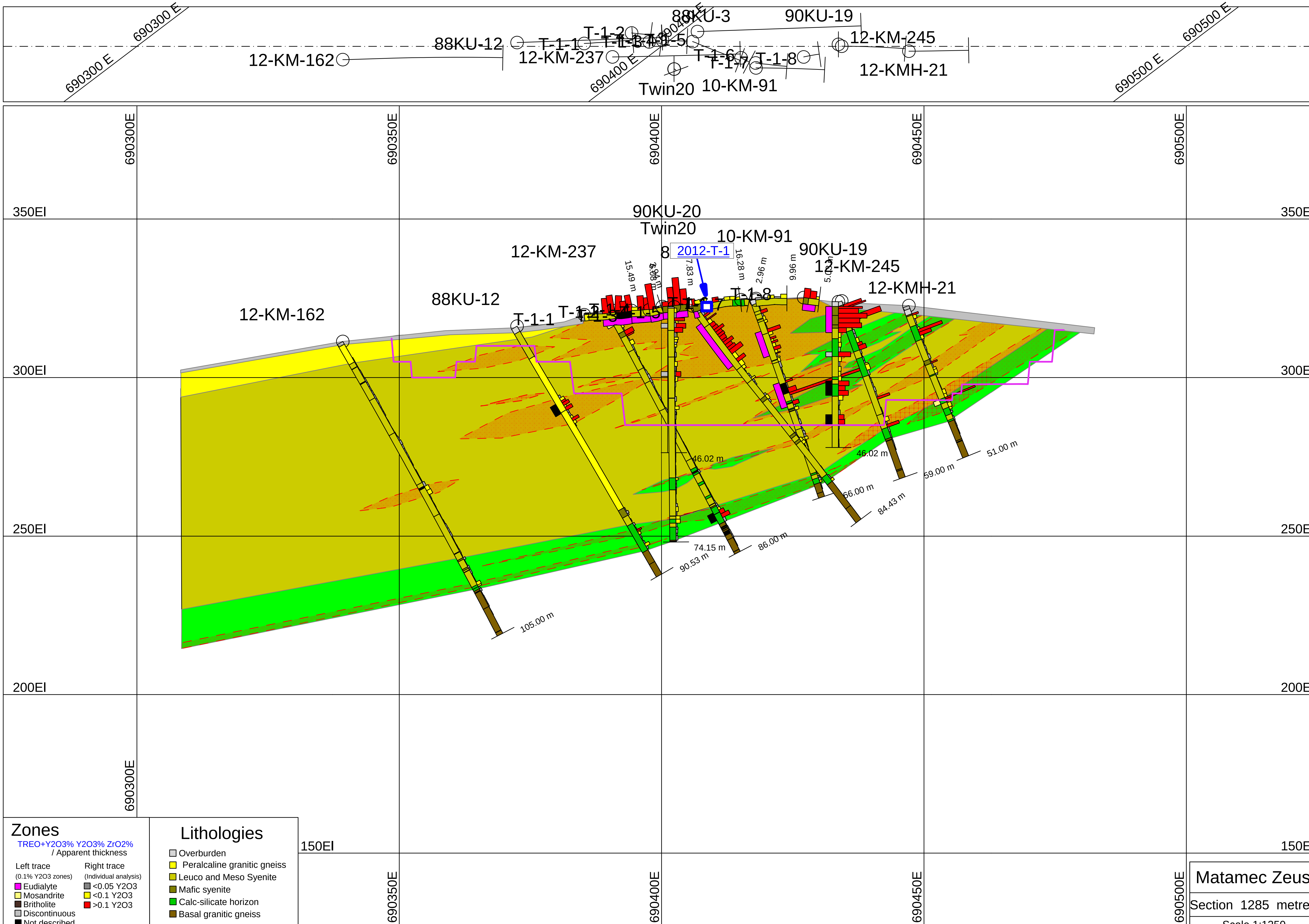
File: 061623-nips1000.dwg

Matamec Explorations Inc.

Kipawa Project

DRILLING CAMPAIGNS

ROCHE



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690400 E
690500 E
88KU-3
90KU-19
12-KM-245
88KU-12
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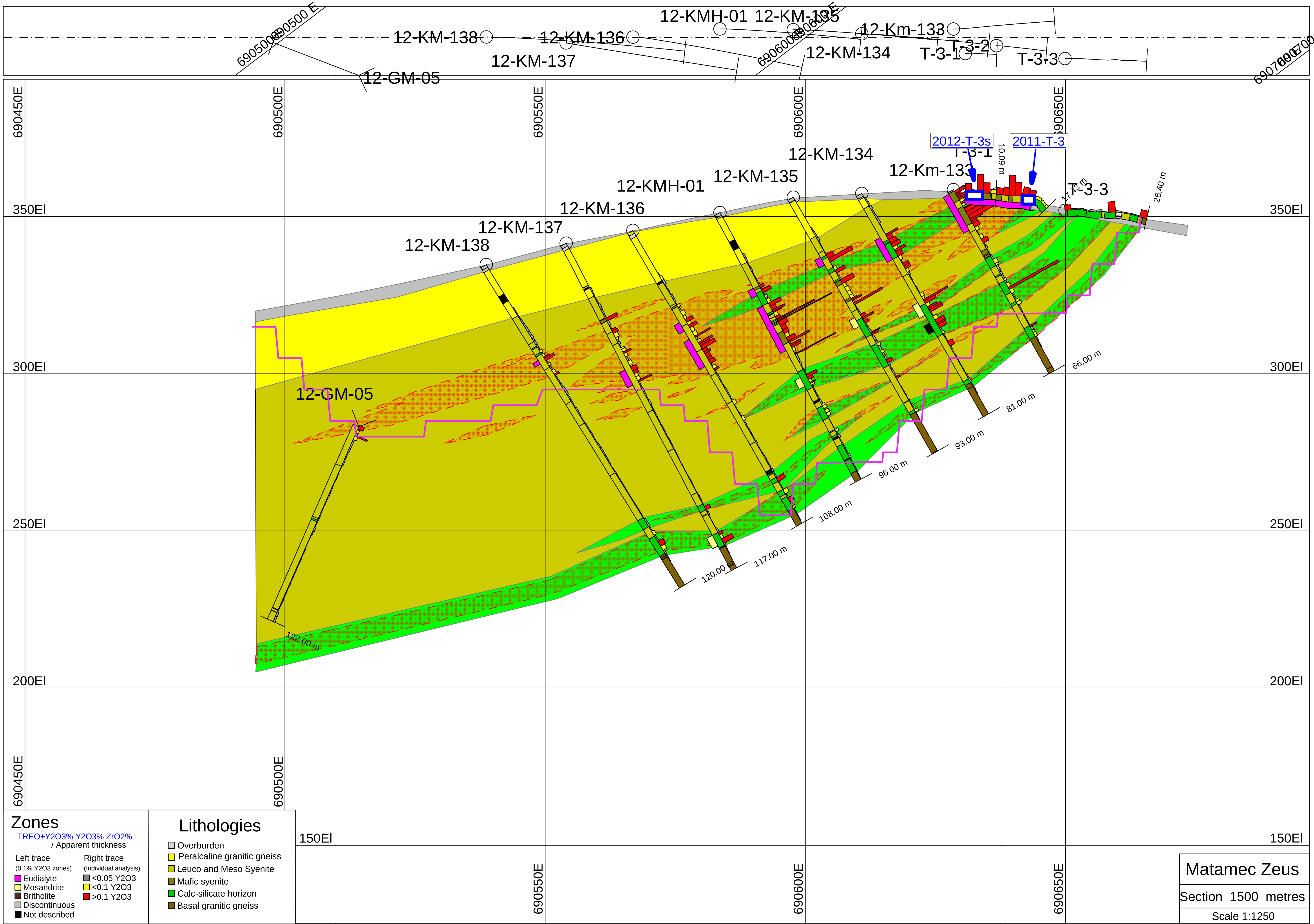
12-KM-237
T-1-1
T-1-2
T-1-5
T-1-6
T-1-7
T-1-8
12-KMH-21
Twin20
10-KM-91
690300E
690350E
690400E
690450E
690500E
350El
300El
250El
200El
150El
90KU-20
Twin20
10-KM-91
90KU-19
12-KM-245
12-KMH-21
12-KM-237
2012-T-1
88KU-12
12-KM-162
T-1-1
T-1-8
15.49 m
7.83 m
16.28 m
2.96 m
9.96 m
46.02 m
46.02 m
51.00 m
59.00 m
66.00 m
84.43 m
86.00 m
74.15 m
90.53 m
105.00 m
Zones
TREO+Y2O3% Y2O3% ZrO2%
/ Apparent thickness
Left trace
(0.1% Y2O3 zones)
Eudialyte
Mosandrite
Britholite
Discontinuous
Not described
Right trace
(Individual analysis)
<0.05 Y2O3
<0.1 Y2O3
>0.1 Y2O3
Lithologies
Overburden
Peralcaline granitic gneiss
Leuco and Meso Syenite
Mafic syenite
Calc-silicate horizon
Basal granitic gneiss
Matamec Zeus
Section 1285 metres
Scale 1:1250



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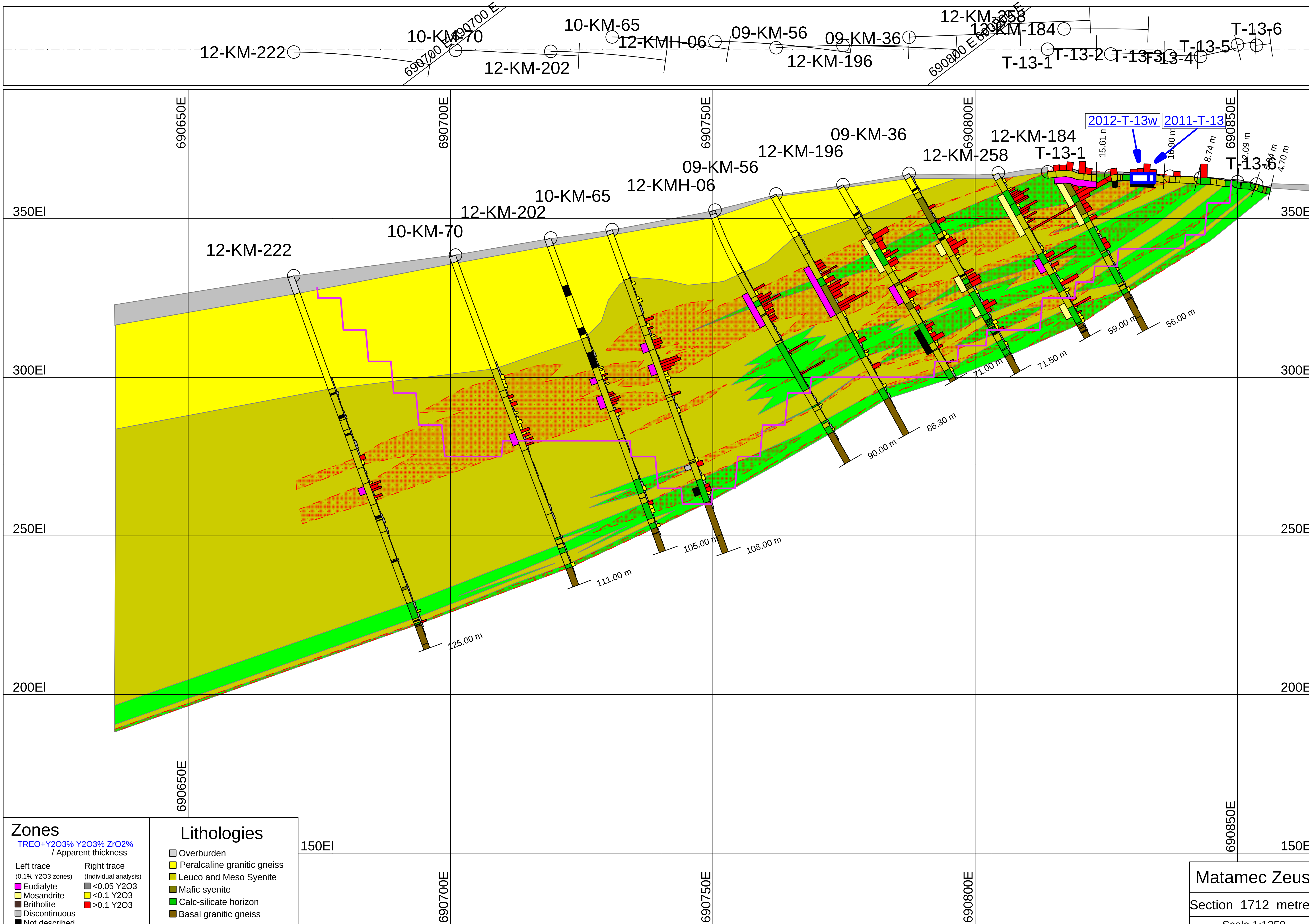
12-KM-137
12-KM-136
12-KMH-01
12-KM-135
12-KM-134
12-Km-133
12-GM-05
T-3-1
T-3-2
T-3-3
690500 E
690600 E
690700 E
690450E
690500E
690550E
690600E
690650E
350El
300El
250El
200El
150El
2012-T-3s
2011-T-3
10.09 m
26.40 m
66.00 m
81.00 m
93.00 m
96.00 m
108.00 m
117.00 m
120.00 m
122.00 m
Zones
TREO+Y2O3% Y2O3% ZrO2%
/ Apparent thickness
Left trace
(0.1% Y2O3 zones)
Eudialyte
Mosandrite
Britholite
Discontinuous
Not described
Right trace
(Individual analysis)
<0.05 Y2O3
<0.1 Y2O3
>0.1 Y2O3
Lithologies
Overburden
Peralcaline granitic gneiss
Leuco and Meso Syenite
Mafic syenite
Calc-silicate horizon
Basal granitic gneiss
Matamec Zeus
Section 1500 metres
Scale 1:1250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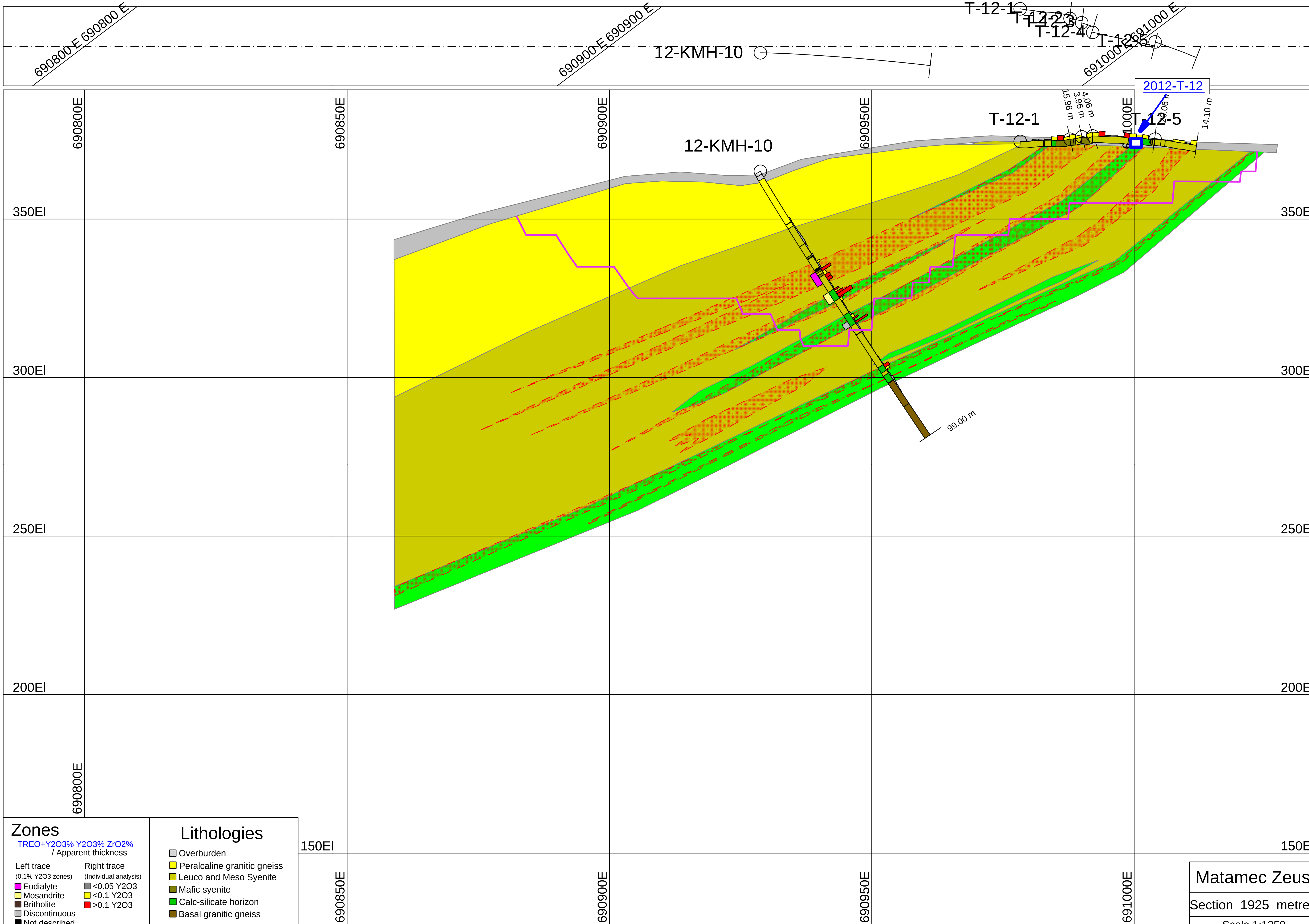
10-KM-70
12-KM-202
10-KM-65
12-KMH-06
09-KM-56
12-KM-196
09-KM-36
12-KM-258
12-KM-184
T-13-1
T-13-2
T-13-3
T-13-4
T-13-5
T-13-6
690700 E
690800 E
2012-T-13w
2011-T-13
690650E
690700E
690750E
690800E
690850E
350El
300El
250El
200El
150El
125.00 m
111.00 m
105.00 m
108.00 m
90.00 m
86.30 m
71.00 m
71.50 m
59.00 m
56.00 m
15.61 m
16.90 m
8.74 m
12.09 m
4.70 m
Zones
TREO+Y2O3% Y2O3% ZrO2%
/ Apparent thickness
Left trace
(0.1% Y2O3 zones)
Eudialyte
Mosandrite
Britholite
Discontinuous
Not described
Right trace
(Individual analysis)
<0.05 Y2O3
<0.1 Y2O3
>0.1 Y2O3
Lithologies
Overburden
Peralcaline granitic gneiss
Leuco and Meso Syenite
Mafic syenite
Calc-silicate horizon
Basal granitic gneiss
Matamec Zeus
Section 1712 metres
Scale 1:1250



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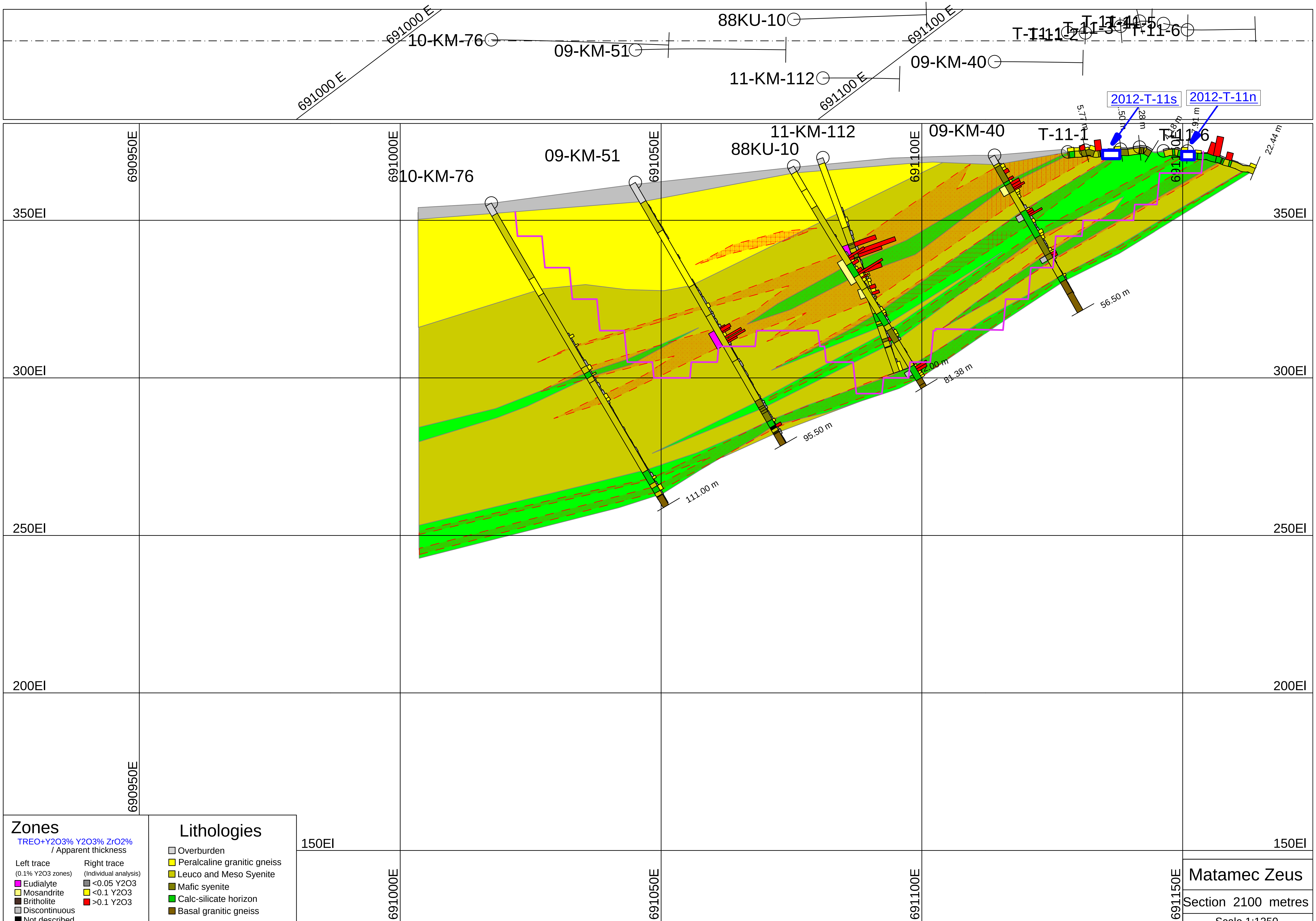
690900 E
691000 E
12-KMH-10
T-12-1
T-12-2
T-12-3
T-12-4
T-12-5
2012-T-12
15.98 m
3.96 m
4.06 m
14.10 m
99.00 m
690800E
690850E
690900E
690950E
691000E
350El
300El
250El
200El
150El
Zones
TREO+Y2O3% Y2O3% ZrO2%
/ Apparent thickness
Left trace
(0.1% Y2O3 zones)
Eudialyte
Mosandrite
Britholite
Discontinuous
Not described
Right trace
(Individual analysis)
<0.05 Y2O3
<0.1 Y2O3
>0.1 Y2O3
Lithologies
Overburden
Peralcaline granitic gneiss
Leuco and Meso Syenite
Mafic syenite
Calc-silicate horizon
Basal granitic gneiss
Matamec Zeus
Section 1925 metres
Scale 1:1250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T-11-2
T-11-3
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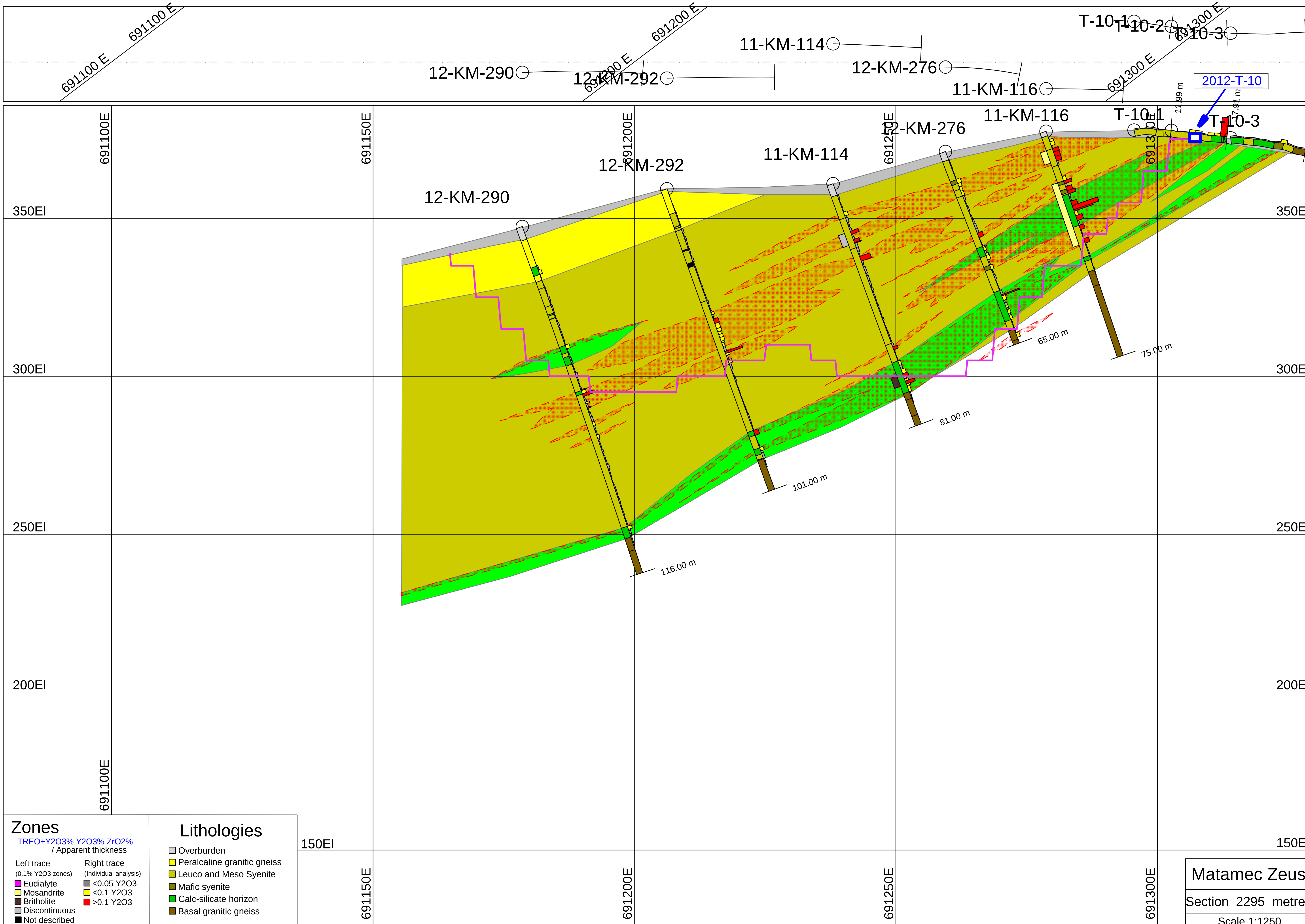
T-11-5
T-11-6
691000 E
691100 E
2012-T-11s
2012-T-11n
690950E
691000E
691050E
691100E
691150E
350El
300El
250El
200El
150El
111.00 m
95.50 m
81.38 m
56.50 m
22.44 m
Zones
TREO+Y2O3% Y2O3% ZrO2%
/ Apparent thickness
Left trace
(0.1% Y2O3 zones)
Eudialyte
Mosandrite
Britholite
Discontinuous
Not described
Right trace
(Individual analysis)
<0.05 Y2O3
<0.1 Y2O3
>0.1 Y2O3
Lithologies
Overburden
Peralcaline granitic gneiss
Leuco and Meso Syenite
Mafic syenite
Calc-silicate horizon
Basal granitic gneiss
Matamec Zeus
Section 2100 metres
Scale 1:1250



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12-KM-292
11-KM-114
12-KM-276
11-KM-116
T-10-1
T-10-2
T-10-3
2012-T-10
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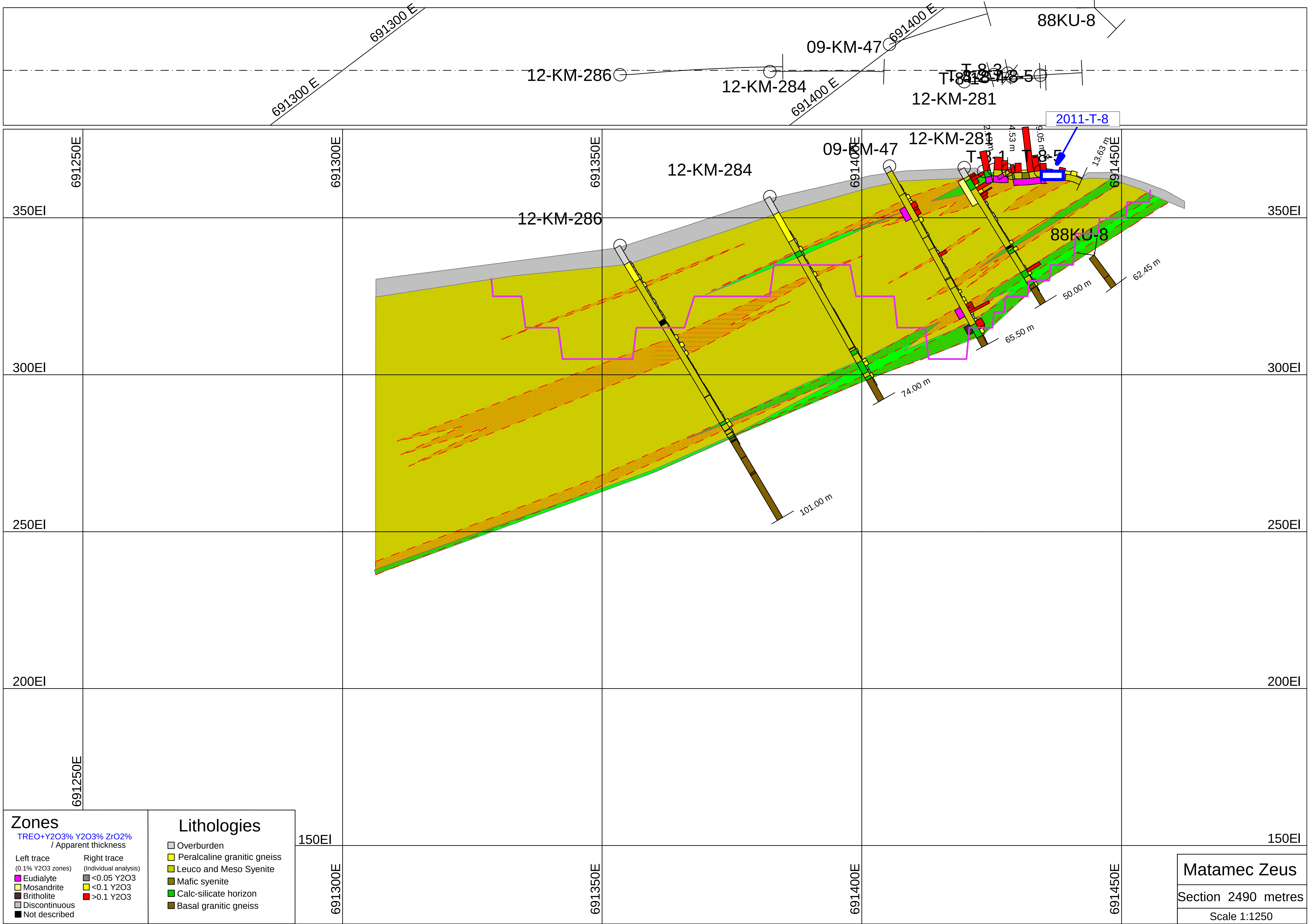
691200 E
691300 E
691100E
691150E
691200E
691250E
691300E
350El
300El
250El
200El
150El
116.00 m
101.00 m
81.00 m
65.00 m
75.00 m
11.99 m
24.11 m
Zones
TREO+Y2O3% Y2O3% ZrO2%
/ Apparent thickness
Left trace
(0.1% Y2O3 zones)
Eudialyte
Mosandrite
Britholite
Discontinuous
Not described
Right trace
(Individual analysis)
<0.05 Y2O3
<0.1 Y2O3
>0.1 Y2O3
Lithologies
Overburden
Peralcaline granitic gneiss
Leuco and Meso Syenite
Mafic syenite
Calc-silicate horizon
Basal granitic gneiss
Matamec Zeus
Section 2295 metres
Scale 1:1250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691400 E
88KU-8
09-KM-47
12-KM-286
12-KM-284
12-KM-281
2011-T-8
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691300E
691350E
691400E
691450E
350El
300El
250El
200El
150El
101.00 m
74.00 m
65.50 m
50.00 m
62.45 m
13.63 m
Zones
TREO+Y2O3% Y2O3% ZrO2%
/ Apparent thickness
Left trace
(0.1% Y2O3 zones)
Eudialyte
Mosandrite
Britholite
Discontinuous
Not described
Right trace
(Individual analysis)
<0.05 Y2O3
<0.1 Y2O3
>0.1 Y2O3
Lithologies
Overburden
Peralcaline granitic gneiss
Leuco and Meso Syenite
Mafic syenite
Calc-silicate horizon
Basal granitic gneiss
Matamec Zeus
Section 2490 metres
Scale 1:1250

CRC 126 Savoie Val D'Or, Qc

Memorandum

To:	Bertho Caron	V.P. Project, Development & Construction MATAMEC
From:	Robert Crépeau	CRC
Date:	28/08/2013	
Re:	SGS Mineral Resource Review	Kipawa Project

Introduction

A new block model was built by SGS-Geostat and forward to CRC on January 21 for review. The model name was BM01; several corrections were made later on. The final model name is BM12 and received on January 31. From BM01 to BM12, several minor corrections were made but in essence the model remains the same. The files received to date comprise block model data, composite files for all mineralized zones, a description of the methodology and parameters used to interpolate the block grades in the model and a set of x-sections showing block grades and composite grades. The work carried out by CRC does not include any verification of assays, geological interpretation nor Qa-Qc. Our work focus on a verification of the block model and mineral resource estimate to assure that it is representative of the mineralization found at Kipawa. The Kipawa rare earth mineralization is a multi-element deposit that should be treated using Net Metal Return value in place of element grades for interpretation and for publication. For the purpose of this report and comparison to the previous estimation, we have selected to use the TREO and/ or TREE grade as key element that is representative of all others. The comparison is more direct since we don't have to deal with difference in process recovery nor with fluctuation in metal price. Following additional density measurement, SGS-Geostat has increased the density of the Eudialyte Zone from 2.86 t/m^3 to 2.88 t/m^3 and from 2.86 t/m^3 to 2.92 t/m^3 for the Mosandrite and Britholite zones (0.7% and 2% increase).

Mineralized zones interpretation

The three mineralized zones were interpreted on x-sections. The 2D mineralized envelopes were meshed to create 3d solids by SGS-Geostat and further validated by Matamec. Criterion used for the interpretation is based on grade values from the assay file. Following that, SGS-Geostat has calculated 1.5m down hole composites inside the individual mineralized solids and inside the syenite. Each composite was flag with a code corresponding to its zone. Each composite contains 18 values; 14 rare earth elements, Y, Zr, Th and U.

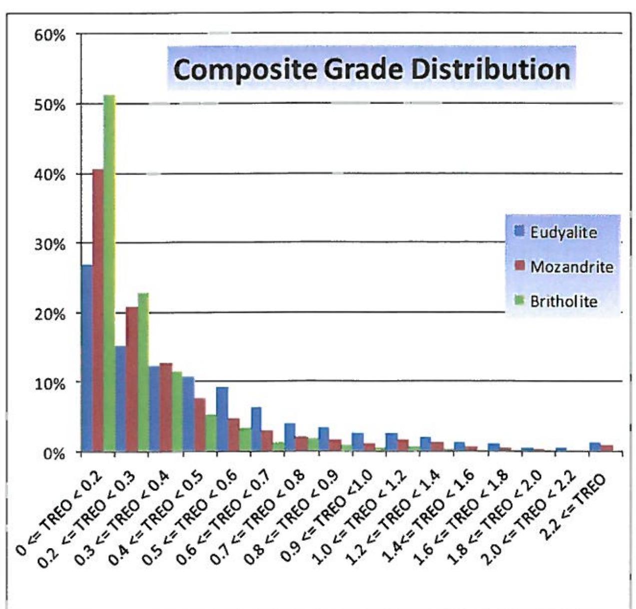
Statistics were run on the composite data, summary is tabled below.

Statistics Composite				
% TREO	Eudyalite	Mozandrite	Britholite	All
Count	4177	2147	1229	7553
Min	0.009	0.013	0.009	0.009
Max	5.141	5.206	3.469	5.206
Mean	**0.489**	**0.357**	**0.259**	**0.414**
Median	0.357	0.235	0.196	0.280
Stdev	0.473	0.415	0.228	0.435
C.V.	96.8%	116.4%	88.2%	105.1%

As shown in the table, the average grade of the three mineralized zone vary for each of them. The mineral resources grade would follow the same trend. The coefficient of variation (C.V.) is in the order of 100% which is reasonable.

The grade distribution table for the composites shows that the population of the three zones are highly skewed, particularly for the Mosandrite and Britholite Zones. Composite grade below 0.2% TREO represents 41% and 51% of the respective population. This, suggest the presence of narrow High Grade mineralization or the inclusion of lower grade mineralization for sake of continuity (Meaning discontinuous zones).

		Mineralized Zones		
Bins	**ALL**	**Eudyalite**	**Mosandrite**	**Britholite**
0 <= TREO < 0.2	35%	27%	41%	51%
0.2 <= TREO < 0.3	18%	15%	21%	23%
0.3 <= TREO < 0.4	12%	12%	13%	12%
0.4 <= TREO < 0.5	9%	11%	8%	5%
0.5 <= TREO < 0.6	7%	9%	5%	3%
0.6 <= TREO < 0.7	5%	6%	3%	1%
0.7 <= TREO < 0.8	3%	4%	2%	2%
0.8 <= TREO < 0.9	2%	3%	2%	1%
0.9 <= TREO <1.0	2%	3%	1%	1%
1.0 <= TREO < 1.2	2%	3%	2%	1%
1.2 <= TREO < 1.4	2%	2%	1%	0%
1.4<= TREO < 1.6	1%	1%	1%	0%
1.6 <= TREO < 1.8	1%	1%	1%	0%
1.8 <= TREO < 2.0	0%	1%	0%	0%
2.0 <= TREO < 2.2	0%	0%	0%	0%
2.2 <= TREO	1%	1%	1%	0%



The composite file contains two set of data, composites coming from the drill holes (1.5m down-hole comps) and surface sampling samples. These lasts were composited along the length of the trenches (1.5m long) and are oriented slightly oblique to the mineralized zone. In general the trench samples are higher in grade than the drill hole samples. Their true thicknesses are significantly smaller than the one coming from the drill holes (See table below)

Composite statistics						
Zones	Trenches			DDH		
	Count	TREE (PPM)	Thickness (m)	Count	TREE (PPM)	Thickness (m)
Eudialyte	239	6564	0.19	3938	3969	1.34
Mozandrite	80	1466	0.23	2067	1067	1.33
Britholite	13	569	0.31	1214	791	1.31
Total	**332**	**5101**	**0.20**	**7219**	**2604**	**1.33**

The use of trench samples having the same weight in the grade interpolation could result in an overestimation of the block grade in vicinity of the trenches. Considering the small amount of surface samples vs DH samples, the effect on the global mineral resources is not significant. As improvement for future estimation, trench samples should be composited in a direction similar to drill holes.

Variography

In order to verify the spatial continuity of the mineralized zones, variograms were modelled for the Eudialyte, the Mosandrite and the Britholite mineralized zones. The variograms are characterized by a very high nugget effect representing 60% to 80% of the sill (Variance). This is was it his called in the industry poor variograms.

Search Ellipsoid

For the first time the grades were interpolated using a system of three passes. The first pass utilises a short range ellipsoid, the second is carried out using radii twice the first ones and the last is done using radii about three times the ones used in the first pass. The previous estimations were done using only one pass equivalent to the largest one of 2013 estimate, except for the North-South direction that was slightly shorter.

Minimum and maximum composites used for the grade interpolation have been increased in 2013. The maximum composites allowed per hole remain the same but the minima and maxima were raise. With the actual drill holes density, the raise of the minimum does not have any impact while the raise of the maximum could slightly lead to an increase of the smoothing of the grade (probably not significant here).

The three pass system used here does not have a significant impact on the grade interpolation but can reduce the computing time. For most blocks, the maximum is reach in the first pass. A two or three pass strategy is usually utilised to reduce the smearing of the high values in situation of widely spaced drill holes and to classify the mineral resources. Say pass one is measured, second pass correspond to indicated and so on.

Grade interpolation

The block grades were interpolated individually for the 18 elements present in the database inside the three mineralized zones and the syenite. Ordinary Kriging was used for the rare earth elements inside the three main mineralized zones while invd^2 was used for the other elements (Zr, U, Th). The blocks located within the syenite were estimated using the invd^2 for all elements. The grade of each element was further converted into oxides values using appropriate conversion factors and sum out to determine LREO, HREO & TREO content (Light, Heavy and Total Rare Earth Oxides).

Classification

For the first time the model contains measured resource in addition to the indicated and inferred categories present in the previous estimation. The classification scheme is based on drill holes density as follows:

Measured Resource:	25m x 25m
Indicated Resource:	50m x 50m
Inferred Resource:	Greater than 50m x 50m

Classification is same as for the 2011- 2012 estimation. The measured resource is located on the western part of the deposit while the indicated fill up the eastern portion.

Block model Review

The 2013 block model differs from the previous one by the grade interpolation technique used and by the addition of 16,152 of infill drilling (195 DH).

In 2013, the grade interpolation was done using a Kriging technique in comparison to the invd^2 used in previous estimates. In general the Ordinary Kriging (OK) method gives a smoother grade distribution compare to the inverse distance method. It produces a larger amount of low grade mineralization and a lower amount of high grade mineralization than other methods.

Mineral Resources Comparison

	Mineral Resource Comparison (TREO >= 0.0%)						
Zone	2011		2013		2013 / 2011	2013 / 2011	2013 / 2011
	Tonnes	% TREO	Tonnes	% TREO	Tonnes	% TREO	Oxides
Eudialyte	14,337,000	0.443	16,605,814	0.412	116%	93%	108%
Mosandrite	5,378,000	0.414	7,687,243	0.348	143%	84%	120%
Britholite	6,181,000	0.305	6,587,279	0.259	107%	85%	91%
TOTAL	**25,895,000**	**0.404**	**30,880,336**	**0.364**	**119%**	**90%**	**107%**

The mineral inventory numbers could differ from SGS-Geostat and are only indicative in this report. The mineralization present in the syenite is not accounted.

The 2013 mineral inventory (Cut-off TREO>= 0) shows an increase of the tonnage of 19% and a grade reduction of 10%. About 1.3% comes from the new density and the remaining has to come from the delineation of larger mineralized zones.

The 2013 drilling program was design to upgrade mineral resource from Inferred to Indicated and a large part of the Indicated were upgraded into the measured category. For feasibility study, only measured and Indicated mineral resources can be used for the mine design and scheduling while for the PEA in 2011 Roche used the three categories. The drilling program was successful to upgrade the mineral resource as shown in the following table.

	2013			2011			**2013/2011**
M & I	**K-Tonnes**	**% TREO**	**Tonnes Ox**	**K-Tonnes**	**% TREO**	**Tonnes Ox**	**Grade**
>= 0.0	27,065	0.375	*101,441*	18,720	0.420	*78,706*	*89%*
>= 0.2	23,518	0.406	*95,497*	17,645	0.435	*76,820*	*93%*
>= 0.3	15,464	0.487	*75,387*	12,472	0.512	*63,856*	*95%*
>= 0.4	9,516	0.576	*54,768*	8,249	0.596	*49,174*	*97%*
>= 0.5	5,525	0.668	*36,930*	4,988	0.693	*34,584*	*96%*

	2013			2011			**2013/2011**
INFERRED	**K-Tonnes**	**% TREO**	**Tonnes Ox**	**K-Tonnes**	**% TREO**	**Tonnes Ox**	**Grade**
>= 0.0	3,816	0.284	*10,831*	7,175	0.361	*25,895*	*79%*
>= 0.2	3,123	0.309	*9,653*	6,805	0.371	*25,242*	*83%*
>= 0.3	1,356	0.393	*5,331*	3,842	0.463	*17,807*	*85%*
>= 0.4	412	0.512	*2,110*	2,011	0.572	*11,512*	*89%*
>= 0.5	146	0.640	*932*	985	0.706	*6,953*	*91%*

	2013			2011			2013/2011
ALL	K-Tonnes	% TREO	Tonnes Ox	K-Tonnes	% TREO	Tonnes Ox	Grade
>= 0.0	30,880	0.364	*112,272*	25,895	0.404	*104,601*	*90%*
>= 0.2	26,641	0.395	*105,149*	24,450	0.417	*102,061*	*95%*
>= 0.3	16,820	0.480	*80,717*	16,314	0.501	*81,663*	*96%*
>= 0.4	9,928	0.573	*56,878*	10,260	0.591	*60,687*	*97%*
>= 0.5	5,671	0.668	*37,862*	5,973	0.695	*41,537*	*96%*

Cut-off based on % TREO

The difference in grade decrease inversely to the cut-off grade (Higher cut-off grade = smaller grade difference). This means that the 2012 model contains a larger proportion of lower grade mineralization. The source of this grade decrease could be multiple such as new drill results, grade interpolation technique, estimation parameters, change in the interpretation of the mineralized zones, etc.

A good point to mention is that the grade increase from the Inferred Class to the Indicated and from Indicated to Measured. The best defined mineralization carried the higher grade material (See table below).

Class	Zone	No Cut-Off		TREO >= 0.2		TREO >= 0.3	
		Tonnes	% TREO	Tonnes	% TREO	Tonnes	% TREO
MEASURED	Eudialyte	6,243,000	0.509	5,936,000	0.527	5,051,000	0.575
	Mosandrite	3,840,000	0.353	3,129,000	0.396	2,060,000	0.473
	Britholite	1,859,000	0.263	1,278,000	0.309	584,000	0.380
	Sub-total	**11,942,000**	**0.421**	**10,343,000**	**0.460**	**7,695,000**	**0.532**
INDICATED	Eudialyte	8,292,000	0.371	7,702,000	0.386	5,268,000	0.448
	Mosandrite	3,436,000	0.336	2,749,000	0.379	1,688,000	0.462
	Britholite	3,395,000	0.262	2,724,000	0.284	814,000	0.371
	Sub-total	**15,123,000**	**0.339**	**13,175,000**	**0.363**	**7,770,000**	**0.443**
M & I	Eudialyte	14,535,000	0.430	13,638,000	0.447	10,318,000	0.510
	Mosandrite	7,276,000	0.345	5,878,000	0.388	3,747,000	0.467
	Britholite	5,253,000	0.263	4,002,000	0.292	1,398,000	0.372
	Sub-total	**27,064,000**	**0.375**	**23,518,000**	**0.406**	**15,463,000**	**0.487**
INFERRED	Eudialyte	2,071,000	0.284	1,676,000	0.312	859,000	0.379
	Mosandrite	411,000	0.402	370,000	0.427	279,000	0.489
	Britholite	1,334,000	0.247	1,077,000	0.264	219,000	0.328
	Sub-total	**3,816,000**	**0.286**	**3,123,000**	**0.307**	**1,357,000**	**0.398**

Total may not match due to rounding

According to the 2011 PEA report, the operational cut-off grade should be around 0.2-0.3 % TREO or equivalent NMR). The mineral inventory to use in the coming pit optimization study would be slightly smaller than the one used for the PEA study. At 0.2 – 0.3 % TREO cut-off, the tonnage and the grade would be lower by few percent resulting in a loss of 6% - 8% in oxide content (See table below).

	2013 M + I			2011 All Categories			Variation (2013 / 2011)		
	K-Tonnes	% TREO	Tonnes Ox	K-Tonnes	% TREO	Tonnes Ox	K-Tonnes	% TREO	Tonnes Ox
>= 0.0	27,065	0.375	101,441	25,895	0.404	104,601	105%	93%	97%
>= 0.2	23,518	0.406	95,497	24,450	0.417	102,061	96%	97%	94%
>= 0.3	15,464	0.487	75,387	16,314	0.501	81,663	95%	97%	92%
>= 0.4	9,516	0.576	54,768	10,260	0.591	60,687	93%	97%	90%
>= 0.5	5,525	0.668	36,930	5,973	0.695	41,537	93%	96%	89%

X-Section Review

A series of 70 x-sections were prepared by SGS-Geostat and forward to CRC. The drawings contain the block model grades, drill holes, composite grades, mineralized zones and PEA pit outline. Visually we have compare block grade to composite grade. For the majority of the sections, the local grade variation present in the drill hole composites is express in the block model but it is difficult to conclude on the accuracy. For the whole deposit, the block grade distribution is quite homogeneous.

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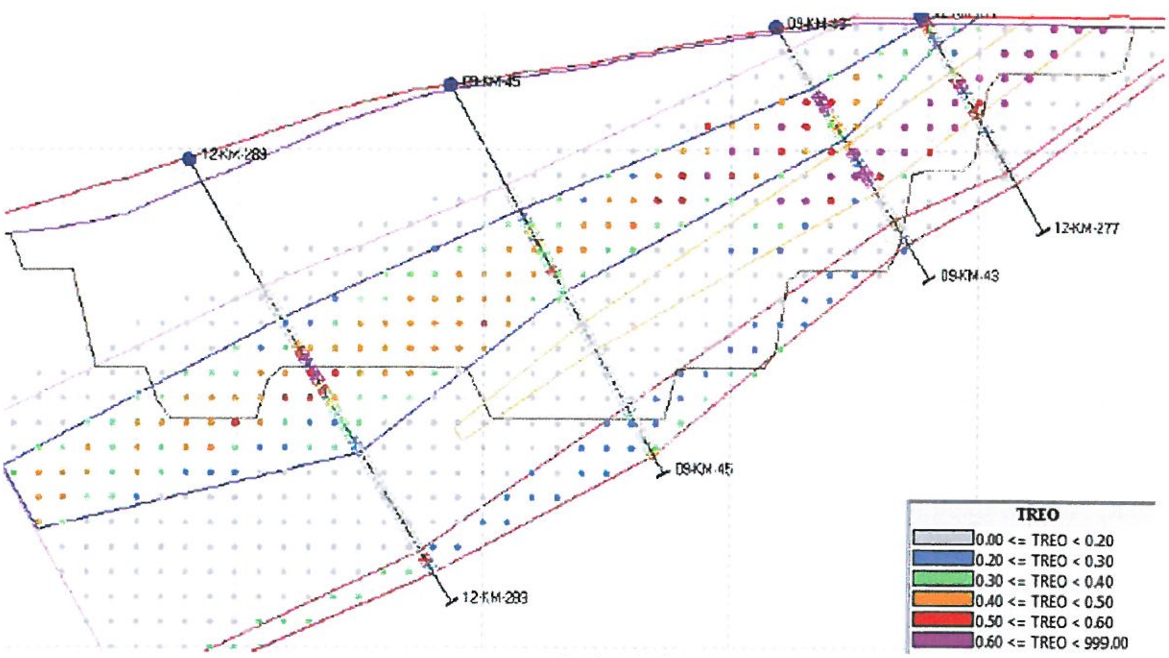


Section 2345

Discussion

Using the most recent information, SGS-Geostat has generated a new block model. This model is different from the previous ones by the use of smaller blocks (10m x 5m x 5m in place of 10m x 10m x 5m) and more importantly by the use of Ordinary Kriging in place of inverse distance square (invd^2) as grade interpolation method. In general, the Ordinary Kriging technique produces a smoother grade distribution than inverse distance. In addition, the different variograms modelled on the mineralized zones show a very high nugget effect ranging from 60% to 80% of the total variance. This high nugget effect (Co) is important and impact significantly the grade distribution. When using a high Co, the weight a composite located away from a block is then more important during the grade interpolation. Depending of the other parameters used, it could increase the smoothing. The end results would be that the proportion of high grade mineralization would decrease and the proportion of lower grade material would increase in comparison to the inverse distance method.

During 2012, the western part of the deposit was drilled on a 25m x 25m DH spacing while the eastern part was infill to 50m x 50m to upgrade the mineral resource into measured and indicated categories. The program was successful to outline measured mineral resources sufficient for five years of production and reduced the inferred resources by ± 50%. The global mineral inventory was increased by some 5 million of tonnes of material grading less than 0.2% TREO. This can be the results of an optimistic interpretation of the mineralized zones or the inclusion of low grade mineralization for sake of continuity. The mineral inventory to be used for the pit optimisation (M &I) would be slightly smaller than the one used for the PEA (M + I + I). This could be compensate by the used of higher Rare Earth price and/or better process recovery.

The limits of the mineralized zones were established with the use of rare earth element grade. In a situation of multi elements having different selling price, it is preferable to use the Net Metal Revenue, (N.M.R) which is an equivalent of the N.S.R. value used in massive sulphide deposits to delimit the mineralized zones. With this method you do not have to guess about including or excluding any given values. The more accurate are the limits, the more accurate would be the mineral inventory. The inclusion of low grade material results in the dilution of the nearby higher grade material reducing the amount of blocks above cut-off grade.

Inverse distance^2 Block Model

Following the first steps of validation and discussion with SGS-Geostat, we commonly agreed on our observation that shows a decrease in TREO grade in the new Ordinary Kriging model (OK). Following that, SGS has run a new block model using the invD^2 grade interpolation technique combine with the 2013 data files. The result is as expected. At no cut-off the mineral inventory is identical (Tonnes, grade & metal content). This means that the global decrease in grade (all categories TREO >< 0.00%) is coming from the new method but from new drilling results or from a new interpretation of the mineralized zones. At cut-off of 0.2-0.3 % TREO, OK shows a tonnage higher by ± 10 % and a grade decrease of 6% to 7%.

2013 Block Model Comparison Invd2 vs Ordinary Kriging

Cut Off 0.2 % TREO		Invd²		Ordinary Kriging		Ratio KRG / Id2		
Zone	Class	Tonnage	% TREO	Tonnage	% TREO	Tonnage	% TREO	TREO
		t	%	t	%			
Eudialyte		12,498,134	0.470	13,637,909	0.447	109%	95%	104%
Mosandrite		5,293,274	0.413	5,878,398	0.388	111%	94%	104%
Britholite		3,473,858	0.310	4,001,510	0.292	115%	94%	109%
TOTAL	M + I	**21,265,267**	**0.430**	**23,517,816**	**0.406**	**111%**	**94%**	**104%**
	tonnes Ox		*91,419*		*95,497*			
Eudialyte		1,558,685	0.316	1,675,908	0.312	108%	99%	106%
Mosandrite		350,159	0.443	369,855	0.427	106%	96%	102%
Britholite		1,003,991	0.273	1,077,217	0.264	107%	97%	104%
TOTAL	Inferred	**2,912,835**	**0.316**	**3,122,980**	**0.309**	**107%**	**98%**	**105%**
	tonnes Ox		*9,211*		*9,653*			

Cut Off 0.3 % TREO		Invd²		Ordinary Kriging		Ratio KRG / Id2		
Zone	Class	Tonnage	% TREO	Tonnage	% TREO	Tonnage	% TREO	TREO
		t	%	t	%			
Eudialyte		9,489,247	0.540	10,318,478	0.510	109%	94%	103%
Mosandrite		3,298,688	0.515	3,747,389	0.468	114%	91%	103%
Britholite		1,313,912	0.417	1,398,498	0.374	106%	90%	96%
TOTAL	M + I	**14,101,847**	**0.523**	**15,464,365**	**0.487**	**110%**	**93%**	**102%**
	tonnes Ox		*73,729*		*75,387*			
Eudialyte		724,399	0.405	858,506	0.379	119%	93%	111%
Mosandrite		266,684	0.506	278,853	0.489	105%	97%	101%
Britholite		260,515	0.352	218,569	0.328	84%	93%	78%
TOTAL	Inferred	**1,251,598**	**0.416**	**1,355,928**	**0.393**	**108%**	**95%**	**102%**
	tonnes Ox		*5,203*		*5,331*			

Source: SGS : files/ BM-ISD03pourRobert.xlsx and BM08pourRobert.xlsx

The metal content is slightly higher for the OK technique. This kind of results is in line with our initial thought. So the OK model is correct since it contains some dilution. It can be used as a base case model to run pit optimization. Following that, and mainly after the determination of the cut-off grade and dilution factor, a review of the impact of the OK model should be carried out. As mentioned earlier, OK technique produces an estimate that contains a larger amount of low grade material. If Matamec select a cut-off smaller than in previous estimation, OK tonnage could be over stated, then Block Model (OK) should be review in regards of the inherent dilution content. The OK model inherent dilution could be estimated via geostatistical method such as "AAF" Affine Correction or "I L C " Indirect Lognormal Correction.

A second validation was carried out by SGS-Geostat in regards of the increase of the size of the mineralized zones. As mentioned in our first observations, the Volume of the mineralized zones was increase by about 5 millions of tonnes. Following some calculations we concluded that the additional tonnage carry a grade below 0.2 % TREO which is probably below operational cut-off grade. SGS has compared the thickness of the intersections used to determine the mineralized envelope for the 2011 and 2013 model. The result is that the 2013 intersections are wider than in the previous estimation. This doesn't answer the whole thing. The envelopes can have been also extrapolated optimistically in the other directions. For the moment we are not really concern with it. Following the determination of the opex, the cut- off grade and the bench height, a review of this interpretation will have to be done. The reason behind that is the introduction of low grade material inside a higher grade envelope has the effect of lowering the grade of the adjacent blocks by a smearing effect. So it introduces low grade or waste blocks inside the mineralized zone but also contribute to lower the grade of other blocks.

Conclusion

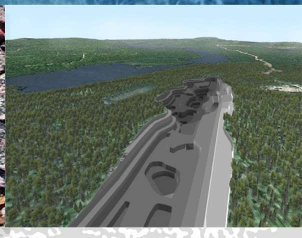
Our review identifies several points showing that the actual Block Model could be over-smoothed due to the use or the Ordinary Kriging technique, high nugget effect and so on. The infill drilling program carried out in 2012 could help to limit the grade smearing. In fact, with a drill hole spacing of 25m x 25m there is not a large room to project ore grade away from real mineralized areas. The effect could be of higher importance in the area the indicated category but a difference of 5% in the mineral inventories coming from two different block models is normal. We do not think that the actual results are very far from the reality. We think that the actual Ordinary Kriging Block Model is representative of the mineralization of the Kipawa deposit and could be used for the envisaged feasibility study. To upgrade the quality of the actual block model, we do recommend additional works mainly to validate the actual results and to reduce inherent dilution as stated in previous sections.

Robert Crépeau

Robert Crépeau, Ing.

CRC working notes are attached to this document

CRC Working Notes



APPENDIX 4- Geotechnical

April 2013

MATAMEC EXPLORATIONS INC. – KIPAWA PROJECT

Geomechanics and Rock Slope Stability Analyses for Kipawa Feasibility Study – CONFIDENTIAL

Submitted to:
Bertho Caron, P.Eng.
Vice President, Project Development and Construction
Matamec Explorations Inc.
1010 Sherbrooke Ouest, Suite 700
Montréal, QC
H3A 2R7

REPORT

Report **Number:** 015-12-1221-0034-Rev0

Distribution:

ecopy: Matamec Explorations Inc., Montréal QC
ecopy: Golder Associés Ltée, Montréal QC

Golder Associés

Executive Summary

Matamec Explorations Inc. (Matamec) retained Golder Associés Ltée (Golder) to provide professional services for the Kipawa Rare Earth Element (REE) Project in the Temiscaming region of Quebec. This report details the geomechanical and hydrogeological investigation and presents the Pit Slope Stability Evaluation and bench geometry recommendations for the proposed Kipawa open pit.

The Kipawa project is located approximately 62 km northeast of the town of Temiscaming, and consists of the development of a heavy rare earth open pit mine extending to a length of about 1.8 km with an average width of 200 m. Based on the original pit design provided by Matamec, the pit is expected to be relatively shallow, that is, about 100 m in depth at its deepest point, but with a maximum inter-ramp slope height of 56 m in rock. The expected mine life of the project is about 13 years, with a total of 19 Mt of ore processed at a rate of 4100 tonnes/day. The site is located on a ridge slope, with a range in elevation from 305 masl to about 355 masl towards the northwest side of the proposed pit. The area is currently largely forested, with a thin veneer of overburden (3 - 5 m typical from current investigation).

The geotechnical and hydrogeological investigation program for the Kipawa project was conducted between August 8 and 21, 2012. This field program included surface mapping, geotechnical core logging of five inclined and oriented boreholes, hydrogeological testing of the boreholes, selection of samples, and point load testing of the rock core. The information from the investigation program has been used to characterize the rock mass, evaluate the structural fabric of the project area, and assess the hydrogeological characteristics of the site. This information was used to determine stable pit slope angles for the proposed pit.

The rock mass at the proposed site consists of a planar slab of syenite of varying composition dipping shallowly to the southwest. Within the syenite unit are lenses of calc-silicate materials, which contain Phlogopite dykes. Mineralization is located as bands or lenses of rare earth elements stacked in three mineralized zones: the Eudialyte, Mosandrite, and Britholite zones. Each zone contains a mix of potentially economic minerals, but the zone name refers to the dominant REE element present within the zones. The zones are stacked with the Eudialyte zone at the top and the Britholite zone at the bottom. The Syenite unit is underlain by a granite biotite gneiss.

The rock mass was subdivided into two main rock types: the Syenite (SY), containing all the syenite variants and the calc-silicate zones, as well as the mineralization; and the Granite Gneiss (GN). The Rock Quality Designations for the SY and GN units are high (98 and 99%, respectively). Rock mass classification for these units indicates that, according to RMR_{76}, the GN and SY units are classified as *Very Good* rock (87 and 82, respectively).

Hydrogeological testing indicates that the rock is of low permeability, suggesting that the inflow into the pit can be easily controlled by conventional dewatering methods and surface water re-direction. For stability assessments, all slopes were assumed dry.

No major structures were identified at the site. Characterization of the discontinuity populations observed a flat lying foliation dipping shallowly to the south, as well as discontinuity sets dipping subvertically to the northeast and steeply to the north, with a few random joint orientations observed. The joints were widely spaced with limited persistence.

Due to the strength of the rock mass and the shallow pit depth, overall slope failure is not expected to be a concern. Determination of acceptable pit slope designs was performed based on kinematic assessments of discontinuity interactions with the proposed pit walls.

The design for the Kipawa pit slopes can be summarized as follows:

- The operating benches will be 10 m in height.
  - Double benching (20 m vertical) may be applied on ultimate slopes in good rock.
- The maximum bench face angle is 70°, where kinematics are favourable. This assumes application of well-controlled trim blasting.
- Minimum catch bench widths for single (i.e. 10 m) benches, determined using the modified Ritchie Formula, shall be 6.5 m. For double (i.e. 20 m high) benches, the minimum catch bench width shall be 8.5 m.
- The design inter-ramp angle varies between 50° and 52°, assuming application of well controlled trim blasting.
- With experience in excavation and assuming favourable structural orientations and dry slope conditions, inter-ramp angles of up to 56° may be achievable. This steepening will be at the discretion of an experienced rock mechanics engineer based on slope performance and blasting and scaling experiences on early benches.
- A detailed geotechnical mapping program should be carried out when the excavation of the pit goes beyond the first bench. This additional information will help to optimize the geologic model and the slope face angles, and to verify the slope design.
- Catch bench width may be increased to reduce the inter-ramp angle to control potential plane or wedge failures at the inter-ramp scale, or to control potential ravelling in specific areas where necessary.
- For slopes exceeding 100 m in height not transected by a ramp, a wider catch bench of 12 m is recommended for every 100 vertical metres as a safety control on rock falls.
- A monitoring program for rock falls and slope movements should be implemented, including the installation of a prism monitoring system. RADAR surveys are an option but may not be required.

The proposed pit design by design sector (slope orientation) is presented in Figure 4 of the attached report.

An alternate design for the pit is also presented, and summarized in Figure 4. The alternate design is based on 5 m bench heights, allowing better selectivity of the ore at the site. The benches for the alternate design are double benched to 10 m, with 7 m berm widths, and the application of trim blasting. This alternate design allows steepening of the bench face angles for the majority of slopes at Kipawa, except where the kinematics are not favourable. The 5 m bench height also allows better selectivity of ore from the deposit.

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APPENDICES

1.0 INTRODUCTION

Golder Associés Ltée (Golder) was retained by Matamec Explorations Inc. (Matamec) to provide professional services for the Kipawa Rare Earth Element (REE) Project in the Temiscaming region of Quebec. This report details the geomechanical investigation and Pit Slope Stability Evaluation. The scope of the services was defined in our proposal no. 002-P2-1221-0034, "Geotechnical/Hydrogeological Investigation and Pit Slope Stability Evaluation," dated May 4, 2012, which was subsequently accepted by Matamec.

This report is part of a series of reports prepared for Matamec for this project. The other reports produced in this series are:

Report No:	Report Title:
005-12-1221-0034	Factual Report – Geomechanics
006-12-1221-0034	Site Visit Report – Mine Waste Management
008-12-1221-0034	Site Selection Report
009-12-1221-0034	Schema – Conceptual
010-12-1221-0034	Kinematic Slope Design Memorandum
011-12-1221-0034	Plan de Restauration Conceptuel
012-12-1221-0034	Plan de Travail Geotechnique

These reports have been prepared as stand-alone documents; however, where required, appropriate references have been made to one or more of the above reports that should be read in conjunction with this report.

2.0 PROPERTY DESCRIPTION AND LOCATION

The Kipawa project is located approximately 62 km northeast of the town of Temiscaming, as shown in Figure 1. The proposed project consists of the development of a heavy rare earth open pit mine extending to a length of about 1.8 km with an average width of 200 m. The pit is expected to be relatively shallow; about 100 m in depth at its deepest point. The expected mine life of the project is about 13 years, with a total of 19 Mt of ore processed at a rate of 4100 tonnes/day. The proposed pit location and orientation is shown in Figure 2.

The site is located on a ridge slope, with a range in elevation from 305 masl to about 355 masl towards the northwest side of the proposed pit. The area is currently largely forested, with a thin veneer of overburden (3 - 5 m typical from current investigation).

3.0 GEOLOGICAL SETTING AND MINERALIZATION

The following section is based on information found in the Preliminary Economic Assessment Study for Kipawa Project (Roche SGS, 2012). It describes the regional geology, including the stratigraphic column, main structural features and deformation phases. The geology at the deposit scale is then discussed, and a description of the mineralization for the project ensues.

3.1 Regional Geology

The Kipawa deposit is located in the Grenville Province of the Canadian Shield, at approximately 55 km south of the contact between the Grenville Province and the Superior Province. The area consists mainly of gneiss with metamorphic grade ranging from green schist to amphibolite and granulite facies.

The regional stratigraphic column is presented in Plate 1 and is summarized in

Table 1, from the bottom to top of the stratigraphic section.

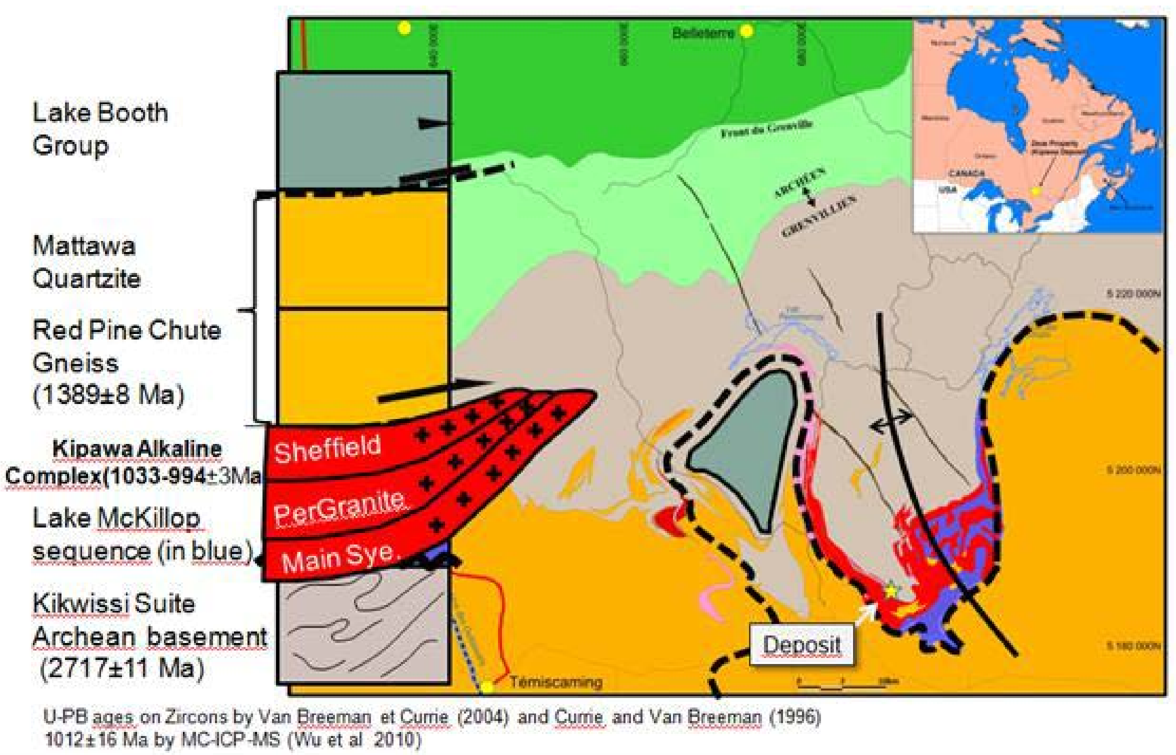


Plate 1: Regional stratigraphic column (after Roche SGS, 2012).

Table 1: Regional Stratigraphic Column

Geological Age	Lithological Group	Rock Type	Structural Description
Archean (2.71 Ga)	Kikwissi Suite	Granite biotite gneiss	Basement gneiss
Not specified in the NI 43-101 report	McKillop Group	Meta-sediments: quartzite, muscovite gneiss, marble	Uncomformable contact with the Kikwissi gneiss
Proterozoic (1.03 Ga)	Kipawa Alkaline Complex	Syenite and granite gneiss	Concordant intrusive
Proterozoic (1.39 Ga)	Red Pine Chute Group	Granite biotite and syenite gneiss	Overlaid by a NW-SE thrust fault during the Grenville orogeny
Not specified in the NI 43-101 report	Matawa Group	Quartzite	
Not specified in the NI 43-101 report	Lake Booth Group	Amphibolite, pelite, granite	Allochthonous rocks overlain by a NW-SE thrust fault during late Grenville orogeny

The Kipawa deposit is contained within the Kipawa Alkaline Complex, an alkaline intrusive that was emplaced around the peak metamorphism of the Grenvillian Orogeny. Rare earth elements are hosted within syenite gneiss and calc-silicate rocks of the Kipawa Alkaline Complex.

Two (2) main deformation phases are reported in the area, both of which occurred during the Grenvillian Orogeny. The first phase, the D1 event, created regional folds trending NE. The second phase, the D2 event, created regional folds trending NW.

Faults striking at 260° (dipping to the north) are observed regionally. Shear zones trending at 65° (dipping to the north) are also common.

3.2 Local Geology

At the site scale, the Kipawa Alkaline Complex shows small-scale internal folding, but at the deposit scale, the Kipawa deposit is nearly undeformed. The Kipawa deposit is located on the west flank of the Sairs Lake Antiform, which was formed during the D2 regional event. The west flank dips to the SW at around 20-30°. The east flank has a more irregular shape. On surface, the Kipawa Alkaline Complex shows a V-shape around the NW-SE fold axis, as can be seen in Plate 1.

The Kipawa Alkaline Complex is divided into two (2) zones: a peralkaline granite gneiss to the SW of the deposit area (structural top) and a syenite gneiss to the NE (structural bottom). The syenite gneiss is the host rock for the rare earth elements (REE) mineralization of the Kipawa deposit. It also has interlayered calc-silicate rocks, which are also mineralized. The syenite gneiss unit is about 50 m thick, and is bounded to the NE by a thin layer of monzonite gneiss and by the granite gneiss from the Kikwissi Suite.

The local geology on a NE-SW cross-section is presented in Plate 2.

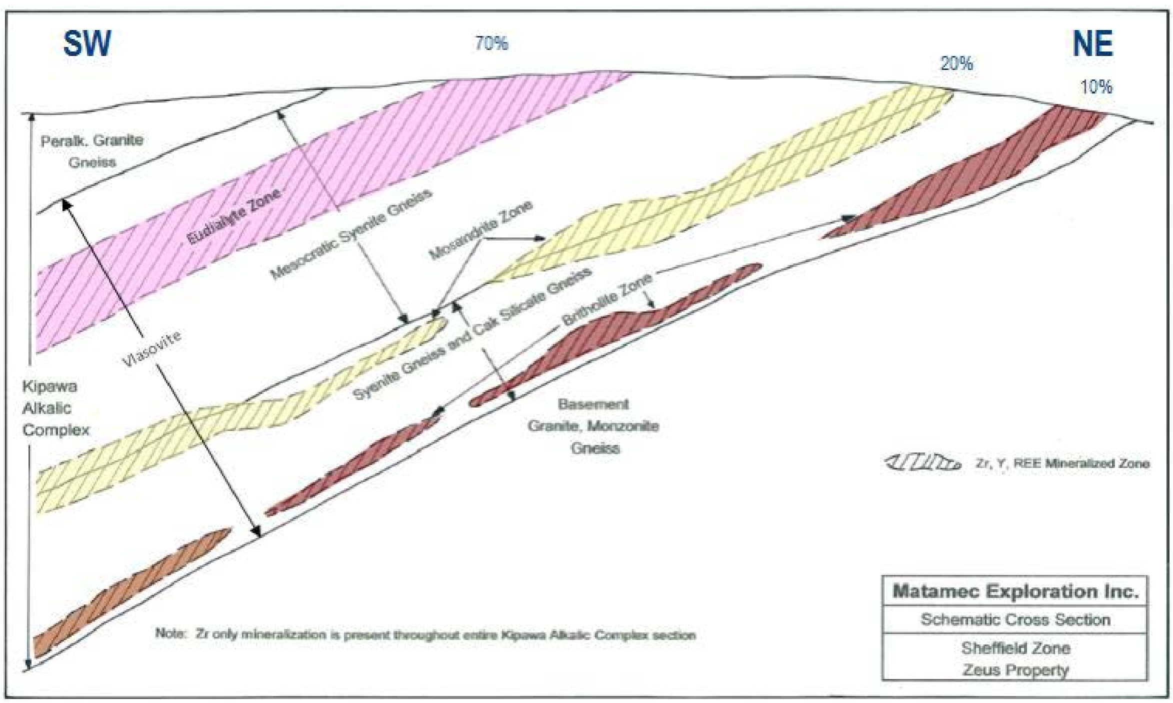


Plate 2: NE-SW cross section of the Kipawa deposit (after Roche SGS, 2012).

The rock types present in the deposit area can be described as follows:

- Peralkaline granite gneiss: This rock type is visually similar to the syenite gneiss, but unmineralized. Decimetric bands of alteration along fractures are observed in the upper five metres (close to surface). It is poorly to moderately foliated.
- Syenite gneiss: This rock type is subdivided into four (4) rock types mainly based on the alkaline content of the rock. Contacts between those sub-units are gradational. The syenite gneiss can contain interlayered calc-silicate bands and some biotite bands.
  - Leucocratic syenite gneiss: massive to moderately foliated, mostly homogeneous with some minerals augens, medium to coarse grained.
  - Mesocratic syenite gneiss: poorly to moderately foliated, contain some minerals augens, medium to coarse grained.
  - Mafic syenite gneiss: poorly to well foliated, medium to very coarse grained.
  - Silver-gray amphibolite: massive.
- Calc-silicate complex: The contacts between these interlayered bands and the syenite gneiss are well-defined. This complex consists of rock with varying content of diopside, feldspar and phlogopite. Marble is also observed. A strongly foliated diopside gneiss unit has also been reported and may be considered part of this complex.
- Monzonite gneiss: This poorly foliated rock type becomes granitic downwards from the syenite contact. It may correspond to a metamorphosed contact with the Archean granitic gneiss.
- Granite gneiss: This rock type is the basement gneiss from the Kikwissi Suite. It is very poorly to moderately foliated.

3.3 Mineralization

Seven (7) deposits are found within Matamec's Zeus property: Kipawa, TH, Surprise, Coin, Falaises, Couleuvre, and PS. Both Kipawa and PS zones are located on the west flank of the Sairs Lake Antiform whereas TH, Coin, Falaises and Couleuvre zones are located on the east flank.

The mineralization in the Kipawa deposit consists mainly of the rare-earth mineral yttrium as well as zirconium, concentrated primarily within the following minerals:

- Eudialyte: Most abundant mineral of the Kipawa deposit, but the least REE enriched. Eudialyte is mostly enriched in zirconium and is often associated with more mafic syenite intervals.
- Mosandrite: Second most important mineral of the Kipawa deposit in terms of REE enrichment and abundance. Mosandrite is a source for yttrium and is mostly associated with more mafic syenite or diopside-feldspar intervals.

- Britholite: Last mineral in terms of abundance, but first in terms of REE enrichment. Britholite is enriched with yttrium. It is associated with marble bands and syenite.
- Vlasovite and its alteration mineral gittinsite are also sources for zirconium. They are found in syenite intervals.

Spatially, vlasovite and gittinsite are distributed uniformly throughout the syenite rock mass. This is not the case for eudialyte, mosandrite and britholite, which are grouped into three distinct enriched zones that are named according to the dominant mineral present in that zone. The enriched zones are described below, from the top of the deposit to the bottom:

- The Eudialyte zone is near the top of the syenite body and is not associated with any calc-silicate banding. This zone contains about 70% of the mineralization.
- The Mosandrite zone is partially hosted within the shallowest calc-silicate horizon. This zone comprises about 20% of the mineralization.
- The Britholite zone is mainly hosted within the deepest calc-silicate horizon which includes a lot of marble. This zone contains about 10% of the mineralization.

All zones cover the same area in plan view, roughly a rectangle oriented NW-SE, 1.45 km long and 200 m wide.

4.0 ENGINEERING GEOLOGY MODEL

4.1 Investigation Program

The geotechnical and hydrogeological investigation program for the Kipawa project was conducted between August 8 and 21, 2012. During the field program, the following tasks were performed by Golder:

- Detailed geotechnical core logging of five (5) inclined, oriented boreholes
- Deviation surveying of boreholes at 40 m intervals
- Photography of drill core in boxes (both wet and dry)
- Selection of 30 rock core samples for laboratory testing
- Hydrogeological testing of boreholes as drilling advanced
- Point Load Testing of core (axial and diametral testing)
- Geotechnical surface mapping of exposed bedrock in exploration trenches within the proposed pit area

The borehole locations and outcrop mapping locations are shown on Figure 2. The information from the investigation program has been used to characterize the rock mass, evaluate the structural fabric of the project area, and assess the hydrogeological characteristics of the site. This information is critical for the determination of stable pit slope angles. Full details of the investigation program are summarized in Appendix A-1; the raw data and data collection techniques are discussed in the factual report (Golder, 2012).

4.2 Characterization of Rock Mass

The rock mass was characterized based on the information collected during the field investigation campaign, which was in turn supplemented by the results of the laboratory testing of samples collected during the field investigation.

Core logging by Matamec geologists divided the core into the following geological units:

- SY Syenite Gneiss
- Leuco Leuco-Syenite Gneiss
- Meso Meso-Syenite Gneiss
- D-F Diopside Feldspar
- S-G Silver-Grey Amphibolite
- PHLO Phlogopite bands
- MAR Marble
- MONZ Monzonite Gneiss

Additional lithologies identified by Matamec at the site include Peralkaline Granitic Gneiss (PerGrn), Mafic-Syenite Gneiss (Mafic), and Granitic Gneiss (GRN).

While these rock types are important from a geology standpoint, simplification was required. As described in Appendix A1, for the purposes of this study, the rock mass was simplified into four basic geotechnical domains. These can be described as follows:

- Syenite (SY), representing the Kipawa Alkalic Complex, and host of the mineralization at the site
- Calc-Silicate Complex (CAL-SIL), usually observed as lenses within the SY unit
- Gneiss (GN), located below the SY unit
- Phlogopite (PH), occurring as bands within the calc-silicate complex; while limited in extent, this unit may be associated with local stability problems within the proposed pit, depending on location

For the rock mass at Kipawa, the CAL-SIL unit occurs as discontinuous lenses within the SY unit, and the PH unit as pods or blebs within the CAL-SIL unit, as shown in Plate 3. The majority of measurements and laboratory testing were performed within the main SY and GN units. The laboratory testing summarized in the Factual Report (Golder 2012) was re-interpreted based on these two main units, and the results are summarized in Appendix A-2. Rock mass classification was also performed for these units, described fully in Appendix A-4. The salient results from these two appendices are summarized in Table 2 below.

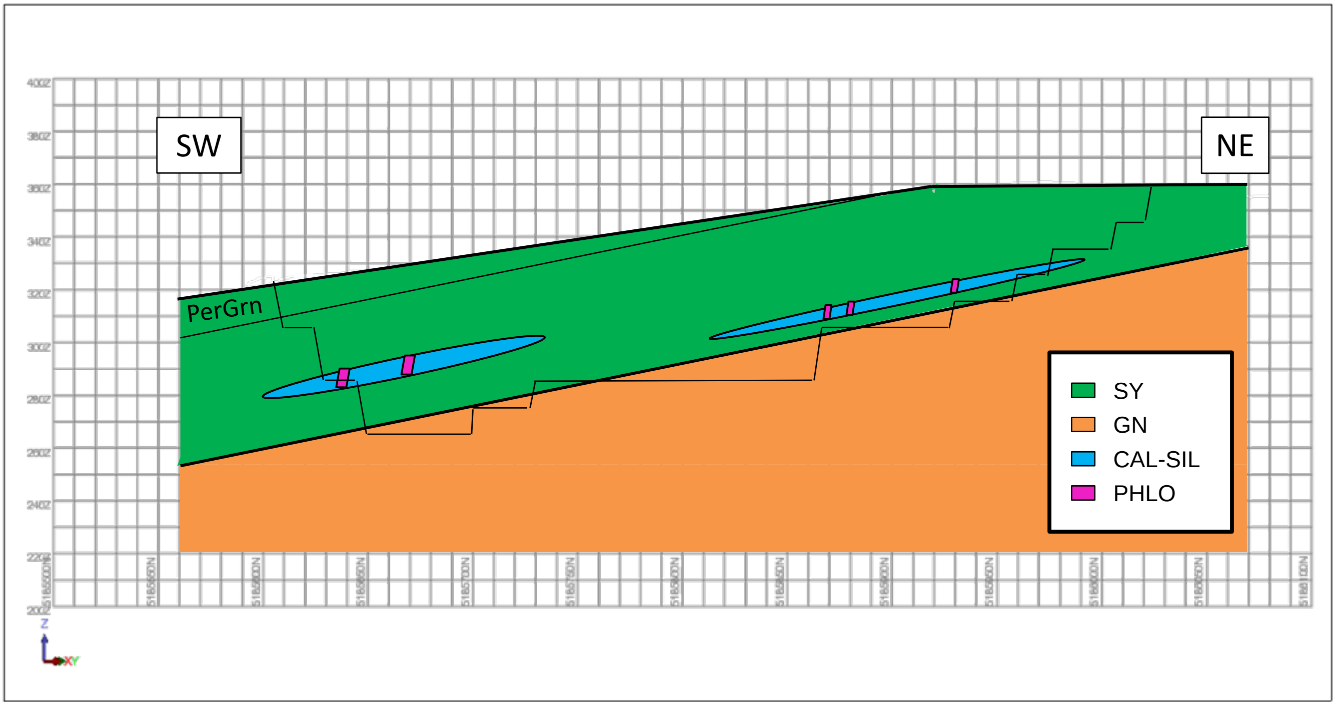


Plate 3: Schematic showing distribution of mine geotechnical domains.

Table 2: Summary of Rock Properties[1]

Rock Type	RQD	Fracturing		Discontinuity Strength Friction Angle (degrees)[2]	UCS (MPa)	m_i[3]	RMR	Q'	GSI
		Fracts/m	Spacing (m)						
SY	98 / 88	0.63 / 1.43	1.6 / 0.7	27°	107 / 79	30	87 / 70	51 / 22	87
GN	99 / 97	0.38 / 1.0	2.6 / 1.0	33°	77 / 56	30	82 / 69	54 / 24	82
Notes:	1. Values are given as Average / Lower Bound. 2. Residual friction angle for joint sets, determined from laboratory direct shear testing. Cohesion = 0 kPa. 3. This parameter was estimated from general guidelines available in RocLab Software (Rocscience™).								

The mineralized zones at Matamec are all located within the SY geotechnical domain; the GN domain represents the waste rock in the footwall of the deposit.

Friction angles from the laboratory testing represent the residual shear strengths of the discontinuities (i.e. the shear strength following significant shearing). Based on the observations made regarding the condition of the discontinuities in the rock mass, the peak friction angles for the rock mass are expected to be higher. For the purposes of the kinematic analyses in Section 6.1, a friction angle of 30° with no cohesion is considered appropriate for all discontinuities. For the purposes of this report, the rock mass classification parameters summarized in Table 2 and in Appendix A-4 were used to estimate rock strengths for input into numerical models, as described in Section 6.2.

4.3 Major Structures and Discontinuities

Major structures have been observed regionally, as described in Section 3.1; however, at the deposit scale, the rock mass is an almost entirely undeformed planar slab dipping gently to the southwest. Because the rock mass is not divided by any major structures and the properties of the two main rock units are so similar, the project area can be considered one structural domain for analyses purposes.

An assessment of the discontinuities mapped on surface and from the core logging is presented in Appendix A-3. A stereoplot showing the concentrations of the measured discontinuity orientations and the major planes is shown in Plate 4. The major plane orientations and descriptions are presented in Table 3. These plane orientations were used for the kinematic assessment of the rock slope design discussed in Section 6.1.

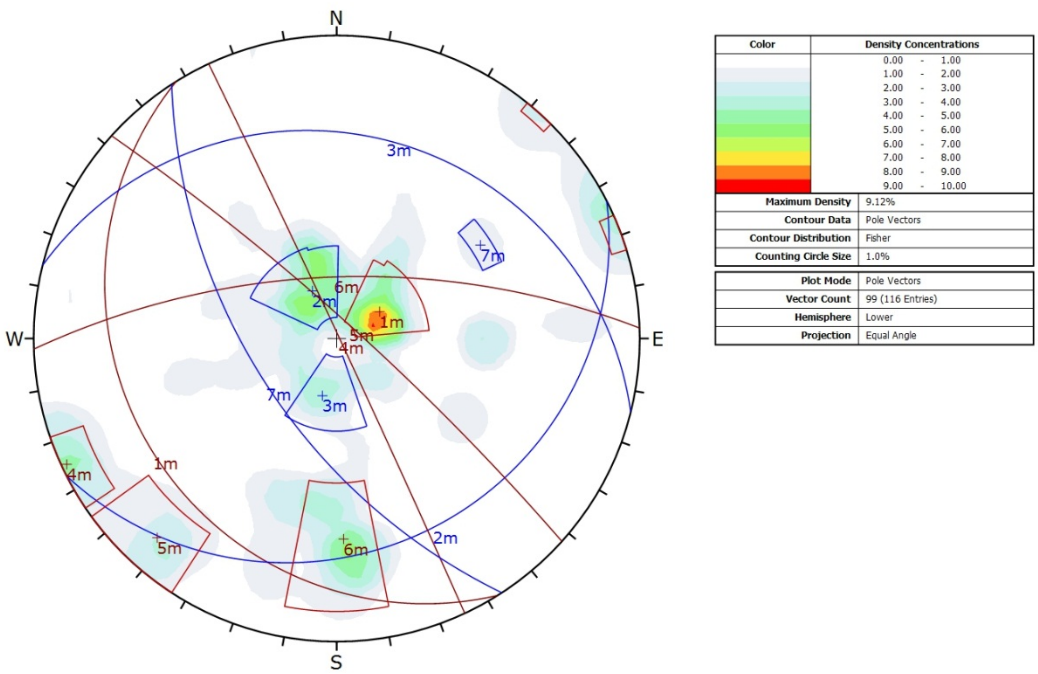


Plate 4: Stereoplot showing discontinuity orientations measured at Kipawa.

Table 3: Discontinuity Sets Identified From Field Program

Set	Dip	Dip Direction	Major/Minor	Description
1	**20**	**236**	**major**	These sets represent the foliation at the site. Main orientation is shallowly dipping to the southwest (Set 1); some variation with dip to southeast (set 2) and to north (set 3).
2	21	155	minor	
3	22	14	minor	
4	**89**	**65**	**major**	Subvertical to steeply northeast dipping major sets are observed across the site. Both sets observed together in the same outcrop.
5	**84**	**41**	**major**	
6	**67**	**358**	**major**	Steeply north-dipping major set.
7	59	237	minor	Minor set dipping moderately to the southwest.

4.4 Principal Elements of Design

The parameters of the main pit can be summarized as follows:

- Pit crest elevations:
  - NE wall: 300 to 380 m
  - SW wall: 305 - 350 m
- Pit floor elevation: 245 m - 295 m, deepest in the SE part of the pit
- Pit length: approximately 1.5 km
- Pit width: 240 m in the southeastern part of the pit; 360 m in the central part of the pit
- Approximate orientation of the pit centreline: 305 degrees

The Kipawa pit will be excavated in competent rock with a combination of flat-lying joints dipping to the southwest, and steeply dipping joints to the northwest and northeast. Because of the competence of the rock mass, it is expected that the slope stability within the pit will be controlled by the orientation of the pit walls relative to the discontinuities. The pit design must be such that the benches retain rock debris from the pit slopes and that the inter-ramp angles do not create formation of too much breakback or debris.

5.0 GROUNDWATER

5.1 Introduction

The objective of the hydrogeological investigation was to gather data to allow for an assessment of the hydraulic conductivity of the rock mass at the site. Five boreholes (GM-12-01 through GM-12-05) were drilled at the site between August 8 and 18, 2012. Hydraulic conductivity data was obtained through packer testing completed in each borehole. A total of 19 packer tests, including 15 falling head tests, one rising head test and two constant head (Lugeon) tests, were completed at various depth intervals within the five boreholes. The hydrogeological investigation also included the measurement of groundwater levels in boreholes completed within the proposed pit boundary, and in selected exploration holes completed in the vicinity of the site.

The following presents the results of the groundwater level measurements and packer testing. The preliminary estimation of pit inflow will be part of a hydrogeological modeling study conducted by Golder Associates Ltd., and will be presented in a separate report.

5.2 Groundwater Level Measurements

Groundwater level measurements were collected from boreholes GM-12-01 through GM-12-03 following the borehole drilling program at the site. At that time, the groundwater levels ranged between 9.59 metres below ground surface (mbgs) at GM-12-03 to greater than 50.6 mbgs at GM-12-02 (i.e. the groundwater level was deeper than the available water level tape could measure). At all three locations, the measured groundwater level was found below the overburden/bedrock contact. Casings were not installed in GM-12-04 and GM-12-05, and the boreholes caved before water levels could be measure.

To gather data on groundwater levels in the vicinity of the proposed pit, water level measurements were collected from a series of exploration boreholes located to the west of the site in late August 2012. At that time, the groundwater levels ranged between 0 mbgs and 28.40 mbgs.

In general terms, the open hole water levels in the geotechnical and exploration holes mirror the site topography. At lower elevations, the depth to groundwater is closer to 0 mbgs; the depth to groundwater increases as one moves up slope, with the maximum depths to groundwater encountered on the crests of the hill.

5.3 Packer Test Results and Discussion

The packer test results are summarized in Table 4. The geological units present in the packer testing intervals are also summarized in the table below, and the complete geology is presented on the borehole logs included in Appendix A of the Factual Report (Golder 2012).

Table 4: Packer Testing Summary

Borehole ID		TESTING INTERVAL INFORMATION			Hydraulic Conductivity Results	
	Interval #	Test Interval Length (m)	Top Interval* (m)	Bottom Interval* (m)	K (m/s)	Geological Units
GM-12-01	1	18.04	13.59	31.63	6E-09	SYE-AMP-DIOF-PHL
	2	28.91	29.91	58.82	2E-08	AMP-SYE-DIOF
	3	50.35	57.41	107.76	1E-08	PHL-SYE-AMP-MOZG
GM-12-02	1	20.26	19.44	39.70	7E-08	SYE-AMP-DIOF
	2	17.58	38.43	56.01	3E-08	SYE-AMP-DIOF-PHL
	3	23.29	51.75	75.04	1E-06	SYE-AMP-MOZG
	4	36.71	73.68	110.39	2E-07	MOZG
	5	31.18	79.21	110.39	7E-08	MOZG
GM-12-03	1	23.47	21.75	45.22	6E-08	SYE-DIOF
	2	36.80	44.05	80.84	4E-08	SYE-PHL-AMP-MOZG
	3	44.95	63.08	108.03	2E-08	MOZG
GM-12-04	1	25.92	11.33	37.25	- -	SYE-PHL
	2	36.80	35.80	72.60	6E-09	SYE-PHL-AMP
	3	36.71	71.24	107.94	1E-08	AMP-SYE-DIOF-PHL-MOZG
GM-12-05	1	23.07	16.40	39.47	4E-08	SYE-PHL
	2	20.17	38.34	58.50	2E-06	SYE-MOZG
	3	20.12	54.74	74.86	3E-08	MOZG-SYE

Notes: * measured vertical from ground surface; SYE: Syenite (meso/leuco); AMP: Amphibolite DIOF: Diopside Feldspar; PHL: Phlogopiteite; MOZG: Monzonite Gneiss

Based on the packer testing results, the hydraulic conductivity of the bedrock at the site varies between 6x10-9 and 2x10-6 metres per second (m/s), with a geometric mean of 4x10-8 m/s. Figure 3 illustrates the variation in hydraulic conductivity with vertical depth. On Figure 1, the hydraulic conductivity results are plotted at the mid-point of the interval tested, and the interval tested is illustrated using vertical bars.

As shown on Figure 3, the majority of the intervals tested at the site (12 of 17 intervals) have a hydraulic conductivity between 1x10-8 m/s and 7x10-8 m/s. For all five borehole locations, the bedrock above approximately 40 metres depth has a hydraulic conductivity equal to or less than 7x10-8 m/s. The highest hydraulic conductivity measured at the site was 2x10-6 m/s at borehole GM-12-05 between 38.34 mbgs and 58.50 mbgs. Based on the borehole log in Appendix A, a section of decreased rock quality designation and/or increased fractures index is present within GM-12-05 between approximately 43 mbgs and 47 mbgs (corresponds to approximately 46.6 to 52 metres along the borehole). This fractured area may be the source of increased hydraulic conductivity at GM-12-05.

Four of the five highest hydraulic conductivity intervals measured at the site were found in borehole GM-12-02. Based on the packer test results for GM-12-02, a zone of increased hydraulic conductivity is present at this location between approximately 56.0 mbgs and 79.2 mbgs. Based on the borehole log in Appendix A, a section of decreased rock quality designation and increased fractures index is present with GM-12-02 at approximately 67.7 mbgs (corresponds to approximately 73.6 metres along the borehole). This fractured area may be the source of increased hydraulic conductivity at GM-12-02.

Boreholes GM-12-02 and GM-12-05, which contain intervals of elevated hydraulic conductivity compared to the remainder of the site, are both located in the northwestern portion of the proposed pit. Based on the packer testing results, a continuous zone of elevated hydraulic conductivity was not encountered in the boreholes at the site, and the zone of elevated conductivity observed at GM-12-02 and GM-12-05 does not appear to extend to the southeast as far as boreholes GM-12-01 and GM-12-04.

6.0 OPEN PIT GEOMECHANICS DESIGN

6.1 Kinematic Analysis

Kinematic analyses of the rock slopes gives an indication of the instability at the bench and inter-ramp scale that can be expected in the rock mass based on the orientations of the discontinuities in the rock mass and the orientations of the walls of the open pit. For the purposes of this assessment, all discontinuities were assigned a design friction angle of 30° and cohesion of 0 kPa. Based on the observations made during core logging, most of the discontinuities measured were planar rough with no infilling, so this friction angle estimate is considered appropriate.

Based on the core logging and field mapping programs, the following observations were made:

- The rock mass is generally intact across foliation; however, bands of weaker rock often occur parallel to foliation, which dips shallowly to the southwest.
- The subvertical fracture traces observed at surface were generally less than 10 m long. The potential for structurally controlled instability is expected to be limited to small scale local failures.
- It is expected that local (bench scale) failures may be controlled by weak bands within the SY unit, and in particular, in the Phlogopite dykes (PHLO) observed in the core. These weak zones will either weather out more rapidly than the surrounding rock mass, or will intersect with larger fractures to create planar wedge-type failures.

6.1.1 Slope Design Assumptions

Bench geometries were developed assuming dewatered slopes. It is assumed that surface runoff will be managed and the groundwater table will be lowered sufficiently in the vicinity of the proposed pit.

The following slope assumptions were made for the purpose of design for the Kipawa pit:

- The overburden at the site is a veneer (3 to 5 m in the geomechanics holes), and slope designs in this material are not addressed.
- The operating benches will be 10 m in height.
  - Double benching (20 m vertical) may be applied on ultimate slopes in good rock.
- Where kinematics are favourable, the maximum bench face angle is 70°. This assumes application of well-controlled trim blasting.
  - Once the operator has experience with proven design and application of pre-split blasting of the bench faces, it may be possible to steepen this angle, as discussed in Section 6.3.
- The minimum catch bench widths for single (i.e. 10 m) benches, determined using the modified Ritchie Formula, shall be 6.5 m. For double (i.e. 20 m high) benches, the minimum catch bench width shall be 8.5 m.
- Catch bench width may be increased to reduce the inter-ramp angle to control potential plane or wedge failures at the inter-ramp scale, or to control potential ravelling in specific areas where necessary.
- For slopes exceeding 100 m in height not transected by a ramp, a wider catch bench of 12 m is recommended for every 100 vertical metres as a safety control on rock falls. Given the less than 100 m overall slope height and the maximum 56 m inter-ramp height from the preliminary pit design, geotechnical benches may not be required on the current ultimate pit plan.
- Potential toppling failures are assumed to apply to +/- 15° of wall dip direction; potential wedges are assumed to occur within +/- 45° of the angle between the dip direction of the wall and the plunge of the wedge intersection. Planar failure is assumed to play a role for planes with a dip direction within +/- 20° of the dip direction of the wall. Planes or wedges with limit equilibrium Factor of Safety of 1.2 or less were considered potential controls on slope design.

On some design sectors, an inter-ramp angle steeper than the plunge or dip of the potential wedge or plane failures considered significant may be recommended. This rationalization may be due to:

- Limited inter-ramp slope height, or assumed to mitigate possible increased risk.
- Limited strike length on adverse wall orientations, such as in concave curved pit walls, where local confinement may mitigate possible increased risk.

6.1.2 Kinematic Slope Design Recommendations

The open pit for the Kipawa project has been broken into five design sectors based on the orientation of the pit walls, as shown in Figure 4. The kinematic assessment for each design sector and the decision table for the choice of slope angle are shown in Appendix A-5. The slope design recommendations based on the kinematic assessment of discontinuities for each design sector are summarized in Table 5. Most sectors can be mined using double benches (20 m height) at bench face angles of 70°, berm widths of 8.5 m and an inter-ramp slope angle of 52°. Design Sector 3, bolded in Table 5, varies from this standard design due to adverse structural orientations. The terminology for the slope design and schematics to illustrate the concept are shown on Figure 4, as are the slope design recommendations.

Table 5: Recommended Conceptual Pit Slope Angles for the Kipawa Rock Slopes

Design Sector	Wall Dip Direction (°)	Bench Face Angle (°)	Vertical Bench Separation (m)	Berm Width (m)	Inter-Ramp Slope Angle (°)
1	217	70	20	8.5	52
2	037	70	20	8.5	52
3	**000**	**67**	**20**	**8.5**	**50**
4	040	70	20	8.5	52
5	090	70	20	8.5	52

6.1.3 Alternate Kinematic Slope Design Recommendations

An alternate slope design is proposed, based on discussions between Golder and Roche. This slope design addresses two slope design changes:

- Reduction of the bench heights to 5 m will provide improved selectivity of the ore within the pit. Final walls would be double benched, giving 10 m vertical separation between benches.
- Application of pre-split / pre-shear wall control allows for potentially steeper bench face angles in competent rock with no strong kinematic controls. For most design sectors, this increases the bench face angle compared to trim blasted final walls, which, based on experience, can produce a 70° bench face angle.

With the exception of Design Sector 3, the discontinuity orientations are favourable to pre-shear bench faces, and allow for steeper bench face angles if pre-splitting is applied. In Design Sector 3, potential failure along a prominent discontinuity set will control the achievable bench face angle. The alternate conceptual pit slope angles for Kipawa based on these assumptions are shown in **Table 6**.

Table 6: Recommended Conceptual Pit Slope Angles for Kipawa Rock Slopes Based on 5-m Bench Heights

Design Sector	Wall Dip Direction (°)	Bench Face Angle (°)	Vertical Bench Separation[1] (m)	Berm Width[2] (m)	Inter-Ramp Slope Angle (°)
1, 2, 4, 5	all others	85	10	7	52
3	**000**	**67**	**10**	**7**	**42**
Notes:	1. Vertical bench separation assumes that double benching is applied to all slopes. 2. The berm width is based on the modified Richie formal with an additional 0.5m for minor crest loss. If significant cress loss occurs, wider berm widths may be required to contain rock fall. The limited maximum inter-ramp heights (56m) are also a mitigating factor.				

6.2 Analysis of Global Wall Stability

6.2.1 Model Construction

To evaluate the overall stability of the rock walls for the Kipawa pit, a numerical model of the ultimate pit was developed using the 2d finite element package Phase 2 (Rocscience™). A typical section was created through the deepest part of the pit, with the slope angles from the kinematic analysis above. A worst-case scenario was adopted in that the pit walls were assumed to be un-interrupted by ramps which would decrease the overall slope angle. The model is shown in Plate 5, with a 100 m deep pit with 52° slope angles. The green material represents the SY (syenite) unit, and the orange represents the GN (granitic gneiss) unit.

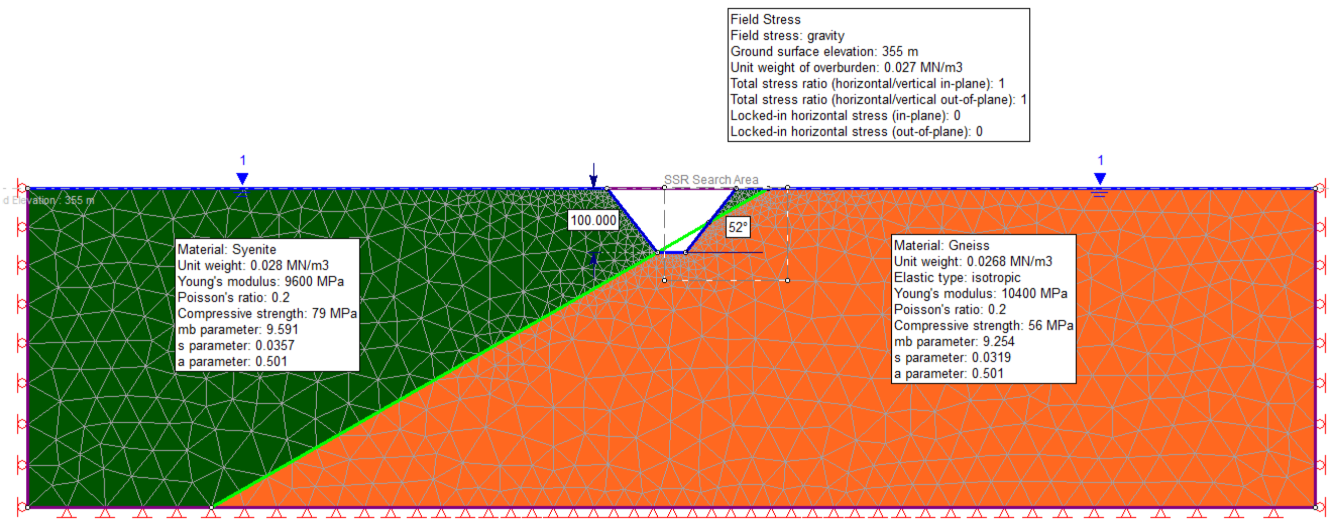


Plate 5: Phase2 model for overall slope stability assessment.

The analyses were performed assuming Hoek-Brown failure criteria for the rock mass. The input parameters for the model are shown in Table 7. For a worst-case scenario, the lower bound rock mass parameters were used for the two rock types in the model.

Table 7: Material Properties Used in the Phase 2 Model

Parameter	Units	Syenite (SY)	Granitic Gneiss (GN)
Unit weight	MN/m^3	0.028	0.027
Poisson's Ratio		0.2	0.2
Young's Modulus E_i	GPa	9.9	10.4
UCS	MPa	79	56
m_b		9.591	9.254
s		0.0357	0.0319
a		0.501	0.501
Material type		Plastic	Plastic

Notes: For determination of rock mass parameters, the GSI value was taken from Table 2; A disturbance factor D of 0 was assumed for the rock mass.

Far field stresses for the model were assumed to be gravitational, with the stress ratio both in-plane and out of plane assumed to be 1. Because of the shallow depth of the pit and the topography at the site, the choice of far field stresses used in the model is expected to have minimal impact on the stability of the pit walls.

6.2.2 Shear Stress Reduction Analyses

A Shear Strength Reduction analysis was performed on the pit slopes. This option of Phase 2 permits automatic finite element slope stability analysis, and computes a critical strength reduction factor for the model. The critical strength reduction factor (SRF) is equivalent to the "safety factor" of the slope (Phase 2 manual, Rocscience). For this type of analyses, the rock mass was assumed to behave perfectly plastically.

The first scenario, shown in Plate 6, assumes that the slope is completely dry. The critical slope is on the right hand side of the model, corresponding to the northeast pit wall. The critical failure plane is shown by the contours of shear strain. The SRF for the dry slope is 6.26.

A second scenario, shown in Plate 7, assumes a fully saturated pit slope. Again, the critical slope is on the right hand side of the model, representing the northeast pit wall. The contours for shear strain indicate the critical failure plane. For the saturated slope, the SRF is 4.05.

Based on the SSR analysis, overall failure of the pit slopes due to failure through the rock mass is considered unlikely. The overall pit walls are considered stable; consequently, the pit wall design is controlled by the kinematics described in Section 6.1.

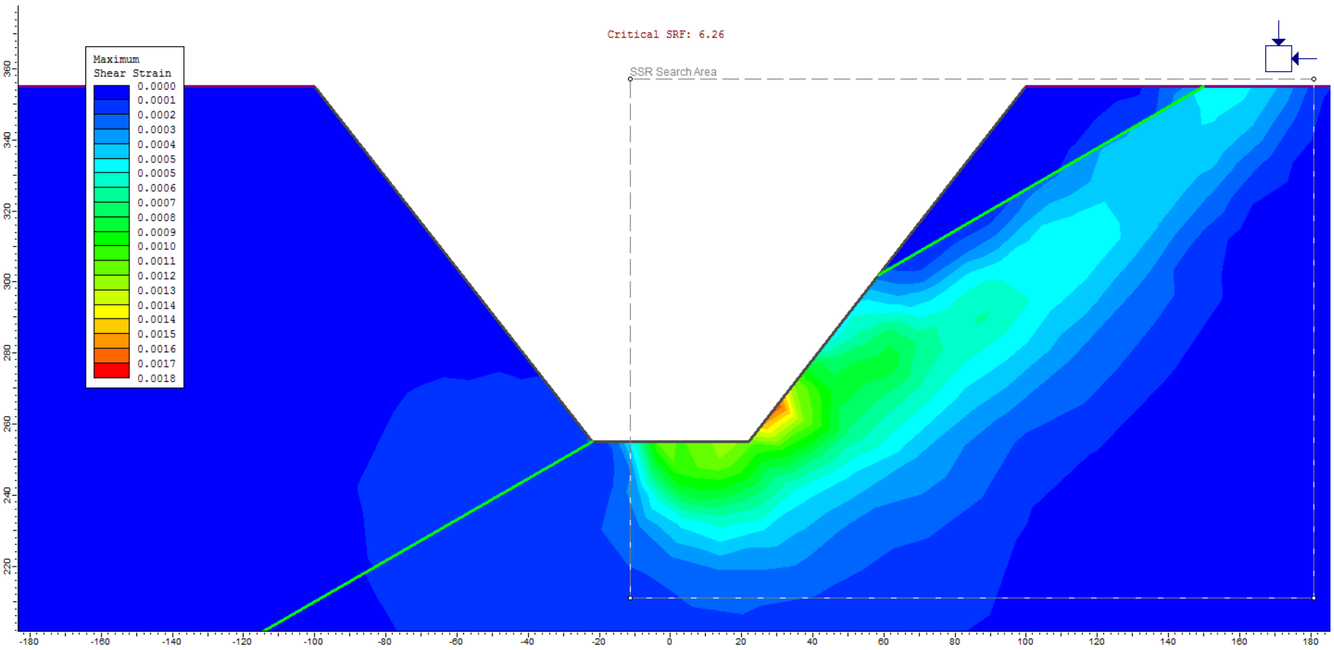


Plate 6: Phase 2 SSR results - dry slope.

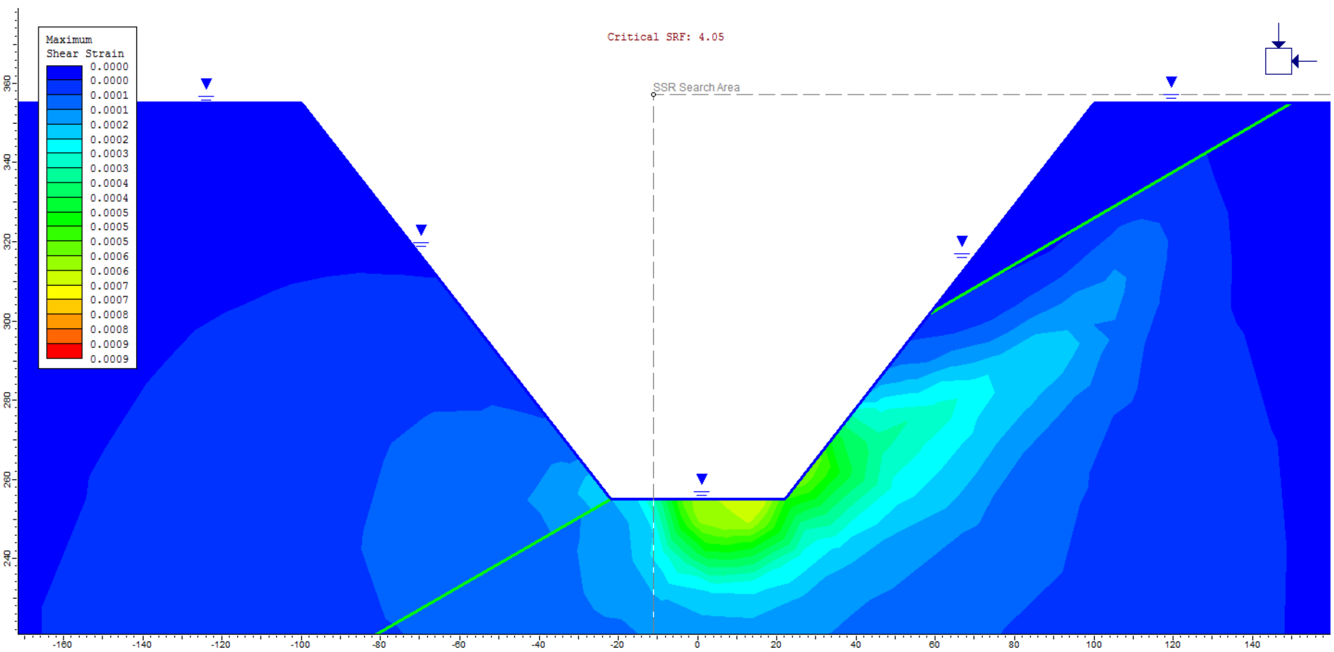


Plate 7: Phase 2 SSR results - fully saturated slope.

6.3 Conclusions and Recommendations for Pit Slopes

Based on the SSR analyses and our understanding of the ground conditions at Kipawa, the kinematic design results presented in Table 5 are considered to represent the recommended slope designs for the project.

Where there are no strong kinematic controls to limit the achievable bench face (batter) angle, standard production and trim blasting typically achieves bench face angles between 65° and 70° due to blast-induced wall damage and typical scaling practices. For Design Sector 3, the structural controls on this orientation limit the bench face angle; however, for the remainder of the design sectors, it has been assumed that a 70° bench face angle is achievable on early benches. The 8.5 m berm width, determined using the Modified Ritchie formula, is considered to be adequate for containment of debris and rock fall catchment for double height (20 m) benches, and wide enough to allow access for periodic removal of debris, as required.

An alternate design is shown **Table 6**, which assumes the application of pre-split blasting and a 5 m bench height, double benched to 10 m. This design assumes 7 m bench widths, determined using the Modified Ritchie formula, with a small additional width added to allow for minor breakback of the crest while still containing debris and rock fall catchment and permitting periodic debris removal, as above.

6.4 Instrumentation and Surveying

Pit slope monitoring is a good practice for open pit mining. The feedback from movement monitoring programs is very useful in the ongoing evaluation of slope performance. In addition, diligent monitoring can give sufficient advance warning of movement, allowing the operator time to implement measures to mitigate failure.

A budget allocation should be made during detailed design for the installation of adequate instrumentation. This could include a permanent, fully automated monitoring system. Several different options are available, including robotic total stations, GPS units, RADAR and LIDAR systems. As a minimum, an electronic total station (EDM) survey program could be implemented, targeting prisms placed strategically throughout the pit.

6.5 Risk Mitigation Measures in the Design and Monitoring of Slopes

The controls on slope design at Matamec are listed below, along with comments on the reliability of the data and descriptions of how the design issues have been addressed for the purposes of a conservative feasibility study design. Where additional information or clarification is required, these are noted as well.

Table 8: Slope Design Issues and Their Mitigation Through Design and Slope Management

Slope Design Issue	Confidence in Data	Mitigative Design and Slope Management Recommendations
Rock mass failure	**High.** Data sources are reasonably comprehensive, including surface mapping, oriented core data and laboratory strength data.	Overall slope rock mass failure is not considered a potential failure mechanism due to the relatively low slope height and strong rock mass. Porewater pressure analyses indicate that the slope stability is not sensitive to the presence of groundwater. **Conservative measures:** ■ Surface water controls preventing water inflow into the pit are also required.
Structural fabric controls on bench geometries	**Moderate to High.** There is good agreement between the structures mapped on surface and measured during the oriented core program targeting the final pit slopes.	**Bench Geometries:** The design bench face angles and inter-ramp geometries provide inter-ramp angles ranging from 50° to 52°. Where a successful program of trim blasting is established, some inter-ramp angles can be increased to 56°. **Conservative Measures:** When the excavation of the pit has progressed past the first bench, a program of detailed structural mapping should be undertaken. The results from this program should be used to improve the geological model for the site, to confirm the structures that are present, and to make any adjustment to the inter-ramp slope angles as required. The orientation and location of weaker zones within the rock mass (e.g. Phlogopite) must also be included in the revised geological model. Local modifications to the slope design can be made to mitigate the impact of these weaker zones. Locally, horizontal drains may be required to reduce potential for bench scale kinematically controlled instabilities, if slope performance indicates that some benches are not draining / depressurizing sufficiently on their own.
Known major structures	**Moderate to High.** No large scale structures were identified during the drilling campaign, and their absence was confirmed by Matamec geologists.	**Conservative Measures:** During the detailed structural mapping, this observation should be tested and confirmed. Any large structures that are exposed as the pit is excavated should be incorporated into the geologic model.
Unanticipated geotechnical conditions and rockfall hazards	**Not applicable.** As a conservative measure, allowances for unexpected ground conditions must be included in the slope design to provide flexibility to the mine planners.	**Pit Access:** During detailed engineering, the ramp(s) need to be evaluated and a risk assessment completed to determine if the ramp design is sound and if additional accesses are required. **Geotechnical Berms:** Wider geotechnical catch benches placed at regular vertical separation intervals to break the slope and provide additional catchment against rock falls where ramps do not occur. For planning purposes, these should be 12 m wide. These are normally place with 100 m vertical spacing, but they may not be required as the ultimate pit depth is shallow.

Slope Design Issue	Confidence in Data	Mitigative Design and Slope Management Recommendations
		Prism/Slope Monitoring: For planning purposes, allow for an array of prisms to be installed at regular intervals as the pit deepens. A full assessment of the number of prisms and spacing can be conducted during the final design. Alternatively, a periodic radar survey of the pit can be considered.
Potential for Toppling	**Moderate.** The potential for toppling exists for the NE wall (Sector 1).	**Conservative Measures:** ■ Depressurizing is the most effective remedial technique to control the development of toppling. The requirement for slope depressurization will depend on the groundwater conditions within the slope and the reaction of the water table to excavation. ■ Regular slope monitoring and visual inspections will be required as excavation progresses so that any signs of movement can be identified quickly. ■ An allowance for horizontal drains should be carried forward in the economic assessment, to be installed on an as-needed basis.

7.0 CLOSURE

We trust that the enclosed is sufficient for your current needs. If you have any questions or comments, please don't hesitate to contact us.

GOLDER ASSOCIÉS LTÉE

ORIGINAL SIGNED BY

James Tod, P.Eng (ON)
Rock Mechanics/Geological Engineer

ORIGINAL SIGNED BY

Marc Rougier, P.Eng. (ON)
Principal/Geological Engineer

JT/MR/no/mg

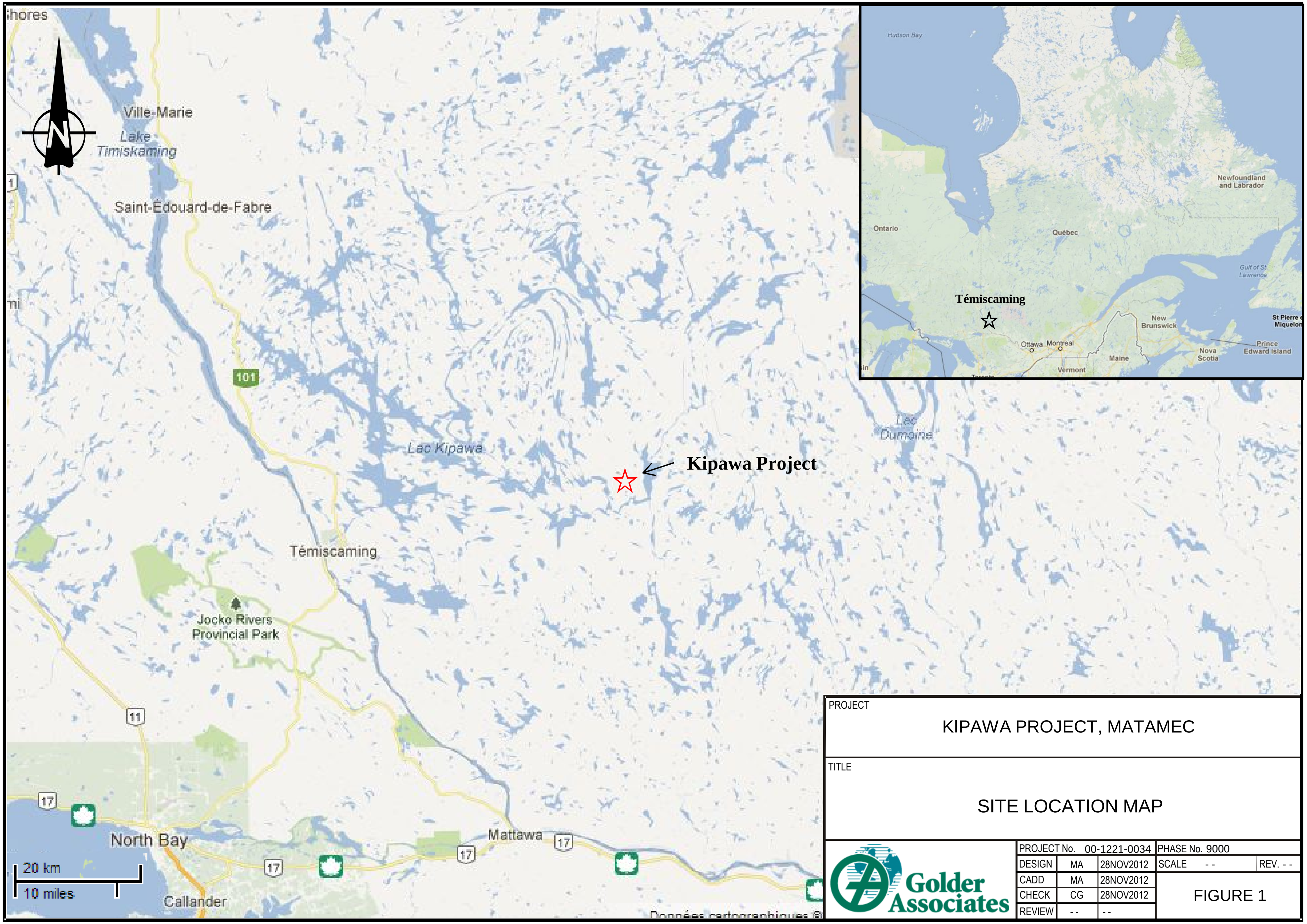
\\golder.gds\gal\montreal\actif\2012\1221\12-1221-0034 matamec kipawa tmf and pit\5 preparation of deliverables\015 geomechanics report\secretariat\015-12-1221-0034-ra-rev0-geomechanics report_track changes.docx

REFERENCES

Brown, E. T. 1981. *Rock characterization, testing and monitoring: ISRM suggested methods.* Oxford: Published for the Commission on Testing Methods, International Society for Rock Mechanics.

Golder. 2012. *Factual Report: Geomechanics*. Report no. 12-1221-0034-005-RA-RevA. Preliminary version issued on December 2012.

Roche SGS. 2012. Preliminary Economic Assessment - Study for Kipawa Project. Roche Ref: 061623.001-200. NI 43-101 Submitted to Matamec Explorations Inc. March 14, 2012.



PROJECT

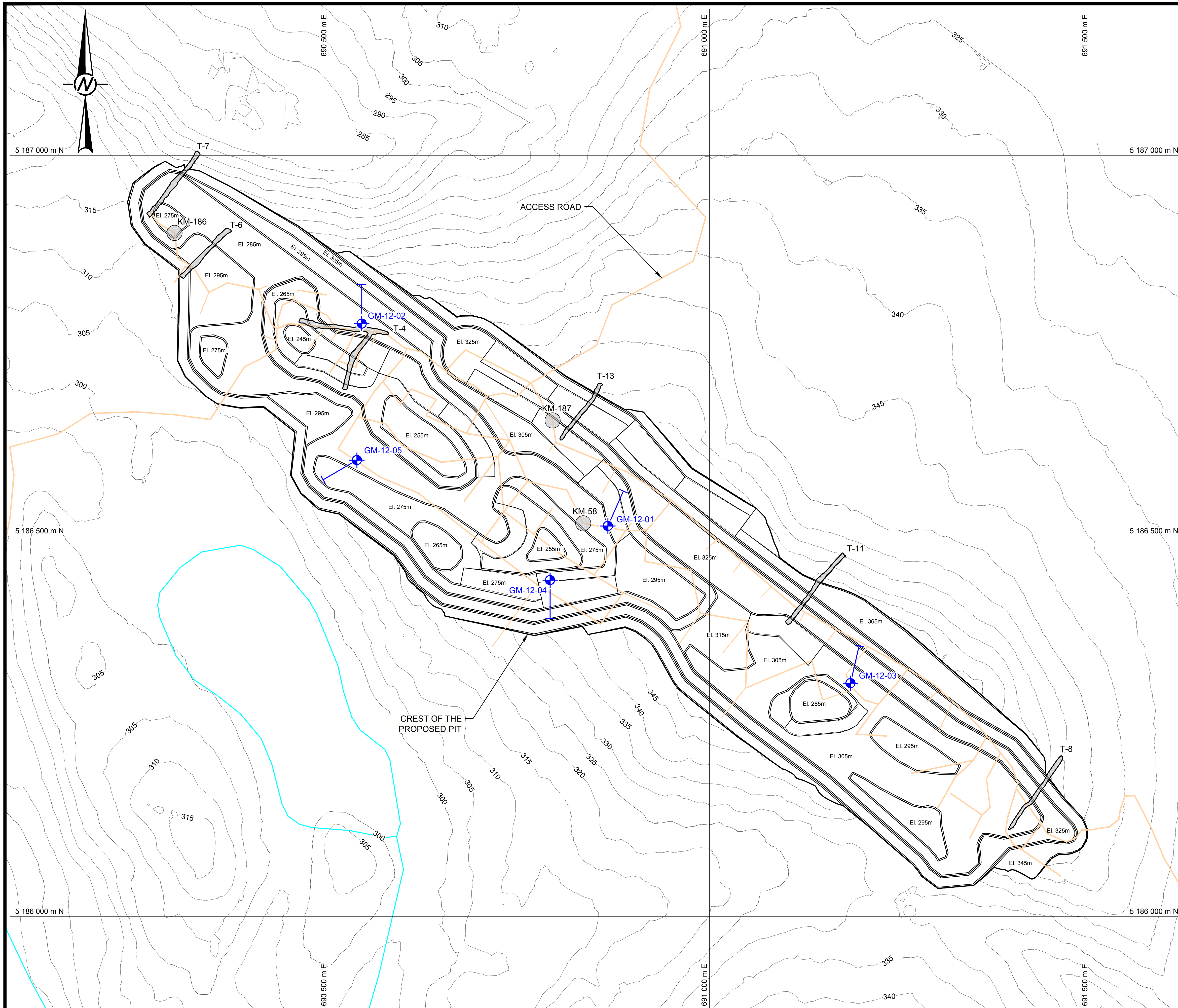
KIPAWA PROJECT, MATAMEC

TITLE

SITE LOCATION MAP

Golder Associates

PROJECT No.	00-1221-0034		PHASE No. 9000
DESIGN	MA	28NOV2012	SCALE - - REV. - -
CADD	MA	28NOV2012	FIGURE 1
CHECK	CG	28NOV2012	
REVIEW	- -	- -	



LEGEND

GM-12-01	BOREHOLE
	TOPOGRAPHIC CONTOURS
	OFF ROAD VEHICULE ROADS
	CREST OF PROPOSED PIT
	CONTOURS OF PROPOSED PIT
	SURFACE MAPPING OF OUTCROPS AND TRENCHES

SOURCES

- PIT SHELL FROM: ROCHE KIPAWA GENERAL LAYOUT, FEB 6, 2012
- TRENCH SURVEY BY: GESTION ALINE LECLERC INC., AUG. 31, 2012

0 100 200 300m

1:5,000

PROJECT

KIPAWA PROJECT, MATAMEC

TITLE

BOREHOLE LOCATION AND SURFACE MAPPING

Golder Associates

PROJECT No.		12-1221-0034	FILE No.	1212210034-9000-05
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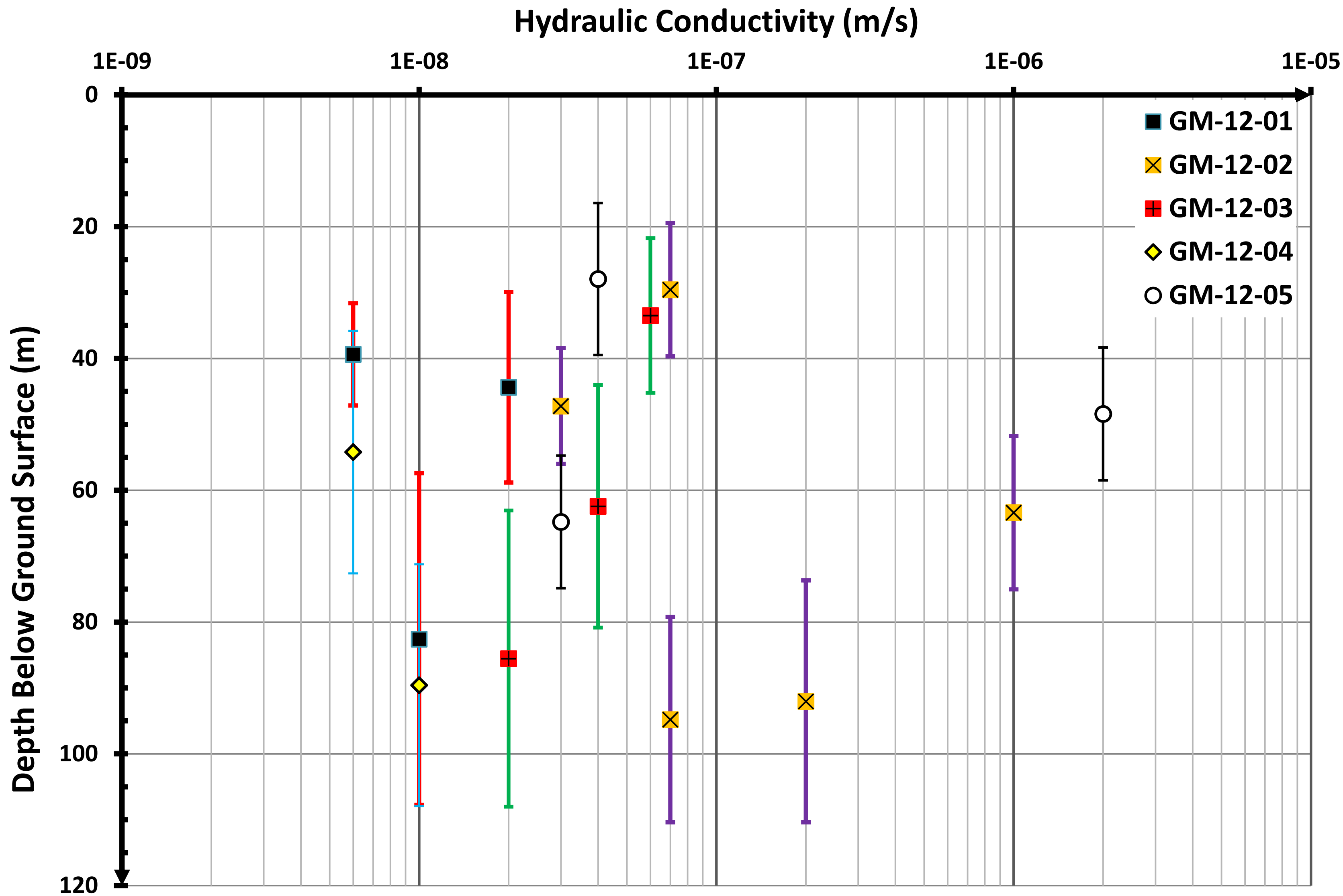
CADD	SB/LF	2013-04-12	FIGURE 2	
CHECK	-	-		
REVIEW	-	-		



Golder Associates	Date: October 2012 Drawn: JPAO Project: 12-1221-0034 Checked: MM	**FIGURE 3: PACKER TEST RESULTS BY DEPTH FOR GM-12-01 THROUGH GM-12-05**

LEGEND

340	TOPOGRAPHIC CONTOURS
	CREST OF PROPOSED PIT
	CONTOURS OF PROPOSED PIT

NOTES

1. IRA = XX° - RECOMMENDED INTER - RAMP ANGLE FOR PRE-FEASABILITY.
2. THIS FIGURE SHOULD BE READ IN CONJUNCTION WITH THE REPORT 015-12-1221-0034.
3. BENCH GEOMETRIES WERE DEVELOPED ASSUMING DEWATERED SLOPES. IT IS ASSUMED THAT SURFACE RUNOFF WILL BE MANAGED AND THE GROUNDWATER TABLE LOWERED SUFFICIENTLY IN THE VICINITY OF THE PROPOSED PIT.
4. BENCH GEOMETRIES ON FIGURE ARE FOR 20 M DOUBLE BENCHES

ASSUMPTIONS

- APPROPRIATE SLOPES IN OVERBURDEN MATERIALS (NOT ADDRESSED FOR THE PURPOSE OF THIS ANALYSIS).
- 10-M VERTICAL HEIGHT OPERATING BENCHES.

  -DOUBLE BENCHING (20 M VERTICAL) MAY BE APPLIED ON ULTIMATE SLOPES IN GOOD ROCK.
- WHERE KINEMATICS ARE FAVOURABLE, THE MAXIMUM BENCH FACE ANGLE IS 70°. THIS ASSUMES APPLICATION OF WELL CONTROLLED TRIM BLASTING.

  -ONCE THE OPERATOR HAS EXPERIENCE WITH PROVEN DESIGN AND APPLICATION OF PRE-SPLIT BLASTING OF THE BENCH FACES, IT MAY BE POSSIBLE TO STEEPEN THIS ANGLE.
- CATCH BENCH WIDTHS FOR SINGLE BENCHES, DETERMINED USING THE MODIFIED RITCHIE FORMULA, SHALL BE 6.5 M. FOR DOUBLE (I.E. 20 M HIGH) BENCHES, THE CATCH BENCH WIDTH SHALL BE 8.5 M.
- CATCH BENCH WIDTH MAY BE INCREASED TO REDUCE THE INTER-RAMP ANGLE TO CONTROL POTENTIAL PLANE OR WEDGE FAILURES AT THE INTER-RAMP SCALE, OR TO CONTROL POTENTIAL RAVELLING IN SPECIFIC AREAS AS NECESSARY.
- FOR SLOPES GREATER THAN 100 M IN HEIGHT NOT TRANSECTED BY A RAMP, A WIDER CATCH BENCH OF 12 M IS RECOMMENDED FOR EVERY 100 M AS A SAFETY CONTROL ON ROCK FALLS.
- POTENTIAL TOPPLING FAILURES ARE ASSUMED TO APPLY TO +/- 20 DEGREES OF STRIKE; POTENTIAL WEDGES ARE ASSUMED TO APPLY TO +/- 45 DEGREES OF THE WEDGES' PLUNGE. PLANES OR WEDGES WITH LIMIT EQUILIBRIUM OF FACTOR OF SAFETY OF 1.2 OR LESS WERE CONSIDERED POTENTIAL CONTROLS ON SLOPE DESIGN.

ON SOME DESIGN SECTORS, AN INTER-RAMP ANGLE STEEPER THAN THE PLUNGE OR DIP OF THE POTENTIAL WEDGE OR PLANE FAILURES CONSIDERED SIGNIFICANT MAY BE RECOMMENDED. THIS RATIONALIZATION MAY BE DUE TO:

- LIMITED INTER-RAMP SLOPE HEIGHT IS ASSUMED TO MITIGATE POSSIBLE INCREASED RISK;
- LIMITED STRIKE LENGTH ON ADVERSE WALL ORIENTATIONS, SUCH AS IN CONCAVE CURVED PIT WALLS, WHERE LOCALLY CONFINEMENT MAY MITIGATE POSSIBLE INCREASED RISK.

Recommended Conceptual Pit Slope Angles for the Kipawa Rock Slopes

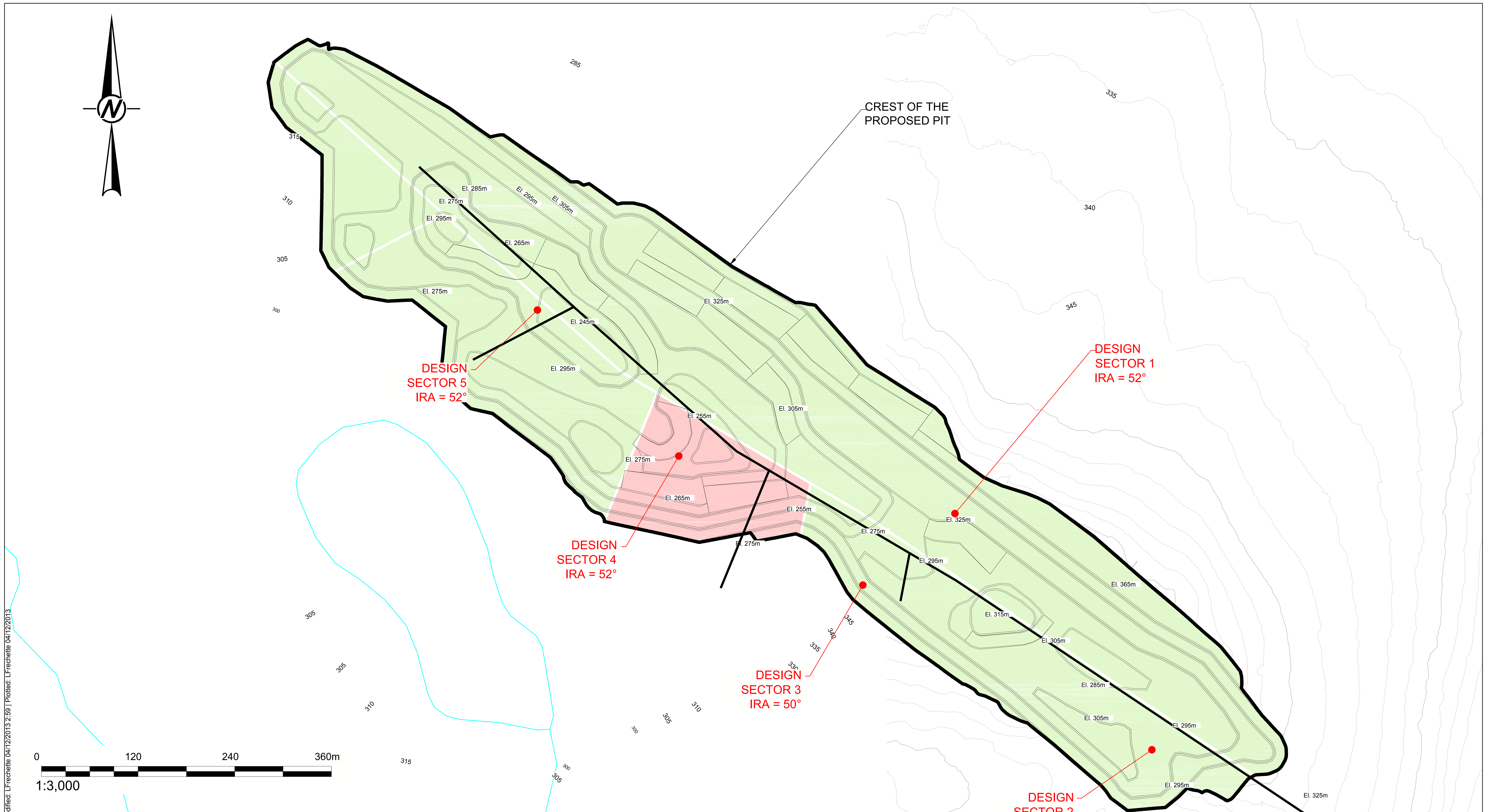
Design Sector	Wall Dip Direction (°)	Bench Face Angle (°)	Vertical Bench Separation (m)	Berm width (m)	Inter-Ramp Slope Angle (°)
1	217	70	20	8.5	52
2	037	70	20	8.5	52
3	**000**	**67**	**20**	**8.5**	**50**
4	040	70	20	8.5	52
5	090	70	20	8.5	52

Alternate Pit Slope Angles for Kipawa Rock Slopes (assuming 5 m bench heigts and successful application of pre-splitting blasting)

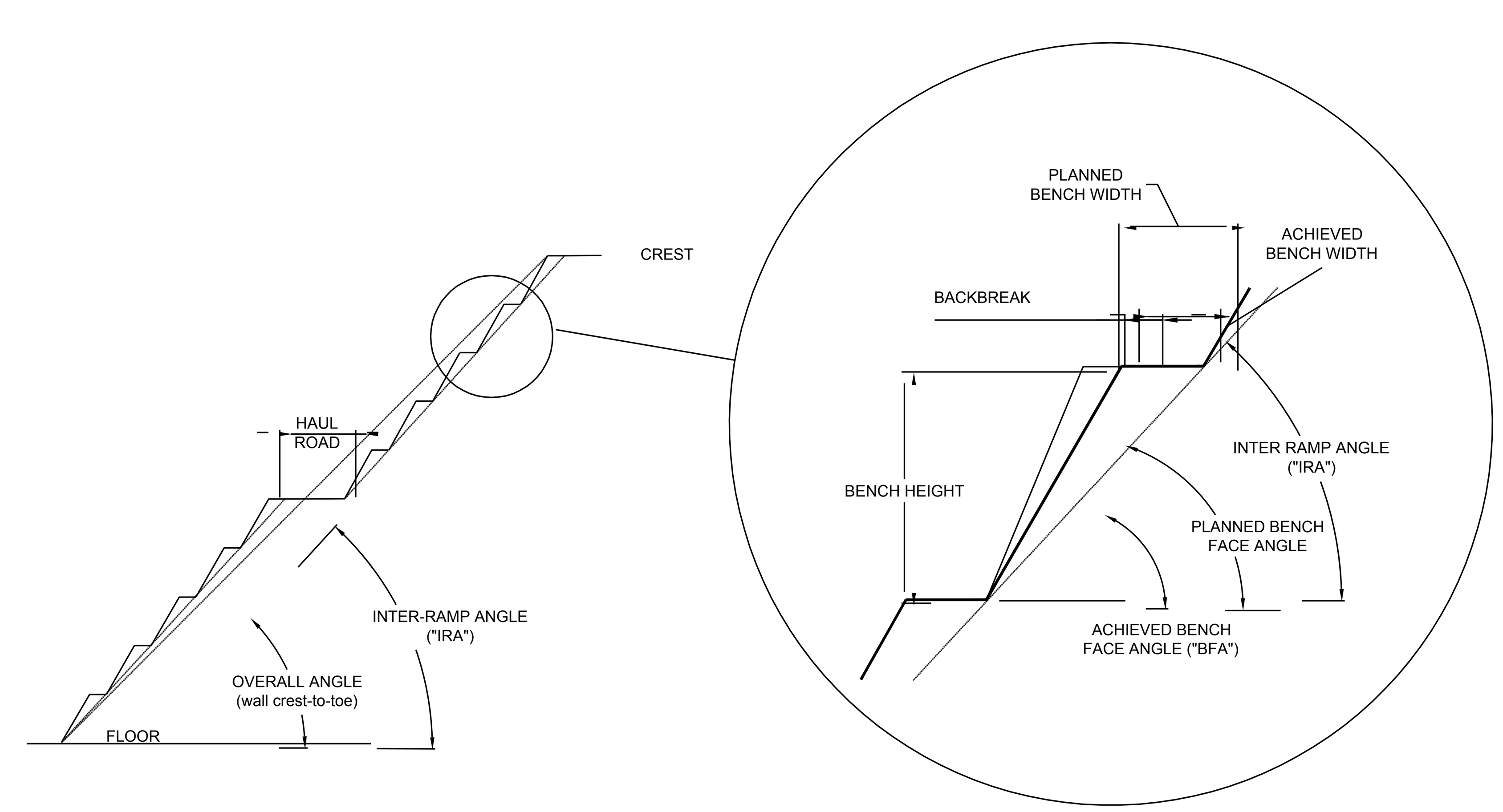
Design Sector[1]	Wall Dip Direction (°)	Bench Face Angle (°)	Vertical Bench Separation[2] (m)	Berm Width (m)	Inter-Ramp Slope Angle (°)
1, 2, 4, 5	all others	85	10	7	52
3	**000**	**67**	**10**	**7**	**42**

REFERENCE

- PIT SHELL FROM: ROCHE KIPAWA GENERAL LAYOUT, FEB 6, 2012

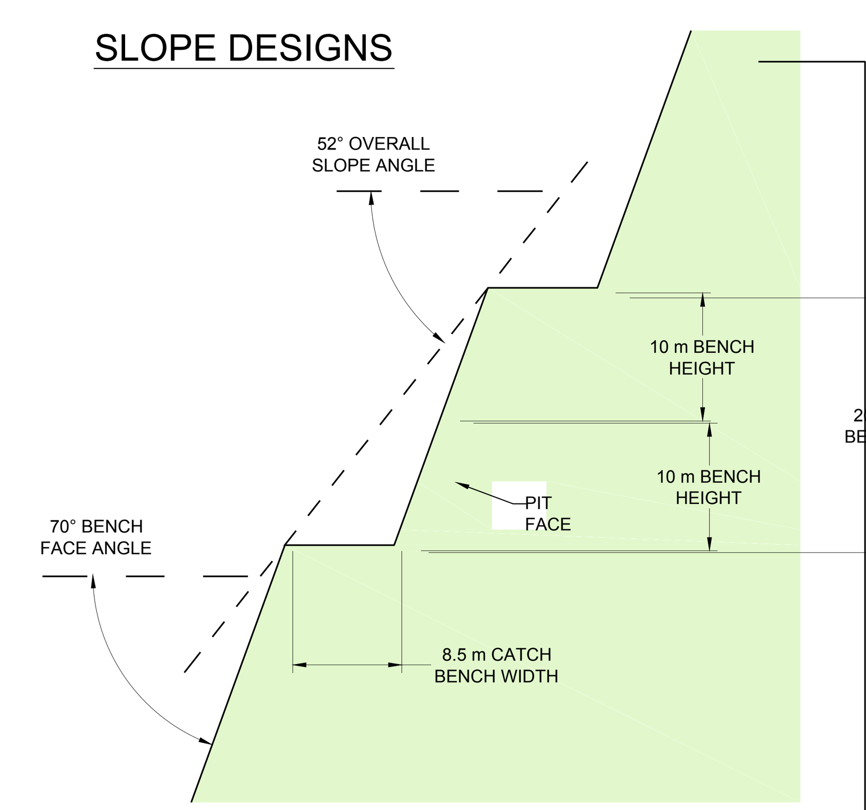


TERMINOLOGY

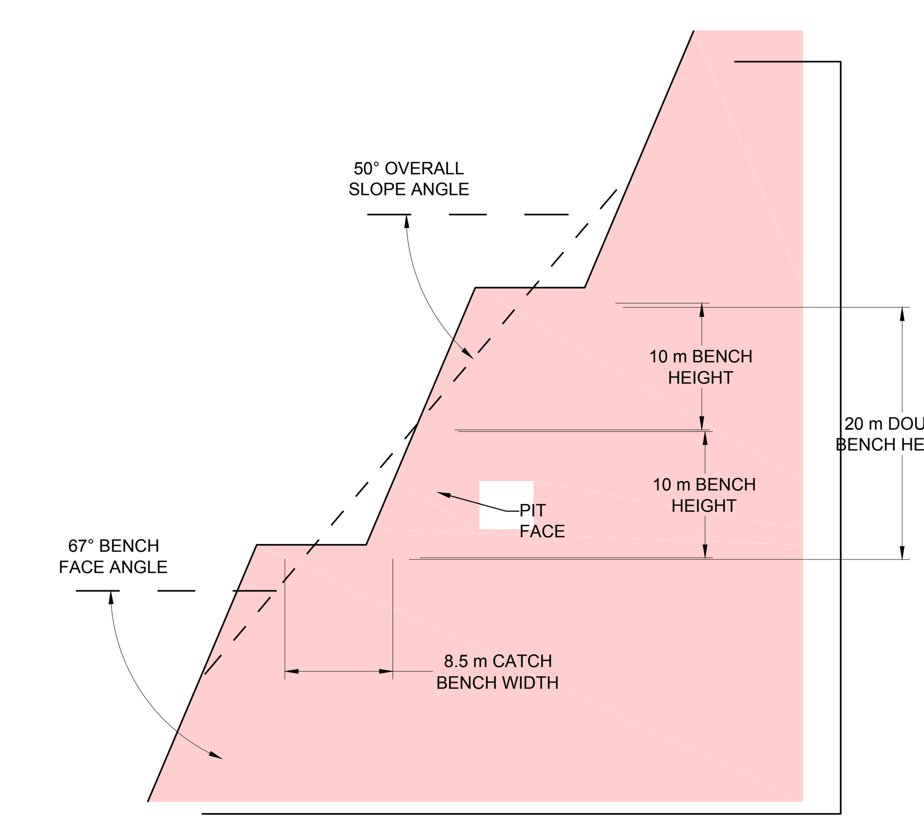


SCHEMATIC REPRESENTATION
NOT TO SCALE

SLOPE DESIGNS



DESIGN SECTORS
1, 2, 4, 5



DESIGN SECTOR 3

0 20 40 60m
1:500

PROJECT	
	KIPAWA PROJECT, MATAMEC
TITLE	**RECOMMENDED DESIGN SLOPE CONFIGURATION**

PROJECT No.		12-1221-0034	FILE No.	1212210034-9000-06
DESIGN	C.G.	2013-04-12	SCALE	INDICATED
CADD	S.B./L.F.	2013-04-12	FIGURE	4
CHECK	C.G.	2013-04-12		
REVIEW	J.T.	2013-04-12		

Golder Associates

APPENDIX A

Pit Design

APPENDIX A-1

Drilling Campaign

1.0 INTRODUCTION

Golder Associés Ltée (Golder) completed the geotechnical and hydrogeological investigations between August 8 and 21, 2012. The field investigations consisted of the following activities:

- Detailed geotechnical core logging of five (5) inclined, oriented boreholes
- Deviation survey of boreholes (every 40 m)
- Wet and Dry Core photography in boxes
- Selection of 30 rock core samples for laboratory testing
- Seventeen (17) downhole hydrogeological tests
- Point Load Testing
- Geotechnical surface mapping of rock outcrop

This appendix presents a discussion on quality control procedures (QA/QC) used by Golder and validations of parameters measured during this campaign. A geotechnical summary of each drillhole presenting data validated and corrected by Golder is presented at the end of this appendix.

Golder's Report 005-12-1221-0034: *Factual Report: Geomechanics* (Golder 2012) presents an overview of the field data collection process and summarizes the field data, logs, core orientation and monitoring data results collected as part of the Geotechnical Investigation and Pit Slope Stability Evaluation mandate.

2.0 DRILLING CAMPAIGN

Geotechnical drilling was carried out at the Kipawa site from August 8 to 9, 2012, by Performax Drilling. The locations of the five (5) NQ3-size geotechnical boreholes are shown in Figure A1-2. Initial borehole locations were proposed by Golder and adjusted on site by Matamec personnel to suit existing site conditions and to make use of existing drill pads. The purpose of the geotechnical boreholes was to gather data to assess Kipawa's rock mass quality and structural fabric in the vicinity of the proposed pit walls. This information is then used to justify pit slope design. Table 1 summarizes boreholes collar locations, orientations and lengths.

Table 1: Borehole Survey

Borehole	Northing	Easting	Ground Elevation	Average Dip	Average Azimuth	Borehole Length	Location Relative to the Proposed Pit
	[m]	[m]	[masl]	[deg.]	[deg.]	[m]	
GM-12-01	690867	5186513	360	65	24	118.9	North wall, center of pit
GM-12-02	690543	5186779	349	65	0	121.8	North wall, west of pit
GM-12-03	691185	5186307	393	65	13	119.15	North wall, east of pit
GM-12-04	690791	5186442	349	65	180	119.1	South wall, centre of pit
GM-12-05	690537	5186600	337	65	240	121.55	South wall, centre of pit

NOTES:

masl = metres above sea level.

Collar location taken with hand-held Garmin™ GPS (Projection UTM Zone 17T, NAD 83) after drilling was completed.

2.1 Geotechnical Summary

A summary of the principal geotechnical information collected during 2012 geotechnical drilling campaign is presented after this appendix. This summary presents most of the collected and validated drilling data, results of uniaxial compression testing, and an evaluation of Bieniawski's Rock Mass Classification (RMR_{76}) for each run. This classification gives a continuous estimate of rock mass properties along the borehole axis.

3.0 DATA QUALITY CONTROL OF (QA/QC)

Borehole logs were reviewed for consistency between the joint parameters Jr and Ja used in NGI's Q classification system (Barton *et al*, 1974) and the parameter Jcon, used in the Rock Mass Rating classification system (Bieniewski, 1976). Where discrepancies between the joint parameters were noted, these values were adjusted to reflect what is indicated in the joint surface descriptions and core photographs. RQD values were compared to fracture frequencies and the locations of broken core zones; a spike in the RQD histogram should be accompanied by a spike in the fracture frequency or by a zone of broken core. Where discrepancies were noted, core photographs were used to verify RQD and fracture frequency values.

4.0 LITHOLOGIES OF THE OPEN PIT

Golder's detailed geotechnical logs of boreholes are presented in the Geomechanics Factual Report (Golder 2012). These logs present complete lithological descriptions of the rock and use the following names and abbreviations, in accordance with Matamec geologist's nomenclature:

- SY Syenite Gneiss
- Leuco Leuco-Syenite Gneiss
- Meso Meso-Syenite Gneiss

- D-F Diopside Feldspar
- S-G Silver-Grey Amphibolite
- PHLO Phlogopite bands
- MAR Marble
- MONZ Monzonite Gneiss

Other lithologies are described by Matamec at Kipawa exploration site, notably:

- PerGrn Peralkaline Granitic Gneiss
- Mafic Mafic-Syenite Gneiss
- GRN Granitic Gneiss

Peralkaline Granite Gneiss is visually similar to the leucocratic syenite or mesocratic syenite, but is unmineralized.

For this geotechnical study, four (4) rock units based on these lithologies were used. Plates 1 to 4 show pictures of representative core in boxes for each rock unit.

- **SYENITE (SY):** Includes Leuco-Syenite, Meso-Syenite, Mafic-Syenite and Silver-Grey Amphibolite, host rocks of the Eudialyte and Mosandrite mineralization zones. Even though Peralkaline Granite is unmineralized, it is included in this unit for its similarity to the Syenite.

Plate 1: Syenite Unit - GM-12-01 (2.7-11.55 m)

- **CALSILCOMPLEX (CAL-SIL):** Includes Marble and Diopside Feldspar. Usually observed as lenses in the Syenite Unit.

Plate 2: CalSilComplex Unit - GM-12-02 (35.31-43.8 m)

- **GNEISS (GN):** Includes Monzonite and Granitic Gneiss, which are located below the Kipawa Alkalic Complex.

Plate 3: Gneiss Unit - GM-12-01 (73.9-82.65 m)

- **PHLOGOPITE (PH):** Phlogopite bands are described by Matamec geologists within the calc-silicate complex as a Diopside-phlogopite rock or Diopside-phlogopite-feldspar rock. These bands are here considered as a separate unit as these zones are considered weaker than surrounding rock and may weather more rapidly, which could lead to stability concerns if not monitored and controlled as required.

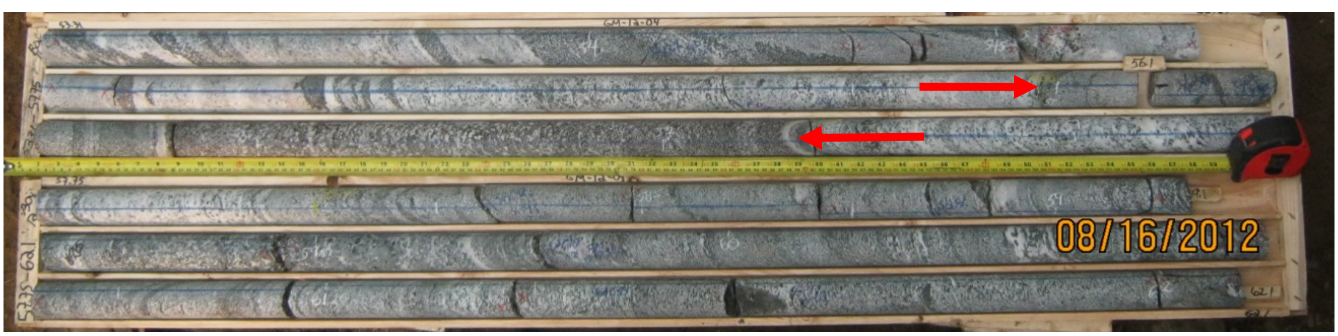


Plate 4: Phlogopite Unit - GM-12-04 (53.31-62.1 m)

5.0 REFERENCES

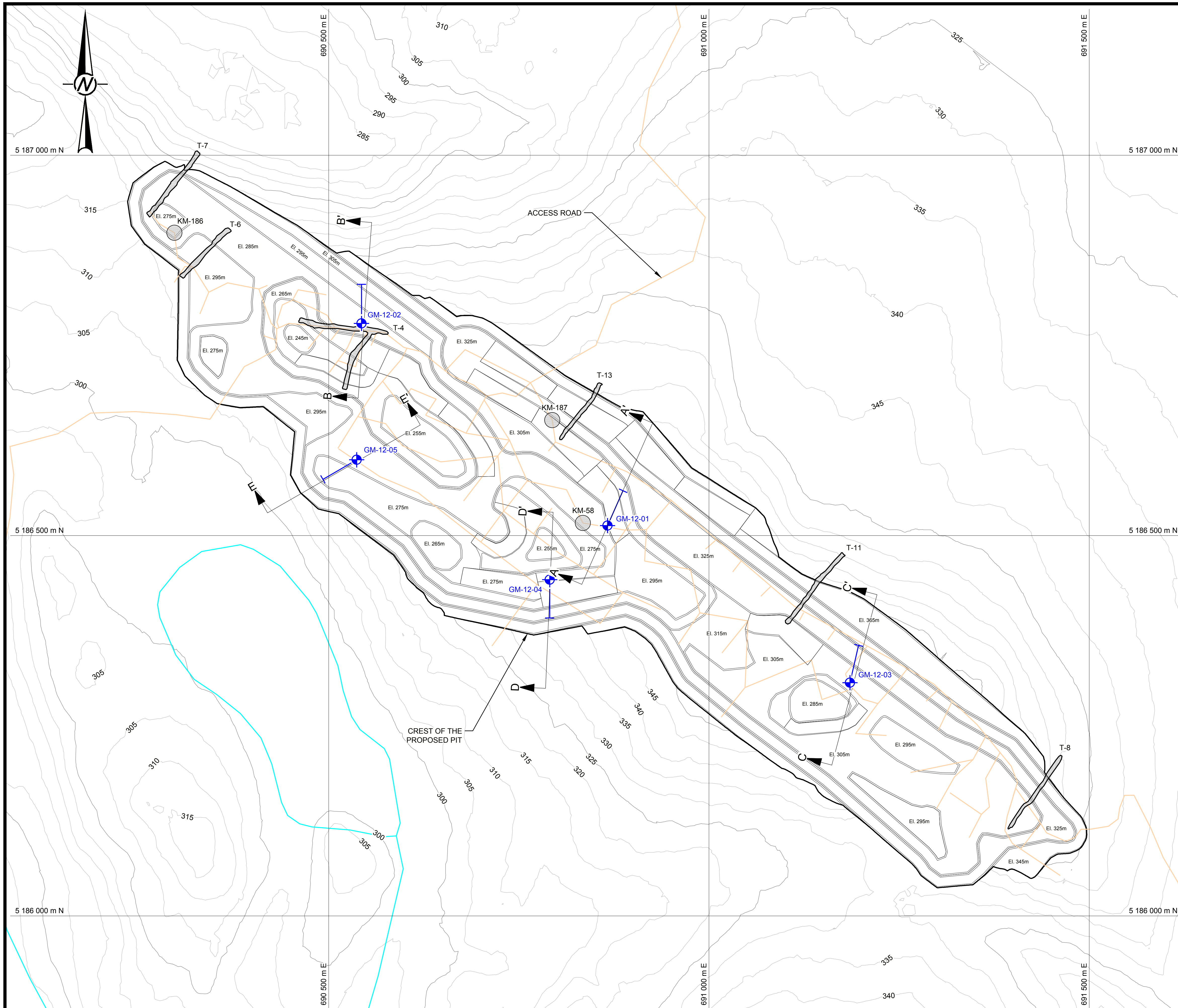
Barton, N., R. Lien, and J. Lunde. 1974. Engineering Classification of Rock Masses for the Design of Tunnel Support. Rock Mechanics 6, (4), pp. 189-236.

Bieniawski, Z.T. 1976. Rock Mass Classifications in Rock Engineering: Proceedings of the Symposium on Exploration for Rock Engineering, Rotterdam Vol. 1, p. 97-106.

Golder. 2012. *Factual Report: Geomechanics*. Report no 12-1221-0034-005-RA-RevA. Preliminary version issued December 2012.

Roche. 2012. Preliminary Economic Assessment – Study for Kipawa Project. NI 43-101 Report. Tsitsi Dangarembga. Submitted to Matamec Exploration Inc., March 14, 2012.

\\golder.gds\gal\montreal\actif\2012\1221\12-1221-0034 matamec kipawa tmf and pit\5 preparation of deliverables\015 geomechanics report\appendix a - pit design\a-1 drilling campaign\appendix a-1_drilling campaign_final.docx



LEGEND

GM-12-01 BOREHOLE

TOPOGRAPHIC CONTOURS

VTT ROADS

CREST OF PROPOSED PIT

CONTOURS OF PROPOSED PIT

SURFACE MAPPING OF OUTCROPS AND TRENCHES

A A' CROSS-SECTION

SOURCES

- PIT SHELL FROM: ROCHE KIPAWA GENERAL LAYOUT, FEB 6, 2012
- TRENCH SURVEY BY: GESTION ALINE LECLERC INC., AUG. 31, 2012

0 100 200 300m

1:5,000

PROJECT

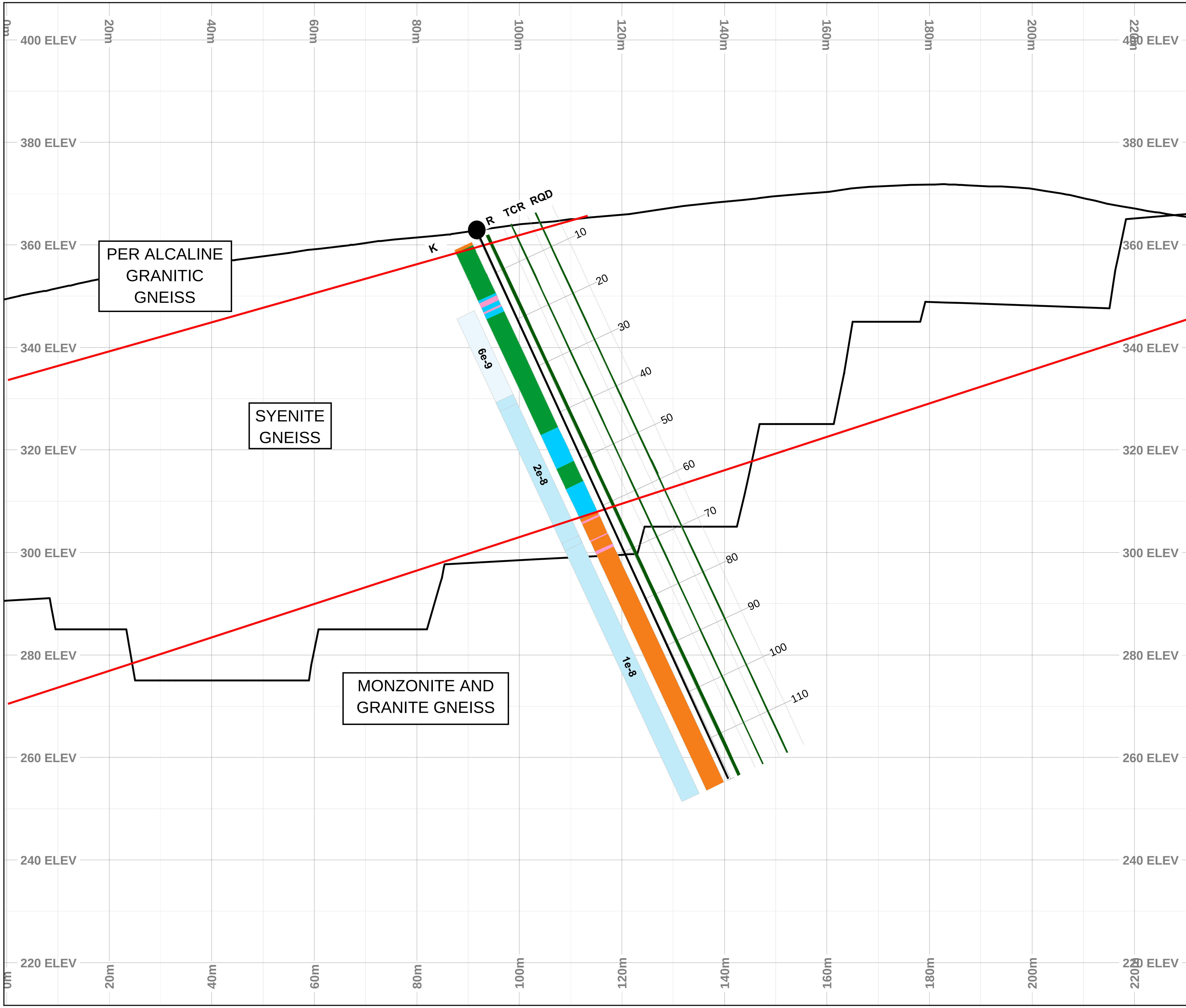
KIPAWA PROJECT, MATAMEC

TITLE

CROSS-SECTION LOCATION

PROJECT No.		12-1221-0034	FILE No.	1212210034-9000-01
DESIGN	CG	2012-09-27	SCALE	AS SHOWN
CADD	SB	2012-09-27	FIGURE	A1-1
CHECK	-	-		
REVIEW	-	-		

Golder Associés



LEGEND

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[1e-7,1e-6]	[4,5]	[75,90]	[75,90]
[1e-8,1e-7]	[3,4]	[50,75]	[50,75]
[1e-10,1e-8]	[2,3]	[25,50]	[25,50]
	[1,2]	[0,25]	[0,25]
	[0,1]		

LITHOLOGY

- [Syenite]
- [Gneiss]
- [CalSilComplex]
- [Phlogopite Dyke]

NOTES

- Borehole collars provided by Matamec Explorations Inc.
- Section azimuth: 23.73° (looking towards west).
  This azimuth is defined along the line between borehole collar and toe.
  The height of the color bars represents the length of the interval on which the test was performed.
- Proposed pit presented
- Schematic Geological interpretation by Golder

REFERENCES

- Topography: C11087lidar_2004_UTM.dwg
  Matamec Explorations Inc, May 19, 2011

- Pit: 3_KipawaGeneralSiteLayout.dwg
  Roche, February 23, 2012

1:750

0 10 20 30 40 50

PROJECT

MATAMEC EXPLORATIONS INC
KIPAWA PROJECT
TEMISCAMINGUE, QUEBEC, CANADA

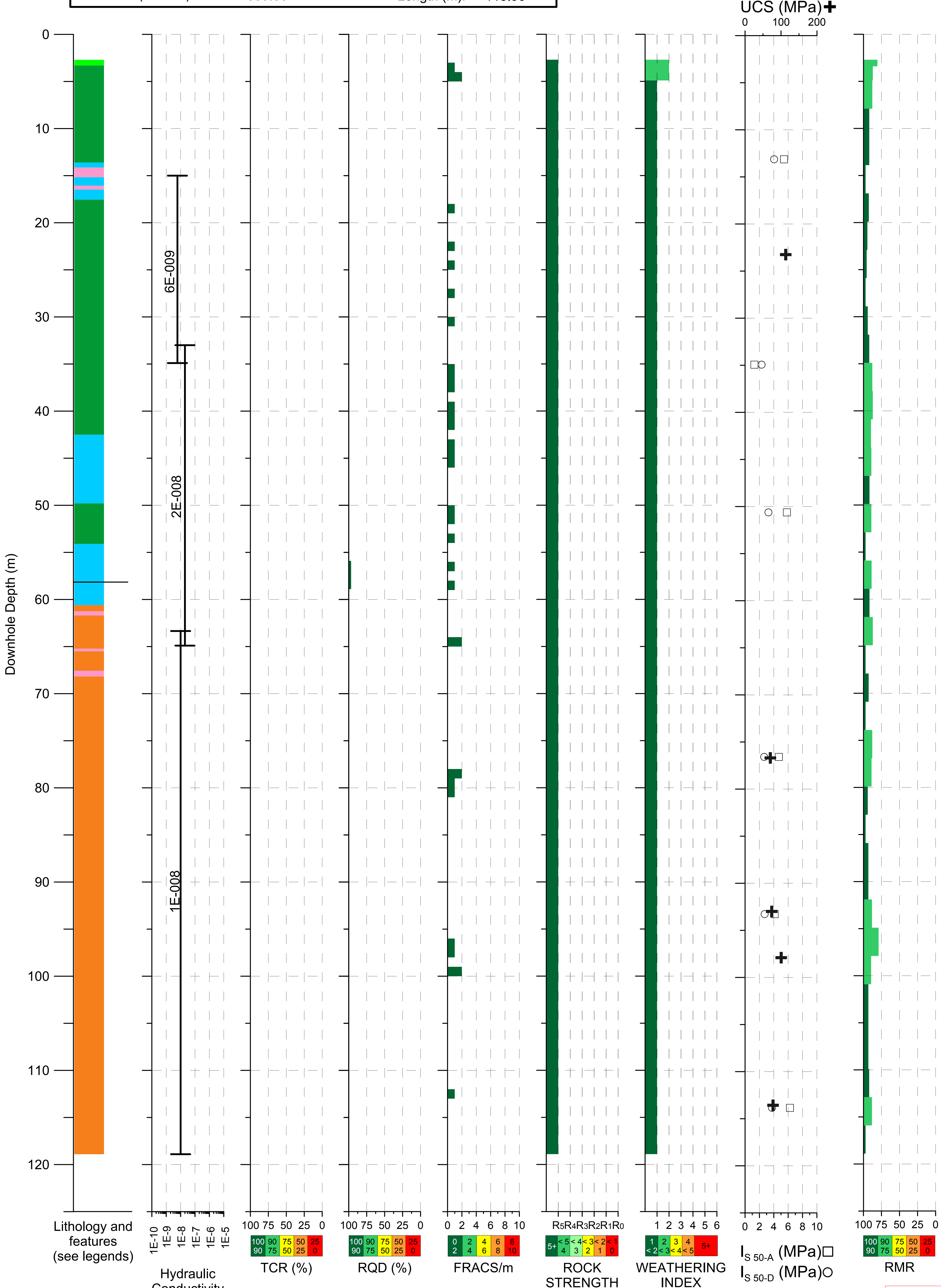
TITLE

Section GM-12-01

Golder Associates

Project #	12-1221-0034	
CADD	A. Pascu	09 NOV 12
CHECK	C. Gravel	09 NOV 12
REVIEW	J. Tod	12 NOV 12

Northing (m):	5186513.00	Azimuth:	24.00°
Easting (m):	690866.60	Inclination:	65.00°
Elevation (m.a.s.l.):	359.80	Length (m):	118.90



DRAFT

LITHOLOGY

- Gneiss
- Syenite
- CalSilComplex
- Phlogopite Dyke
- Per Alkaline Granite

FEATURES

- Lost Core
- Inferred Fault / Shear
- Broken Core

PROJECT	Matamec - Témiscamingue				
TITLE	HISTOGRAM SUMMARY PLOT GM-12-01				
Golder Associates	PROJECT No.	12-1221-0034		SCALE	1:400
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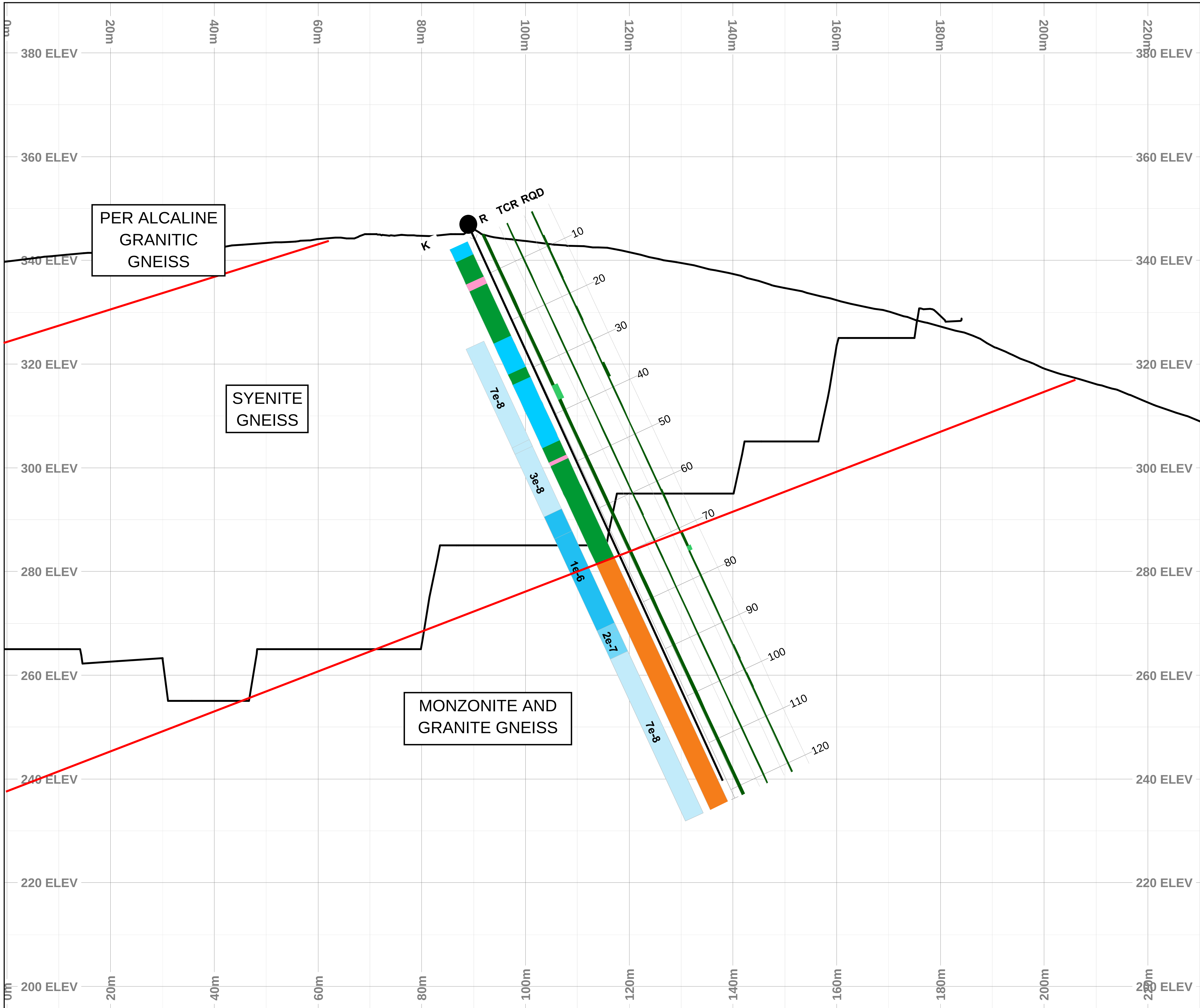
	CHECK	CG	06 NOV 12		
	REVIEW	JT	06 NOV 12		



LEGEND

HYDRAULIC CONDUCTIVITY	R (ISRM)	TCR	RQD
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[1e-7,1e-6]	[4,5]	[75,90]	[75,90]
[1e-8,1e-7]	[3,4]	[50,75]	[50,75]
[1e-10,1e-8]	[2,3]	[25,50]	[25,50]
	[1,2]	[0,25]	[0,25]
	[0,1]		

LITHOLOGY

- [Syenite]
- [Gneiss]
- [CalSilComplex]
- [Phlogopite Dyke]

NOTES

- Borehole collars provided by Matamec Explorations Inc.
- Section azimuth: 4.38° (looking towards west).
  This azimuth is defined along the line between borehole collar and toe.
  The height of the color bars represents the length of the interval on which the test was performed.
- Proposed pit presented
- Schematic Geological Interpretation by Golder

REFERENCES

- Topography: C11087lidar_2004_UTM.dwg
  Matamec Explorations Inc, May 19, 2011

- Pit: 3_KipawaGeneralSiteLayout.dwg
  Roche, February 23, 2012

1:750

0 10 20 30 40 50

PROJECT

MATAMEC EXPLORATIONS INC
KIPAWA PROJECT
TEMISCAMINGUE, QUEBEC, CANADA

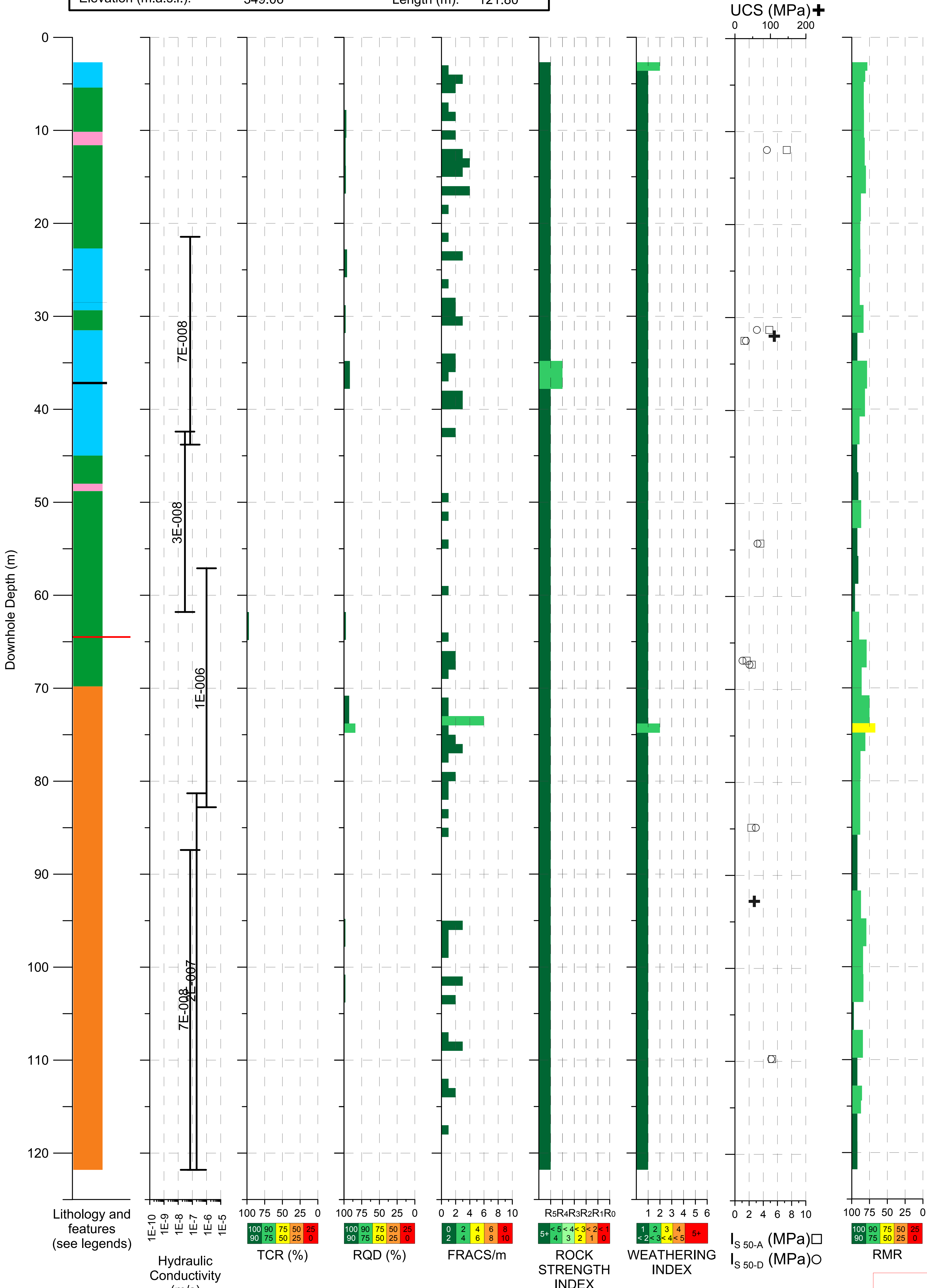
TITLE

Section GM-12-02

Golder Associates

Project #	12-1221-0034	
CADD	A. Pascu	09 NOV 12
CHECK	C. Gravel	09 NOV 12
REVIEW	J. Tod	12 NOV 12

Northing (m):	5186779.00	Azimuth:	.00°
Easting (m):	690543.11	Inclination:	65.00°
Elevation (m.a.s.l.):	349.06	Length (m):	121.80



DRAFT

LITHOLOGY

- Gneiss
- Syenite
- CalSilComplex
- Phlogopite Dyke
- Per Alkaline Granite

FEATURES

- Lost Core
- Inferred Fault / Shear
- Broken Core

PROJECT
Matamec - Témiscamingue

TITLE
HISTOGRAM SUMMARY PLOT
GM-12-02

Golder Associates

PROJECT No.		12-1221-0034	SCALE	1:400
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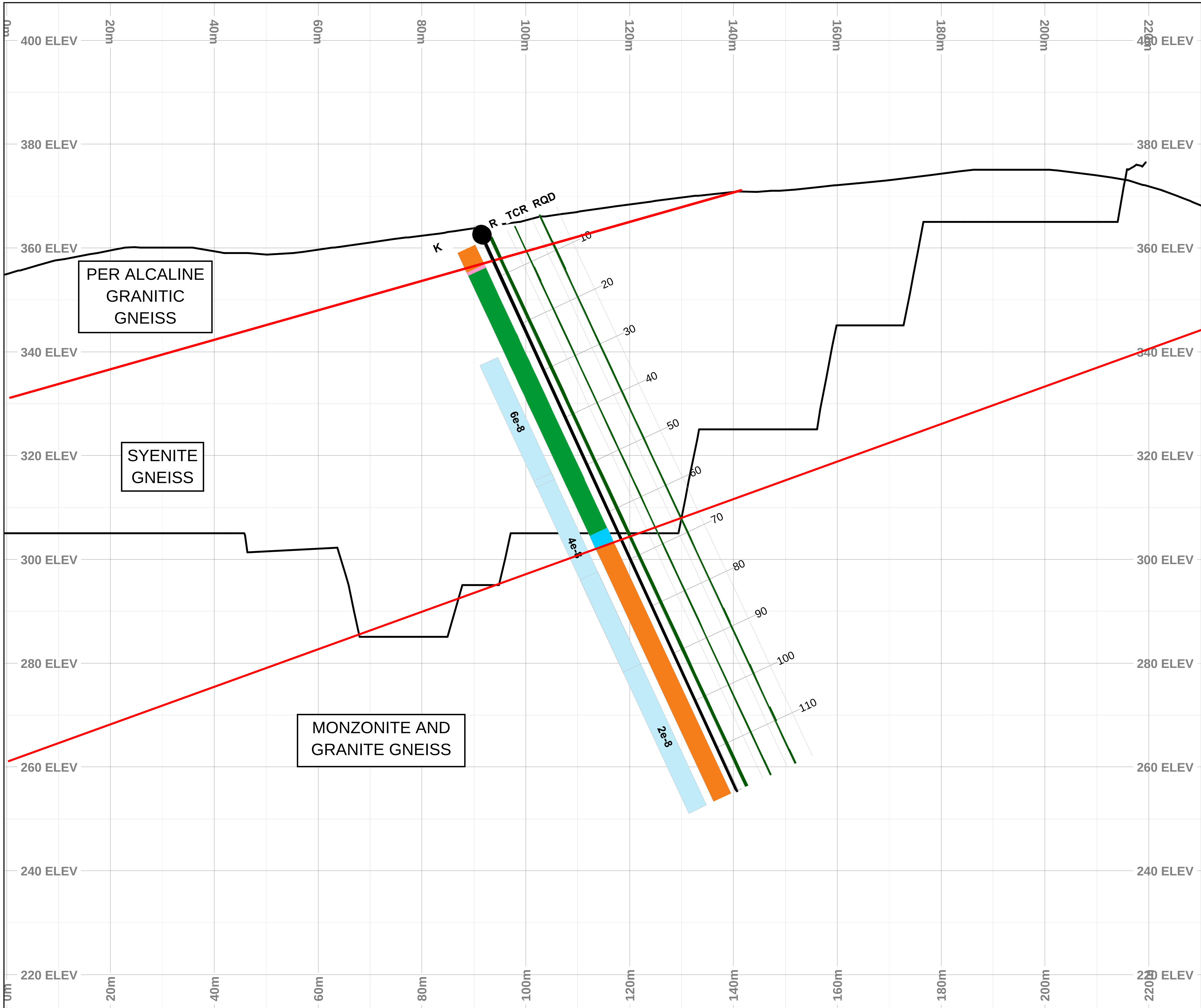
CHECK	CG	06 NOV 12		
REVIEW	JT	06 NOV 12		



LEGEND

HYDRAULIC CONDUCTIVITY	R (ISRM)	TCR	RQD
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[1e-7,1e-6]	[4,5]	[75,90]	[75,90]
[1e-8,1e-7]	[3,4]	[50,75]	[50,75]
[1e-10,1e-8]	[2,3]	[25,50]	[25,50]
	[1,2]	[0,25]	[0,25]
	[0,1]		

LITHOLOGY
- [Syenite]
- [Gneiss]
- [CalSilComplex]
- [Phlogopite Dyke]

NOTES

- Borehole collars provided by Matamec Explorations Inc.
- Section azimuth: 14.86° (looking towards west).
  This azimuth is defined along the line between borehole collar and toe.
  The height of the color bars represents the length of the interval on which the test was performed.
- Proposed pit presented
- Schematic Geological Interpretation by Golder

REFERENCES

- Topography: C11087lidar_2004_UTM.dwg
  Matamec Explorations Inc, May 19, 2011
- Pit: 3_KipawaGeneralSiteLayout.dwg
  Roche, February 23, 2012

1:750

0 10 20 30 40 50

PROJECT

MATAMEC EXPLORATIONS INC
KIPAWA PROJECT
TEMISCAMINGUE, QUEBEC, CANADA

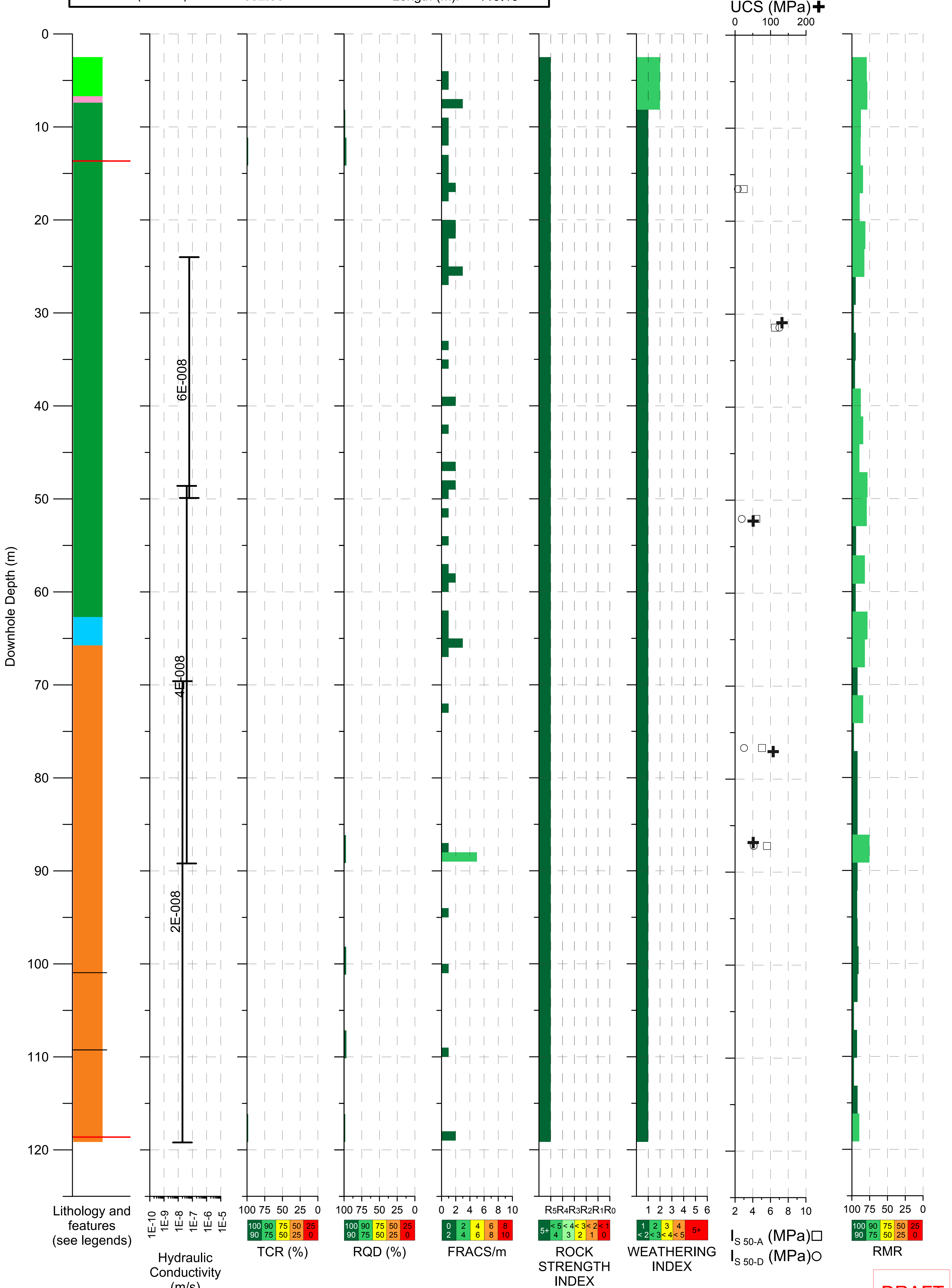
TITLE

Section GM-12-03

Golder Associates

Project #	12-1221-0034	
CADD	A. Pascu	09 NOV 12
CHECK	C. Gravel	09 NOV 12
REVIEW	J. Tod	12 NOV 12

Northing (m):	5186307.00	Azimuth:	13.00°
Easting (m):	691185.35	Inclination:	65.00°
Elevation (m.a.s.l.):	392.86	Length (m):	119.15



DRAFT

LITHOLOGY

- Gneiss
- Syenite
- CalSilComplex
- Phlogopite Dyke
- Per Alkaline Granite

FEATURES

- Lost Core
- Inferred Fault / Shear
- Broken Core

PROJECT	Matamec - Témiscamingue				
TITLE	HISTOGRAM SUMMARY PLOT GM-12-03				
Golder Associates	PROJECT No.	12-1221-0034		SCALE	1:400
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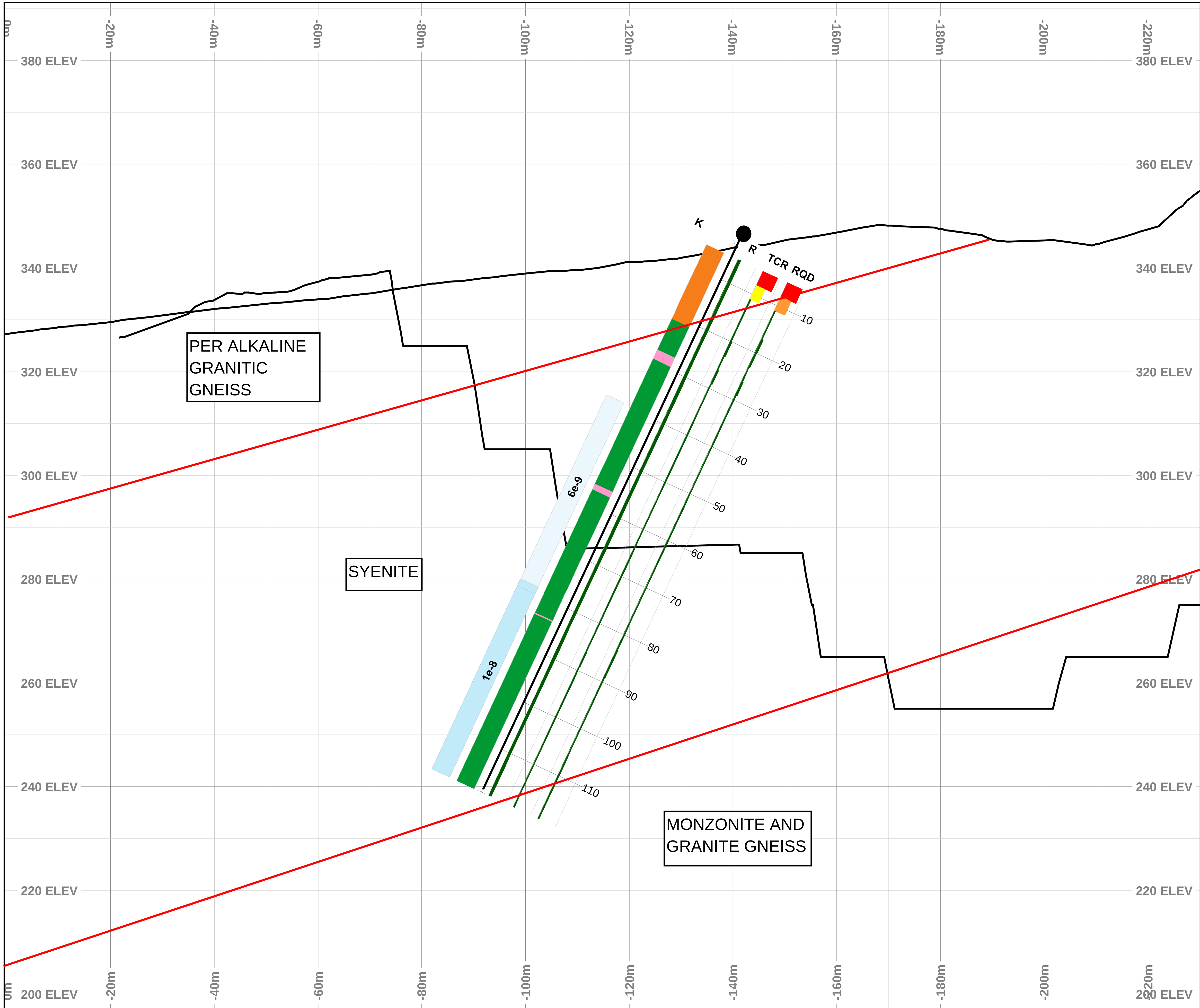
	REVIEW	JT	06 NOV 12		



LEGEND

HYDRAULIC CONDUCTIVITY	R (ISRM)	TCR	RQD
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[1e-7,1e-6]	[4,5]	[75,90]	[75,90]
[1e-8,1e-7]	[3,4]	[50,75]	[50,75]
[1e-10,1e-8]	[2,3]	[25,50]	[25,50]
	[1,2]	[0,25]	[0,25]
	[0,1]		

LITHOLOGY

- [Syenite]
- [Gneiss]
- [CalSilComplex]
- [Phlogopite Dyke]

NOTES

- Borehole collars provided by Matamec Explorations Inc.
- Section azimuth: 182.48° (looking towards west).
  This azimuth is defined along the line between borehole collar and toe.
  The height of the color bars represents the length of the interval on which the test was performed.
- Proposed pit presented
- Schematic Geological Interpretation by Golder

REFERENCES

- Topography: C11087lidar_2004_UTM.dwg
  Matamec Explorations Inc, May 19, 2011

- Pit: 3_KipawaGeneralSiteLayout.dwg
  Roche, February 23, 2012

1:750

0 10 20 30 40 50

PROJECT

MATAMEC EXPLORATIONS INC
KIPAWA PROJECT
TEMISCAMINGUE, QUEBEC, CANADA

TITLE

Section GM-12-04

Golder Associates

Project #	12-1221-0034	
CADD	A. Pascu	09 NOV 12
CHECK	C. Gravel	09 NOV 12
REVIEW	J. Tod	12 NOV 12

Northing (m):	5186442.00	Azimuth:	180.00°
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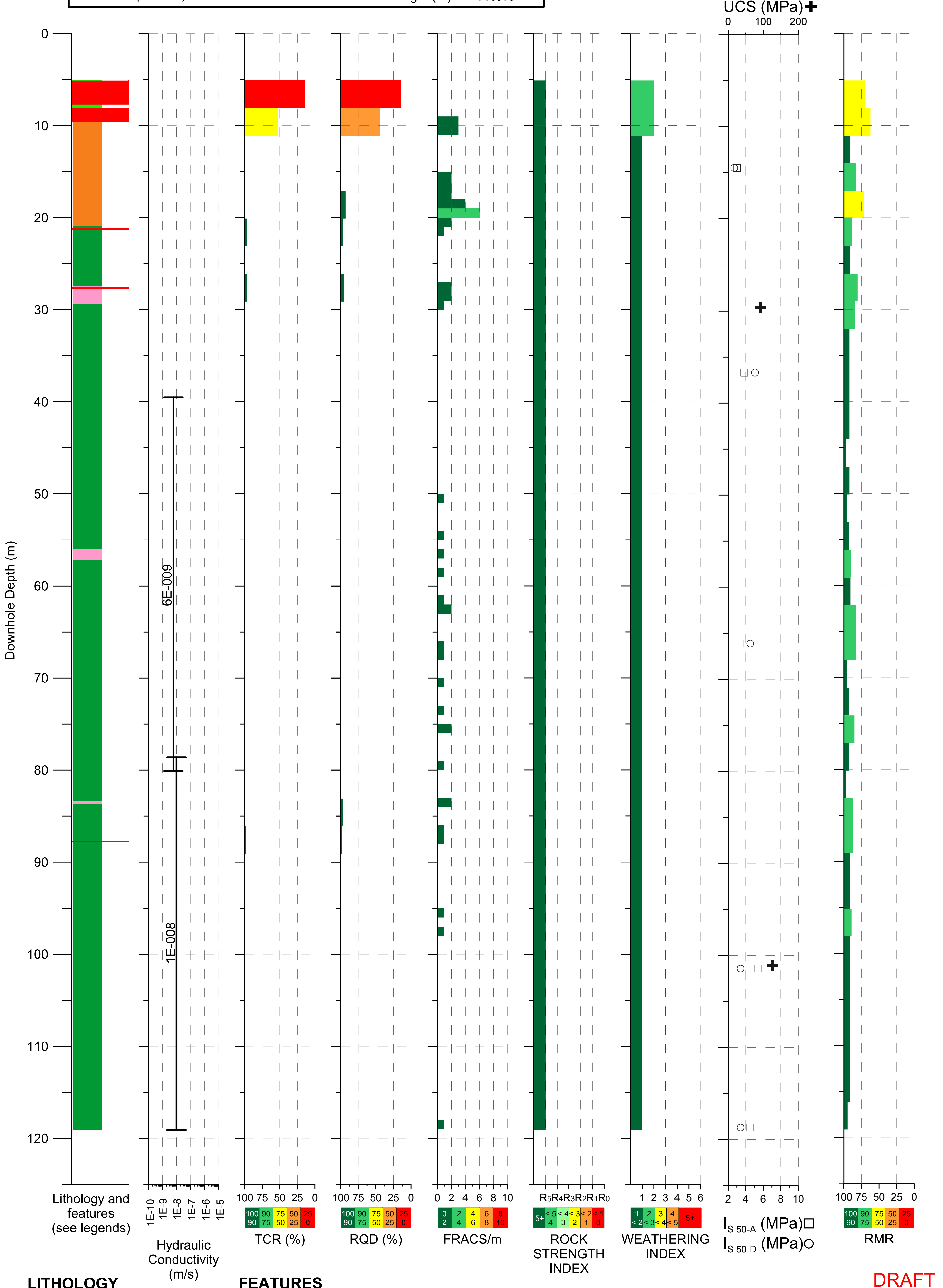

LITHOLOGY

- Gneiss
- Syenite
- CalSilComplex
- Phlogopite Dyke
- Per Alkaline Granite

FEATURES

- Lost Core
- Inferred Fault / Shear
- Broken Core

PROJECT

Matamec - Témiscamingue

TITLE

HISTOGRAM SUMMARY PLOT
GM-12-04

Golder Associates

PROJECT No.	12-1221-0034	SCALE	1:400
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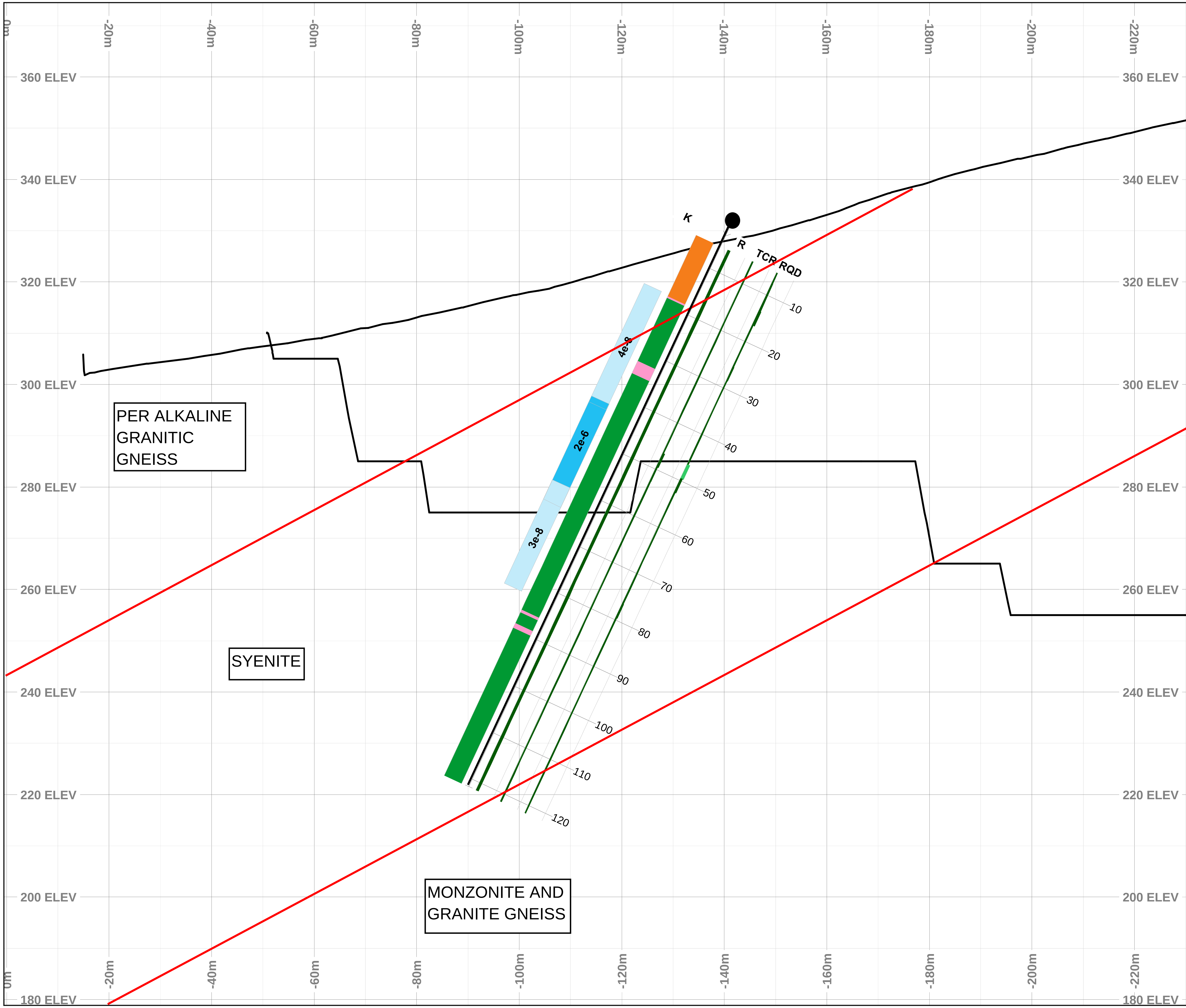
CHECK	CG	06 NOV 12	04
REVIEW	JT	06 NOV 12	



LEGEND

HYDRAULIC CONDUCTIVITY
- [1e-6,1e-5]
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- [1e-8,1e-7]
- [1e-10,1e-8]

R (ISRM)
- [5]
- [4,5]
- [3,4]
- [2,3]
- [1,2]
- [0,1]

TCR
- [90,100]
- [75,90]
- [50,75]
- [25,50]
- [0,25]

RQD
- [90,100]
- [75,90]
- [50,75]
- [25,50]
- [0,25]

LITHOLOGY
- [Syenite]
- [Gneiss]
- [CalSilComplex]
- [Phlogopite Dyke]

NOTES

- Borehole collars provided by Matamec Explorations Inc.
- Section azimuth: 240.05° (looking towards north).
  This azimuth is defined along the line between borehole collar and toe.
  The height of the color bars represents the length of the interval on which the test was performed.
- Proposed pit presented
- Schematic Geological Interpretation by Golder

REFERENCES

- Topography: C11087lidar_2004_UTM.dwg
  Matamec Explorations Inc, May 19, 2011

- Pit: 3_KipawaGeneralSiteLayout.dwg
  Roche, February 23, 2012

1:750

0 10 20 30 40 50

PROJECT

MATAMEC EXPLORATIONS INC
KIPAWA PROJECT
TEMISCAMINGUE, QUEBEC, CANADA

TITLE

Section GM-12-05

Golder Associates

Project #	12-1221-0034	
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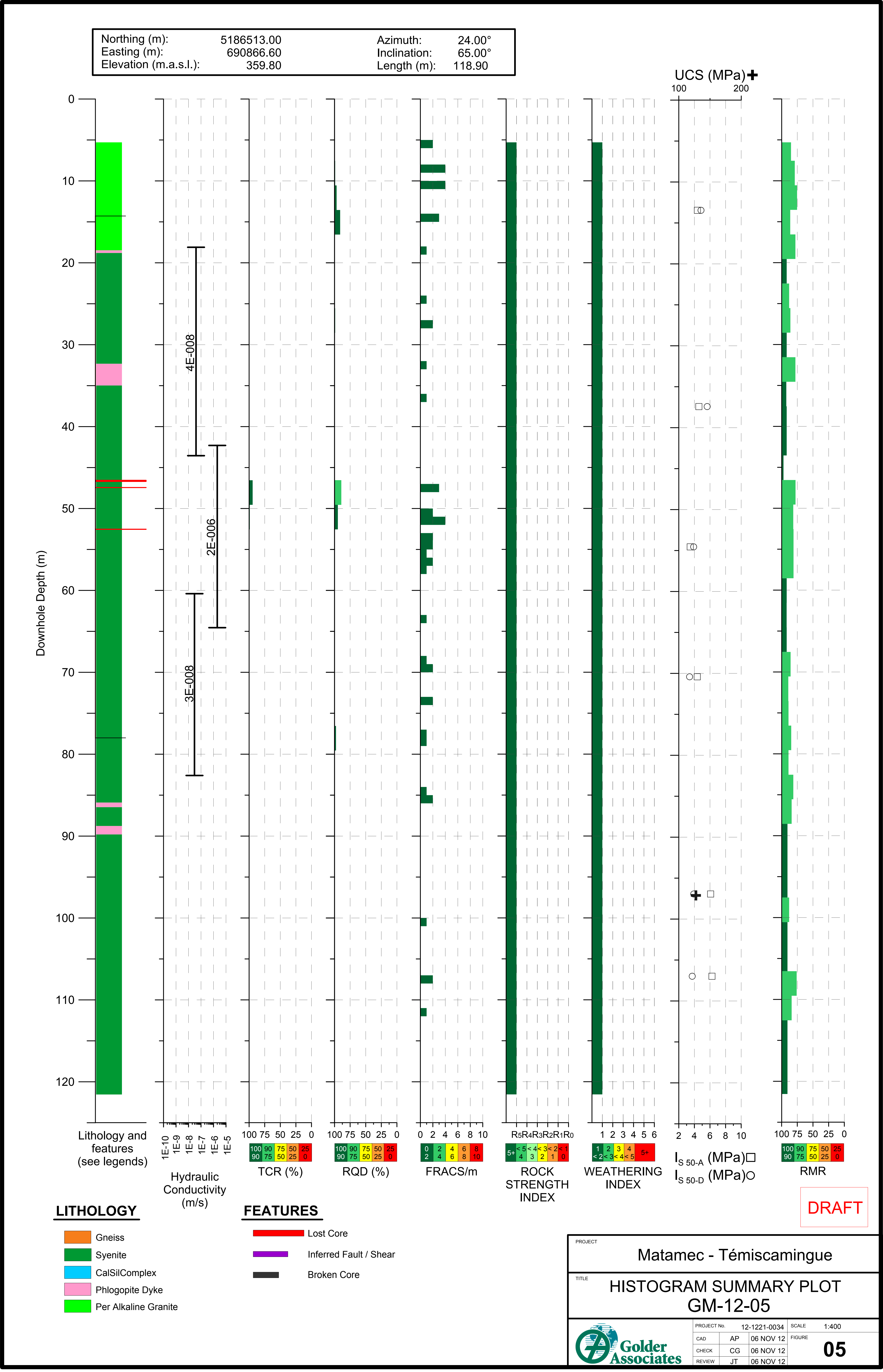
CHECK	C. Gravel	09 NOV 12
REVIEW	J. Tod	12 NOV 12



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Easting (m): 690866.60
Elevation (m.a.s.l.): 359.80
Azimuth: 24.00°
Inclination: 65.00°
Length (m): 118.90
Downhole Depth (m)
Lithology and features (see legends)
4E-008
2E-006
3E-008
Hydraulic Conductivity (m/s)
TCR (%)
RQD (%)
FRACS/m
ROCK STRENGTH INDEX
WEATHERING INDEX
UCS (MPa)
$I_{S\ 50-A}$ (MPa)
$I_{S\ 50-D}$ (MPa)
RMR
DRAFT
LITHOLOGY
Gneiss
Syenite
CalSilComplex
Phlogopite Dyke
Per Alkaline Granite
FEATURES
Lost Core
Inferred Fault / Shear
Broken Core
PROJECT Matamec - Témiscamingue
TITLE HISTOGRAM SUMMARY PLOT GM-12-05
Golder Associates
PROJECT No. 12-1221-0034
SCALE 1:400
CAD AP 06 NOV 12
CHECK CG 06 NOV 12
REVIEW JT 06 NOV 12
FIGURE 05

APPENDIX A-2

Laboratory Testing

TABLE OF CONTENTS

1.0 INTRODUCTION

An essential part of a rock mass characterization program is the evaluation of intact rock strength for the different domains present in the study area.

The intact rock strength is usually expressed as the uniaxial compressive strength (UCS), which can be obtained through laboratory tests on rock core samples. To complement laboratory testing, it is possible to carry out strength estimation in the field based on field rock hardness (Brown 1981) or through point load tests (ASTM 2008). Point load tests provide indexed strength values similar to laboratory UCS tests. The advantage of point load tests is that they can be done with significantly less effort (and less cost) and therefore more tests can be completed and a larger sample size of data obtained. When conducted correctly, point load tests are considered a reliable measure of the intact rock strength. The field rock hardness estimate is usually performed during core logging, and gives an order of magnitude estimate of the strength of the rock unit.

To complete a rock mass characterization, it is also important to understand the strength parameters of the discontinuities as well as the intact rock. As such, direct shear tests were also conducted on rock core samples.

This appendix summarizes the results of the testing carried out in order to characterize the intact rock strength and discontinuity characteristics of the different domains considered for the Kipawa open pit project. Detailed laboratory results are included in Appendices F and H of Golder's factual report "Matamec Kipawa Heavy Rare Earths Project – Factual Report: Geomechanics" issued in December 2012 (Golder Associates, 2012).

2.0 GEOTECHNICAL DOMAINS AND ROCK TYPES

Four (4) rock units have been considered in the Engineering Geology Model (EGM). The EGM rock units have been created based on local geology, with a rock mechanics' perspective. The EGM rock units may contain different rock types, as presented in Section 3.2 (Local Geology) of the main report. The EGM rock units are summarized below:

- Syenite gneiss (SY): Includes all sub-divisions of the syenite gneiss (Leuco, Meso, Mafic, SG), as well as the peralkaline granite gneiss (PerGrn).
- Calco-silicate complex (CAL-SIL): Includes marble (MAR) and diopside-feldspar (D-F) lenses in the SY unit.
- Granitic gneiss (GN): Includes monzonite gneiss (MONZ) and granitic basement gneiss (GRN).
- Phlogopite (PH): Consists of phlogopite bands within the CAL-SIL unit.

Intact rock strength has been evaluated for two (2) EGM rock units: GN and SY. Those two (2) units are the principal ones at the Kipawa deposit area. Core samples were available and tested only on those units.

Plate 1 presents a schematic NE-SW cross-section of the EGM rock units. The pit design has been superimposed for reference.

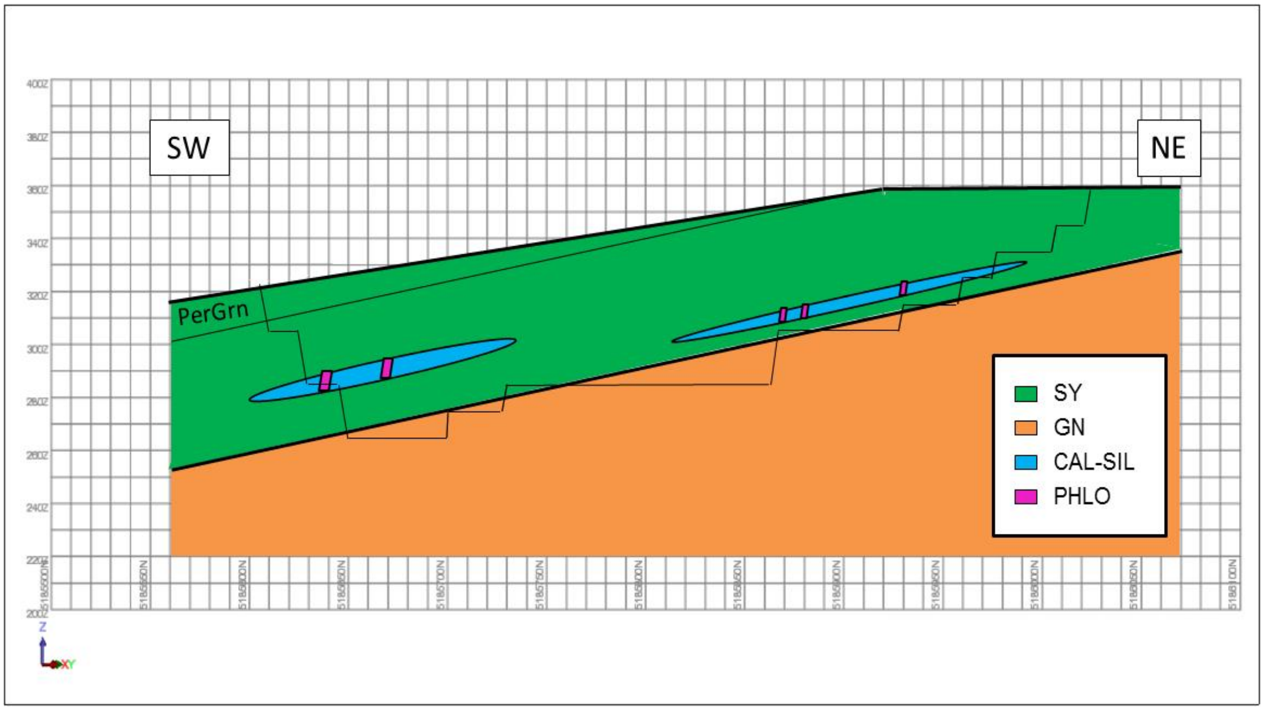


Plate 1: Schematic section of distribution of mine geotechnical domains

3.0 LABORATORY TESTING

3.1 Unconfined Compressive Strength (UCS)

A total of 15 core samples were prepared in order to estimate the Unconfined Compressive Strength (UCS) for the geotechnical domains of the Kipawa rock mass; however, one of the samples broke during sample preparation and was rejected. A total of 14 samples were successfully tested for UCS.

Statistics of UCS testing results are shown on Table 1, by geotechnical domain. The UCS for the GN domain ranges between 51 and 108 MPa, with an average UCS of 77 MPa and a standard deviation of 21 MPa. The UCS results for the SY domain material range between 51 and 132 MPa, with an average UCS of 107 MPa, but with a standard deviation of 28 MPa.

Table 1: Statistics of UCS Obtained From Laboratory Testing by Mine Domain

Domain	Average (MPa)	Max (MPa)	Min (MPa)	St. Dev. (MPa)	Number of Samples
GN	**77**	108	51	21	7
SY	**107**	132	51	28	7

3.2 Direct Shear

Samples for direct shear testing on discontinuities were taken from drill core in geological holes drilled during the 2012 geotechnical investigation campaign. A total of 5 samples were selected, based on the structures available for direct shear testing. Drill core with representative joints, veins and phologopite bands was selected and described, including aperture, infilling, JCR, roughness of surface and host rock lithology and alteration. The detailed results of the 5 direct shear tests are included in Table 2.

Table 2: Residual Shear Strength Parameters Obtained from Direct Shear Test

Sample Number	Depth (m)	Logged Lithology	Domain	Feature Type	Residual Strength	
					φ (°)	c (kPa)
10	113,47	Monzonite	GN	Joint	27,2	61
9	55,98	Syenite	SY	Phlogopite Band	28,9	13
12	66,39	Syenite	SY	Joint	33,8	83
17	53,87	Syenite	SY	Phlogopite Band	30,4	0
20	104,32	Monzonite	SY	Vein	39,3	134

The average results of the residual strength data from direct shear testing are presented in Table 3 for each geological domain.

Table 3: Summary of Shear Strength Parameters Obtained from Direct Shear Test

Domain	GN	SY
φ (°)	27,2	33,1
c (kPa)	61,0	57,5

It is possible to estimate the shear strength of discontinuities base on the parameters collected for the rock mass classification. Barton *et al* (1974) indicate the approximate interval for the residual shear strength based on the observed values of Ja. The typical value for Ja for the rock mass at Kipawa is 1.0, which corresponds to an estimated residual friction angle of 25° to 35°, within the range of the laboratory direct shear tests above.

The quotient Jr/Ja represents the frictional characteristics (roughness and degree of alteration) of the joint surface or filling materials. Jr and Ja values were assigned to each discontinuity during core logging. A detailed description of the Jr and Ja parameters is presented in Appendix A of the Geomechanics Factual Report (Golder Associates, 2012).

The function tan^{-1}(Jr/Ja) is considered to represent a fair approximation of the actual shear strength (peak total friction angle) of discontinuities based on the various combinations of wall roughness and alteration (Barton, et al., 1974). It is important to note that this correlation gives exaggeratedly high “peak total friction angles” for rough and unaltered joints (i.e. $tan^{-1}(Jr/Ja) > 70°$), which dilate most under shear, and exaggeratedly low “peak total friction angles” for the thick strain-softening discontinuities (i.e. $tan^{-1}(Jr/Ja) < 10°$), which dilate minimally or contract under shear. Discontinuities with intermediate values of Jr/Ja (between 0.2 and 2), which undergo minimal dilation and do not contract under shear, give results resembling friction angles measured in shear tests under moderate normal stress levels.

The joint roughness and joint alteration numbers for each discontinuity were analyzed, as shown in Table 4. Most of the joints in the rock mass are characterized as planar/rough with no alteration. As a result, the estimated friction angles are high. For analyses purposes, a friction angle of For analyses purposes, a friction angle of 30° with no cohesion will be used, which is considered conservative.

Table 4: Estimated Friction Angle Based on the Ratio of Jr/Ja for Each Rock Type

Rock Type	Count	Jr/Ja[1]			Estimated Friction Angle (°)[2]	
		Average	Std. Dev	L. Bound[3]	Average	L. Bound
SY	211	2.1	1.6	0.5	64	27
GN	90	2.2	1.8	0.4	65	20
CAL-SIL	23	2.0	1.3	0.7	63	35
PHLO	15	1.5	1.5	0.1[4]	56	7[4]

Notes:
1. Jr and Ja estimated for each discontinuity individually.
2. Friction angle estimated using the relation $tan^{-1}(Jr/Ja)$.
3. Lower bound taken as (Average – 1 Standard Deviation).
4. Lower bound uses the minimum observed value for Jr/Ja for PHLO, with calculated friction angle

4.0 POINT LOAD TESTING

The Point Load Test (PLT) testing was conducted on samples taken on the drill core collected in the 2012 geotechnical investigation campaign. PLT provides a field index of the intact rock strength by compressing core between conical steel platens until the sample fails, and recording the pressure at failure. These results are then corrected to the standard “equivalent diameter” of 50 mm to determine the point load strength index ($Is_{(50)}$) of rock specimens via the relationship:

$$Is_{(50)} = {}^{P}/_{De^2}$$

where:

P = failure load
De = Equivalent core diameter

A total of 30 samples were tested (213 breaks) on different rock types and mine domains. Table 5 summarizes the statistics of the testing results by geotechnical domain.

Table 5: Statistics of $Is_{(50)}$, by Geotechnical Domain

Domain	Average (MPa)	Max (MPa)	Min (MPa)	St. Dev. (MPa)	Break Count
GN	4,2	5,2	2,7	1,0	38
SY	3,8	6,8	1,4	1,3	175

To assess the anisotropy of the rock mass, statistics were calculated for the GN and SY units by test type (axial and diametral). Table 6 summarizes the results, and some differences can be observed between the axial and diametral tests, with the axial tests giving slightly higher values, on average. However, possible anisotropy was explicitly assessed in the field. Samples were tested for different foliation orientation orientations and no preferential breaking planes were identified.

Table 6: Comparison of Axial and Diametral Test Results

Domain	Test Type	Average (MPa)	Max (MPa)	Min (MPa)	St. Dev. (MPa)	Break Count
GN	A	4,8	6,3	2,3	1,4	18
	D	3,6	5,1	2,7	0,9	20
SY	A	4,3	7,3	1,3	1,6	85
	D	3,5	7,0	1,1	1,3	90

Point load testing causes failure of the rock in tension; the accuracy of the UCS prediction from PLT data depends on the ratio between the UCS and the tensile strength. Typically the laboratory UCS is equal to 15 to 25 times the value of the point load index $Is_{(50)}$ (ASTM, 2008). As shown on Table 5, a correlation has been obtained by matching adjacent samples of PLT and UCS obtained for several depths. The geotechnical domains were treated independently. From the best-fit curve of the correlation data, a correlation factor of 22.6 was determined for the GN domain and a factor of 20.6 was determined for the SY domain. These factors can be used to estimate the unconfined compressive strength from point load test results through the correlations UCS = $23.5 \cdot Is_{(50)}$ and UCS = $20.6 \cdot Is_{(50)}$ for the GN and SY domains, respectively.

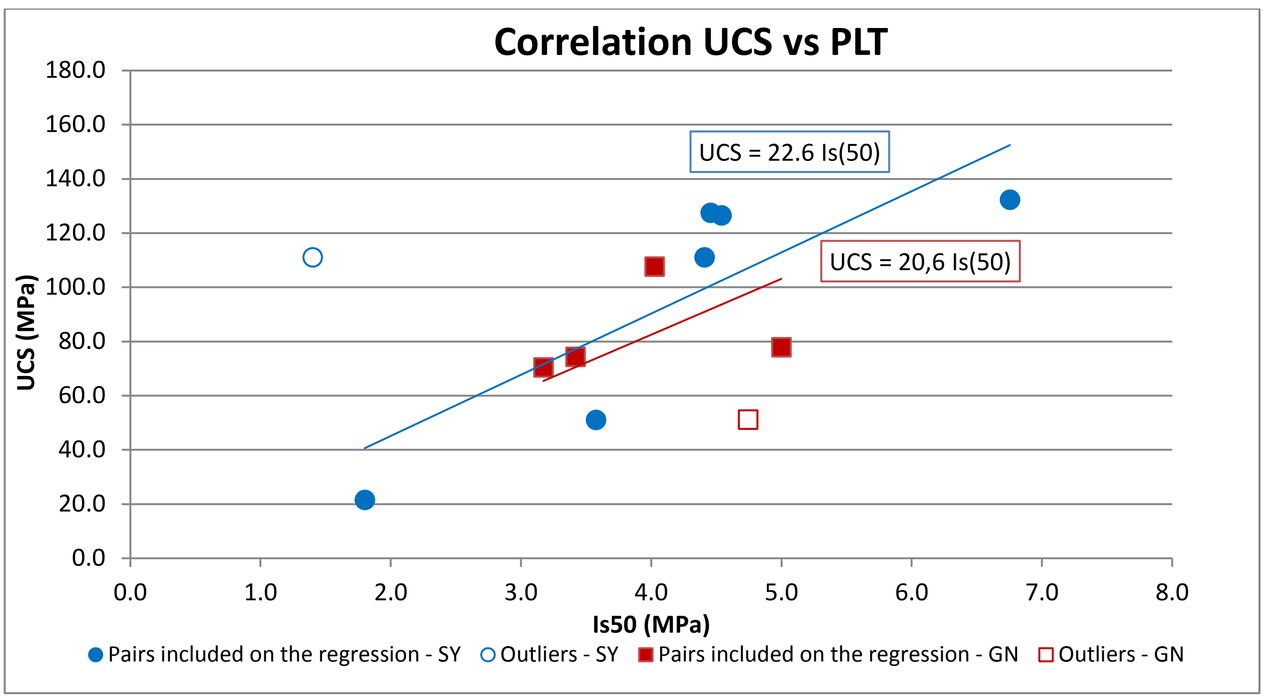


Plate 2: Correlation between UCS and Is50 obtained by matching adjacent samples of PLT and UCS obtained from several depths

Table 7 presents a statistical summary of the UCS values estimated from PLT results for each domain using the correlation factors from Plate 2.

Table 7: Statistics of UCS Values Estimated From PLT Correlation, by Geotechnical Domain

Domains	Average (MPa)	Max (MPa)	Min (MPa)	St. Dev. (MPa)	Count
GN	81	107	55	36	2
SY	84	134	31	29	17

The average value of UCS calculated from the Point Load Test compare favourably for the GN domain (within 5%). The minimal and maximal values are also comparable. The average values of UCS calculated from the PLT is less representative for the SY domain, with an obtained value around 20% lower than the average calculated from the UCS tests. It should be noted that the minimal value is significantly lower using the correlation than for the UCS test results. To some degree, this discrepancy can be attributed to the variation within the PLT results. The limited number of UCS test performed also comes into play.

5.0 FIELD HARDNESS ESTIMATION

The strength of the intact rock was also estimated during the geotechnical core logging using standard field identification methods (Brown, 1981). The field hardness values are described in Table 8. This observational approach provides a cost-effective estimate of intact rock strength on a per run basis. Given that UCS and PLT testing data are available for the Matamec rock mass, the field hardness estimations are presented herein for completeness and comparison only.

Table 8: Intact Rock Strength Estimation From Field Hardness Classification (ISRM, 1981)

Description	Grade	Field Identification	Estimated Range of UCS (MPa)
Extremely Weak Rock	R0	Indented by thumbnail.	0.25 – 1.0
Very Weak Rock	R1	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1.0 – 5.0
Weak Rock	R2	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5 – 25
Medium Strong Rock	R3	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer.	25 – 50
Strong Rock	R4	Specimen requires more than one blow of geological hammer to fracture it.	50 – 100
Very Strong Rock	R5	Specimen requires many blows of geological hammer to fracture it.	100 – 250
Extremely Strong Rock	R6	Specimen can only be chipped with geological hammer.	> 250

Plate 3 summarizes the field rock hardness of the drill core, by geotechnical domain, estimated from the ranges shown in Table 8.

The following can be observed on Plate 3:

- All the data falls into the Strong to Very Strong Rock categories for field hardness values.
- The GN domain has an estimated hardness of R5 (100 to 250 MPa).
- The SY domain has an overall estimated hardness of R5 (100 to 250 MPa) with a few meters in the R4 range (50 to 100 MPa).

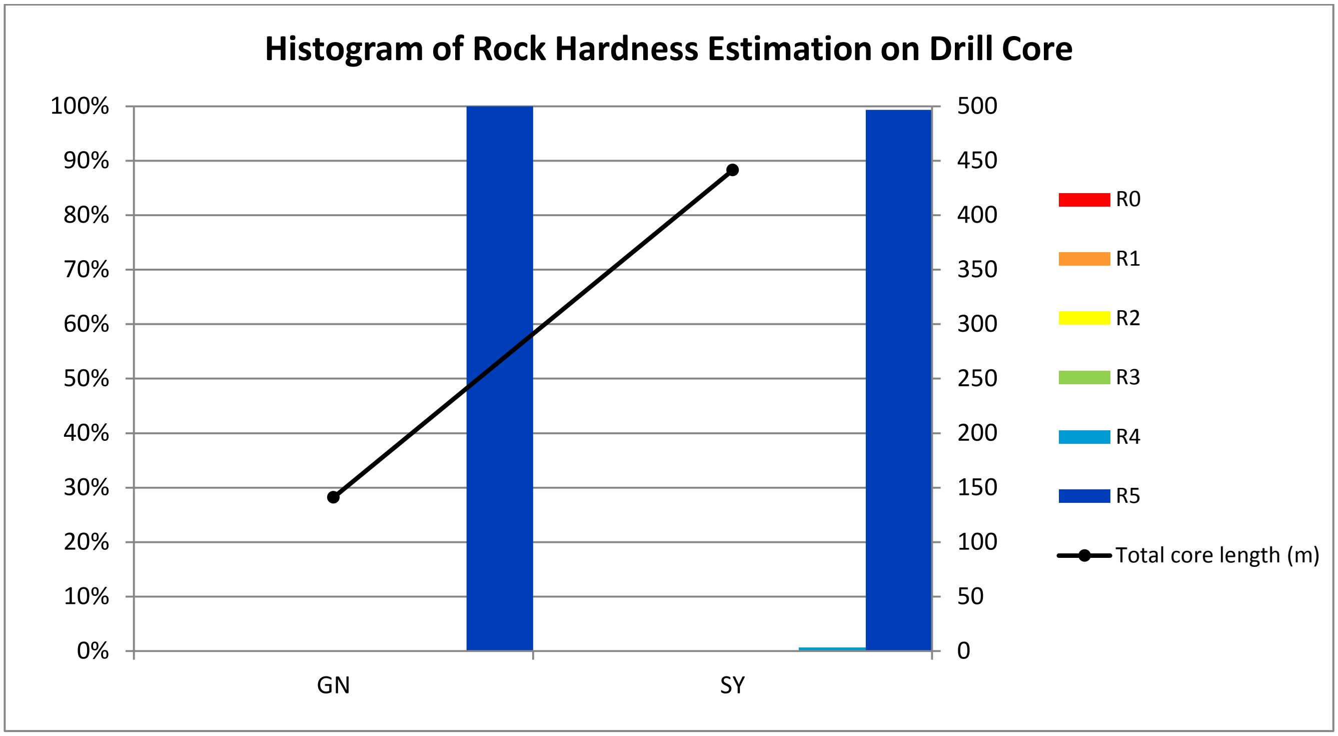


Plate 3: Histogram of rock hardness estimation on drill core

The Field Hardness estimates from the core logging appear to be fairly consistent with the values from the UCS and PLT Data. Average values by domain for the tests are within the 50 to 100 MPa (R4) and 100 to 250 MPa (R5) intervals. The presence of the R4 type rock in the rock hardness estimation data is confirmed by the correlated PLT results, where the calculated average for the SY domain falls into the R4 category (50 to 100 MPa). It is possible that the field hardness was affected by factors other than the rock strength; these factors, which include fracturing, infilling and weathering, are addressed in the rock mass classification parameters discussed in Appendix A. of the Geomechanics Factual Report (Golder Associates, 2012).

Table 9 presents a summary of the calculated and estimated UCS statistics for the UCS tests, the PLT correlations and the Field Hardness Estimation UCS ranges.

Table 9: Summary of UCS Test, UCS Estimated From PLT Correlation and UCS From Field Hardness Estimation (FHE) Statistics

Domains	Test Type	Average (MPa)	Max (MPa)	Min (MPa)	St. Dev. (MPa)	Count
GN	UCS	77	108	51	21	7
	UCS (from PLT corr.)	81	107	55	36	2
	FHE	100 - 250	250	100	-	49
SY	UCS	107	132	51	28	7
	UCS from PLT corr.)	84	134	31	29	17
	FHE	100 - 250	250	50	-	150

The average value of UCS calculated from the Point Load Test compare favourably for the GN domain (within 5%). The minimal and maximal values are also comparable. The average values of UCS calculated from the PLT is less representative for the SY domain, with an obtained value around 20% lower than the average calculated from the UCS tests.

The Field Hardness Estimates from the core logging appear to be fairly consistent with the values from the UCS and PLT Data. Average values by domain for the tests are within the 50 to 100 MPa (R4) and 100 to 250 MPa (R5) intervals. The presence of the R4 type rock in the rock hardness estimation data is confirmed by the correlated PLT results, where the calculated average for the SY domain falls into the R4 category (50 to 100 MPa). It is to be noted that the FHE is a crude approximation of the UCS only and offers very little precision.

6.0 YOUNG'S MODULUS AND POISSON'S RATIO

6.1 Young's Modulus

During UCS testing, stress and strain data was recorded for some of the samples, to allow an approximation of Young's Modulus. Young's Modulus is the ratio of stress over unit strain in the elastic range, and indicates the amount of axial deformation during sample compression. Table 10 shows a summary of the Young's Modulus testing results by domain. The overall averages for the two domains are similar, but the variation is greater for the SY domain.

Table 10: Young's Modulus by Domain

Domains	Average (GPa)	Max (GPa)	Min (GPa)	St. Dev. (GPa)	Number of Samples
GN	19,1	25,2	12,6	4,6	7
SY	22,5	32,8	5,2	9,4	8

6.2 Poisson's Ratio

Stress and strain data recorded during UCS testing also allows an approximation of Poisson's Ratio, the ratio of expansion in the lateral direction to compression in the axial direction. Table 11 shows the summary of Poisson's ratio testing results by domain. The two domains show the same average and variation.

Table 11: Poisson's Ratio by Domain

Domains	Average	Max	Min	St. Dev.	Number of Samples
GN	0,2	0,5	0,1	0,1	7
SY	0,2	0,4	0,1	0,1	8

7.0 CLOSURE

The results from field estimations, field testing and laboratory testing from the field program at Matamec are summarized herein. These factors are used to determine various rock mass parameters to be used in modeling for Matamec. These parameters, as well as the process used to derive them, are presented in Appendix A of the Geomechanics Factual Report (Golder Associates, 2012).

8.0 REFERENCES

ASTM. 2008. *Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Mass Classifications.* West Conshohocken: American Society for Testing of Materials, 2008. D 5731-08.

Barton, N. R., R. Lien, and J. Lunde. 1974. Engineering Classification of Rock Masses for the Design of Tunnel Support. Rock Mechanics Vol. 6. New York: s.n., 1974, pp. 189-236.

Brown, E.T. 1981. Rock characterization, Testing & Monitoring: ISRM Suggested Methods. Oxford: Published for the Commission on Testing Methods, International Society for Rock Mechanics, 1981.

Golder. 2012. Factual Report: Geomechanics. Report no. 12-1221-0034-005-RA-RevA. Preliminary version issued December 2012.

APPENDIX A-3

Structural Analysis and Selection of Structural Domains

1.0 INTRODUCTION

This appendix presents the analysis of the structural data obtained during the geomechanics field campaign for the Kipawa project during the summer of 2012.

2.0 AVAILABLE DATA

The structural data obtained during the summer geotechnical program is presented in detail in Appendix D of Golder's Report 005-12-1221-0034: *Factual Report: Geomechanics* (Golder 2012). The procedure for orientating the core and the general methods of representations for the discontinuities are also presented there. In total, 5 geotechnical boreholes were logged for a total length of 600.5 m of oriented core. The geotechnical boreholes were oriented to intersect the final walls of the open pit at approximately 2/3 of the ultimate pit depth. Three boreholes were located in the north wall, and 2 were located in the south wall of the pit.

Seven (7) trenches had been excavated to bedrock in the study area during exploration work at Kipawa. To complement the core logging data and to provide information on the persistence of geological structure in the study area, scanline mapping of the bedrock exposed in these trenches was undertaken. The locations of the boreholes and the trenches are shown in Figure 2 of the main report. The number of features measured in each borehole and in the surface mapping is summarized in Table 1.

Table 1: Structural Data Measurements Taken for the Kipawa Project

Survey Type	Identification	Location	Number of Structural Measurements
Oriented core	GM-12-01	Northeast wall	40
	GM-12-02	Northeast wall	97
	GM-12-03	Northeast wall	62
	GM-12-04	Southwest wall	58
	GM-12-05	Southwest wall	53
Surface Mapping	T-4, T-6, T-7, T-8, T-11 and T-13	Northeast wall and central pit	52

3.0 ROCK MASS STRUCTURES

Regionally, faults trending towards 260° can be observed from aerial photos. Shear zones trending towards 65° have also been observed (Roche SGS, 2012). At the deposit scale, however, no major structures were recorded. The entire rock mass is an almost entirely undeformed gently southwest dipping linear slab. Consequently, the structural data was not subdivided based on location relative to major structures.

4.0 ORIENTATION OF DISCONTINUITIES

4.1 Borehole Orientation and Blind Zones

The orientations of the boreholes are illustrated on Plate 1, which also shows the blind zone associated with each borehole. The blind zone is defined as the window in which structures are less likely to be intersected by a borehole as their orientation is within +/- 15° of the azimuth of the drillhole [check]. Plate 1 shows that the holes are oriented to compensate for these blind zones.

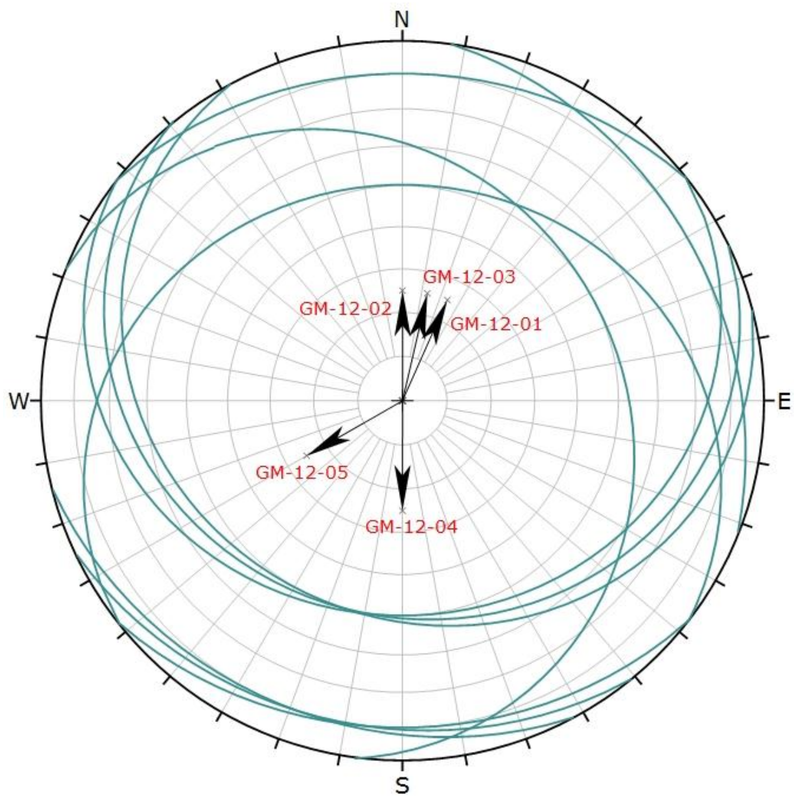


Plate 1: Borehole orientations and blind zones for Kipawa geotechnical investigation.

4.2 Analysis of Structural Data

Structural data from the site was analyzed using Dips software (Rocscience ™). The structural data from each borehole was first plotted on lower hemisphere equal area projections as shown in Figures A3-1 and A3-2. These figures show the clusters of poles to the observed mapped planes, as well as the orientation of the borehole, and the "blind zone" for each borehole. The data for all the boreholes was combined and the results compared based on the Validation (confidence) rankings for each of the holes (as discussed in Appendix 4 of the factual report (Golder, 2012). These plots, shown in Figure A3-3, indicate that all holes with a confidence rating (Validation) of 1 and greater are suitable for use in the subsequent analyses.

Data was then analyzed based on rock type, as shown in Figure A3-4, with Syenite and Monzonite Gneiss considered as the major rock types at Kipawa. As can be seen from this figure, there is no variation in structural orientations by rock type.

During the core logging, the major discontinuity types that were recorded were joints, veins and foliation, given by the logging codes JN, VN and FO, respectively. The poles for these discontinuity types are overlain over the contour plots on Figure A3-5 for JN and VN, and Figure A3-6 for FO.

Data from surface mapping is plotted on the stereonet in Figure A3-7. The data from the oriented core was then compared to the mapping data on Figure A3-8 where it can be seen that the concentrations from the surface mapping data correspond well to the clusters of orientations identified from the oriented core.

4.3 Selection of Structural Domains

Based on the information shown in Figures A3-1 to A3-7, combined with the lack of major structures and the similarity of structural orientations between the major rock types, the rock mass at Kipawa is considered as a single structural domain.

4.4 Selection of Major and Minor Planes

Using the combined mapping and oriented core data, major and minor planes were selected for the Kipawa rock mass. The criteria for selection of major and minor planes are as follows:

- Major sets:
  - Fractures observed during mapping of the trenches on site;
  - Greater than 4% concentration of population on the stereonets.
- Minor sets:
  - Poorly developed sets perpendicular to the foliation;
  - Variations on the orientation of the foliation.

A stereonet showing the contours of the pole populations, the windows used to select the joint orientations and the corresponding planes is shown in Plate 2. The orientations of the major planes are shown in Table 2.

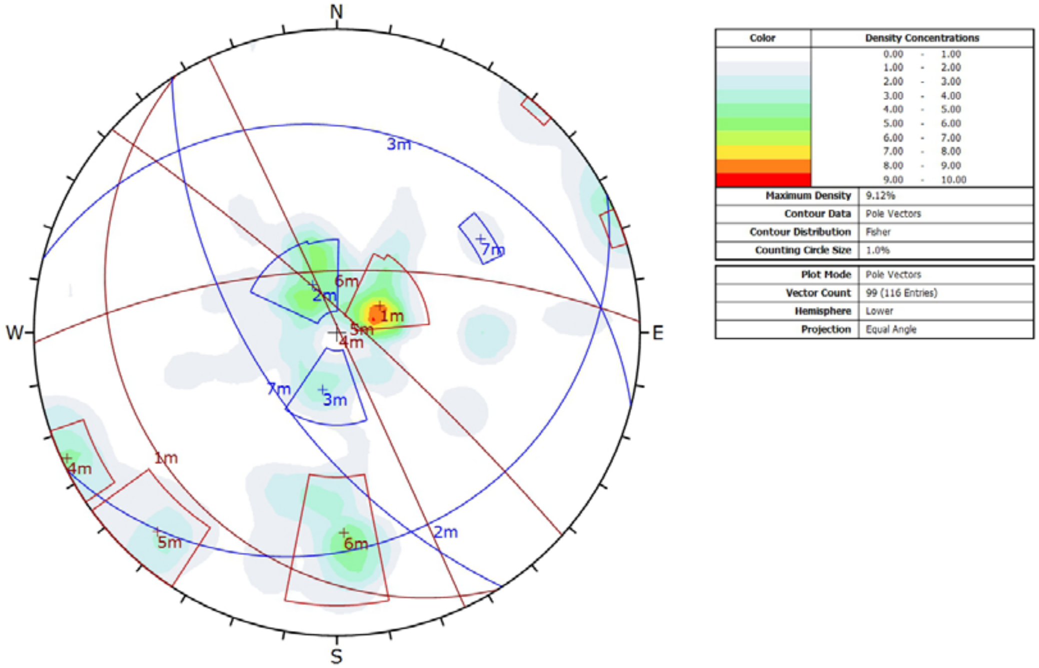


Plate 2: Contour plot showing set selection windows, plus major and minor planes for Kipawa.

Table 2: Discontinuity Sets Identified From Field Program

Set	Dip	Dip Direction	Major/Minor	Description
1	**20**	**236**	**major**	These sets represent the foliation at the site. Main orientation is shallowly dipping to the southwest (Set 1); some variation with dip to southeast (set 2) and to north (set 3).
2	21	155	minor	
3	22	14	minor	
4	**89**	**65**	**major**	Subvertical to steeply northeast dipping major sets observed across site. Both sets observed together in the same outcrop.
5	**84**	**41**	**major**	
6	**67**	**358**	**major**	Steeply north-dipping major set.
7	59	237	minor	Minor set dipping moderately to the southwest

5.0 CONCLUSIONS

The analyses presented in this appendix suggest that the rock mass at Kipawa can be considered as one structural domain for all rock types. The major discontinuity set observed at the site is a flat-lying set dipping shallowly to the southeast, with minor variations tipping to the southeast and to the north. Other major sets were identified dipping steeply to the east and northeast, as well as to the north. Additional minor sets were also observed.

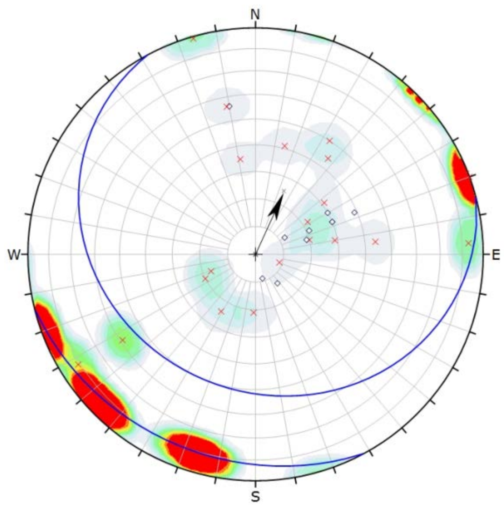
REFERENCES

Golder. 2012. *Factual Report: Geomechanics*. Report no. 12-1221-0034-005-RA-RevA. Preliminary version issued December 2012.

Roche SGS. 2012. Preliminary Economic Assessment Study for Kipawa Project. Roche Ref: 061623.001-200NI 43-101 Submitted to Matamec Explorations Inc. March 14, 2012.

\\golder.gds\gal\montreal\actif\2012\1221\12-1221-0034 matamec kipawa tmf and pit\5 preparation of deliverables\015 geomechanics report\appendix a - pit design\a-3 structural analysis and selection of structural domains\appendix a-3_final.docx

a) GM-12-01 – All Data



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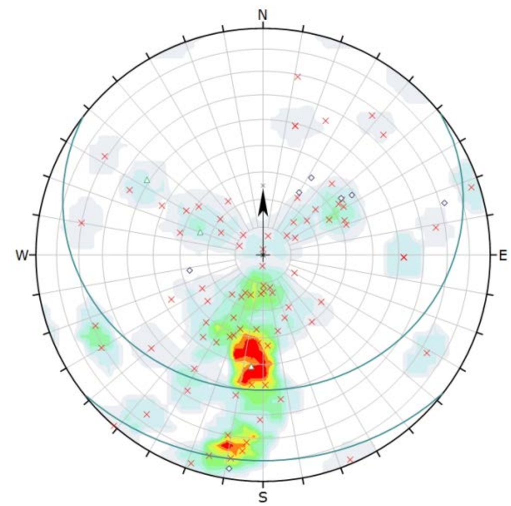
Projection	Equal Area

b) GM-12-02 – All Data



Plot Mode	Pole Vectors
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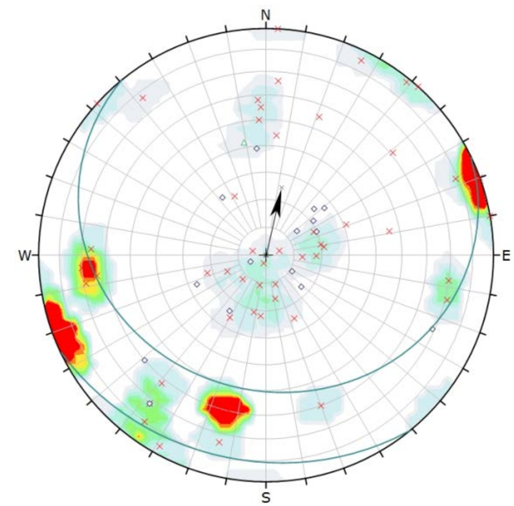
Terzaghi Weighting	Minimum Bias Angle 15°
Hemisphere	Lower
Projection	Equal Area

c) GM-12-03 – All Data



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Vector Count	62 (76 Entries)
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Hemisphere	Lower
Projection	Equal Area

Legend

Quantity	Blind zone	Hole average direction
◇ 0 × 1 △ 2		→

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
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	3.00 - 4.00
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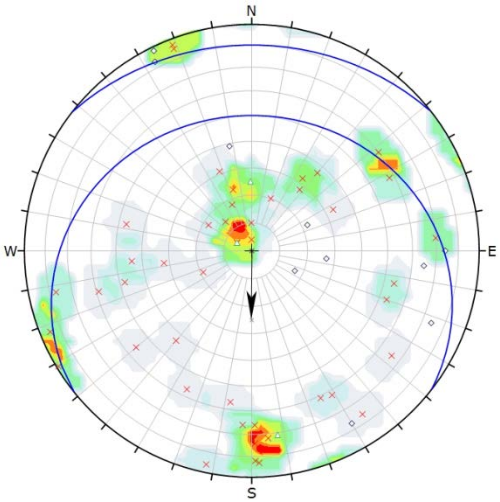
d) GM-12-04 – All Data



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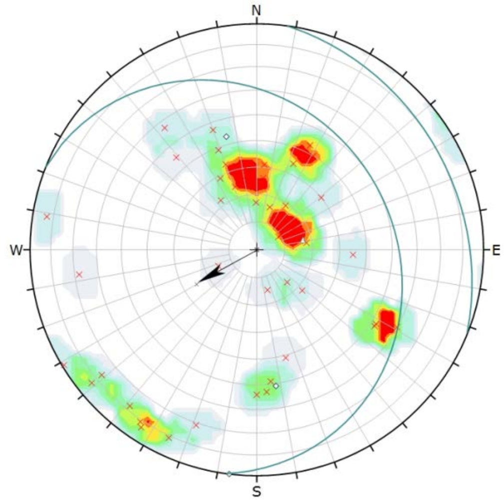
Hemisphere	Lower
Projection	Equal Area

Legend

Quantity	Blind zone	Hole average direction
◇ 0 × 1 △ 2		→

e) GM-12-05 – All Data



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Terzaghi Weighting	Minimum Bias Angle 15°
Hemisphere	Lower
Projection	Equal Area

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	1.00 - 2.00
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	3.00 - 4.00
	4.00 - 5.00
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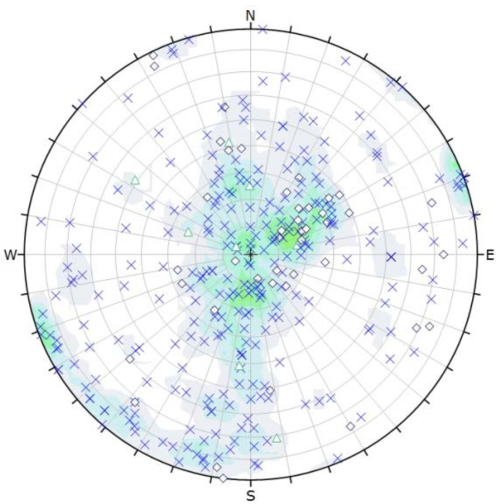
	9.00 <

a) All holes – All validity



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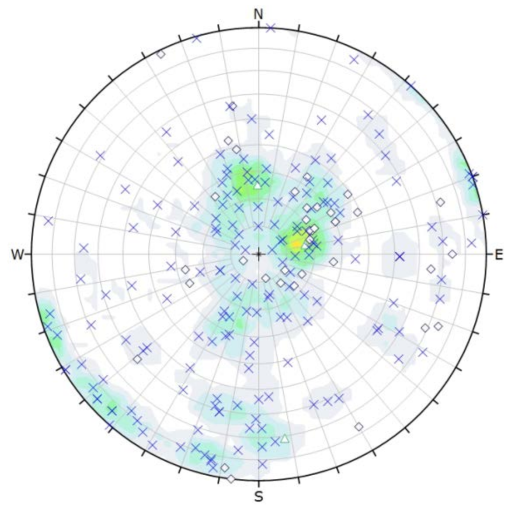
b) All holes - Validation 1+



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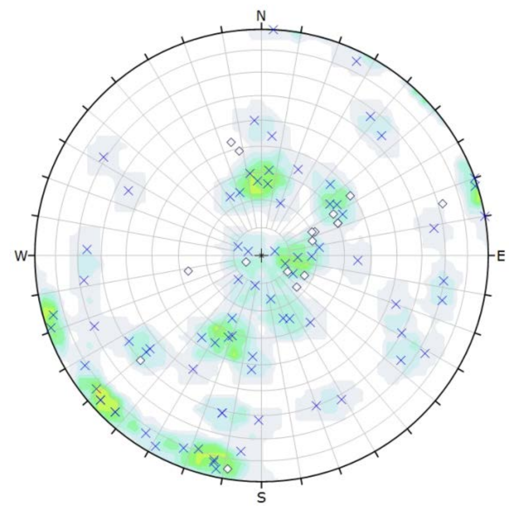
Hemisphere	Lower
Projection	Equal Area

c) All holes - Validation 2+



Plot Mode	Pole Vectors
Vector Count	80 (97 Entries)
Hemisphere	Lower
Projection	Equal Area

Legend

Quantity	Blind zone	Hole average direction
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× 1		
△ 2		

Color	Density Concentrations
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	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 <

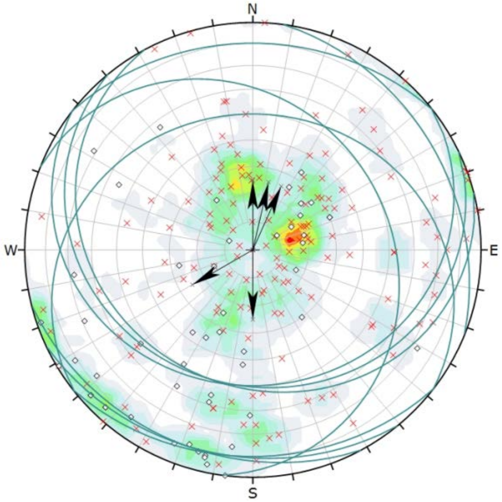
Validity 1+ shows good distribution quality

Date: April 2013
Project No: 12-1221-0034

Projected: CG Checked: CG
Drawn: MA Approved: JT

Golder Associés

a) Syenite + Monzonite Gneiss



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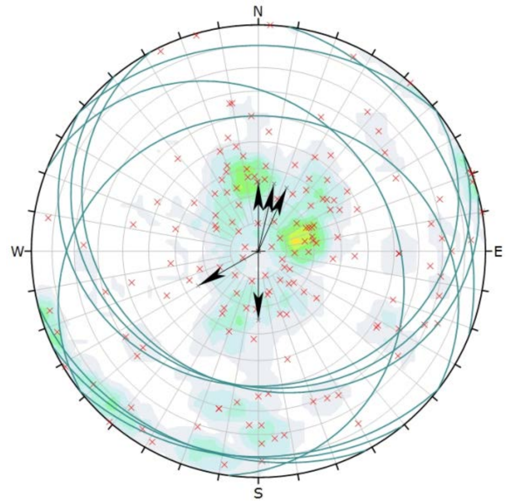
b) Syenite



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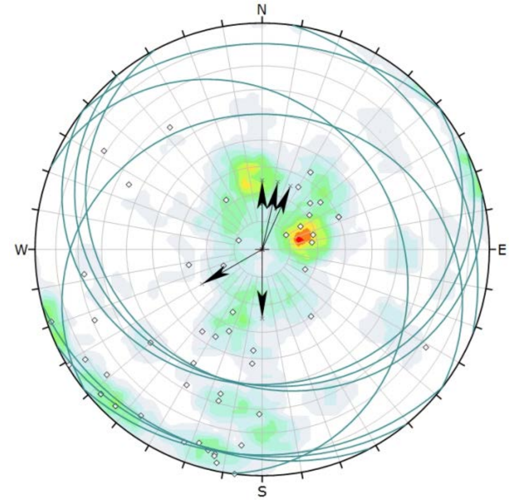
Hemisphere	Lower
Projection	Equal Area

c) Monzonite Gneiss



Plot Mode	Pole Vectors
Vector Count	179 (213 Entries)
Hemisphere	Lower
Projection	Equal Area

Legend

Type	Blind zone	Hole average direction
◇ 0 × 1		→

Color	Density Concentrations
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	4.00 - 5.00
	5.00 - 6.00
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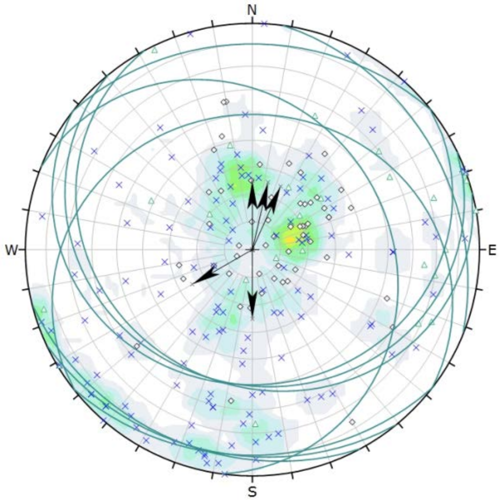
	9.00 <

No structural variability with rock type

a) All Data (Validity 1+)



Plot Mode	Pole Vectors
Vector Count	179 (213 Entries)
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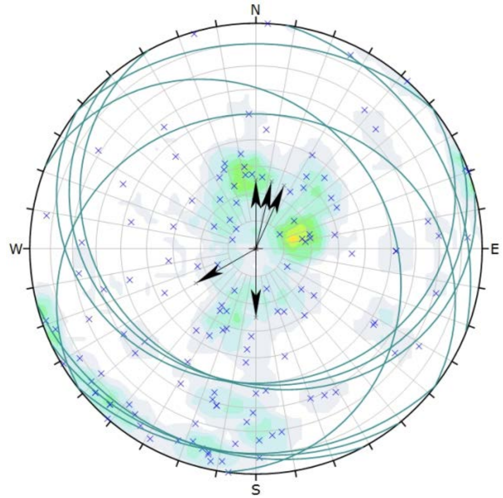
Projection	Equal Area

Legend		
Type	Blind zone	Hole average direction
◇ Foliation × Joint △ Vein		⟶

b) Joint(JN)



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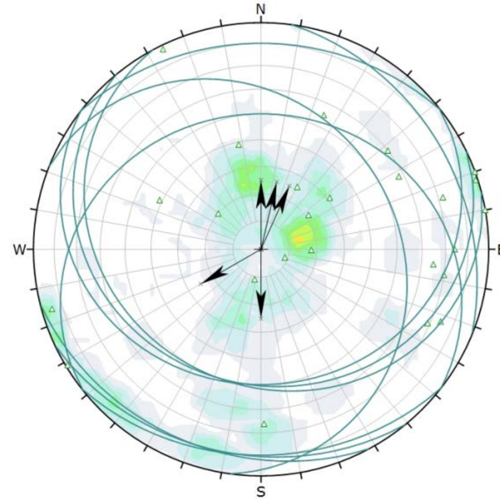
c) Vein (VN)



Symbol	TYPE	Quantity
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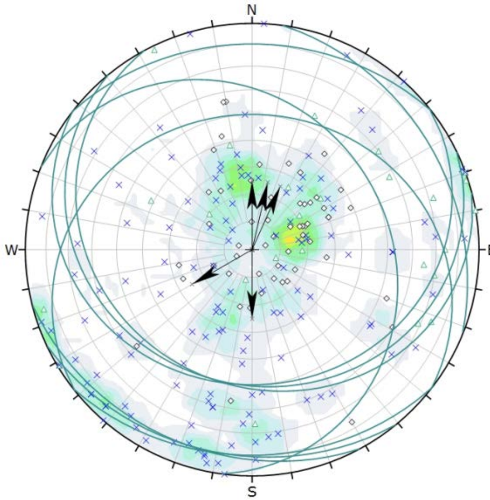
	Others	163

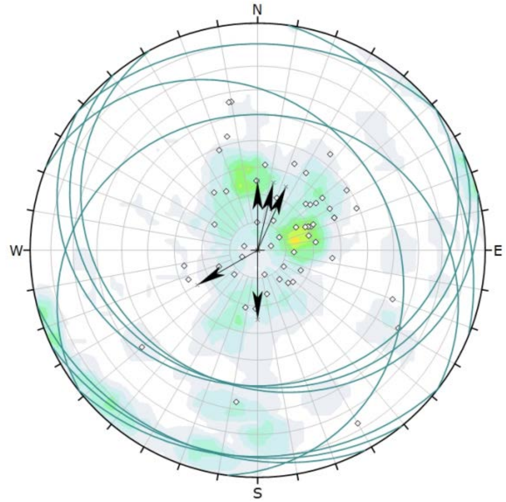
d) All Data (Validity 1+)



Plot Mode	Pole Vectors
Vector Count	179 (213 Entries)
Hemisphere	Lower
Projection	Equal Area

Legend		
Type	Blind zone	Hole average direction
◇ Foliation × Joint △ Vein		

e) Folitation (FO)



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	Others	148

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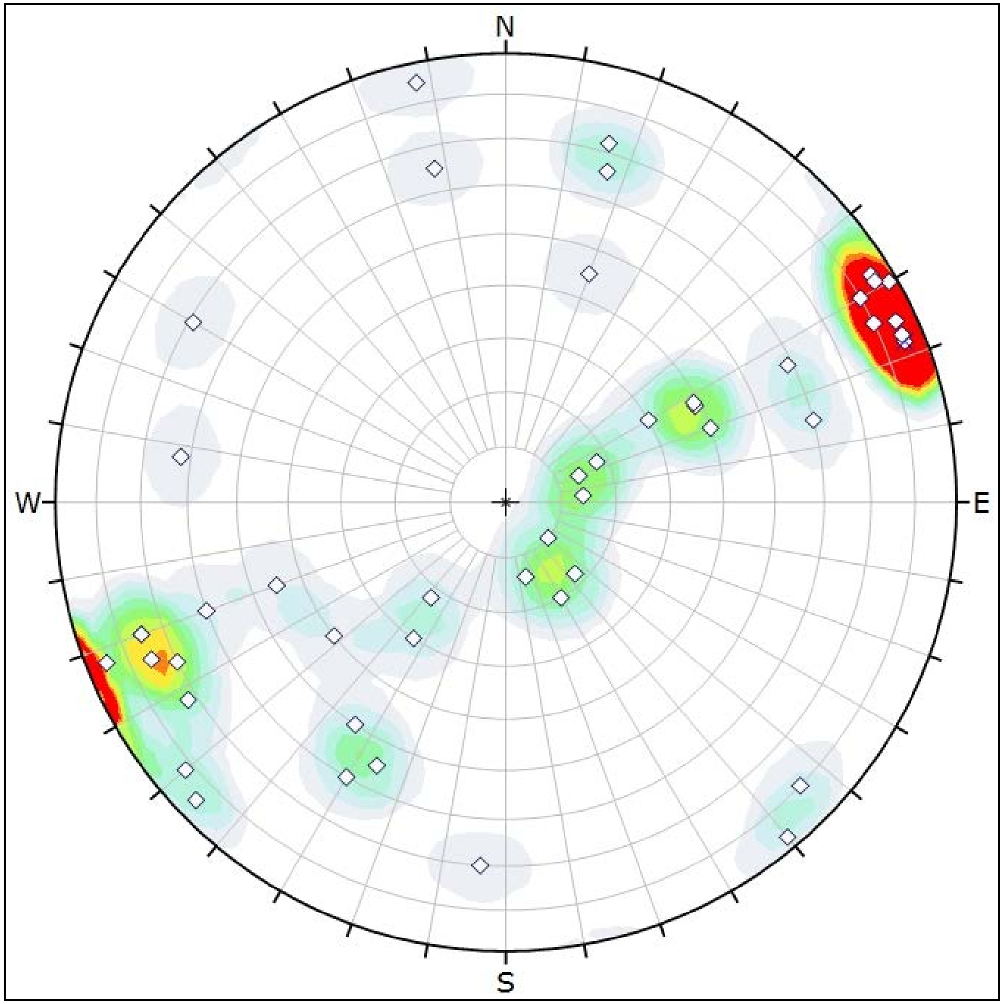
	9.00 <

MATAMEC EXPLORATIONS INC – KIPAWA PROJECT
STRUCTURAL ANALYSES
Surface mapping

FIGURE A3-7



Symbol	Quantity
◇	1
×	4

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 <

Plot Mode	Pole Vectors
Vector Count	52 (49 Entries)
Hemisphere	Lower
Projection	Equal Area

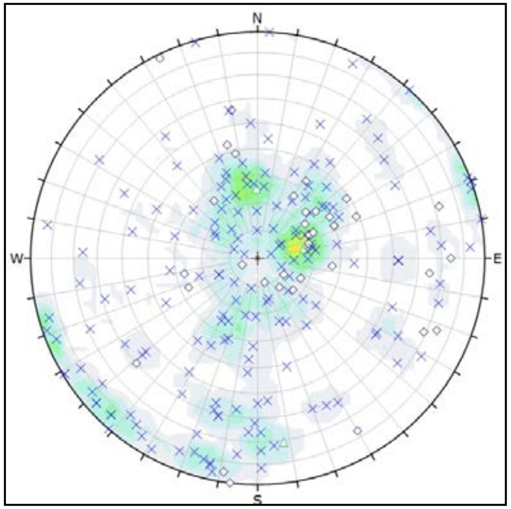
Maximum Density	22.30%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Date: April 2013
Project No: 12-1221-0034

Projected: CG Checked: CG
Drawn: MA Approved: JT

Golder Associés

a) Oriented core (Validation 1+)

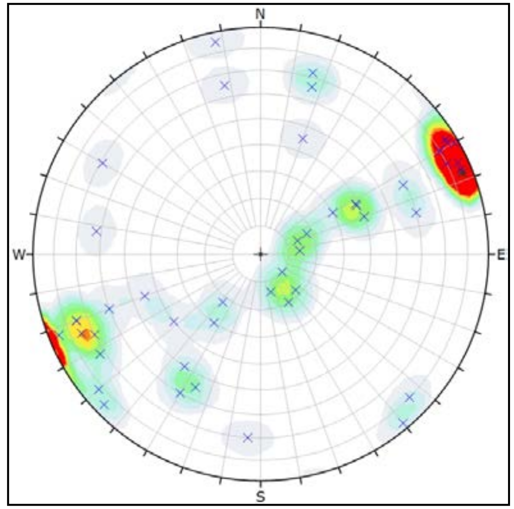


Plot Mode	Pole Vectors
Vector Count	179 (213 Entries)
Hemisphere	Lower
Projection	Equal Area

Legend

Quantity	Blind zone	Hole average direction
0		
1		
2		
4		

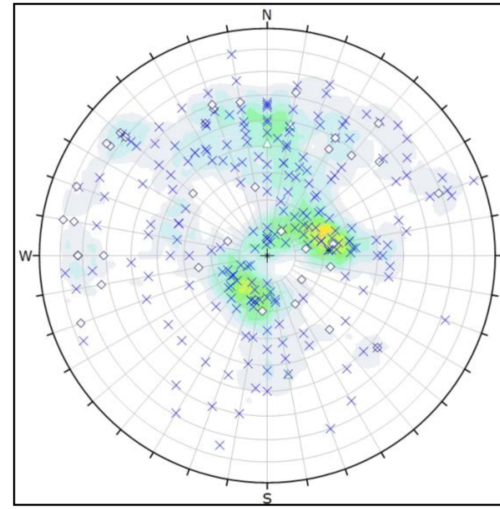
b) Surface mapping



Plot Mode	Pole Vectors
Vector Count	52 (49 Entries)
Hemisphere	Lower
Projection	Equal Area

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 <

c) Oriented Core (1+) + Mapping



Plot Mode	Pole Vectors
Vector Count	262 (262 Entries)
Hemisphere	Lower
Projection	Equal Area

APPENDIX A-4

Rock Mass Classification

1.0 INTRODUCTION

Rock mass classification systems are used for rock engineering projects to provide a quantitative index of rock mass quality based on measurements and observations of rock mass parameters.

The rock mass classification data for the Kipawa project was collected from the geotechnical boreholes and surface mapping. As described in Appendix A-3, the engineering geology model for Kipawa consists of four units: Granitic Gneiss (GN), Syenitic Gneiss (SY), Calc-Silicate Complex (CAL-SIL), and Phlogopite (PHLO). While data was collected in all four units, the CAL-SIL and PHLO units exist as minor sub-units within the SY unit, and limited data was available. Consequently, rock mass classification was only conducted on the main SY and GN units. The CAL-SIL and PHLO units are expected to be weaker zones within the host SY unit; characterization of these units can be refined as mining progresses and additional geotechnical data becomes available.

An assessment of the overall quality of GN and SY units has been prepared using the following classification systems:

- Rock Mass Rating (RMR), (Bieniawski, 1976);
- Norwegian Geotechnical Institue's (NGI) Q system (Barton et al., 1974).

The determination of each rock mass parameter in the classification systems is presented for the GN and SY units. The classification systems are then briefly described and applied. The results of the two classification parameters are then compared to see if they are in general agreement, and finally, rock mass parameters are obtained.

2.0 ANALYSIS OF GEOTECHNICAL PARAMETERS

Data from all five (5) geotechnical boreholes and the surface mapping was combined to evaluate rock mass parameters. The GN and SY units were evaluated based on the parameters given below. For each parameter, an average value is given, as well as a lower bound representing a worst case scenario. These parameters are:

- Intact rock strength;
- Rock Quality Designation (RQD);
- Joint set number (Jn);
- Discontinuity spacing throughout the rock mass;
- Characteristics of discontinuities (Jr, Ja, Jcon).

The geotechnical parameters and appropriate ranges are presented in this section. The values contained herein are then converted to the appropriate values for the rock mass classification systems in Section 3.0 below.

2.1 Intact Rock Strength

The intact rock strength is a key parameter for the RMR classification system. Intact rock strength was evaluated using the following three methods:

- Uniaxial compressive strength tests (UCS);
- Point load tests (PLT);
- Field hardness estimation.

Results from those tests are detailed in Appendix A-2 of this report. Results obtained from each method are in general agreement, as shown in Plate A4 - 1, which presents the intact rock strength for each rock type from UCS, PLT and field strength estimates. The mean value is indicated above each column. The error bars on the plot indicate the approximate standard deviation of samples tested.

Comparison of the results shows reasonable agreement between the three methods, and indicates that the two units are similar, but that the SY unit is slightly stronger than the GN unit.

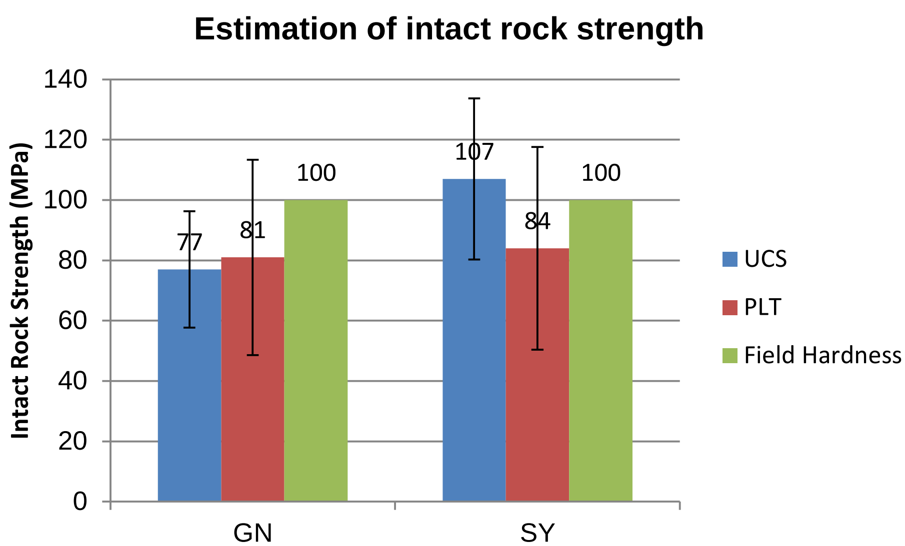


Plate A4 - 1: Compressive strength of the intact rock estimated by different methods for each domain

As UCS are direct measurements, the intact rock strength from these tests was used for design. However, it should be kept in mind that only seven (7) samples per rock unit were tested. The average and lower bound values for UCS for the GN and SY units are shown in Table A4 - 1.

Table A4 - 1: Selected design values of intact rock strength for EGM rock units

EGM Rock Unit	Average (MPa)	Lower Bound (MPa)[1]	Number of tests
GN	77	56	7
SY	107	79	7

Notes: [1] Lower bound = Average – 1 standard deviation.

2.2 Rock Quality Designation (RQD)

The Rock Quality Designation (RQD) was developed by Deere (1963) to provide a quantitative estimate of rock mass quality from drill core logs. RQD is defined as the percentage of intact core pieces longer than 10 cm in the total length of core, and is a key input parameter for both rock mass classification systems.

Deere's classification values are shown in Table A4 - 2.

Table A4 - 2: Rock Quality Designation (RQD) as an Index of Rock Quality

RQD (%)	Description of Rock Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

RQD values were calculated for each run of the five (5) geotechnical boreholes. Plate A4 - 2 shows the distribution of RQD for the GN and SY units. From this Plate, it can be observed that RQD values are persistently very high (90 – 100%) for both rock units, with an average value of 99% and 97%, respectively.

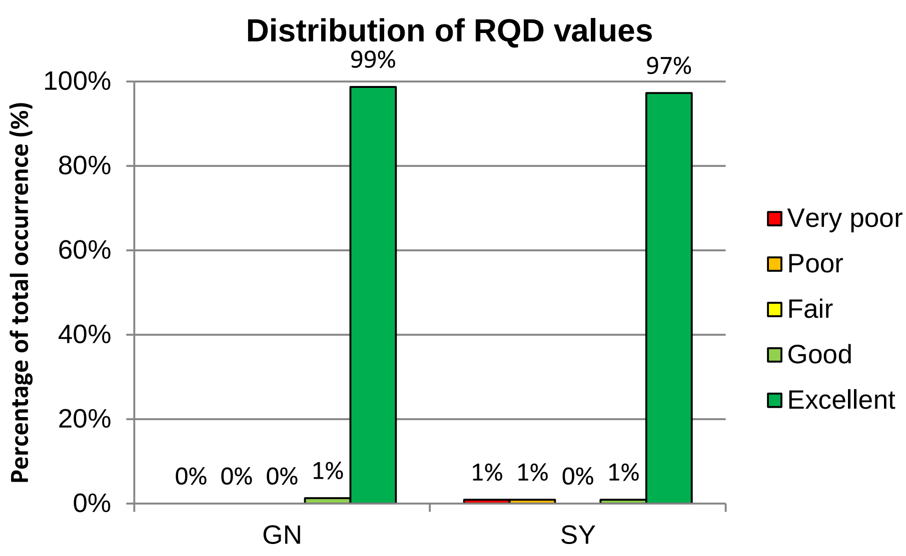


Plate A4 - 2: Distribution of RQD values for the GN and SY units.

Table A4 - 3 shows average RQD values for the GN and SY units as well as a lower bound, taken to be one standard deviation less than the average value. Based on the relationship presented in Table A4 - 2, both rock units can be categorized as *Good* to *Excellent*. The Q classification system uses the straight RQD value; the RMR system assigns a value, as shown in Table A4-3.

Table A4 - 3: Selected Design Values of RQD for EGM Rock Units

EGM Rock Unit	Average	Lower Bound[1]
GN	99	97
SY	98	88

Notes: [1] Lower bound = Average – 1 standard deviation.

2.3 Number of joint sets (Jn)

The behaviour of a rock mass can be highly dependent on the interaction between different joint sets. The number of joint sets has been assessed following two (2) different approaches:

- From the structural analysis presented in Appendix A3;
- From core runs' observations.

Seven (7) joint sets have been identified from the structural analysis. For the purpose of rock mass classification, those can be regrouped into three (3). The foliation at the site was grouped into one main set; sets that were close to horizontal were grouped into another; and the remaining major set was considered separately. No distinction between rock units is made at this scale.

Observations at the core scale have shown a lower number of joints. For both GN and SY units, one joint set has been reported on average. In some cases, two joint sets have been clearly identified in addition to one randomly oriented.

For the rock mass classification, the number of joint sets from the structural analysis (Appendix A-3) is used as it is considered more representative of the overall rock mass behavior. The number of joint sets for the GN and SY units is considered to range between two joint sets (Jn = 4) and three joint sets (Jn = 9).

2.4 Discontinuity spacing

Discontinuity spacing is considered in the RMR classification system. To evaluate joint spacing, the number of open discontinuities per run (typically 3 m) was recorded for the five (5) geotechnical boreholes. This count provides a reasonable estimate of the intensity of the fracturing and overall fracture spacing. The average value of fracture spacing per run is obtained by dividing the run length by the number of fractures counted within that run, assuming that the fractures counted along the run are uniformly distributed. The average fracture frequency is considered a reasonable estimation of overall discontinuity spacing.

Statistical analysis of the fracture frequency data measured per run was performed for the GN and SY units; the results are presented in Table A4 - 4. The lower bound is taken to be one standard deviation less than the average value.

Table A4 - 4: Selected Design Values of Discontinuity Spacing for EGM Rock Units

EGM Rock Unit	Average (m)	Lower Bound (m)
GN	2.6	1.0
SY	1.6	0.7

2.5 Characteristics of discontinuities

Rock mass classification for engineering purposes requires an assessment of the characteristics of both the intact rock material and the discontinuities that are present within the rock mass.

The characteristics of the discontinuities were assessed by recording joint roughness, planarity, and the type and nature of any infillings or coatings. From these, the Joint Roughness (Jr) and Joint Alteration (Ja) ratings for the NGI's Q System (Barton et al., 1974), and the Joint Condition Rating (JCR) for the Rock Mass Rating system (Bieniawski, 1976), were estimated.

The discontinuities surface condition description was collected in all five (5) geotechnical boreholes.

2.5.1 Jcon for Bieniawski RMR_{76}

The Joint Condition Rating (Jcon) is an input parameter of Bieniawski's (1976) rock mass classification which accounts for the separation or aperture of joints, their continuity, surface roughness, wall condition (hard or soft), and the presence of infilling materials. It is noted that fracture continuity cannot be reliably assessed from core alone; however, persistence of fractures is inferred from other characteristics observable at the scale of the rock core and from surface mapping data.

During the geotechnical core logging program, a value of Jcon was associated to each fracture based on its observed conditions. Plate A4 - 3 shows a histogram of Jcon values estimated for each domain. Table A4 - 5 summarizes the typical conditions of the discontinuities based on the Jcon assessment. A description of these values is found in Figure A4-1 at the end of this Appendix.

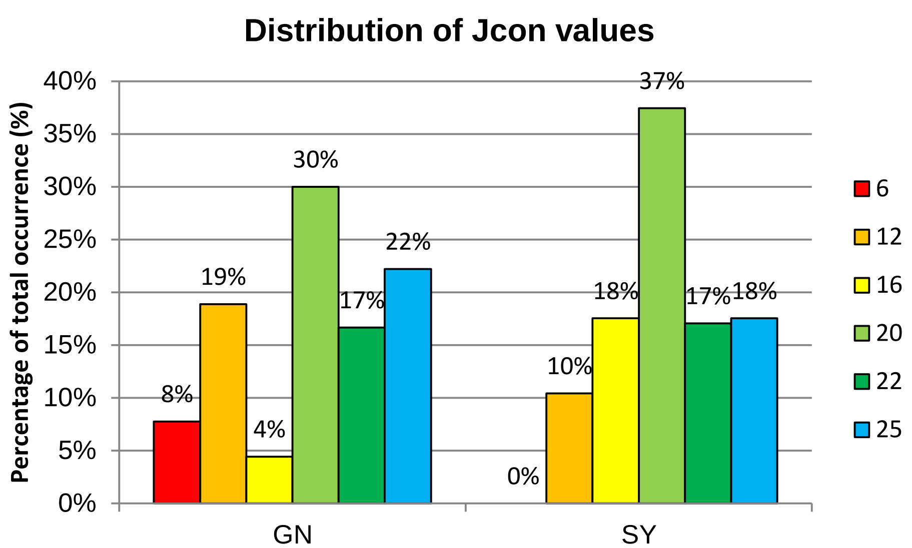


Plate A4 - 3: Distribution of Jcon values for the GN and SY units.

Table A4 - 5: Selected Design Values of Jcon for EGM Rock Units

EGM Rock Unit	Average	Lower Bound
GN	20	12
SY	20	16

The values presented correspond to unfilled joints. Different combinations of joint characteristics can lead to these values as shown in Figure A4 – 1.

2.5.2 Ja and Jr for NGI's Q system

The quotient Jr/Ja represents the frictional characteristics of the joint walls or filling materials. This quotient is weighted in favor of rough, unaltered joints in direct contact. It is expected that such surfaces will be close to peak strength, that they will dilate and shear, and they will therefore be especially favorable to pit stability.

During core logging, the surface roughness of each discontinuity is qualitatively described on both the small and large scale, and the infilling materials or alteration of the discontinuities are recorded. Ja and Jr values are then determined based on these values. Quantification of the rock mass properties is then performed statistically by using the ratio of Jr/Ja values on a per run basis.

Plate A4 - 4 shows a concentration diagram of Ja and Jr values of the open discontinuities for the GN and SY units. From the contours of the diagram, the concentration of combinations of Jr and Ja values can be inferred.

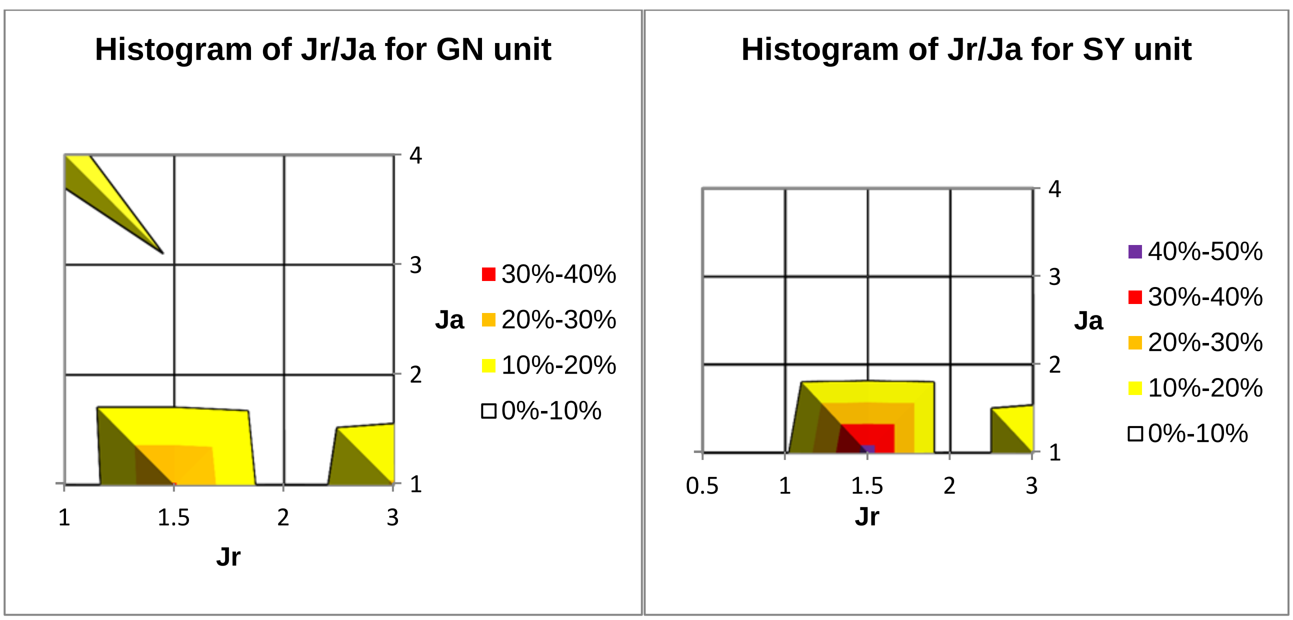


Plate A4 - 4: Concentration diagrams of Jr/Ja for GN and SY units.

The most common pairings of Jr and Ja for both rock units are Jr = 1.5 and Ja = 1, corresponding to rough and planar joint surfaces with no alteration.

Table A4 - 6 summarizes the design values of Jr/Ja. The average values are directly computed from the observations per run. The lower bounds are taken as the highest quotient concentration shown in Plate A4 - 4.

Table A4 - 6: Selected Design Values of Jr/Ja for EGM Rock Units

EGM Rock Unit	Average	Lower Bound
GN	2.2	1.5
SY	2.1	1.5

3.0 ROCK MASS CLASSIFICATION

Generally, it is not possible to perform tests to obtain a direct measurement of the strength and deformation characteristics of the rock mass. Consequently, the characteristics of the rock mass are estimated using empirical relations based on rock mass classification systems. Bieniawski's RMR method is generally used for slope design and also for rock mass strength parameters. While the NGI's Q system is more often used for tunnel design, it is evaluated in this project as a check to see if the two values are in agreement.

Based on the information presented above, the rock mass classification for the GN and SY units is presented for both the RMR and the Q systems. An average value is given as well as a lower bound conservative estimate. The lower bound of each parameter is generally taken to be one standard deviation less than the average. This value is considered to be more representative of the rock mass properties as a whole compared to the minimum value observed, which is more likely to represent an individual weak zone.

3.1 RMR Bieniawski (1976)

The RMR method classifies the rock mass by assigning individual ratings associated with each of the following five (5) parameters:

- Uniaxial compressive strength of intact rock material (UCS);
- Rock Quality Designation (RQD);
- Spacing of discontinuities;
- Condition of discontinuities (JCR);
- Groundwater conditions.

Since the various parameters are not equally important for the overall classification of a rock mass, importance ratings are allocated to the different parameters, with a higher rating indicating better rock mass conditions. A value is assigned to each parameter, and the sum of all parameters gives the resulting RMR value.

The RMR system classifies the rock mass on a scale of 0 to 100, where 0 is the worst quality and 100 the best quality. Table A4 - 7 shows the range scale and description of the rock mass based on RMR.

Table A4 - 7: Geotechnical Rock Mass Quality Based on RMR System

RMR_{76}	Geotechnical Quality
0 – 20	Very Poor
20 – 40	Poor
40 – 60	Fair
60 – 80	Good
80 – 100	Very Good

Table A4 - 8 summarizes the parameters used to compute RMR_{76} for the GN and SY units. The groundwater condition was assumed to be dry (groundwater rating = 10). This assumption should be verified as more data becomes available.

Table A4 - 8: RMR_{76} Calculation

EGM Rock Unit	UCS Rating		RQD Rating		Joint Spacing Rating		JCR Rating		Ground Water Rating	RMR_{76}		Classification	
	Avg	Low	Avg	Low	Avg	Low	Avg	Low	Avg	Avg	Low	Avg	Low
GN	7	7	20	20	25	20	20	12	10	**82**	**69**	Very Good	Good
SY	12	7	20	17	25	20	20	16	10	**87**	**70**	Very Good	Good

Both rock types are classified as *Very Good* with a lower bound of *Good* based on the RMR_{76} system. The higher rating for the SY unit reflects the higher UCS results compared to the GN unit (107 MPa vs. 77 MPa, for a UCS rating of 20 vs. 17).

3.2 NGI's Q System

The Norwegian Geotechnical Institute's (NGI) Q index incorporates six different rock parameters for the classification of the overall rock mass quality. The Q index is calculated via the following relation (Barton et al., 1974):

$$Q = \left(\frac{RQD}{J_n}\right) \times \left(\frac{J_r}{J_a}\right) \times \left(\frac{J_w}{SRF}\right)$$

Where *RQD* is the Rock Quality Designation of the rock mass;

J_n is a value that describes the number of joint sets in the rock mass;

J_r is a measure of the joint roughness;

J_a is a measure of the degree of alteration of the discontinuities

J_w is a measure of the groundwater conditions; and

SRF is the Stress Reduction Factor, a factor applied to reflect the stress conditions at the site.

The first quotient (RQD/Jn) represents the structure of the rock mass, and is a crude measure of the block or particle size. The second quotient (Jr/Ja) estimates the frictional characteristics of the joint walls or filling materials and the third coefficient is an empirical factor which is related to the 'active stress'.

The modified Tunneling Quality index (Q') is an index of overall rock mass quality, without taking into account active stresses or water condition.

$$Q' = \left(\frac{RQD}{J_n}\right) \times \left(\frac{J_r}{J_a}\right)$$

The value of Q or Q' is expressed on a logarithmic scale. Table A4 - 9 shows the range scale and a description of the rock mass based on Q system.

Table A4 - 9: Geotechnical Rock Mass Quality based on Q System

Q range	Geotechnical quality
0.001 to 0.1	Exceptionally to extremely poor
0.1 to 1	Very poor
1 to 4	Poor
4 to 10	Fair
10 to 40	Good
40 to 100	Very Good
100 to 1000	Extremely to exceptionally good

Table A4 - 10 summarizes the parameters used to compute Q' for the GN and SY units.

Table A4 - 10: Q' calculation

EGM Rock Unit	RQD (%)		Jn		Jr/Ja		Q'		Classification	
	Avg	Low	Avg	Low	Avg	Low	Avg	Low	Avg	Low
GN	99	97	4	9	2.2	1.5	**54**	**16**	Very Good	Good
SY	98	88	4	9	2.1	1.5	**51**	**15**	Very Good	Good

3.3 Geological Strength Index (GSI)

The Geological Strength Index (GSI) is a rock mass index that estimates the strength reduction of the rock mass in different geological conditions. It is used in the rock mass parameters determination. The GSI value can be estimated directly from the RMR value according to the following empirical relationship:

$$GSI = RMR_{76}$$

This empirical relationship is valid for RMR values higher than 25, dry water conditions, and no adjustment for orientation of discontinuities.

GSI can also be estimated from Q according to the following empirical relationship:

$$GSI = 9 \ln Q' + 44$$

Table A4 - 11 presents the GSI estimates for both of the above calculations for the lower bound and average values. It is verified that results obtained from both classification systems are in general agreement.

GSI values from Q' are slightly lower than the ones from RMR_{76}. This observation could be related to the fact that fracture spacing is considered at the core scale for RMR and at the rock mass scale for Q' (Jn).

Table A4 - 11: Comparison of GSI Estimates from RMR and Q

EGM rock unit	GSI from RMR_{76}		GSI from Q'	
	Avg	Low	Avg	Low
GN	82	69	80	69
SY	87	70	79	68

GSI values from RMR_{76} were used for design.

4.0 ROCK MASS STRENGTH

For modeling purposes, the rock mass strength parameters are based on the Hoek-Brown criterion (Hoek *et al*, 2002) expressed as:

$$\sigma_1' = \sigma_3' + C_{0i}\left(m_b \frac{\sigma_3'}{C_{0i}} + s\right)^a$$

where: σ_1' and σ_3' are respectively the axial and confining effective principal stresses;

C_0 is the uniaxial compressive strength of the intact rock;

m_b, a, s are rock mass constants defined below. For intact rocks, $m_b = m_i$, a = 0.5 and s = 1. D is the disturbance factor; it varies from 0 for undisturbed rock masses to 1 for highly disturbed rock masses. D was taken to be equal to 0 in the following calculations. GSI values computed from RMR_{76} were considered in the calculations.

$$m_b = m_i exp\left(\frac{GSI - 100}{28 - 14D}\right)$$

$$s = exp\left(\frac{GSI - 100}{9 - 3D}\right)$$

$$a = \frac{1}{2} + \frac{1}{6}\left(e^{-GSI/15} - e^{-20/3}\right)$$

An equivalent Mohr-Coulomb criterion is defined based on the Hoek-Brown criterion for rock mass. This is done by fitting a linear equation through the Hoek-Brown curve for a range defined by $T_{0m} < \sigma_3' < \sigma_{3MAX}'$. σ_{3MAX}' was taken to be equal to 1.5 MPa, because it was considered to be an upper limit for the confinement pressure at the base of the pit.

The Young's modulus of the rock mass (E_{rm}) is calculated from the generalized Hoek-Diederichs' equation. This empirical relation is given below. Complete reference is found in Hoek & Diederichs (2006).

$$E_{rm} = E_i\left(\frac{1-\frac{D}{2}}{1+e^{\left(\frac{60+15D-GSI}{11}\right)}}\right)$$

Rock mass is described by its uniaxial compressive strength (C_{0m}) and its tensile strength (T_{0m}). Those parameters are calculated from the equations presented below. The tensile strength is negative following the sign convention used (compression positive; tension negative).

$$C_{0m} = C_{0i}s^a$$

$$T_{0m} = \frac{-sC_{0i}}{m_b}$$

Rock mass can also be described by its *global rock mass strength* (σ_{grm}). The global rock mass strength is given by the following equation (Hoek & Brown, 1997):

$$\sigma_{grm} = \frac{2c'cos\phi'}{1-sin\phi'}$$

where c' and ϕ' are Mohr-Coulomb parameters determined for the stress range $T_{0m} < \sigma_3' < \frac{C_{0m}}{4}$

Based on laboratory test results and on rock mass classifications, rock mass strength parameters were obtained for GN and SY units. Average values are presented in Table A4 - 12; lower bound values are presented in Table A4 - 13.

Table A4 - 12: Average Rock Mass Strength Parameters

		Intact Rock Parameters				Hoek-Brown Criterion			Mohr-Coulomb Criterion		Rock Mass Parameters			
EGM Units	**GSI**	**ν[a]**	**E_i[a] (GPa)**	**m_i[b]**	**Den.[c] (t/m^3)**	**m_b**	**s**	**a**	**c (MPa)**	**ϕ (°)**	**E_{rm} (GPa)**	**C_{0m} (MPa)**	**T_{0m} (MPa)**	**σ_{grm} (MPa)**
GN	82	0.20	19.1	30	2.68	15.77	0.135	0.500	2.9	65	17.2	28.3	-0.66	46
SY	87	0.20	22.5	30	2.80	18.86	0.236	0.500	5.2	66	21.2	51.9	-1.34	73
Notes:	[a] Young's modulus and Poisson's ratio for intact rock were taken from deformation measurements acquired during UCS testing (refer to Appendix A-2 for more details). [b] This parameter was estimated from general guidelines available in RocLab Software (RocScience Inc.) [c] Density measurements were performed prior to UCS testing.													

Table A4 - 13: Lower Bound Rock Mass Strength Parameters

		Intact Rock Parameters				Hoek-Brown Criterion			Mohr-Coulomb Criterion		Rock Mass Parameters			
EGM Units	GSI	ν[a]	E_i[a] (GPa)	m_i[b]	Den.[c] (t/m^3)	m_b	s	a	c (MPa)	ϕ (°)	E_{rm} (GPa)	C_{0m} (MPa)	T_{0m} (MPa)	σ_{grm} (MPa)
GN	69	0.20	14.5	28	2.68	9.25	0.032	0.501	1.4	61	10.4	10.0	-0.19	24
SY	70	0.20	13.1	28	2.80	9.59	0.036	0.501	1.7	63	9.6	14.9	-0.29	34
Notes:		[a] Young's modulus and Poisson's ratio for intact rock were taken from deformation measurements acquired during UCS testing (refer to Appendix A-2 for more details). [b] This parameter was estimated from general guidelines available in RocLab Software (RocScience Inc.) [c] Density measurements were performed prior to UCS testing.												

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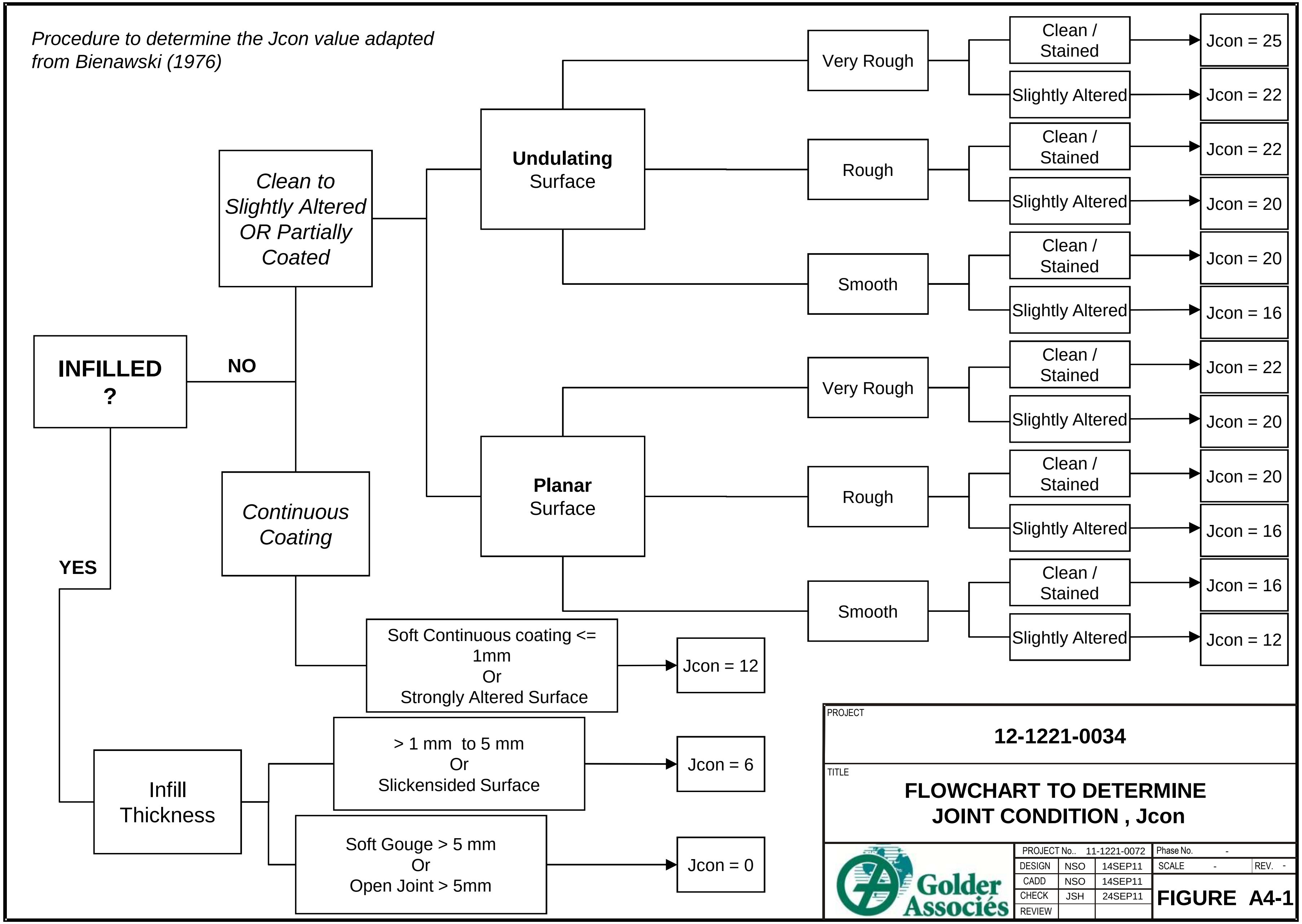


Procedure to determine the Jcon value adapted from Bienawski (1976)
INFILLED ?
NO
YES
Clean to Slightly Altered OR Partially Coated
Continuous Coating
Undulating Surface
Planar Surface
Very Rough
Rough
Smooth
Very Rough
Rough
Smooth
Clean / Stained
Slightly Altered
Clean / Stained
Slightly Altered
Clean / Stained
Slightly Altered
Clean / Stained
Slightly Altered
Clean / Stained
Slightly Altered
Clean / Stained
Slightly Altered
Jcon = 25
Jcon = 22
Jcon = 22
Jcon = 20
Jcon = 20
Jcon = 16
Jcon = 22
Jcon = 20
Jcon = 20
Jcon = 16
Jcon = 16
Jcon = 12
Soft Continuous coating <= 1mm Or Strongly Altered Surface
Jcon = 12
Infill Thickness
> 1 mm to 5 mm Or Slickensided Surface
Jcon = 6
Soft Gouge > 5 mm Or Open Joint > 5mm
Jcon = 0
PROJECT
12-1221-0034
TITLE
FLOWCHART TO DETERMINE JOINT CONDITION , Jcon
Golder Associés
PROJECT No. 11-1221-0072
Phase No. -
DESIGN NSO 14SEP11
CADD NSO 14SEP11
CHECK JSH 24SEP11
REVIEW
SCALE -
REV. -
FIGURE A4-1

APPENDIX A-5

Kinematic Analyses

MATAMEC EXPLORATIONS INC. – KIPAWA PROJECT
KINEMATIC ANALYSIS
Kinematic Failure Assessment

FIGURE A5-1

**ASSESSMENT OF KINEMATICALLY POSSIBLE MECHANISMS OF INSTABILITY
INVOLVING DISCONTINUITY POPULATIONS FROM ORIENTED CORE DATA AND SURFACE MAPPING
COLLECTED BY GOLDER (2012)**

STRUCTURAL DOMAIN	DESIGN SECTOR	WALL ORIENTATION	POTENTIAL TOPPLING FAILURE	POTENTIAL PLANAR FAILURE (FOS <1.2)	POTENTIAL WEDGE FAILURE (FOS <1.2)	REFERENCE	COMMENTS	RECOMMENDED BENCH GEOMETRY (10m bench height; 20m double benches; trim blasting)				RECOMMENDED BENCH GEOMETRY (5m bench height; 10m double benches; pre-split blasting)			
								BFA	Bench Height =	Berm Width =	IRA	BFA	Bench Height =	Berm Width =	IRA
KIPAWA PIT See Figures A5-2 to A5-6 for stereonets of the deterministic kinematic analysis.	1	NE WALL **Dip Direction 217°**	Toppling potential on Set 5 (dipping 84° towards 041°)	Possible planar failure on set 7 at 59° (minor).	Wedges only present at low angles (<25°).		**Sector 1.** This slope design is for the northeast wall of the pit. Toppling on Set 5 considered unlikely. Planar failure will be local (minor set). Berm widths designed to catch small failures and ravelling debris.	**70°**	20m	8.5m	52°	**85°**	10m	7m	52°
	2	SW WALL - S End **Dip Direction 037°**	No potential for toppling. All joint poles are oblique to wall orientation.	Possible planar failure on Set 5 (major) dipping at 84° to the northeast.	No wedge failures.		**Sector 2.** This slope design is for the southern portion of the southeast wall. Planar failure potential exists on steeply dipping set; slope angle will be shallower than dip of set. Berm widths designed to catch small failures and ravelling debris.	**70°**	20m	8.5m	52°	**85°**	10m	7m	52°
	3	SW Wall - Middle S Portion **Dip Direction 000°**	No potential for toppling. All joint poles are oblique to wall orientation.	Possible planar failure on Set 6 (major) dipping at 67° towards the north.	Wedges only present at low angles (<25°).		**Sector 3.** This slope design is for the southern portion of the southeast wall. Planar failure potential exists on steeply dipping set; slope angle will be shallower than dip of set. Berm widths designed to catch small failures and ravelling debris.	**67°**	20m	8.5m	50°	**67°**	10m	7m	42°
	4	SW Wall - Middle N Portion **Dip Direction 040°**	No potential for toppling. All joint poles are oblique to wall orientation.	Possible planar failure on Set 5 (major) dipping at 84° to the northeast.	Wedges only present at low angles (<25°).		**Sector 4.** This slope design is for the north central portion of the southeast wall. Planar potential exists on steeply dipping set; slope angle will be shallower than dip of set. Berm widths designed to catch small failures and ravelling debris.	**70°**	20m	8.5m	52°	**85°**	10m	7m	52°
	5	SW Wall - N End **Dip Direction 090°**	No potential for toppling. All joint poles are oblique to wall orientation.	No planar failures.	Wedges only present at low angles (<25°).		**Sector 5.** This slope design is for the north portion of the southeast wall. Nop potential for planar, wedge or toppling failures. Berm widths designed to catch small failures and ravelling debris.	**70°**	20m	8.5m	52°	**85°**	10m	7m	52°

NOTES
1. BFA = Bench Face Angle,
   IRA = Interramp Angle
2. Discontinuities were all assigned c=0 kPa and friction angle PHI = 30 degrees.
3. See Figure 3 for Design Sector locations.

Date: April 2013

Project No: 12-1221-0034

Projected: JT **Checked: JT**

Drawn: CG **Approved: MR**

Golder Associés

MATAMEC EXPLORATIONS INC. – KIPAWA PROJECT
KINEMATIC ANALYSIS
Design Sector 1

FIGURE A5-2

Sector 1
Wall dip direction: 217º

Planes

Peak orientation of potential plane failure set

Window = 40º

Toppling

Peak orientation of potential toppling failure set

Window = 40º

Wedges:

1.2 < FS < 2.0

FS <= 1.2

Window = 90º

0.34 Factor of Safety

59° Failure plane pole or Plunge of potential wedge

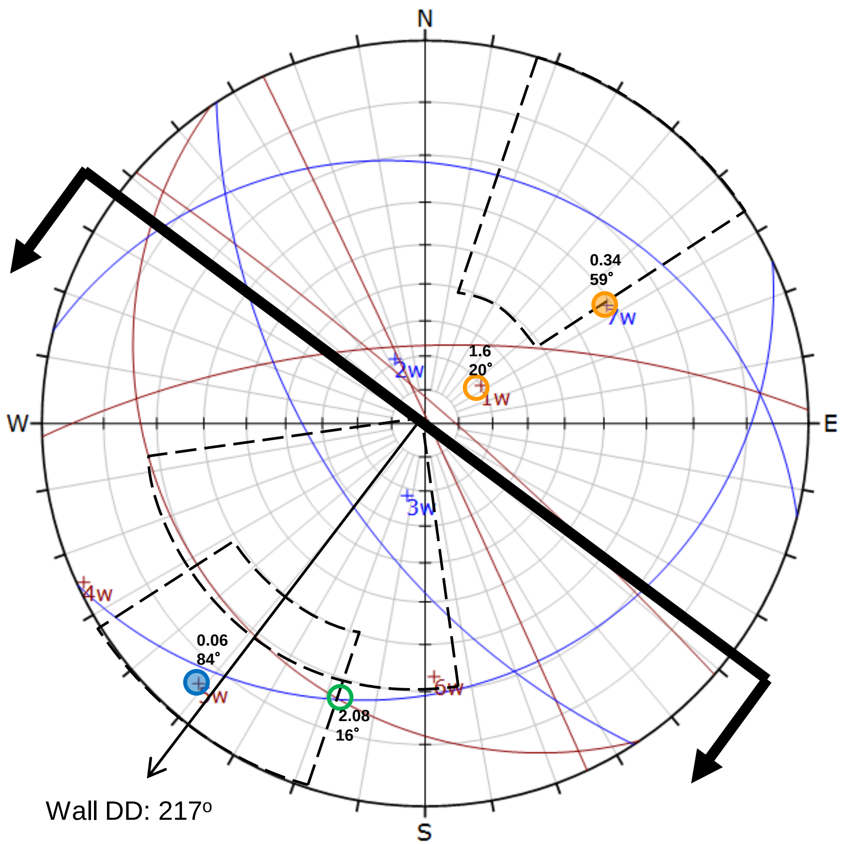
Major set plane

Minor set plane

Mean pit wall dip direction

Discontinuity Shear Strengths:

30º friction angle and cohesion of 0 kPa assumed for all discontinuity sets.



Potential Planar Failures

Minor Set 7 – 59º

Potential Toppling Failures

Major Set 5 – 84º

Potential Wedge Failure:

No critical wedge

	Color	Dip	Dip Direction
		Mean Set Planes	
1w		20	236
2w		21	155
3w		22	14
4w		89	65
5w		84	41
6w		67	358
7w		59	237

Date: April 2013
Project No: 12-1221-0034
Projected: JT
Checked: JT
Drawn: CG
Approved: MR
Golder Associés

Planes

Peak orientation of potential plane failure set

Window = 40º

Toppling

Peak orientation of potential toppling failure set

Window = 40º

Wedges:

1.2 < FS < 2.0

FS <= 1.2

Window = 90º

0.34 Factor of Safety

59° Failure plane pole or Plunge of potential wedge

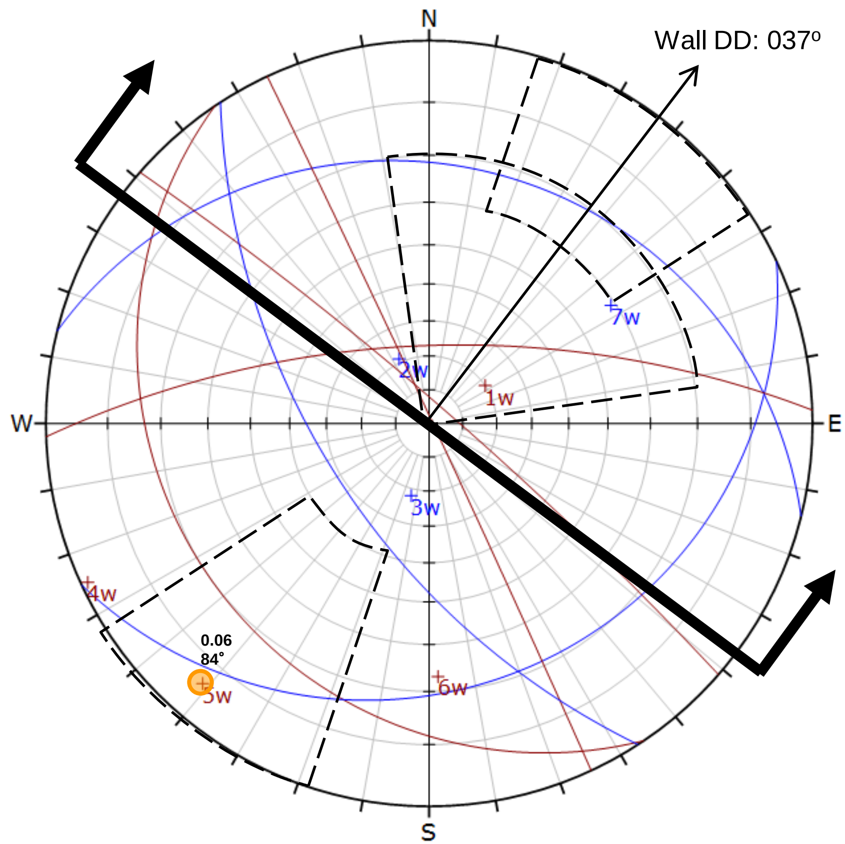
Major set plane

Minor set plane

Mean pit wall dip direction

Discontinuity Shear Strengths:

30º friction angle and cohesion of 0 kPa assumed for all discontinuity sets.



Sector 2
Wall dip direction: 037º

Potential Planar Failures

Major Set 5 – 84º

Potential Toppling Failures

No toppling failure

Potential Wedge Failure:

No wedge

	Color	Dip	Dip Direction
		Mean Set Planes	
1w		20	236
2w		21	155
3w		22	14
4w		89	65
5w		84	41
6w		67	358
7w		59	237

Planes
Peak orientation of potential plane failure set
Window = 40º

Toppling
Peak orientation of potential toppling failure set
Window = 40º

Wedges:
1.2 < FS < 2.0
FS <= 1.2
Window = 90º

0.34 Factor of Safety
Failure plane pole or
59˚ Plunge of potential wedge

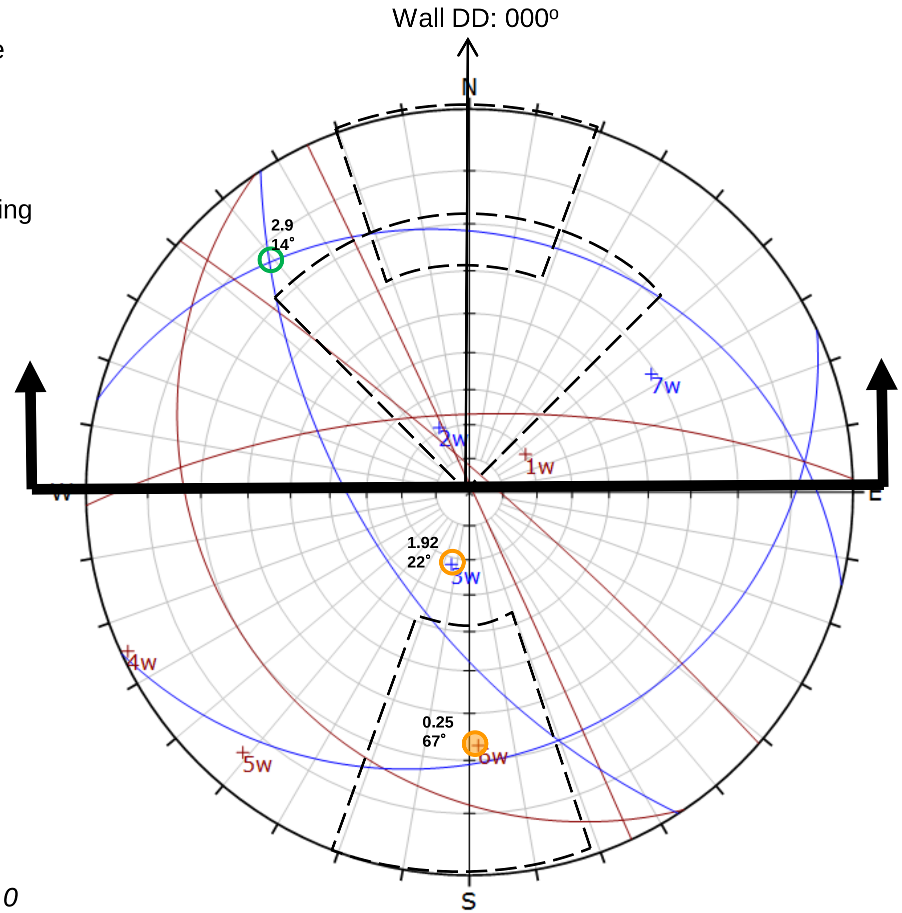
Major set plane

Minor set plane

Mean pit wall dip direction

Discontinuity Shear Strengths:

30º friction angle and cohesion of 0 kPa assumed for all discontinuity sets.



Sector 3
Wall dip direction: 000º

Potential Planar Failures

Major Set 6 – 67º

Potential Toppling Failures

No toppling failure

Potential Wedge Failure:

No critical wedge

	Color	Dip	Dip Direction
		Mean Set Planes	
1w		20	236
2w		21	155
3w		22	14
4w		89	65
5w		84	41
6w		67	358
7w		59	237

MATAMEC EXPLORATIONS INC. – KIPAWA PROJECT
KINEMATIC ANALYSIS
Design Sector 4

FIGURE A5-5

Planes
Peak orientation of potential plane failure set
Window = 40º

Toppling
Peak orientation of potential toppling failure set
Window = 40º

Wedges:
1.2 < FS < 2.0
FS <= 1.2
Window = 90º

0.34 Factor of Safety
Failure plane pole or
59° Plunge of potential wedge

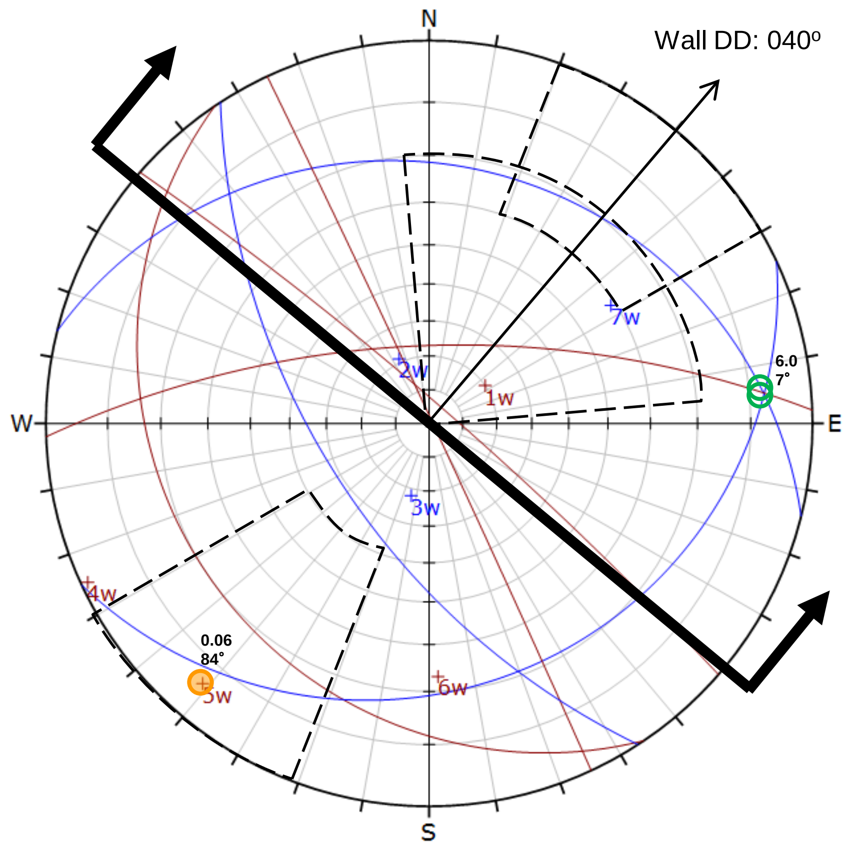
Major set plane

Minor set plane

Mean pit wall dip direction

Discontinuity Shear Strengths:

30º friction angle and cohesion of 0 kPa assumed for all discontinuity sets.



Sector 4
Wall dip direction: 040º

Potential Planar Failures

Major Set 5 – 84º

Potential Toppling Failures

No toppling failure

Potential Wedge Failure:

No critical wedge

	Color	Dip	Dip Direction
		Mean Set Planes	
1w		20	236
2w		21	155
3w		22	14
4w		89	65
5w		84	41
6w		67	358
7w		59	237

Date: April 2013
Project No: 12-1221-0034

Projected: JT **Checked: JT**
Drawn: CG **Approved: MR**

Planes

Peak orientation of potential plane failure set

Window = 40º

Toppling

Peak orientation of potential toppling failure set

Window = 40º

Wedges:

1.2 < FS < 2.0

FS <= 1.2

Window = 90º

0.34 Factor of Safety

Failure plane pole or

59° Plunge of potential wedge

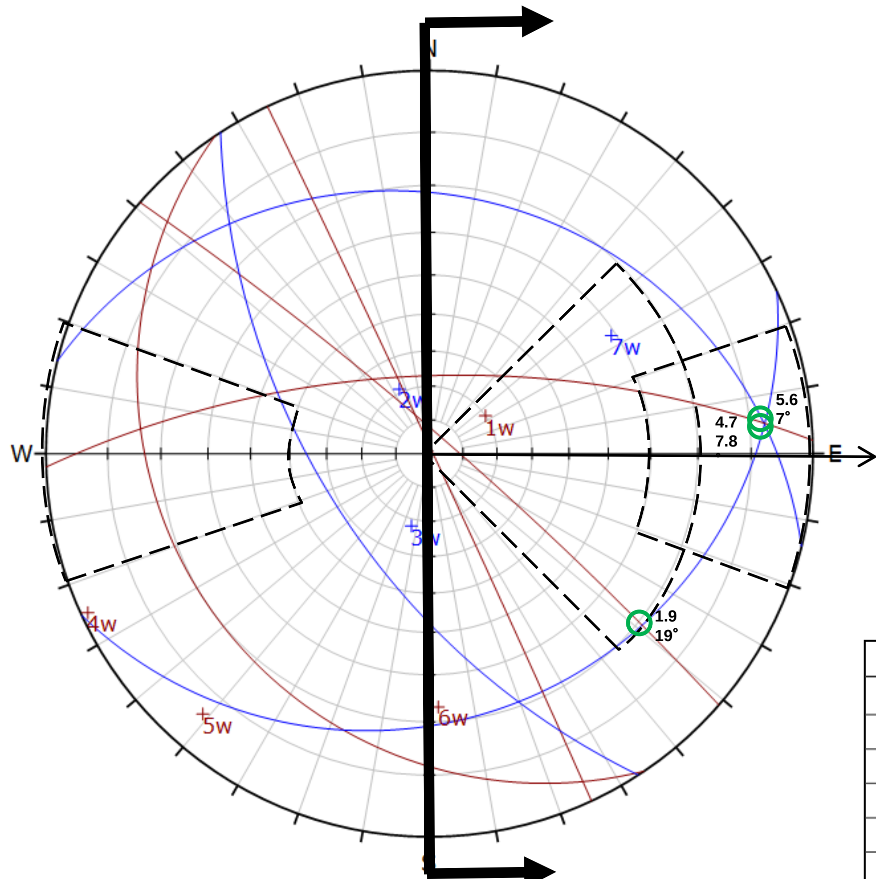
Major set plane

Minor set plane

Mean pit wall dip direction

Discontinuity Shear Strengths:

30º friction angle and cohesion of 0 kPa assumed for all discontinuity sets.



Wall DD: 090º

Sector 5
Wall dip direction: 090º

Potential Planar Failures

No planar failure

Potential Toppling Failures

No toppling failure

Potential Wedge Failure:

No critical wedge

	Color	Dip	Dip Direction
		Mean Set Planes	
1w	(dark red)	20	236
2w	(blue)	21	155
3w	(blue)	22	14
4w	(dark red)	89	65
5w	(dark red)	84	41
6w	(dark red)	67	358
7w	(blue)	59	237

APPENDIX B

Conditions and Limitations

GENERAL CONDITIONS AND LIMITATIONS
GEOMECHANICS REPORT

USE OF THE REPORT AND ITS CONTENTS

This report has been prepared for the exclusive use of the Client or his agents. The factual information, interpretations, comments and recommendations contained herein are specific to the project described in this report and do not apply to any other project or site. This report must be read in its entirety as some sections could be falsely interpreted when taken individually or out-of-context. As well, the text of the final version of this report supersedes any other text, opinion or preliminary version produced by Golder.

The comments, interpretations and recommendations expressed in this report are based on a limited assessment of underground conditions according to the scope of the study and are formulated for the sole purpose of orienting the design of the project. Unless otherwise specified, the interpretations, comments and recommendations presented in this report have been formulated on the basis of our knowledge of the site conditions, the current and/or planned use of the site, the applicable regulations, standards and criteria, as well as the professional rules and practices recognized and accepted at the time of the study, taking into account, in all cases, the location of the site. References to acts and regulations contained in this report are informally provided on a technical basis. Since acts and regulations are subject to interpretation, Golder recommends its Client to consult with legal counsel to obtain suitable advice.

Golder shall not be held responsible for unpredictable underground conditions or conditions that may be unknown to Golder at the time of the study. Golder shall not be held responsible for damages resulting from unknown conditions, from erroneous information provided by other sources than Golder, and from ulterior changes in the site conditions unless informed by the client and given the possibility of revising the interpretations, comments and recommendations contained in this report following any event, activity, information and past or future discovery susceptible of modifying the underground conditions described in this report. Golder shall not be held responsible for damages resulting from any future modification, nor for any use of this report by a third party, nor for its use for other purposes than those intended. Finally, Golder shall not be held responsible for any decrease, real or perceived, of the property/site's value or any failure to complete a transaction, as a consequence of reporting factual information.

The analysis and modeling work conducted by Golder and described in this report has been performed in compliance with the professional rules and practices recognized and accepted at that time. Unless otherwise specified, the results of previous or simultaneous work provided by sources other than Golder and quoted and/or used in this report were considered as having been obtained according to recognized and accepted professional rules and practices, and are deemed valid.

Any numerical model is a simplification of reality. It must be noted that uncertainties are associated with the results obtained from such numerical models and their interpretation. In particular, the validity of numerical modeling results rests on the level of knowledge with respect to the heterogeneity of geological rock units, the level of accuracy of the information considered in the models and the simplifying assumptions that are mentioned in the report.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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Asia	+ 86 21 6258 5522
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Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associés Ltée
1001 Blvd. de Maisonneuve West, 7th floor
Montreal (Québec) H3A 3C8
Canada
T: +1 (514) 383-0990

Golder Associés

TECHNICAL MEMORANDUM

DATE April 11, 2013 **REFERENCE No.** 021-12-1221-0034

TO Bertho Caron
Matamec Explorations Inc.

CC Andrée Drolet

FROM James Tod, Marc Rougier **EMAIL** jtod@golder.com

ADJUSTMENTS TO PIT SLOPE ANGLES FOR KIPAWA ROCK SLOPES

Dear Bertho:

As part of our mandate to Matamec Explorations Inc. (Matamec), Golder Associates Ltd. (Golder) prepared a Pit Slope Stability Evaluation and bench geometry recommendations for the proposed Kipawa open pit, released as Golder report 015-12-1221-0034 - *Geomechanics and Rock Slope Stability Analyses for Kipawa Feasibility Study*. The draft of this report was released in December 2012, and the final version of the report is expected to be released in April, 2013.

As per discussions between Golder and Pierre Casgrain of Roche on April 8, 2013, we have made adjustments to the pit slope designs for the Kipawa rock slopes to address two slope design changes:

- The operating single bench height will be 5 m, not 10 m as originally presented to Golder. The use of 5 m benches is required for improved selectivity of the ore within the pit. Consequently, final walls would be double benched (10-m vertical separation) rather than 20 m.
- The final walls will be drilled with pre-split / pre-shear wall control. This allows for potentially steeper bench face angles in competent rock with no strong kinematic controls. Previously trim blasted final walls had been assumed, which, based on experience, can produce a 70° bench face angle.

With the exception of Design Sector 3, the discontinuity orientations are favourable to pre-shear bench faces, and allow for steeper bench face angles if pre-splitting is applied. In Design Sector 3, potential failure along a prominent discontinuity set will control the achievable bench face angle.

Based on our reassessment, the new slope designs for Kipawa are as follows:

Table 1: Recommended Conceptual Pit Slope Angles for Kipawa Rock Slopes Based on 5-m Bench Heights

Design Sector[1]	Wall Dip Direction (°)	Bench Face Angle (°)	Vertical Bench Separation[2] (m)	Berm Width (m)	Inter-Ramp Slope Angle (°)
1, 2, 4, 5	all others	85	10	7	52
3	**000**	**67**	**10**	**7**	**42**

Notes:
1. Design Sectors are displayed on Figure 4 of Golder report 015-12-1221-0034 (Geomechanics and Rock Slope Stability Analyses for Kipawa Feasibility Study).
2. Vertical bench separation assumes that double benching is applied to all slopes.
3. The Berm Width is based the modified Richie formal with an additional 0.5m for minor crest loss. If significant cress loss occurs, wider berm widths may be required to contain rock fall. The limited maximum inter-ramp heights (56m) are also a mitigative factor.

Schematics showing the revised slope design are attached.

This information will be incorporated into the final report as an alternative to the original slope design.

We trust this information is sufficient for your current needs. If you have any questions or comments, please don't hesitate to contact us.

Respectfully submitted,

GOLDER ASSOCIÉS LTÉE

ORIGINAL SIGNED BY

James Tod, P. Eng.(ON)
Rock Mechanics Specialist

ORIGINAL SIGNED BY

Marc Rougier, P.Eng.(ON)
Principal, Geological Engineer

JDT/MR/no

Attachment: Schematics for Revised Slope Design

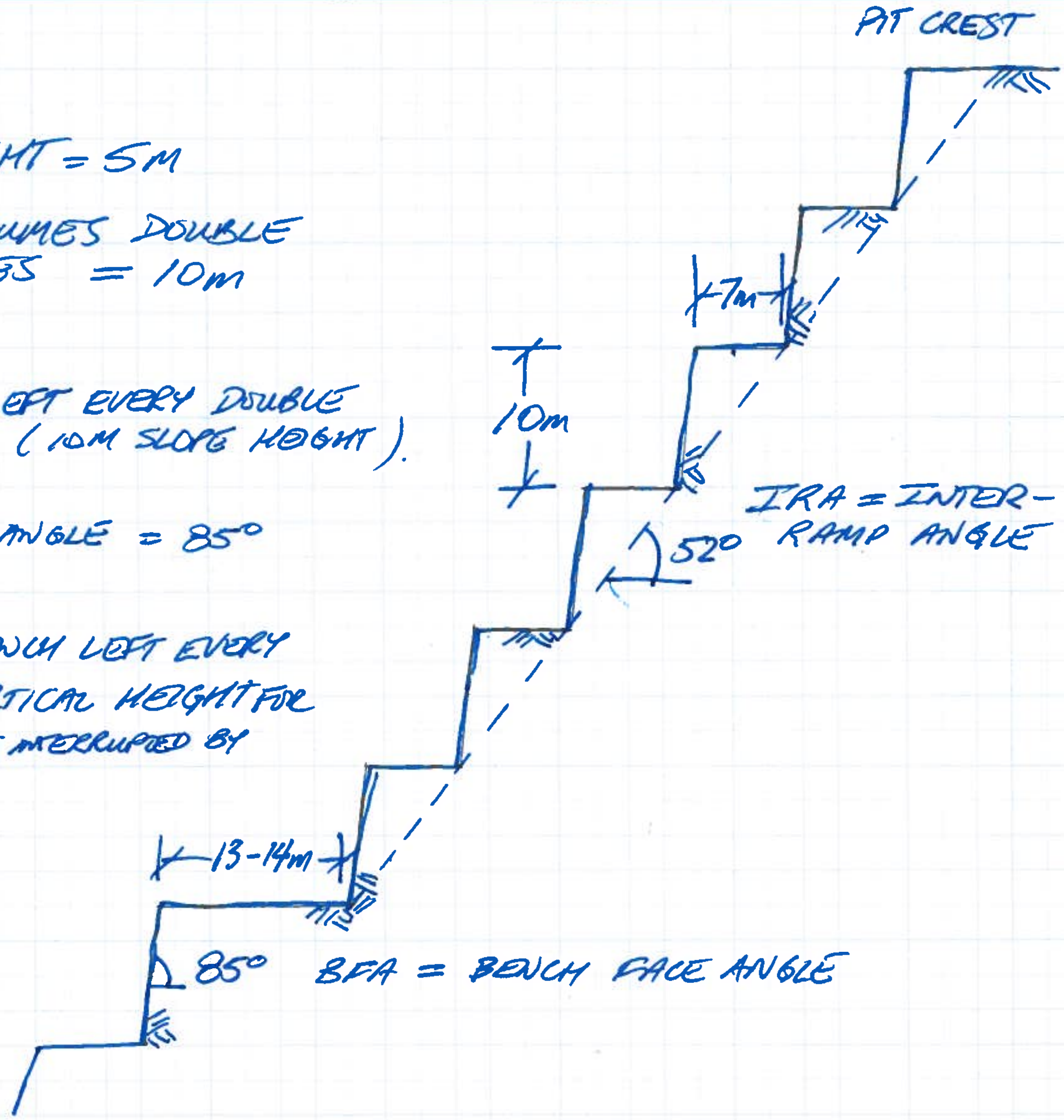
n:\actif\2012\1221\12-1221-0034 matamec kipawa tmf and pit\6 deliverables issued\021-12-1221-0034 technical memorandum re slope design modifications.docx

Golder Associés

SUJET MATAMEC SLOPE DESIGN – 5M BENCH HEIGHT

Projet MATAMEC – KIPAWA	Fait par: J. TODD.	Date: APRIL 10, 2013
Réf. 12-1221-0034	Vérifié par:	Feuille 1 de
	Revisé par:	

- BENCH HEIGHT = 5M
- DESIGN ASSUMES DOUBLE BENCHES = 10m
- 7m BERM LEFT EVERY DOUBLE BENCH (10M SLOPE HEIGHT).
- BENCH FACE ANGLE = 85°
- 13 – 14m BENCH LEFT EVERY 60M VERTICAL HEIGHT FOR SLOPES NOT INTERRUPTED BY RAMP.

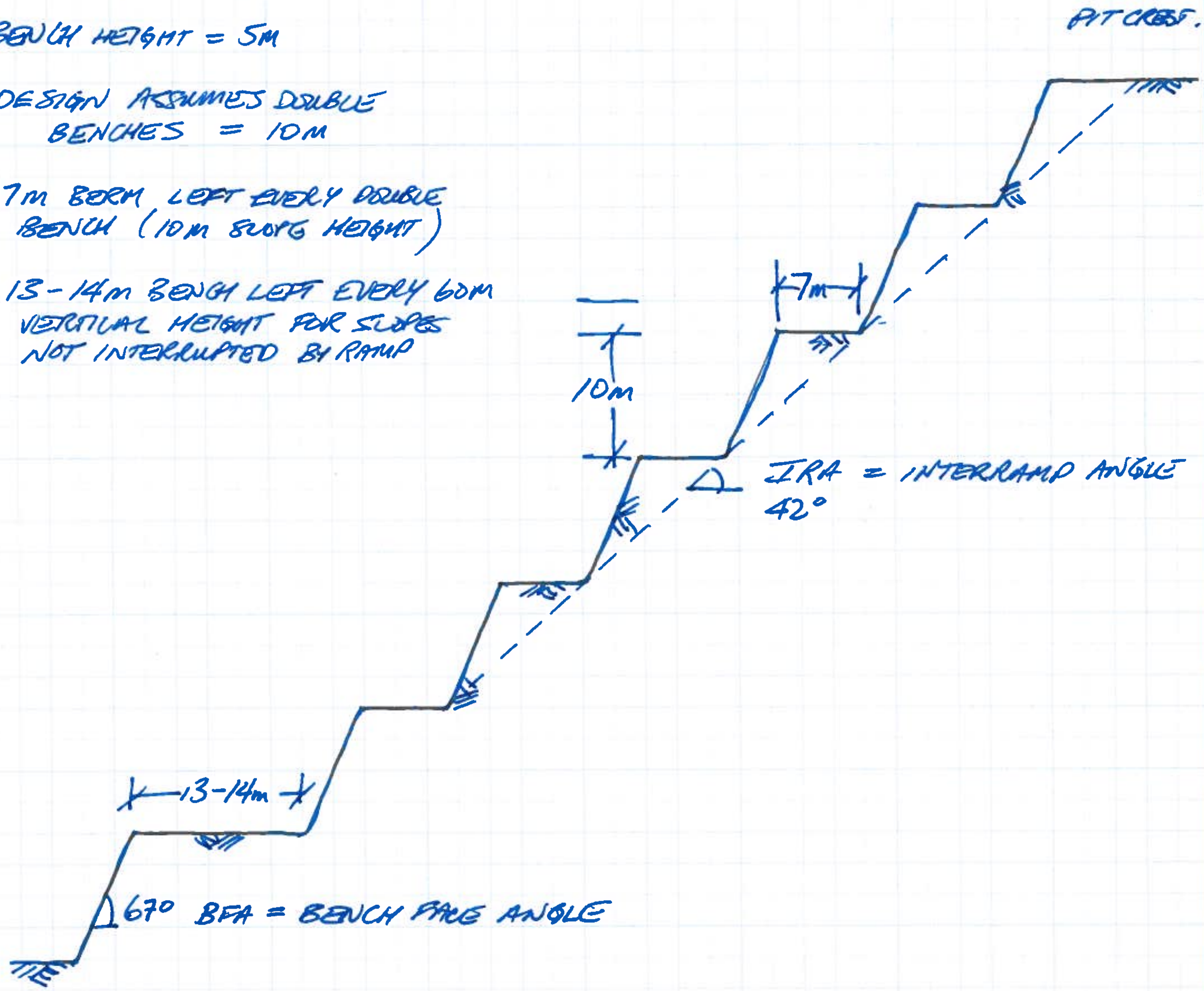


THIS DESIGN APPLIES TO SECTORS 1, 2, 4 AND 5

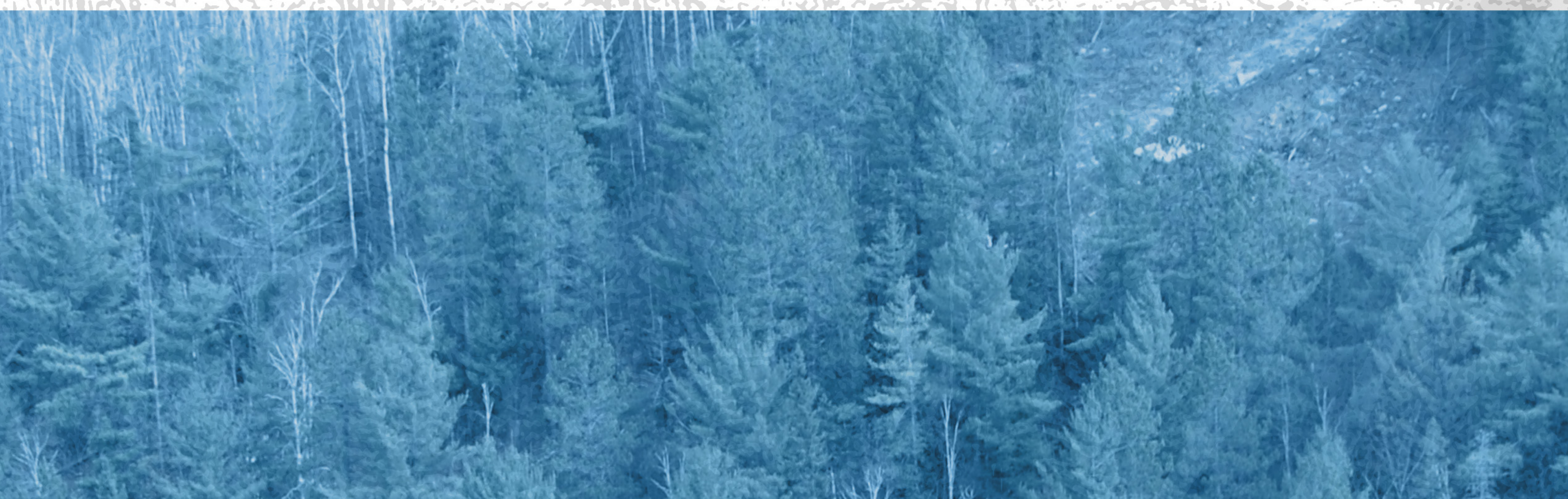
Golder Associés

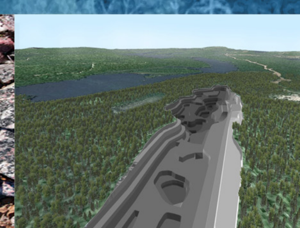
SUJET MATAMEC SLOPE DESIGN – 5M BENCH HEIGHT.		
Projet MATAMEC – KIPAWA Réf. 12-1221-0034	Fait par: J. TODD. Vérifié par: Revisé par:	Date: APRIL 10, 2013 Feuille 2 de

- BENCH HEIGHT = 5M
- DESIGN ASSUMES DOUBLE BENCHES = 10M
- 7m BERM LEFT EVERY DOUBLE BENCH (10m SLOPE HEIGHT)
- 13-14m BENCH LEFT EVERY 60M VERTICAL HEIGHT FOR SLOPES NOT INTERRUPTED BY RAMP



THIS DESIGN APPLIES TO SECTOR 3. (SLOPE DIP DIRECTION 000°)

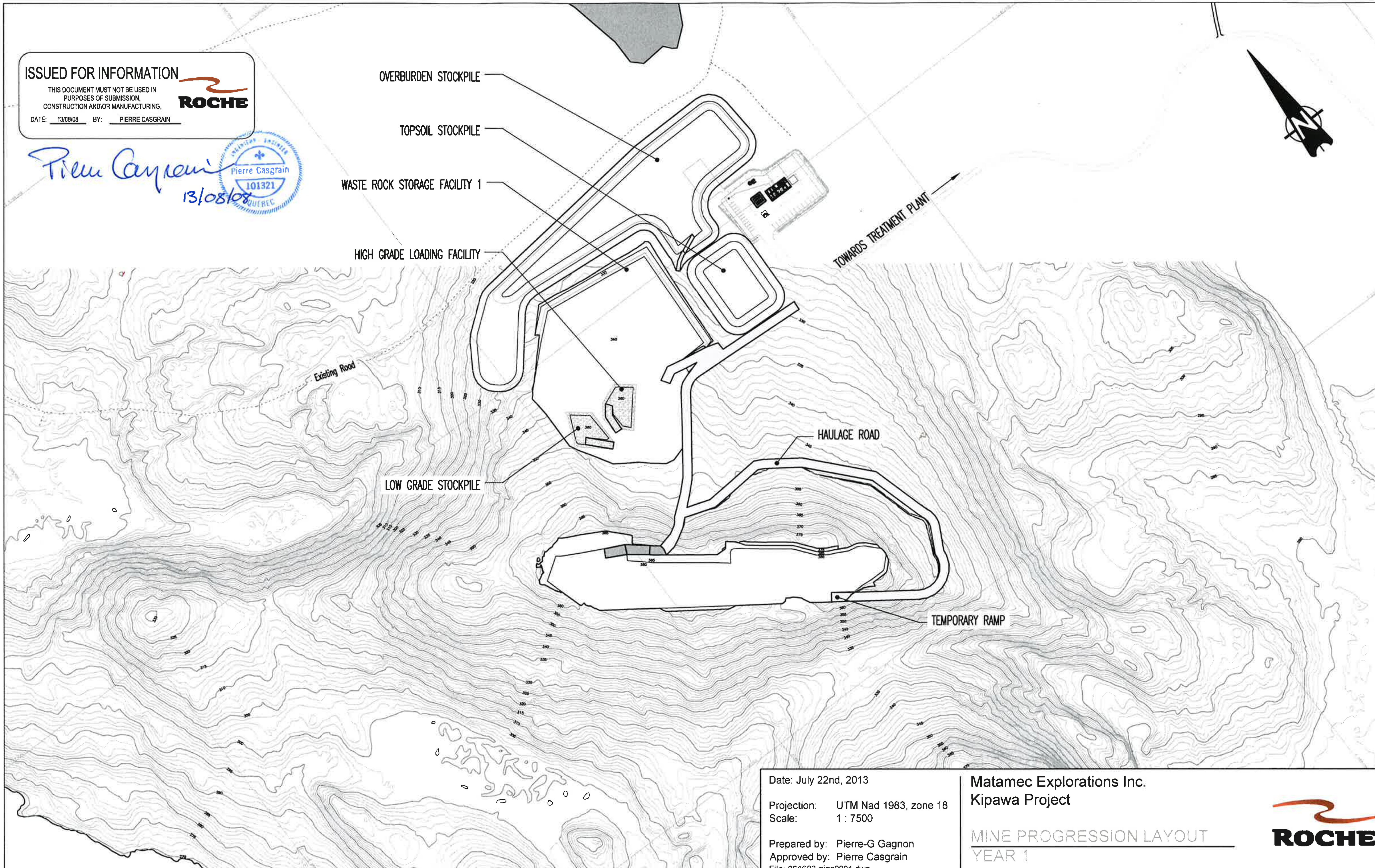




APPENDIX 5- Mining

DETAILED YEARLY MNE PRODUCTION PER BENCH																	
		YEAR															
Bench	**Type**	**-1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
375	Waste	27,000															
375	Ore*	22,000															
370	Waste	58,000	138,000		14,000												
370	Ore*		179,000		15,000												
365	Waste	262,000	292,000		42,000												
365	Ore*		333,000		46,000												
360	Waste	121,000	499,000	32,000	165,000												
360	Ore*		359,000	33,000	147,000												
355	Waste			627,000	488,000												
355	Ore*			549,000	203,000												
350	Waste			359,000	934,000												
350	Ore*			560,000	376,000												
345	Waste			107,000	202,000	1,109,000			11,000								
345	Ore*			200,000	571,000	280,000			5,000								
340	Waste					726,000	695,000		7,000								
340	Ore*					1,009,000	120,000		10,000								
335	Waste					33,000	699,000	755,000	17,000								
335	Ore*					71,000	944,000	282,000	16,000								
330	Waste						83,000	547,000	772,000								
330	Ore*						293,000	792,000	277,000								
325	Waste							180,000	557,000	648,000							
325	Ore*							294,000	715,000	456,000							
320	Waste								456,000	209,000	388,000	137,000					
320	Ore*								386,000	473,000	439,000	221,000					
315	Waste									435,000	101,000	630,000					
315	Ore*									364,000	134,000	1,088,000					
310	Waste									146,000	161,000		730,000				
310	Ore*									80,000	223,000	35,000	1,219,000				
305	Waste										270,000		94,000	600,000			
305	Ore*										262,000		166,000	1,070,000			
300	Waste										134,000			182,000	400,000		
300	Ore*										149,000			287,000	810,000		
295	Waste										71,000				604,000		
295	Ore*										100,000				642,000	245,000	
290	Waste										14,000					380,000	
290	Ore*										35,000					660,000	
285	Waste										5,000					381,000	
285	Ore*										14,000					484,000	84,000
280	Waste															200,000	123,000
280	Ore*															60,000	285,000
275	Waste																247,000
275	Ore*																208,000
270	Waste																144,000
270	Ore*																132,000
265	Waste																109,000
265	Ore*																106,000
260	Waste																46,000
260	Ore*																67,000
255	Waste																32,000
255	Ore*																53,000
250	Waste																9,000
250	Ore*																21,000
245	Waste																5,000
245	Ore*																9,000
TOTAL	**Waste**	**468,000**	**928,000**	**1,125,000**	**1,846,000**	**1,868,000**	**1,477,000**	**1,482,000**	**1,822,000**	**1,439,000**	**1,144,000**	**767,000**	**825,000**	**782,000**	**1,004,000**	**961,000**	**714,000**
TOTAL	**LG**		**9,000**	**10,000**	**27,000**	**24,000**	**22,000**	**32,000**	**73,000**	**41,000**	**26,000**	**16,000**	**52,000**	**25,000**	**118,000**	**116,000**	**39,000**
TOTAL	**HG**	**22,000**	**861,000**	**1,332,000**	**1,331,000**	**1,336,000**	**1,335,000**	**1,336,000**	**1,335,000**	**1,332,000**	**1,330,000**	**1,328,000**	**1,333,000**	**1,331,000**	**1,334,000**	**1,333,000**	**927,000**

** To reduce the size of this table, for the benches, 'Ore' includes the Low Grade Ore (LG) and the High Grade Ore (HG)*



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ROCHE

DATE: 13/08/08 BY: PIERRE CASGRAIN

Pierre Casgrain 101321 QUÉBEC

13/08/08

Date: July 22nd, 2013

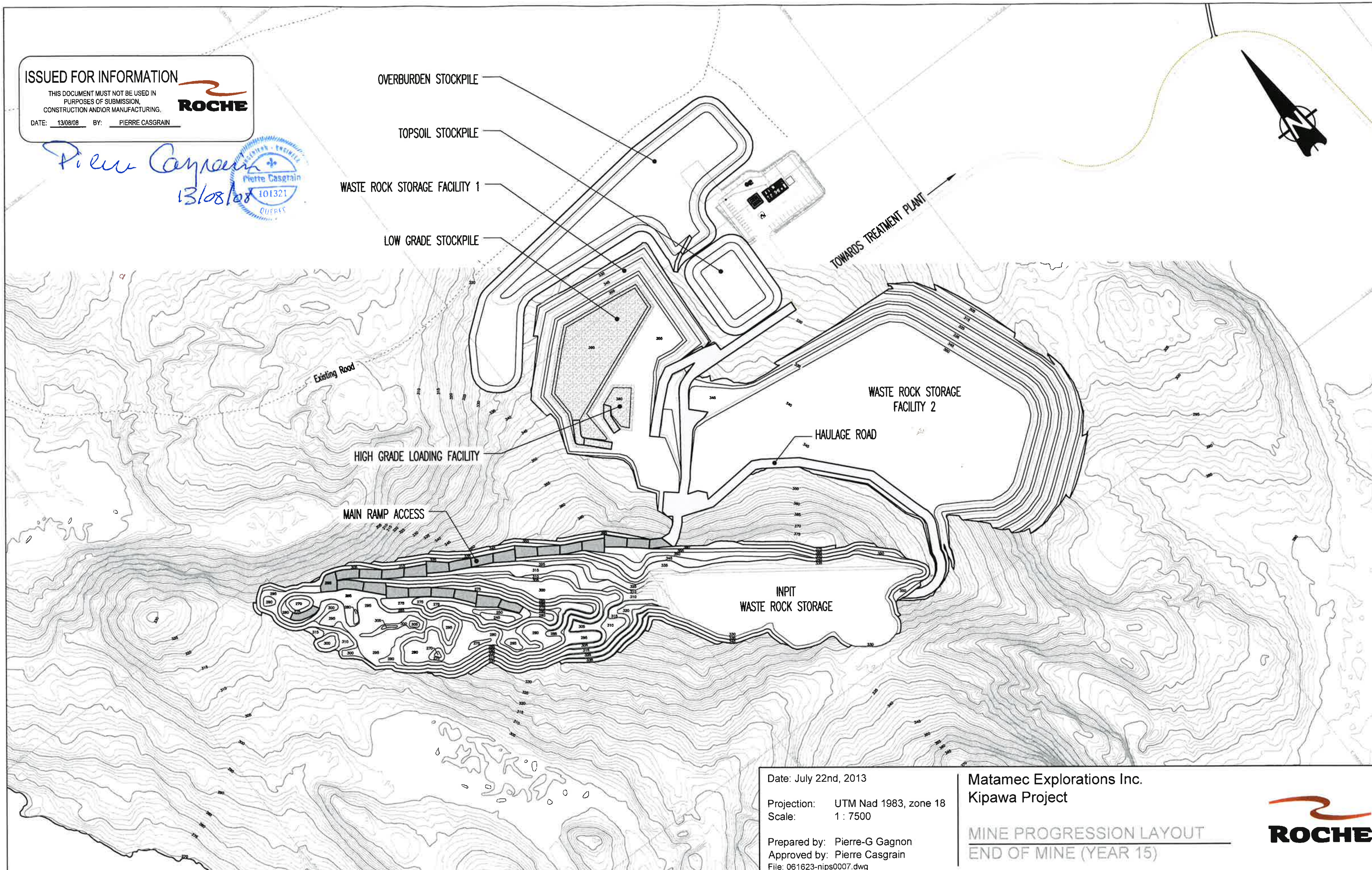
Projection: UTM Nad 1983, zone 18
Scale: 1 : 7500

Prepared by: Pierre-G Gagnon
Approved by: Pierre Casgrain
File: 061623-nips0001.dwg

Matamec Explorations Inc.
Kipawa Project

MINE PROGRESSION LAYOUT
YEAR 1

ROCHE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ROCHE
DATE: 13/08/08 BY: PIERRE CASGRAIN
Pierre Casgrain
13/08/08
Pierre Casgrain
101321
OVERBURDEN STOCKPILE
TOPSOIL STOCKPILE
WASTE ROCK STORAGE FACILITY 1
LOW GRADE STOCKPILE
TOWARDS TREATMENT PLANT
Existing Road
WASTE ROCK STORAGE FACILITY 2
HAULAGE ROAD
HIGH GRADE LOADING FACILITY
MAIN RAMP ACCESS
INPIT WASTE ROCK STORAGE
Date: July 22nd, 2013
Projection: UTM Nad 1983, zone 18
Scale: 1 : 7500
Prepared by: Pierre-G Gagnon
Approved by: Pierre Casgrain
File: 061623-nips0007.dwg
Matamec Explorations Inc.
Kipawa Project
MINE PROGRESSION LAYOUT
END OF MINE (YEAR 15)
ROCHE

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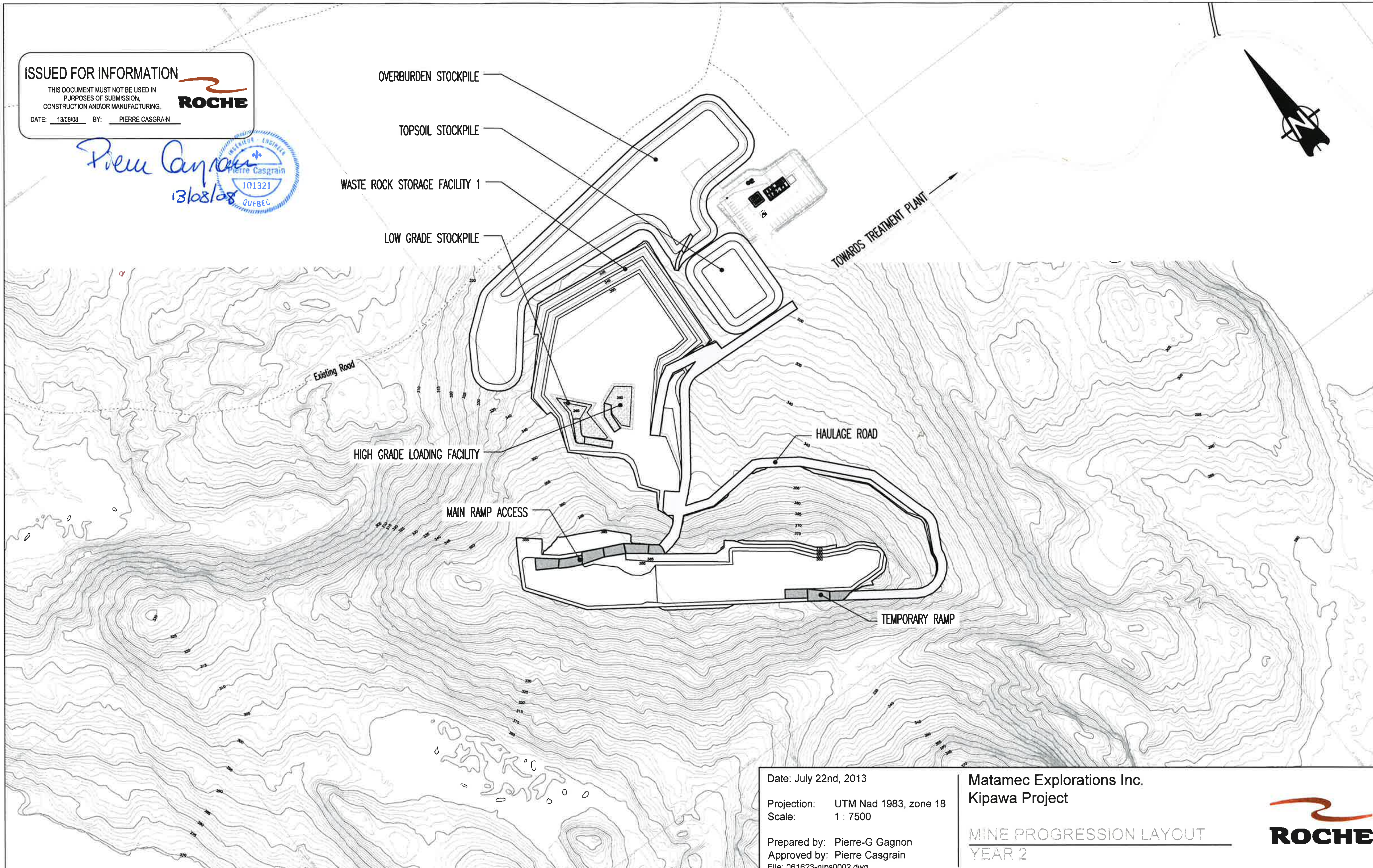
DATE: 13/08/08 BY: PIERRE CASGRAIN

Pierre Casgrain 13/08/08

INGÉNIEUR · ENGINEER Pierre Casgrain 101321 QUÉBEC



Date: July 22nd, 2013

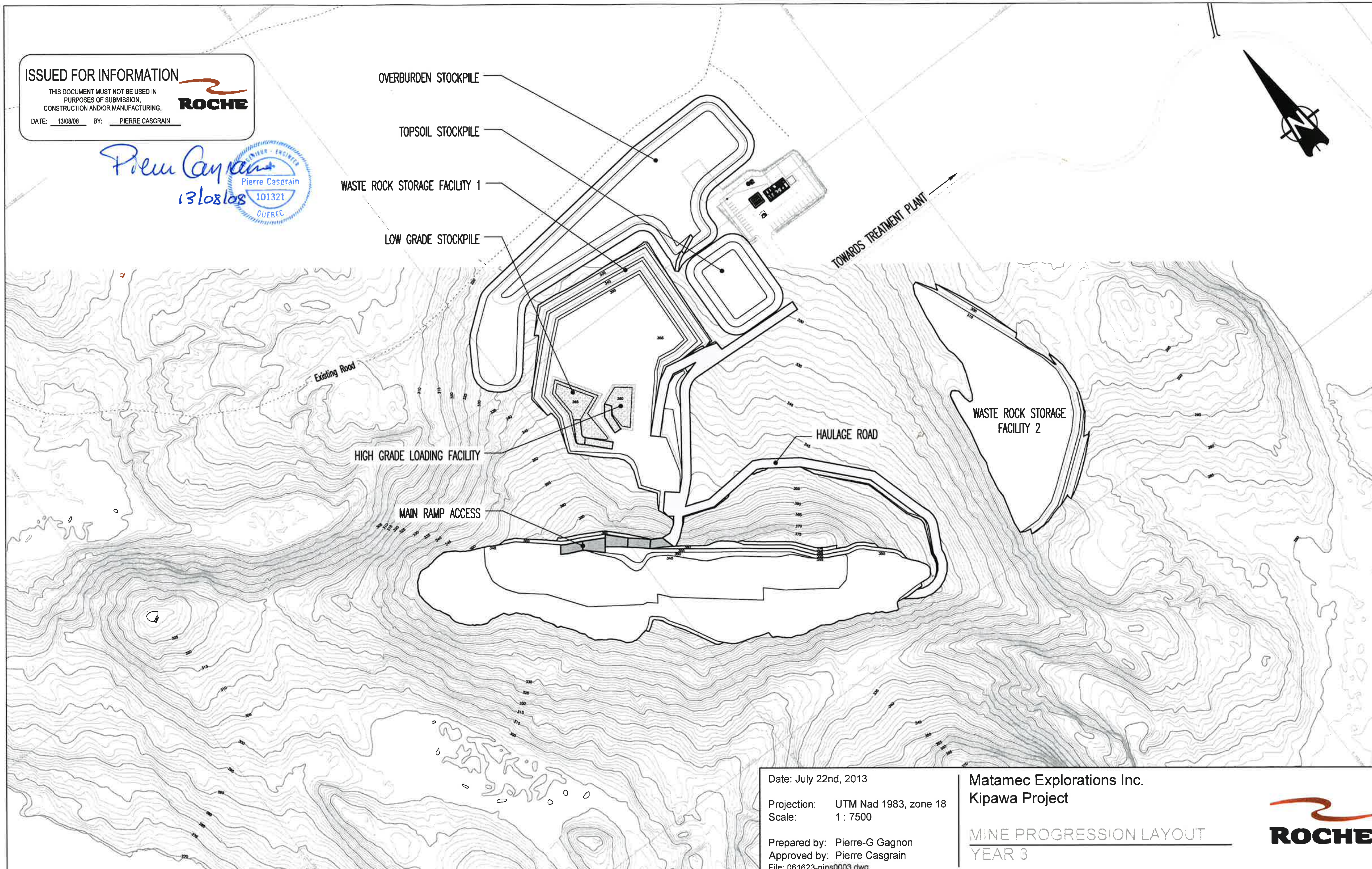
Projection: UTM Nad 1983, zone 18
Scale: 1 : 7500

Prepared by: Pierre-G Gagnon
Approved by: Pierre Casgrain
File: 061623-nips0002.dwg

Matamec Explorations Inc.
Kipawa Project

MINE PROGRESSION LAYOUT
YEAR 2

ROCHE



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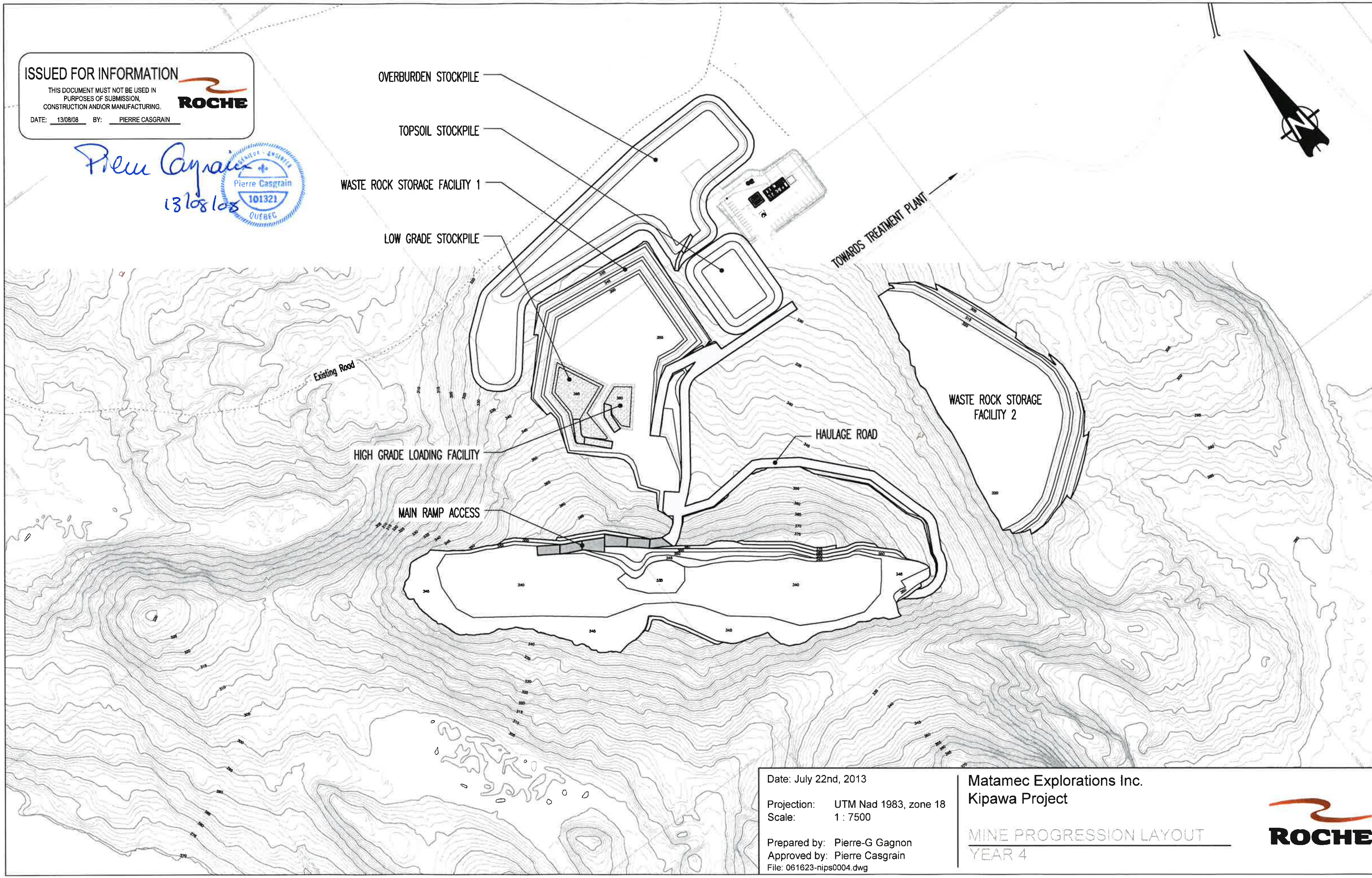
Matamec Explorations Inc.
Kipawa Project

MINE PROGRESSION LAYOUT
YEAR 3

ROCHE



Date: July 22nd, 2013

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Matamec Explorations Inc.
Kipawa Project

MINE PROGRESSION LAYOUT
YEAR 4

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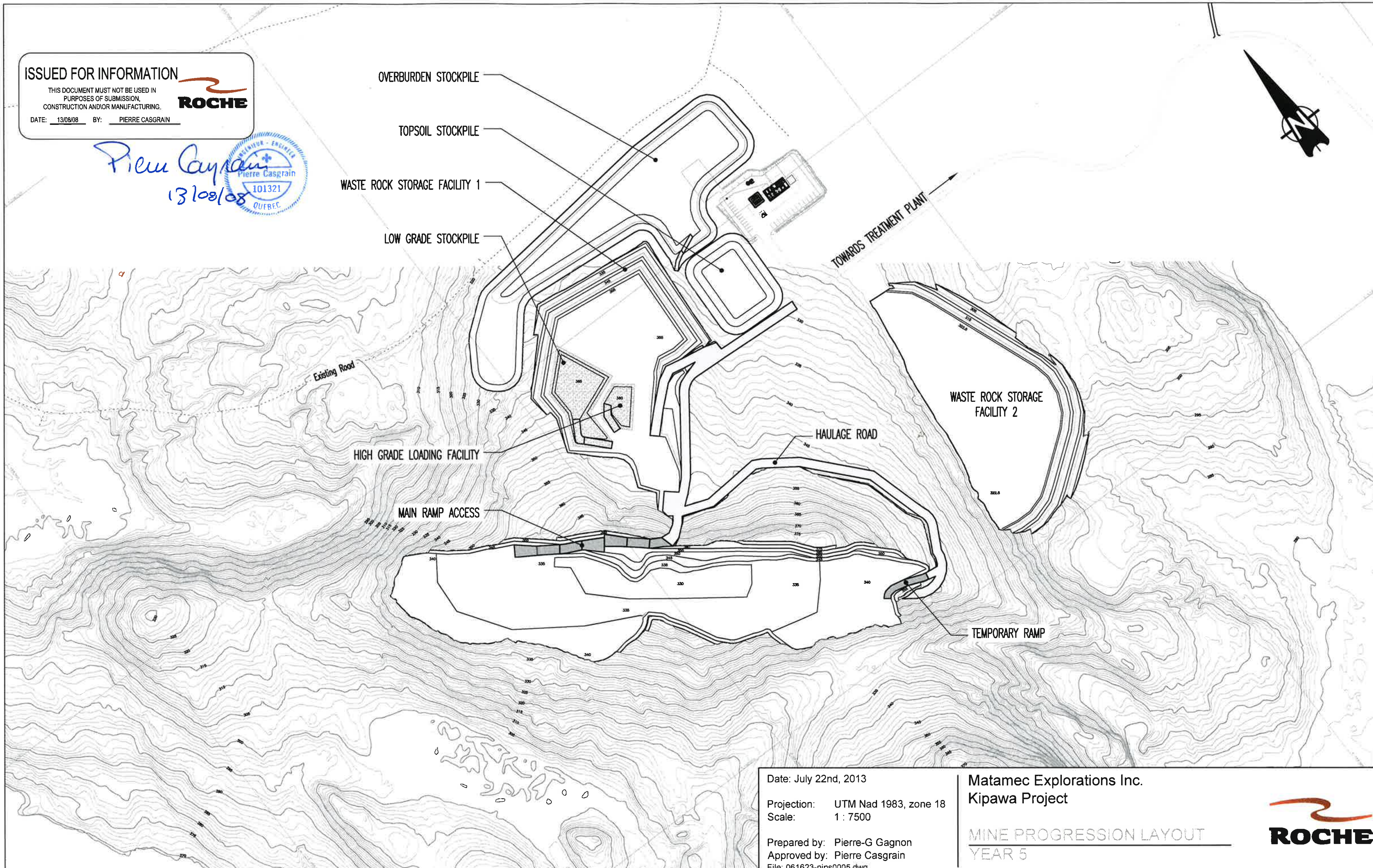

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Pierre Casgrain
101321
QUÉBEC
13/08/08
OVERBURDEN STOCKPILE
TOPSOIL STOCKPILE
WASTE ROCK STORAGE FACILITY 1
LOW GRADE STOCKPILE
TOWARDS TREATMENT PLANT
Existing Road
WASTE ROCK STORAGE FACILITY 2
HAULAGE ROAD
HIGH GRADE LOADING FACILITY
MAIN RAMP ACCESS
TEMPORARY RAMP
Date: July 22nd, 2013
Projection: UTM Nad 1983, zone 18
Scale: 1 : 7500
Prepared by: Pierre-G Gagnon
Approved by: Pierre Casgrain
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Matamec Explorations Inc.
Kipawa Project
MINE PROGRESSION LAYOUT
YEAR 5
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Pierre Casgrain 13/08/08

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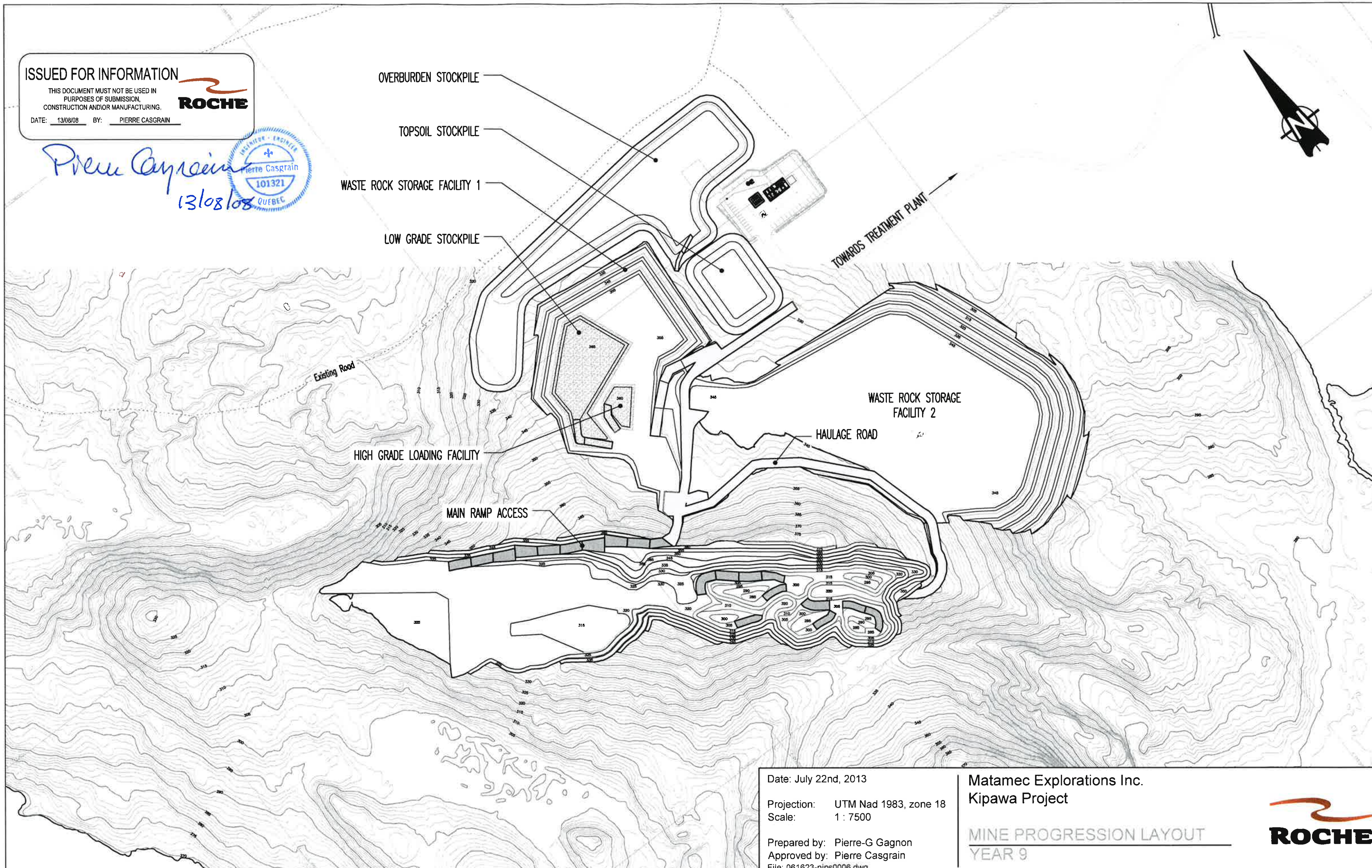

Date: July 22nd, 2013

Projection: UTM Nad 1983, zone 18
Scale: 1 : 7500

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Matamec Explorations Inc.
Kipawa Project

MINE PROGRESSION LAYOUT
YEAR 9

ROCHE

Detailed Utilization of the Mining Equipment

In-Pit trucks estimated yearly operating hours

Equipment	Total	Year -1	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
Truck 1	119	851	2076	2902	4319	4448	4063	4448	5286	4982	4906	3718					
Truck 2	42000	851	2076	2902	4319	4448	4063	4448	5286	4982	4906	3718					
Truck 3	42000		2076	2902	4319	4448	4063	4448	5286	4982	4906	4569					
Truck 4	42000											1339	4626	3374	4448	4170	3559
Truck 5	21516												4626	3374	4448	4170	3559
Truck 6	20177												4626	3374	4448	4170	3559

Excavator estimated yearly operating hours

Equipment	Total	Year -1	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
Excavator 1	119	35	1341	2075	2074	2082	2079	2080	2079	2075	2071	2069	2076	2074	2079	2076	2076
Excavator 2	30440																

Road Haulers estimated yearly operating hours

Equipment	Total	Year -1	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
Road Haul 1	119		2734	2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644
Road Haul 2	39755		2734	2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644
Road Haul 3	39755		2734	2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644
Road Haul 4	39755		2734	2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644
Road Haul 5	39755		2734	2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644
Road Haul 6	39755			2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644
Road Haul 7	37021			2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644
Road Haul 8	37021			2644	2642	2652	2648	2650	2648	2643	2638	2635	2644	2642	2648	2644	2644

Wheel Loaders estimated yearly operating hours

Equipment	Total	Year -1	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
W. Loader 1	119	822	3018	4139	5376	5417	4755	4782	5419	2272							
W. Loader 2	36000									2446	4194	3542	3708	3589	4121	4045	2818

Auxilliary Excavators estimated yearly operating hours

Equipment	Total	Year -1	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
Aux. Exc. 1	119	3241	3241	3241	3241	3241	3241	3241	3241	1975							
Aux. Exc. 2	27903									1266	3241	3241	3241	3241	3241	3241	3241

Track Dozers estimated yearly operating hours

		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Dozer 1	28000	4806	4806	4806	4806	4806	3970										
Dozer 2	28000	4806	4806	4806	4806	4806	3970										
Dozer 3	28000						836	4806	4806	4806	4806	4806	3134				
Dozer 4	28000						836	4806	4806	4806	4806	4806	3134				
Dozer 5	20896												1672	4806	4806	4806	4806
Dozer 6	20896												1672	4806	4806	4806	4806

Graders estimated yearly operating hours

		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Grader 1	24500	3204	3204	3204	3204	3204	3204	3204	2072								
Grader 2	24500	3204	3204	3204	3204	3204	3204	3204	2072								
Grader 3	26764								1132	3204	3204	3204	3204	3204	3204	3204	3204
Grader 4	26764								1132	3204	3204	3204	3204	3204	3204	3204	3204

Water truck estimated yearly operating hours

		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Watertruck 1	30992	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937

Lube truck estimated yearly operating hours

		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Lube truck 1	25000	2783	2783	2783	2783	2783	2783	2783	2783	2736							
Lube truck 2	19528									47	2783	2783	2783	2783	2783	2783	2783

Tool carrier estimated yearly operating hours

		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ToolCarrier 1	22500	2474	2474	2474	2474	2474	2474	2474	2474	2474	234						
ToolCarrier 2	17084										2240	2474	2474	2474	2474	2474	2474

DTH estimated yearly operating hours

		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DTH drill 1	40000	665.9	2444	3352	4353.1	4387	3851	3872	4388	3821	3396	2868	2603				
DTH drill 2	12201												400	2906.4	3337	3275	2282
DTH drill 3	0																

Pump estimated yearly operating hours

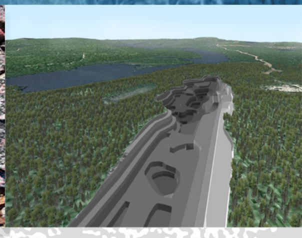
		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pump 1	20000	1583	1583	1583	1583	1583	1583	1583	1583	1583	1583	1583	1583	1004			
Pump 2	5328													579	1583	1583	1583

Stemming loader estimated yearly operating hours																	
		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
StemLoader 1	12499.7	633.4	2375	3167	3167	3157											
StemLoader 2	12500					10	3167	3167	3167	2989							
StemLoader 3	12500									178	3167	3167	3167	2821			
StemLoader 4	9055													346	3167	3167	2375

Shuttle bus estimated yearly operating hours																	
		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Shuttlebus 1	24999.5	1584	3167	3167	3167	3167	3167	3167	3167	1247							
Shuttlebus 2	24089									1920	3167	3167	3167	3167	3167	3167	3167

Portable Diesel light estimated yearly operating hours																	
		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DieselLight 1	25000	3167	3167	3167	3167	3167	3167	3167	2831								
DieselLight 2	25000	3167	3167	3167	3167	3167	3167	3167	2831								
DieselLight 3	25000	3167	3167	3167	3167	3167	3167	3167	2831								
DieselLight 4	25672								336	3167	3167	3167	3167	3167	3167	3167	3167
DieselLight 5	25672								336	3167	3167	3167	3167	3167	3167	3167	3167
DieselLight 6	25672								336	3167	3167	3167	3167	3167	3167	3167	3167

Pickup trucks estimated yearly operating hours																	
		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Equipment	Total	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pickup MineMtn 1	15000	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	700				
Pickup MineMtn 2	5800												600	1300	1300	1300	1300
PickupSnrGF 1	15000	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	700				
PickupSnrGF 2	5800												600	1300	1300	1300	1300
PickupSupProd 1	15000	6552	6552	1896													
PickupSupProd 2	15000			4656	6552	3792											
PickupSupProd 3	15000					2760	6552	5688									
PickupSupProd 4	15000							864	6552	6552	1032						
PickupSupProd 5	15000										5520	6552	2928				
PickupSupProd 6	15000												3624	6552	4824		
PickupSupProd 7	14832														1728	6552	6552
PickupSupD&B 1	15000	6552	6552	1896													
PickupSupD&B 2	15000			4656	6552	3792											
PickupSupD&B 3	15000					2760	6552	5688									
PickupSupD&B 4	15000							864	6552	6552	1032						
PickupSupD&B 5	15000										5520	6552	2928				
PickupSupD&B 6	15000												3624	6552	4824		
PickupSupD&B 7	14832														1728	6552	6552
PickupMineHelp 1	15000	6552	6552	1896													
PickupMineHelp 2	15000			4656	6552	3792											
PickupMineHelp 3	15000					2760	6552	5688									
PickupMineHelp 4	15000							864	6552	6552	1032						
PickupMineHelp 5	15000										5520	6552	2928				
PickupMineHelp 6	15000												3624	6552	4824		
PickupMineHelp 7	14832														1728	6552	6552
PickupBlaster 1	15000	4368	4368	4368	1896												
PickupBlaster 2	15000				2472	4368	4368	3792									
PickupBlaster 3	15000							576	4368	4368	4368	1320					
PickupBlaster 4	15000											3048	4368	4368	3216		
PickupBlaster 5	9888														1152	4368	4368
PickupMech 1	15000	5460	5460	4080													
PickupMech 2	15000			1380	5460	5460	2700										
PickupMech 3	15000						2760	5460	5460	1320							
PickupMech 4	15000									4140	5460	5400					
PickupMech 5	15000											60	5460	5460	4020		
PickupMech 6	12360														1440	5460	5460
PickupEng 1	15000	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	700				
PickupEng 2	5800												600	1300	1300	1300	1300
PickupSurv 1	15000	1820	1820	1820	1820	1820	1820	1820	1820	440							
PickupSurv 2	14120									1380	1820	1820	1820	1820	1820	1820	1820
PickupGeo 1	15000	1560	1560	1560	1560	1560	1560	1560	1560	1560	960						
PickupGeo 2	9960										600	1560	1560	1560	1560	1560	1560



APPENDIX 6-
Plan & Schedule

Package Breakdown Structure (PBS) with Work Breakdown Structure (WBS) included

PROJECT	SUB-PROJECT	AREA	WBS	PROJECT	SUB-PROJECT	AREA
5	11	000	5-11-000	MATAMEC CONSTRUCTION	OFF-SITE INSTALLATIONS (5KM RADIUS OF TEMISCAMING)	GENERAL
5	11	210	5-11-210	MATAMEC CONSTRUCTION	OFF-SITE INSTALLATIONS (5KM RADIUS OF TEMISCAMING)	MAIN SUB-STATION (Temiscaming - 120kV)
5	11	215	5-11-215	MATAMEC CONSTRUCTION	OFF-SITE INSTALLATIONS (5KM RADIUS OF TEMISCAMING)	HYDRO-QUEBEC 14KM 120 kV POWER LINE
5	11	305	5-11-305	MATAMEC CONSTRUCTION	OFF-SITE INSTALLATIONS (5KM RADIUS OF TEMISCAMING)	PARKING AT TEMISCAMING
5	10	000	5-10-000	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	GENERAL
5	10	110	5-10-110	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINING EQUIPMENT

5	10	115	5-10-115	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE ROADS
5	10	120	5-10-120	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE DEWATERING
5	10	130	5-10-130	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE PRE-PRODUCTION
5	10	150	5-10-150	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE EXPLOSIVE STORAGE
5	10	170	5-10-170	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE ELECTRICAL DISTRIBUTION & LIGHTING (Incl in Area 330)
5	10	180	5-10-180	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE COMMUNICATIONS HARDWARE & SOFTWARE (Incl in Area 225 and 330)
5	10	235	5-10-235	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	SECONDARY SUB-STATION (Mine Site) (Included in Area 330)
5	10	310	5-10-310	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	ACCESS ROADS (Mine Maintenance Shop - Plant Site)
5	10	330	5-10-330	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE MAINTENANCE SHOP (Garage)
5	10	334	5-10-334	MATAMEC CONSTRUCTION	MINE SITE (KIPAWA)	MINE SITE FUEL STORAGE
5	14	000	5-14-000	MATAMEC CONSTRUCTION	INTER-SITE SERVICES	GENERAL
5	14	220	5-14-220	MATAMEC CONSTRUCTION	INTER-SITE SERVICES	POWER LINES (between Sub-Station 120kV and Plant Site)
5	14	225	5-14-225	MATAMEC CONSTRUCTION	INTER-SITE SERVICES	COMMUNICATIONS
5	14	227	5-14-227	MATAMEC CONSTRUCTION	INTER-SITE SERVICES	CELL COMMUNICATIONS

5	14	310	5-14-310	MATAMEC CONSTRUCTION	INTER-SITE SERVICES	ACCESS ROAD (From Maniwaki Road To Plant Site)
5	18	000	5-18-000	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	GENERAL
5	18	230	5-18-230	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MAIN SUB-STATION (Hydromet Site)
5	18	250	5-18-250	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	SITE POWER DISTRIBUTION (Incl in Area 230 - Main Sub-Station (Hydromet Site))
5	18	310	5-18-310	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	ACCESS ROAD (Crusher access Road)
5	18	320	5-18-320	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	GENERAL PLANT SITE PREPARATION
5	18	336	5-18-336	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PLANT SITE FUEL STORAGE
5	18	340	5-18-340	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	ADMINISTRATION & SERVICE BUILDING
5	18	342	5-18-342	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PLANT SITE WAREHOUSE
5	18	344	5-18-344	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	ASSAY LABORATORY
5	18	346	5-18-346	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	GUARD HOUSE (Incl in Area 340)
5	18	348	5-18-348	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	SURFACE SUPPORT MOBILE EQUIPMENT
5	18	350	5-18-350	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	REAGENT STORAGE (Cold Storage)
5	18	362	5-18-362	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	POTABLE WATER TREATMENT & DISTRIBUTION (Included with Area 320)

5	18	366	5-18-366	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	SEWAGE TREATMENT SYSTEM & DIST. (Included with Area 320)
5	18	390	5-18-390	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	SITE FIRE PROTECTION - PUMPING STATION & PIPELINE LOOPS
5	18	510	5-18-510	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	CRUSHING
5	18	515	5-18-515	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	ORE STORAGE
5	18	520	5-18-520	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	GRINDING
5	18	525	5-18-525	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MAGNETIC SEPARATION
5	18	530	5-18-530	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MAGNETIC SEPARATION CONCENTRATE REGRIND
5	18	535	5-18-535	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MAGNETIC SEPARATION CONCENTRATE DEWATERING
5	18	540	5-18-540	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MAIN BUILDING PROCESS PLANT
5	18	550	5-18-550	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MAGNETIC SEPARATION TAILINGS DEWATERING
5	18	552	5-18-552	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	ACID LEACHING
5	18	554	5-18-554	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	AL TAILINGS DEWATERING
5	18	556	5-18-556	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PRE-NEUTRALIZATION
5	18	558	5-18-558	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PN RE-LEACH

5	18	560	5-18-560	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	IMPURITIES REMOVAL
5	18	562	5-18-562	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	RARE EARTH PRECIPITATION
5	18	564	5-18-564	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	REP RE-LEACH
5	18	566	5-18-566	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PRECIPITATE DEWATERING & LOADOUT
5	18	568	5-18-568	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	FINAL TAILING NEUTRALISATION
5	18	570	5-18-570	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PROCESS & FRESH WATER DISTRIBUTION
5	18	572	5-18-572	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	REAGENT PREPARATION & DISTRIBUTION
5	18	574	5-18-574	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	COMPRESSORS ROOM & AIR DITRIBUTION
5	18	576	5-18-576	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PRIMARY ELECTRICAL ROOM
5	18	577	5-18-577	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	SECONDARY ELECTRICAL ROOM
5	18	580	5-18-580	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MILL CONTROL SYSTEM (hardware, software & programming)
5	18	590	5-18-590	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PLANT METALLURGICAL LABORATORY (architectural, equipment & furniture)
5	18	592	5-18-592	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PLANT OFFICES (finish, electrical & furniture) (Included in Area 540)
5	18	594	5-18-594	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PLANT WAREHOUSE / SHOP (Incl in Area 540 - Main Building Process Plant)

5	18	598	5-18-598	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	PLANT TOOLS, MOBILE EQUIPMENTS & VEHICULES
5	18	805	5-18-805	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	FRESH WATER PUMPING STATION and PIPELINE
5	18	810	5-18-810	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	TAILINGS POND (one cell for one third of mine life)
5	18	820	5-18-820	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	TAILING PIPELINE
5	18	830	5-18-830	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	RECLAIM PUMPING STATION & PIPELINE
5	18	850	5-18-850	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	MEASURING STATION (not required if we have effluent treatment plant)
5	18	860	5-18-860	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	EFFLUENT WATER TREATMENT (if required)
5	18	880	5-18-880	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	SITE DRAINAGE POND
5	00	910	5-00-910	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	CONSTRUCTION INDIRECTS
5	00	945	5-00-945	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	CONSTRUCTION CONTINGENCY (15% of Direct Costs & Construction Indirect Costs)
5	00	950	5-00-950	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	OWNER'S COSTS
5	00	995	5-00-995	MATAMEC CONSTRUCTION	HYDROMET PLANT SITE	OWNER'S COST CONTINGENCY (15% of Owner's Costs)

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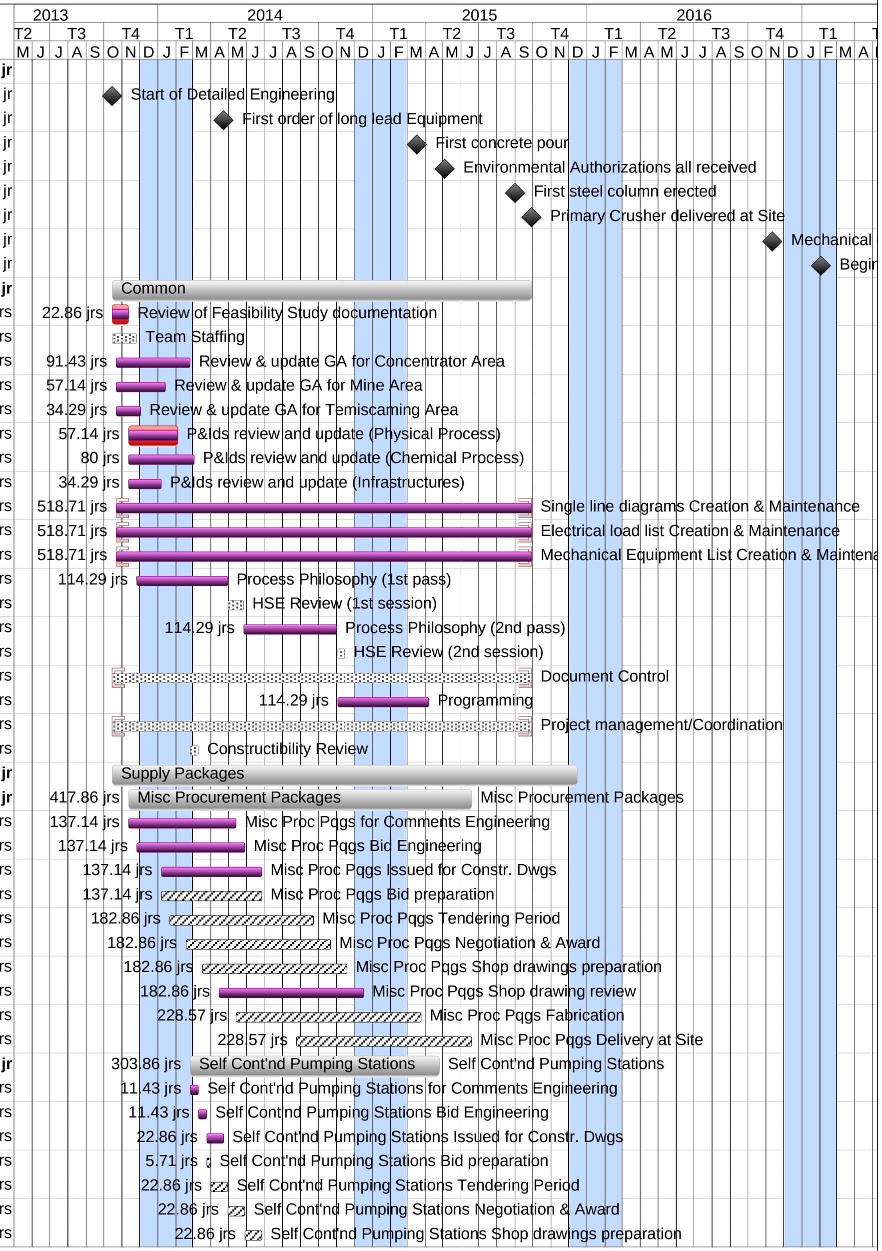
N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
1		**Key Milestones**	**2013-10-15**	**2017-02-02**	**0 hr**	**0 jr**
2	00-0	Start of Detailed Engineering	2013-10-15	2013-10-15	0 hr	0 jr
3	00-0	First order of long lead Equipment	2014-04-22	2014-04-22	0 hr	0 jr
4	00-0	First concrete pour	2015-03-17	2015-03-17	0 hr	0 jr
5	00-0	Environmental Authorizations all received	2015-05-04	2015-05-04	0 hr	0 jr
6	00-0	First steel column erected	2015-08-31	2015-08-31	0 hr	0 jr
7	00-0	Primary Crusher delivered at Site	2015-09-28	2015-09-28	0 hr	0 jr
8	00-0	Mechanical Completion	2016-11-11	2016-11-11	0 hr	0 jr
9	00-0	Begining of Ramp-up	2017-02-02	2017-02-02	0 hr	0 jr
10		**Common**	**2013-10-15**	**2015-09-28**	**22 960 hr**	**0 jr**
11	00-0	Review of Feasibility Study documentation	2013-10-15	2013-11-11	500 hr	31.29 jrs
12	00-0	Team Staffing	2013-10-15	2013-11-25	500 hr	47.29 jrs
13	00-0	Review & update GA for Concentrator Area	2013-10-22	2014-02-24	2 500 hr	143.29 jrs
14	00-0	Review & update GA for Mine Area	2013-10-22	2014-01-13	2 500 hr	95.29 jrs
15	00-0	Review & update GA for Temiscaming Area	2013-10-22	2013-12-02	2 500 hr	47.29 jrs
16	00-0	P&Ids review and update (Physical Process)	2013-11-12	2014-02-03	600 hr	95.29 jrs
17	00-0	P&Ids review and update (Chemical Process)	2013-11-12	2014-03-03	1 000 hr	127.29 jrs
18	00-0	P&Ids review and update (Infrastructures)	2013-11-12	2014-01-06	600 hr	63.29 jrs
19	00-0	Single line diagrams Creation & Maintenance	2013-10-22	2015-09-28	1 500 hr	807.29 jrs
20	00-0	Electrical load list Creation & Maintenance	2013-10-22	2015-09-28	1 500 hr	807.29 jrs
21	00-0	Mechanical Equipment List Creation & Maintenance	2013-10-22	2015-09-28	1 500 hr	807.29 jrs
22	00-0	Process Philosophy (1st pass)	2013-11-26	2014-04-29	400 hr	176.43 jrs
23	00-0	HSE Review (1st session)	2014-04-30	2014-05-26	320 hr	30.14 jrs
24	00-0	Process Philosophy (2nd pass)	2014-05-27	2014-10-31	400 hr	179.86 jrs
25	00-0	HSE Review (2nd session)	2014-11-03	2014-11-14	320 hr	13 jrs
26	00-0	Document Control	2013-10-15	2015-09-28	2 000 hr	815.29 jrs
27	00-0	Programming	2014-11-03	2015-04-06	2 000 hr	176.43 jrs
28	00-0	Project management/Coordination	2013-10-15	2015-09-28	2 000 hr	815.29 jrs
29	00-0	Constructibility Review	2014-02-25	2014-03-10	320 hr	15.29 jrs
30		**Supply Packages**	**2013-10-15**	**2015-12-15**	**20 920 hr**	**0 jr**
31		**Misc Procurement Packages**	**2013-11-12**	**2015-06-18**	**15 500 hr**	**0 jr**
32	00-5.10	Misc Proc Pqgs for Comments Engineering	2013-11-12	2014-05-13	2 500 hr	208.43 jrs
33	00-5.10	Misc Proc Pqgs Bid Engineering	2013-11-26	2014-05-28	2 000 hr	209.57 jrs
34	00-5.10	Misc Proc Pqgs Issued for Constr. Dwgs	2014-01-07	2014-06-26	2 000 hr	194.71 jrs
35	00-5.10	Misc Proc Pqgs Bid preparation	2014-01-07	2014-06-26	1 000 hr	194.71 jrs
36	00-5.10	Misc Proc Pqgs Tendering Period	2014-01-21	2014-09-22	1 000 hr	279.29 jrs
37	00-5.10	Misc Proc Pqgs Negotiation & Award	2014-02-18	2014-10-21	2 000 hr	280.43 jrs
38	00-5.10	Misc Proc Pqgs Shop drawings preparation	2014-03-18	2014-11-18	500 hr	280.43 jrs
39	00-5.10	Misc Proc Pqgs Shop drawing review	2014-04-15	2014-12-16	2 000 hr	280.43 jrs
40	00-5.10	Misc Proc Pqgs Fabrication	2014-05-14	2015-03-24	2 000 hr	359.29 jrs
41	00-5.10	Misc Proc Pqgs Delivery at Site	2014-08-25	2015-06-18	500 hr	339.86 jrs
42		**Self Cont'nd Pumping Stations**	**2014-02-25**	**2015-04-24**	**310 hr**	**0 jr**
43	18-8.05	Self Cont'nd Pumping Stations for Comments Engineering	2014-02-25	2014-03-10	50 hr	15.29 jrs
44	18-8.05	Self Cont'nd Pumping Stations Bid Engineering	2014-03-11	2014-03-24	40 hr	15.29 jrs
45	18-8.05	Self Cont'nd Pumping Stations Issued for Constr. Dwgs	2014-03-25	2014-04-22	40 hr	32.43 jrs
46	18-8.05	Self Cont'nd Pumping Stations Bid preparation	2014-03-25	2014-03-31	20 hr	7.29 jrs
47	18-8.05	Self Cont'nd Pumping Stations Tendering Period	2014-04-01	2014-04-29	20 hr	32.43 jrs
48	18-8.05	Self Cont'nd Pumping Stations Negotiation & Award	2014-04-30	2014-05-28	40 hr	32.43 jrs
49	18-8.05	Self Cont'nd Pumping Stations Shop drawings preparation	2014-05-29	2014-06-26	10 hr	32.43 jrs



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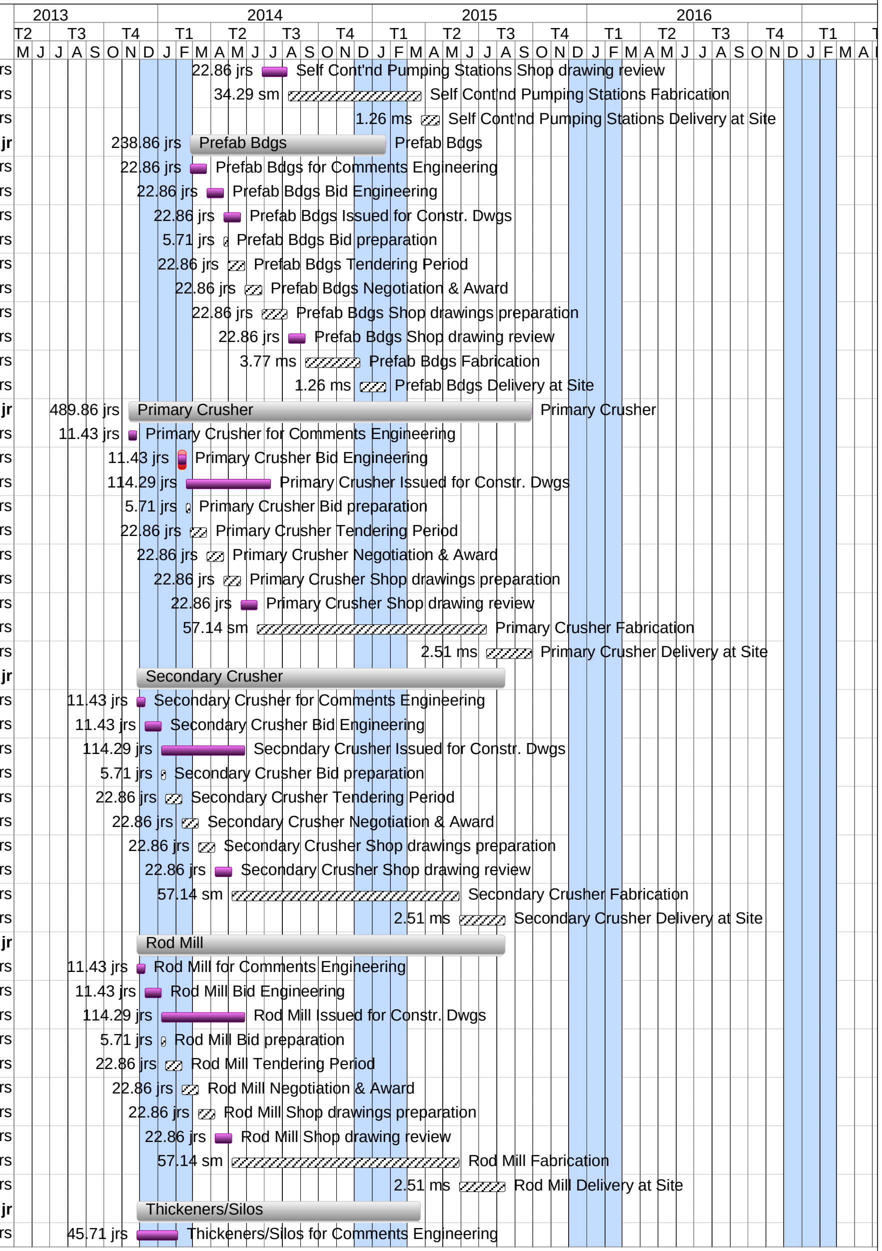
Critical | Procurement | Start-up | Progress
Hammock | Summary | Operations | Reported Progress
Engineering | Construction | Management | Milestone

N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
50	18-8.05	Self Cont'nd Pumping Stations Shop drawing review	2014-06-27	2014-08-08	40 hr	48.43 jrs
51	18-8.05	Self Cont'nd Pumping Stations Fabrication	2014-08-11	2015-03-24	40 hr	257.57 jrs
52	18-8.05	Self Cont'nd Pumping Stations Delivery at Site	2015-03-25	2015-04-24	10 hr	34.71 jrs
53		**Prefab Bdgs**	**2014-02-25**	**2015-01-23**	**380 hr**	**0 jr**
54	00-3.00	Prefab Bdgs for Comments Engineering	2014-02-25	2014-03-24	80 hr	31.29 jrs
55	00-3.00	Prefab Bdgs Bid Engineering	2014-03-25	2014-04-22	80 hr	32.43 jrs
56	00-3.00	Prefab Bdgs Issued for Constr. Dwgs	2014-04-23	2014-05-21	40 hr	32.43 jrs
57	00-3.00	Prefab Bdgs Bid preparation	2014-04-23	2014-04-29	20 hr	7.29 jrs
58	00-3.00	Prefab Bdgs Tendering Period	2014-04-30	2014-05-28	20 hr	32.43 jrs
59	00-3.00	Prefab Bdgs Negotiation & Award	2014-05-29	2014-06-26	40 hr	32.43 jrs
60	00-3.00	Prefab Bdgs Shop drawings preparation	2014-06-27	2014-08-08	10 hr	48.43 jrs
61	00-3.00	Prefab Bdgs Shop drawing review	2014-08-11	2014-09-08	40 hr	32.43 jrs
62	00-3.00	Prefab Bdgs Fabrication	2014-09-09	2014-12-10	40 hr	105.57 jrs
63	00-3.00	Prefab Bdgs Delivery at Site	2014-12-11	2015-01-23	10 hr	49.57 jrs
64		**Primary Crusher**	**2013-11-12**	**2015-09-28**	**310 hr**	**0 jr**
65	18-5.10	Primary Crusher for Comments Engineering	2013-11-12	2013-11-25	50 hr	15.29 jrs
66	18-5.10	Primary Crusher Bid Engineering	2014-02-04	2014-02-17	40 hr	15.29 jrs
67	18-5.10	Primary Crusher Issued for Constr. Dwgs	2014-02-18	2014-07-11	40 hr	163.86 jrs
68	18-5.10	Primary Crusher Bid preparation	2014-02-18	2014-02-24	20 hr	7.29 jrs
69	18-5.10	Primary Crusher Tendering Period	2014-02-25	2014-03-24	20 hr	31.29 jrs
70	18-5.10	Primary Crusher Negotiation & Award	2014-03-25	2014-04-22	40 hr	32.43 jrs
71	18-5.10	Primary Crusher Shop drawings preparation	2014-04-23	2014-05-21	10 hr	32.43 jrs
72	18-5.10	Primary Crusher Shop drawing review	2014-05-22	2014-06-18	40 hr	31.29 jrs
73	18-5.10	Primary Crusher Fabrication	2014-06-19	2015-07-13	40 hr	445 jrs
74	18-5.10	Primary Crusher Delivery at Site	2015-07-14	2015-09-28	10 hr	87.29 jrs
75		**Secondary Crusher**	**2013-11-26**	**2015-08-14**	**310 hr**	**0 jr**
76	18-5.10	Secondary Crusher for Comments Engineering	2013-11-26	2013-12-09	50 hr	15.29 jrs
77	18-5.10	Secondary Crusher Bid Engineering	2013-12-10	2014-01-06	40 hr	31.29 jrs
78	18-5.10	Secondary Crusher Issued for Constr. Dwgs	2014-01-07	2014-05-28	40 hr	161.57 jrs
79	18-5.10	Secondary Crusher Bid preparation	2014-01-07	2014-01-13	20 hr	7.29 jrs
80	18-5.10	Secondary Crusher Tendering Period	2014-01-14	2014-02-10	20 hr	31.29 jrs
81	18-5.10	Secondary Crusher Negotiation & Award	2014-02-11	2014-03-10	40 hr	31.29 jrs
82	18-5.10	Secondary Crusher Shop drawings preparation	2014-03-11	2014-04-07	10 hr	31.29 jrs
83	18-5.10	Secondary Crusher Shop drawing review	2014-04-08	2014-05-06	40 hr	32.43 jrs
84	18-5.10	Secondary Crusher Fabrication	2014-05-07	2015-05-28	40 hr	441.57 jrs
85	18-5.10	Secondary Crusher Delivery at Site	2015-05-29	2015-08-14	10 hr	88.43 jrs
86		**Rod Mill**	**2013-11-26**	**2015-08-14**	**310 hr**	**0 jr**
87	18-5.20	Rod Mill for Comments Engineering	2013-11-26	2013-12-09	50 hr	15.29 jrs
88	18-5.20	Rod Mill Bid Engineering	2013-12-10	2014-01-06	40 hr	31.29 jrs
89	18-5.20	Rod Mill Issued for Constr. Dwgs	2014-01-07	2014-05-28	40 hr	161.57 jrs
90	18-5.20	Rod Mill Bid preparation	2014-01-07	2014-01-13	20 hr	7.29 jrs
91	18-5.20	Rod Mill Tendering Period	2014-01-14	2014-02-10	20 hr	31.29 jrs
92	18-5.20	Rod Mill Negotiation & Award	2014-02-11	2014-03-10	40 hr	31.29 jrs
93	18-5.20	Rod Mill Shop drawings preparation	2014-03-11	2014-04-07	10 hr	31.29 jrs
94	18-5.20	Rod Mill Shop drawing review	2014-04-08	2014-05-06	40 hr	32.43 jrs
95	18-5.20	Rod Mill Fabrication	2014-05-07	2015-05-28	40 hr	441.57 jrs
96	18-5.20	Rod Mill Delivery at Site	2015-05-29	2015-08-14	10 hr	88.43 jrs
97		**Thickeners/Silos**	**2013-11-26**	**2015-03-23**	**460 hr**	**0 jr**
98	18-5.00	Thickeners/Silos for Comments Engineering	2013-11-26	2014-02-03	200 hr	79.29 jrs



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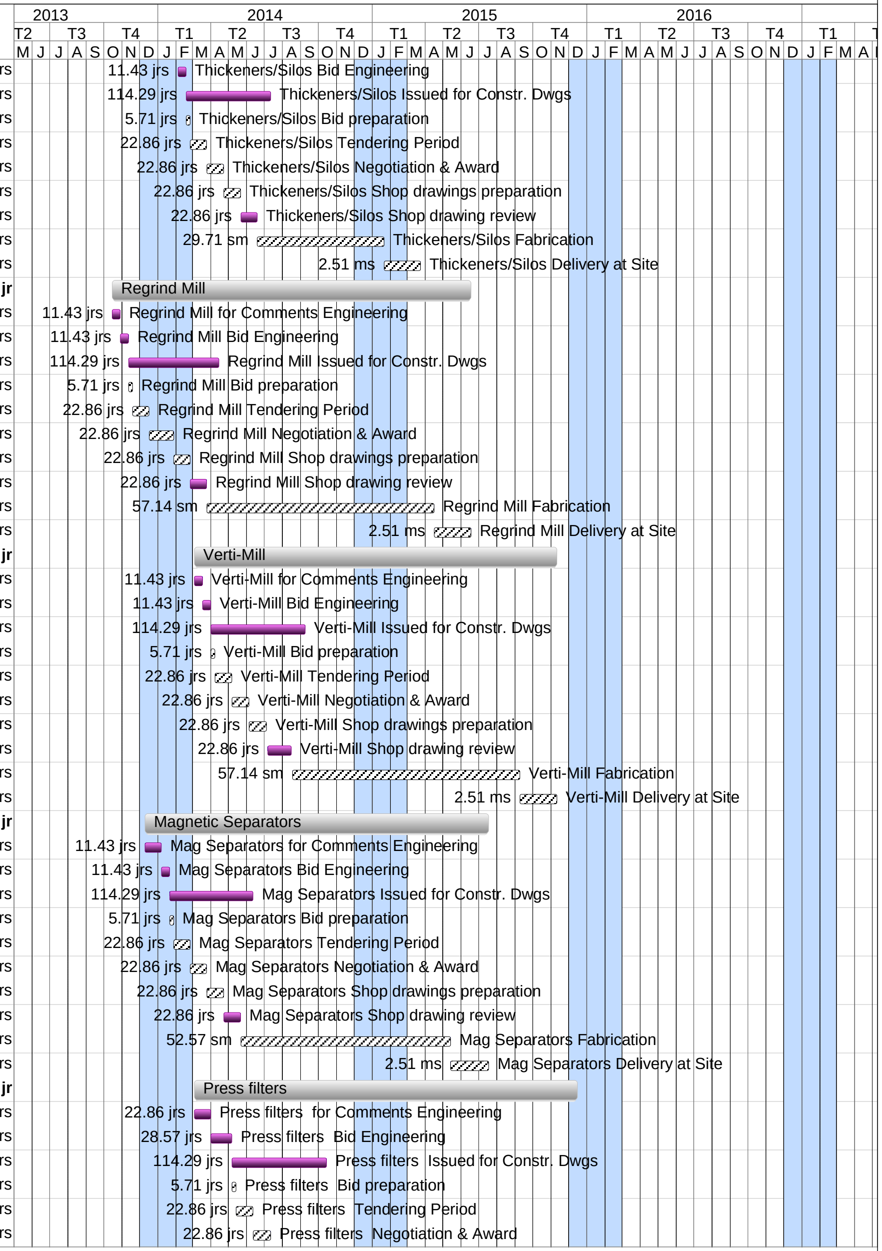
Critical		Procurement		Start-up		Progress	
Hammock		Summary		Operations		Reported Progress	
Engineering		Construction		Management		Milestone	

N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
99	18-5.00	Thickeners/Silos Bid Engineering	2014-02-04	2014-02-17	40 hr	15.29 jrs
100	18-5.00	Thickeners/Silos Issued for Constr. Dwgs	2014-02-18	2014-07-11	40 hr	163.86 jrs
101	18-5.00	Thickeners/Silos Bid preparation	2014-02-18	2014-02-24	20 hr	7.29 jrs
102	18-5.00	Thickeners/Silos Tendering Period	2014-02-25	2014-03-24	20 hr	31.29 jrs
103	18-5.00	Thickeners/Silos Negotiation & Award	2014-03-25	2014-04-22	40 hr	32.43 jrs
104	18-5.00	Thickeners/Silos Shop drawings preparation	2014-04-23	2014-05-21	10 hr	32.43 jrs
105	18-5.00	Thickeners/Silos Shop drawing review	2014-05-22	2014-06-18	40 hr	31.29 jrs
106	18-5.00	Thickeners/Silos Fabrication	2014-06-19	2015-01-20	40 hr	246.14 jrs
107	18-5.00	Thickeners/Silos Delivery at Site	2015-01-21	2015-03-23	10 hr	70.14 jrs
108		**Regrind Mill**	**2013-10-15**	**2015-06-17**	**310 hr**	**0 jr**
109	18-5.20	Regrind Mill for Comments Engineering	2013-10-15	2013-10-28	50 hr	15.29 jrs
110	18-5.20	Regrind Mill Bid Engineering	2013-10-29	2013-11-11	40 hr	15.29 jrs
111	18-5.20	Regrind Mill Issued for Constr. Dwgs	2013-11-12	2014-04-14	40 hr	175.29 jrs
112	18-5.20	Regrind Mill Bid preparation	2013-11-12	2013-11-18	20 hr	7.29 jrs
113	18-5.20	Regrind Mill Tendering Period	2013-11-19	2013-12-16	20 hr	31.29 jrs
114	18-5.20	Regrind Mill Negotiation & Award	2013-12-17	2014-01-27	40 hr	47.29 jrs
115	18-5.20	Regrind Mill Shop drawings preparation	2014-01-28	2014-02-24	10 hr	31.29 jrs
116	18-5.20	Regrind Mill Shop drawing review	2014-02-25	2014-03-24	40 hr	31.29 jrs
117	18-5.20	Regrind Mill Fabrication	2014-03-25	2015-04-15	40 hr	441.57 jrs
118	18-5.20	Regrind Mill Delivery at Site	2015-04-16	2015-06-17	10 hr	71.29 jrs
119		**Verti-Mill**	**2014-03-04**	**2015-11-10**	**310 hr**	**0 jr**
120	18-5.72	Verti-Mill for Comments Engineering	2014-03-04	2014-03-17	50 hr	15.29 jrs
121	18-5.72	Verti-Mill Bid Engineering	2014-03-18	2014-03-31	40 hr	15.29 jrs
122	18-5.72	Verti-Mill Issued for Constr. Dwgs	2014-04-01	2014-09-08	40 hr	183.29 jrs
123	18-5.72	Verti-Mill Bid preparation	2014-04-01	2014-04-07	20 hr	7.29 jrs
124	18-5.72	Verti-Mill Tendering Period	2014-04-08	2014-05-06	20 hr	32.43 jrs
125	18-5.72	Verti-Mill Negotiation & Award	2014-05-07	2014-06-04	40 hr	32.43 jrs
126	18-5.72	Verti-Mill Shop drawings preparation	2014-06-05	2014-07-04	10 hr	33.57 jrs
127	18-5.72	Verti-Mill Shop drawing review	2014-07-07	2014-08-15	40 hr	45 jrs
128	18-5.72	Verti-Mill Fabrication	2014-08-18	2015-09-08	40 hr	441.57 jrs
129	18-5.72	Verti-Mill Delivery at Site	2015-09-09	2015-11-10	10 hr	71.29 jrs
130		**Magnetic Separators**	**2013-12-10**	**2015-07-17**	**310 hr**	**0 jr**
131	18-5.25	Mag Separators for Comments Engineering	2013-12-10	2014-01-06	50 hr	31.29 jrs
132	18-5.25	Mag Separators Bid Engineering	2014-01-07	2014-01-20	40 hr	15.29 jrs
133	18-5.25	Mag Separators Issued for Constr. Dwgs	2014-01-21	2014-06-11	40 hr	161.57 jrs
134	18-5.25	Mag Separators Bid preparation	2014-01-21	2014-01-27	20 hr	7.29 jrs
135	18-5.25	Mag Separators Tendering Period	2014-01-28	2014-02-24	20 hr	31.29 jrs
136	18-5.25	Mag Separators Negotiation & Award	2014-02-25	2014-03-24	40 hr	31.29 jrs
137	18-5.25	Mag Separators Shop drawings preparation	2014-03-25	2014-04-22	10 hr	32.43 jrs
138	18-5.25	Mag Separators Shop drawing review	2014-04-23	2014-05-21	40 hr	32.43 jrs
139	18-5.25	Mag Separators Fabrication	2014-05-22	2015-05-13	40 hr	407.29 jrs
140	18-5.25	Mag Separators Delivery at Site	2015-05-14	2015-07-17	10 hr	73.57 jrs
141		**Press filters**	**2014-03-04**	**2015-12-15**	**420 hr**	**0 jr**
142	18-5.54	Press filters for Comments Engineering	2014-03-04	2014-03-31	100 hr	31.29 jrs
143	18-5.54	Press filters Bid Engineering	2014-04-01	2014-05-06	100 hr	40.43 jrs
144	18-5.54	Press filters Issued for Constr. Dwgs	2014-05-07	2014-10-14	40 hr	183.29 jrs
145	18-5.54	Press filters Bid preparation	2014-05-07	2014-05-13	20 hr	7.29 jrs
146	18-5.54	Press filters Tendering Period	2014-05-14	2014-06-11	20 hr	32.43 jrs
147	18-5.54	Press filters Negotiation & Award	2014-06-12	2014-07-11	40 hr	33.57 jrs



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Critical	Procurement	Start-up	Progress
Hammock	Summary	Operations	Reported Progress
Engineering	Construction	Management	Milestone

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KIPAWA PROJECT - DETAILED SCHEDULE
revised as of 2013-08-08
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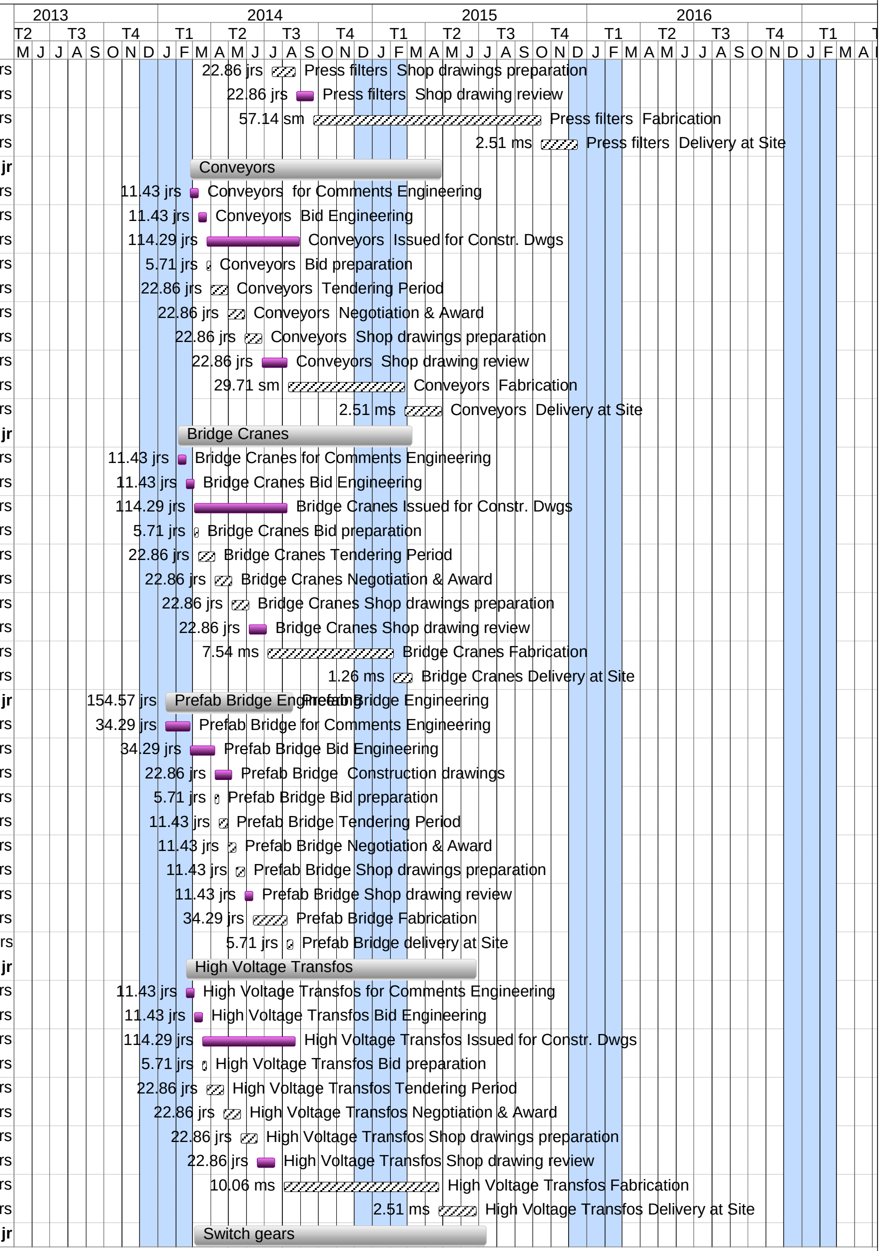
N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
148	18-5.54	Press filters Shop drawings preparation	2014-07-14	2014-08-22	10 hr	45 jrs
149	18-5.54	Press filters Shop drawing review	2014-08-25	2014-09-22	40 hr	32.43 jrs
150	18-5.54	Press filters Fabrication	2014-09-23	2015-10-14	40 hr	441.57 jrs
151	18-5.54	Press filters Delivery at Site	2015-10-15	2015-12-15	10 hr	70.14 jrs
152		**Conveyors**	**2014-02-25**	**2015-04-28**	**310 hr**	**0 jr**
153	18-5.35	Conveyors for Comments Engineering	2014-02-25	2014-03-10	50 hr	15.29 jrs
154	18-5.35	Conveyors Bid Engineering	2014-03-11	2014-03-24	40 hr	15.29 jrs
155	18-5.35	Conveyors Issued for Constr. Dwgs	2014-03-25	2014-08-29	40 hr	179.86 jrs
156	18-5.35	Conveyors Bid preparation	2014-03-25	2014-03-31	20 hr	7.29 jrs
157	18-5.35	Conveyors Tendering Period	2014-04-01	2014-04-29	20 hr	32.43 jrs
158	18-5.35	Conveyors Negotiation & Award	2014-04-30	2014-05-28	40 hr	32.43 jrs
159	18-5.35	Conveyors Shop drawings preparation	2014-05-29	2014-06-26	10 hr	32.43 jrs
160	18-5.35	Conveyors Shop drawing review	2014-06-27	2014-08-08	40 hr	48.43 jrs
161	18-5.35	Conveyors Fabrication	2014-08-11	2015-02-24	40 hr	225.57 jrs
162	18-5.35	Conveyors Delivery at Site	2015-02-25	2015-04-28	10 hr	71.29 jrs
163		**Bridge Cranes**	**2014-02-04**	**2015-03-09**	**310 hr**	**0 jr**
164	18-5.40	Bridge Cranes for Comments Engineering	2014-02-04	2014-02-17	50 hr	15.29 jrs
165	18-5.40	Bridge Cranes Bid Engineering	2014-02-18	2014-03-03	40 hr	15.29 jrs
166	18-5.40	Bridge Cranes Issued for Constr. Dwgs	2014-03-04	2014-08-08	40 hr	179.86 jrs
167	18-5.40	Bridge Cranes Bid preparation	2014-03-04	2014-03-10	20 hr	7.29 jrs
168	18-5.40	Bridge Cranes Tendering Period	2014-03-11	2014-04-07	20 hr	31.29 jrs
169	18-5.40	Bridge Cranes Negotiation & Award	2014-04-08	2014-05-06	40 hr	32.43 jrs
170	18-5.40	Bridge Cranes Shop drawings preparation	2014-05-07	2014-06-04	10 hr	32.43 jrs
171	18-5.40	Bridge Cranes Shop drawing review	2014-06-05	2014-07-04	40 hr	33.57 jrs
172	18-5.40	Bridge Cranes Fabrication	2014-07-07	2015-02-05	40 hr	243.86 jrs
173	18-5.40	Bridge Cranes Delivery at Site	2015-02-06	2015-03-09	10 hr	35.86 jrs
174		**Prefab Bridge Engineering**	**2014-01-14**	**2014-08-18**	**440 hr**	**0 jr**
175	10-3.10	Prefab Bridge for Comments Engineering	2014-01-14	2014-02-24	100 hr	47.29 jrs
176	10-3.10	Prefab Bridge Bid Engineering	2014-02-25	2014-04-07	120 hr	47.29 jrs
177	10-3.10	Prefab Bridge Construction drawings	2014-04-08	2014-05-06	40 hr	32.43 jrs
178	10-3.10	Prefab Bridge Bid preparation	2014-04-08	2014-04-14	20 hr	7.29 jrs
179	10-3.10	Prefab Bridge Tendering Period	2014-04-15	2014-04-29	20 hr	16.43 jrs
180	10-3.10	Prefab Bridge Negotiation & Award	2014-04-30	2014-05-13	40 hr	15.29 jrs
181	10-3.10	Prefab Bridge Shop drawings preparation	2014-05-14	2014-05-28	10 hr	16.43 jrs
182	10-3.10	Prefab Bridge Shop drawing review	2014-05-29	2014-06-11	40 hr	15.29 jrs
183	10-3.10	Prefab Bridge Fabrication	2014-06-12	2014-08-08	40 hr	65.57 jrs
184	10-3.10	Prefab Bridge delivery at Site	2014-08-08	2014-08-18	10 hr	11.33 jrs
185		**High Voltage Transfos**	**2014-02-18**	**2015-06-26**	**310 hr**	**0 jr**
186	00-2.10	High Voltage Transfos for Comments Engineering	2014-02-18	2014-03-03	50 hr	15.29 jrs
187	00-2.10	High Voltage Transfos Bid Engineering	2014-03-04	2014-03-17	40 hr	15.29 jrs
188	00-2.10	High Voltage Transfos Issued for Constr. Dwgs	2014-03-18	2014-08-22	40 hr	179.86 jrs
189	00-2.10	High Voltage Transfos Bid preparation	2014-03-18	2014-03-24	20 hr	7.29 jrs
190	00-2.10	High Voltage Transfos Tendering Period	2014-03-25	2014-04-22	20 hr	32.43 jrs
191	00-2.10	High Voltage Transfos Negotiation & Award	2014-04-23	2014-05-21	40 hr	32.43 jrs
192	00-2.10	High Voltage Transfos Shop drawings preparation	2014-05-22	2014-06-18	10 hr	31.29 jrs
193	00-2.10	High Voltage Transfos Shop drawing review	2014-06-19	2014-07-18	40 hr	33.57 jrs
194	00-2.10	High Voltage Transfos Fabrication	2014-08-04	2015-04-23	40 hr	299.86 jrs
195	00-2.10	High Voltage Transfos Delivery at Site	2015-04-24	2015-06-26	10 hr	72.43 jrs
196		**Switch gears**	**2014-03-04**	**2015-07-13**	**310 hr**	**0 jr**



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Critical		Procurement		Start-up		Progress	
Hammock		Summary		Operations		Reported Progress	
Engineering		Construction		Management		Milestone	

N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
197	00-2.10	Switch gears for Comments Engineering	2014-03-04	2014-03-17	50 hr	15.29 jrs
198	00-2.10	Switch gears Bid Engineering	2014-03-18	2014-03-31	40 hr	15.29 jrs
199	00-2.10	Switch gears Issued for Constr. Dwgs	2014-04-01	2014-09-08	40 hr	183.29 jrs
200	00-2.10	Switch gears Bid preparation	2014-04-01	2014-04-07	20 hr	7.29 jrs
201	00-2.10	Switch gears Tendering Period	2014-04-08	2014-05-06	20 hr	32.43 jrs
202	00-2.10	Switch gears Negotiation & Award	2014-05-07	2014-06-04	40 hr	32.43 jrs
203	00-2.10	Switch gears Shop drawings preparation	2014-06-05	2014-07-04	10 hr	33.57 jrs
204	00-2.10	Switch gears Shop drawing review	2014-07-07	2014-08-15	40 hr	45 jrs
205	00-2.10	Switch gears Fabrication	2014-08-18	2015-05-07	40 hr	299.86 jrs
206	00-2.10	Switch gears Delivery at Site	2015-05-08	2015-07-13	10 hr	75.86 jrs
207		**MCC**	**2014-03-18**	**2015-08-10**	**310 hr**	**0 jr**
208	00-2.10	MCC for Comments Engineering	2014-03-18	2014-03-31	50 hr	15.29 jrs
209	00-2.10	MCC Bid Engineering	2014-04-01	2014-04-14	40 hr	15.29 jrs
210	00-2.10	MCC Issued for Constr. Dwgs	2014-04-15	2014-09-22	40 hr	183.29 jrs
211	00-2.10	MCC Bid preparation	2014-04-15	2014-04-22	20 hr	8.43 jrs
212	00-2.10	MCC Tendering Period	2014-04-23	2014-05-21	20 hr	32.43 jrs
213	00-2.10	MCC Negotiation & Award	2014-05-22	2014-06-18	40 hr	31.29 jrs
214	00-2.10	MCC Shop drawings preparation	2014-06-19	2014-07-18	10 hr	33.57 jrs
215	00-2.10	MCC Shop drawing review	2014-08-04	2014-08-29	40 hr	29 jrs
216	00-2.10	MCC Fabrication	2014-09-02	2015-05-22	40 hr	299.86 jrs
217	00-2.10	MCC Delivery at Site	2015-05-25	2015-08-10	10 hr	88.43 jrs
218		**Construction Packages**	**2013-11-26**	**2015-03-24**	**5 110 hr**	**0 jr**
219		**Mining Works Engineering**	**2014-01-14**	**2014-06-26**	**300 hr**	**0 jr**
220	10-1	Mining Works for Comments Engineering	2014-01-14	2014-02-24	50 hr	47.29 jrs
221	10-1	Mining Works Bid Engineering	2014-02-25	2014-03-10	40 hr	15.29 jrs
222	10-1	Mining Works Construction drawings	2014-03-11	2014-04-07	40 hr	31.29 jrs
223	10-1	Mining Works Bid preparation	2014-03-11	2014-03-17	20 hr	7.29 jrs
224	10-1	Mining Works Tendering Period	2014-03-18	2014-04-14	20 hr	31.29 jrs
225	10-1	Mining Works Negotiation & Award	2014-04-15	2014-05-13	40 hr	32.43 jrs
226	10-1	Mining Works Shop drawings preparation	2014-05-14	2014-05-28	10 hr	16.43 jrs
227	10-1	Mining Works Shop drawing review	2014-05-29	2014-06-11	40 hr	15.29 jrs
228	10-1	Mining Works Mobilization	2014-06-12	2014-06-26	40 hr	16.43 jrs
229		**Civil Works Engineering**	**2013-11-26**	**2014-09-15**	**430 hr**	**0 jr**
230	00-0	Civil Works for Comments Engineering	2013-11-26	2014-01-20	100 hr	63.29 jrs
231	00-0	Civil Works Bid Engineering	2014-04-01	2014-05-13	120 hr	48.43 jrs
232	00-0	Civil Works Construction drawings	2014-05-14	2014-06-11	40 hr	32.43 jrs
233	00-0	Civil Works Bid preparation	2014-05-14	2014-05-21	20 hr	8.43 jrs
234	00-0	Civil Works Tendering Period	2014-05-22	2014-06-18	20 hr	31.29 jrs
235	00-0	Civil Works Negotiation & Award	2014-06-19	2014-07-18	40 hr	33.57 jrs
236	00-0	Civil Works Shop drawings preparation	2014-08-04	2014-08-15	10 hr	13 jrs
237	00-0	Civil Works Shop drawing review	2014-08-18	2014-08-29	40 hr	13 jrs
238	00-0	Civil Works Mobilization	2014-09-02	2014-09-15	40 hr	15.29 jrs
239		**Concrete Works Engineering**	**2014-06-19**	**2014-11-18**	**300 hr**	**0 jr**
240	00-0	Concrete Works for Comments Engineering	2014-06-19	2014-07-04	50 hr	17.57 jrs
241	00-0	Concrete Works Bid Engineering	2014-07-07	2014-07-18	40 hr	13 jrs
242	00-0	Concrete Works Construction drawings	2014-08-04	2014-08-29	40 hr	29 jrs
243	00-0	Concrete Works Bid preparation	2014-08-04	2014-08-08	20 hr	5 jrs
244	00-0	Concrete Works Tendering Period	2014-08-11	2014-09-08	20 hr	32.43 jrs
245	00-0	Concrete Works Negotiation & Award	2014-09-09	2014-10-06	40 hr	31.29 jrs

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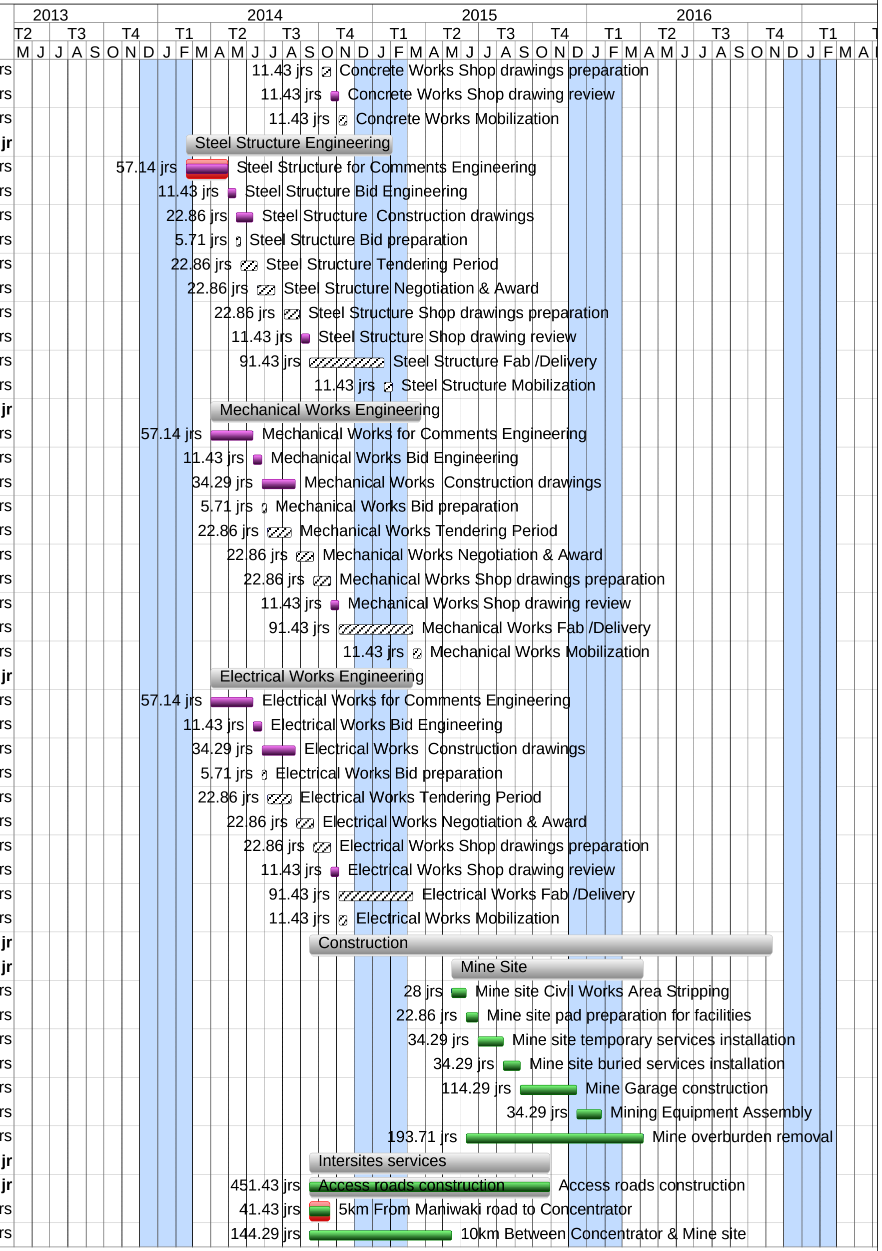
Critical · Hammock · Engineering · Procurement · Summary · Construction · Start-up · Operations · Management · Progress · Reported Progress · Milestone

N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
246	00-0	Concrete Works Shop drawings preparation	2014-10-07	2014-10-21	10 hr	16.43 jrs
247	00-0	Concrete Works Shop drawing review	2014-10-22	2014-11-04	40 hr	15.29 jrs
248	00-0	Concrete Works Mobilization	2014-11-05	2014-11-18	40 hr	15.29 jrs
249		**Steel Structure Engineering**	**2014-02-18**	**2015-02-03**	**1 360 hr**	**0 jr**
250	00-0	Steel Structure for Comments Engineering	2014-02-18	2014-04-29	300 hr	80.43 jrs
251	00-0	Steel Structure Bid Engineering	2014-04-30	2014-05-13	100 hr	15.29 jrs
252	00-0	Steel Structure Construction drawings	2014-05-14	2014-06-11	100 hr	32.43 jrs
253	00-0	Steel Structure Bid preparation	2014-05-14	2014-05-21	20 hr	8.43 jrs
254	00-0	Steel Structure Tendering Period	2014-05-22	2014-06-18	20 hr	31.29 jrs
255	00-0	Steel Structure Negotiation & Award	2014-06-19	2014-07-18	40 hr	33.57 jrs
256	00-0	Steel Structure Shop drawings preparation	2014-08-04	2014-08-29	20 hr	29 jrs
257	00-0	Steel Structure Shop drawing review	2014-09-02	2014-09-15	80 hr	15.29 jrs
258	00-0	Steel Structure Fab /Delivery	2014-09-16	2015-01-20	640 hr	144.43 jrs
259	00-0	Steel Structure Mobilization	2015-01-21	2015-02-03	40 hr	15.29 jrs
260		**Mechanical Works Engineering**	**2014-04-01**	**2015-03-24**	**1 360 hr**	**0 jr**
261	00-0	Mechanical Works for Comments Engineering	2014-04-01	2014-06-11	300 hr	81.57 jrs
262	00-0	Mechanical Works Bid Engineering	2014-06-12	2014-06-26	100 hr	16.43 jrs
263	00-0	Mechanical Works Construction drawings	2014-06-27	2014-08-22	100 hr	64.43 jrs
264	00-0	Mechanical Works Bid preparation	2014-06-27	2014-07-04	20 hr	8.43 jrs
265	00-0	Mechanical Works Tendering Period	2014-07-07	2014-08-15	20 hr	45 jrs
266	00-0	Mechanical Works Negotiation & Award	2014-08-25	2014-09-22	40 hr	32.43 jrs
267	00-0	Mechanical Works Shop drawings preparation	2014-09-23	2014-10-21	20 hr	32.43 jrs
268	00-0	Mechanical Works Shop drawing review	2014-10-22	2014-11-04	80 hr	15.29 jrs
269	00-0	Mechanical Works Fab /Delivery	2014-11-05	2015-03-10	640 hr	143.29 jrs
270	00-0	Mechanical Works Mobilization	2015-03-11	2015-03-24	40 hr	15.29 jrs
271		**Electrical Works Engineering**	**2014-04-01**	**2015-03-10**	**1 360 hr**	**0 jr**
272	00-0	Electrical Works for Comments Engineering	2014-04-01	2014-06-11	300 hr	81.57 jrs
273	00-0	Electrical Works Bid Engineering	2014-06-12	2014-06-26	100 hr	16.43 jrs
274	00-0	Electrical Works Construction drawings	2014-06-27	2014-08-22	100 hr	64.43 jrs
275	00-0	Electrical Works Bid preparation	2014-06-27	2014-07-04	20 hr	8.43 jrs
276	00-0	Electrical Works Tendering Period	2014-07-07	2014-08-15	20 hr	45 jrs
277	00-0	Electrical Works Negotiation & Award	2014-08-25	2014-09-22	40 hr	32.43 jrs
278	00-0	Electrical Works Shop drawings preparation	2014-09-23	2014-10-21	20 hr	32.43 jrs
279	00-0	Electrical Works Shop drawing review	2014-10-22	2014-11-04	80 hr	15.29 jrs
280	00-0	Electrical Works Fab /Delivery	2014-11-05	2015-03-10	640 hr	143.29 jrs
281	00-0	Electrical Works Mobilization	2014-11-05	2014-11-18	40 hr	15.29 jrs
282		**Construction**	**2014-09-15**	**2016-11-11**	**469 359.57 hr**	**0 jr**
283		**Mine Site**	**2015-05-15**	**2016-04-06**	**30 400 hr**	**0 jr**
284	10-1.30	Mine site Civil Works Area Stripping	2015-05-15	2015-06-09	700 hr	28.33 jrs
285	10-1.30	Mine site pad preparation for facilities	2015-06-09	2015-06-29	800 hr	22.81 jrs
286	10-1.30	Mine site temporary services installation	2015-06-29	2015-08-11	2 000 hr	49.1 jrs
287	10-1.30	Mine site buried services installation	2015-08-11	2015-09-09	1 200 hr	33.1 jrs
288	10-1.30	Mine Garage construction	2015-09-09	2015-12-14	8 000 hr	109.67 jrs
289	10-3.00	Mining Equipment Assembly	2015-12-14	2016-01-25	1 000 hr	47.95 jrs
290	10-3.00	Mine overburden removal	2015-06-09	2016-04-06	16 700 hr	344.9 jrs
291		**Intersites services**	**2014-09-15**	**2015-10-29**	**73 701 hr**	**0 jr**
292		**Access roads construction**	**2014-09-15**	**2015-10-29**	**73 701 hr**	**0 jr**
293	14-3.10	5km From Maniwaki road to Concentrator	2014-09-15	2014-10-20	5 000 hr	40 jrs
294	14-3.10	10km Between Concentrator & Mine site	2014-09-15	2015-05-15	10 000 hr	276.57 jrs



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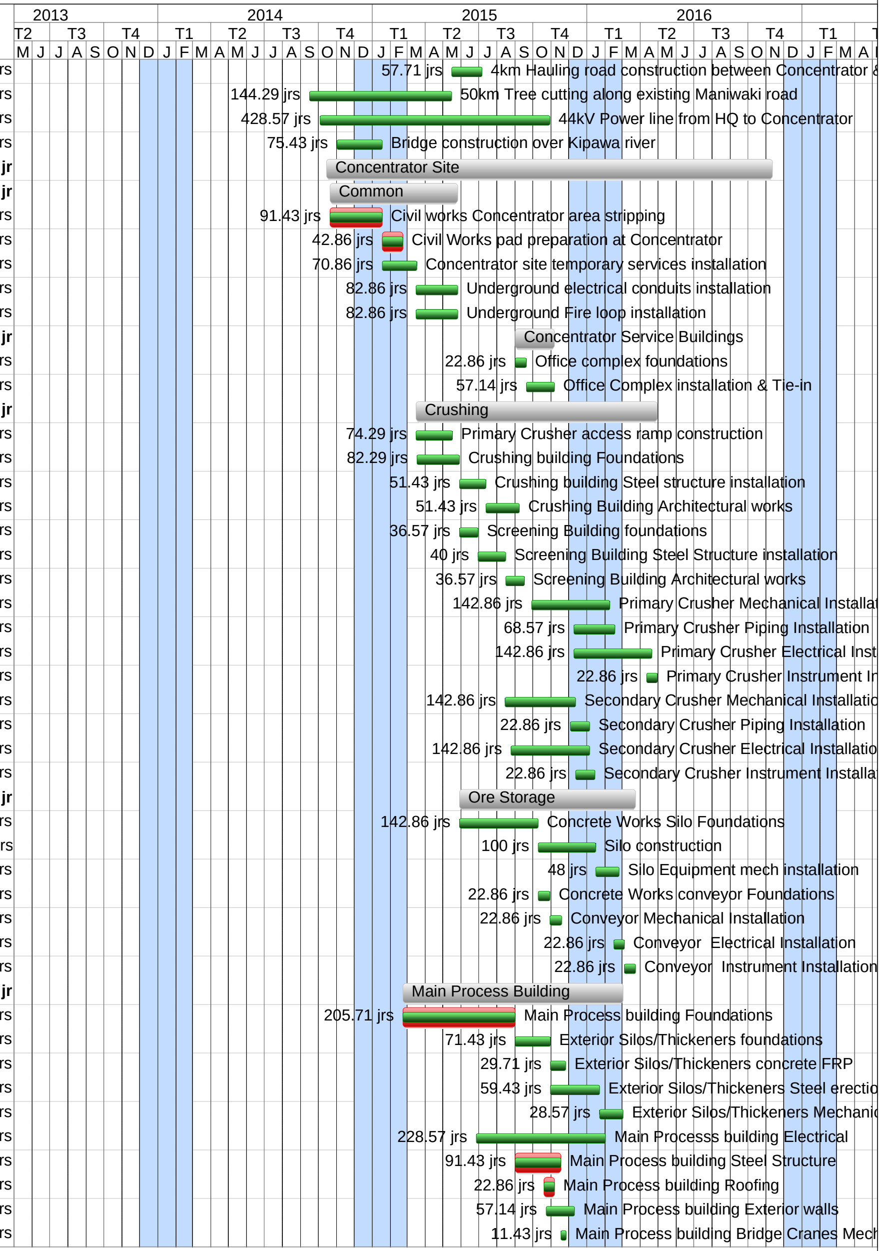
Critical		Procurement		Start-up		Progress	
Hammock		Summary		Operations		Reported Progress	
Engineering		Construction		Management		Milestone	

N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
295	14-3.10	4km Hauling road construction between Concentrator & Tailings	2015-05-15	2015-07-06	4 000 hr	59.09 jrs
296	14-3.10	50km Tree cutting along existing Maniwaki road	2014-09-15	2015-05-15	13 000 hr	276.57 jrs
297	14-3.10	44kV Power line from HQ to Concentrator	2014-10-03	2015-10-29	30 001 hr	446.86 jrs
298	14-3.10	Bridge construction over Kipawa river	2014-11-01	2015-01-17	11 700 hr	87.9 jrs
299		**Concentrator Site**	**2014-10-14**	**2016-11-11**	**361 208.57 hr**	**0 jr**
300		**Common**	**2014-10-20**	**2015-05-25**	**24 400 hr**	**0 jr**
301	18-5.00	Civil works Concentrator area stripping	2014-10-20	2015-01-17	8 000 hr	101.71 jrs
302	18-5.00	Civil Works pad preparation at Concentrator	2015-01-17	2015-02-21	3 000 hr	40 jrs
303	18-3.00	Concentrator site temporary services installation	2015-01-17	2015-03-17	5 000 hr	67.19 jrs
304	18-3.00	Underground electrical conduits installation	2015-03-16	2015-05-25	4 200 hr	80.52 jrs
305	18-3.00	Underground Fire loop installation	2015-03-16	2015-05-25	4 200 hr	80.52 jrs
306		**Concentrator Service Buildings**	**2015-08-31**	**2015-11-06**	**5 000 hr**	**0 jr**
307	18-3.40	Office complex foundations	2015-08-31	2015-09-19	1 000 hr	21.71 jrs
308	18-3.40	Office Complex installation & Tie-in	2015-09-19	2015-11-06	4 000 hr	54.86 jrs
309		**Crushing**	**2015-03-16**	**2016-04-29**	**85 728.57 hr**	**0 jr**
310	18-5.10	Primary Crusher access ramp construction	2015-03-16	2015-05-16	5 000 hr	70.24 jrs
311	18-5.10	Crushing building Foundations	2015-03-17	2015-05-29	11 500 hr	83.19 jrs
312	18-5.10	Crushing building Steel structure installation	2015-05-29	2015-07-13	7 000 hr	51.43 jrs
313	18-5.10	Crushing Building Architectural works	2015-07-13	2015-09-08	7 000 hr	65.14 jrs
314	18-5.10	Screening Building foundations	2015-05-29	2015-06-29	3 000 hr	35.76 jrs
315	18-5.10	Screening Building Steel Structure installation	2015-06-29	2015-08-15	2 800 hr	53.71 jrs
316	18-5.10	Screening Building Architectural works	2015-08-15	2015-09-16	5 000 hr	36.33 jrs
317	18-5.10	Primary Crusher Mechanical Installation	2015-09-28	2016-02-08	20 000 hr	152 jrs
318	18-5.10	Primary Crusher Piping Installation	2015-12-09	2016-02-17	1 428.57 hr	80 jrs
319	18-5.10	Primary Crusher Electrical Installation	2015-12-09	2016-04-20	5 000 hr	152 jrs
320	18-5.10	Primary Crusher Instrument Installation	2016-04-11	2016-04-29	1 000 hr	20.57 jrs
321	18-5.10	Secondary Crusher Mechanical Installation	2015-08-14	2015-12-12	10 000 hr	137.14 jrs
322	18-5.10	Secondary Crusher Piping Installation	2015-12-03	2016-01-05	1 000 hr	37.71 jrs
323	18-5.10	Secondary Crusher Electrical Installation	2015-08-24	2016-01-05	5 000 hr	153.14 jrs
324	18-5.10	Secondary Crusher Instrument Installation	2015-12-12	2016-01-14	1 000 hr	37.71 jrs
325		**Ore Storage**	**2015-05-29**	**2016-03-23**	**20 200 hr**	**0 jr**
326	18-5.15	Concrete Works Silo Foundations	2015-05-29	2015-10-10	10 000 hr	153.14 jrs
327	18-5.15	Silo construction	2015-10-10	2016-01-16	4 200 hr	112 jrs
328	18-5.15	Silo Equipment mech installation	2016-01-16	2016-02-24	2 000 hr	44.9 jrs
329	18-5.15	Concrete Works conveyor Foundations	2015-10-10	2015-10-30	1 000 hr	22.86 jrs
330	18-5.15	Conveyor Mechanical Installation	2015-10-30	2015-11-19	1 000 hr	22.86 jrs
331	18-5.15	Conveyor Electrical Installation	2016-02-15	2016-03-04	1 000 hr	20.57 jrs
332	18-5.15	Conveyor Instrument Installation	2016-03-04	2016-03-23	1 000 hr	21.71 jrs
333		**Main Process Building**	**2015-02-21**	**2016-03-02**	**108 980 hr**	**0 jr**
334	18-5.40	Main Process building Foundations	2015-02-21	2015-08-31	50 000 hr	218.29 jrs
335	18-5.40	Exterior Silos/Thickeners foundations	2015-08-31	2015-10-30	5 000 hr	68.57 jrs
336	18-5.40	Exterior Silos/Thickeners concrete FRP	2015-10-30	2015-11-25	1 680 hr	29.62 jrs
337	18-5.40	Exterior Silos/Thickeners Steel erection	2015-10-30	2016-01-22	4 200 hr	95.71 jrs
338	18-5.40	Exterior Silos/Thickeners Mechanical Installation	2016-01-22	2016-03-02	1 700 hr	46 jrs
339	18-5.40	Main Processs building Electrical	2015-06-26	2016-02-01	22 500 hr	251.43 jrs
340	18-5.40	Main Process building Steel Structure	2015-08-31	2015-11-17	16 000 hr	89.14 jrs
341	18-5.40	Main Process building Roofing	2015-10-19	2015-11-06	1 000 hr	20.57 jrs
342	18-5.40	Main Process building Exterior walls	2015-10-23	2015-12-10	2 000 hr	54.86 jrs
343	18-5.40	Main Process building Bridge Cranes Mech Installation	2015-11-17	2015-11-26	200 hr	10.29 jrs



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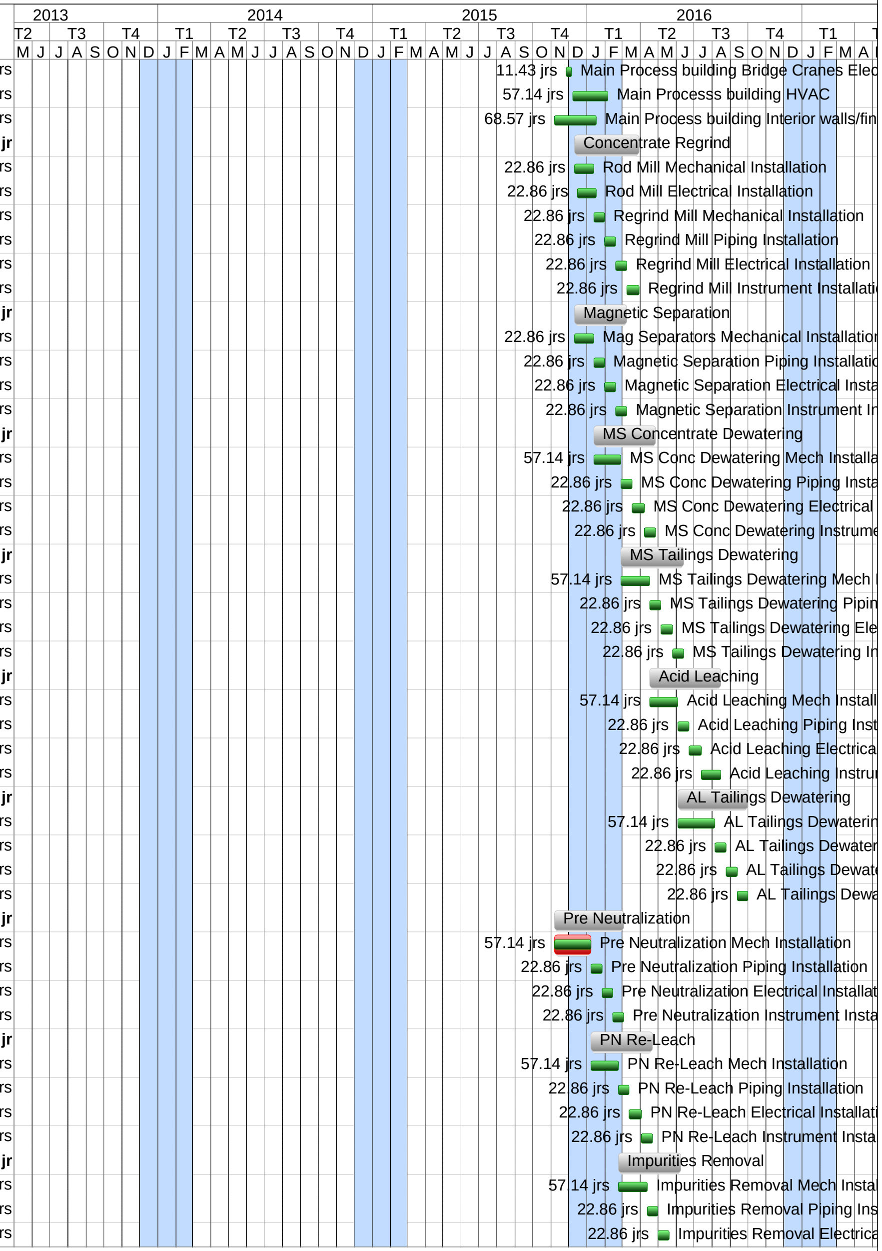
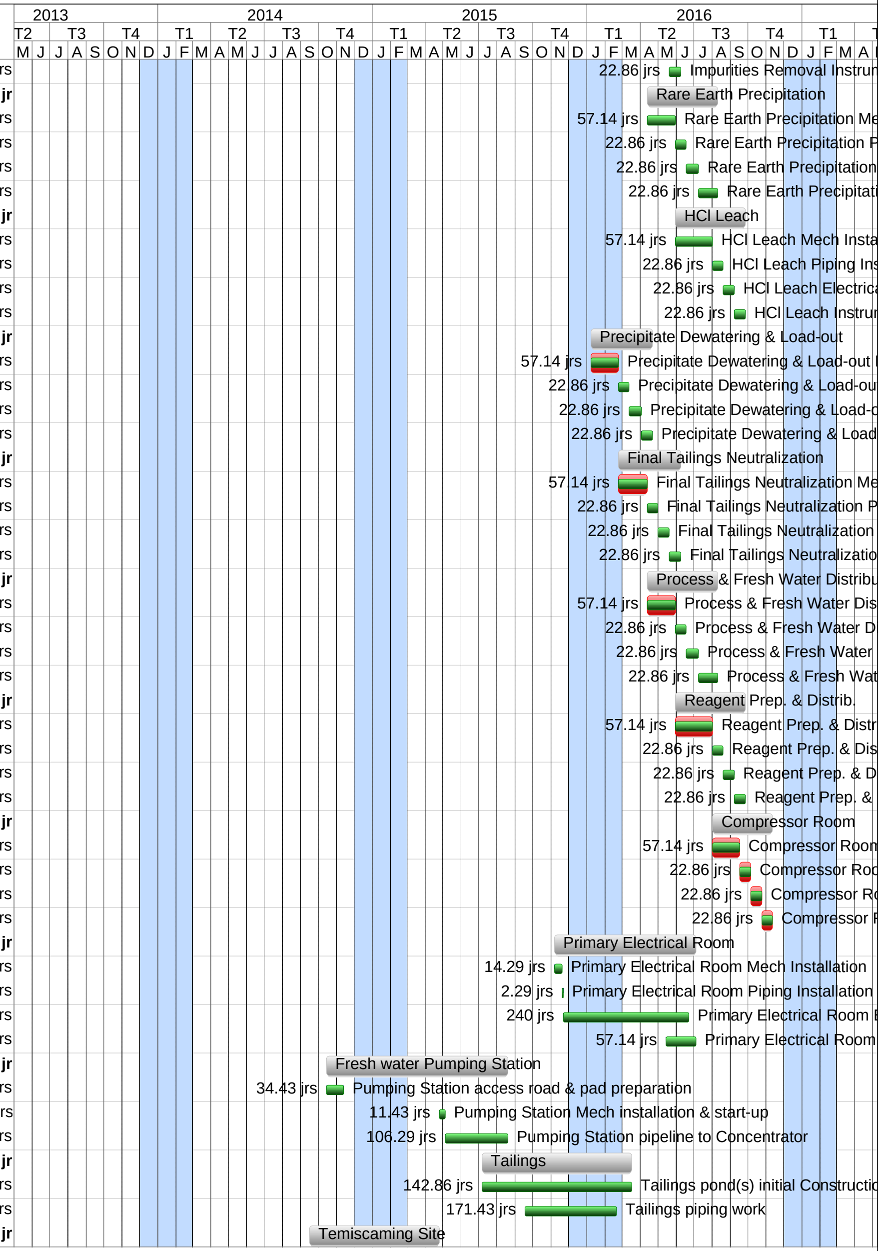
Critical		Procurement		Start-up		Progress	
Hammock		Summary		Operations		Reported Progress	
Engineering		Construction		Management		Milestone	

N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
344	18-5.40	Main Process building Bridge Cranes Elec Installation	2015-11-26	2015-12-05	200 hr	10.29 jrs
345	18-5.40	Main Processs building HVAC	2015-12-07	2016-02-05	1 500 hr	68.57 jrs
346	18-5.40	Main Process building Interior walls/finishes	2015-11-06	2016-01-16	3 000 hr	81.14 jrs
347		**Concentrate Regrind**	**2015-12-10**	**2016-03-29**	**5 000 hr**	**0 jr**
348	18-5.20	Rod Mill Mechanical Installation	2015-12-10	2016-01-12	500 hr	37.71 jrs
349	18-5.20	Rod Mill Electrical Installation	2015-12-15	2016-01-16	500 hr	36.57 jrs
350	18-5.20	Regrind Mill Mechanical Installation	2016-01-12	2016-01-30	1 000 hr	20.57 jrs
351	18-5.20	Regrind Mill Piping Installation	2016-01-30	2016-02-18	1 000 hr	21.71 jrs
352	18-5.20	Regrind Mill Electrical Installation	2016-02-18	2016-03-08	1 000 hr	21.71 jrs
353	18-5.20	Regrind Mill Instrument Installation	2016-03-08	2016-03-29	1 000 hr	24 jrs
354		**Magnetic Separation**	**2015-12-10**	**2016-03-08**	**4 000 hr**	**0 jr**
355	18-5.25	Mag Separators Mechanical Installation	2015-12-10	2016-01-12	1 000 hr	37.71 jrs
356	18-5.25	Magnetic Separation Piping Installation	2016-01-12	2016-01-30	1 000 hr	20.57 jrs
357	18-5.25	Magnetic Separation Electrical Installation	2016-01-30	2016-02-18	1 000 hr	21.71 jrs
358	18-5.25	Magnetic Separation Instrument Installation	2016-02-18	2016-03-08	1 000 hr	21.71 jrs
359		**MS Concentrate Dewatering**	**2016-01-12**	**2016-04-26**	**4 500 hr**	**0 jr**
360	18-5.35	MS Conc Dewatering Mech Installation	2016-01-12	2016-02-27	2 500 hr	52.57 jrs
361	18-5.35	MS Conc Dewatering Piping Installation	2016-02-27	2016-03-17	1 000 hr	21.71 jrs
362	18-5.35	MS Conc Dewatering Electrical Installation	2016-03-17	2016-04-07	500 hr	24 jrs
363	18-5.35	MS Conc Dewatering Instrument Installation	2016-04-07	2016-04-26	500 hr	21.71 jrs
364		**MS Tailings Dewatering**	**2016-02-27**	**2016-06-13**	**4 000 hr**	**0 jr**
365	18-5.50	MS Tailings Dewatering Mech Installation	2016-02-27	2016-04-16	2 000 hr	56 jrs
366	18-5.50	MS Tailings Dewatering Piping Installation	2016-04-16	2016-05-05	1 000 hr	21.71 jrs
367	18-5.50	MS Tailings Dewatering Electrical Installation	2016-05-05	2016-05-25	500 hr	22.86 jrs
368	18-5.50	MS Tailings Dewatering Instrument Installation	2016-05-25	2016-06-13	500 hr	21.71 jrs
369	**18-5.52**	**Acid Leaching**	**2016-04-16**	**2016-08-15**	**4 000 hr**	**0.43 jr**
370	18-5.52	Acid Leaching Mech Installation	2016-04-16	2016-06-03	2 000 hr	54.86 jrs
371	18-5.52	Acid Leaching Piping Installation	2016-06-03	2016-06-22	1 000 hr	21.71 jrs
372	18-5.52	Acid Leaching Electrical Installation	2016-06-22	2016-07-13	500 hr	24 jrs
373	18-5.52	Acid Leaching Instrument Installation	2016-07-13	2016-08-15	500 hr	37.71 jrs
374	**18-5.52**	**AL Tailings Dewatering**	**2016-06-03**	**2016-09-30**	**4 000 hr**	**0.43 jr**
375	18-5.54	AL Tailings Dewatering Mech Installation	2016-06-03	2016-08-05	2 000 hr	72 jrs
376	18-5.54	AL Tailings Dewatering Piping Installation	2016-08-05	2016-08-24	1 000 hr	21.71 jrs
377	18-5.54	AL Tailings Dewatering Electrical Installation	2016-08-24	2016-09-12	500 hr	21.71 jrs
378	18-5.54	AL Tailings Dewatering Instrument Installation	2016-09-12	2016-09-30	500 hr	20.57 jrs
379	**18-5.56**	**Pre Neutralization**	**2015-11-06**	**2016-03-03**	**4 000 hr**	**0.43 jr**
380	18-5.56	Pre Neutralization Mech Installation	2015-11-06	2016-01-07	2 000 hr	70.86 jrs
381	18-5.56	Pre Neutralization Piping Installation	2016-01-07	2016-01-26	1 000 hr	21.71 jrs
382	18-5.56	Pre Neutralization Electrical Installation	2016-01-26	2016-02-13	500 hr	20.57 jrs
383	18-5.56	Pre Neutralization Instrument Installation	2016-02-13	2016-03-03	500 hr	21.71 jrs
384	**18-5.56**	**PN Re-Leach**	**2016-01-07**	**2016-04-21**	**4 000 hr**	**0.43 jr**
385	18-5.58	PN Re-Leach Mech Installation	2016-01-07	2016-02-23	2 000 hr	53.71 jrs
386	18-5.58	PN Re-Leach Piping Installation	2016-02-23	2016-03-12	1 000 hr	20.57 jrs
387	18-5.58	PN Re-Leach Electrical Installation	2016-03-12	2016-04-02	500 hr	24 jrs
388	18-5.58	PN Re-Leach Instrument Installation	2016-04-02	2016-04-21	500 hr	21.71 jrs
389	**18-5.60**	**Impurities Removal**	**2016-02-23**	**2016-06-08**	**4 000 hr**	**0.43 jr**
390	18-5.60	Impurities Removal Mech Installation	2016-02-23	2016-04-12	2 000 hr	56 jrs
391	18-5.60	Impurities Removal Piping Installation	2016-04-12	2016-04-30	1 000 hr	20.57 jrs
392	18-5.60	Impurities Removal Electrical Installation	2016-04-30	2016-05-19	500 hr	21.71 jrs



N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
393	18-5.60	Impurities Removal Instrument Installation	2016-05-19	2016-06-08	500 hr	22.86 jrs
394	**18-5.62**	**Rare Earth Precipitation**	**2016-04-12**	**2016-08-10**	**4 000 hr**	**0.43 jr**
395	18-5.62	Rare Earth Precipitation Mech Installation	2016-04-12	2016-05-30	2 000 hr	54.86 jrs
396	18-5.62	Rare Earth Precipitation Piping Installation	2016-05-30	2016-06-17	1 000 hr	20.57 jrs
397	18-5.62	Rare Earth Precipitation Electrical Installation	2016-06-17	2016-07-08	500 hr	24 jrs
398	18-5.62	Rare Earth Precipitation Instrument Installation	2016-07-08	2016-08-10	500 hr	37.71 jrs
399	**18-5.62**	**HCl Leach**	**2016-05-30**	**2016-09-26**	**4 000 hr**	**0.43 jr**
400	18-5.64	HCl Leach Mech Installation	2016-05-30	2016-08-01	2 000 hr	72 jrs
401	18-5.64	HCl Leach Piping Installation	2016-08-01	2016-08-19	1 000 hr	20.57 jrs
402	18-5.64	HCl Leach Electrical Installation	2016-08-19	2016-09-07	500 hr	21.71 jrs
403	18-5.64	HCl Leach Instrument Installation	2016-09-07	2016-09-26	500 hr	21.71 jrs
404	**18-5.62**	**Precipitate Dewatering & Load-out**	**2016-01-07**	**2016-04-21**	**4 000 hr**	**0.43 jr**
405	18-5.66	Precipitate Dewatering & Load-out Mech Installation	2016-01-07	2016-02-23	2 000 hr	53.71 jrs
406	18-5.66	Precipitate Dewatering & Load-out Piping Installation	2016-02-23	2016-03-12	1 000 hr	20.57 jrs
407	18-5.66	Precipitate Dewatering & Load-out Electrical Installation	2016-03-12	2016-04-02	500 hr	24 jrs
408	18-5.66	Precipitate Dewatering & Load-out Instrument Installation	2016-04-02	2016-04-21	500 hr	21.71 jrs
409	**18-5.62**	**Final Tailings Neutralization**	**2016-02-23**	**2016-06-08**	**4 000 hr**	**0.43 jr**
410	18-5.68	Final Tailings Neutralization Mech Installation	2016-02-23	2016-04-12	2 000 hr	56 jrs
411	18-5.68	Final Tailings Neutralization Piping Installation	2016-04-12	2016-04-30	1 000 hr	20.57 jrs
412	18-5.68	Final Tailings Neutralization Electrical Installation	2016-04-30	2016-05-19	500 hr	21.71 jrs
413	18-5.68	Final Tailings Neutralization Instrument Installation	2016-05-19	2016-06-08	500 hr	22.86 jrs
414	**18-5.62**	**Process & Fresh Water Distribution**	**2016-04-12**	**2016-08-10**	**4 000 hr**	**0.43 jr**
415	18-5.70	Process & Fresh Water Distribution Mech Installation	2016-04-12	2016-05-30	2 000 hr	54.86 jrs
416	18-5.70	Process & Fresh Water Distribution Piping Installation	2016-05-30	2016-06-17	1 000 hr	20.57 jrs
417	18-5.70	Process & Fresh Water Distribution Electrical Installation	2016-06-17	2016-07-08	500 hr	24 jrs
418	18-5.70	Process & Fresh Water Distribution Instrument Installation	2016-07-08	2016-08-10	500 hr	37.71 jrs
419	**18-5.62**	**Reagent Prep. & Distrib.**	**2016-05-30**	**2016-09-26**	**4 000 hr**	**0.43 jr**
420	18-5.72	Reagent Prep. & Distrib. Mech Installation	2016-05-30	2016-08-01	2 000 hr	72 jrs
421	18-5.72	Reagent Prep. & Distrib. Piping Installation	2016-08-01	2016-08-19	1 000 hr	20.57 jrs
422	18-5.72	Reagent Prep. & Distrib. Electrical Installation	2016-08-19	2016-09-07	500 hr	21.71 jrs
423	18-5.72	Reagent Prep. & Distrib. Instrument Installation	2016-09-07	2016-09-26	500 hr	21.71 jrs
424	**18-5.62**	**Compressor Room**	**2016-08-01**	**2016-11-11**	**4 000 hr**	**0.43 jr**
425	18-5.74	Compressor Room Mech Installation	2016-08-01	2016-09-16	2 000 hr	52.57 jrs
426	18-5.74	Compressor Room Piping Installation	2016-09-16	2016-10-05	1 000 hr	21.71 jrs
427	18-5.74	Compressor Room Electrical Installation	2016-10-05	2016-10-24	500 hr	21.71 jrs
428	18-5.74	Compressor Room Instrument Installation	2016-10-24	2016-11-11	500 hr	20.57 jrs
429	**18-5.62**	**Primary Electrical Room**	**2015-11-06**	**2016-07-04**	**12 600 hr**	**0.43 jr**
430	18-5.76	Primary Electrical Room Mech Installation	2015-11-06	2015-11-19	500 hr	14.86 jrs
431	18-5.76	Primary Electrical Room Piping Installation	2015-11-19	2015-11-21	100 hr	2.05 jrs
432	18-5.76	Primary Electrical Room Electrical Installation	2015-11-21	2016-06-22	10 000 hr	244.52 jrs
433	18-5.76	Primary Electrical Room Instrument Installation	2016-05-14	2016-07-04	2 000 hr	58.24 jrs
434		**Fresh water Pumping Station**	**2014-10-14**	**2015-08-19**	**6 800 hr**	**0 jr**
435	18-8.05	Pumping Station access road & pad preparation	2014-10-14	2014-11-12	300 hr	33.19 jrs
436	18-8.05	Pumping Station Mech installation & start-up	2015-04-24	2015-05-04	500 hr	11.43 jrs
437	18-8.05	Pumping Station pipeline to Concentrator	2015-05-04	2015-08-19	6 000 hr	121.95 jrs
438		**Tailings**	**2015-07-06**	**2016-03-17**	**32 000 hr**	**0 jr**
439	10-8.10	Tailings pond(s) initial Construction	2015-07-06	2016-03-17	20 000 hr	291.43 jrs
440	10-8.10	Tailings piping work	2015-09-17	2016-02-20	12 000 hr	178.29 jrs
441		**Temiscaming Site**	**2014-09-15**	**2015-04-24**	**4 050 hr**	**0 jr**



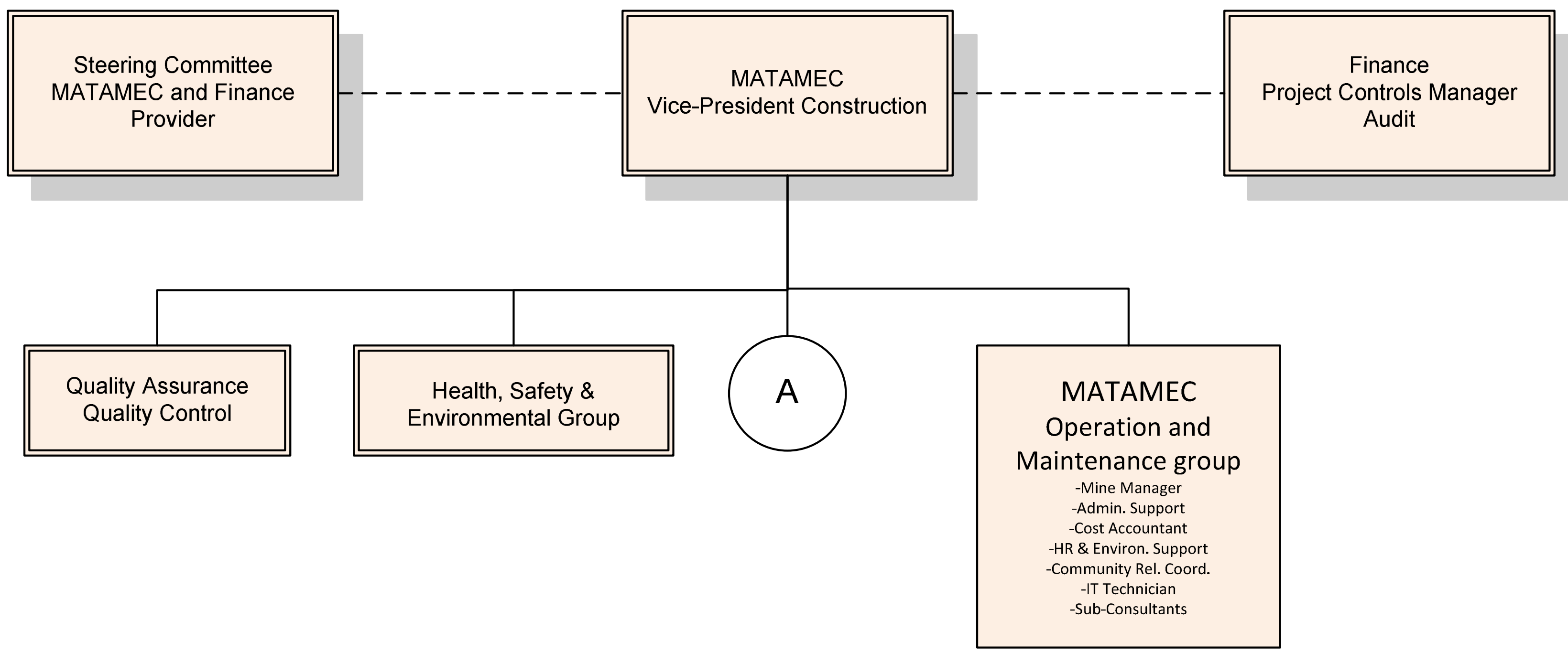
Projet1-00-R1-MSCH-00-801 Rev PH_Detailed Construction Schedule
2013-08-08 ISSUED FOR FEASIBILITY STUDY — imprimé le: 2013-08-08 à 09:29
2013-06-13 For Draft Report — Date d'état: NC

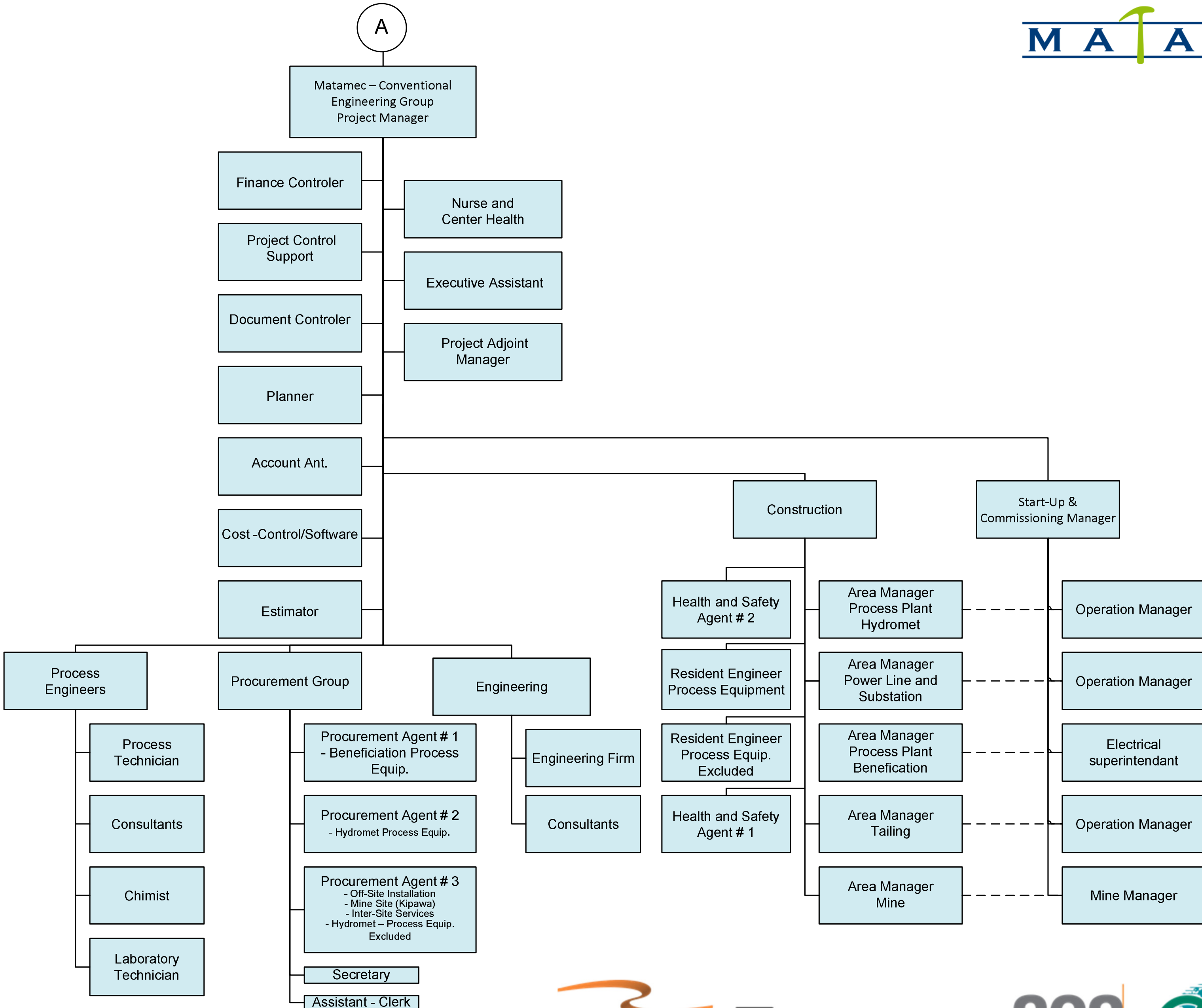
Legend: Critical, Hammock, Engineering, Procurement, Summary, Construction, Start-up, Operations, Management, Progress, Reported Progress, Milestone

N°	Sub/Area	Name	Start	Finish	Work	Calc Duration
442	11-3.05	Temiscaming Parking Lot Construction	2014-09-15	2014-10-14	240 hr	33.14 jrs
443	11-3.05	Temiscaming Offices/Facilities Construction	2014-10-14	2014-10-23	500 hr	10.29 jrs
444	11-2.10	Temiscaming Substation Construction	2014-10-14	2015-04-24	3 310 hr	219.43 jrs
445	11-2.20	High Voltage Aerial Line Construction (HQ)	2014-10-23	2015-03-11	0 hr	158.62 jrs
446	00-0	Pre-Operational Verifications	2016-11-11	2017-02-02	10 000 hr	94.52 jrs

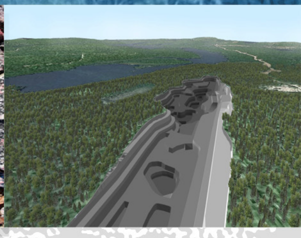
18.0 PROJECT EXECUTION PLAN

Fig. xxx – x. Project Construction Management Organization Chart (MATAMEC-Kipawa Project)





Feasibility Study for Kipawa Project
Matamec Explorations Inc.



APPENDIX 7-
Risk Assessment

Risk Register

Risk ID	Risk Identification	Risk Category	Risk Description *Why is it a risk?*	When can the Risk Occur?					Evaluation			Evaluation Justifications			Risk Value	Importance	Risk Owner	Mitgate in this phase (Now), or in a future phase (Later)
				Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	Financial Value	Occurrence Value	Detection Value	Justification (Financial)	Justification (Occurrence)	Justification (Detection)				
ALL03	Location of infrastructures and facilities including hydromet plant apart from beneficiation plant or not.	Other : multiple origins or impacts	• Starting a mine where there are no other mines. • The ore deposit is there.	X	X				4.0	2.0	1.5	The cost of additional studies regarding the infrastructure + facilities	Already in agreement with the community (always in contact with the community)	Attentive, present in the community, in continual contact with community	12.0	Low	BC	Later
COM01	Major decrease in demand of final product in the long term (quantity) (REE)	Commercial (clients, market, competition, etc.)	• The partner does not require as much REEs • Potential substitutes for REEs • The difficulty associated with the extraction and rarity of REEs • Social acceptability of REE extraction • Increase in recycling of REEs				X		5.0	2.0	3.0	Due to the loss of revenue and sales	Long-term agreement will secure a certain demand	Market information is available	30.0	Important	AG	Now (See mitigation actions)
COM01A	Major increase in demand of final product in the long term (quantity) (REE)	Commercial (clients, market, competition, etc.)	• The partner requires more REEs • New applications for REEs • The project becomes a more secure/attractive supplier of REEs • Increase in operating costs in China related to salary and environmental control				X		5.0	3.0	3.0	Due to increase sales	Higher chance that the application of REE increases than decreases	Market information is available	45.0	High	AG	Later
COM01B	Increase in the global supply of the final product in the long term (quantity) (REE)	Commercial (clients, market, competition, etc.)	• More applications require REEs • Technological advancements and an increase of knowledge of REEs				X		3.0	3.0	2.0	Due to potential decrease in sales and sales price	Higher chance that the application of REE increases than decreases	Market information is available	18.0	Medium	AG	Later
COM02	Change in final product specification (quality)	Commercial (clients, market, competition, etc.)	• Change in quality requirement by market and customer • Change in separation plant • Change in fabrication process • Change in regulations	X	X	X	X		2.0	1.5	2.0	Minor modifications to the plant	Impurities in final product are already very low	Contract negotiated ahead of time	6.0	Low	AG/BC	Later
COM03	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)	Commercial (clients, market, competition, etc.)	• Changes in supply and/or demand • Volatile market • China's embargo on exports of REEs	X					3.0	4.0	3.0	Over the life of mine, the impact could easily be over $50M, if there is no long-term agreement on price and quantity	Recent (2008-2013) major variations in REEs	Market studies, OMC tries to stabilize the market	36.0	High	AG	Now (See mitigation actions)
COM07	Matamec - TRECan (Toyota Rare Earth Canada) partnership broken and no off-take agreement with Toyota Tsusho before construction	Commercial (clients, market, competition, etc.)	• TRECan decides they no longer need the final product or they find another supplier • Commercial conditions with Matamec no longer interest TRECan • Project parameters for each party do not align each other (Matamec and TRECan)	X	X				3.0	3.0	2.0	There is no more client or funding; sunk costs	Preliminary agreement, and discussions in progress for final agreements	In direct contact with TRECan	18.0	Medium	AG	Later
COM07A	Partner takes only select REEs (-)	Commercial (clients, market, competition, etc.)	• TRECan have no need for certain REEs • TRECan cannot find interested parties	X	X		X		3.0	2.0	2.0	Loss of income	Negotiations in progress	In direct contact with TRECan	12.0	Low	AG	Later
COM07B	Partner takes only select REEs and Matamec invests to further separate the REEs	Commercial (clients, market, competition, etc.)	• Results in a new separation line by Matamec • Brings new revenue to Matamec • TRECan have no need for certain REEs		X		X		4.0	2.0	2.0	Generation of new income despite additional investments	It requires investments, work, and time	In direct contact with TRECan and other investors	16.0	Low	AG	Later
COM09	Substitutes to replace REE for magnets and other products during the life of mine	Commercial (clients, market, competition, etc.)	• Rarity and price • The difficulty of extraction/production • A lack of information and experience for REE extraction, even among Universities and scholars • REEs extraction is relatively new	X	X	X	X		4.0	2.0	2.0	Reduced or no demand	Product cycle + certification of substitutes would take 15+ years	Current contents, scholarly journals and articles	16.0	Low	AG	Later
COM10	Market is taken by other producers before start-up	Commercial (clients, market, competition, etc.)	• Project delays • Difficulty with the process finalization • Lack of funding or insufficient funding • Offtake agreement is delayed • Permitting is delayed	X	X	X			5.0	3.0	2.0	Can lose all previous investments. Over the life of mine, the impact could easily be over $50M, if there is no long-term agreement on price and quantity	Many deposits, many project in development	Easily detectable events	30.0	High	AG	Now (See mitigation actions)
COMM01	Social non-acceptability in regard of radioactivity	Communication (stakeholders, governments, community, etc.)	• Dangers of low-level radioactivity are misunderstood by the community • Misinformation associated with radioactivity • People have a fear of radioactivity	X	X				3.0	2.0	2.0	Project rejected by local population (sunk costs)	Due to current indications from public information meetings	Constant contact with the population	12.0	Low	AG/BC,SD,CB,AL	Later

Risk Register

Risk ID	Risk Identification	Risk Category	Risk Description *Why is it a risk?*	When can the Risk Occur?					Evaluation			Evaluation Justifications			Risk Value	Importance	Risk Owner	Mitgate in this phase (Now), or in a future phase (Later)
				Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	Financial Value	Occurrence Value	Detection Value	Justification (Financial)	Justification (Occurrence)	Justification (Detection)				
COMM02	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	Communication (stakeholders, governments, community, etc.)	• Miscommunication and misunderstanding between parties • Project is not explained well to the stakeholders, or the promoter does not listen to the concerns of the stakeholders • Interests of stakeholders are divergent	X	X	X	X	X	3.0	3.0	3.0	Project rejected by stakeholders or cost to solve conflict	More complex negotiations with First Nations	Possibility of uncontrolled groups not previously heard	27.0	High	AG/BC,SD,CB,AL	Now (See mitigation actions)
COMM04	Focus on opponents and neglect the favourable stakeholders	Communication (stakeholders, governments, community, etc.)	• Opponents more organized • Opponents receive more media coverage	X	X				1.5	1.5	2.0	Should not have a large impact on the project	Currently dealing with all stakeholders in the same manner	Constant survey of all stakeholders opinions	4.5	Low	AG/BC,SD,CB,AL	Later
COMM07	Bad media coverage before construction	Communication (stakeholders, governments, community, etc.)	• The media focuses on negative news • The media is misinformed • Matamec is not proactive with their public relations	X	X				3.0	3.0	3.0	Project rejected by stakeholders (sunk costs)	General trend of the media is to focus on negative news	Limited control over media, but public relation firm hired and local presence	27.0	High	AG/CB	Later
COMM05	Interpretation of technical information/data/documents distributed to all stakeholders	Communication (stakeholders, governments, community, etc.)	• It could cause confusion if misinterpreted • Too much information has been released • The information is not at the correct level of understanding for the readers	X	X				3.0	2.0	3.0	Project rejected by stakeholders (sunk costs)	Distribution of data is controlled by Matamec	Limited control over interpretation	18.0	Low	BC/SD,CB	Later
FIN01	Project Financing - availability of investors (other than offtaker)	Financial (credit, exchange rates, financing, etc.)	• Financing mining projects is difficult • The global and Quebec economic conjuncture is not favorable • Uncertainty due to new regulations (pending) • The fear of a global recession (or slump or depression)	X	X				3.0	3.0	2.0	Investors are hesitant to invest in new mining project (sunk costs)	Not a huge project, there is a partner, but still a challenge to complete financing	Easily detectable events	18.0	Medium	AG	Later
FIN02	Changes in capital allowances	Financial (credit, exchange rates, financing, etc.)	• Estimate based on unforeseen conditions	X	X	X			2.0	2.0	4.0	Not many capital allowances in the estimate	Allowances are based on historical data, calculations, and preliminary data	Almost only detectable once the allowances have changes	16.0	Low	BC/Roche, Genivar, Golder	Later
FIN03	Exchange rate fluctuations	Financial (credit, exchange rates, financing, etc.)	• The global economic conjuncture	X		X	X		3.0	2.0	3.0	Exchange rate historical trends and forecasts	Exchange rate historical trends and forecasts	Global economic conditions are generally known and available	18.0	Low	AG	Later
FIN08	Matamec bought-out by a rival REE project	Financial (credit, exchange rates, financing, etc.)	• The project is interesting for an outsider with funds • The share values are low • The project is attractive to a company already involved with REE projects	X		X	X		1.5	2.0	4.0	No effect on the project	Clause in Matamec-TRECan joint-venture which protects the project	Difficult to detect if aggressive	12.0	Low	AG	Later
FIN09	Over evaluation of CAPEX	Financial (credit, exchange rates, financing, etc.)	• The market conditions have change since quotes were received for major equipment and manpower (when demand was high for mining equipment in January and February 2013) • Many mining projects were in development • Equipment quotes were over-evaluated by suppliers due to incomplete technical data	X	X	X			4.0	2.0	3.0	Precision of the estimate (15% of $300M)	General tendency to be under rather than over	You need to be ahead in the project to be able to detect it	24.0	Low	BC/Roche, Genivar, Golder	Later
FIN09A	Under evaluation of CAPEX	Financial (credit, exchange rates, financing, etc.)	• The market conditions have change since quotes were received for major equipment and manpower (when demand was high for mining equipment in January and February 2013) • The global economic conditions can change • Equipment quotes were under-evaluated by suppliers due to incomplete technical data • Manpower costs can increase due to recent discussions	X	X	X			4.0	2.0	3.0	Precision of the estimate (15% of $300M)	General tendency to be under rather than over. Capex estimate was carried out with a higher level of detail	You need to be ahead in the project to be able to detect it	24.0	Low	BC/Roche, Genivar, Golder	Now (See mitigation actions)
FIN10	Over evaluation of OPEX	Financial (credit, exchange rates, financing, etc.)	• The quotes receive from reagent and utility suppliers, or the quantity of reagents or power required was over-evaluated due to incomplete technical data (only lab-scale data)	X			X		2.0	2.0	3.0	Precision of the estimate, based on lab-tests	Experience and historical data	Quantities based on lab-tests; prices based on quantities required	12.0	Low	BC/Roche, Genivar,	Later
FIN10A	Under evaluation of OPEX	Financial (credit, exchange rates, financing, etc.)	• The quotes receive from reagent and utility suppliers, or the quantity of reagents or power required was under-evaluated due to incomplete technical data (only lab-scale data)	X			X		2.0	2.0	3.0	Precision of the estimate, based on lab-tests	Experience and historical data	Quantities based on lab-tests; prices based on quantities required	12.0	Low	BC/Roche, Genivar,	Later

Risk ID	Risk Identification	Risk Category	Risk Description *Why is it a risk?*	When can the Risk Occur?					Evaluation			Evaluation Justifications			Risk Value	Importance	Risk Owner	Mitigate in this phase (Now), or in a future phase (Later)
				Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	Financial Value	Occurrence Value	Detection Value	Justification (Financial)	Justification (Occurrence)	Justification (Detection)				
FIN11	Project financing delayed by 2 years	Financial (credit, exchange rates, financing, etc.)	• Delay in permitting • Delay in offtake agreement • The social acceptability of the project • Unfavorable metal price predictions	X	X				3.0	3.0	3.0	Project abandoned due to delay (sunk costs)	Current market is difficult	Few items can only be detected as they occur	27.0	High	AG/BC	Now (See mitigation actions)
LEG01	Delay in signature of Impact and Benefit Agreement with First Nations	Legal (contracts, law, etc.)	• Disagreements between the First Nations and Matamec • The government may delay permitting until settlement	X	X				2.0	2.0	2.0	Costs associated with stand-by	MOU (memorandum of understanding) already signed and other negotiations in progress.	From experience and ongoing communication with First Nations	8.0	Low	AG/CB	Later
OPS03	Acid/Chemical Spills	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• There is a lot of handling of acids and chemicals • Human error or incident • Poor inspection of equipment and piping • Poor road maintenance			X	X		1.5	2.0	4.0	Remediation costs	Historical experience	Not predictable with instruments	12.0	Low	BC/SD	Later
OPS06	Loss of electrical power (less than a week)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• There will be only one electrical line which is susceptible to power outages • The generators no longer function • Natural disasters or "Acts of God"			X	X		2.0	2.0	5.0	Loss of production, restarting costs	Historical data on power outages in northern regions	Not predictable (weather hazards)	20.0	Low	BC	Later
OPS06A	Availability of electrical power	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The Hydro Québec sub-station may not supply the required power • There is not enough power available • The delivery time for new transformers is 2-5 years	X		X	X		3.0	2.0	1.5	The cost of 20-25MW generators	Hydro Québec indicates that they will be able to supply the required power	Will be detected during discussions with Hydro Québec	9.0	Low	BC	Later
OPS15	Contamination, Ground water	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Spills during chemical shipments (in transit, or during transfer to reservoirs) • Leaking equipment • Defects, human error, or failure of equipment			X	X	X	2.0	1.5	1.5	Emergency plan in place to keep incidents under control	Emergency plan in place to keep incidents under control	Monitoring equipment in place	4.5	Low	BC/SD	Later
OPS16	Contamination, Radioactivity	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Level of radioactivity exceed permitted level			X	X	X	3.0	2.0	1.5	If during operation the level of radioactivity is higher than permitting then loss of production and cost to find right solution	Actual studies show that the level of radioactivity should be fairly easy to manage but to handle with care • Because of public opinion	Monitoring equipment in place and regular inspection	9.0	Low	BC/SD	Later
OPS17	Contamination, Surface water	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Spills during chemical shipments (in transit, or during transfer to reservoirs) • Leaking equipment • Defects, human error, or failure of equipment • A failure of the polishing pond • A lack of maintenance or inspection			X	X	X	1.5	1.5	1.5	Emergency plan in place to keep incidents under control	Emergency plan in place to keep incidents under control	Monitoring equipment in place and regular inspection	3.4	Low	BC/SD	Later
OPS21	Damages to environment due to dust	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Contamination due to dust from the tailings pond transferred by wind • Mine blasting operation			X	X	X	1.5	1.5	1.5	It can be detect at early stage and solutions are available	Rigorous sampling program	Monitoring program in place	3.4	Low	BC/SD	Later
OPS22	Delays in equipment delivery (more than 2 weeks than the anticipated delivery date)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The suppliers do not respect the delivery agreements • Accidents during transportation of equipment • Extreme weather events			X			2.0	2.0	2.0	Additional storage costs and reorganization of installation schedule	Approx. 1/10 of equipment are delayed	Easy access to suppliers' progress information	8.0	Low	BC	Later

Risk ID	Risk Identification	Risk Category	Risk Description *Why is it a risk?*	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	Evaluation: Financial Value	Occurrence Value	Detection Value	Evaluation Justifications: Justification (Financial)	Justification (Occurrence)	Justification (Detection)	Risk Value	Importance	Risk Owner	Mitgate in this phase (Now), or in a future phase (Later)
OPS33	Major failure in open pit (wall failure)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Uncontrolled/unmonitored geotechnical features • Under-evaluation of geotechnical data				X		4.0	1.5	2.0	Can stop production, loss of equipment, and cause deaths	Major failures are rare	Easily detectable with proper monitoring	12.0	Low	BC	Later
OPS35	Delay to obtain permits	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Questions issued by the government are not answered adequately • External pressure on the government • Political reasons	X	X	X			2.0	1.5	2.0	Costs associated with stand-by	No reason to have delay if all required information has been supplied	Constant communication with government agencies	6.0	Low	BC	Later
OPS37	Final flowsheet needs major modifications after pilot plant has run	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The samples used in lab tests were not representative of the deposit • The lab tests used do not scale-up	X		X			3.0	2.0	1.5	The changes required during the lab-tests were large	There has already been two sets of changes, thus there is less of a chance of it happening again	Easily detectable after tests	9.0	Low	BC/SD	Later
OPS38	Major fire impacting the operation for several weeks (fuel, conveyors, electrical room, ...)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Human error, defective equipment, poor maintenance, poor inspection, poor detection system			X	X		3.0	1.5	4.0	Repair costs, restart costs, replacement equipment cost	Major fires are rare due to the detection systems in place	Fire would occur in spite of the detection systems in place	18.0	Low	BC	Later
OPS39	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The waste rock and tailings sampling program is not completely representative of reality	X			X	X	3.0	1.5	**1.5**	Cost of potential infrastructure modifications	Rigorous sampling program	Monitoring program in place	6.8	Low	BC/SD, Golder	Later
OPS40	Geotechnical evaluation is insufficient; causing improper wall angle	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Uncontrolled/unmonitored geotechnical features • Under-evaluation of geotechnical data	X		X	X		2.0	1.5	2.0	Cost of correcting wall angle	Not a large mine	Easily detectable with proper monitoring	6.0	Low	BC/Golder	Later
OPS41	Grade control process in the mine is insufficient	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Improper sampling procedure in the mine • The operations are faster than the lab • A improper identification of mineral and waste limits			X	X		2.0	2.0	1.5	Mining historical data of losses due to dilution of ore by waste	Low probability with the monitoring systems in place	Easily detectable with proper monitoring	6.0	Low	BC	Later
OPS42	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The grinding index has not been measured for fine material • It is not required for a feasibility level	X		X	X		1.5	2.0	1.5	Change the size of the regrind mill	Current test work does not indicate that this will be a problem	Easily detectable with test work results	4.5	Low	BC/Roche	Later
OPS44	Ore silica content variations might cause gypsum filtration problems (Process)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Potential variations of silica content in different zones of the deposit	X	X	X	X		2.0	1.5	2.0	Cost related to engineering and equipment adjustment	Process has been adjusted to take these variation into account as much as possible	Easily detectable with proper monitoring	6.0	Low	BC/Roche	Later

Risk ID	Risk Identification	Risk Category	Risk Description *Why is it a risk?*	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	Evaluation Financial Value	Occurrence Value	Detection Value	Evaluation Justifications Justification (Financial)	Justification (Occurrence)	Justification (Detection)	Risk Value	Importance	Risk Owner	Mitgate in this phase (Now), or in a future phase (Later)
OPS46	Head grade variation which can cause ore recovery variation	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Improper blending at the mine • Insufficient grade control process at the mine				X		1.5	2.0	2.0	Easy to rectify with ore blending	Ore blending	Ore sampling	6.0	Low	BC	Later
OPS48	High amount of fines generated from grinding which can cause higher mass recovery than expected in the beneficiation process	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The grinding circuit is not appropriate for the ore • Improper definition at the pilot plant scale • The samples tested were not representative of the deposit	X			X		2.0	1.5	1.5	Adjustments to the beneficiation circuit	Appropriate testing has been done	Daily sampling	4.5	Low	BC	Later
OPS49	High radionuclide emission at the waste rock dump	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Some mineralized zones have higher U/Th content than anticipated	X			X	X	3.0	1.5	2.0	Cost to modify storage facility	Usually U/Th will follow REE to the plant	Monitoring equipment	9.0	Low	BC/SD	Later
OPS50	Higher radioactivity in the process plant tailings than anticipated	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Some mineralized zones have higher U/Th content than anticipated	X			X		3.0	1.5	2.0	Cost to modify tailings facility	Drilling program and variability sampling program has been conducted	Monitoring equipment	9.0	Low	BC/SD	Now (See mitigation actions)
OPS58	Long term legacies after closure	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Wrong evaluation of potential contaminant	X				X	3.0	1.5	1.5	Remediation costs after mine closure	All residues characterized before project, as well as progressive restoration during operation in order to prove its efficiency	Monitoring equipment and progressive restorations	6.8	Low	BC/SD	Later
OPS60	Hydrometallurgical plant recovery lower than expected	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The process is not designed to accept the variance in the concentrate input • Bad control of the process parameters • The scale-up from pilot-plant to full-size plant	X			X		3.0	2.0	1.5	The cost of modifications to the equipment and/or operating parameters	The pilot plant should give a good indication of whether or not the process is adequate	Daily sampling	9.0	Low	BC	Later
OPS61	Beneficiation plant recovery is not as expected	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The process is not designed to accept the variance in the ore input • Bad control of the process parameters • The scale-up from pilot-plant to full-size plant	X			X		3.0	2.0	1.5	The cost of modifications to the equipment and/or operating parameters	The pilot plant should give a good indication of whether or not the process is adequate	Daily sampling	9.0	Low	BC	Later
OPS62	Mill efficiency affected by geological variability	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• The variability of the ore is not as predicted • The structure of the deposit is more variable than expected • The presence of other accessory minerals	X			X		3.0	1.5	1.5	The cost of modifications to the equipment and/or operating parameters	Variability testwork program has been conducted	Daily sampling	6.8	Low	BC/AL	Later
OPS69	Ore reserve calculation (ore tonnage and/or grade are lower than expected)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Unforeseen geological features • Inadequate sampling				X		4.0	1.5	1.5	Over the mine life	Definition drilling at 25m interval completed, and sampled according to mining industry standards	Daily sampling	9.0	Low	BC/AL,Roche,Go Stat	Later

Risk Register

Risk ID	Risk Identification	Risk Category	Risk Description *Why is it a risk?*	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	Evaluation Financial Value	Occurrence Value	Detection Value	Evaluation Justifications Justification (Financial)	Justification (Occurrence)	Justification (Detection)	Risk Value	Importance	Risk Owner	Mitgate in this phase (Now), or in a future phase (Later)
OPS72	Piping failure from mills to tailings	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• A lack-of or poor inspection and/or maintenance • An accident or human error	X			X		1.5	1.5	2.0	Cost of repair and clean-up	Inspection and maintenance programs will be in place	Many detection methods and inspections	4.5	Low	BC/SD	Later
OPS72A	Other piping failures	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• A lack-of or poor inspection and/or maintenance • An accident or human error	X			X		1.5	1.5	1.5	Cost of repair and clean-up	Inspection and maintenance programs will be in place	Piping is visible to employees and easily detectable	3.4	Low	BC	Later
OPS97	Tailings dams leaks (minor)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• A lack-of or poor inspection and/or maintenance • An accident or human error	X			X		1.5	2.0	2.0	Cost of repair and clean-up	Inspection and maintenance programs will be in place	Daily inspections and visible to employees	6.0	Low	BC/SD	Later
OPS97A	Tailings dams break (major)	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• A lack-of or poor inspection and/or maintenance • An accident or human error • An "Act of God" or natural disaster • Sabotage, terrorist attacks, or conflict situations	X			X		4.0	1.5	2.0	Cost of repair and clean-up	Inspection and maintenance programs will be in place	Daily inspections and visible to employees	12.0	Low	BC	Later
OPS102	Traffic Accident on access road	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Human error or meteorological events • Defective equipment or defective roads	X		X	X		1.5	2.0	5.0	Worst case: the cost to clean up a sulfuric acid truck accident	Well trained drivers, not a lot of traffic, no operation during unfavorable weather conditions	It's an accident!	15.0	Low	BC/SD	Later
OPS111	All worker injury, fatality or disability	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Prevention procedure not respected • Human error • Defective equipment • Improper training			X	X		1.5	3.0	3.0	Insurance and workman's compensation cost	High • Because taking into account small injuries	Difficult to predict incident but can be mitigated by proper prevention measures	13.5	Medium	Mine mgr	Later
OPS112	Visitor injury, fatality or disability	Operations (plant operation, construction, closure, admin., damages to environment, etc.)	• Prevention procedure not respected • Human error • Defective equipment • Improper training			X	X		1.5	1.5	3.0	Insurance cost	With procedures in place, good historical experience	Difficult to predict incident but can be mitigated by proper prevention measures	6.8	Low	Mine mgr	Later
PEO01	First Nations experts review the ESIA report	People (HR, citizen, communities, etc.)	• The outcome is unknown • Previous reports have been critical	X					1.5	1.5	1.5	It could increase the cost of few studies.	85% of ESIA completed and of far no major impact	Now good experience with FN reviewers	3.4	Low	BC/SD	Later
PEO02	Availability of personnel, skilled people, qualified labor	People (HR, citizen, communities, etc.)	• The location of the project • The market of qualified people is difficult			X	X		2.0	2.0	2.0	More training could be required	Market difficult but mining activities is slowing down in the next few years	It is fairly easy to find statistic about this subject	8.0	Low	BC	Later
PEO04	Departure (loss) of key Matamec people during project preparation	People (HR, citizen, communities, etc.)	• The project depends on a few key people	X	X				1.5	2.0	3.0	Possibility of some lost time in the process of replacement	Due to the risks related to project financing and company stability	Discussions to be carried on between the few key people	9.0	Low	AG/BC	Later
PEO07	First Nation socio-economic and land use assessment	People (HR, citizen, communities, etc.)	• The outcome is unknown	X	X				2.0	2.0	2.0	Assessment has been delivered to Matamec	On going discussions	Continuous contact	8.0	Low	AG/CB	Later
PEO10	Negotiation with local First Nations	People (HR, citizen, communities, etc.)	• The outcome is unknown	X	X	X			2.0	2.0	3.0	Depending on final IBA agreement	Relation with FN leaders are relatively good but there could be always little group that can cause problems	Beside regular discussions with FN it is hard to evaluate	12.0	Low	AG/CB,AL,BC	Later

Risk ID	Risk Identification	Risk Category	Risk Description *Why is it a risk?*	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	Evaluation: Financial Value	Occurrence Value	Detection Value	Evaluation Justifications: Justification (Financial)	Justification (Occurrence)	Justification (Detection)	Risk Value	Importance	Risk Owner	Mitgate in this phase (Now), or in a future phase (Later)
PEO14	Bad Perception of the community concerning Uranium/Thorium	People (HR, citizen, communities, etc.)	• There is a lack of information and a mis-information • The negative media coverage concerning uranium and thorium	X	X	X			1.5	2.0	2.0	Cost for more studies and more public information	This is one of the important worry of the local population	This subject is discussed constantly and good information has been provided so far	6.0	Low	AG/BC,SD,CB,AL	Now (See mitigation actions)
PEO16	Project to be rejected by local communities	People (HR, citizen, communities, etc.)	• Negative information about the mining industry	X	X	X			3.0	1.5	2.0	Project abandoned due to rejection by the public (sunk costs)	A lot of public information sessions have been done and so far majority of population seem to desire the project	Continue constant public information	9.0	Low	AG/BC,SD,CB,AL	Later
PEO18	Public pressure to have "Gold-Plated" waste management	People (HR, citizen, communities, etc.)	• The concerns of the stakeholders	X	X				2.0	2.0	2.0	Basic design is already above normal standards	Still possibility to do more even if it become over common sense	Continue constant public information	8.0	Low	AG/BC,SD,CB,AL	Later
POL01	Increase in municipal taxation	Political (variety of government levels and authorities involved)	• The municipality has increased the taxes • A change in land or building value	X	X	X	X		1.5	1.5	1.5	Municipal taxes are a minor cost	Municipality has a minor interest in increasing the taxes	Easily detectable	3.4	Low	AG/CB	Later
POL02	Changes in laws (mining, environmental, etc.)	Political (variety of government levels and authorities involved)	• A change in federal or provincial government • A response to pressure from the citizen	X	X	X	X		2.0	3.0	1.5	Depends on the timing of the change	The government is trying to conform to international standards	Easily detectable • Because law change have long approval process	9.0	Medium	AG	Later
POL04	Election in the First Nations communities	Political (variety of government levels and authorities involved)	• The requests of the First Nations community can change	X	X	X			2.0	1.5	3.0	Could make negotiation longer but should not kill the project	Even if local FN are relatively open to discussions it can always be disturbed by small groups	Even with constant discussion it is hard to detect small groups preparing potential problems.	9.0	Low	AG/CB,BC,AL	Later
REG01	Changes in regulations (mining, environmental, etc.)	Regulations	• A change in federal or provincial government • A response to pressure from the citizen	X	X	X	X		2.0	3.0	1.5	Depends on the timing of the change	The government is trying to conform to international standards	Easily detectable because law change have long approval process	9.0	Medium	AG	Later

MATAMEC

October 11, 2012

SUBJECT : Risk analysis workshop

MATAMEC Exploration Inc.	André	Gauthier	President
	Aline	Leclerc	V-P Exploration
	Bertho	Caron	V-P Project Development
	Claude	Brisson	Relations with Communities
	Paul	Blatter	Director Metallurgy
	Eliza	Ngai	Lab Metallurgist
	Sylvain	Doire	Director Environment
	Frederic	Fleury	Project Geologist
	Robert	Crépeau	Mining Geologist
TRECan (Toyota)	Naoto	Yamagishi	
	Tsutomu	Aoki	
SGS Geostat	Ian	Camus	Project Engineer
GOLDER	Andrée	Drolet	Project Coordinator – TMF
	Christine	Guay	Project Coordinator – Biology
ROCHE	Guy	Saucier	
	Pierre	Casgrain	Mining Director
	Philippe	Côté	Metallurgist
	Eric or Tommee	Larochelle	Metallurgist
	William	Leclerc	Estimator
	Claude	Noreau	Project Coordinator
GENIVAR	Eric	Poirier	Infrastructures Project Coordinator
	Yves	Bouchard	
SENES	Grant	Feasby	Radioactivity Consultant

You are cordially invited to attend a workshop meeting concerning the Risk Analysis for the KIPAWA PROJECT (Project), in order to contribute to data collection, discussions, explanation and evaluation of potential risks that can impair the performance of the Project and to facilitate the identification of ways to prevent and/or to manage them.

This workshop will take place in Montréal, October the 23rd, at 1010, Sherbrooke Street West on the 15th floor. The agenda of the workshop starts at 8:00 and goes on till approximately 21:00. There will be 15 minutes coffee brakes at 10:00 and 15:00, a 45 minutes lunch brake on site, at 12:00 and a light supper brake of 30 minutes at 17:30, also on site.

STEP ONE: PERSONAL IDENTIFICATION OF POTENTIAL RISKS (PRIOR TO WORKSHOP)

Our first step in the Risk Analysis Process is to build an inventory of all potential risks that can impact the performance of the Project. In order to do this, we must collect these risks without discriminating subjectively those that we think are not important or those that we believe we can handle relatively easily. All risks which you think of must be treated!

This inventory will be put together with the contribution of people working for MATAMEC, in their capacity of employees, managers, TOYOTA representatives or consultants, which have an overall appreciation of the Project and also a more specific control or insight into an activity, process or a management function.

Individual reflexion

At this stage, your personal contribution to the activity of collecting potential risks associated with the KIPAWA PROJECT is twofold:

1. Make a reflexion base **on your activities/responsibilities** in the Project and identify all potential risk that can impact on targeted performances.
2. Make a reflexion base **on the Project as a whole**, considering what you know and what you think about the project, and identify all potential risks that you possibly can, that could impact on its performance.

Two (2) separate forms attached to this document will help you report your findings and thoughts.

To make sure you better comprehend the risks involved in your field of expertise and in the Project, think of frustrations you experience, articles that you have read, questions that you have been asked by friends or family, commentaries/reports/news that you have heard on radio/tv, past experiences, your imagination…

THANK YOU FOR COMPLETING THE FORMS (2) ATTACHED AND RETURN THEM TO MICHEL LABRECQUE MICHEL.LABRECQUE@ROCHE.CA ,
WITH SUPPLEMENT INFORMATION, IF YOU WISH, NO LATER THAN OCTOBER 16.

STEP TWO: PARTICIPATION IN THE WORKSHOP

Our second step in the Risk Analysis Process is to hold a workshop, to which you are hereby invited to participate. The objective of this activity is primarily to share information, thoughts and ideas on risks that can impair our Project, define and evaluate them and briefly suggest how they can be managed and by whom.

Collective brain storming

The overall results of the data collected in step one, will be presented and discussed at our meeting by risks categories, in order to better identify, define and share the understanding of each risk and its potential impact on the performances of the Project. Also, this activity should give us the opportunity to identify collectively other risks which will complete the initial inventory.

Each risk that will be studied in the workshop will be evaluated regarding to its importance, the likelihood that it happens and the facility to detect it. Suggestions will also be made by participants, discussed and shared, in relation to the management of some of those risks that will be under study.

FURTHER STEPS will be taken following the workshop:

All data collected prior to and at the workshop will be reviewed by the consultant in charge. Some data that will not have been address at all or fully at the workshop will be completed with discussions between himself and anyone of you. The consultant will write and submit his report to the senior management of the Project and discuss his recommendations. A further Risk Analysis should be held in early 2013.

Michel Labrecque, CRHA
Management Consultant

Claude Noreau, P. Eng., M.B.A.
Senior Project Manager

MATAMEC

Potential Risks Self Assessment

KIPAWA PROJECT AS A WHOLE

Name: Position/Role in the Project: Date completed:

Category of risks (third column):

1. **Reputation** (project, managers, owners,…)
2. **Political** (Governments involved,…)
3. **Financial** (Credit, exchange rate…,)
4. **Environmental,**
5. **People** (Human resources, community,…)
6. **Operational**
7. **Legal**
8. **Commercial** (clients, market,…)
9. **International Relations** (inter cultural issues,…)
10. **Communications**
11. **Regulation**

And al other risk suspected (please complete)

12. ____________________
13. ____________________
14. ____________________
15. ____________________

	RISK IDENTIFICATION	Number Risk Category	BRIEF DEFINITION	IMPACT ON PROJECT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10	...			

Please return to : Michel.Labrecque@roche.ca

Potential Risks Self Assessment

RISKS RELATED TO YOUR ACTIVITIES AND RESPONSIBILITIES

Name: Position/Role in the Project: Date completed:

Category of risks (third column):

1. **Reputation** (project, managers, owners,…)
2. **Political** (Governments involved,…)
3. **Financial** (Credit, exchange rate…,)
4. **Environmental,**
5. **People** (Human resources, community,…)
6. **Operational**
7. **Legal**
8. **Commercial** (clients, market,…)
9. **International Relations** (inter cultural issues,…)
10. **Communications**
11. **Regulation**

And al other risk suspected (please complete)

12. ____________________
13. ____________________
14. ____________________
15. ____________________

	RISK IDENTIFICATION	Number Risk Category	BRIEF DEFINITION	IMPACT ON PROJECT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10	...			

Please return to : Michel.Labrecque@roche.ca

List of Attendees at the October 23rd Workshop

MATAMEC Exploration Inc.	André	Gauthier	President
	Aline	Leclerc	V-P Exploration
	Bertho	Caron	V-P Project Development
	Claude	Brisson	Relations with Communities
	Paul	Blatter	Director Metallurgy
	Eliza	Ngai	Lab Metallurgist
	Sylvain	Doire	Director Environment
	Frederic	Fleury	Project Geologist
	Robert	Crépeau	Mining Geologist
TRECan (Toyota)	Naoto	Yamagishi	Project General Manager
	Takeru	Moriyama	Supervisor
			New Project Development
	Masaharu	Katayama	Group Leader
			New Project Development
	Tsutomu	Aoki	Assistant Manager
			New Project Development
SGS Geostat	Jean-Philippe	Paiement	
GOLDER	Andrée	Drolet	Project Coordinator – TMF
	Mayana	Kissiova	Associée
	Christine	Guay	Project Coordinator – Biology
ROCHE	Guy	Saucier	VP Mining and Metallurgy
	Pierre	Casgrain	Mining Director
	Philippe	Côté	Metallurgist
	Eric	Larochelle	Metallurgist
	William	Leclerc	Estimator
	Claude	Noreau	Project Coordinator
GENIVAR	Eric	Poirier	Infrastructures Project Coordinator
	Michel	Garon	Director Mining and Metallurgy
SENES	Grant	Feasby	Radioactivity Consultant

Compiled List of Potential Risks Collected (Before and During Workshop)
With Duplicates Removed

ID	*Category*	*Risk*	*Contributor(s)*
ALL01	Multiple Origins	Delay of project	William Leclerc
ALL02	Multiple Origins	Delays with approvals	Michel Garon
ALL03	Multiple Origins	Location of infrastructures and facilities	Christine Guay
ALL04	Multiple Origins	Plan - Water pumping location	Pierre Casgrain
ALL05	Multiple Origins	Pressure to change hydrometallurgical plant location	Aline Leclerc
ALL06	Multiple Origins	Requirements that process plant be split into two parts	Paul Blatter
COM01	Commercial	Change in demand of final product (quantity) (REE)	Michel Garon, Pierre Casgrain, William Leclerc, Workshop
COM02	Commercial	Change in product specifiation (quality)	Workshop
COM03	Commercial	Change in product value / product value not as expected ($$)	Yann Camus, Paul Blatter, Guy Saucier, Michel Garon, William Leclerc
COM04	Commercial	Competition	Michel Garon
COM05	Commercial	Development / marketing of by-products	Workshop
COM06	Commercial	Difficulty to sell the product	Michel Garon
COM07	Commercial	Matamec partnership broken	William Leclerc, Paul Blatter
COM08	Commercial	Sales agreement with TREECan (Toyota)	Bertho Caron
COM09	Commercial	Substitutes REE for magnets and other products	William Leclerc
COM10	Commercial	Timing -product too late on market	Claude Noreau
COMM01	Communication	Communications on radioactivity	Christine Guay
COMM02	Communication	Conflict between stakeholders (First Nations, consultants, shareholder, etc.)	Workshop
COMM03	Communication	Efficient system of communicatons	Michel Garon
COMM04	Communication	Focus on opponents and neglect the favourable stakeholders	Christine Guay
COMM05	Communication	Management of technical infomation/data/documents (distribution to all parties)	Workshop, Michel Garon
COMM06	Communication	Many people from different backgrounds working together	Aline Leclerc, Workshop
COMM07	Communication	Bad Media coverage	Workshop
COMM08	Communication	Overall bad communication	André Gauthier
COMM10	Communication	Two partners	Aline Leclerc
ENV01	Environment	Access road closure due to weather	Claude Brisson
ENV02	Environment	Climate change	Workshop
ENV03	Environment	Open pit - Flood	Workshop
ENV04	Environment	Other extreme weather events	Michel Garon
ENV05	Environment	Seismic activities	Michel Garon
ENV06	Environment	Snowfall	Workshop
ENV07	Environment	Temperature	Workshop
ENV08	Environment	Tornado	Workshop
FIN01	Financial	Project Financing - availability of investors	Michel Garon
FIN02	Financial	Changes in capital allowances	Michel Garon
FIN03	Financial	Exchange rate fluctuations	William Leclerc, Michel Garon
FIN04	Financial	Existing assets conditions	Michel Garon
FIN05	Financial	Existing assets sale value	Michel Garon
FIN06	Financial	Inflation	Michel Garon
FIN07	Financial	Interest rates increase	William Leclerc
FIN08	Financial	Matamec bought-out by a rival REE project	Paul Blatter
FIN09	Financial	Over evaluation of CAPEX	Claude Noreau, Guy Saucier, Michel Garon, Yann Camus, Michel Garon
FIN10	Financial	Over evaluation of OPEX	Claude Noreau, Guy Saucier, Michel Garon, Paul Blatter
FIN11	Financial	Project financing delayed	Guy Saucier
FIN12	Financial	Residual value of assets	Michel Garon
FIN13	Financial	TRECan doesn't exercise their option for the other 24% in the joint-venture Project	André Gauthier
FIN14	Financial	Under evaluation of CAPEX	Claude Noreau, Guy Saucier, Michel Garon, Yann Camus, Michel Garon
FIN15	Financial	Under evaluation of OPEX	Claude Noreau, Guy Saucier, Michel Garon, Paul Blatter
INT01	International	Changes in international trade agreements	Workshop
INT02	International	Restriction of Chinese REE exports	Workshop
LEG01	Legal	First Nations land claims	Workshop, Yann Camus
LEG02	Legal	Contractual claims	Michel Garon
LEG03	Legal	Project ownership	Workshop
LEG04	Legal	Technological ownership (intellectual property)	Workshop
OPS01	Operations	Accidental damage to equipment	Michel Garon
OPS02	Operations	Achievability of progressive reclamation	Workshop
OPS03	Operations	Acid/Chemical Spills	Guy Saucier, Michel Garon, Claude Brisson
OPS04	Operations	Any technical failure (geotechnical / physical failure)	Workshop
OPS05	Operations	Archaeological discoveries	Michel Garon
OPS06	Operations	Availability and dependability of power	Michel Garon, Bertho Caron, Claude Brisson, Guy Saucier
OPS07	Operations	Availability of consumables (and reagents)	Michel Garon, Eliza Ngai

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Compiled List of Potential Risks Collected (Before and During Workshop)
With Duplicates Removed

ID	*Category*	*Risk*	*Contributor(s)*
OPS08	Operations	Blast vibration above regulations	Pierre Casgrain
OPS09	Operations	Building and equipment foundation	Philippe Côté
OPS10	Operations	Change in mining or milling costs	Yann Camus
OPS11	Operations	Closure strategies (financial and technological risk)	Workshop
OPS12	Operations	Construction defects	Michel Garon
OPS13	Operations	Contamination, Dust	Workshop
OPS14	Operations	Contamination, Environmental	Grant Feasby
OPS15	Operations	Contamination, Ground water	Workshop
OPS16	Operations	Contamination, Radioactivity	Pierre Casgrain
OPS17	Operations	Contamination, Water	Claude Brisson
OPS18	Operations	Control of radioactivity	Guy Saucier
OPS19	Operations	Corruption	Michel Garon
OPS20	Operations	Creation of jobs and skills for the community	Workshop
OPS21	Operations	Damages to environment	Michel Garon
OPS22	Operations	Delays in equipment delivery	Guy Saucier
OPS23	Operations	Delays with procurement of materials	Michel Garon
OPS24	Operations	Deposit's internal variability	Frédéric Fleury
OPS25	Operations	Design delays	Michel Garon
OPS26	Operations	Development of community	Workshop
OPS27	Operations	Diversification of local economy	Workshop
OPS28	Operations	Effluent discharge location	Christine Guay
OPS29	Operations	Effluents not to specifications	Guy Saucier, Michel Garon
OPS30	Operations	Emergency response plan (environnment , health and safety, etc)	Workshop
OPS31	Operations	Environmental practices obsolescence	Michel Garon
OPS32	Operations	Error in scope or quantity evaluation in the estimate	William Leclerc
OPS33	Operations	Failure in open pit	Workshop
OPS34	Operations	Failure to comply with regulations and laws	Workshop
OPS35	Operations	Problem and delays to obtain permits	Bertho Caron, Workshop
OPS36	Operations	Feasibility study not written as NI 43-101	André Gauthier
OPS37	Operations	Final flowsheet requires confirmatory pilot plant	Paul Blatter
OPS38	Operations	Fire	Claude Brisson, Michel Garon
OPS39	Operations	Geochemical conditions different than expected (impacts treatment permits, etc)	Workshop
OPS40	Operations	Geotechnical evaluation (wall angle)	Pierre Casgrain
OPS41	Operations	Grade control process (in the mine)	Workshop, Michel Garon
OPS42	Operations	Grinding index for fine material	Philippe Côté
OPS43	Operations	Ground water conditions different than expected	Workshop
OPS44	Operations	Gypsum filtration variability with calcite content (Process)	Paul Blatter
OPS45	Operations	Harming wildlife and plantlife (due to construction of roads and facilities)	Workshop
OPS46	Operations	Head grade variation	Philippe Côté, Yann Camus
OPS47	Operations	Health and Safety	Michel Garon, Grant Feasby
OPS48	Operations	High amount of fines generated from grinding	Eliza Ngai
OPS49	Operations	High radionuclide emission	Eliza Ngai
OPS50	Operations	Higher radioactivity in the mill tails than anticipated	Eliza Ngai, Bertho Caron
OPS51	Operations	Identification of the chemical process	Claude Noreau
OPS52	Operations	Inability to meet discharge water / air requirements	Workshop
OPS53	Operations	Inadequate basis for design	Michel Garon
OPS54	Operations	Inadequate design	Michel Garon
OPS55	Operations	Insolvency of contractors and suppliers (bankrupcies)	Michel Garon
OPS56	Operations	Lack of flexibility of the equipment/process	Workshop
OPS57	Operations	Late design changes	Michel Garon
OPS58	Operations	Long term legacies	Grant Feasby
OPS59	Operations	Mag Sep poor separation	Eliza Ngai
OPS60	Operations	Metallurgical Process overall and final	André Gauthier
OPS61	Operations	Mill - Processing Recovery	Pierre Casgrain, Michel Garon
OPS62	Operations	Mill efficiency affected by geological variability	Yann Camus
OPS63	Operations	Mill output lower than anticipated	Guy Saucier
OPS64	Operations	Mill throughput	Pierre Casgrain
OPS65	Operations	Noise and visual pollution above regulations	Pierre Casgrain, Michel Garon
OPS66	Operations	Open sections	Frédéric Fleury
OPS67	Operations	Ore grade higher than anticipated	Guy saucier
OPS68	Operations	Ore grade lower than expected	Guy Saucier
OPS69	Operations	Ore reserve calculation	Aline Leclerc
OPS70	Operations	Orebody (mineralised areas) variability	Aline Leclerc
OPS71	Operations	Pipeline failure	Workshop
OPS72	Operations	Piping failure from mills to tailings (or otherwise)	Workshop
OPS73	Operations	Pit slope failure	Guy Saucier
OPS74	Operations	Planning - Site layout	Pierre Casgrain
OPS75	Operations	Planning - Traffic management	Pierre Casgrain
OPS76	Operations	Pollution of the Kipawa River	André Gauthier
OPS77	Operations	Problem in mining selectivity	Yann Camus
OPS78	Operations	Processing plants cannot handle concentrate (tonnage)	Workshop
OPS79	Operations	Product recovery not as expected (REE recovery)	Paul Blatter

Compiled List of Potential Risks Collected (Before and During Workshop)
With Duplicates Removed

ID	Category	Risk	Contributor(s)
OPS80	Operations	Product specifiation not as expected	Workshop, Eliza Ngai, Guy Saucier
OPS81	Operations	Production throughput	Michel Garon
OPS82	Operations	Provides economical support to local social organizations	Workshop
OPS83	Operations	Purchased wrong equipment or need additional equipment	Workshop
OPS84	Operations	Reagent transportation (acid) on road	Philippe Côté
OPS85	Operations	Record on health and safety	Workshop
OPS86	Operations	Representativity of ore samples used	Michel Garon, Philippe Côté
OPS87	Operations	Resource tonnage not as expected	Yann Camus
OPS88	Operations	Restricted flowsheet (carbonate concentrate)	Paul Blatter
OPS89	Operations	Rock conditions different than expected	Workshop
OPS90	Operations	Settling and filtration rate for magnetic separation tails	Philippe Côté
OPS91	Operations	Site access problems	Michel Garon
OPS92	Operations	Site availability	Michel Garon
OPS93	Operations	Slopes stability	Michel Garon
OPS94	Operations	Slow filtration issues	Eliza Ngai
OPS95	Operations	Spill of uranium strip solution in the plant	Eliza Ngai
OPS96	Operations	Sufficient test work lab + pilot plant	Michel Garon
OPS97	Operations	Tailings dams leaks/failure (or Dike break)	Michel Garon, Claude Brisson, Guy Saucier
OPS98	Operations	Tailings stream do not meet design criteria (mill)	Workshop
OPS99	Operations	Tailings stream is not as expected (%solids, tonnage, quality, etc.)	Workshop
OPS100	Operations	Technological obsolescence	Michel Garon
OPS101	Operations	Timing of a new bulk sample	Aline Leclerc
OPS102	Operations	Traffic Accident	Claude Brisson
OPS103	Operations	Unachievable discharge water quality	Workshop
OPS104	Operations	Uncertainty or variation in slope profile	Pierre Casgrain
OPS105	Operations	Unexpected need for water treatment	Workshop
OPS106	Operations	Unexpected seepage from overall mining facilities	Workshop
OPS107	Operations	Unforeseen ground conditions	Michel Garon
OPS108	Operations	Unprecise resource estimation (good or bad)	Workshop
OPS109	Operations	Unproven technology	Michel Garon
OPS110	Operations	Variations in hardness	Frédéric Fleury
PEO01	People	First Nations experts review the ESIA report	Christine Guay
PEO02	People	Availability of personnel, skilled people, qualified labor	Michel Garon, Yann Camus, Bertho Caron, William Leclerc, Guy Saucier
PEO03	People	Conflict between First Nations communities	Workshop
PEO04	People	Departure (loss) of key Matamec people	André Gauthier
PEO05	People	Departure (loss) of the President of Matamec	André Gauthier
PEO06	People	Fear of the contamination of Lake Kipawa	Claude Brisson
PEO07	People	First Nation socio-economic and land use assessment	Christine Guay
PEO08	People	Friction between external workers and local community	Workshop
PEO09	People	Local community support	Eliza Ngai
PEO10	People	Negotiation with local First Nations	Bertho Caron
PEO11	People	Non acceptability of project by local communities	Philippe Côté
PEO12	People	Opposing stakeholders: Mining Watch and Russ Diabo	Christine Guay
PEO13	People	People working together for the first time	Aline Leclerc
PEO14	People	Perception of the community concerning Uranium/Thorium	Aline Leclerc, Grant Feasby
PEO15	People	Populations are against the project	Guy saucier
PEO16	People	Project to be accepted by local communities	Bertho Caron
PEO17	People	Protestors blocking roads or site access	Workshop
PEO18	People	Public pressure to have "Gold-Plated" waste management	Grant Feasby
PEO19	People	Relationships with First Nations	Michel Garon
PEO20	People	Required recruitment native workforce	Pierre Casgrain
PEO21	People	Strikes	Michel Garon
PEO22	People	Theft and vandalism	Michel Garon
PEO23	People	Training	Michel Garon
PEO24	People	Understanding of radioactivity by Communities	André Gauthier
PEO25	People	Union relationships (operations, construction, etc.)	Workshop
PEO26	People	Worker conditions / treatment	Workshop
POL01	Political	Change in municipal taxation	Workshop
POL02	Political	Changes in laws (mining, environmental, etc)	Workshop
POL03	Political	Changes Mining taxes	Guy Saucier
POL04	Political	Election in the First Nations communities	Christine Guay
POL05	Political	Go to the BAPE process if change to the law	Bertho Caron
POL06	Political	Government change	Guy Saucier
POL07	Political	Government misunderstanding (permits)	Claude Noreau
POL08	Political	Government pressure to have "Gold-Plated" waste management	Grant Feasby
POL09	Political	Level of assessment required by governments for the ESIA	Christine Guay
POL10	Political	Misunderstanding about radioactivity	Grant Feasby
POL11	Political	New environmental regulations	Michel Garon

Compiled List of Potential Risks Collected (Before and During Workshop)
With Duplicates Removed

ID	*Category*	*Risk*	*Contributor(s)*
POL12	Political	New provincial government policies (BAPE, Mining Taxes, Radioactivity	André Gauthier
POL13	Political	New requirements for permits	Workshop
POL14	Political	Potential issues created by mayor Young's opposition	Christine Guay
POL15	Political	Project deemed a uranium project	Paul Blatter
POL16	Political	Taxation	Michel Garon
POL17	Political	Value added tax	Michel Garon
REG01	Regulations	Changes in regulations (mining, environmental, etc.)	Workshop, William Leclerc
REG02	Regulations	Delays in getting permits and authorisations	Guy Saucier
REG03	Regulations	Shipping regulation changes	Workshop
REP01	Reputation	Major accident at another rare earth mine	Claude Brisson
REP02	Reputation	Overall mining reputation	Workshop
REP03	Reputation	Project name «Kipawa»	Christine Guay
REP04	Reputation	Quality of the President's management performance	André Gauthier
REP05	Reputation	Transparency of the President of Matamec	André Gauthier
REP06	Reputation	Trust of the population for the project and for Government representatives	Claude Noreau
REP07	Reputation	Working with Toyota (creates high expectations for employees)	Workshop
REP08	Reputation	Working with Toyota (Their reputation affects our reputation)	Workshop
REP09	Reputation	Working with world renound person	Workshop

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Condensed List of Potential Risks Collected
(Risks Evaluated in this Feasibility Study)

ID	*Category*	*Risk*
ALL03	Multiple Origins	Location of infrastructures and facilities including hydromet plant apart from beneficiation plant or not.
COM01	Commercial	Major decrease in demand of final product in the long term (quantity) (REE)
COM01A	Commercial	Major increase in demand of final product in the long term (quantity) (REE)
COM01B	Commercial	Increase in the global supply of the final product in the long term (quantity) (REE)
COM02	Commercial	Change in final product specification (quality)
COM03	Commercial	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)
COM07	Commercial	Matamec - TRECan (Toyota Rare Earth Canada) partnership broken and no off-take agreement with Toyota Tsusho before construction
COM07A	Commercial	Partner takes only select REEs (-)
COM07B	Commercial	Partner takes only select REEs and Matamec invests to futher separate the REEs
COM09	Commercial	Substitutes REE for magnets and other products during the life of mine
COM10	Commercial	Market is taken by other producers before start-up
COMM01	Communication	Social non-acceptability in regard of radioactivity
COMM02	Communication	Conflict between stakeholders (community, First Nations, shareholder, ZEC) and promoter (Matamec)
COMM04	Communication	Focus on opponents and neglect the favourable stakeholders
COMM05	Communication	Interpretation of technical information/data/documents distributed to all stakeholders
COMM07	Communication	Bad media coverage before construction
FIN01	Financial	Project Financing - availability of investors (other than offtaker)
FIN02	Financial	Changes in capital allowances
FIN03	Financial	Exchange rate fluctuations
FIN08	Financial	Matamec bought-out by a rival REE project
FIN09	Financial	Over evaluation of CAPEX
FIN09A	Financial	Under evaluation of CAPEX
FIN10	Financial	Over evaluation of OPEX
FIN10A	Financial	Under evaluation of OPEX
FIN11	Financial	Project financing delayed by 2 years
LEG01	Legal	Delay in signature of Impact and Benefit Agreement with First Nations
OPS03	Operations	Acid/Chemical Spills
OPS06	Operations	Loss of electrical power (less than a week)
OPS06A	Operations	Availability of electrical power
OPS15	Operations	Contamination, Ground water
OPS16	Operations	Contamination, Radioactivity
OPS17	Operations	Contamination, Surface water
OPS21	Operations	Damages to environment due to dust
OPS22	Operations	Delays in equipment delivery (more than 2 weeks than the anticipated delivery date)
OPS33	Operations	Major failure in open pit (wall failure)
OPS35	Operations	Delay to obtain permits
OPS37	Operations	Final flowsheet needs major modifications after pilot plant has run
OPS38	Operations	Major fire impacting the operation for several weeks (fuel, conveyors, electrical room, …)
OPS39	Operations	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations
OPS40	Operations	Geotechnical evaluation is insufficient; causing improper wall angle
OPS41	Operations	Grade control process in the mine is insufficient
OPS42	Operations	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill
OPS44	Operations	Ore silica content variations might cause gypsum filtration problems (Process)
OPS46	Operations	Head grade variation which can cause ore recovery variation
OPS48	Operations	High amount of fines generated from grinding which can cause higher mass recovery than expected in beneficiation process
OPS49	Operations	High radionuclide emission at the waste rock dump
OPS50	Operations	Higher radioactivity in the process plant tailings than anticipated
OPS58	Operations	Long term legacies after closure
OPS60	Operations	Hydrometallurgical plant recovery lower than expected
OPS61	Operations	Beneficiation plant recovery is not as expected
OPS62	Operations	Mill efficiency affected by geological variability
OPS69	Operations	Ore reserve calculation (ore tonnage and/or grade are lower than expected)
OPS72	Operations	Piping failure from mills to tailings
OPS72A	Operations	Other piping failures
OPS97	Operations	Tailings dams leaks (minor)
OPS97A	Operations	Tailings dams break (major)
OPS102	Operations	Traffic Accident on access road
OPS111	Operations	All worker injury, fatality or disabilily
OPS112	Operations	Visitor injury, fatality or disabilily
PEO01	People	First Nations experts review the ESIA report
PEO02	People	Availability of personnel, skilled people, qualified labor
PEO04	People	Departure (loss) of key Matamec people during project preparation
PEO07	People	First Nation socio-economic and land use assessment
PEO10	People	Negotiation with local First Nations
PEO14	People	Bad Perception of the community concerning Uranium/Thorium
PEO16	People	Project to be rejected by local communities
PEO18	People	Public pressure to have “Gold-Plated” waste management
POL01	Political	Increase in municipal taxation
POL02	Political	Changes in laws (mining, environmental, etc)
POL04	Political	Election in the First Nations communities
REG01	Regulations	Changes in regulations (mining, environmental, etc.)

Evaluation of the Condensed Risks, Sorted by Category

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts 25 to 50 M$ = 4 pts 10 to 25 M$ = 3 pts 3 to 10 M$ = 2 pts < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts avg 50% = 4 pts 25 to 50% = 3 pts 2 to 25% = 2 pts < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts easy = 2 pts moderate = 3 pts hard = 4 pts undetectable = 5 pts	Risk Value
ALL03	Multiple Origins	Location of infrastructures and facilities including hydromet plant apart from beneficiation plant or not.	x	x				4,0	2,0	1,5	12,0
COM01	Commercial	Major decrease in demand of final product in the long term (quantity) (REE)				x		5,0	2,0	3,0	30,0
COM01A	Commercial	Major increase in demand of final product in the long term (quantity) (REE)				x		5,0	3,0	3,0	45,0
COM01B	Commercial	Increase in the global supply of the final product in the long term (quantity) (REE)				x		3,0	3,0	2,0	18,0
COM02	Commercial	Change in final product specification (quality)	x	x	x	x		2,0	1,5	2,0	6,0
COM03	Commercial	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)	x					3,0	4,0	3,0	36,0
COM07	Commercial	Matamec - TRECan (Toyota Rare Earth Canada) partnership broken and no off-take agreement with Toyota Tsusho before construction	x	x				3,0	3,0	2,0	18,0
COM07A	Commercial	Partner takes only select REEs (-)	x	x		x		3,0	2,0	2,0	12,0
COM07B	Commercial	Partner takes only select REEs and Matamec invests to further separate the REEs		x		x		4,0	2,0	2,0	16,0
COM09	Commercial	Substitutes to replace REE for magnets and other products during the life of mine	x	x	x	x		4,0	2,0	2,0	16,0
COM10	Commercial	Market is taken by other producers before start-up	x	x	x			5,0	3,0	2,0	30,0
COMM01	Communication	Social non-acceptability in regard of radioactivity	x	x				3,0	2,0	2,0	12,0
COMM02	Communication	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	x	x	x	x	x	3,0	3,0	3,0	27,0
COMM04	Communication	Focus on opponents and neglect the favourable stakeholders	x	x				1,5	1,5	2,0	4,5
COMM07	Communication	Bad media coverage before construction	x	x				3,0	3,0	3,0	27,0
COMM05	Communication	Interpretation of technical information/data/documents distributed to all stakeholders	x	x				3,0	2,0	3,0	18,0
FIN01	Financial	Project Financing - availability of investors (other than offtaker)	x	x				3,0	3,0	2,0	18,0
FIN02	Financial	Changes in capital allowances	x	x	x			2,0	2,0	4,0	16,0
FIN03	Financial	Exchange rate fluctuations	x		x	x		3,0	2,0	3,0	18,0
FIN08	Financial	Matamec bought-out by a rival REE project	x		x	x		1,5	2,0	4,0	12,0
FIN09	Financial	Over evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN09A	Financial	Under evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN10	Financial	Over evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
FIN10A	Financial	Under evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
FIN11	Financial	Project financing delayed by 2 years	x	x				3,0	3,0	3,0	27,0
LEG01	Legal	Delay in signature of Impact and Benefit Agreement with First Nations	x	x				2,0	2,0	2,0	8,0
OPS03	Operations	Acid/Chemical Spills			x	x		1,5	2,0	4,0	12,0
OPS06	Operations	Loss of electrical power (less than a week)			x	x		2,0	2,0	5,0	20,0
OPS06A	Operations	Availability of electrical power	x		x	x		3,0	2,0	1,5	9,0
OPS15	Operations	Contamination, Ground water			x	x	x	2,0	1,5	1,5	4,5
OPS16	Operations	Contamination, Radioactivity			x	x	x	3,0	2,0	1,5	9,0
OPS17	Operations	Contamination, Surface water			x	x	x	1,5	1,5	1,5	3,4
OPS21	Operations	Damages to environment due to dust			x	x	x	1,5	1,5	1,5	3,4
OPS22	Operations	Delays in equipment delivery (more than 2 weeks than the anticipated delivery date)			x			2,0	2,0	2,0	8,0
OPS33	Operations	Major failure in open pit (wall failure)				x		4,0	1,5	2,0	12,0
OPS35	Operations	Delay to obtain permits	x	x	x			2,0	1,5	2,0	6,0
OPS37	Operations	Final flowsheet needs major modifications after pilot plant has run	x		x			3,0	2,0	1,5	9,0

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Evaluation of the Condensed Risks, Sorted by Category

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts 25 to 50 M$ = 4 pts 10 to 25 M$ = 3 pts 3 to 10 M$ = 2 pts < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts avg 50% = 4 pts 25 to 50% = 3 pts 2 to 25% = 2 pts < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts easy = 2 pts moderate = 3 pts hard = 4 pts undetectable = 5 pts	Risk Value
OPS38	Operations	Major fire impacting the operation for several weeks (fuel, conveyors, electrical room, ...)			x	x		3,0	1,5	4,0	18,0
OPS39	Operations	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations	x			x	x	3,0	1,5	1,5	6,8
OPS40	Operations	Geotechnical evaluation is insufficient; causing improper wall angle	x		x	x		2,0	1,5	2,0	6,0
OPS41	Operations	Grade control process in the mine is insufficient			x	x		2,0	2,0	1,5	6,0
OPS42	Operations	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill	x		x	x		1,5	2,0	1,5	4,5
OPS44	Operations	Ore silica content variations might cause gypsum filtration problems (Process)	x	x	x	x		2,0	1,5	2,0	6,0
OPS46	Operations	Head grade variation which can cause ore recovery variation				x		1,5	2,0	2,0	6,0
OPS48	Operations	High amount of fines generated from grinding which can cause higher mass recovery than expected in the beneficiation process	x			x		2,0	1,5	1,5	4,5
OPS49	Operations	High radionuclide emission at the waste rock dump	x			x	x	3,0	1,5	2,0	9,0
OPS50	Operations	Higher radioactivity in the process plant tailings than anticipated	x			x		3,0	1,5	2,0	9,0
OPS58	Operations	Long term legacies after closure	x				x	3,0	1,5	1,5	6,8
OPS60	Operations	Hydrometallurgical plant recovery lower than expected	x			x		3,0	2,0	1,5	9,0
OPS61	Operations	Beneficiation plant recovery is not as expected	x			x		3,0	2,0	1,5	9,0
OPS62	Operations	Mill efficiency affected by geological variability	x			x		3,0	1,5	1,5	6,8
OPS69	Operations	Ore reserve calculation (ore tonnage and/or grade are lower than expected)				x		4,0	1,5	1,5	9,0
OPS72	Operations	Piping failure from mills to tailings	x			x		1,5	1,5	2,0	4,5
OPS72A	Operations	Other piping failures	x			x		1,5	1,5	1,5	3,4
OPS97	Operations	Tailings dams leaks (minor)	x			x		1,5	2,0	2,0	6,0
OPS97A	Operations	Tailings dams break (major)	x			x		4,0	1,5	2,0	12,0
OPS102	Operations	Traffic Accident on access road	x		x	x		1,5	2,0	5,0	15,0
OPS111	Operations	All worker injury, fatality or disability			x	x		1,5	3,0	3,0	13,5
OPS112	Operations	Visitor injury, fatality or disability			x	x		1,5	1,5	3,0	6,8
PEO01	People	First Nations experts review the ESIA report	x					1,5	1,5	1,5	3,4
PEO02	People	Availability of personnel, skilled people, qualified labor			x	x		2,0	2,0	2,0	8,0
PEO04	People	Departure (loss) of key Matamec people during project preparation	x	x				1,5	2,0	3,0	9,0
PEO07	People	First Nation socio-economic and land use assessment	x	x				2,0	2,0	2,0	8,0
PEO10	People	Negotiation with local First Nations	x	x	x			2,0	2,0	3,0	12,0
PEO14	People	Bad Perception of the community concerning Uranium/Thorium	x	x	x			1,5	2,0	2,0	6,0
PEO16	People	Project to be rejected by local communities	x	x	x			3,0	1,5	2,0	9,0
PEO18	People	Public pressure to have "Gold-Plated" waste management	x	x				2,0	2,0	2,0	8,0
POL01	Political	Increase in municipal taxation	x	x	x	x		1,5	1,5	1,5	3,4
POL02	Political	Changes in laws (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0
POL04	Political	Election in the First Nations communities	x	x	x			2,0	1,5	3,0	9,0
REG01	Regulations	Changes in regulations (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0

Evaluation of the Condensed Risks, Sorted by Risk Value

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts 25 to 50 M$ = 4 pts 10 to 25 M$ = 3 pts 3 to 10 M$ = 2 pts < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts avg 50% = 4 pts 25 to 50% = 3 pts 2 to 25% = 2 pts < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts easy = 2 pts moderate = 3 pts hard = 4 pts undetectable = 5 pts	Risk Value
COM01A	Commercial	Major increase in demand of final product in the long term (quantity) (REE)				x		5,0	3,0	3,0	45,0
COM03	Commercial	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)	x					3,0	4,0	3,0	36,0
COM01	Commercial	Major decrease in demand of final product in the long term (quantity) (REE)				x		5,0	2,0	3,0	30,0
COM10	Commercial	Market is taken by other producers before start-up	x	x	x			5,0	3,0	2,0	30,0
COMM02	Communication	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	x	x	x	x	x	3,0	3,0	3,0	27,0
COMM07	Communication	Bad media coverage before construction	x	x				3,0	3,0	3,0	27,0
FIN11	Financial	Project financing delayed by 2 years	x	x				3,0	3,0	3,0	27,0
FIN09	Financial	Over evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN09A	Financial	Under evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
OPS06	Operations	Loss of electrical power (less than a week)			x	x		2,0	2,0	5,0	20,0
COM01B	Commercial	Increase in the global supply of the final product in the long term (quantity) (REE)				x		3,0	3,0	2,0	18,0
COM07	Commercial	Matamec - TRECan (Toyota Rare Earth Canada) partnership broken and no off-take agreement with Toyota Tsusho before construction	x	x				3,0	3,0	2,0	18,0
COMM05	Communication	Interpretation of technical information/data/documents distributed to all stakeholders	x	x				3,0	2,0	3,0	18,0
FIN01	Financial	Project Financing - availability of investors (other than offtaker)	x	x				3,0	3,0	2,0	18,0
FIN03	Financial	Exchange rate fluctuations	x		x	x		3,0	2,0	3,0	18,0
OPS38	Operations	Major fire impacting the operation for several weeks (fuel, conveyors, electrical room, ...)			x	x		3,0	1,5	4,0	18,0
COM07B	Commercial	Partner takes only select REEs and Matamec invests to further separate the REEs		x		x		4,0	2,0	2,0	16,0
COM09	Commercial	Substitutes to replace REE for magnets and other products during the life of mine	x	x	x	x		4,0	2,0	2,0	16,0
FIN02	Financial	Changes in capital allowances	x	x	x			2,0	2,0	4,0	16,0
OPS102	Operations	Traffic Accident on access road	x		x	x		1,5	2,0	5,0	15,0
OPS111	Operations	All worker injury, fatality or disability			x	x		1,5	3,0	3,0	13,5
ALL03	Multiple Origins	Location of infrastructures and facilities including hydromet plant apart from beneficiation plant or not.	x	x				4,0	2,0	1,5	12,0
COM07A	Commercial	Partner takes only select REEs (-)	x	x		x		3,0	2,0	2,0	12,0
COMM01	Communication	Social non-acceptability in regard of radioactivity	x	x				3,0	2,0	2,0	12,0
FIN08	Financial	Matamec bought-out by a rival REE project	x		x	x		1,5	2,0	4,0	12,0
FIN10	Financial	Over evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
FIN10A	Financial	Under evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
OPS03	Operations	Acid/Chemical Spills			x	x		1,5	2,0	4,0	12,0
OPS33	Operations	Major failure in open pit (wall failure)				x		4,0	1,5	2,0	12,0
OPS97A	Operations	Tailings dams break (major)	x			x		4,0	1,5	2,0	12,0
PEO10	People	Negotiation with local First Nations	x	x	x			2,0	2,0	3,0	12,0
OPS06A	Operations	Availability of electrical power	x		x	x		3,0	2,0	1,5	9,0
OPS16	Operations	Contamination, Radioactivity			x	x	x	3,0	2,0	1,5	9,0
OPS37	Operations	Final flowsheet needs major modifications after pilot plant has run	x		x			3,0	2,0	1,5	9,0
OPS49	Operations	High radionuclide emission at the waste rock dump	x			x	x	3,0	1,5	2,0	9,0
OPS50	Operations	Higher radioactivity in the process plant tailings than anticipated	x			x		3,0	1,5	2,0	9,0
OPS60	Operations	Hydrometallurgical plant recovery lower than expected	x			x		3,0	2,0	1,5	9,0

Evaluation of the Condensed Risks, Sorted by Risk Value

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts 25 to 50 M$ = 4 pts 10 to 25 M$ = 3 pts 3 to 10 M$ = 2 pts < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts avg 50% = 4 pts 25 to 50% = 3 pts 2 to 25% = 2 pts < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts easy = 2 pts moderate = 3 pts hard = 4 pts undetectable = 5 pts	Risk Value
OPS61	Operations	Beneficiation plant recovery is not as expected	x			x		3,0	2,0	1,5	9,0
OPS69	Operations	Ore reserve calculation (ore tonnage and/or grade are lower than expected)				x		4,0	1,5	1,5	9,0
PEO04	People	Departure (loss) of key Matamec people during project preparation	x	x				1,5	2,0	3,0	9,0
PEO16	People	Project to be rejected by local communities	x	x	x			3,0	1,5	2,0	9,0
POL02	Political	Changes in laws (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0
POL04	Political	Election in the First Nations communities	x	x	x			2,0	1,5	3,0	9,0
REG01	Regulations	Changes in regulations (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0
LEG01	Legal	Delay in signature of Impact and Benefit Agreement with First Nations	x	x				2,0	2,0	2,0	8,0
OPS22	Operations	Delays in equipment delivery (more than 2 weeks than the anticipated delivery date)			x			2,0	2,0	2,0	8,0
PEO02	People	Availability of personnel, skilled people, qualified labor			x	x		2,0	2,0	2,0	8,0
PEO07	People	First Nation socio-economic and land use assessment	x	x				2,0	2,0	2,0	8,0
PEO18	People	Public pressure to have "Gold-Plated" waste management	x	x				2,0	2,0	2,0	8,0
OPS112	Operations	Visitor injury, fatality or disability			x	x		1,5	1,5	3,0	6,8
OPS39	Operations	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations	x			x	x	3,0	1,5	1,5	6,8
OPS58	Operations	Long term legacies after closure	x				x	3,0	1,5	1,5	6,8
OPS62	Operations	Mill efficiency affected by geological variability	x			x		3,0	1,5	1,5	6,8
COM02	Commercial	Change in final product specification (quality)	x	x	x	x		2,0	1,5	2,0	6,0
OPS35	Operations	Delay to obtain permits	x	x	x			2,0	1,5	2,0	6,0
OPS40	Operations	Geotechnical evaluation is insufficient; causing improper wall angle	x		x	x		2,0	1,5	2,0	6,0
OPS41	Operations	Grade control process in the mine is insufficient			x	x		2,0	2,0	1,5	6,0
OPS44	Operations	Ore silica content variations might cause gypsum filtration problems (Process)	x	x	x	x		2,0	1,5	2,0	6,0
OPS46	Operations	Head grade variation which can cause ore recovery variation				x		1,5	2,0	2,0	6,0
OPS97	Operations	Tailings dams leaks (minor)	x			x		1,5	2,0	2,0	6,0
PEO14	People	Bad Perception of the community concerning Uranium/Thorium	x	x	x			1,5	2,0	2,0	6,0
COMM04	Communication	Focus on opponents and neglect the favourable stakeholders	x	x				1,5	1,5	2,0	4,5
OPS15	Operations	Contamination, Ground water			x	x	x	2,0	1,5	1,5	4,5
OPS42	Operations	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill	x		x	x		1,5	2,0	1,5	4,5
OPS48	Operations	High amount of fines generated from grinding which can cause higher mass recovery than expected in the beneficiation process	x			x		2,0	1,5	1,5	4,5
OPS72	Operations	Piping failure from mills to tailings	x			x		1,5	1,5	2,0	4,5
OPS17	Operations	Contamination, Surface water			x	x	x	1,5	1,5	1,5	3,4
OPS21	Operations	Damages to environment due to dust			x	x	x	1,5	1,5	1,5	3,4
OPS72A	Operations	Other piping failures	x			x		1,5	1,5	1,5	3,4
PEO01	People	First Nations experts review the ESIA report	x					1,5	1,5	1,5	3,4
POL01	Political	Increase in municipal taxation	x	x	x	x		1,5	1,5	1,5	3,4

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Evaluation of the Condensed Risks, Sorted by When the Risk can Occur

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts 25 to 50 M$ = 4 pts 10 to 25 M$ = 3 pts 3 to 10 M$ = 2 pts < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts avg 50% = 4 pts 25 to 50% = 3 pts 2 to 25% = 2 pts < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts easy = 2 pts moderate = 3 pts hard = 4 pts undetectable = 5 pts	Risk Value
ALL03	Multiple Origins	Location of infrastructures and facilities including hydromet plant apart from beneficiation plant or not.	x	x				4,0	2,0	1,5	12,0
COM02	Commercial	Change in final product specification (quality)	x	x	x	x		2,0	1,5	2,0	6,0
COM03	Commercial	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)	x					3,0	4,0	3,0	36,0
COM07	Commercial	Matamec - TRECan (Toyota Rare Earth Canada) partnership broken and no off-take agreement with Toyota Tsusho before construction	x	x				3,0	3,0	2,0	18,0
COM07A	Commercial	Partner takes only select REEs (-)	x	x		x		3,0	2,0	2,0	12,0
COM09	Commercial	Substitutes to replace REE for magnets and other products during the life of mine	x	x	x	x		4,0	2,0	2,0	16,0
COM10	Commercial	Market is taken by other producers before start-up	x	x	x			5,0	3,0	2,0	30,0
COMM01	Communication	Social non-acceptability in regard of radioactivity	x	x				3,0	2,0	2,0	12,0
COMM02	Communication	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	x	x	x	x	x	3,0	3,0	3,0	27,0
COMM04	Communication	Focus on opponents and neglect the favourable stakeholders	x	x				1,5	1,5	2,0	4,5
COMM05	Communication	Interpretation of technical information/data/documents distributed to all stakeholders	x	x				3,0	2,0	3,0	18,0
COMM07	Communication	Bad media coverage before construction	x	x				3,0	3,0	3,0	27,0
FIN01	Financial	Project Financing - availability of investors (other than offtaker)	x	x				3,0	3,0	2,0	18,0
FIN02	Financial	Changes in capital allowances	x	x	x			2,0	2,0	4,0	16,0
FIN03	Financial	Exchange rate fluctuations	x		x	x		3,0	2,0	3,0	18,0
FIN08	Financial	Matamec bought-out by a rival REE project	x		x	x		1,5	2,0	4,0	12,0
FIN09	Financial	Over evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN09A	Financial	Under evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN10	Financial	Over evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
FIN10A	Financial	Under evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
FIN11	Financial	Project financing delayed by 2 years	x	x				3,0	3,0	3,0	27,0
LEG01	Legal	Delay in signature of Impact and Benefit Agreement with First Nations	x	x				2,0	2,0	2,0	8,0
OPS06A	Operations	Availability of electrical power	x		x	x		3,0	2,0	1,5	9,0
OPS102	Operations	Traffic Accident on access road	x		x	x		1,5	2,0	5,0	15,0
OPS35	Operations	Delay to obtain permits	x	x	x			2,0	1,5	2,0	6,0
OPS37	Operations	Final flowsheet needs major modifications after pilot plant has run	x		x			3,0	2,0	1,5	9,0
OPS39	Operations	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations	x			x	x	3,0	1,5	1,5	6,8
OPS40	Operations	Geotechnical evaluation is insufficient; causing improper wall angle	x		x	x		2,0	1,5	2,0	6,0
OPS42	Operations	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill	x		x	x		1,5	2,0	1,5	4,5
OPS44	Operations	Ore silica content variations might cause gypsum filtration problems (Process)	x	x	x	x		2,0	1,5	2,0	6,0
OPS48	Operations	High amount of fines generated from grinding which can cause higher mass recovery than expected in the beneficiation process	x			x		2,0	1,5	1,5	4,5
OPS49	Operations	High radionuclide emission at the waste rock dump	x			x	x	3,0	1,5	2,0	9,0
OPS50	Operations	Higher radioactivity in the process plant tailings than anticipated	x			x		3,0	1,5	2,0	9,0
OPS58	Operations	Long term legacies after closure	x				x	3,0	1,5	1,5	6,8
OPS60	Operations	Hydrometallurgical plant recovery lower than expected	x			x		3,0	2,0	1,5	9,0
OPS61	Operations	Beneficiation plant recovery is not as expected	x			x		3,0	2,0	1,5	9,0
OPS62	Operations	Mill efficiency affected by geological variability	x			x		3,0	1,5	1,5	6,8
OPS72	Operations	Piping failure from mills to tailings	x			x		1,5	1,5	2,0	4,5
OPS72A	Operations	Other piping failures	x			x		1,5	1,5	1,5	3,4

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Evaluation of the Condensed Risks, Sorted by When the Risk can Occur

ID	*Category*	*Risks*	*When can the Risk Occur?* Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	*FINANCIAL IMPACT* > 50 M$ = 5 pts; 25 to 50 M$ = 4 pts; 10 to 25 M$ = 3 pts; 3 to 10 M$ = 2 pts; < 3 M$ = 1.5 pts	*OCCURING PROBABILITY* >50% = 5 pts; avg 50% = 4 pts; 25 to 50% = 3 pts; 2 to 25% = 2 pts; < 2% = 1.5 pts	*DETECTION FACILITY* very easy = 1.5 pts; easy = 2 pts; moderate = 3 pts; hard = 4 pts; undetectable = 5 pts	*Risk Value*
OPS97	Operations	Tailings dams leaks (minor)	x			x		1,5	2,0	2,0	6,0
OPS97A	Operations	Tailings dams break (major)	x			x		4,0	1,5	2,0	12,0
PE001	People	First Nations experts review the ESIA report	x					1,5	1,5	1,5	3,4
PE004	People	Departure (loss) of key Matamec people during project preparation	x	x				1,5	2,0	3,0	9,0
PE007	People	First Nation socio-economic and land use assessment	x	x				2,0	2,0	2,0	8,0
PE010	People	Negotiation with local First Nations	x	x	x			2,0	2,0	3,0	12,0
PE014	People	Bad Perception of the community concerning Uranium/Thorium	x	x	x			1,5	2,0	2,0	6,0
PE016	People	Project to be rejected by local communities	x	x	x			3,0	1,5	2,0	9,0
PE018	People	Public pressure to have "Gold-Plated" waste management	x	x				2,0	2,0	2,0	8,0
POL01	Political	Increase in municipal taxation	x	x	x	x		1,5	1,5	1,5	3,4
POL02	Political	Changes in laws (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0
POL04	Political	Election in the First Nations communities	x	x	x			2,0	1,5	3,0	9,0
REG01	Regulations	Changes in regulations (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0

Evaluation of the Condensed Risks, Sorted by When the Risk can Occur

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ALL03	Multiple Origins	Location of infrastructures and facilities including hydromet plant apart from beneficiation plant or not.	x	x				4,0	2,0	1,5	12,0
COM02	Commercial	Change in final product specification (quality)	x	x	x	x		2,0	1,5	2,0	6,0
COM07	Commercial	Matamec - TRECan (Toyota Rare Earth Canada) partnership broken and no off-take agreement with Toyota Tsusho before construction	x	x				3,0	3,0	2,0	18,0
COM07A	Commercial	Partner takes only select REEs (-)	x	x		x		3,0	2,0	2,0	12,0
COM07B	Commercial	Partner takes only select REEs and Matamec invests to further separate the REEs		x		x		4,0	2,0	2,0	16,0
COM09	Commercial	Substitutes to replace REE for magnets and other products during the life of mine	x	x	x	x		4,0	2,0	2,0	16,0
COM10	Commercial	Market is taken by other producers before start-up	x	x	x			5,0	3,0	2,0	30,0
COMM01	Communication	Social non-acceptability in regard of radioactivity	x	x				3,0	2,0	2,0	12,0
COMM02	Communication	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	x	x	x	x	x	3,0	3,0	3,0	27,0
COMM04	Communication	Focus on opponents and neglect the favourable stakeholders	x	x				1,5	1,5	2,0	4,5
COMM05	Communication	Interpretation of technical information/data/documents distributed to all stakeholders	x	x				3,0	2,0	3,0	18,0
COMM07	Communication	Bad media coverage before construction	x	x				3,0	3,0	3,0	27,0
FIN01	Financial	Project Financing - availability of investors (other than offtaker)	x	x				3,0	3,0	2,0	18,0
FIN02	Financial	Changes in capital allowances	x	x	x			2,0	2,0	4,0	16,0
FIN09	Financial	Over evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN09A	Financial	Under evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN11	Financial	Project financing delayed by 2 years	x	x				3,0	3,0	3,0	27,0
LEG01	Legal	Delay in signature of Impact and Benefit Agreement with First Nations	x	x				2,0	2,0	2,0	8,0
OPS35	Operations	Delay to obtain permits	x	x	x			2,0	1,5	2,0	6,0
OPS44	Operations	Ore silica content variations might cause gypsum filtration problems (Process)	x	x	x	x		2,0	1,5	2,0	6,0
PEO04	People	Departure (loss) of key Matamec people during project preparation	x	x				1,5	2,0	3,0	9,0
PEO07	People	First Nation socio-economic and land use assessment	x	x				2,0	2,0	2,0	8,0
PEO10	People	Negotiation with local First Nations	x	x	x			2,0	2,0	3,0	12,0
PEO14	People	Bad Perception of the community concerning Uranium/Thorium	x	x	x			1,5	2,0	2,0	6,0
PEO16	People	Project to be rejected by local communities	x	x	x			3,0	1,5	2,0	9,0
PEO18	People	Public pressure to have "Gold-Plated" waste management	x	x				2,0	2,0	2,0	8,0
POL01	Political	Increase in municipal taxation	x	x	x	x		1,5	1,5	1,5	3,4
POL02	Political	Changes in laws (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0
POL04	Political	Election in the First Nations communities	x	x	x			2,0	1,5	3,0	9,0
REG01	Regulations	Changes in regulations (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0

Evaluation of the Condensed Risks, Sorted by When the Risk can Occur

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts; 25 to 50 M$ = 4 pts; 10 to 25 M$ = 3 pts; 3 to 10 M$ = 2 pts; < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts; avg 50% = 4 pts; 25 to 50% = 3 pts; 2 to 25% = 2 pts; < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts; easy = 2 pts; moderate = 3 pts; hard = 4 pts; undetectable = 5 pts	Risk Value
COM02	Commercial	Change in final product specification (quality)	x	x	x	x		2,0	1,5	2,0	6,0
COM09	Commercial	Substitutes to replace REE for magnets and other products during the life of mine	x	x	x	x		4,0	2,0	2,0	16,0
COM10	Commercial	Market is taken by other producers before start-up	x	x	x			5,0	3,0	2,0	30,0
COMM02	Communication	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	x	x	x	x	x	3,0	3,0	3,0	27,0
FIN02	Financial	Changes in capital allowances	x	x	x			2,0	2,0	4,0	16,0
FIN03	Financial	Exchange rate fluctuations	x		x	x		3,0	2,0	3,0	18,0
FIN08	Financial	Matamec bought-out by a rival REE project	x		x	x		1,5	2,0	4,0	12,0
FIN09	Financial	Over evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
FIN09A	Financial	Under evaluation of CAPEX	x	x	x			4,0	2,0	3,0	24,0
OPS03	Operations	Acid/Chemical Spills			x	x		1,5	2,0	4,0	12,0
OPS06	Operations	Loss of electrical power (less than a week)			x	x		2,0	2,0	5,0	20,0
OPS06A	Operations	Availability of electrical power	x		x	x		3,0	2,0	1,5	9,0
OPS102	Operations	Traffic Accident on access road	x		x	x		1,5	2,0	5,0	15,0
OPS111	Operations	All worker injury, fatality or disability			x	x		1,5	3,0	3,0	13,5
OPS112	Operations	Visitor injury, fatality or disability			x	x		1,5	1,5	3,0	6,8
OPS15	Operations	Contamination, Ground water			x	x	x	2,0	1,5	1,5	4,5
OPS16	Operations	Contamination, Radioactivity			x	x	x	3,0	2,0	1,5	9,0
OPS17	Operations	Contamination, Surface water			x	x	x	1,5	1,5	1,5	3,4
OPS21	Operations	Damages to environment due to dust			x	x	x	1,5	1,5	1,5	3,4
OPS22	Operations	Delays in equipment delivery (more than 2 weeks than the anticipated delivery date)			x			2,0	2,0	2,0	8,0
OPS35	Operations	Delay to obtain permits	x	x	x			2,0	1,5	2,0	6,0
OPS37	Operations	Final flowsheet needs major modifications after pilot plant has run	x		x			3,0	2,0	1,5	9,0
OPS38	Operations	Major fire impacting the operation for several weeks (fuel, conveyors, electrical room, ...)			x	x		3,0	1,5	4,0	18,0
OPS40	Operations	Geotechnical evaluation is insufficient; causing improper wall angle	x		x	x		2,0	1,5	2,0	6,0
OPS41	Operations	Grade control process in the mine is insufficient			x	x		2,0	2,0	1,5	6,0
OPS42	Operations	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill	x		x	x		1,5	2,0	1,5	4,5
OPS44	Operations	Ore silica content variations might cause gypsum filtration problems (Process)	x	x	x	x		2,0	1,5	2,0	6,0
PEO02	People	Availability of personnel, skilled people, qualified labor			x	x		2,0	2,0	2,0	8,0
PEO10	People	Negotiation with local First Nations	x	x	x			2,0	2,0	3,0	12,0
PEO14	People	Bad Perception of the community concerning Uranium/Thorium	x	x	x			1,5	2,0	2,0	6,0
PEO16	People	Project to be rejected by local communities	x	x	x			3,0	1,5	2,0	9,0
POL01	Political	Increase in municipal taxation	x	x	x	x		1,5	1,5	1,5	3,4
POL02	Political	Changes in laws (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0
POL04	Political	Election in the First Nations communities	x	x	x			2,0	1,5	3,0	9,0
REG01	Regulations	Changes in regulations (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0

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Evaluation of the Condensed Risks, Sorted by When the Risk can Occur

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts; 25 to 50 M$ = 4 pts; 10 to 25 M$ = 3 pts; 3 to 10 M$ = 2 pts; < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts; avg 50% = 4 pts; 25 to 50% = 3 pts; 2 to 25% = 2 pts; < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts; easy = 2 pts; moderate = 3 pts; hard = 4 pts; undetectable = 5 pts	Risk Value
COM01	Commercial	Major decrease in demand of final product in the long term (quantity) (REE)				x		5,0	2,0	3,0	30,0
COM01A	Commercial	Major increase in demand of final product in the long term (quantity) (REE)				x		5,0	3,0	3,0	45,0
COM01B	Commercial	Increase in the global supply of the final product in the long term (quantity) (REE)				x		3,0	3,0	2,0	18,0
COM02	Commercial	Change in final product specification (quality)	x	x	x	x		2,0	1,5	2,0	6,0
COM07A	Commercial	Partner takes only select REEs (-)	x	x		x		3,0	2,0	2,0	12,0
COM07B	Commercial	Partner takes only select REEs and Matamec invests to further separate the REEs		x		x		4,0	2,0	2,0	16,0
COM09	Commercial	Substitutes to replace REE for magnets and other products during the life of mine	x	x	x	x		4,0	2,0	2,0	16,0
COMM02	Communication	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	x	x	x	x	x	3,0	3,0	3,0	27,0
FIN03	Financial	Exchange rate fluctuations	x		x	x		3,0	2,0	3,0	18,0
FIN08	Financial	Matamec bought-out by a rival REE project	x		x	x		1,5	2,0	4,0	12,0
FIN10	Financial	Over evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
FIN10A	Financial	Under evaluation of OPEX	x			x		2,0	2,0	3,0	12,0
OPS03	Operations	Acid/Chemical Spills			x	x		1,5	2,0	4,0	12,0
OPS06	Operations	Loss of electrical power (less than a week)			x	x		2,0	2,0	5,0	20,0
OPS06A	Operations	Availability of electrical power	x		x	x		3,0	2,0	1,5	9,0
OPS102	Operations	Traffic Accident on access road	x		x	x		1,5	2,0	5,0	15,0
OPS111	Operations	All worker injury, fatality or disability			x	x		1,5	3,0	3,0	13,5
OPS112	Operations	Visitor injury, fatality or disability			x	x		1,5	1,5	3,0	6,8
OPS15	Operations	Contamination, Ground water			x	x	x	2,0	1,5	1,5	4,5
OPS16	Operations	Contamination, Radioactivity			x	x	x	3,0	2,0	1,5	9,0
OPS17	Operations	Contamination, Surface water			x	x	x	1,5	1,5	1,5	3,4
OPS21	Operations	Damages to environment due to dust			x	x	x	1,5	1,5	1,5	3,4
OPS33	Operations	Major failure in open pit (wall failure)				x		4,0	1,5	2,0	12,0
OPS38	Operations	Major fire impacting the operation for several weeks (fuel, conveyors, electrical room, ...)			x	x		3,0	1,5	4,0	18,0
OPS39	Operations	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations	x			x	x	3,0	1,5	1,5	6,8
OPS40	Operations	Geotechnical evaluation is insufficient; causing improper wall angle	x		x	x		2,0	1,5	2,0	6,0
OPS41	Operations	Grade control process in the mine is insufficient			x	x		2,0	2,0	1,5	6,0
OPS42	Operations	Grinding index is not properly defined for fine material (less than 100um) which could affect the size of the regrind mill	x		x	x		1,5	2,0	1,5	4,5
OPS44	Operations	Ore silica content variations might cause gypsum filtration problems (Process)	x	x	x	x		2,0	1,5	2,0	6,0
OPS46	Operations	Head grade variation which can cause ore recovery variation				x		1,5	2,0	2,0	6,0
OPS48	Operations	High amount of fines generated from grinding which can cause higher mass recovery than expected in the beneficiation process	x			x		2,0	1,5	1,5	4,5
OPS49	Operations	High radionuclide emission at the waste rock dump	x			x	x	3,0	1,5	2,0	9,0
OPS50	Operations	Higher radioactivity in the process plant tailings than anticipated	x			x		3,0	1,5	2,0	9,0
OPS60	Operations	Hydrometallurgical plant recovery lower than expected	x			x		3,0	2,0	1,5	9,0
OPS61	Operations	Beneficiation plant recovery is not as expected	x			x		3,0	2,0	1,5	9,0
OPS62	Operations	Mill efficiency affected by geological variability	x			x		3,0	1,5	1,5	6,8
OPS69	Operations	Ore reserve calculation (ore tonnage and/or grade are lower than expected)				x		4,0	1,5	1,5	9,0
OPS72	Operations	Piping failure from mills to tailings	x			x		1,5	1,5	2,0	4,5
OPS72A	Operations	Other piping failures	x			x		1,5	1,5	1,5	3,4
OPS97	Operations	Tailings dams leaks (minor)	x			x		1,5	2,0	2,0	6,0
OPS97A	Operations	Tailings dams break (major)	x			x		4,0	1,5	2,0	12,0

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PEO02	People	Availability of personnel, skilled people, qualified labor			x	x		2,0	2,0	2,0	8,0
POL01	Political	Increase in municipal taxation	x	x	x	x		1,5	1,5	1,5	3,4
POL02	Political	Changes in laws (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0
REG01	Regulations	Changes in regulations (mining, environmental, etc.)	x	x	x	x		2,0	3,0	1,5	9,0

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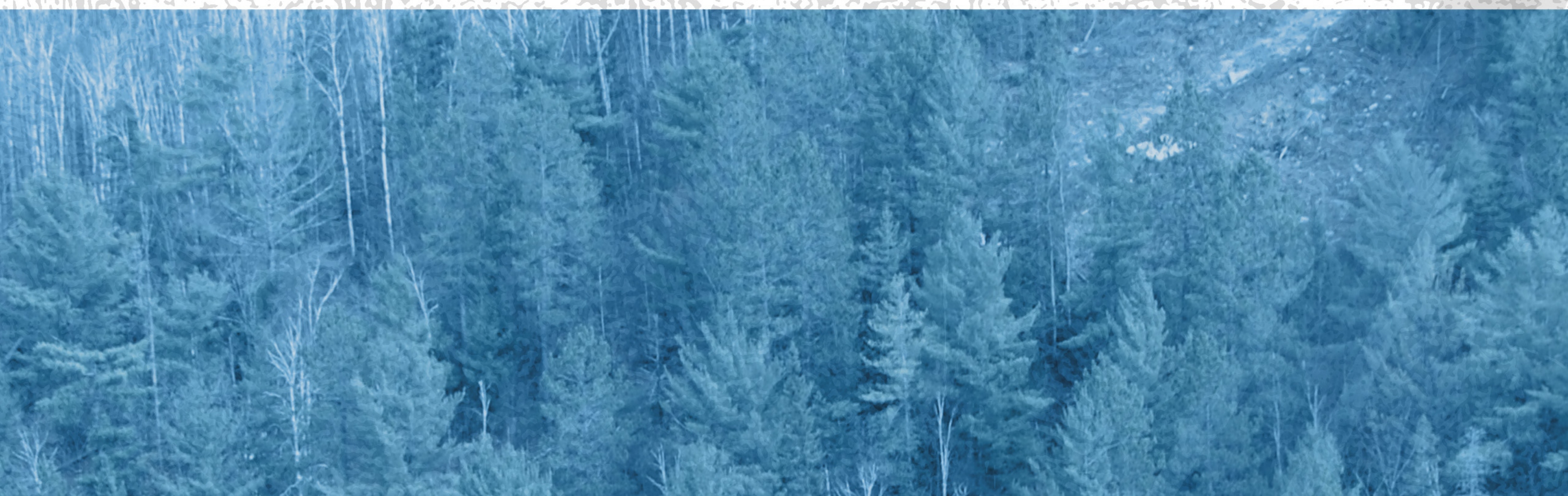
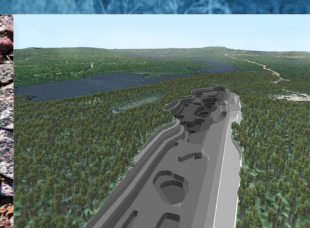
Evaluation of the Condensed Risks, Sorted by When the Risk can Occur

ID	Category	Risks	When can the Risk Occur? Before end of the feasibility study	Engineering and permitting period	Engineering Procurement Construction	During Mine Operation	Mine Closure and Thereafter	FINANCIAL IMPACT > 50 M$ = 5 pts 25 to 50 M$ = 4 pts 10 to 25 M$ = 3 pts 3 to 10 M$ = 2 pts < 3 M$ = 1.5 pts	OCCURING PROBABILITY >50% = 5 pts avg 50% = 4 pts 25 to 50% = 3 pts 2 to 25% = 2 pts < 2% = 1.5 pts	DETECTION FACILITY very easy = 1.5 pts easy = 2 pts moderate = 3 pts hard = 4 pts undetectable = 5 pts	Risk Value
COMM02	Communication	Conflict between stakeholders (communities, First Nations, shareholder, ZEC) and promoter (Matamec)	x	x	x	x	x	3,0	3,0	3,0	27,0
OPS15	Operations	Contamination, Ground water			x	x	x	2,0	1,5	1,5	4,5
OPS16	Operations	Contamination, Radioactivity			x	x	x	3,0	2,0	1,5	9,0
OPS17	Operations	Contamination, Surface water			x	x	x	1,5	1,5	1,5	3,4
OPS21	Operations	Damages to environment due to dust			x	x	x	1,5	1,5	1,5	3,4
OPS39	Operations	Waste rock and tailings geochemical conditions different than expected which brings unexpected contaminations	x			x	x	3,0	1,5	1,5	6,8
OPS49	Operations	High radionuclide emission at the waste rock dump	x			x	x	3,0	1,5	2,0	9,0
OPS58	Operations	Long term legacies after closure	x				x	3,0	1,5	1,5	6,8

List of Mitigation Actions for the Eight (8) Risks to be Managed "Now"

Risks		***Mitigation Actions***
HIGH PRIORITY RISKS		
COM03	Change in final product value not as expected for the life of mine in feasibility evaluation ($$)	Have Matamec management do the following: 1. Work with well-recognized firms in order to obtain best possible projections of REE prices 2. Verify REE price predictions with client(s) on a continual basis 3. Stay fully informed of changes in the metal market by every available means
COM10	Market is taken by other producers before start-up	Avoid delay in Project by having Matamec management do the following: 1. Develop financing and commercial agreements with TRECAN 2. Develop continuous relationships with other potential investors 3. Keep constant good relationships with local communities 4. Continuously inform all level of governmental authorities about the Kipawa Project 5. Finalize permit applications and maintain constant follow ups with government authorities
COMM02	Conflict between stakeholders (communities, First Nations, ZEC) and promoter (Matamec)	Have Matamec management and representatives do the following: 1. Keep constant presence locally to inform citizens about the Project and about new important developments that can impact them, and to be informed about and to feel the reactions to the Project 2. Maintain constant negotiations with First Nations representatives in order to finalize appropriate agreements regarding progress of the Project 3. Participate in and initiate as much as possible educational and awareness activities regarding environmental issues and management 4. Whenever feasible, take local representatives to visit similar operations in order to better understand the nature of the Project
FIN11	Project financing delayed by 2 years	Have Matamec management do the following: 1. Work intensively on the completion of the offtake agreement with client(s) 2. Finalize the documentation for permit applications until November 2013 3. Communicate continuously with local communities
IMPORTANT RISKS		
COM01	Major decrease in demand of final product in the long term (quantity) (REE)	Have Matamec management do the following: 1. Negotiate offtake agreement with client(s) including clauses that protects Matamec for a number of years against potential drops in demand of REE 2. Stay aware of technological developments that can impact the demand of final product 3. Keep contacts with potential new clients 4. Optimize operating cost with talented key people recruited to lead the operation 5. Demonstrate that REE mining can be as clean as any other responsible mining operation 6. Develop a first class health and safety programs for the people working on site and for the population 7. Develop first class environmental controls that will minimize any impact on workers, population, and environment 8. Establish a sound communication program for people working on site and for the population in order to inform them and raise their awareness concerning the nature of a mining operation in 2015
LOW PRIORITY RISKS		
FIN09A	Under evaluation of CAPEX	Have Matamec management do the following: 1. Finalize agreement with major equipment suppliers as soon as possible and before March 2014, with a letter of intent signed by both parties 2. Increase geotechnical field investigation in order to secure concepts and costs related to civil works, to be done by the engineering firm that will perform the detailed engineering studies (May or June 2014)
OPS50	Higher radioactivity in the process plant tailings than anticipated	Have Matamec management do the following: 1. Perform all proper characterization test work on the process plant tailings 2. Establish a double check program on the primary test work and on the sampling method to confirm first results showing a very low level of radioactivity and a low difficulty of managing it 3. Hire a specialist in radioactivity to analyse the test work results and compare them to other mining operations which deal with radioactive elements 4. Establish proper radioactivity management with a specialist
PEO14	Bad Perception of the community concerning Uranium/Thorium	Have Matamec management do the following: 1. Finalize studies regarding U/Th in order to obtain real analysis result numbers 2. Communicate to the citizen with the right pedagogy the information regarding U/Th final analysis results, assuring their proper understanding of the low or non-existing radioactivity contamination risk (since it is a rare earth project, not an Uranium project) 3. Assign a communication firm to establish a communication program, test it with a pilot group, and then disseminate it





APPENDIX 8- CAPEX

ROCHE GENIVAR SGS Golder Associates

ROCHE GENIVAR | SUMMARY CAPEX | MATAMEC

KIPAWA REE PROJECT - FEASIBILITY STUDY

REV. 0G

DESCRIPTION	MATERIAL Total Cost	EQUIPEMENT Total Cost	INSTALLATION / Labor Total Cost	TOTAL CDN$
TOTAL DIRECT + INDIRECT COSTS & CONTINGENCY				374,382,075 $
TOTAL DIRECT COSTS	127,941,227	84,782,356	45,269,147	257,992,730 $
SUB-PROJECT 11 - OFF-SITE INSTALLATIONS (5KM RADIUS OF TEMISCAMING)	9,057,358	0	705,442	9,762,799 $
AREA 210 - MAIN SUB-STATION (Temiscaming - 120kV)	2,885,637	0	688,362	3,573,998
AREA 215 - HYDRO-QUEBEC 2KM 120 kV POWER LINE	5,540,000	0	0	5,540,000
AREA 305 - PARKING AT TEMISCAMING	631,721	0	17,080	648,801
SUB-PROJECT 10 - MINE SITE (KIPAWA)	25,171,176	14,861,567	1,889,687	41,922,429
AREA 110 - MINING EQUIPMENT	0	13,379,394	139,690	13,519,084
AREA 115 - MINE ROADS	412,975	0	0	412,975
AREA 120 - MINE DEWATERING	20,000	34,800	17,080	71,880
AREA 130 - MINE PRE-PRODUCTION	10,117,634	0	0	10,117,634
AREA 150 - MINE EXPLOSIVE STORAGE	137,939	0	42,376	180,315
AREA 170 - MINE ELECTRICAL DISTRIBUTION & LIGHTING (Incl in Area 330)	N/A	N/A	N/A	N/A
AREA 180 - MINE COMMUNICATIONS HARDWARE & SOFTWARE (Incl in Area 225 and 330)	N/A	N/A	N/A	N/A
AREA 235 - SECONDARY SUB-STATION (Mine Site) (Included in Area 330)	N/A	N/A	N/A	N/A
AREA 310 - ACCESS ROADS (Mine Maintenance Shop - Plant Site)	9,709,458	0	20,289	9,729,747
AREA 330 - MINE MAINTENANCE SHOP (Garage)	4,680,854	1,272,373	1,588,683	7,541,910
AREA 334 - MINE SITE FUEL STORAGE	92,317	175,000	81,569	348,886
SUB-PROJECT 14 - INTER-SITE SERVICES	12,357,592	0	994,757	13,352,349
AREA 220 - POWER LINES (between Sub-Station 120kV and Plant Site)	9,457,278	0	0	9,457,278
AREA 225 - COMMUNICATIONS	647,450	0	994,757	1,642,207
AREA 310 - ACCESS ROAD (From Maniwaki Road To Plant Site)	2,252,864	0	0	2,252,864

DESCRIPTION	MATERIAL Total Cost	EQUIPEMENT Total Cost	INSTALLATION / Labor Total Cost	TOTAL CDN$
SUB-PROJECT 18 - HYDROMET PLANT SITE	**81,355,102**	**69,920,789**	**41,679,261**	**192,955,152**
AREA 230 - MAIN SUB-STATION (Hydromet Site)	4,500,367	0	1,397,995	5,898,361
AREA 250 - SITE POWER DISTRIBUTION (Included in Area 230)	N/A	N/A	N/A	N/A
AREA 310 - ACCESS ROAD (Crusher access Road)	152,089	0	0	152,089
AREA 320 - GENERAL PLANT SITE PREPARATION	5,888,144	0	45,860	5,934,004
AREA 336 - PLANT SITE FUEL STORAGE	61,362	156,000	69,552	286,914
AREA 340 - ADMINISTRATION & SERVICE BUILDING	3,128,139	0	421,258	3,549,397
AREA 342 - PLANT SITE WAREHOUSE	836,878	0	486,900	1,323,778
AREA 344 - ASSAY LABORATORY	1,260,802	1,906,119	774,836	3,941,757
AREA 346 - GUARD HOUSE (Included in Area 340)	N/A	N/A	N/A	N/A
AREA 348 - SURFACE SUPPORT MOBILE EQUIPMENT	0	876,000	0	876,000
AREA 350 - REAGENT STORAGE (Cold Storage)	576,222	0	244,887	821,108
AREA 362 - POTABLE WATER TREATMENT & DISTRIBUTION (Included with Area 320)	N/A	N/A	N/A	N/A
AREA 366 - SEWAGE TREATMENT SYSTEM & DIST. (Included with Area 320)	N/A	N/A	N/A	N/A
AREA 390 - SITE FIRE PROTECTION - PUMPING STATION & PIPELINE LOOPS	488,450	0	0	488,450
AREA 510 - CRUSHING	3,317,853	3,733,495	2,359,503	9,410,851
AREA 515 - ORE STORAGE	1,325,994	1,956,160	1,509,453	4,791,607
AREA 520 - GRINDING	30,000	3,556,314	1,006,256	4,592,570
AREA 525 - MAGNETIC SEPARATION	23,000	5,275,869	1,226,100	6,524,969
AREA 530 - MAGNETIC SEPARATION CONCENTRATE REGRIND	25,000	2,211,500	796,660	3,033,160
AREA 535 - MAGNETIC SEPARATION CONCENTRATE DEWATERING	0	873,529	373,320	1,246,849
AREA 540 - MAIN BUILDING PROCESS PLANT	30,520,871	1,392,342	16,477,312	48,390,525
AREA 550 - MAGNETIC SEPARATION TAILINGS DEWATERING	0	3,136,828	959,896	4,096,724
AREA 552 - ACID LEACHING	0	1,832,034	1,061,400	2,893,434
AREA 554 - AL TAILINGS DEWATERING	0	10,570,023	1,906,860	12,476,883
AREA 556 - PRE-NEUTRALIZATION	0	2,342,460	973,560	3,316,020
AREA 558 - PN RE-LEACH	0	4,299,916	400,160	4,700,076
AREA 560 - IMPURITIES REMOVAL	0	2,034,316	439,200	2,473,516
AREA 562 - RARE EARTH PRECIPITATION	0	519,934	204,960	724,894

DESCRIPTION	MATERIAL Total Cost	EQUIPEMENT Total Cost	INSTALLATION / Labor Total Cost	TOTAL CDN$
AREA 564 - REP RE-LEACH	0	5,081,855	818,620	5,900,475
AREA 566 - PRECIPITATE DEWATERING & LOADOUT	0	2,834,046	763,720	3,597,766
AREA 568 - FINAL TAILING NEUTRALISATION	0	498,067	224,480	722,547
AREA 570 - PROCESS & FRESH WATER DISTRIBUTION	100,066	1,218,969	739,457	2,058,492
AREA 572 - REAGENT PREPARATION & DISTRIBUTION	0	6,262,808	610,000	6,872,808
AREA 574 - COMPRESSORS ROOM & AIR DITRIBUTION	30,849	982,500	94,184	1,107,533
AREA 576 - PRIMARY ELECTRICAL ROOM	1,737,755	0	696,461	2,434,216
AREA 577 - SECONDARY ELECTRICAL ROOM	2,710,562	0	857,501	3,568,063
AREA 580 - MILL CONTROL SYSTEM (hardware, software & programming)	0	0	0	0
AREA 590 - PLANT METALLURGICAL LABORATORY (architectural, equipment & furniture)	80,000	100,000	109,800	289,800
AREA 592 - PLANT OFFICES (finish, electrical & furniture) (Included in Area 540)	N/A	N/A	N/A	N/A
AREA 594 - PLANT WAREHOUSE / SHOP (Included in Area 540)	N/A	N/A	N/A	N/A
AREA 598 - PLANT TOOLS, MOBILE EQUIPMENTS & VEHICULES	0	1,981,355	3,660	1,985,015
AREA 805 - FRESH WATER PUMPING STATION and PIPELINE	2,604,924	1,165,000	1,015,900	4,785,824
AREA 810 - TAILINGS MANAGEMENT FACILITIES	18,174,013	469,350	759,664	19,403,027
AREA 820 - TAILING PIPELINE	1,808,055	0	215,940	2,023,995
AREA 830 - RECLAIM PUMPING STATION & PIPELINE	573,707	854,000	535,946	1,963,653
AREA 850 - MEASURING STATION (not required if we have effluent treatment plant)	N/A	N/A	N/A	N/A
AREA 860 - EFFLUENT WATER TREATMENT	1,400,000	1,800,000	1,098,000	4,298,000
TOTAL INDIRECT COSTS & CONTINGENCY	**18,746,000**	**1,950,000**	**46,860,900**	**116,389,345**
AREA 910 - CONSTRUCTION INDIRECTS	17,246,000	450,000	35,420,900	53,116,900
AREA 945 - CONSTRUCTION CONTINGENCY (15% of Direct Costs & Construction Indirect Costs)	0	0	0	46,666,445
AREA 950 - OWNER'S COSTS	1,500,000	1,500,000	11,440,000	14,440,000
AREA 995 - OWNER'S COST CONTINGENCY (15% of Owner's Costs)	0	0	0	2,166,000

Matamec Explorations Inc.

KIPAWA PROJECT
Temiscaming

CODIFICATION
and
PROJECT STRUCTURE

COST CODING CHART

Revision 06
For Feasibility Study
AUGUST 14th, 2013

Project Codification Example

Codification will be done by digits numbers :

Sub-Project	Area	Activities	Sequential
aa-	bbb-	cccc-	dd

Example according to the Cost Coding Chart listed in this document:

Mine Site - Definition drilling:	10-030-0010-01
Hydromet Site - Leach tank #1	18-552-5605-01
Hydromet Site - Regrind Mill	18-550-5212-01
Mine Site Access Roads - cut & fill	10-310-1021-01
Inter site - Road - cut & fill	14-310-1021-01

PROJECTS and SUB-PROJECTS

Sub-Project ID	**Description**

0 1	**Feasibility Study Kipawa Project**

10 to 99	**PROJECTS**
1 0	Mine Site
1 1	Off-site installations (5km radius of Temiscaming)
1 4	Inter- sites Services (power line, optic fiber…)
1 8	Hydromet Plant Site

AREAS

AREA	Description

001 to 099	GEOLOGY
0 2 0	Exploration Drilling
0 3 0	Definition Drilling
0 3 6	Resources Calculation
0 3 7	Reserves Calculation

100 to 199	MINING
1 1 0	Mining Equipment
1 1 5	Mine Roads and Crusher Access Ramp
1 2 0	Mine Dewatering
1 3 0	Mine Pre-Production
1 5 0	Mine Explosives Storages
1 6 0	Mine Other Auxiliaries
1 7 0	Mine Electrical Dist. and Lighting
1 8 0	Mine Communications Hardware and Software
1 9 2	Mining Planning and Scheduling

200 to 299	Main Electrical Dist. & Communications
2 1 0	Main substation (Temiscaming - 120kV)
2 1 5	Hydro Quebec 2km 120kV Power line
2 2 0	Power line (between Temiscaming 120kV and Plant site)
2 2 5	Communications (between Temiscaming and Plant site)
2 2 7	Cell communications infrastructures
2 3 0	Main substation (Hydromet site)
2 3 5	Secondary substation (Mine site)
2 5 0	Site power distribution

AREAS

AREA	Description
300 to 399	**Infrastructures**
3 0 5	Parking at Temiscaming
3 1 0	Access Roads
3 2 0	General Plant Site (pads, yards, site roads, fences & others)
3 3 0	Mine Maintenance Shop
3 3 4	Mine site - Fuel Storage
3 3 6	Plant site - Fuel Storage
3 4 0	Administration and Service building (include dry)
3 4 2	Plant site Warehouse
3 4 4	Assay Laboratory
3 4 6	Guard House
3 4 8	Surface support mobile equipment
3 5 0	Reagent Storage (if required)
3 6 2	Potable Water treatment and distribution
3 6 6	Sewage Water treatment and distribution
3 9 0	Site Fire Protection - Pumping Station & Pipeline loops

AREAS

AREA	Description
500 to 599	**Processing Plant**
5 1 0	Crushing
5 1 2	Overland conveyor
5 1 5	Ore Storage
5 2 0	Grinding
5 2 5	Magnetic Separation
5 3 0	Concentrate regrind
5 3 5	MS Concentrate Dewatering
5 4 0	Main Building Process Plant
5 5 0	MS Rejects dewatering
5 5 2	Acid Leaching
5 5 4	AL Tailings Dewatering
5 5 6	Pre-Neutralization
5 5 8	PN Re-Leach
5 6 0	Impurities Removal
5 6 2	Rare Earth Precipitation
5 6 4	REP Re-Leach
5 6 6	Precipitate Dewatering and Loadout
5 6 8	Final Tailing Neutralisation
5 7 0	Process and Fresh Water Dist.
5 7 2	Reagent Preparation and Distribution
5 7 4	Compressors Room and Air Dist.
5 7 6	Primary Electrical Room
5 7 7	Secondary Electrical Room
5 8 0	Mill Control System (hardware, software and programming)
5 9 0	Plant Metallurgical Laboratory (architectural, equipment & furniture)
5 9 2	Plant Offices (finish, electrical & furniture)
5 9 4	Plant Warehouse / Shop
5 9 8	Plant Tools, Mobile Equipments & Vehicules

AREAS

AREA	Description

800 to 899	Tailings and Water Management
8 0 5	Fresh Water Pumping Station and Pipeline
8 1 0	Tailings Management Facilities
8 2 0	Tailing Pipeline
8 3 0	Reclaim Pumping Station and Pipeline
8 5 0	Mesuring Station (if required)
8 6 0	Effluent Water Treatment (if required)
8 8 0	Site Drainage Pond and diversion ditches

900 to 999	Indirects and Owner's Costs
9 1 0	Construction Indirects
9 4 5	Construction Contingency
9 5 0	Owner's Cost
9 9 5	Owner's Cost Contingency

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
0	**0**	**0**	**0**	***Geology Exploration***
0	0	0	0	***General Geology work - Allowance***
0	**0**	**1**	**0**	**General Drilling**
0	0	1	1	
0	0	1	2	
0	0	1	4	
0	**0**	**9**	**0**	**Bulk Sampling**

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
1	**0**	**0**	**0**	***EARTHWORK***
1	0	0	0	***General Earthwork - Allowance***
1	**0**	**1**	**0**	**General Site Preparation**
1	0	1	1	Site Preparation
1	0	1	2	Clearing and Grubbing
1	0	1	4	Stripping
1	**0**	**2**	**0**	**Excavation**
1	0	2	1	Cut and Fill
1	0	2	2	Excavation - Mass
1	0	2	3	Excavation - Structural
1	0	2	4	Excavation - Trench
1	0	2	5	Drilling and Blasting
1	0	2	6	Rock Excavation
1	0	2	8	Dregging
1	**0**	**3**	**0**	**Backfill**
1	0	3	2	Backfill - Loose
1	0	3	4	Backfill and Compaction - Mass
1	0	3	5	Backfill and Compaction - Structural
1	0	3	6	Backfill - Trench
1	0	3	7	Aggregate
1	0	3	8	Engineered Fill
1	**0**	**4**	**0**	**General Drainage**
1	0	4	2	Drainage Ditch
1	0	4	3	Diversion Ditch
1	0	4	4	Engineered Granular Drain
1	0	4	6	French Drain
1	0	4	7	Culverts
1	0	4	8	Dewatering
1	**0**	**5**	**0**	**Finishing Works**
1	0	5	2	Asphalt
1	0	5	3	Plantation
1	0	5	4	Landscaping
1	0	5	6	Rip-Rap
1	0	5	7	Fencing and Gates
1	0	5	8	Roadsigns and Safety Panels
1	0	5	9	Guard Rails and Protections

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
1	**0**	**0**	**0**	***EARTHWORK*** ***(continous)***
1	**0**	**6**	**0**	**Underground Development**
1	0	6	1	Drift - Drilling and Blasting
1	0	6	2	Drift - Excavation
1	0	6	4	Drift - Support and Stabilization
1	0	6	6	Raise - Drilling and Blasting
1	0	6	7	Raise - Excavation
1	0	6	8	Raise - Support and Stabilization
1	**0**	**7**	**0**	**Specialized Civil and Earthwork**
1	0	7	1	Well Drilling
1	0	7	2	Septic Installation
1	0	7	3	Earthwork Aggregate Preparation
1	0	7	4	Geomembrane
1	0	7	5	Man-Hole and Catch Bassin
1	0	7	6	Rails and Ties
1	0	7	7	Retaining Walls (other than concrete)
1	0	7	8	Slope Stabilization
1	0	7	9	Sheet Piling and Shoring
1	0	8	0	Bridge Work

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
2	**0**	**0**	**0**	***CONCRETE***
2	0	0	0	***General Concrete Work - Allowance***
2	**0**	**1**	**0**	**Concrete preparation**
2	0	1	2	Concrete Batching
2	0	1	4	Concrete Aggregate Preparation
2	**0**	**2**	**0**	**Concrete Foundation**
2	0	2	2	Lean Concrete
2	0	2	3	Concrete Footings
2	0	2	4	Concrete Walls and Curbs
2	0	2	5	Concrete Piers and Columns
2	0	2	6	Concrete Beams
2	**0**	**3**	**0**	**Concrete Slab**
2	0	3	2	Slab on grade
2	0	3	3	Slab on deck
2	0	3	4	Elevated Structural Slab
2	0	3	5	Structural Slab on grade
2	0	3	6	Concrete Sidewalk
2	**0**	**4**	**0**	**Equipment Concrete Bases**
2	0	4	2	Equipment Concrete Bases
2	0	4	4	Equipment Concrete Sub-Bases (radier)
2	**0**	**5**	**0**	**Miscellaneous Concrete**
2	0	5	2	Open Concrete Channel
2	0	5	4	Baden
2	0	5	6	Concrete Protection - Buried Services
2	**0**	**7**	**0**	**Concrete Work Accessories**
2	0	7	2	Embedded Steel and Rebars
2	0	7	3	Anchors Bolts
2	0	7	5	Control Joints
2	0	7	6	Concrete Surface Traitment
2	0	7	7	Weather Protection
2	**0**	**9**	**0**	**Specialized Concrete Work**
2	0	9	1	Concrete Injection
2	0	9	2	Grouting
2	0	9	3	Concrete Demolition and Cutting
2	0	9	4	Shortcrete
2	0	9	6	Prefab Concrete
2	0	9	8	Piling

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
3	**0**	**0**	**0**	***STRUCTURE***
3	0	0	0	***General Structural Work - Allowance***
3	**0**	**1**	**0**	**Structure - Main Frame**
3	0	1	1	Steel Structure - Main Frame
3	0	1	2	Wood Structure - Main Frame
3	0	1	3	Power Line Steel Structure
3	0	1	4	Power Line Wood Structure
3	0	1	9	Structure - Grouting
3	**0**	**2**	**0**	**Secondary Structure**
3	0	2	1	Secondary Steel Structure
3	0	2	2	Grating
3	0	2	4	Checkered Plate
3	0	2	6	Decking
3	**0**	**3**	**0**	**Structure - Equipment**
3	0	3	2	Structure - Equipment Support
3	0	3	4	Access Platform
3	0	3	6	Equipment Auxillary
3	**0**	**4**	**0**	**Pre-Fab Building**
3	0	4	2	Pre-Assembled Building
3	0	4	4	Foldaway
3	0	4	6	Tubular Structure and Canvas Building
3	**0**	**5**	**0**	**Structure Painting and Coating**
3	0	5	2	Structure Special Protection Coating
3	**0**	**6**	**0**	**Dismantling - Structure**
3	0	6	1	Dismantling - Steel Structure
3	0	6	2	Dismantling - Wood Structure
3	**0**	**9**	**0**	**Miscellaneous Structure**
3	0	9	1	Miscellaneous Steel
3	0	9	2	Handrails
3	0	9	4	Stairs
3	0	9	6	Multi-Plates
3	0	9	7	Ladders
3	0	9	8	Guard Rail and Other Safety Element
3	0	9	9	Bollard

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
4	**0**	**0**	**0**	***ARCHITECTURE***
4	0	0	0	***General Architecture - Allowance***
4	**0**	**1**	**0**	**Exterior Shell**
4	0	1	1	Roofing
4	0	1	2	Cladding
4	0	1	6	Thermal Insulation
4	**0**	**2**	**0**	**Doors & Windows**
4	0	2	1	Doors, Frames & Hardware
4	0	2	2	Windows & Hardware
4	0	2	6	Overhead Doors
4	0	2	7	Rolling Doors
4	0	2	8	Sliding Doors
4	0	2	9	Industrial Doors
4	**0**	**3**	**0**	**Floor Finishes**
4	0	3	1	Floor - Painting & Coating
4	0	3	2	Floor - Ceramic Tiles
4	0	3	3	Floor - Tiles & Covering
4	0	3	4	Floor - Carpet
4	0	3	8	Special Floor
4	**0**	**4**	**0**	**Walls**
4	0	4	1	Concrete Blocks Walls
4	0	4	2	Dry Wall - Partitions
4	0	4	7	Walls - Painting & Coating
4	0	4	8	Ceramic Tile Finishes - Walls
4	0	4	9	Other Specialized Wall Finishes
4	**0**	**5**	**0**	**Ceiling Finishes**
4	0	5	1	Dry Wall Ceiling
4	0	5	2	Suspended Ceiling
4	0	5	7	Ceiling Painting & Coating
4	0	5	9	Special Ceiling
4	**0**	**6**	**0**	**Furniture**
4	0	6	1	Office Furniture
4	0	6	2	Locker & Basket
4	0	6	3	Bedroom Furniture
4	0	6	4	Kitchen Furniture
4	0	6	5	Lab Counters & Accessories
4	0	6	6	Rec-Hall Furniture
4	0	6	8	Shelving & Racking
4	0	6	9	Other Specialized Furniture

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
4	**0**	**0**	**0**	***ARCHITECTURE*** ***(continous)***
4	**0**	**9**	**0**	**Architectural Specialities**
4	0	9	1	Others Architectural Specialities
4	0	9	2	Architectural Concrete Blocks
4	0	9	3	Washroom Accessories
4	0	9	4	Washroom Partitions & Hardware
4	0	9	5	Loovers
4	0	9	8	Gutters

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
5	**0**	**0**	**0**	***MECHANICAL***
5	0	0	0	**Mechanical Equipment**
5	**0**	**0**	**1**	**Mining Equipment**
5	0	0	2	Drills
5	0	0	3	Shovels
5	0	0	4	Backhoes
5	0	0	5	Loaders
5	0	0	6	Mining Trucks
5	0	0	7	Wheel Dozers
5	0	0	8	Track Dozers
5	0	0	9	Graders
5	0	1	2	Compactors
5	0	1	6	Cranes
5	0	1	8	Forklifts
5	0	2	0	Trucks - General
5	0	2	2	Cable Reels Trucks
5	0	2	4	Fuel Trucks
5	0	2	6	Lube Trucks
5	0	2	8	Maintenance Trucks
5	0	3	2	Low Bed Trucks (or Tractor c/w Low Bed)
5	0	3	4	Pick-up Trucks
5	0	3	6	Powerline Service Trucks
5	0	3	7	Fire Trucks
5	0	3	8	4WD Ambulances
5	0	3	9	Bus
5	0	4	0	Mobile Welding Machines
5	0	4	2	Mobile Compressors
5	0	4	4	Diesel Portable Pumps
5	0	5	0	Lighting Towers
5	0	6	0	Snow Blower
5	0	6	2	Snow Plows
5	0	9	0	Misc.

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
5	**0**	**0**	**0**	***MECHANICAL*** ***(continous)***
5	**1**	**0**	**0**	**Conveying & Hoisting Equipment**
5	1	0	1	Belt Conveyors / Convoyeur à courroie
5	1	0	5	Belt Trippers / Tendeur de courroie
5	1	1	5	Belt Scales / Balance de courroie
5	1	2	0	Screw Conveyors / Convoyeur à vis
5	1	2	5	Slat Conveyors / Convoyeur à lattes
5	1	3	0	Portables Conveyors / Convoyeur mobile
5	1	3	2	Beltwall Convoyors
5	1	3	5	Gravity Conveyors
5	1	4	0	Tube Conveyors
5	1	4	2	Pneumatic Conveyors
5	1	4	5	Vibrating Feeders
5	1	4	8	Belts Feeders
5	1	5	0	Vibrating Devices (like vibrating cones)
5	1	5	5	Magnets / Electro-aimants
5	1	6	0	Metal Detectors / Detecteur de metal
5	1	6	5	Bucket Elevators / élévateur à godet
5	1	7	0	Stacker Reclaimer / Empileur
5	1	7	5	Palletizer
5	1	8	0	Cranes / Pont roulant, grue roulante
5	1	8	5	Hoist / Treuil, palan
5	**2**	**0**	**0**	**Process Equipment**
5	2	0	2	Grizzlies / Grille (barreaux)
5	2	0	4	Rock Breakers & Lifters
5	2	0	5	Crushers / Concasseurs
5	2	0	6	Crushers auxiliaries equipment (like lube system)
5	2	0	8	SAG Mills / Broyeurs SAG
5	2	0	9	SAG Mills Auxiliaries (clutch, pinion, lub unit, liners, trommel...)
5	2	1	0	Rod Mills
5	2	1	1	Rod Mills Auxiliaries (clutch, pinion, lub unit, liners, trommel...)
5	2	1	2	Ball Mills
5	2	1	3	Ball Mills Auxiliaries (clutch, pinion, lub unit, liners, trommel...)
5	2	1	4	Vertical Mills
5	2	1	5	Vertical Mills Auxiliaries (clutch, pinion, lub unit, liners, trommel...)
5	2	1	6	Liner Handler
5	2	1	8	Rod Charger / Chargeur à barres

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
5	**0**	**0**	**0**	***MECHANICAL (continous)***
5	2	1	9	Static screen / Tamis statique
5	2	2	0	Vibrating Screens / Tamis Vibrants
5	2	2	1	Rotating screen / tamis cylindrique
5	2	2	4	Cyclones / Cyclone, Hydrocyclone
5	2	2	6	Classifiers / Classificateur
5	2	2	8	Cones (separators or classifier) /Cone séparateur ou classificateur
5	2	3	0	Classifiers spirals (Humphrey) / Classificateur à spirales
5	2	3	2	Magnetic Separator / Séparateur magnétique
5	2	3	4	Pneumatic Separator / Séparateur pneumatique
5	2	3	6	Fluid Separator
5	2	3	8	Conditioners
5	2	4	0	Flottation Cells & Columns (Roughers)
5	2	4	2	Flottation Cells & Columns - 1st Cleaners
5	2	4	4	Flottation Cells & Columns - 2nd Cleaners
5	2	4	6	Flottation Cells & Columns - 3rd Cleaners
5	2	4	8	Scavengers
5	2	5	2	Educators & Dispensers / Alimentateur doseur
5	2	5	4	Sampling Devices / Échantillioneur
5	2	5	6	Agitators & Mixers / Agitateurs
5	2	5	8	Lime Slacker / Délayeur à chaux
5	2	6	0	Flocculant Mixers / Mélangeur à floculant
5	2	6	2	Thickener / Épassisseur
5	2	6	4	Thickener méchanism / Mécanisme d'épaississeur
5	2	6	6	Clarifier Mechanism
5	2	6	8	Disc filter / Filitre à disque
5	2	7	0	Filter Press / Filtre-presse
5	2	7	2	Drum Filter / Filtre à tambour
5	2	7	4	Plate Filter
5	2	7	6	Sand Filter / Filtre à sable
5	2	7	7	Belt Filter / Filtre a bande
5	2	7	8	Liquid Filter / Filtre pour liquide
5	2	7	9	Slurry Filter / Filtre pour pulpe
5	2	8	0	Dryers
5	2	8	2	Furnaces & Kilns /Ovens (refinery)
5	2	8	4	Vibrating Tables / Table vibrante
5	2	8	6	Electrowinning Cells / Cellules électro-placage
5	2	8	7	Micronizer Mills
5	2	8	8	Bagging Machine
5	2	9	0	Wrapping Machine
5	2	9	2	Palettizor
5	2	9	3	Slurry Mills (final product)
5	2	9	4	Precipitate Equipment
5	2	9	6	Deaeration Tower
5	2	9	8	Jigs
5	3	0	0	Merrill Crowe Plant
5	3	9	4	Splitter Valve
5	3	9	6	Rotary Valve
5	3	9	7	Slide Gate / Vanne a glissiere

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
5	**0**	**0**	**0**	***MECHANICAL*** ***(continous)***
5	**4**	**0**	**0**	**Process Heating, Ventilating & Cooling Equipment**
5	4	0	1	Boilers / Chaudières
5	4	0	5	Heat Exchangers / Échangeurs de chaleur
5	4	1	0	Exhaust & Ventilation Fans / Ventilateurs d'évacuation et d'aeration
5	4	1	5	Air Conditioning / Climatisation
5	4	2	0	Air filters / Filtre à air (aeration)
5	4	2	5	Unit Heaters & Misc. Heaters / Unité de chauffantes (radiateur)
5	4	3	0	Water Heaters / Chauffe-eau
5	4	9	0	Stack & Ducting
5	**5**	**0**	**0**	**Pumps, Compressors & Process Fans**
5	5	0	1	Compressors / Compresseurs
5	5	0	2	Compressors Accessories
5	5	0	3	Air Receiver / Réservoir d'air
5	5	0	5	Air Dryer
5	5	1	0	Vacuum Pumps / Pompe à vide
5	5	1	1	Silencers
5	5	1	2	Inlet & Outlet Filters, (process) / Filtres
5	5	1	4	Process Fans / Ventilateurs de procede
5	5	1	5	Blowers / Soufflantes (procédé)
5	5	1	6	Combustion Blowers / Soufflante de combustion
5	5	1	8	Dust & Product Collector / Collecteur de poussière et de produit
5	5	2	0	Slurry Pumps / Pompes à pulpe
5	5	2	2	Centrifugal Pumps / Pompes Centrifuge
5	5	2	5	Sump Pumps / Pompe de puisard
5	5	3	0	Water Pumps / Pompe à eau
5	5	3	5	Filtrate Pumps / Pompe à filtrat
5	5	4	0	Reagents Pumps / Pompe de reactifs
5	5	4	5	Solutions Pumps
5	5	5	0	Carbon Pumps / Pompe charbon
5	5	5	5	Oil & Hydaulic Pumps / Pompe d'huile & Hydraulique
5	5	6	0	Sampling Pumps (process) / Pompe échantillionneuse
5	5	6	5	Barrel Type Pumps
5	5	7	0	Fuel Pumps
5	5	7	2	Other Pumps / Autres Pumps

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
5	**0**	**0**	**0**	***MECHANICAL*** ***(continous)***
5	**6**	**0**	**0**	**Plate Work**
5	6	0	1	Bins / Silo
5	6	0	2	Bins / Silo - Painting & Coating
5	6	0	5	Tanks / Réservoir, cuve
5	6	0	6	Tanks / Réservoir, cuve - Painting & Coating
5	6	1	0	Pumps & Feeds Boxes / Boîte de pompe et d'alimentation
5	6	1	5	Pressure Vessels / Réservoir sous-pression
5	6	1	8	Embeded chute / Chute encastrée
5	6	2	0	Chutes / Chute, déversoir
5	6	2	5	Hoppers / Trémie
5	6	3	0	Launders & Underpans / Goulotte et boîte de rejet
5	6	3	5	Buckets / Benne, godet
5	6	4	0	Collection Boxes / Récupérateur
5	6	4	5	Distributors & Splitters Boxes / Boîte de distribution et de dérivation
5	**7**	**0**	**0**	**Special Equipment**
5	7	1	X	Smelter Equipment (Anode Mold)
5	7	3	X	Robotization Equip. (Bag Flattener)
5	7	4	1	Truck Scale
5	7	5	X	Water Treatment Equipment
5	7	6	X	Sewage Treatment Equipment
5	7	7	X	Laboratory Equipment
5	7	7	5	Monitoring Equipment
5	7	7	9	Emergency Shower
5	7	8	X	Camp Equipment
5	7	9	3	Door operator / Ouvre-porte motorisé
5	**9**	**0**	**0**	**Construction Equipment & Tools**
				Seq.#
5	9	1	0	10 - Shops, Hydraulics Equipment
				20 - Shops, Machinerie Equipment
				30 - Shops, Welding & Cutter Equipment
				40 - Shops, Misc. Equipment
5	9	1	5	Mobile or Earthwork Equipments, barges (Excluding Mining Equip.)
				10 - Drills
				20 - Loaders / Backhoe-Loaders
				30 - Backhoes
				40 - Haul Trucks
				50 - Dozers
				60 - Graders
				60 - Compactors

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
5	**0**	**0**	**0**	***MECHANICAL*** ***(continous)***
5	9	2	0	Lifting Equipment :
				10 - Cranes
				20 - Boomtruck
				30 - Tool Carrier
				40 - Skytrack Forklift
				50 - Forklift
5	9	2	5	Concrete Equipment (PCC) :
				10 - Concrete Plant
				20 - Ready MIx
				30 - Concrete Pumps
5	9	3	0	Aggregate Production :
				10 - Aggregate Plant
				20 - Grizzlies
				30 - Feeders
				40 - Crushers
				50 - Screening Equipment
				60 - Washing Equipment
5	9	3	5	Hauling & Rolling :
				10 - Services Trucks
				20 - Maintenance Trucks
				30 - Fuel Trucks
				40 - Garbage Trucks
				50 - Buses
				60 - Tractor Trucks
				70 - Low Bed & Flat bed trailers
				80 - Light Vehicles (Pickups)
				90 - ATV's 4x4
5	9	4	0	Generators / Lights :
				10 - Generators
				20 - Towers Lights
5	9	4	5	Pumps & Compressors :
				10 - Pumps (water, waterjets)
				20 - Compressors

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
5	**0**	**0**	**0**	***MECHANICAL*** ***(continous)***
5	9	5	0	Tunneling Equipment :
				10 - Jumbos
				20 - Scrooptram
				30 - Rock Bolters
				40 - Stationnary Compressor (diesel)
				50 - Ventilation Fans
				55 - Powerhouse
				60 - Magazines
5	9	5	5	Marine Equipment :
				10 - Barges
				20 - Boats
5	9	6	0	Miscellaneous :
				10 - Trailers & Storage Vans
				20 - Equipment Attachments (Ripper wich, buckets etc.)
				30 - Welding Equipment
				40 - Ambulance
				50 - Snowmobile
				55 - Shotcrete Equipment
				60 - Temporary Tanks (oil, diesel, gas etc.)
				70 - HDPE Piping Fusing Machine
				90 - Site Laboratory Equipment
5	9	7	0	10 - Carpenter Tools
				20 - Concrete Tools
				30 - Pipe Fitting & Plumbing Tools
				40 - Electrician Tools
				50 - Millright Tools
				60 - Rigger Tools
				70 - Temporary Maintenance Shop Tools
				80 - Instrumentation (calibration) Tools
				90 - Linesmen Tools

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
6	**0**	**0**	**0**	**PIPING**
6	0	0	0	***General Piping -Allowance***
6	**0**	**1**	**0**	**General Slurry & Pulp - Mill Piping**
6	0	1	1	Slurry & Pulp - Piping
6	0	1	2	Slurry & Pulp - Manual Valving
6	**0**	**2**	**0**	**General Water Distribution**
6	0	2	1	Water Distribution - Piping
6	0	2	2	Water Distribution - Manual Valving
6	**0**	**3**	**0**	**General Air Distribution - Piping**
6	0	3	1	Air Distribution - Piping
6	0	3	2	Air Distribution - Manual Valving
6	0	3	6	Vacuum - Piping
6	0	3	7	Vacuum - Manual Valving
6	**0**	**4**	**0**	**General Reagents - Piping**
6	0	4	1	Reagent - Piping
6	0	4	2	Reagent - Manual Valving
6	**0**	**5**	**0**	**General Solution - Piping**
6	0	5	1	Solution - Piping
6	0	5	2	Solution - Manual Valving
6	**0**	**6**	**0**	**General Plumbing**
6	0	6	1	Plumbing
6	**0**	**7**	**0**	**General Petroleum & Synthetic Product - Piping**
6	0	7	1	Petroleum & Synthetic Product - Piping
6	0	7	2	Petroleum & Synthetic Product - Manual Valving
6	**0**	**8**	**0**	**General Fire Protection - Piping**
6	0	8	1	Fire Protection - Piping
6	0	8	2	Fire Protection - Manual Valving
6	**0**	**9**	**0**	**Auxiliary Piping**
6	0	9	1	Test & Commissionning
6	0	9	2	Painting & Coating
6	0	9	7	Hardware (supports, hanging rods, etc…)

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
7	**0**	**0**	**0**	***ELECTRICAL and INSTRUMENTATION***
7	0	0	0	***General Electrical - Allowance***
7	**1**	**0**	**0**	**Major Electrical Equipment**
7	1	1	0	Power Generation Equipment
7	1	2	0	High Voltage Equipment
7	1	2	5	Switch Gear
7	1	3	0	Power Transformation Equipment
7	1	3	1	Transformers (600 volts and less)
7	1	3	2	Transformers (601 to 15000 volts)
7	1	3	3	Transformers (more than 15000 volts)
7	1	4	0	Distribution Equipment
7	1	5	0	Regulating & Conditionning Equipment
7	1	6	0	Motor Control Center Equipment
7	1	9	0	Electrical Test
7	**2**	**2**	**0**	**Raceways and Accessories**
7	2	1	0	Main Raceways (including fittings)
7	2	3	0	Motors and Instruments Drops
7	2	5	0	Conduits and Ducts
7	2	7	0	Hardware (supports, hanging rods, etc…)
7	**3**	**3**	**0**	**Power Cables & Terminations**
7	3	1	0	Power Cables
7	3	2	0	Power Cables Terminations
7	3	5	0	Overhead Power Cables
7	3	6	0	Overhead Lines Insulaters & Hardware
7	**4**	**0**	**0**	**Lighting & Services - General**
7	4	1	0	Lighting & Services - Dist. Transformers & Panel
7	4	3	0	Lighting & Services - Cables, Fixtures & Devices
7	**5**	**0**	**0**	**Grounding & Lightning Systems**
7	5	1	0	Grounding Rods & Hardware
7	5	3	0	Grounding Cables
7	5	5	0	Lightning Protections
7	5	9	0	Grounding Test (including earth conductivity test)
7	**6**	**6**	**0**	**Control Devices, Process Instruments & Instrumented Valves**
7	6	1	0	Control System - PLC & DCS
7	6	2	0	Computers & Operator Interfaces Hardware
7	6	3	0	Software & Programming
7	6	4	0	Control Devices
7	6	5	0	Process Instruments
7	6	6	0	Instrumented Valves
7	6	7	0	Control & Instrumentation Cables
7	6	8	0	Control & Instrumentation Cable Terminations
7	6	9	0	Instrumentation Tests & Calibrations

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
7	**0**	**0**	**0**	***ELECTRICAL and INSTRUMENTATION*** ***(Continous)***
7	**7**	**0**	**0**	**Auxiliary Systems**
7	7	1	0	Administration Network Wiring
7	7	3	0	Cable TV System
7	7	4	0	Communication System (including telephone)
7	7	6	0	Security System
7	7	8	0	Fire Alarm System
7	7	9	0	Fire Alarm System - Tests & Certifications
7	**8**	**0**	**0**	**Available for Electrical Equipment identification**
7	**9**	**0**	**0**	**Others - Electrical & Communications Activities**
				(particular to a project)

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
8	**0**	**0**	**0**	***Building Heating, Ventilation & Air conditioning system***
8	0	0	0	***General HVAC System - Allowance***
8	**0**	**1**	**0**	Major HVAC Equipment
8	**0**	**2**	**0**	HVAC Distribution Ducting
8	**0**	**3**	**0**	HVAC Control System
8	**0**	**4**	**0**	Fans & Louvers
8	**0**	**9**	**0**	Miscellaneous HVAC Accessories

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
9	**0**	**0**	**0**	***CONSTRUCTION INDIRECTS and Owner's Costs*** ***(Note: Pre-Production Period)***
9	**0**	**0**	**0**	**Engineering & Technical Assistance**
9	0	1	0	Detail Engineering - General
9	0	1	1	Detail Engineering - Permanent Power Generation
9	0	1	5	Detail Engineering - Process Plant
9	0	2	0	Detail Engineering - Leach Pad & Ponds
9	0	2	5	Detail Engineering - Tailings Pond
9	0	5	0	Detail Engineering - Auxiliary Building Package
9	0	6	0	Vendor Representative Assistance
9	0	6	2	QA/QC Consultant
9	0	6	4	Surveying Support
9	0	7	0	Site supervision - Consultants
9	0	7	2	Miscellaneous Consultation
9	**0**	**8**	**0**	**Consultations for Studies**
9	0	8	2	Scoping Study
9	0	8	4	Feasibility Study
9	0	8	6	Environmental Impact Study
9	**1**	**0**	**0**	**Construction Management**
9	1	1	0	Salary - Project construction personnel
9	1	2	0	Site supervision - Consultants
9	1	3	0	Travelling - Project construction Personnel
9	1	4	0	Site Food & Lodging
9	1	5	0	Personnel Relocation
9	1	6	0	House Trailer Rental
9	1	7	0	Vehicle Rental
9	1	8	0	Long Term Leasing
9	1	9	0	Turn Around Personnel Travelling & Expenses
9	**2**	**0**	**0**	**Temporary Services & Facilities**
9	2	2	0	Temporary Facilities
9	2	3	0	Temporary Heat
9	2	4	0	Temporary Electricity
9	2	6	0	Security Supplies
9	2	7	0	Security Services
9	2	8	0	Health & Safety Supplies
9	2	9	0	Containers

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
9	**0**	**0**	**0**	***CONSTRUCTION INDIRECTS and Owner's Costs*** ***(Note: Pre-Production Period) (continous)***
9	**3**	**0**	**0**	**Office Operation Expenses (during construction period)**
9	3	1	0	Site Office Supplies
9	3	2	0	Site Reproduction
9	3	3	0	Site Mail & Courrier
9	3	4	0	Site Communication
9	3	5	0	Site Electrical Consumption
9	3	5	5	Site Gazoline/Fuel/Oil
9	3	8	2	Site Janitorial
9	3	8	4	Site Trash Removal
9	3	8	6	Site Snow Removal
9	**4**	**0**	**0**	**Site Equipment**
9	4	1	0	Computers, Hardwares & Softwares
9	4	2	0	Office Furnitures
9	4	3	0	Surveying Equipment
9	4	4	0	Small Tools
9	4	9	0	Specialized Equipment
9	**5**	**0**	**0**	**Maintenance**
9	5	1	0	Site Office Maintenance
9	5	2	0	Vehicles Repairs & Maintenance
9	5	3	0	Mobile Equipment Maintenance
9	**5**	**5**	**0**	**Freight**
9	5	5	1	Land Freight
9	5	5	2	Ocean Freight
9	5	5	3	Air Freight
9	5	5	9	Railroad Freight
9	**6**	**0**	**0**	**Mill First Load**
9	6	0	2	Mill First Load (balls, reagents…)
9	6	0	4	Mill First Order - Consumables
9	**6**	**5**	**0**	**Startup**
9	6	5	2	Plant Cold Commissioning
9	6	5	4	Startup External Assistance
9	6	5	8	Plant ramp-up period (to be discussed)

DISCIPLINES and ACTIVITIES

Discipline	Activity			Description
9	**0**	**0**	**0**	***CONSTRUCTION INDIRECTS and Owner's Costs*** ***(Note: Pre-Production Period) (continous)***
9	**7**	**0**	**0**	**Pre-Production Activities - Owner's Cost**
9	7	1	0	Final Cleanup
9	7	2	0	Insurances
9	7	2	2	Permits & Certifications
9	7	2	4	Performance Bonds
9	7	2	6	Taxes / Duties
9	7	2	8	Tax Recovery
9	7	3	0	Land Acquisition
9	**7**	**4**	**0**	**Operating Personnel Pre-Production Period**
9	7	4	1	Salaries and Benefits
9	7	4	5	Training Expenses
9	**7**	**5**	**0**	**Consultants**
9	7	5	5	Security
9	**7**	**6**	**0**	**Human Resources**
9	7	6	5	Public Relations
9	**7**	**7**	**0**	**Environmental Follow-up Pre-Production Period**
9	**7**	**7**	**5**	**Health & Safety Operation Pre-Production Period**
9	**7**	**8**	**0**	**Spares**
9	7	8	2	Mill Equipment Spare Parts
9	7	8	4	Mine Equipment Spare Parts and first order consumables
9	**7**	**9**	**0**	**Startup**
9	7	9	2	Startup External Assistance
9	7	9	4	Plant ramp-up period (to be discussed)
9	**8**	**0**	**0**	**Head Office Support & Capitalized Operation Expenses**
9	8	1	1	Head Office Support
9	**9**	**9**	**0**	**Contingency**
9	**9**	**9**	**6**	Unbudgeted items during construction

MATAMEC
KIPAWA PROJECT - FEASIBILITY STUDY
LOT REGISTER

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	38	39
2										Request For Quotation (RFQ)		Bid Received		Bid Analysis					
3	ITEM	REV	Project	Discipline	Contract type	Sequential number	Lot #	Description	Supplier(s) / tenderer(s)	RFQ Planned Date	RFQ Real Date	Bid Receiv. Planned Date	Bid Receiv. Real Date	Bid Anal. Planned Date	Bid Anal. Real Date	Estimated Delivery Time (Weeks)	Price of Selected Supplier	Comments	Responsability
4	**1**	**0G**	**KPW**	**00**	**S**	**101**	**KPW-00-S-101**	**Construction Equipement**	**Équipements TNO**		**2013-04-05**	**2013-04-12**	**2013-04-08**	**2013-05-08**				**Cannot supply outside electr. panels**	**G1**
5	**1**	**0G**	**KPW**	**00**	**S**	**101**	**KPW-00-S-101**	**Construction Equipement**	**Location d'outils Simplex**		**2013-04-05**	**2013-04-12**	**2013-04-17**	**2013-05-08**					**G1**
6	**2**	**0G**	**KPW**	**00**	**S**	**102**	**KPW-00-S-102**	**Miscelaneous electrical**	**Agence Béliveau-Turmel**				**2013-04-23**					**Requestd by Alex Sidorenko**	**G1**
7	3	0E	KPW	05	S	101	KPW-05-S-101	Assay Lab Material	Anachemia Science				2012-10-11	2013-02-08					G1
8	3	0E	KPW	05	S	101	KPW-05-S-101	Assay Lab Material	UEE (Unit Electr.Eng.)										G1
9	3	0E	KPW	05	S	101	KPW-05-S-101	Assay Lab Material	SGS				2012-11-11	2013-02-08					G1
10	4	0E	KPW	11	C	101	KPW-11-C-101	Fencing	Clôture Abitem		2012-09-28		2012-10-01		2013-02-12	2	96 $/ m.lin	Price is for a height of 6 feet	G1
11	5	0E	KPW	11	S	101	KPW-11-S-101	Infrastructure Earthworks				Internal Estimate							G1
12	6	0E	KPW	11	S	102	KPW-11-S-102	Kipawa Access Bridge	Ind. Atlantic		2012-10-10		2012-10-15		2013-02-12	8	1 004 715,00 $		G1
13	7	0E	KPW	11	S	103	KPW-11-S-103	Potable & Fresh water (Mill Site)	Dagua		2012-11-13		2013-01-10		2013-02-12				G1
14	7	0E	KPW	11	S	103	KPW-11-S-103	Potable & Fresh water (Mill Site)	H2O Innovation		2012-11-14		2012-11-21	2013-02-08	2013-02-12	TBC	246 000,00 $	Container Kit	G1
15	8	0E	KPW	11	S	104	KPW-11-S-104	Sewage Water (Mill Site)	Bionest Kodiak		2012-11-08					TBC	285 000,00 $	Container Kit	G1
16	~~0~~	~~0E~~	~~KPW~~	~~11~~	~~S~~	~~105~~	~~KPW-11-S-105~~	~~Potable & Fresh water (Mine Site)~~	~~Dagua~~									Cancelled	G1
17	~~0~~	~~0E~~	~~KPW~~	~~11~~	~~S~~	~~105~~	~~KPW-11-S-105~~	~~Potable & Fresh water (Mine Site)~~	~~H2O Innovation~~									Cancelled	G1
18	9	0E	KPW	11	S	106	KPW-11-S-106	Sewage Water (Mine Site)	Bionest Kodiak		2012-11-08					TBC	128 000,00 $	SA-6000 Container Kit	G1
19	10	0G	KPW	11	S	107	KPW-11-S-107	Garage Doors	Porte Levasseur		2013-02-04	2013-02-08	2013-03-04	2013-02-16	2013-03-08				G1
20	10	0G	KPW	11	S	107	KPW-11-S-107	Garage Doors	Portes Commerciales		2013-02-04	2013-02-08	2013-03-02	2013-02-16	2013-03-08				G1
21	11	0G	KPW	12	S	101	KPW-12-S-101	Infrastructure Concrete Supply	Béton Marik Inc	2012-11-05	2012-11-06		2012-11-08	2013-02-16	2013-01-23				G1
22	11	0G	KPW	12	S	101	KPW-12-S-101	Infrastructure Concrete Supply	Fournier & Fils Inc	2012-11-05	2012-11-05		2012-11-07	2013-02-16	2013-01-23	n/a	240$/m³	Concrete Plant included	G1
23	11	0G	KPW	12	S	101	KPW-12-S-101	Infrastructure Concrete Supply	Rainbow Concrete Industries	2012-11-05	2012-12-07	2013-01-07	nil						G1
24	12	0E	KPW	12	C	101	KPW-12-C-101	Concrete installation				Internal Estimate							G1
25	13	0E	KPW	13	C	101	KPW-13-C-101	Structure installation				Internal Estimate							G1
26	14	0E	KPW	13	C	102	KPW-13-C-102	Buildings Fold Away	Structures GB	2012-12-07	2012-12-07	2012-12-20	2012-12-20		2013-01-23				G1
27	14	0E	KPW	13	C	102	KPW-13-C-102	Buildings Fold Away	Acier MYK	2012-12-07	2012-12-07	2012-12-20	n/a		2013-01-23				G1
28	14	0E	KPW	13	C	102	KPW-13-C-102	Buildings Fold Away	ATCO Structure	2012-12-07	2012-12-07	2012-12-20	2012-12-19		2013-01-23				G1
29	14	0E	KPW	13	C	102	KPW-13-C-102	Buildings Fold Away	Canam Econox	2012-12-07	2012-12-07	2012-12-20	2012-12-20		2013-01-23	4	848 000,00 $	Packing, installation and freight cost included	G1
30	15	0E	KPW	13	C	103	KPW-13-C-103	Prefab - Modular Building	Outland		2012-11-13	2012-12-04							G1
31	16	0E	KPW	13	S	101	KPW-13-S-101	Process plant Structure				Internal Estimate							G1
32	17	0G	KPW	13	S	102	KPW-13-S-102	Dome (Ore Storage)	Triodetic	2012-12-06	2012-12-07	2012-12-20	2012-12-20			20	540 800,00 $	Installation not included (3700 Mhrs)	G1
33	18	0E	KPW	13	S	103	KPW-13-S-103	Other Buildings Structure				Internal Estimate							G1
34	19	0E	KPW	13	S	104	KPW-13-S-104	Process plant Architecture				Internal Estimate							G1
35	20	0E	KPW	13	S	105	KPW-13-S-105	Other Building Architecture				Internal Estimate							G1
36	21	0E	KPW	15	S	101	KPW-15-S-101	Bridge cranes	COH Inc		2012-10-18	2012-11-09	2012-11-20						G1
37	21	0E	KPW	15	S	101	KPW-15-S-101	Bridge cranes	Konecranes		2012-10-18	2012-11-09	2012-10-30		2013-03-21	24	994 480,00 $	New bid received 2013-03-21	G1
38	21	0E	KPW	15	S	101	KPW-15-S-101	Bridge cranes	P.R. Protech Inc		2012-10-18	2012-11-09	2012-11-15						G1
39	22	0E	KPW	15	S	102	KPW-15-S-102	Compressors, Air Dryer, Air Receiver, Air Filter	Larry Industries	2012-12-19									G1
40	22	0E	KPW	15	S	102	KPW-15-S-102	Compressors, Air Dryer, Air Receiver, Air Filter	Comairco	2012-12-19									G1
41	22	0E	KPW	15	S	102	KPW-15-S-102	Compressors, Air Dryer, Air Receiver, Air Filter	Atlas Copco	2012-12-19									G1
42	23	0E	KPW	15	S	103	KPW-15-S-103	water pumps		2012-12-14									G1
43	24	0E	KPW	15	S	104	KPW-15-S-104	High Pressure Washer	UNI-SELECT		2012-11-21		2012-11-27		2013-02-12	n/a	3 275,00 $	Freight included	G1
44	25	0G	KPW	15	S	105	KPW-15-S-105	Flotation Blowers	Aircom Technologies		2013-04-17	2013-05-02	2013-05-02	2013-05-08					
45	25	0G	KPW	15	S	105	KPW-15-S-105	Flotation Blowers	ASN Compression		2013-04-17	2013-05-02	2013-04-18	2013-05-08					
46	25	0G	KPW	15	S	105	KPW-15-S-105	Flotation Blowers	Entreprises Larry		2013-04-17	2013-05-02	2013-05-02	2013-05-08					
47	26	0G	KPW	15	S	106	KPW-15-S-106	Fresh Water Tank's	ASDR Industries	2012-12-13	2013-03-19	2013-03-26	2013-04-10		2013-04-30		TBC		G1
48	26	0G	KPW	15	S	106	KPW-15-S-106	Fresh Water Tank's	Fournier	2012-12-13	2012-03-15	2013-03-26	2013-03-26		2013-04-30		TBC		G1
49	26	0G	KPW	15	S	106	KPW-15-S-106	Fresh Water Tank's	Shuot	2012-12-13	2012-03-18	2013-03-26	n/a	n/a	n/a		TBC		G1
50	26	0G	KPW	15	S	106	KPW-15-S-106	Fresh Water Tank's	Marquis	2012-12-13	2012-03-15	2013-03-26	2013-03-26		2013-04-30		TBC		G1
51	~~0~~	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~107~~	~~KPW-15-S-107~~	~~Potable Water Tank's~~	~~Masters~~										~~G1~~
52	27	0E	KPW	15	S	108	KPW-15-S-108	Oil Distribution System	Lubequip		2012-11-15		2012-11-20	2013-02-16	2013-02-12	n/a	14 228,00 $	Freight cost not included	G1
53	27	0E	KPW	15	S	108	KPW-15-S-108	Oil Distribution System	Stewart Warner		2012-11-15		2012-11-20	2013-02-16	2013-02-12				G1
54	28	0E	KPW	15	S	109	KPW-15-S-109	Jockey Pump/Fire protection pumps				Internal Estimate							G1
55	29	0E	KPW	15	S	110	KPW-15-S-110	Platework & Chutes		Internal Estimate									G1
56	30	0G	KPW	15	S	111	KPW-15-S-111	Fuel Tanks & Gas Boy	SM Construction		2013-03-19		n/a	2013-02-16			TBC	~~New bid received 2013-04-02~~	G1
57	30	0G	KPW	15	S	111	KPW-15-S-111	Fuel Tanks & Gas Boy	Industries Desjardins		2013-03-19		2013-04-02	2013-02-16	2013-04-30		TBC	~~New bid received 2013-04-03~~	G1
58	30	0G	KPW	15	S	111	KPW-15-S-111	Fuel Tanks & Gas Boy	Serv.&Constr. Mobile		2013-03-19		2013-04-05	2013-02-16	2013-04-30		TBC		G1
59	31	0E	KPW	15	S	112	KPW-15-S-112	Belt scale	Siemens (Miltronics)	2013-01-15									G1
60	31	0E	KPW	15	S	112	KPW-15-S-112	Belt scale	Ramsey	2013-01-15									G1
61	32	0E	KPW	15	S	113	KPW-15-S-113	Grizzly screen		Internal Estimate									G1
62	33	0E	KPW	15	S	114	KPW-15-S-114	Screw conveyors	Continental	2013-01-17									G1
63	33	0E	KPW	15	S	114	KPW-15-S-114	Screw conveyors	Shuot	2013-01-17									G1
64	33	0E	KPW	15	S	114	KPW-15-S-114	Screw conveyors	Con-V-air	2013-01-17									G1
65	34	0G	KPW	15	S	116	KPW-15-S-116	Belt Conveyors	Continental	2012-12-07		2012-12-20	2013-01-15						G1
66	34	0E	KPW	15	S	116	KPW-15-S-116	Belt Conveyors	Aciers JP (AJP)	2012-12-07		2012-12-20	2012-12-20	2013-02-06					G1
67	34	0G	KPW	15	S	116	KPW-15-S-116	Belt Conveyors	Ind. Fournier	2012-12-07		2012-12-20	n/a						G1
68	34	0E	KPW	15	S	116	KPW-15-S-116	Belt Conveyors	S. Huot	2012-12-07		2012-12-20	2012-12-20	2013-02-06					G1
69	34	0E	KPW	15	S	116	KPW-15-S-116	Belt Conveyors	TS Manufacturing Co.	2012-12-07		2012-12-20	2012-12-20	2013-02-06					G1
70	35	0E	KPW	15	S	117	KPW-15-S-117	Belt Feeder		2013-01-10									G1
71	36	0E	KPW	15	S	118	KPW-15-S-118	CIL Lander Gate Valve	Industries Fournier	2013-02-01									G1
72	36	0E	KPW	15	S	118	KPW-15-S-118	CIL Lander Gate Valve	Kemix	2013-02-01									G1
73	37	0E	KPW	15	S	119	KPW-15-S-119	Oil Separator	Capteur GR		2012-11-15		2012-11-20	2013-02-08					G1
74	37	0E	KPW	15	S	119	KPW-15-S-119	Oil Separator	Procepteur		2012-11-15		2012-11-20	2013-02-08					G1
75	37	0E	KPW	15	S	119	KPW-15-S-119	Oil Separator	Can aqua		2012-11-15		2012-11-20	2013-02-08					G1
76	38	0E	KPW	15	S	120	KPW-15-S-120	Roof Top	Master		2012-11-15		2012-11-20	2013-02-08					G1
77	38	0E	KPW	15	S	120	KPW-15-S-120	Roof Top	Trane		2012-11-15		2012-11-20	2013-02-08					G1
78	38	0E	KPW	15	S	120	KPW-15-S-120	Roof Top	Aaon		2012-11-15		2012-11-20	2013-02-08					G1
79	39	0E	KPW	15	S	121	KPW-15-S-121	Gas Detection	Vulcain	2013-01-07									G1
80	39	0E	KPW	15	S	121	KPW-15-S-121	Gas Detection	Msa	2013-01-07									G1
81	39	0E	KPW	15	S	121	KPW-15-S-121	Gas Detection	Opera	2013-01-07									G1
82	40	0E	KPW	15	S	122	KPW-15-S-122	Plant Fire Protection	Viking	2013-01-07									G1
83	40	0E	KPW	15	S	122	KPW-15-S-122	Plant Fire Protection	Grinnel	2013-01-07									G1
84	41	0E	KPW	15	S	123	KPW-15-S-123	Electric Heater	Master			Internal Estimate							G1
85	41	0E	KPW	15	S	123	KPW-15-S-123	Electric Heater	Trane			Internal Estimate							G1
86	42	0E	KPW	15	S	124	KPW-15-S-124	Compressed Air	Enteprise Larry	2013-01-07									G1
87	42	0E	KPW	15	S	124	KPW-15-S-124	Compressed Air	Compresseur Laval	2013-01-07									G1
88	42	0E	KPW	15	S	124	KPW-15-S-124	Compressed Air	Compresseur Quebec	2013-01-07									G1
89	43	0E	KPW	15	S	125	KPW-15-S-125	Plumbing Equipment	Entreprise Rolanf Lajoie			Internal Estimate							G1
90	43	0E	KPW	15	S	125	KPW-15-S-125	Plumbing Equipment	Cana aqua			Internal Estimate							G1
91	43	0E	KPW	15	S	125	KPW-15-S-125	Plumbing Equipment	Woseley			Internal Estimate							G1
92	44	0G	KPW	15	S	126	KPW-15-S-126	Water Station	Technosub	2013-01-16	2013-02-13	2013-02-28	2013-02-07	2013-03-11	2013-03-13		1 387 500,00 $	Contingency not included	G1
93	44	0E	KPW	15	S	126	KPW-15-S-126	Water Station	Pompaction	2013-01-16	2013-02-13	2013-02-28	2013-02-28	2013-03-11	2013-03-13				G1
94	44	0G	KPW	15	S	126	KPW-15-S-126	Water Station	Kn Equipement	2013-01-16	2013-02-13	2013-02-28	n/a	n/a	n/a				G1
95	44	0G	KPW	15	S	126	KPW-15-S-126	Water Station	KAD Industries Service	2013-01-16	2013-02-13	2013-02-28	2013-02-21	n/a	n/a			Quoted on Pumps Only	G1
96	45	0G	KPW	15	S	127	KPW-15-S-127	Mechanical Installation											G1
97	46	0G					KPW-15-S-128	Ore Storage Silo	Industries Fournier		2013-04-19	2013-05-03							
98	47	0E	KPW	16	S	101	KPW-16-S-101	Piping	Ipex	2013-01-23									G1
99	47	0E	KPW	16	S	101	KPW-16-S-101	Piping	Woseley	2013-01-23									G1
100	47	0E	KPW	16	S	101	KPW-16-S-101	Piping	Groupe Deschesne	2013-01-23									G1
101	48	0E	KPW	16	S	102	KPW-16-S-102	Rubber Lined piping	Rematech	2013-01-23									G1
102	49	0E	KPW	16	S	103	KPW-16-S-103	HDPE piping		2013-01-25									G1
103	50	0E	KPW	16	S	104	KPW-16-S-104	Steel piping	Wolsley canada	2013-01-30									G1
104	50	0E	KPW	16	S	104	KPW-16-S-104	Steel piping	Legault Metal	2013-01-30									G1
105	50	0E	KPW	16	S	104	KPW-16-S-104	Steel piping	Marcel Baril	2013-01-30									G1
106	51	0E	KPW	16	S	105	KPW-16-S-105	Heate traced piping	Urecon	2013-01-16									G1
107	52	0E	KPW	16	S	106	KPW-16-S-106	Manuel valve	Tech pro	2013-01-16									G1
108	53	0E	KPW	17	C	101	KPW-17-C-101	Electrical installation	Promec										G1
109	53	0E	KPW	17	C	101	KPW-17-C-101	Electrical installation	Moreau										G1
110	53	0E	KPW	17	C	101	KPW-17-C-101	Electrical installation	Blais										G1
111	54	0E	KPW	17	S	101	KPW-17-S-101	Transformers High voltage	Moteur du Cuivre (WEG)	2012-12-13	2012-12-13	2013-01-15	2013-01-15	2013-02-08					G1
112	54	0E	KPW	17	S	101	KPW-17-S-101	Transformers High voltage	Wesco	2012-12-13	2012-12-13	2013-01-15	2013-01-15	2013-02-08	2013-02-12	42	823 750,00 $	Packing and freight cost included	G1
113	54	0G	KPW	17	S	101	KPW-17-S-101	Transformers High voltage	Nedco (Schneider)	2012-12-13	2012-12-13	2013-01-15	2013-01-18	2013-02-08					G1
114	55	0E	KPW	17	S	102	KPW-17-S-102	High Voltage Power Line 44 kV	Promec	2013-01-24	2013-02-28	2013-03-19	2013-03-19	2013-03-19	2013-03-19		TBD		G1
115	55	0E	KPW	17	S	102	KPW-17-S-102	High Voltage Power Line 44 kV	Moreau	2013-01-24	2013-02-28	2013-03-19	2013-03-19	2013-03-19	2013-03-19		TBD		G1
116	55	0E	KPW	17	S	102	KPW-17-S-102	High Voltage Power Line 44 kV	Arno	2013-01-24	2013-02-28	2013-03-19	n/a				TBD		G1
117	55	0E	KPW	17	S	102	KPW-17-S-102	High Voltage Power Line 44 kV	Industries Blais	2013-01-24	2013-02-28	2013-03-19	2013-03-19	2013-03-19	2013-03-19		TBD		G1
118	56	0G	KPW	17	S	103	KPW-17-S-103	Transformers Medium / Low Voltage	Moteur du Cuivre (WEG)	2013-01-15	2013-02-01	2013-02-15	2013-02-22	2013-03-08	2013-03-27				G1
119	56	0E	KPW	17	S	103	KPW-17-S-103	Transformers Medium / Low Voltage	Wesco	2013-01-15	2013-02-01	2013-02-15	2013-02-15	2013-03-08	2013-03-27				G1
120	56	0G	KPW	17	S	103	KPW-17-S-103	Transformers Medium / Low Voltage	Nedco (Schneider)	2013-01-15	2013-02-01	2013-02-15	2013-02-13	2013-03-08	2013-03-27				G1
121	56	0E	KPW	17	S	103	KPW-17-S-103	Transformers Medium / Low Voltage	Westburne	2013-01-15	2013-02-01	2013-02-15	2013-02-15	2013-03-08	2013-03-27	20	1 072 880,00 $		G1
122	57	0G	KPW	17	S	104	KPW-17-S-104	Substation Material	Nedco Canada	2013-02-01	2013-03-19	2013-04-02	2013-04-09	2013-04-12					G1
123	57	0G	KPW	17	S	104	KPW-17-S-104	Substation Material	Moteur du Cuivre (ABB)	2013-02-01	2013-02-28	2013-03-19	2013-04-10	2013-04-12					G1
124	57	0E	KPW	17	S	104	KPW-17-S-104	Substation Material	Wesco	2013-02-01	2013-02-28	2013-03-19	2013-03-26	2013-04-12					G1
125	57	0E	KPW	17	S	104	KPW-17-S-104	Substation Material	SurplecHV	2013-02-01	2013-02-28	2013-03-19	2013-03-18	2013-04-12					G1
126	58	0G	KPW	17	S	105	KPW-17-S-105	Switchgears	Nedco (Schneider)	2013-01-18	2013-02-19	2013-03-07	2013-03-07		2013-03-13	26	1 632 641,00 $	Freight included	G1
127	58	0G	KPW	17	S	105	KPW-17-S-105	Switchgears	Lumen (Siemens)	2013-01-18	2013-02-19	2013-03-07	2013-03-13		2013-03-13				G1
128	58	0G	KPW	17	S	105	KPW-17-S-105	Switchgears	Moteur du Cuivre (ABB)	2013-01-18	2013-02-19	2013-03-07	2013-03-06		2013-03-13				G1
129	58	0G	KPW	17	S	105	KPW-17-S-105	Switchgears	~~Wesco (GE)~~	~~2013-01-18~~	~~2013-02-19~~	~~2013-03-07~~	n/a	n/a	n/a				G1
130	59	0E	KPW	17	S	106	KPW-17-S-106	MCC & VFD	Wesco (GE)	2013-02-12									G1
131	59	0E	KPW	17	S	106	KPW-17-S-106	MCC & VFD	Lumen	2013-02-12									G1
132	59	0E	KPW	17	S	106	KPW-17-S-106	MCC & VFD	Schneider (Nedco)	2013-02-12									G1
133	60	0E	KPW	17	S	107	KPW-17-S-107	Power and Control Cables	Anixter	2013-02-15									G1
134	60	0E	KPW	17	S	107	KPW-17-S-107	Power and Control Cables	Lumen	2013-02-15									G1
135	60	0E	KPW	17	S	107	KPW-17-S-107	Power and Control Cables	Westburne	2013-02-15									G1
136	61	0E	KPW	17	S	108	KPW-17-S-108	Cable Trays	Anixter	2013-02-15									G1
137	61	0E	KPW	17	S	108	KPW-17-S-108	Cable Trays	Lumen	2013-02-15									G1
138	61	0E	KPW	17	S	108	KPW-17-S-108	Cable Trays	Westburne	2013-02-15									G1
139	62	0G	KPW	17	S	109	KPW-17-S-109	Emergency genset	Hewitt	2013-01-10	2013-01-25	2013-02-07	2013-02-07		2013-02-12				G1
140	62	0G	KPW	17	S	109	KPW-17-S-109	Emergency genset	Cummins	2013-01-10	2013-01-25	2013-02-07	2013-02-07		2013-02-12	20	1 289 920,00 $	Freight cost included	G1
141	63	0E	KPW	17	S	110	KPW-17-S-110	Distribution Panels	Nedco	2013-02-18									G1
142	63	0E	KPW	17	S	110	KPW-17-S-110	Distribution Panels	Lumen	2013-02-18									G1
143	63	0E	KPW	17	S	110	KPW-17-S-110	Distribution Panels	Westburne	2013-02-18									G1
144	64	0E	KPW	17	S	111	KPW-17-S-111	Grounding	Nedco	2013-02-22									G1
145	64	0E	KPW	17	S	111	KPW-17-S-111	Grounding	Westburne	2013-02-22									G1
146	64	0E	KPW	17	S	111	KPW-17-S-111	Grounding	Lumen	2013-02-22									G1
147	65	0E	KPW	17	S	112	KPW-17-S-112	Lighting & Services	Wesco	2013-02-19									G1
148	65	0E	KPW	17	S	112	KPW-17-S-112	Lighting & Services	Lumen	2013-02-19									G1
149	65	0E	KPW	17	S	112	KPW-17-S-112	Lighting & Services	Nedco	2013-02-19									G1
150	66	0E	KPW	17	S	113	KPW-17-S-113	Medium Voltage Starter		2013-02-12									G1
151	67	0E	KPW	18	S	101	KPW-18-S-101	HVAC	Master		2012-11-15		2012-11-20	2013-02-08					G1
152	67	0E	KPW	18	S	101	KPW-18-S-101	HVAC	Trane		2012-11-15		2012-11-20	2013-02-08					G1
153	67	0E	KPW	18	S	101	KPW-18-S-101	HVAC	Enertrak		2012-11-15		2012-11-20	2013-02-08					G1
154	68	0E	KPW	18	S	102	KPW-18-S-102	Fans	Master		2012-11-15		2012-11-20	2013-02-08					G1
155	68	0E	KPW	18	S	102	KPW-18-S-102	Fans	Trane		2012-11-15		2012-11-20	2013-02-08					G1
156	68	0E	KPW	18	S	102	KPW-18-S-102	Fans	Enertrak		2012-11-15		2012-11-20	2013-02-08					G1
157	69	0E	KPW	18	S	103	KPW-18-S-103	Blower	Master		2012-11-15		2012-11-20	2013-02-08					G1
158	69	0E	KPW	18	S	103	KPW-18-S-103	Blower	Trane		2012-11-15		2012-11-20	2013-02-08					G1
159	69	0E	KPW	18	S	103	KPW-18-S-103	Blower	Enertrak		2012-11-15		2012-11-20	2013-02-08					G1
160	70	0E	KPW	18	S	104	KPW-18-S-104	Make up Air Units			2012-11-20		2012-11-22	2013-02-08					G1
161	71	0E	KPW	27	S	101	KPW-27-S-101	Automation Networking Equipments & Materials	Nedco	2013-02-15									G1
162	71	0E	KPW	27	S	101	KPW-27-S-101	Automation Networking Equipments & Materials	Lumen	2013-02-15									G1
163	71	0E	KPW	27	S	101	KPW-27-S-101	Automation Networking Equipments & Materials	Wesco	2013-02-15									G1
164	72	0E	KPW	27	S	102	KPW-27-S-102	PLC Cabinets & Junction Boxes	Adria	2013-01-22			Internal estimate						G1
165	72	0E	KPW	27	S	102	KPW-27-S-102	PLC Cabinets & Junction Boxes	Meglab	2013-01-22									G1
166	73	0E	KPW	27	S	103	KPW-27-S-103	UPS	Nedco	2013-01-25			Internal estimate						G1
167	73	0E	KPW	27	S	103	KPW-27-S-103	UPS	Wesco	2013-01-25									G1
168	73	0E	KPW	27	S	103	KPW-27-S-103	UPS	Chess Controls	2013-01-25									G1
169	74	0E	KPW	27	S	104	KPW-27-S-104	PLC & HMI Software	Nedco	2013-02-22									G1
170	74	0E	KPW	27	S	104	KPW-27-S-104	PLC & HMI Software	Wonderware	2013-02-22									G1

*** Series 100 and 200 reserved for Genivar, series 300 and 400 reserved for Roche

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MATAMEC
KIPAWA PROJECT - FEASIBILITY STUDY
LOT REGISTER

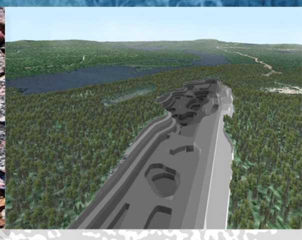
2										Request For Quotation (RFQ)		Bid Received		Bid Analysis					
3	ITEM	REV	Project	Discipline	Contract type	Sequential number	Lot #	Description	Supplier(s) / tenderer(s)	RFQ Planned Date	RFQ Real Date	Bid Receiv. Planned Date	Bid Receiv. Real Date	Bid Anal. Planned Date	Bid Anal. Real Date	Estimated Delivery Time (Weeks)	Price of Selected Supplier	Comments	Responsability
171	75	0E	KPW	27	S	105	KPW-27-S-105	Instrumentation - Blocked chute	Endress & Hauser	2013-02-22	2013-02-25	2013-03-04							G1
172	75	0E	KPW	27	S	105	KPW-27-S-105	Instrumentation - Blocked chute	Ramsey	2013-02-22									G1
173	75	0E	KPW	27	S	105	KPW-27-S-105	Instrumentation - Blocked chute	Drexelbrook	2013-02-22									G1
174	76	0E	KPW	27	S	106	KPW-27-S-106	Instrumentation - Conveyors (speed switch, pull cords, belt drift)	Nedco	2013-02-22	2013-02-25	2013-03-04							G1
175	76	0E	KPW	27	S	106	KPW-27-S-106	Instrumentation - Conveyors (speed switch, pull cords, belt drift)	Lumen	2013-02-22	2013-02-25	2013-03-04							G1
176	77	0E	KPW	27	S	107	KPW-27-S-107	Instrumentation - Density transmitter	Endress & Hauser	2013-02-22	2013-02-25	2013-03-04							G1
177	77	0E	KPW	27	S	107	KPW-27-S-107	Instrumentation - Density transmitter	Controvalve (Ronan)	2013-02-22	2013-02-25	2013-03-04							G1
178	77	0E	KPW	27	S	107	KPW-27-S-107	Instrumentation - Density transmitter	Everest Automation (Ohmart-Vega)	2013-02-22	2013-02-25	2013-03-04							G1
179	78	0E	KPW	27	S	108	KPW-27-S-108	Instrumentation - Flowmeters	Endress & hauser	2013-02-26	2013-02-25	2013-03-04							G1
180	78	0E	KPW	27	S	108	KPW-27-S-108	Instrumentation - Flowmeters	Siemens (Chess Controls)	2013-02-26	2013-02-25	2013-03-04							G1
181	78	0E	KPW	27	S	108	KPW-27-S-108	Instrumentation - Flowmeters	Everest (ABB)	2013-02-26	2013-02-25	2013-03-04							G1
182	78	0E	KPW	27	S	108	KPW-27-S-108	Instrumentation - Flowmeters	Contrôle Laurentide (Rosemont)	2013-02-26	2013-02-25	2013-03-04							G1
183	79	0E	KPW	27	S	109	KPW-27-S-109	Instrumentation - Gate Valve	Techpro (Clarkson)	2013-02-26	2013-02-25	2013-03-04							G1
184	79	0E	KPW	27	S	109	KPW-27-S-109	Instrumentation - Gate Valve	Contrôle Laurentide	2013-02-26	2013-02-25	2013-03-04							G1
185	79	0E	KPW	27	S	109	KPW-27-S-109	Instrumentation - Gate Valve	Everest	2013-02-26	2013-02-25	2013-03-04							G1
186	79	0E	KPW	27	S	109	KPW-27-S-109	Instrumentation - Gate Valve	Chess Controls	2013-02-26	2013-02-25	2013-03-04							G1
187	80	0E	KPW	27	S	110	KPW-27-S-110	Instrumentation - Gas Detectors	Everest (Drage)	2013-02-28									G1
188	80	0E	KPW	27	S	110	KPW-27-S-110	Instrumentation - Gas Detectors	Chess Controls (Honeywell)	2013-02-28									G1
189	80	0E	KPW	27	S	110	KPW-27-S-110	Instrumentation - Gas Detectors	Controlvalve (Yokogawa)	2013-02-28									G1
190	81	0E	KPW	27	S	111	KPW-27-S-111	Instrumentation - Horns and Rotated Lights	Lumen	2013-02-28									G1
191	81	0E	KPW	27	S	111	KPW-27-S-111	Instrumentation - Horns and Rotated Lights	Nedco	2013-02-28									G1
192	82	0E	KPW	27	S	112	KPW-27-S-112	Instrumentation - Level transmitters	Endress & Hauser	2013-02-28	2013-02-25	2013-03-04							G1
193	82	0E	KPW	27	S	112	KPW-27-S-112	Instrumentation - Level transmitters	Everest (Ohmart-Vega)	2013-02-28	2013-02-25	2013-03-04							G1
194	82	0E	KPW	27	S	112	KPW-27-S-112	Instrumentation - Level transmitters	Chess Controls (Siemens)	2013-02-28	2013-02-25	2013-03-04							G1
195	83	0E	KPW	27	S	113	KPW-27-S-113	Instrumentation - Modulated Valve	Chess Controls (Elite)	2013-02-28	2013-02-25	2013-03-04							G1
196	83	0E	KPW	27	S	113	KPW-27-S-113	Instrumentation - Modulated Valve	Everest Automation (Jamesbury)	2013-02-28	2013-02-25	2013-03-04							G1
197	83	0E	KPW	27	S	113	KPW-27-S-113	Instrumentation - Modulated Valve	Contrôle Laurentide (Fisher)	2013-02-28	2013-02-25	2013-03-04							G1
198	83	0E	KPW	27	S	113	KPW-27-S-113	Instrumentation - Modulated Valve	Controlvalve (Masoneilan)	2013-02-28	2013-02-25	2013-03-04							G1
199	84	0E	KPW	27	S	114	KPW-27-S-114	Instrumentation - On-Off Valve	Chess Controls (Elite)	2013-02-28	2013-02-25	2013-03-04							G1
200	84	0E	KPW	27	S	114	KPW-27-S-114	Instrumentation - On-Off Valve	Everest Automation	2013-02-28	2013-02-25	2013-03-04							G1
201	84	0E	KPW	27	S	114	KPW-27-S-114	Instrumentation - On-Off Valve	Contrôle Laurentide	2013-02-28	2013-02-25	2013-03-04							G1
202	84	0E	KPW	27	S	114	KPW-27-S-114	Instrumentation - On-Off Valve	Controlvalve	2013-02-28	2013-02-25	2013-03-04							G1
203	85	0E	KPW	27	S	115	KPW-27-S-115	Instrumentation - pH probe	Endress & Hauser	2013-02-28	2013-02-25	2013-03-04							G1
204	85	0E	KPW	27	S	115	KPW-27-S-115	Instrumentation - pH probe	Contrôle Laurentide	2013-02-28	2013-02-25	2013-03-04							G1
205	85	0E	KPW	27	S	115	KPW-27-S-115	Instrumentation - pH probe	Everest Automation	2013-02-28	2013-02-25	2013-03-04							G1
206	86	0E	KPW	27	S	116	KPW-27-S-116	Instrumentation - Pressure indicators	Chess Controls	2013-02-28	2013-02-25	2013-03-04							G1
207	86	0E	KPW	27	S	116	KPW-27-S-116	Instrumentation - Pressure indicators	Wika	2013-02-28									G1
208	86	0E	KPW	27	S	116	KPW-27-S-116	Instrumentation - Pressure indicators	Everest	2013-02-28	2013-02-25	2013-03-04							G1
209	87	0E	KPW	27	S	117	KPW-27-S-117	Instrumentation - Pressure transmitters	Chess Controls (Siemens)	2013-02-28	2013-02-25	2013-03-04							G1
210	87	0E	KPW	27	S	117	KPW-27-S-117	Instrumentation - Pressure transmitters	Everest (ABB)	2013-02-28	2013-02-25	2013-03-04							G1
211	87	0E	KPW	27	S	117	KPW-27-S-117	Instrumentation - Pressure transmitters	Contrôle Laurentide (Rosemont)	2013-02-28	2013-02-25	2013-03-04							G1
212	88	0E	KPW	27	S	118	KPW-27-S-118	Instrumentation - Temperature transmitters	Chess Controls (Siemens)	2013-02-28	2013-02-25	2013-03-04							G1
213	88	0E	KPW	27	S	118	KPW-27-S-118	Instrumentation - Temperature transmitters	Everest (ABB)	2013-02-28	2013-02-25	2013-03-04							G1
214	88	0E	KPW	27	S	118	KPW-27-S-118	Instrumentation - Temperature transmitters	Contrôle Laurentide (Rosemont)	2013-02-28	2013-02-25	2013-03-04							G1
215	89	0E	KPW	15	S	301	KPW-15-S-301	Ball magnets	Magotteaux		2012-12-03	2013-01-15					- $		R1-TR
216	90	0E	KPW	15	S	302	KPW-15-S-302	Rod charger	Outotec		2012-11-06	2013-01-15		2013-02-01			- $		R1-TR
217	90	0E	KPW	15	S	302	KPW-15-S-302	Rod charger	Metso		2012-11-06		2012-11-20	2013-02-01	2012-12-13	52		EXW only one quotation for packages 302-313-314-315	R1-TR
218	90	0E	KPW	15	S	302	KPW-15-S-302	Rod charger	FL Smidth		2012-11-06		2012-11-16	2013-02-01	2012-12-13				R1-TR
219	90	0E	KPW	15	S	302	KPW-15-S-302	Rod charger	Heath & Sherwood		2012-11-13		2012-11-27	2013-02-01	2012-12-13	36			R1-TR
220	90	0E	KPW	15	S	302	KPW-15-S-302	Rod charger	McLellan		2012-11-06		2012-11-12	2013-02-01	2012-12-13	24	191 800,00 $	information to be to receive from delivery	R1-TR
221	0	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~303~~	~~KPW-15-S-303~~	~~Screw conveyors~~									~~$~~	**Genivar Responsability**	~~R1-TR~~
222	91	0E	KPW	15	S	304	KPW-15-S-304	Sodium carbonate package	CHEMACTION inc		**2013-05-16**	**2013-06-01**		**2013-06-03**	**2013-06-04**	38	1 050 000,00 $	ɋutations not concordance with Datasheet (Solution makedown tank) and silos;EXW	R1-TR
223	92	0E	KPW	15	S	305	KPW-15-S-305	Vibrating feeder	Metso		2012-11-01	2013-01-15	2012-12-11	2013-01-25	2013-01-17			email follow-up bid 8 january 2013	R1-TR
224	92	0E	KPW	15	S	305	KPW-15-S-305	Vibrating feeder	Eriez (Warco)		2012-11-01		2012-11-16	2013-01-25	2013-01-17	22			R1-TR
225	92	0E	KPW	15	S	305	KPW-15-S-305	Vibrating feeder	Sandvik		2012-11-01		2012-12-06	2013-01-25	2013-01-17	20	103 200,00 $		R1-TR
226	92	0E	KPW	15	S	305	KPW-15-S-305	Vibrating feeder	Sandvik		2013-02-11	2013-02-18	2013-03-01	2013-02-19		20	64 000,00 $	MLEWIS New proposal (Equip # 510-145-001) remplaced retractable belt conveyor 510-148-002 Only one bid, request by GENIVAR.	R1-TR
227	93	0E	KPW	15	S	306	KPW-15-S-306	Apron feeder	Metso		2012-11-01		2012-12-11	2012-12-21	2012-12-19	54	268 779,00 $	ry Proposal =42,Delivery email January 21, 37 weeks: Details to be provided in the	R1-TR
228	93	0E	KPW	15	S	306	KPW-15-S-306	Apron feeder	FL Smidth		2012-11-01		2012-11-03				- $	Declined to bid	R1-TR
229	93	0E	KPW	15	S	306	KPW-15-S-306	Apron feeder	Sandvik		2012-11-01		20102-12-06	2012-12-21	2012-12-19	28		no epron feeder but pan feeder	R1-TR
230	**94**	**0F**	**KPW**	**15**	**S**	**307**	**KPW-15-S-307**	**Retractable belt feeder**	**Obsolete**	**Obsolete**	**Obsolete**	**Obsolete**	**Obsolete**	**Obsolete**	**Obsolete**		**- $**	**nivar Responsability, To be rempalced by Vibrating feeder Mlewis 11 february 2(**	**R1-TR**
231	95	0E	KPW	15	S	308	KPW-15-S-308	Autoclean magnet (tramp metal magnet)	Ohio Magnetics, Inc. / Stearns Division		2012-11-01		2012-11-14	2013-01-18	2013-01-07	18			R1-TR
232	95	0E	KPW	15	S	308	KPW-15-S-308	Autoclean magnet (tramp metal magnet)	Walker Magnetics		2012-11-01		2012-11-15	2013-01-18	2013-01-07	18			R1-TR
233	95	0E	KPW	15	S	308	KPW-15-S-308	Autoclean magnet (tramp metal magnet)	Eriez (Warco)		2012-11-01		2012-11-16	2013-01-18	2013-01-07	18	60 000,00 $		R1-TR
234	0	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~309~~	~~KPW-15-S-309~~	~~Grizzly screen~~	Merged to KPW - 15 - S - 1	d to KPW - 15 - S	d to KPW - 15 - S	to KPW - 15 -	to KPW - 15	d to KPW - 15 -	d to KPW - 15 - S - 113		~~$~~	**Genivar Responsability**	~~R1-TR~~
235	96	0E	KPW	15	S	310	KPW-15-S-310	Rock breaker	TRAMAC		2012-11-01		2012-11-15	2013-02-01	2013-01-17	28			R1-TR
236	96	0E	KPW	15	S	310	KPW-15-S-310	Rock breaker	BTI (TELEDYNE)		2012-11-01		2012-11-15	2013-02-01	2013-01-17	16	179 744,00 $		R1-TR
237	96	0E	KPW	15	S	310	KPW-15-S-310	Rock Breaker	Sandvik		2012-11-12		2012-11-19	2013-02-01	2013-01-17	20			R1-TR
238	96	0E	KPW	15	S	310	KPW-15-S-310	Rock breaker	TECMAN via KN Equipment		2012-11-01		2012-11-09	2013-02-01	2013-01-17	Not specified			R1-TR
239	97	0E	KPW	15	S	311	KPW-15-S-311	Jaw crusher	Metso		2012-11-01		2012-11-28	2012-12-21	2012-12-12	52		C145 model to quotation, C160 model demanded on datasheet	R1-TR
240	97	0E	KPW	15	S	311	KPW-15-S-311	Jaw crusher	FL Smidth		2012-11-01		2012-11-30	2012-12-21	2012-12-12	56		bid planified receive nov 30 Ok reception le 30 Nov	R1-TR
241	97	0E	KPW	15	S	311	KPW-15-S-311	Jaw crusher	Sandvik		2012-11-01		2012-11-16	2012-12-21	2012-12-12	52	455 600,00 $	20 weeks for delivery and transport is not realist	R1-TR
242	98	0E	KPW	15	S	312	KPW-15-S-312	Cone crusher (secondary)	Metso		2012-11-01		2012-11-28	2012-12-21	2012-12-13	52	1 577 360,00 $	experience with Metso with another crusher 52 weeks	R1-TR
243	98	0E	KPW	15	S	312	KPW-15-S-312	Cone crusher (secondary)	FL Smidth		2012-11-01		2012-11-20	2012-12-21	2012-12-13	53			R1-TR
244	98	0E	KPW	15	S	312	KPW-15-S-312	Cone crusher (secondary)	Sandvik		2012-11-01		2012-11-16	2012-12-21	2012-12-13	28			R1-TR
245	99	0E	KPW	15	S	313	KPW-15-S-313	Rod mill	Metso		2012-11-01		2012-11-20	2012-12-21	2012-12-17	65	1 649 000,00 $	EXW one bid for the packages 302-313-314-315	R1-TR
246	99	0E	KPW	15	S	313	KPW-15-S-313	Rod mill	FL Smidth		2012-11-01		2012-11-16	2012-12-21	2012-12-17	63			R1-TR
247	99	0E	KPW	15	S	313	KPW-15-S-313	Rod mill	Outotec		2012-11-01		2012-11-26	2012-12-21	2012-12-17	63		trsp to precise (in package with ball-mill)	R1-TR
248	100	0E	KPW	15	S	314	KPW-15-S-314	Regrind mill	Metso		2012-11-01		2012-11-20	2012-12-21	2012-12-18	65	1 682 000,00 $	EXW one bid for the pakages 302-313-314-315	R1-TR
249	100	0E	KPW	15	S	314	KPW-15-S-314	Regrind mill	FL Smidth		2012-11-01		2012-11-16	2012-12-21	2012-12-18	63		trsp to precise (in package with rod-mill)	R1-TR
250	100	0E	KPW	15	S	314	KPW-15-S-314	Regrind mill	Outotec		2012-11-01		2012-11-26	2012-12-21	2012-12-18	73			R1-TR
251	101	0E	KPW	15	S	315	KPW-15-S-315	Verti-mill	Metso		2012-11-13		2012-11-20	2012-12-21		57	1 445 600,00 $	EXW one bid for the packages 302-313-314-315	R1-TR
252	102	0E	KPW	15	S	316	KPW-15-S-316	Grizzly scalper	Metso		2012-11-05	2013-01-15		2013-01-25			- $	email follow-up bid 8 january 2013	R1-TR
253	102	0E	KPW	15	S	316	KPW-15-S-316	Grizzly scalper	FL Smidth		2012-11-01		2012-11-14	2013-01-25	2013-01-16	24	128 990,00 $		R1-TR
254	102	0E	KPW	15	S	316	KPW-15-S-316	Grizzly scalper	Sandvik		2012-11-01		2012-11-16	2013-01-25	2013-01-16	52		20 weeks for delivery and transport is not realist	R1-TR
255	103	0E	KPW	15	S	317	KPW-15-S-317	Screen #1	Metso		2012-11-01	2013-01-15		2013-01-25			- $	email follow-up bid 8 january 2013	R1-TR
256	103	0E	KPW	15	S	317	KPW-15-S-317	Screen #1	FL Smidth		2012-11-01		2012-11-14	2013-01-25	2013-01-18	24	106 970,00 $		R1-TR
257	103	0E	KPW	15	S	317	KPW-15-S-317	Screen #1	Sandvik		2012-11-01		2012-12-06	2013-01-25	2013-01-18	24			R1-TR
258	104	0E	KPW	15	S	318	KPW-15-S-318	Grinding screen	Metso		2012-11-01	2012-01-15		2013-01-18			- $		R1-TR
259	104	0E	KPW	15	S	318	KPW-15-S-318	Grinding screen	Sizetec		2012-11-01		2012-11-14	2013-01-18	2013-01-18	24	491 240,00 $		R1-TR
260	104	0E	KPW	15	S	318	KPW-15-S-318	Grinding screen	W.S. Tyler		2012-11-01	2012-01-15		2013-01-18			- $		R1-TR
261	104	0E	KPW	15	S	318	KPW-15-S-318	Grinding screen Spiral Classifier	FL Smidth		2013-02-27	N/A	N/A	N/A	N/A	52	833 358,24 $	MLewis (March26,2013) equip choiced by MATAMEC Transport inclued in the price is estimated preliminary at 40 000$ can; 2 x 22+7.5kW=51,5 kW	R1-QC
262	105	0E	KPW	15	S	319	KPW-15-S-319	Regrind screen	Derrick corporation		2012-11-01	2012-01-15	2012-11-09	2012-12-21	2013-01-16	30	1 443 858,00 $		R1-TR
263	~~0~~	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~320~~	~~KPW-15-S-320~~	~~Dewatering screen~~	~~Weir~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~		~~$~~	~~MLewis21 nov precision (Équipement non-requis courriel 20121130-1022 PCo)~~	~~R1-TR~~
264	~~0~~	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~320~~	~~KPW-15-S-320~~	~~Dewatering screen~~	~~Metso~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~		~~$~~	~~(Équipement non-requis courriel 20121130-1022 PCo)~~	~~R1-TR~~
265	~~0~~	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~320~~	~~KPW-15-S-320~~	~~Dewatering screen~~	~~McLanahan~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~	~~Obsolete~~		~~$~~	~~(Équipement non-requis courriel 20121130-1022 PCo)~~	~~R1-TR~~
266	106	0E	KPW	15	S	321	KPW-15-S-321	Cyclones	FL Smidth - Mill Ore		2012-11-01		2012-11-15	2013-01-25	2013-01-22	36	63 615,00 $		R1-TR
267	106	0E	KPW	15	S	321	KPW-15-S-321	Cyclones	Multotec		2012-11-01	2012-01-15		2013-01-25	2013-01-22		- $		R1-TR
268	106	0E	KPW	15	S	321	KPW-15-S-321	Cyclones	Weir		2012-11-01		2012-11-19	2013-01-25	2013-01-22				R1-TR
269	107	0E	KPW	15	S	322	KPW-15-S-322	Rougher Magnetic separator	Outotec		2012-11-01		2012-12-06	2012-12-21	2012-12-20	66	2 473 447,00 $	r = 3 units (2 of 2500 High-Gradient and 1 of 1750 High-Gradient) + Spare parts = (	R1-TR
270	108	0E	KPW	15	S	323	KPW-15-S-323	Scavenger magnetic separator	Outotec		2012-11-01		2012-12-06	2012-12-21	2012-12-20	66	2 227 535,00 $	er = 1 TESLA FOR TOTAL = (2 UNITS) + spare parts = (2 * 947375) + 919 + 274510	R1-TR
271	109	0E	KPW	15	S	324	KPW-15-S-324	Agitator	Hayward Gordon	2012-12-07		2012-12-21		2013-01-18			- $		R1-TR
272	109	0E	KPW	15	S	324	KPW-15-S-324	Agitator	Mixpro	2012-12-07		2012-12-21		2013-01-18			- $		R1-TR
273	109	0E	KPW	15	S	324	KPW-15-S-324	Agitator	Mixpro		2013-03-12	2013-03-20	2013-04-26	2013-04-16	2013-04-29			New bid for april 5 2013	R1-TR
274	109	0E	KPW	15	S	324	KPW-15-S-324	Agitator	Stanley Consulting (Philadelphia Mixers)	2012-12-07		2012-12-21		2013-01-18			- $		R1-TR
275	110	0E	KPW	15	S	325	KPW-15-S-325	Thickener (Conventional, with mechanism)	Delkor Global		2012-11-05		2012-11-15	2013-01-18		54	2 648 900,00 $	Supplier is located at Mexico or Chile	R1-TR
276	110	0E	KPW	15	S	325	KPW-15-S-325	Thickener (Conventional, with mechanism)	Westech Inc		2012-11-05		2012-11-16	2013-01-18		36	2 839 000,00 $	Supplier is located at UTAH	R1-TR
277	110	0E	KPW	15	S	325	KPW-15-S-325	Thickener (Conventional, with mechanism)	FL Smidth		2012-11-05		2012-11-23	2013-01-18		79	4 129 549,00 $		R1-TR
278	110	0E	KPW	15	S	325	KPW-15-S-325	Thickener (Conventional, with mechanism)	Eimco-KCP		2012-11-05		2012-11-20	2013-01-18		60	1 684 000,00 $	Supplier is located at Chennai India M. Ravi Shankar work filiale EIMCO and M. A Deenadayalan in India	R1-TR
279	111	0E	KPW	15	S	326	KPW-15-S-326	Thickener (Cone, no mechanism)	Delkor Global		2012-11-01		2012-11-15	2013-01-18	2013-01-15	54		2 units	R1-TR
280	111	0E	KPW	15	S	326	KPW-15-S-326	Thickener (Cone, no mechanism)	Westech Inc		2012-11-01		2012-11-16	2013-01-18	2013-01-15	53		1 602 000,00 $	R1-TR
281	111	0E	KPW	15	S	326	KPW-15-S-326	Thickener (Cone, no mechanism)	FL Smidth		2012-11-01		2012-12-06	2013-01-18	2013-01-15	53	1 541 772,00 $	s + 2 * (instrum bed level and pressure) =2*748886 no rake assembly + 2 *(17705+	R1-TR
282	111	0E	KPW	15	S	326	KPW-15-S-326	Thickener SAND DEWATERING UNIT	McLanahan		2013-02-27	N/A	N/A	N/A	N/A		208 345,00 $	MLewis (March26,2013) equip choiced by MATAMEC ;100 HP	R1-QC
283	111	0E	KPW	15	S	326	KPW-15-S-326	Thickener (Cone, no mechanism)	Westech		2013-03-15	2013-04-05	2013-04-05	2013-04-06	2013-04-10	30		RFQ2 - EXW CHINA	R1-TR
284	111	0E	KPW	15	S	326	KPW-15-S-326	Thickener (Cone, no mechanism)	Delkor Global		2013-03-15	2013-04-05	2013-04-12	2013-04-06	2013-04-16	60		RFQ2 - EXW USA	R1-TR
285	111	0E	KPW	15	S	326	KPW-15-S-326	Thickener (Cone, no mechanism)	FL Smidth		2013-03-15	2013-04-05	2013-04-17	2013-04-06				New Bid - RFQ2 - Technical questions answer in process	R1-TR
286	112	0E	KPW	15	S	327	KPW-15-S-327	Large filter press	Phoenix - Distributor for Diemme		2012-11-08		2012-12-07	2013-01-18		68	10 563 376,00 $	EURO 5 filter-press (ref email from tommee larochelle nov 29 15h51 (Releach filter = 4 and Pre-Neutralization =1)	R1-TR
287	112	0E	KPW	15	S	327	KPW-15-S-327	Large filter press	Phoenix - Distributor for Diemme		2013-03-07	2013-03-28	2013-04-05	2013-03-28	2013-04-08	52		RFQ2 - FOB Italia	R1-TR
288	112	0E	KPW	15	S	327	KPW-15-S-327	Large filter press	Delkor Global		2012-11-08		2012-11-23	2013-01-18		106	5 352 000,00 $	Located Chile, 5 filter-press (ref email from tommee larochelle nov 29 15h51 (Releach filter = 4 and Pre-Neutralization =1)	R1-TR
289	112	0E	KPW	15	S	327	KPW-15-S-327	Large filter press	Delkor Global		2013-03-07	2013-03-28	2013-04-12	2013-04-16	2013-04-16	84		RFQ2 - EXW - India	R1-TR
290	113	0E	KPW	15	S	328	KPW-15-S-328	Small filter press	Outotec	?							- $		R1-TR
291	113	0E	KPW	15	S	328	KPW-15-S-328	Small filter press	Phoenix - Distributor for D	2012?	?	?	?	?	?		?		R1-TR
292	113	0E	KPW	15	S	328	KPW-15-S-328	Small filter press	Best H2O inc - Distributor for Diemme		2013-03-07	2013-03-26	2013-03-26	2013-03-28	2013-04-04			RFQ2 - FOB Italia	R1-TR
293	113	0E	KPW	15	S	328	KPW-15-S-328	Small filter press	Delkor Global	2012?	?	?	?	?	?		?		R1-TR
294	113	0E	KPW	15	S	328	KPW-15-S-328	Small filter press	Delkor Global		2013-03-07	2013-03-26	?	2013-03-28				New Bid - RFQ2 previous bid receive for the 8 april	R1-TR
295	114	0E	KPW	15	S	329	KPW-15-S-329	Sand filter	Westech Inc	?	?	?	?	2013-02-01	?		- $		R1-TR
296	114	0E	KPW	15	S	329	KPW-15-S-329	Sand filter	Veolia - John Meunier	?	?	?	?	2013-02-01	?		- $		R1-TR
297	114	0E	KPW	15	S	329	KPW-15-S-329	Sand filter	Delkor Global	?	?	?	?	2013-02-01	?		- $		R1-TR
298	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	Phoenix - Distributor for D	2012-12-07		2012-12-21	2012-12-07	2013-01-18			- $		R1-TR
299	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	RPA process technologies	2012-12-07		2012-12-21	2012-12-17	2013-01-18	2013-01-18	96	1 137 500,00 $	910000 Euro = 1,25 * 910000 = 1137500	R1-TR
300	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	RPA process technologies	2013-03-06	2013-03-06	2013-03-20	2013-03-21	2013-03-21	2013-04-04	40		RFQ2 - EXW - France	R1-TR
301	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	Enviro-Clear (Warco)	2012-12-07		2012-12-21	2012-12-14	2013-01-18	2013-01-18	69		2046000 USD	R1-TR
302	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	Enviro-Clear (Warco)	2013-03-06	2013-03-06	2013-03-20	2013-03-13	2013-03-21	No Bid			New Bid - RFQ2 Refused to bid	R1-TR
303	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	Bokela		2013-03-14	2013-03-21	2013-03-21	2013-03-21	2013-04-05			New Bid - RFQ2 Refered by KJJ Filter from Warco, Ready for Bid Analysis	R1-TR
304	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	Eimco-KCP	2013-03-21	2013-03-21	2013-04-08	2031-04-09	2013-04-09				New Bid - RFQ2	R1-TR
305	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	FL Smidth	2013-03-21	2013-03-19	2013-04-08	2013-04-10	2013-04-09				New Bid - RFQ2	R1-TR
306	115	0E	KPW	15	S	330	KPW-15-S-330	Belt filter	Outotec	2013-03-21	2013-03-19	2013-04-08	2013-04-08	2013-04-09				New Bid - RFQ2	R1-TR
307	116	0E	KPW	15	S	331	KPW-15-S-331	Ion exchanger	Internal		Internal						- $		R1-TR
308	117	0E	KPW	15	S	332	KPW-15-S-332	Silo and gate	Fournier Industries		2012-11-13		2012-11-26	2012-12-21			948 000,00 $	Price only for tank 572-601-001 A/B/C/D, no shipping included	R1-TR

*** Series 100 and 200 reserved for Genivar, series 300 and 400 reserved for Roche

\\TR-dc01\Fic-Projet\061623.002_Temiscaming_REE_Matamec\2300_Ingenierie\6_Emission\061623.002_Feasibility Study Issued\8_Soumis_capex (MLe-R1)\1-00-G1R1-MLST-00-015_Rev0G.

2										Request For Quotation (RFQ)		Bid Received		Bid Analysis						
3	ITEM	REV	Project	Discipline	Contract type	Sequential number	Lot #	Description	Supplier(s) / tenderer(s)	RFQ Planned Date	RFQ Real Date	Bid Receiv. Planned Date	Bid Receiv. Real Date	Bid Anal. Planned Date	Bid Anal. Real Date	Estimated Delivery Time (Weeks)	Price of Selected Supplier		Comments	Responsability
309	117	0E	KPW	15	S	332	KPW-15-S-332	Silo and gate	Canmec		2012-11-14		2012-11-26	2012-12-21			1 414 000,00	$	Price only for tank 572-601-001 A/B/C/D, no shipping included	R1-TR
310	117	0E	KPW	15	S	332	KPW-15-S-332	Silo and gate	Beroma		2012-11-14			2012-12-21			-	$	No answer recieved yet	R1-TR
311	118	0E	KPW	15	S	333	KPW-15-S-333	Tank exhaust fan	Internal		Internal						-	$		R1-TR
312	119	0E	KPW	15	S	334	KPW-15-S-334	Water heater	Internal		Internal						-	$		R1-TR
313	~~0~~	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~335~~	~~KPW-15-S-335~~	~~Sodium carbonate compressor and receiver~~	~~Internal~~		~~Internal~~						~~-~~	~~$~~	~~Cancelled, included in vendor package~~	~~R1-TR~~
314	120	0E	KPW	15	S	336	KPW-15-S-336	Vacuum pump	GD Nash (via SA McLernon	2013-01-18		2013-02-01		2013-02-15			-	$		R1-TR
315	121	0E	KPW	15	S	337	KPW-15-S-337	Dust collector	Aspectair		2012-11-01	2013-01-15		2013-02-01			-	$		R1-TR
316	121	0E	KPW	15	S	337	KPW-15-S-337	Dust collector	Wheelabrator (Siemens Energy)		2012-11-01	2013-01-15		2013-02-01			-	$	Richard Saab probleme transfer with the bid, transfer to Eric Desjardins Envisecure dec 3 2012	R1-TR
317	121	0E	KPW	15	S	337	KPW-15-S-337	Dust collector	Dynagroup Technologies		2012-11-01		2012-11-16	2013-02-01			259 000,00	$		R1-TR
318	122	0E	KPW	15	S	338	KPW-15-S-338	Scrubber	Fabricated Plastics		2013-04-02		2013-04-23				-	$		R1-TR
319	123	0E	KPW	15	S	339	KPW-15-S-339	Slurry pump - Benificiation Plant	FL Smidth - Mill Ore		2012-11-01		2012-11-15	2012-12-21			556 590,00	$	Rev. 1 receive Nov 30, 2012, shipping included (No RFQ2 because there was no modifications to the datasheets GM 2013-03-28)	R1-TR
320	123	0E	KPW	15	S	339	KPW-15-S-339	Slurry pump - Benificiation Plant	Weir		2012-11-01		2012-11-14	2012-12-21			991 245,00	$	attention rev1, shipping included, pump 525-520-001/002 missing	R1-TR
321	123	0E	KPW	15	S	339	KPW-15-S-339	Slurry pump - Benificiation Plant	Pompaction		2012-11-01		2012-11-15	2012-12-21			821 169,00	$	Shipping included	R1-TR
322	124	0E	KPW	15	S	340	KPW-15-S-340	Slurry pump - Hydromet	FL Smidth - Mill Ore		2012-11-07		2012-11-14	2012-12-21			-	$	Dont bid	R1-TR
323	124	0E	KPW	15	S	340	KPW-15-S-340	Slurry pump - Hydromet	Weir		2012-11-07		2012-11-19	2012-12-21	2013-02-15	28	144 000,00	$	February18 2013 New Option, Option C 3 pumps in series all metal lined 3 pumps = 144 000$ / Request the modification of type for the pump Nov 15 ok, shipping included, didn't quote on 16 pumps	R1-TR
324	124	0E	KPW	15	S	340	KPW-15-S-340	Slurry pump - Hydromet	Weir		2013-03-12	2013-04-05	2013-04-05	2013-04-11	2013-04-16				NewBid	R1-TR
325	124	0E	KPW	15	S	340	KPW-15-S-340	Slurry pump - Hydromet	ITT (Dist by Liquiteck Montreal)		2012-11-12		2012-11-14	2012-12-21					No shipping included, only few pumps quoted	
326	124	0E	KPW	15	S	340	KPW-15-S-340	Slurry pump - Hydromet	Pompaction		2012-11-07		2012-11-30	2012-12-21					shipping included, tailing pump 568-520-002 not included	R1-TR
327	125	0E	KPW	15	S	341	KPW-15-S-341	Solution pump - Hydromet	Weir		2012-11-07		2012-11-19	2013-01-18			90 628,00	$	Shipping included, didn't quote on all the pump. Quoted with package 340	
328	125	0E	KPW	15	S	341	KPW-15-S-341	Solution pump - Hydromet	ITT (Dist by Liquiteck Montreal)		2012-11-12		2012-11-16	2013-01-18			149 146,00	$	Shipping not included	R1-TR
329	125	0E	KPW	15	S	341	KPW-15-S-341	Solution pump - Hydromet	Pompaction		2012-11-07		2012-11-30	2013-01-18			187 992,00	$	transmit in the package 340 by Mlewis, has been retransmit Nov 22 by Mlewis email, shipping included	R1-TR
330	125	0E	KPW	15	S	341	KPW-15-S-341	Solution pump - Hydromet	Weir		2013-03-18	2013-04-05	2013-04-04	2013-04-11	2013-04-11		-	$	New Bid	R1-TR
331	126	0E	KPW	15	S	342	KPW-15-S-342	Sump pump - Benificiation Plant	FL Smidth - Mill Ore		2012-11-05		2012-11-15	2013-01-18			117 800,00	$	No shipping, no spare part included in price (No RFQ2 because there was no modifications to the datasheets GM 2013-03-28)	R1-TR
332	126	0E	KPW	15	S	342	KPW-15-S-342	Sump pump - Benificiation Plant	Weir		2012-11-05		2012-11-14	2013-01-18			184 736,00	$	bad number of the package by seller in th email show the bid, shipping included	R1-TR
333	126	0E	KPW	15	S	342	KPW-15-S-342	Sump pump - Benificiation Plant	Pompaction		2012-11-05		2012-11-15	2013-01-18			142 623,00	$	spare parts receive nov 21 , shipping included, spare part not included in price	R1-TR
334	127	0E	KPW	15	S	343	KPW-15-S-343	Sump pump - Hydromet	FL Smidth - Mill Ore		2012-11-07		2012-11-15	2013-01-18			67 550,00	$	spare parts recues 21 nov, shipping included, spare part not included in price	R1-TR
335	127	0E	KPW	15	S	343	KPW-15-S-343	Sump pump - Hydromet	Weir		2012-11-07		2012-11-15	2013-01-18			156 519,00	$	shipping included	R1-TR
336	127	0E	KPW	15	S	343	KPW-15-S-343	Sump pump - Hydromet	Weir		2013-03-12	2013-04-05	2013-04-02	2013-04-11	2013-04-15				New bid, Ready for Bid Analysis	R1-TR
337	127	0E	KPW	15	S	343	KPW-15-S-343	Sump pump - Hydromet	Pompaction		2012-11-07		2012-11-28	2013-01-18			329 496,00	$	shipping included	R1-TR
338	128	0E	KPW	15	S	344	KPW-15-S-344	Water pump	ITT (Dist by Liquiteck Montreal)		2012-11-08		2012-11-15	2013-01-18			73 976,00	$		R1-TR
339	128	0E	KPW	15	S	344	KPW-15-S-344	Water pump	Pompaction		2012-11-08		2012-11-15	2013-01-18			63 752,00	$	Shipping included	R1-TR
340	128	0E	KPW	15	S	344	KPW-15-S-344	Water pump	Pompaction		2013-03-18	2013-03-29	2013-04-03	2013-04-11	2013-04-15		-	$	New Bid	R1-TR
341	129	0E	KPW	15	S	345	KPW-15-S-345	Large tanks - Steel	Fournier Industries		2012-11-06			2012-12-21			4 220 098,00	$	2012-11-14 info supp a recevoir, price for 44W steel, no shipping included. Stainless steel price is $5 861 998, platform and access not included	R1-TR
342	0	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~345~~	~~KPW-15-S-345~~	~~Large tanks - Steel~~	~~CanmecAnnule~~		~~2012-11-06~~						~~-~~	~~$~~	No Bid, Modification of contact for this supplier by another one	R1-TR
343	129	0E	KPW	15	S	345	KPW-15-S-345	Large tanks - Steel	Canmec		2012-11-14		2012-11-26	2012-12-21			4 095 200,00	$	No shipping included	R1-TR
344	129	0E	KPW	15	S	345	KPW-15-S-345	Large tanks - Steel	Canmec		2013-03-11	2013-04-05	2013-04-05	2013-04-11	2013-04-16		-	$	New bid	R1-TR
345	129	0E	KPW	15	S	345	KPW-15-S-345	Large tanks - Steel	Beroma		2012-11-14		2012-11-26	2012-12-21			1 270 737,00	$	No shipping included	R1-TR
346	130	0E	KPW	15	S	346	KPW-15-S-346	Large tanks - FRP	Fournier Industries	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required			-	$	No large tank FRP	R1-TR
347	130	0E	KPW	15	S	346	KPW-15-S-346	Large tanks - FRP	CanmecAnnule	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required			-	$	No large tank FRP, Modification of contact at the supplier	R1-TR
348	130	0E	KPW	15	S	346	KPW-15-S-346	Large tanks - FRP	Canmec	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required			-	$	No large tank FRP	R1-TR
349	130	0E	KPW	15	S	346	KPW-15-S-346	Large tanks - FRP	Beroma	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required	New Furn. Required			-	$	No large tank FRP	R1-TR
350	131	0E	KPW	15	S	347	KPW-15-S-347	Small tanks - Steel	Fournier Industries		2012-11-06		2012-11-26	2013-01-18			157 000,00	$	No shipping included, price for 44W steel tank. Stainless steel tank price is $238 300	R1-TR
351	0	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~347~~	~~KPW-15-S-347~~	~~Small tanks - Steel~~	~~CanmecAnnule~~		~~2012-11-06~~						~~-~~	~~$~~	No Bid, Modification of contact for this supplier by another one	R1-TR
352	131	0E	KPW	15	S	347	KPW-15-S-347	Small tanks - Steel	Canmec		2012-11-14		2012-11-28	2013-01-18			103 500,00	$	No shipping included	R1-TR
353	131	0E	KPW	15	S	347	KPW-15-S-347	Small tanks - Steel	Canmec		2013-03-11	2013-04-05	2013-04-05	2013-04-11	2013-04-16				New bid	R1-TR
354	131	0E	KPW	15	S	347	KPW-15-S-347	Small tanks - Steel	Beroma		2012-11-14			2013-01-18			-	$	No answer received yet	R1-TR
355	132	0E	KPW	15	S	348	KPW-15-S-348	Small tanks - FRP	Fournier Industries		2012-11-06		2012-11-26	2013-01-18			448 000,00	$	No shipping included, price for 44W steel tank. Stainless steel tank price is $735 000	R1-TR
356	0	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~348~~	~~KPW-15-S-348~~	~~Small tanks - FRP~~	~~CanmecAnnule~~		~~2012-11-06~~			~~2013-01-18~~			~~-~~	~~$~~	No Bid, Modification of contact for this supplier by another one	R1-TR
357	132	0E	KPW	15	S	348	KPW-15-S-348	Small tanks - FRP	Canmec		2012-11-14			2013-01-18			-	$	Canmec will not quote, because they doesn't build Fiber glass tank	R1-TR
358	132	0E	KPW	15	S	348	KPW-15-S-348	Small tanks - FRP	Fibre Mauricie		2012-12-03		2012-12-06	2013-01-18			453 389,00	$	Price only for tank, no ladder or platform included. Can't do tank 572-605-008	
359	132	0E	KPW	15	S	348	KPW-15-S-348	Small tanks - FRP	Fibre Mauricie		2013-03-12	2013-03-18	2013-03-18	2013-04-15	2013-04-16				New bid	R1-TR
360	132	0E	KPW	15	S	348	KPW-15-S-348	Small tanks - FRP	Beroma		2012-11-14			2013-01-18			-	$	No answer received yet	R1-TR
361	132	0E	KPW	15	S	348	KPW-15-S-348	Small tanks - FRP	Fabricated Plastics		2013-03-28	2013-04-09		2013-04-15	2013-04-16		-	$	New Bid	R1-TR
362	0	~~0E~~	~~KPW~~	~~15~~	~~S~~	~~349~~	~~KPW-15-S-349~~	~~Isolation Gate~~									-	$	**Genivar Responsability**	~~R1-TR~~
363	133	**0E**	**KPW**	**15**	**S**	**350**	**KPW-15-S-350**	**Others - standard items (safety shower, eyewash station, etc.)**	Internal		Internal						-	$		**R1-TR**
364	134	**0F**	**KPW**	**15**	**S**	**351**	**KPW-15-S-351**	**Metal detector**	Internal		Internal						-	$		**R1-TR**
365	135	**0F**	**KPW**	**15**	**S**	**352**	**KPW-15-S-352**	**Sampler - Benificiation Plant**	**Heath & Sherwood**		**2012-11-13**		**2012-11-26**	**2013-01-18**			**387 100,00**	**$**		R1-TR
366	136	**0F**	**KPW**	**15**	**S**	**353**	**KPW-15-S-353**	**Cyclones - regrind**	FL Smidth - Mill Ore		**2013-01-28**								**To replace regrind screen**	R1-TR
367	136	**0F**	**KPW**	**15**	**S**	**353**	**KPW-15-S-353**	**Cyclones - regrind**	Weir		**2013-01-28**								**To replace regrind screen**	R1-TR
368	137	**0F**	**KPW**	**15**	**S**	**354**	**KPW-15-S-354**	**Polyethylene tanks**	Fabco Plastics		**2013-03-19**	**2013-03-28**		**2013-04-16**					**New bid, Ready for Bid Analysis**	R1-TR
369	**138**	**0G**	**KPW**	**15**	**S**	**355**	**KPW-15-S-355**	**Limestone vendor package**	CHEMACTION inc		**2013-05-16**	**2013-06-01**		**2013-06-03**	**2013-06-04**	**38**	**2 998 000,00**	**$**	**y MATAEMEC 1 silo and manipulation equip associat. Price to modified (data sh**	**R1-TR**
370	139	**0G**	**KPW**	**15**	**S**	**356**	**KPW-15-S-356**	**Lime vendor package**	CHEMACTION inc		**2013-05-16**	**2013-06-01**		**2013-06-03**	**2013-06-04**	**38**	**798 000,00**	**$**	**QUOTE=208M3) and slurry storage capacity too small (data sheet 137m3; quote**	**R1-TR**
371	**140**	**0G**	**KPW**	**15**	**S**	**357**	**KPW-15-S-357**	**Flocculant vendor package**	CHEMACTION inc		**2013-05-16**	**2013-06-01**		**2013-06-03**	**2013-06-04**	**ND**	**350 000,00**	**$**	**With skid with pumps and static mixer;EXW**	**R1-TR**
372	141	**0G**	**KPW**	**15**	**S**	**358**	**KPW-15-S-358**	**Polyox vendor package**	CHEMACTION inc		**2013-05-16**	**2013-06-01**		**2013-06-03**	**2013-06-04**	**ND**	**254 000,00**	**$**	**With skid with pumps and static mixer;EXW**	**R1-TR**
373	141	**0G**	**KPW**	**15**	**S**	**358**	**KPW-15-S-358**	**Polyox vendor package**	**Dow Chemical**		**2013-05-16**	**2013-06-01**		**2013-06-03**	**2013-06-04**				**Incomplete**	**R1-TR**
374	**142**	**0G**	**KPW**	**15**	**S**	**359**	**KPW-15-S-359**	**Sulfuric vendor package**	CHEMACTION inc		**2013-05-16**	**2013-06-01**		**2013-06-03**	**2013-06-04**	**ND**	**90 000,00**	**$**	**Pump only unloading pump 2 (tot72K$)and storage tank pump2(tot18K$);EXW**	**R1-TR**
375	143	**0G**	**KPW**	**15**	**S**	**360**	**KPW-15-S-360**	**Crushing circuit**	**Sandvik**				**2013-05-18**						**Asked et received by MATAMEC #QM-10112-5**	**R1-MTL**
376	144	**0F**	**KPW**	**07**	**S**	**401**	**KPW-07-S-401**	**Major mining equipment part 1 of 3**	**SMS - Komatsu**	**2012-12-10**	**2012-12-11**	**2013-01-16**	**2013-01-30**	**2013-02-08**	**2013-03-05**		-	$		**R1-MTL**
377	144	**0F**	**KPW**	**07**	**S**	**401**	**KPW-07-S-401**	**Major mining equipment part 1 of 3**	**Hewitt - Caterpillar**	**2012-12-10**	**2012-12-10**	**2012-12-21**	**2012-12-21**	**2013-02-08**	**2013-03-05**		-	$		**R1-MTL**
378	144	**0F**	**KPW**	**07**	**S**	**401**	**KPW-07-S-401**	**Major mining equipment part 1 of 3**	**Mic-A-Nic Terex/Kawasak**	**2013-01-14**	**2013-01-14**	**2013-01-25**	**2013-01-30**	**2013-02-08**	**2013-03-05**					**R1-MTL**
379	145	**0F**	**KPW**	**07**	**S**	**402**	**KPW-07-S-402**	**Major mining equipment part 2 of 3**	**Mabo - Western Star**	**2013-01-11**	**2013-01-14**	**2013-01-18**	**2013-01-25**	**2013-02-08**	**2013-03-05**		-	$		**R1-MTL**
380	145	**0F**	**KPW**	**08**	**S**	**402**	**KPW-08-S-402**	**Major mining equipment part 2 of 3**	**ReadyQuip - Terex**	**2012-12-19**	**2012-12-19**	**2012-12-31**	**2013-01-18**	**2013-02-08**	**2013-03-05**					**R1-MTL**
381	146	**0F**	**KPW**	**07**	**S**	**403**	**KPW-07-S-403**	**Major mining equipment part 3 of 3**	**Sandvik - Mining equipme**	**2013-01-11**	**2013-01-18**	**2013-02-01**	**2013-02-05**	**2013-02-15**	**2013-03-05**		-	$		**R1-MTL**
382	146	**0F**	**KPW**	**07**	**S**	**403**	**KPW-07-S-403**	**Major mining equipment part 3 of 3**	**Atlas Copco**	**2013-01-11**	**2013-01-14**	**2013-01-25**	**2013-01-31**	**2013-02-15**	**2013-03-05**		-	$		**R1-MTL**
383	147	**0F**	**KPW**	**07**	**S**	**404**	**KPW-07-S-404**	**Pick up**	**Internal**		**Internal**						-	$		**R1-MTL**
384	148	**0F**	**KPW**	**07**	**S**	**405**	**KPW-07-S-405**	**Fork lift**	**Internal**		**Internal**						-	$		**R1-MTL**
385	149	**0F**	**KPW**	**07**	**S**	**406**	**KPW-07-S-406**	**Lowbed + tractor**	**Internal**		**Internal**						-	$		**R1-MTL**
386	150	**0F**	**KPW**	**07**	**S**	**407**	**KPW-07-S-407**	**Mechanic Field Service Truck**	**Internal**		**Internal**						-	$		**R1-MTL**
387	151	**0F**	**KPW**	**07**	**S**	**408**	**KPW-07-S-408**	**Worker Shuttle Bus**	**Autobus Girardin Inc.**		**Internal**						-	$	**Phone conversation w/ Michel Labrie 1-800-567-1467**	**R1-MTL**
388	152	**0F**	**KPW**	**07**	**S**	**409**	**KPW-07-S-409**	**Portable Diesel Lights**	**Internal**		**Internal**						-	$		**R1-MTL**
389	153	**0F**	**KPW**	**07**	**S**	**410**	**KPW-07-S-410**	**Ambulance**	**Internal**		**Internal**						-	$		**R1-MTL**
390	154	**0F**	**KPW**	**07**	**S**	**411**	**KPW-07-S-411**	**Trailer equiped for Environmental Emergency**	**Internal**		**Internal**						-	$	**Included in lot 401**	**R1-MTL**
391	0	~~0F~~	~~KPW~~	~~07~~	~~S~~	~~415~~	~~KPW-07-S-415~~	~~Skid Steer Loader~~	~~Internal~~		~~Internal~~						-	$		**R1-MTL**
392	155	**0F**	**KPW**	**07**	**S**	**412**	**KPW-07-S-412**	**Fuel & Lube Truck**	**Internal**		**Internal**								Maybe divided into two trucks: Fuel Truck & Lube Truck. TBD	R1-MTL
393	156	**0F**	**KPW**	**07**	**S**	**413**	**KPW-07-S-413**	**Explosives**	**Dyno Nobel**	**2013-01-18**	**2013-01-18**	**2013-02-08**	**2013-02-12**	**2013-02-22**	**2013-03-05**					**R1-MTL**

*** Series 100 and 200 reserved for Genivar, series 300 and 400 reserved for Roche



APPENDIX 9- OPEX

ANNUAL TONNES MINED	**2 559 039 tpy**	
ANNUAL TONNES MINED - WASTE	1 226 789 tpy	
STRIPPING RATIO	0.92	
ANNUAL TONNES MILLED	**1 332 250 tpy**	
ANNUAL TONNES OF TREO - FS 2013	**3 650 tpy**	**Source: FS Study - Average for Life of mine**
ANNUAL TONNES OF TREO - PEA 2011	***5 257 tpy***	***Source: PEA Study - Average of Y2-Y12***

Rev. 0J

MATAMEC

OPEX ESTIMATE SUMMARY

FEASIBILITY STUDY

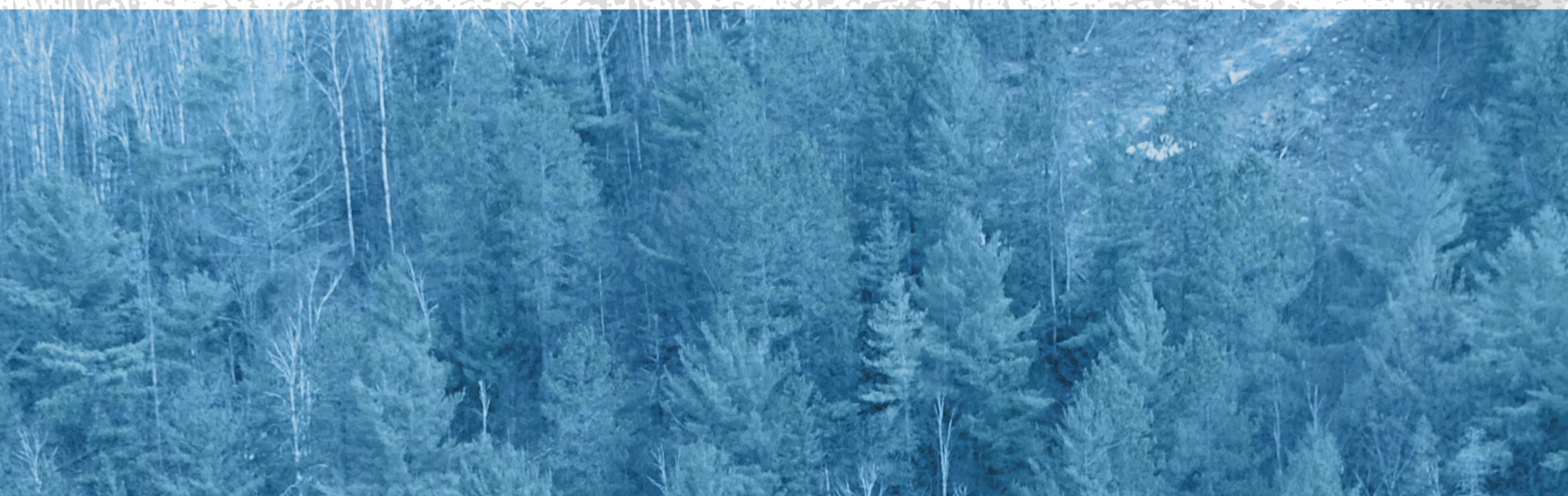
Rev. No.	COST ITEMS	Full Production Year ANNUAL COST ($/y)	ANNUAL COST PER TONNE MINED ($/t)	ANNUAL COST PER TONNE MILLED CONCENTRATOR ($/t)	ANNUAL COST PER kg OF TREO ($/kg)	From PEA study ANNUAL COST ($/y)	ANNUAL COST PER kg OF TREO ($/kg)	Var. vs. Fix.
	GENERAL & ADMINISTRATION	**11 606 417**	**4.54**	**8.71**	**3.18**	**$ 8 841 000**	**1.68**	
0H	MAN POWER - Administration	3 708 401	1.45	2.78	1.02	$ 3 672 000	0.698	F
0H	CONTRACTS	2 190 800	0.86	1.64	0.60	$ 2 971 000	0.565	F
0H	GENERAL	4 957 936	1.94	3.72	1.36	$ 1 343 000	0.255	F
0H	MARKETING	350 000	0.14	0.26	0.10	$ 450 000	0.086	F
0H	MUNICIPAL TAXES	399 280	0.16	0.30	0.11	$ 405 000	0.077	F
	MINING	**18 140 457**	**7.03**	**13.62**	**4.97**	**$ 16 619 000**	**3.16**	
	MINING ORE (Sub-Total) [$/t of ore]	10 801 078	*8.04*	*8.11*	*2.96*			
0H	Man Power - Mining - Ore	6 745 753	*5.02*	5.06	1.85			F
0I	Equipment & Consummables - Ore	4 055 326	*3.02*	3.04	1.11			V
	MINING - WASTE (Sub-Total) [$/t of waste]	7 339 379	*5.93*	*5.51*	*2.01*			
0H	Man Power - Mining - Waste	4 598 447	*3.72*	3.45	1.26			F
0I	Equipment & Consummables - Waste	2 740 931	*2.22*	2.06	0.75			V
	PROCESS	**48 725 000**	**19.04**	**36.57**	**13.35**	**$ 62 790 000**	**11.94**	
0H	MAN POWER - Process	8 541 000	3.34	6.41	2.34	$ 10 571 000	2.011	F
0H	ENERGY	5 397 966	2.11	4.05	1.48	$ 9 781 000	1.861	V
0G	FRESH WATER	20 102	0.01	0.02	0.01	$ 98 000	0.019	V
0H	REAGENTS	22 343 520	8.73	16.77	6.12	$ 29 207 000	5.556	V
0H	CONSUMMABLES	6 982 786	2.73	5.24	1.91	$ 4 741 000	0.902	V
0H	OTHER PROCESSING	674 000	0.26	0.51	0.18	$ 8 152 000	1.551	V
0H	TAILINGS	4 765 000	1.86	3.58	1.31	$ 240 000	0.046	V
TOTAL		**78 471 248**	**30.6**	**58.9**	**21.5**	**$ 88 250 000**	**16.8**	

NOTES:
Estimate is in Canadian Dollars (CAD)
Base date of preliminary estimate is June 1st 2013

PEA Other processing include: Transport of concentrate from Kipawa Mine Site to Temiscaming Hydromet Facility.
PEA Energy include: Mine site Gen set fuel consumption
PEA Municipal Taxes include: Mining Righs
PEA Annual Tonnes of TREO : 5257 tpy

0G	**Fixed Operating Costs**	**$**	**31 491 617**	**F**
0G	**Variable Operating Costs**	**$**	**46 979 630**	**V**

MATAMEC



APPENDIX 10- Financial Analysis

ROCHE GENIVAR SGS Golder Associates

Kipawa Project – Matamec - Feasibility Study - 2013

FINANCIAL ANALYSIS

Fraction: 0.17

All monetary values in CAD unless otherwise specified			Year	Total	-2	-1	1	2	3	4	5	6	7	8
Annual Mill Feed (t)				19 768 914		-	883 552	1 332 391	1 331 338	1 336 466	1 334 502	1 335 644	1 334 534	1 332 213
Annual Waste (t)				18 650 978		467 600	928 351	1 124 568	1 845 702	1 868 271	1 477 137	1 482 287	1 821 700	1 439 102
Annual Mineralization (High Grade) (t)				19 136 911		22 424	861 128	1 332 391	1 331 338	1 336 466	1 334 502	1 335 644	1 334 534	1 332 213
Mill Feed Grades														
Element	**Mag Recovery**	**Leach Recovery**												
Ce2O3	85,0%	77,1%		0,1196%			0,1256%	0,1428%	0,1274%	0,1373%	0,1362%	0,1315%	0,1140%	0,1221%
La2O3	85,0%	80,5%		0,0588%			0,0558%	0,0661%	0,0580%	0,0647%	0,0654%	0,0644%	0,0562%	0,0614%
Nd2O3	85,0%	77,2%		0,0550%			0,0602%	0,0675%	0,0599%	0,0643%	0,0628%	0,0601%	0,0522%	0,0553%
Pr2O3	85,0%	78,9%		0,0146%			0,0159%	0,0178%	0,0159%	0,0170%	0,0168%	0,0160%	0,0139%	0,0148%
Sm2O3	85,0%	81,5%		0,0123%			0,0135%	0,0153%	0,0134%	0,0145%	0,0140%	0,0135%	0,0118%	0,0124%
Eu2O3	85,0%	83,3%		0,0015%			0,0017%	0,0020%	0,0017%	0,0018%	0,0018%	0,0017%	0,0015%	0,0016%
Gd2O3	85,0%	85,0%		0,0119%			0,0130%	0,0148%	0,0129%	0,0140%	0,0135%	0,0131%	0,0114%	0,0120%
Tb2O3	85,0%	86,3%		0,0022%			0,0025%	0,0028%	0,0024%	0,0026%	0,0025%	0,0025%	0,0022%	0,0023%
Dy2O3	85,0%	86,7%		0,0147%			0,0162%	0,0182%	0,0159%	0,0174%	0,0166%	0,0164%	0,0144%	0,0150%
Ho2O3	85,0%	87,4%		0,0032%			0,0036%	0,0040%	0,0036%	0,0038%	0,0036%	0,0036%	0,0032%	0,0033%
Er2O3	85,0%	84,9%		0,0101%			0,0115%	0,0125%	0,0112%	0,0119%	0,0113%	0,0113%	0,0100%	0,0103%
Tm2O3	85,0%	81,1%		0,0016%			0,0018%	0,0019%	0,0018%	0,0018%	0,0017%	0,0017%	0,0016%	0,0016%
Yb2O3	85,0%	74,7%		0,0096%			0,0111%	0,0116%	0,0109%	0,0111%	0,0105%	0,0106%	0,0096%	0,0097%
LuO3	85,0%	62,1%		0,0013%			0,0015%	0,0016%	0,0015%	0,0015%	0,0014%	0,0015%	0,0013%	0,0013%
Y2O3	85,0%	85,4%		0,0943%			0,1052%	0,1173%	0,1044%	0,1123%	0,1062%	0,1058%	0,0936%	0,0970%
ZrO2	0,0%	0,0%												
Exchange Rate (USD/CAD)	1,000													
Revenues														
Element	**Price ($US/kg)**	**Trans. & Ref. Charges**	**% Production Sold**											
Ce2O3	$ 5,90	30,0%	100,0%	$ 63 926 439			$ 3 001 611	$ 5 145 151	$ 4 587 612	$ 4 962 947	$ 4 916 668	$ 4 749 514	$ 4 115 294	$ 4 401 214
La2O3	$ 5,95	30,0%	100,0%	$ 33 120 242			$ 1 404 180	$ 2 509 434	$ 2 197 621	$ 2 463 715	$ 2 487 042	$ 2 448 861	$ 2 134 302	$ 2 329 128
Nd2O3	$ 75,00	30,0%	100,0%	$ 374 453 908			$ 18 324 888	$ 30 974 376	$ 27 464 979	$ 29 606 685	$ 28 834 743	$ 27 638 302	$ 23 972 834	$ 25 387 656
Pr2O3	$ 75,40	30,0%	100,0%	$ 101 886 874			$ 4 973 715	$ 8 395 850	$ 7 500 761	$ 8 017 919	$ 7 915 938	$ 7 561 677	$ 6 557 714	$ 6 967 506
Sm2O3	$ 6,85	30,0%	100,0%	$ 8 048 808			$ 396 604	$ 675 671	$ 591 218	$ 643 677	$ 620 625	$ 599 568	$ 521 981	$ 548 104
Eu2O3	$ 1 100,00	30,0%	100,0%	$ 165 486 454			$ 8 305 535	$ 14 208 365	$ 12 205 077	$ 13 407 659	$ 12 868 720	$ 12 381 455	$ 10 830 088	$ 11 333 151
Gd2O3	$ 59,40	30,0%	100,0%	$ 70 520 694			$ 3 460 243	$ 5 912 170	$ 5 146 894	$ 5 637 705	$ 5 422 145	$ 5 253 336	$ 4 588 298	$ 4 818 792
Tb2O3	$ 1 076,00	30,0%	100,0%	$ 241 635 791			$ 12 112 276	$ 20 569 109	$ 17 786 893	$ 19 452 970	$ 18 595 346	$ 18 261 495	$ 15 997 336	$ 16 650 973
Dy2O3	$ 713,00	30,0%	100,0%	$ 1 066 608 485			$ 52 701 602	$ 89 310 936	$ 78 008 165	$ 85 662 404	$ 81 654 852	$ 80 494 404	$ 70 696 017	$ 73 283 398
Ho2O3	$ 53,60	40,0%	100,0%	$ 15 245 817			$ 767 066	$ 1 281 439	$ 1 137 500	$ 1 224 088	$ 1 162 337	$ 1 156 813	$ 1 021 712	$ 1 055 879
Er2O3	$ 63,60	40,0%	74,0%	$ 40 565 002			$ 2 063 360	$ 3 404 155	$ 3 037 625	$ 3 239 129	$ 3 074 538	$ 3 074 179	$ 2 732 843	$ 2 805 651
Tm2O3	$ 1 200,00	40,0%	15,0%	$ 22 824 224			$ 1 177 490	$ 1 902 991	$ 1 747 876	$ 1 815 999	$ 1 707 843	$ 1 723 044	$ 1 548 370	$ 1 570 946
Yb2O3	$ 56,70	40,0%	46,0%	$ 18 870 527			$ 975 783	$ 1 535 318	$ 1 446 231	$ 1 472 633	$ 1 395 830	$ 1 407 188	$ 1 274 545	$ 1 284 834
LuO3	$ 1 400,00	40,0%	40,0%	$ 46 495 763			$ 2 427 004	$ 3 707 345	$ 3 643 693	$ 3 581 281	$ 3 422 139	$ 3 433 541	$ 3 132 185	$ 3 155 880
Y2O3	$ 29,40	30,0%	100,0%	$ 278 291 644			$ 13 877 382	$ 23 339 135	$ 20 750 467	$ 22 422 208	$ 21 158 988	$ 21 110 105	$ 18 660 203	$ 19 299 233
ZrO2	$ -	0,0%	0,0%	$ -			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL: REVENUE ($)				**$ 2 547 980 672**			**$ 125 968 738**	**$ 212 871 446**	**$ 187 252 611**	**$ 203 611 018**	**$ 195 237 752**	**$ 191 293 483**	**$ 167 783 722**	**$ 174 892 345**

All monetary values in CAD unless otherwise specified	9	10	11	12	13	14	15	16
Annual Mill Feed (t)	1 329 596	1 328 140	1 331 603	1 331 603	1 331 603	1 331 603	1 332 250	231 875
Annual Waste (t)	1 143 672	766 692	911 893	911 893	911 893	911 893	638 325	-
Annual Mineralization (High Grade) (t)	1 329 596	1 328 140	1 331 603	1 331 603	1 331 603	1 331 603	932 122	-
Mill Feed Grades								
Element								
Ce2O3	0,1211%	0,1454%	0,1045%	0,1045%	0,1045%	0,1045%	0,0867%	0,0452%
La2O3	0,0621%	0,0732%	0,0540%	0,0540%	0,0540%	0,0540%	0,0445%	0,0226%
Nd2O3	0,0557%	0,0660%	0,0473%	0,0473%	0,0473%	0,0473%	0,0396%	0,0216%
Pr2O3	0,0148%	0,0175%	0,0124%	0,0124%	0,0124%	0,0124%	0,0104%	0,0057%
Sm2O3	0,0126%	0,0147%	0,0103%	0,0103%	0,0103%	0,0103%	0,0086%	0,0047%
Eu2O3	0,0016%	0,0019%	0,0013%	0,0013%	0,0013%	0,0013%	0,0010%	0,0006%
Gd2O3	0,0123%	0,0143%	0,0100%	0,0100%	0,0100%	0,0100%	0,0083%	0,0044%
Tb2O3	0,0023%	0,0027%	0,0018%	0,0018%	0,0018%	0,0018%	0,0015%	0,0008%
Dy2O3	0,0154%	0,0175%	0,0122%	0,0122%	0,0122%	0,0122%	0,0102%	0,0054%
Ho2O3	0,0034%	0,0039%	0,0026%	0,0026%	0,0026%	0,0026%	0,0022%	0,0012%
Er2O3	0,0105%	0,0119%	0,0083%	0,0083%	0,0083%	0,0083%	0,0070%	0,0039%
Tm2O3	0,0016%	0,0018%	0,0013%	0,0013%	0,0013%	0,0013%	0,0011%	0,0007%
Yb2O3	0,0096%	0,0110%	0,0081%	0,0081%	0,0081%	0,0081%	0,0071%	0,0046%
LuO3	0,0013%	0,0015%	0,0011%	0,0011%	0,0011%	0,0011%	0,0010%	0,0008%
Y2O3	0,0977%	0,1130%	0,0776%	0,0776%	0,0776%	0,0776%	0,0649%	0,0354%
ZrO2								
Exchange Rate (USD/CAD)								
Revenues								
Element								
Ce2O3	$ 4 354 829	$ 5 221 744	$ 3 765 228	$ 3 765 228	$ 3 765 228	$ 3 765 228	$ 3 125 233	$ 283 709
La2O3	$ 2 351 585	$ 2 768 478	$ 2 046 727	$ 2 046 727	$ 2 046 727	$ 2 046 727	$ 1 689 930	$ 149 061
Nd2O3	$ 25 488 803	$ 30 197 543	$ 21 671 553	$ 21 671 553	$ 21 671 553	$ 21 671 553	$ 18 150 014	$ 1 726 874
Pr2O3	$ 6 951 061	$ 8 226 186	$ 5 861 653	$ 5 861 653	$ 5 861 653	$ 5 861 653	$ 4 906 434	$ 465 501
Sm2O3	$ 556 655	$ 649 566	$ 456 744	$ 456 744	$ 456 744	$ 456 744	$ 382 044	$ 36 116
Eu2O3	$ 11 610 731	$ 13 531 803	$ 9 121 043	$ 9 121 043	$ 9 121 043	$ 9 121 043	$ 7 609 780	$ 709 919
Gd2O3	$ 4 892 405	$ 5 699 464	$ 4 010 349	$ 4 010 349	$ 4 010 349	$ 4 010 349	$ 3 339 439	$ 308 408
Tb2O3	$ 17 052 974	$ 19 585 944	$ 13 346 559	$ 13 346 559	$ 13 346 559	$ 13 346 559	$ 11 141 668	$ 1 042 569
Dy2O3	$ 75 147 407	$ 85 474 418	$ 59 940 708	$ 59 940 708	$ 59 940 708	$ 59 940 708	$ 49 842 978	$ 4 569 074
Ho2O3	$ 1 079 088	$ 1 225 750	$ 840 860	$ 840 860	$ 840 860	$ 840 860	$ 703 894	$ 66 812
Er2O3	$ 2 839 060	$ 3 231 252	$ 2 247 242	$ 2 247 242	$ 2 247 242	$ 2 247 242	$ 1 890 366	$ 183 874
Tm2O3	$ 1 585 361	$ 1 791 029	$ 1 265 219	$ 1 265 219	$ 1 265 219	$ 1 265 219	$ 1 079 857	$ 112 542
Yb2O3	$ 1 268 701	$ 1 450 194	$ 1 078 315	$ 1 078 315	$ 1 078 315	$ 1 078 315	$ 939 177	$ 106 835
LuO3	$ 3 079 305	$ 3 516 591	$ 2 670 159	$ 2 670 159	$ 2 670 159	$ 2 670 159	$ 2 405 390	$ 310 775
Y2O3	$ 19 390 500	$ 22 418 265	$ 15 430 199	$ 15 430 199	$ 15 430 199	$ 15 430 199	$ 12 917 770	$ 1 226 591
ZrO2	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL: REVENUE ($)	**$ 177 648 465**	**$ 204 988 227**	**$ 143 752 558**	**$ 143 752 558**	**$ 143 752 558**	**$ 143 752 558**	**$ 120 123 975**	**$ 11 298 658**

Kipawa Project – Matamec - Feasibility Study - 2013

FINANCIAL ANALYSIS

Fraction: 0.17

All monetary values in CAD unless otherwise specified	($/y)	($/t milled) / With Ind. & Cont.	Year	Total	-2	-1
Operating Expenses (OPEX)	($/y)	($/t milled)				
GENERAL & ADMINISTRATION	**11 606 417**	**8,71**		**182 801 075**		
MAN POWER - Administration	3 708 401	2,78		58 407 323		
CONTRACTS	2 190 800	1,64		34 505 100		
GENERAL	4 957 936	3,72		78 087 492		
MARKETING	350 000	0,26		5 512 500		
MUNICIPAL TAXES	399 280	0,30		6 288 660		
MINING (Including Mine Manpower)	**18 140 457**			**263 584 811**		
MINING - ORE (Cost per tonne ORE)	10 801 078	8,00	*t ore per year	157 985 704		
MINING - WASTE (Cost per tonne WASTE)	7 339 379	5,81	*t waste per year	105 599 107		
PROCESS	**48 724 374**	**36,57**		**734 279 279**		
MAN POWER - Process	8 541 000	6,41		134 520 750		
ENERGY	5 397 966	4,05		80 567 550		
FRESH WATER	20 102	0,02		300 028		
REAGENTS	22 343 520	16,77		333 489 090		
CONSUMMABLES	6 982 786	5,24		104 221 845		
OTHER PROCESSING	674 000	0,51		10 059 814		
TAILINGS	4 765 000	3,58		71 120 202		
TOTAL OPERATING EXPENSES ($)	**78 471 248**			**1 180 665 165**		
Operating Profit ($) (EBITDA)				**1 367 315 507**	-	-
Capital Expenses (CAPEX)		With Ind. & Cont.			**40%**	**60%**
Direct Costs	**257 992 730**	**369 207 075**		**369 207 075**	**147 682 830**	**221 524 245**
SUB-PROJECT 11 - OFF-SITE INSTALLATIONS	9 762 799	13 971 303		13 971 303	5 588 521	8 382 782
SUB-PROJECT 10 - MINE SITE	38 043 160	54 442 635		54 442 635	21 777 054	32 665 581
MINE DEVELOPMENT	3 879 269	5 551 527		5 551 527	2 220 611	3 330 916
SUB-PROJECT 14 - INTER-SITE SERVICES	13 352 349	19 108 220		19 108 220	7 643 288	11 464 932
SUB-PROJECT 18 - HYDRO-MET PLANT SITE	57 731 374	82 617 955		82 617 955	33 047 182	49 570 773
PROCESS PLANT	135 223 778	193 515 435		193 515 435	77 406 174	116 109 261
		With Contingency				
Sustaining Capital & Rehabilitation Expenses	**32 808 247**	**37 729 484**		**37 729 484**		
Mine fleet growth & equipment replacement	12 046 729	13 853 738		13 853 738		
Open pit dewatering (pumps + piping)	221 000	254 150		254 150		
Tailings Management Facilites Sustaining Capex	440 000	506 000		506 000		
Rehabilitation costs	20 100 518	23 115 596		23 115 596		
Indirect Costs	***67 556 900***					
Construction indirects	48 616 900					
Mill First Loads [1]	*2 500 000*			2 875 000		2 875 000
Capitalized Spare Parts [1]	*2 000 000*			2 300 000		2 300 000
Owner's costs	14 440 000					
Contingency	**53 753 682**					
Construction indirects contingency (15% Direct + Const. Indirect)	46 666 445	15%				
Owner's costs contingency (15% Owner's costs)	2 166 000	15%				
Sustaining Capital & Rehab contingency (15% Sust. Capex)	4 921 237	15%				
ADDITIONAL WC[2]		3,0	months	-		11 169 590
TOTAL CAPITAL EXPENSES ($)	**412 111 559**	412 111 559	406 936 559	**406 936 559**	**147 682 830**	**237 868 835**
						385 551 664
Corporate Income Taxes & Mining Taxes						
Federal Corporate Income Taxes				**128 851 932**	-	-
Provincial Corporate Income Taxes				**102 222 532**	-	-
Quebec Mining Taxes				**127 082 091**	-	-
Total Corporate Income Taxes and Mining Taxes ($)				**358 156 555**	**-**	**-**
PRE-TAX CASH FLOW ($)				**960 378 948**	**(147 682 830)**	**(237 868 835)**
Cumulative CF					-$ 147 682 830	-$ 385 551 664
Payback period work area						1,00
AFTER-TAX CASH FLOW ($)				**602 222 393**	**(147 682 830)**	**(237 868 835)**
Cumulative CF					-$ 147 682 830	-$ 385 551 664
Payback period work area						1,00

Year	1	2	3	4	5	6	7	8
GENERAL & ADMINISTRATION	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**
MAN POWER - Administration	3 708 401	3 708 401	3 708 401	3 708 401	3 708 401	3 708 401	3 708 401	3 708 401
CONTRACTS	2 190 800	2 190 800	2 190 800	2 190 800	2 190 800	2 190 800	2 190 800	2 190 800
GENERAL	4 957 936	4 957 936	4 957 936	4 957 936	4 957 936	4 957 936	4 957 936	4 957 936
MARKETING	350 000	350 000	350 000	350 000	350 000	350 000	350 000	350 000
MUNICIPAL TAXES	399 280	399 280	399 280	399 280	399 280	399 280	399 280	399 280
MINING (Including Mine Manpower)	**15 093 411**	**17 012 893**	**18 469 932**	**18 554 847**	**17 828 638**	**17 967 500**	**18 854 705**	**20 354 743**
MINING - ORE (Cost per tonne ORE)	8 246 825	10 528 835	9 435 039	9 433 074	9 992 222	10 080 445	9 815 217	10 659 011
MINING - WASTE (Cost per tonne WASTE)	6 846 586	6 484 058	9 034 893	9 121 773	7 836 416	7 887 055	9 039 488	9 695 732
PROCESS	**38 678 530**	**48 728 626**	**48 696 866**	**48 851 537**	**48 792 298**	**48 826 744**	**48 793 264**	**48 723 258**
MAN POWER - Process	8 541 000	8 541 000	8 541 000	8 541 000	8 541 000	8 541 000	8 541 000	8 541 000
ENERGY	4 048 474	5 398 537	5 394 270	5 415 048	5 407 090	5 411 717	5 407 220	5 397 816
FRESH WATER	15 076	20 104	20 088	20 165	20 136	20 153	20 136	20 101
REAGENTS	16 757 640	22 345 885	22 328 225	22 414 228	22 381 289	22 400 442	22 381 826	22 342 899
CONSUMMABLES	5 237 089	6 983 525	6 978 006	7 004 883	6 994 589	7 000 575	6 994 757	6 982 592
OTHER PROCESSING	505 500	674 071	673 539	676 133	675 139	675 717	675 156	673 981
TAILINGS	3 573 750	4 765 505	4 761 739	4 780 080	4 773 055	4 777 140	4 773 170	4 764 868
TOTAL OPERATING EXPENSES ($)	**65 378 359**	**77 347 937**	**78 773 215**	**79 012 801**	**78 227 354**	**78 400 661**	**79 254 386**	**80 684 418**
Operating Profit ($) (EBITDA)	**60 590 379**	**135 523 509**	**108 479 395**	**124 598 217**	**117 010 398**	**112 892 822**	**88 529 336**	**94 207 927**
Sustaining Capital & Rehabilitation Expenses	**13 123 943**	**11 730 298**	**97 520**	**412 850**	**1 771 742**	**270 020**	**862 500**	**1 921 708**
Mine fleet growth & equipment replacement	1 566 145	172 500	57 500	412 850	1 587 000	230 000	862 500	1 881 688
Open pit dewatering (pumps + piping)	-	-	40 020	-	-	40 020	-	40 020
Tailings Management Facilites Sustaining Capex	-	-	-	-	184 742	-	-	-
Rehabilitation costs	11 557 798	11 557 798	-	-	-	-	-	-
ADDITIONAL WC[2]	2 992 395	356 320	59 896	-$ 196 362	43 327	213 431	357 508	-$ 722 299
TOTAL CAPITAL EXPENSES ($)	**16 116 337**	**12 086 617**	**157 416**	**216 488**	**1 815 069**	**483 451**	**1 220 008**	**1 199 408**
Federal Corporate Income Taxes	-	-	-	6 189 100	14 512 171	14 752 668	11 600 530	12 230 472
Provincial Corporate Income Taxes	-	-	-	4 910 019	11 512 989	11 703 783	9 203 087	9 702 841
Quebec Mining Taxes	233 068	261 768	3 600 032	9 450 241	10 460 802	12 419 741	8 645 221	10 951 636
Total Corporate Income Taxes and Mining Taxes ($)	**233 068**	**261 768**	**3 600 032**	**20 549 360**	**36 485 962**	**38 876 192**	**29 448 838**	**32 884 949**
PRE-TAX CASH FLOW ($)	**44 474 042**	**123 436 892**	**108 321 979**	**124 381 729**	**115 195 330**	**112 409 370**	**87 309 328**	**93 008 519**
Cumulative CF	-$ 341 077 622	-$ 217 640 731	-$ 109 318 752	15 062 977	130 258 307	242 667 677	329 977 005	422 985 524
Payback period work area	1,00	1,00	1,00	0,88	0,00	0,00	0,00	0,00
AFTER-TAX CASH FLOW ($)	**44 240 974**	**123 175 124**	**104 721 947**	**103 832 369**	**78 709 368**	**73 533 178**	**57 860 490**	**60 123 571**
Cumulative CF	-$ 341 310 690	-$ 218 135 566	-$ 113 413 619	-$ 9 581 250	69 128 118	142 661 296	200 521 786	260 645 356
Payback period work area	1,00	1,00	1,00	1,00	0,12	0,00	0,00	0,00

Year	9	10	11	12	13	14	15	16
GENERAL & ADMINISTRATION	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**11 606 417**	**8 704 813**
MAN POWER - Administration	3 708 401	3 708 401	3 708 401	3 708 401	3 708 401	3 708 401	3 708 401	2 781 301
CONTRACTS	2 190 800	2 190 800	2 190 800	2 190 800	2 190 800	2 190 800	2 190 800	1 643 100
GENERAL	4 957 936	4 957 936	4 957 936	4 957 936	4 957 936	4 957 936	4 957 936	3 718 452
MARKETING	350 000	350 000	350 000	350 000	350 000	350 000	350 000	262 500
MUNICIPAL TAXES	399 280	399 280	399 280	399 280	399 280	399 280	399 280	299 460
MINING (Including Mine Manpower)	**17 544 480**	**16 882 825**	**17 090 657**	**16 713 510**	**17 452 537**	**17 319 035**	**15 877 004**	**568 094**
MINING - ORE (Cost per tonne ORE)	10 797 389	11 770 439	11 770 631	11 630 716	11 499 250	11 561 347	10 197 170	568 094
MINING - WASTE (Cost per tonne WASTE)	6 747 091	5 112 386	5 320 026	5 082 794	5 953 287	5 757 688	5 679 834	-
PROCESS	**48 644 324**	**48 600 408**	**48 704 868**	**48 704 868**	**48 704 868**	**48 704 868**	**48 724 383**	**13 399 572**
MAN POWER - Process	8 541 000	8 541 000	8 541 000	8 541 000	8 541 000	8 541 000	8 541 000	6 405 750
ENERGY	5 387 212	5 381 313	5 395 345	5 395 345	5 395 345	5 395 345	5 397 967	939 503
FRESH WATER	20 062	20 040	20 092	20 092	20 092	20 092	20 102	3 499
REAGENTS	22 299 009	22 274 590	22 332 674	22 332 674	22 332 674	22 332 674	22 343 525	3 888 837
CONSUMMABLES	6 968 875	6 961 244	6 979 396	6 979 396	6 979 396	6 979 396	6 982 787	1 215 338
OTHER PROCESSING	672 657	671 921	673 673	673 673	673 673	673 673	674 000	117 308
TAILINGS	4 755 508	4 750 300	4 762 687	4 762 687	4 762 687	4 762 687	4 765 002	829 337
TOTAL OPERATING EXPENSES ($)	**77 795 221**	**77 089 650**	**77 401 942**	**77 024 795**	**77 763 822**	**77 630 320**	**76 207 804**	**22 672 479**
Operating Profit ($) (EBITDA)	**99 853 244**	**127 898 576**	**66 350 616**	**66 727 763**	**65 988 736**	**66 122 238**	**43 916 171**	**-$ 11 373 821**
Sustaining Capital & Rehabilitation Expenses	**270 020**	**1 412 723**	**5 187 896**	**380 765**	**287 500**	**-**	**-**	**-**
Mine fleet growth & equipment replacement	230 000	1 091 465	5 133 846	340 745	287 500	-	-	-
Open pit dewatering (pumps + piping)	40 020	-	54 050	40 020	-	-	-	-
Tailings Management Facilites Sustaining Capex	-	321 258	-	-	-	-	-	-
Rehabilitation costs	-	-	-	-	-	-	-	-
ADDITIONAL WC[2]	-$ 176 393	78 073	-$ 94 287	184 757	-$ 33 376	-$ 355 629	-$ 13 383 831	-$ 5 668 120
TOTAL CAPITAL EXPENSES ($)	**93 627**	**1 490 796**	**5 093 609**	**565 522**	**254 125**	**(355 629)**	**(13 383 831)**	**(5 668 120)**
Federal Corporate Income Taxes	12 933 077	16 430 026	8 535 683	8 624 888	8 567 943	8 622 097	5 853 279	-
Provincial Corporate Income Taxes	10 260 241	13 034 487	6 771 642	6 842 411	6 797 235	6 840 197	4 643 601	-
Quebec Mining Taxes	14 282 584	24 065 569	6 838 843	7 178 100	7 259 571	7 434 533	3 989 083	11 299
Total Corporate Income Taxes and Mining Taxes ($)	**37 475 902**	**53 530 082**	**22 146 167**	**22 645 399**	**22 624 749**	**22 896 826**	**14 485 963**	**11 299**
PRE-TAX CASH FLOW ($)	**99 759 616**	**126 407 780**	**61 257 007**	**66 162 241**	**65 734 611**	**66 477 867**	**57 300 002**	**(5 705 701)**
Cumulative CF	522 745 141	649 152 921	710 409 928	776 572 169	842 306 780	908 784 647	966 084 649	960 378 948
Payback period work area	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
AFTER-TAX CASH FLOW ($)	**62 283 714**	**72 877 699**	**39 110 839**	**43 516 842**	**43 109 862**	**43 581 041**	**42 814 039**	**(5 717 000)**
Cumulative CF	322 929 070	395 806 769	434 917 608	478 434 451	521 544 313	565 125 353	607 939 392	602 222 393
Payback period work area	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Notes:
1. The indirect capital expenses identified in *italic* are working capital items. They are thus recovered at the end of mine life.
2. The additional working capital (WC) requirement is estimated as the number of months (entered in cell D76) of operating costs less the items identified in *italic*.

Assumptions:
Y1 - Opex is evaluated at 75% of typical year opex for G&A and Processing operating costs
Y16 - Opex is evaluated at 75% of typical year opex for fixed costs. Mining opex is calculated based on the haulage cost for the low grade ore, Processing variable costs are based on tonnage at the mill and cost per tonne of consummables, energy, etc...

Kipawa Project – Matamec - Feasibility Study - 2013

FINANCIAL ANALYSIS

FINANCIAL INDICATORS				
Pre Tax				
Payback Period (years)			**3,88**	
NPV @	6,0%	**$**	**449 703 890**	
NPV @	8,0%	**$**	**344 383 193**	
NPV @	10,0%	**$**	**259 712 764**	
NPV @	12,0%	**$**	**191 192 743**	
Internal Rate of Return			**21,6%**	Effective
After Tax				Tax Rates
Payback Period (years)			**4,12**	37,3%
NPV @	6,0%	**$**	**257 093 042**	42,8%
NPV @	8,0%	**$**	**185 432 572**	46,2%
NPV @	10,0%	**$**	**127 660 289**	50,8%
NPV @	12,0%	**$**	**80 791 349**	57,7%
Internal Rate of Return			**16,8%**	


ROCHE
GENIVAR
Golder Associates
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