



Preliminary Economic Assessment on Metallurgical Grade Alumina Project

NI 43-101 Technical Report



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GENIVAR INC.
1600, René-Lévesque West Blvd, 16th floor
Montréal (Québec) Canada H3H 1P9

TEL. : 514 340-0046
FAX : 514 340-1337
WWW.GENIVAR.COM

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PRELIMINARY ECONOMIC ASSESSMENT ON ORBITE ALUMINAE INC.

METALLURGICAL GRADE ALUMINA PROJECT

Quebec, Canada

Rod Doran, P.Eng., GENIVAR Inc.

André-Martin Bouchard, Eng., GENIVAR Inc.

Jean-Guy Levaque, Eng.

NI 43-101 TECHNICAL REPORT

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Prepared by:



In cooperation with: Jean-Guy Levaque, Eng.

DATE AND SIGNATURE PAGE

This report is effective as of the 24th day of November 2011, which is the cut-off date for all scientific and technical information included in the Technical Report. The effective date for all geology-related scientific and technical information is November 23th, 2011.



Rod Doran, P. Eng.,
Senior Mining Engineer
GENIVAR Inc.

January 12, 2012

Date



André-Martin Bouchard, Eng.,
Senior Environmental Engineer
Vice-President – Environment
GENIVAR Inc.

January 12, 2012

Date



Jean-Guy Levaque, Eng.,
Senior Geologist

January 12, 2012

Date

CERTIFICATE FOR JOHN RODNEY DORAN, P. ENG

I, John Rodney Doran, P. Eng., do hereby certify:

1. I reside at 1722 Latimer Crescent, Sudbury, Ontario P3E 2V7 and do hereby certify that;
2. I am contract employed by and carried out this assignment for GENIVAR Inc.

1600 René-Lévesque West, 16th Floor
Montreal QC H3H 1P9
Canada
Email: rod.doran@genivar.com;
3. I hold the following academic qualifications:
 - Diploma Technologist, Haileybury School of Mines;
 - B.S. Mining Engineering, South Dakota School of Mines and Technology;
 - B.S. Engineering Administration, Michigan Technological University;
4. I am a registered member, in good standing, of the Professional Engineer of Ontario (reg. 11936010), as well, I am a registered member in good standing of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) and a registered member of the Society for Mining, Metallurgy, and Exploration Inc. (SME);
5. I have worked as a mining engineer in the mineral and metallurgical industry for over 30 years;
6. I have read the definition of “Qualified Person”, set out in the National Instrument 43-101 Standards of Disclosure for Mineral Project (NI 43-101), and certify that, by reason of my education, affiliation with a professional association, and past relevant work experience among others as mine and metallurgical engineering and management in numerous underground and open pit mine operations, I fulfill the requirements to be an independent qualified person for the purposes of NI 43-101;
7. I am responsible for the coordination of the complete Technical Report and for the preparation of Sections 1-3, 13, 16-26 of the report entitled “Technical Report NI 43-101 for the Preliminary Economic Assessment of the Orbite Aluminae Inc. metallurgical grade alumina project”, (the “Technical Report”);
8. I have had no prior involvement with the properties that are the subject of the Technical Report;
9. I visited the project mine site and the Cap-Chat pilot plant facility on August 31, 2011;

10. I state that, as of the effective date of the Technical Report, and to the best of my qualified knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to not make the Technical Report misleading;
11. I have no personal knowledge, as of the date of this certificate, of any material fact or change, which is not reflected in this report;
12. Neither I, nor any affiliated entity of mine, is at present under an agreement, arrangement or understanding or expects to become an insider, associate, affiliated entity or employee of Orbite Aluminae Inc. (Orbite), or any associated or affiliated entities;
13. Neither I, nor any affiliated entity of mine, own directly or indirectly, nor expect to receive, any interest in the properties or securities of Orbite, or any associated or affiliated companies;
14. Neither I, nor any affiliated entity of mine, have earned the majority of our income during the preceding three years from Orbite, or any associated or affiliated companies;
15. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with the generally accepted Canadian Mining Industry practice and, as of the date of the certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to not make the Technical Report misleading.

This January 12th, 2012



John Rodney Doran, P. Eng.,
Senior Mining Engineer
GENIVAR Inc.

CERTIFICATE FOR ANDRÉ-MARTIN BOUCHARD, ENG.


I, André-Martin Bouchard, Eng., do hereby certify:

1. I am currently employed as Vice President – Environment in the consulting firm.

GENIVAR Inc.
1600 René-Lévesque West, 16th Floor
Montreal QC H3H 1P9
Canada
2. I graduated from École Polytechnique de Montréal, in 1993, as a Civil Engineer, and practicing environmental engineering since then;
3. I am a registered member, in good standing, of the Ordre des ingénieurs du Québec, since 1996 (reg. # 112394);
4. I am an Environmental Engineer, practicing in different type of projects, including mining, for the last 18 years. For example, I have been a Qualified Person for Osisko for the Canadian Malartic Gold Project, Preliminary Assessment.
5. I have read the definition of “Qualified Person”, set out in the National Instrument 43-101 Standards of Disclosure for Mineral Project (NI 43-101), and certify that, by reason of my education, affiliation with a professional association, and past relevant work experience in numerous projects, I fulfill the requirements to be an independent qualified person for the purposes of NI 43-101;
6. I am responsible for the preparation of section 20, and part of section 1, 25 and 26 of the complete Technical Report done by GENIVAR based on my past experience and knowledge, as well as information gathered by Orbite, analyzed by myself, and/or by my team of people working directly for me of the report entitled “Technical Report NI 43-101 for the Preliminary Economic Assessment of the Orbite Aluminae Inc. metallurgical grade alumina project”, (the “Technical Report”);
7. I have had no prior involvement with the properties that are the subject of the Technical Report;
8. I have not personally visited the site, but Bernard Fournier, M.Sc., Environmental Manager working for me, did visit the site on August 31th 2011, with Mr. Rod Doran, Project Manager;
9. I state that, as of the date of this certificate, and to the best of my qualified knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to not make the Technical Report misleading;

10. I have no personal knowledge, as of the effective date of the Technical Report, of any changes in fact or circumstances with respects to the subject matter of this report which materially affects the contents of the report or conclusion reached;
11. Neither I, nor any affiliated entity of mine, is at present under an agreement, arrangement or understanding or expects to become an insider, associate, affiliated entity or employee of Orbite Aluminae Inc. (Orbite), or any associated or affiliated entities;
12. Neither I, nor any affiliated entity of mine, own directly or indirectly, nor expect to receive, any interest in the properties or securities of Orbite, or any associated or affiliated companies;
13. Neither I, nor any affiliated entity of mine, have earned the majority of our income during the preceding three years from Orbite, or any associated or affiliated companies;
14. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with the generally accepted Canadian Mining Industry practice and, as of the date of the certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to not make the Technical Report misleading;
15. I consent to the filing of the Technical Report, with any stock exchange or any regulatory authority and any publication by them, including electronic publication in the public company files on their websites accessible by the public of Technical Report;
16. A copy of the Technical Report is submitted as a computer readable file. The requirement of electronic filing necessitates submitting the report as an unlocked editable file. I accept no responsibility for any changes made to the computer file after it leaves my control.

This January 12th, 2012



André-Martin Bouchard, Eng.
Vice-President - Environment
GENIVAR Inc.

CERTIFICATE FOR JEAN-GUY LEVAQUE, ENG.

I, Jean-Guy Levaque, Eng., do hereby certify:

1. I reside at 30 Fortin, Boisbriand, Quebec, J7G 1R3 and do hereby certify that;
2. I graduated from École Polytechnique de Montréal, in 1970 as a geological engineer;
3. I am a registered member, in good standing, of the Ordre des ingénieurs du Québec, since 1970 (reg. # 21570);
4. I have worked as a geologist continuously since my graduation from university and I recently retired from the Lafarge Group in 2006 after a 25 year career. (With some 90,000 employees, the Lafarge Group is present in 76 countries and had a revenue in 2007 of 17.6 billion € with a net result of 1.9 billion €.) I started as chief geologist for North America at the Corporate Technical Center in Montreal, responsible for quality and reserves for 20 cement plants and 35 quarries producing some 20 million tonnes per year. I was also responsible for optimizing mining plans, mining techniques and updating rehabilitation plans. For the last four years, I fulfilled the same mandate from the International Technical Center in Lyon, France, responsible for South America, Africa, Middle East and developing projects in China and India. Previously, I had been senior hydro-geologist for Géomines Ltd working in Africa, West Indies and Canada. I was also Chief Engineer for Sidbec-Normines on the Fire Lake Project. I started my career with the Noranda Group in Murdochville as a geologist and chief geologist;
5. I have read the definition of “Qualified Person”, set out in the National Instrument 43-101 Standards of Disclosure for Mineral Project (NI 43-101), and certify that, by reason of my education and experience I fulfill the requirements to be an independent qualified person for the purposes of NI 43-101;
6. I have participated in the preparation of the complete Technical Report and for the preparation of Sections 1, 2-12, 14 and 15 of the report entitled “Technical Report NI 43-101 for the Preliminary Economic Assessment of the Orbite Aluminae Inc. metallurgical grade alumina project”, (the “Technical Report”);
7. I have no prior involvement with the Orbite Aluminae Inc. project, which is the subject of the Technical Report, except for the preparation of Technical Report dated March 31, 2011 and amended on August 21, 2011 entitled “Technical Report NI 43-101 2010 Field Work Grande-Vallée Property”, prepared in accordance with NI 43-101;
8. I visited the project mine site and the Cap-Chat pilot plant facility on various occasions over the last year. I have reviewed all available and pertinent documents and technical data regarding the Orbite Aluminae project;

9. I state that, as of the date of this certificate, and to the best of my qualified knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to not make the Technical Report misleading;
10. I have no personal knowledge, as of the effective date of the Technical Report, of any material fact or change, which is not reflected in this report;
11. I am independent of Orbite Aluminae Inc, as defined by Section 1.5 of the NI 43-101 and I have not received nor hope to receive any interest in the company Orbite Aluminae Inc.;
12. Neither I own directly or indirectly, nor expect to receive, any interest in the properties or securities of Orbite, or any associated or affiliated companies;
13. Neither I have earned the majority of our income during the preceding three years from Orbite, or any associated or affiliated companies;
14. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with the generally accepted Canadian Mining Industry practice and, as of the date of the certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to not make the Technical Report misleading.

This January 12th, 2012



Jean-Guy Levaque, Eng.,
Senior Geologist.

GLOSSARY

4N purity	Measure of metal purity (99.99%)
ASL	Above Sea Level
ALP	Acid Leaching Plant
ARP	Acid Recovery Plant
Al ₂ O ₃	Alumina, Aluminium Oxide
ACP	Alumina Calcining Plant
Atm	Atmospheric
barg	Bar gauge (Pressure)
B	Billion
BFD	Block Flow Diagram
BAPE	Bureau d'audiences publiques en environnement
CCME	Canadian Council of Ministers of the Environment
C\$	Canadian dollars
CEAA	Canadian Environmental Assessment Act
CIM	Canadian Institute of Mining, Metallurgy and Petroleum
CSA	Canadian Standards Association
CAPEX	Capital Expenditures
Cat	Caterpillar
CDPNQ	Centre de données sur le patrimoine naturel du Québec
CEPROCQ	Centre d'études des procédés chimiques du Québec
CTMP	Centre de technologie minérale et de plasturgie
Ce	Cerium
CoA	Certificate of Authorization

CFB	Circulating Fluidized Bed
CPP	Clay Preparation Plant
CKD	Clinker Kiln Dust
CAGR	Compound Annual Growth Rate
COREM	Consortium de recherche appliquée en traitement et transformation des substances minérales
cm ³	Cubic centimeters
DNA	Deoxyribonucleic acid
DCS	Distributed Control System
Dpi	Dot per inch
Dy	Dysprosium
EBITDA	Earning Before Interests, Taxes, Depreciation & Amortization, and stock based compensation, bonuses, mining rights and corporate overhead.
ERO	Environmental Reject Objective
Er	Erbium
Eu	Europium
FeCl ₃	Ferric Chloride
Fe ₂ O ₃	Ferric Oxide, Hematite
FOB	Free or Freight On Board
Gd	Gadolinium
Ga	Gallium
GJ	Giga Joule
GDP	Gross Domestic Product
HAZOP	Hazard and Operability study
HSE	Health, Safety & Environment

ha	Hectare
HPA	High Purity Alumina
HPQ	High Purity Quartz
HCl	Hydrochloric Acid
INRS	Institut national de recherche scientifique
IBC	Intermediate Bulk Containers
IRR	Internal Rate of Return
KPI	Key Performance indicator
kPag	kilopascal gauge (Pressure)
km	kilometer
kV	kilovolt
kWh	kilowatt-hour
KCl	Potassium Chloride
La	Lanthanum
LED	Light-Emitting Diode
LCD	Liquid Crystal Display
LQE	Loi sur la qualité de l'environnement
LOI	Loss on Ignition
m ³	Cubic meter
MgCl ₂	Magnesium Chloride
MgO	Magnesium Oxide
MDC	Map Designation of Claims
MAWP	Maximum Allowable Working Pressure
MPa	Megapascal (unit of pressure)

MW	Megawatt
MMER	Metal Mining Effluent Regulation
m	Meter
µm	Micro meter
M	Million
Mtpy	Million tonne per year
MDDEP	Ministère du Développement durable, de l'Environnement et des Parcs
MRNF	Ministère des Ressources naturelles et de la Faune du Québec
MDEIE	Quebec's Ministry of Economic Development, Innovation and Export Trade
NEMA	National Electrical Manufacturers Association
NRC-IRAP	National Research Council of Canada Industrial Research Assistance Program
NTS	National Topographic System
Nd	Neodymium
NI 43-101	National Instrument 43-101 Standards of Disclosure for Mineral Project, rev. June 30 th , 2011
NPV	Pre-tax Net Present Value
NAD	North American Datum
NaCl	Sodium Chloride
NaOH	Sodium Hydroxide, Caustic Soda
OPEX	Operational Expenditures
OEE	Overall Equipment Efficiency
ppb	Part per billion
ppm	Part per million
Pr	Praseodymium
PEA	Preliminary Economic Assessment

PFD	Process Flow Diagram
PART	Programme d'aide à la recherche technologique
QP	Qualified Person
QEQA	Quebec Environmental Quality Act
RE	Rare Earths
RE-Cl	Rare Earth Chloride
REE	Rare Earth Elements
REO	Rare Earth Oxide
RM	Rare Metals
RM-Cl	Rare Metal Chloride
RMO	Rare Metal Oxide
RoM	Run-of-Mine
RQD	Rock Quality Designation
SG&A	Safety, General and Administration expenses
Sm	Samarium
Sc	Scandium
s	Second
SMM	Secretariat of Mi'gmawei Mawiomi
SiO	Silicon Dioxide, Silicon Oxide
SGA	Smelter Grade Alumina
SME	Society for Mining, Metallurgy, and Exploration Inc.
SOFC	Solid Oxide Fuel Cell
SQRT	Square Root
scfm	Standard cubic feet per minute

TCE	Threshold Concentration producing an Effect
tph	Tonne per hour
tpy	Tonne per year
TREO	Total Rare Earth Oxide Ratio
US\$	American dollars
UV	Ultra-violet
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
WWTP	Wash Water Treatment Plant
wt	Weight
Y	Yttrium
ZEC	Zone d'exploitation contrôlée

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1 SUMMARY

Orbite Aluminae Inc. (Orbite) commissioned Genivar Inc. (GENIVAR) to prepare a Technical Report (the Report) on its wholly own (100%) mining rights on the Grande-Vallée property of approximately 6,441 hectares, the site of an aluminous clay deposit located 23 km South of Grande-Vallée, for its metallurgical grade alumina or smelter grade alumina (“SGA”) Project (the Project) in the Province of Quebec, Canada. This PEA technical report does not cover Orbite’s high purity alumina (“HPA”) project planned in Cap Chat, Qc. The Report incorporates a revised mineral resource estimate for the Project, which was completed by Mr. Jean-Guy Levaque, Eng. Independent and QP with the collaboration of Mr. Michel Rheault, P.Geo., M.Sc., Vice President – Business Development, Earth Observation VIASAT GeoTechnologies Inc., and provides information on a Preliminary Economic Assessment (PEA) that was based on these mineral resources and that includes a sensitivity analysis exercise.

The PEA is preliminary in nature and it includes in some areas inferred or indicated mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the conclusions reached in the PEA will be realized. Mineral resources that are not mineral reserves do not have demonstrated economic viability.

Unless otherwise specified all values reported in the Technical report are in Canadian dollars and metric units are the reference.

1.1 Principal Outcomes and Executive Summary

1.1.1 Business Strategy

- This NI 43-101F1 Technical report outlines the Principal Corporate focus of Orbite, which is to focus on alumina as the primary product. This report focuses solely on the metallurgical grade alumina business unit.
- The data presented in this Technical report are for a single plant whereas Orbite’s strategy is to build multiple plants (5 to 10) to ultimately capture a significant portion of the Quebec’s alumina requirements and initiate exports overseas.
- The report is elaborated in order to also address the Orbite’s environmentally friendly policy.

1.1.2 Specific Outcomes

- The in-pit mineral resources calculated, using a 18% Al_2O_3 cut-off grade, are totalizing 1,040 million metric tonnes minimum grading 23.37% Al_2O_3 , 52.62% SiO_2 , 8.42% Fe_2O_3 , 1.64% MgO , and 6.90% as mixed oxides in the indicated resources category.

Additional in-pit mineral resources calculated at 780.0 million metric tonnes, 573 ppm (on average) as rare earths (REO) and rare metals (RMO) oxides, have been categorized in the Inferred category. The mineral resource estimate was completed by Mr. Jean-Guy Levaque, Eng. Independent and QP following the 2011 Exploration Work in the Marin Sector, which is the sector of interest for this current PEA. In order to be further conservative, GENIVAR has nevertheless considered an average concentration of 530 ppm (REO and REO). This value is used throughout the Technical Report economical analysis. 12 recoverable REO and RMO are considered in this study.

- The conceptual mine plan was developed using the open-pit approach. Mining would be at an average rate of 2.45 Mtpy over a 25-year duration (actual Project life considered for the PEA).
- Taking into consideration the Project perspective, the rated Al_2O_3 average annual rate capacity, after full capacity is achieved, would be about 539,711 tpy over the 25 year Project duration.
- Similarly, the average annual forecast production, based on the hypothesis of the elements contained in the clay, established LOI, and individuals yield within the developed process, as well as considering a 95% Overall Equipment Efficiency, should be approximately the following:
 - Iron oxide - hematite (Fe_2O_3): 189,298 tpy
 - Silicon oxide (SiO_2): 1,228,628 tpy
 - Magnesium oxide (MgO): 27,816 tpy
 - Mixed oxides: 104,089 tpy
- Rare earths (REO) and rare metals oxides (RMO): 974.5 tpy of twelve pure rare earth elements (in the form of oxides), including scandium and gallium.
- This project assumes 93.18% recovery of Al_2O_3 from the Marin Sector claystone/mudstone, and average recoveries of minimum 90% for all other elements, except rare earths and rare metals oxides where 75% recovery was assumed, based on the various chemical pilot test accomplished.

- The conceptual process design uses a patented technology developed by Orbite, which is based on a hydrochloric acid (HCl) high pressure and high temperature semi-continuous leaching, to produce Al₂O₃ suitable for use with aluminum smelters.
- Marketable value added products will be produced, in specific cases and for certain elements, to be recoverable individually while regenerating the hydrochloric acid in the continuous process developed by Orbite.
- Operating costs over the Project life actually considered (25 year extent) were evaluated based on 2 scenarios, and all reported in \$/tonne of Al₂O₃ produced as the reference product, in terms of standard operating cost:
 - Reference Scenario 1 (production of Alumina & Hematite only): \$201.02 per tonne of Al₂O₃ produced equivalent for both products combined;
 - Reference Scenario 2 (Alumina, Hematite and other value added products): \$209.59 per tonne of Al₂O₃ produced excluding all value added products credits.

Capital expenditures (CAPEX) (+/- 30%):

CAPEX (mine and plant) was evaluated for both scenarios for the NI 43-101F1 Technical Report. Preferred scenario, Scenario 2, is reported in Table 1-1. It should be noted that \$27M additional was estimated required (included into Table 1-1) for the realization of Scenario 2. All figures presented were estimated to be required within a +/- 30% accuracy, which is the standard margin of error normally applicable for a Preliminary Economical assessment study (PEA).

Table 1-1 Project CAPEX (Mine and Chemical Plant)

Processing Plant	Estimated Cost
Total mine CAPEX	\$ 33,820,000
Total chemical process CAPEX	\$ 466,554,400
Total plant capital costs	\$ 500,374,400
Mine & Plant closure costs	\$ 7,588,400

Note: Figures have been rounded and as a result, some rounding errors have been introduced.

– **Economic Analysis** (Scenario 1) (Revenues from Alumina and Hematite only)

Assuming a 25 years operation requiring a \$473 M initial investment, generating annual steady EBITDA of \$154 M, the calculated internal rate of return (IRR) would be 33%, and the pre-tax net present value (NPV) at 5% discount rate would be \$1.7 B. The payback period would be 3.1 years. This shows that alumina and hematite alone are able to support the viability of Orbite's operations and profitability. At 10% discount rate, the NPV for the first SGA plant is \$949 M.

A sensitivity analysis performed on Scenario 1, varying alumina prices from \$325/t to \$425/t simultaneously to having the hematite prices following the same trends (\$125/t to \$200/t), makes the IRR vary from 19% to 33%, and the NPV from \$791 M to \$1.74 B, or from \$3.86/share to \$8.51/share on a fully diluted basis when using a 5% discount rate. Market alumina prices have varied between \$325 and \$425 over the last 12 months. A detailed sensitivity analysis, varying each element separately, including CAPEX and OPEX as well as the discount rate is presented in Section 22.

– **Economic Analysis** (Scenario 2) (Revenues from all potential marketable products)

Assuming a 25 years operation requiring a \$500 M initial investment, generating annual steady EBITDA of \$572 M, the calculated internal rate of return (IRR) would be 114%, and the net present value (NPV) at 5% discount rate would be \$7.7 B. The payback period would be less than one year. Preliminary marketability analysis information tends to confirm the potential market for these products, although further detailed market analysis will have to be carried out during the Feasibility study stage.

A sensitivity analysis was performed on Scenario 2, using same hypothesis as Scenario 1 for alumina and hematite pricing range, and varying simultaneously silica market price from \$10 to \$25/ton, revenues from magnesium oxide and other oxides from \$8.6 M to \$11.6 M and rare earths and metal by 20 to 65%. When adding silicon dioxide, magnesium oxide, other oxides revenues, these represent \$11.6 M of additional revenues. REO+RMO's revenues account alone to \$392.9 M (calculated as of August 2011 market price). It is worth to mention that these oxides all together add up to \$702 M in annual revenues as per GENIVAR's calculation.

When adding the revenues from the 12 REO+RMO's as oxides, magnesium and other oxides, and high purity silicon dioxide; sensitivity is of course less important due to the important portion of additional potential revenues. GENIVAR has therefore factored a reduction in the revenue from the REO+RMO's of +/- 65%. This sensitivity analysis then makes the IRR varying from 48% to 114%, and the NPV from \$2.9 B to \$7.7 B or from \$14.22/share to \$37.74/share on a fully

diluted basis using a 5% discount rate. At 10% discount rate, the NPV for the first SGA plant varies from \$1.7 B to \$4.8 B, or from \$8.25/share to \$23.35/share on a fully diluted basis.

A detailed sensitivity analysis for this scenario, varying each element separately, including CAPEX and OPEX as well as the discount rate, is also presented in section 22.

1.1.3 Qualified Person's Global Conclusions and Recommendations

A basic geological interpretation was carried out by independent geologists. The geometrical modeling and resources estimation were performed by Mr. Jean-Guy Levaque, Eng., QP and verified by Mr. J. R. (Rod) Doran, P. Eng., QP. The classification of the mineral resource for the Marin sector of the Grande Vallée project was based on the geological and grade continuity of claystone and mudstone of the L'Original Formation. The CIM Definitions, Standards on Mineral Resources and Mineral Reserves (2010) have been used for the resource classification.

Based on verifications in the field and on the information provided for this assessment, the geology independent qualified persons (QP's) believe that the geological interpretation and the data are valid. Overall, it is their opinions that the parameters assumptions, geological model and data reflect a reasonable approach, and are representative of the type and setting of the claystone and mudstone deposit of the Grande Vallée property. The QP's believe that the resources estimate is reasonable and appropriate. The mineral resources described in the Statement above, constitute contained material in the ground and have not been included in any formal plan of Exploitation. GENIVAR and Mr. Jean-Guy Levaque, Eng. QP are unaware of any known material issues related to environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant issues which may affect the mineral resources.

The GENIVAR QP's responsible for the chemical processing and extraction associated (including Environmental aspects) are very satisfied that the laboratory and Pilot Plant testing, and basic engineering studies, that have been carried out by Orbite either locally and internationally in association with SMS Siemag, Outotec GmbH, among others, have met the requirements of a Preliminary Economic Assessment. Demonstration of the chemistry of the Orbite Proprietary Process on a sustained, batch and continuous basis represents major milestones in the development of the Project. What the various pilot plants (Canada and Europe) have demonstrated is that the principal components of the chemical process, namely leaching and ion separation (mainly aluminum and iron) are technically valid and that the process can be operated on a large scale. The ability to produce alumina meeting and exceeding the smelter grade specification and even producing aluminum ingots has also been demonstrated.

For all intents and purposes, a sufficient body of information has been developed to warrant GENIVAR's recommendation to continue with the next stage of the Project which consists in the basic engineering leading to the Feasibility Study. It is GENIVAR's opinion that the most significant risk associated with the developed process is one of integration of multiple adapted and proven technologies together. The acid recovery system, which is the heart of the process, will represent an engineering challenge. Orbite is dealing with leaders in the World in that regards, which should minimize the risk.

1.2 Property and Ownership

Orbite owns 100% of the mining rights on its 6,441 hectares Grande-Vallée property, the site of three aluminous clay deposits located approximately 23 kilometers south of the town of Grande-Vallée, Quebec. The property is composed of 115 claims and is divided into 3 sectors: to the West, the Simoneau sector, in the middle, the Madeleine sector and to the East, the Marin Sector. It is this last sector which has seen the vast majority of field work, especially within the last 2 years of exploration.

All claims are in good standing and registered as 100% under the name of Exploration Orbite VSPA Inc. (now Orbite Aluminae Inc.)

1.3 Geology, Deposit Type, Mineralization

The general concept of mineral deposit does not apply to the Grande-Vallée site. The red claystone and red and green mudstone are friable rocks, the outcrops are generally covered with non-consolidated reddish deposits, weathered claystone. The claystone, weathered or not, is characterized by relatively high alumina content, varying between 23% and 26% Al_2O_3 , compared to alumina content varying between 15% and 21% for other rocks in the L'Original Formation.

These rocks cannot be compared, such as in the case of metallic deposits, to any particular type of deposits. They may be classified as belonging to the broad category of sedimentary aluminous clays which represent possible alternative sources of alumina to bauxite. These rocks, due to their reactive silica content, are not suitable to the Bayer Process, used in the standard extraction of alumina from Bauxite. The Grande-Vallée mudstone and claystone must be treated with acid processes, from which alumina is extracted using hydrochloric acid solutions unlike the Bayer process which uses caustic solutions.

1.4 Permits

In order to allow mining operations to proceed, the mining claims in the Marin Sector had to be surveyed and brought to the status of a mining lease. The request to obtain all necessary surface rights and permits from the Ministère des Ressources Naturelles et de la Faune de Québec (MRNF) was registered at the MRNF on September 14, 2011, with the dossier number 1120559 with the mining lease # 1013. Note that only 9 claims are involved out of 115. As for permits associated with construction, operation etc., of the chemical processing facility, GENIVAR has established within this PEA the list of permits eventually required and these have been based on the requirements and specific timeline of the Project. These will be detailed during Feasibility stage and firmly incorporated within the Project schedule.

1.5 History and Exploration

The first campaign was performed in June 2000, on the Eastern portion of the site. At the time, six 15 kilogram samples were collected from clay outcrops located along the edges of new logging routes. Composite samples yielded Al_2O_3 concentrations varying between 22.3% and 22.6% at the time including the following other mineralogical components: kaolinite, quartz, feldspars, mica and chlorite.

In July 2000, R. W. Turner, P. Geo. performed geological cartography and surface deposit sampling works for Poly-Vein. A total of 34 samples were collected for analysis. Following this work, three zones of red clay associated with red shale outcrops were delineated with the help of surface sampling. Core analysis indicated that the component shale and red mudstones had relatively high alumina content, varying from 24% to 25%.

A lithochemical survey and a bulk sampling were performed by the Institut National de Recherche scientifique (INRS) in November 2005 in the part of the site East of the Madeleine River, specifically on claims MDC 84880 to 84891 (Laflèche et coll., 2006⁽¹⁰⁾). In total, 88 samples of shale and mudstone were collected. The chemical composition of the fragmentary shale was characterized by relatively elevated alumina and iron contents relative to the surrounding lithological units, which are composed of shale or red, green or occasionally black shale.

The chemical analyses performed on the red fragmentary shale revealed average Al_2O_3 content of 23.36% and 8.95% iron as Fe_2O_3 . For other shales, the average content of Al_2O_3 and Fe_2O_3 respectively ranged between 17.17% and 20.74%, and 6.88% and 8.38%.

According to the INRS, the red shale's composition is unusual for this region of Québec, and is characterized by an elevated degree of alteration. Mineralogical analyses also indicate phases containing high levels of Al_2O_3 (up to 41% Al_2O_3) and relatively low K_2O , indicating the presence of kaolinite in the matrix.

From 2005 to 2007 prospecting was conducted and has allowed the identification of five zones with red clay deposits or fragmentary shale, associated with units of red shale of the Orignal Formation. At the time these zones were identified with the letters A, B and C (Marin Sector). From July 2007 to December 2007, Orbite conducted exploration work including prospecting on the Western part of the site, as well as excavations and trenches for the purposes of sampling, as well as drilling in the part of Zone A which is within the site. These activities allowed for the identification of two new zones.

The analysis results indicated that the red shale, of which the bedrock in Zone A is composed, have a chemical composition very similar to the non-consolidated fragmentary shale. The shale had Al_2O_3 contents evolving between 22.6% and 25.6%, and Fe_2O_3 contents evolving between 7.98% and 10.4%. Other lithologies are composed of shale (mudstones or siltstones) having somewhat lower Al_2O_3 (between 20% and 22%).

In 2008, the company was very active on the Grande-Vallée property. The exploration was conducted mostly in the extension of sectors where previous work had been engaged. 219 trenches or exploration pits were dug and sampled. The yearly results confirmed the previously defined geological environment.

In 2009, the company performed relatively low amount of drilling and few data collected were included in the work of 2010 and reported in 2010 Field work, Grande-Vallée Property, NI 43-101 Technical Report, dated March 31, 2011, amended August 21, 2011, prepared for Exploration ORBITE VSPA Inc (now Orbite Aluminae Inc.) by Mr. Jean-Guy Levaque.

Finally the 2011 exploration drilling was mostly oriented in the better definition of the geological model in order to be ready to launch a mathematical model with reputable software (Gencom). It also added to the confidence level on the homogeneity of both the claystone and the mudstone as well as for specific elements (resources) such as rare earths and rare metals.

The Orbite pilot plant also demonstrated in early 2011 the viability of clay containing as little as 18% Al_2O_3 . It meant that the mudstone, previously considered as waste, could be included with the higher alumina claystone. The yearly results were in line with the previous year's averages and variations. Table 1-2 summarizes the drilling accomplished in the Marin sector over the years.

Table 1-2 Holes and Total Length Drilled per Year in the Marin Sector

Year	Number of Holes	Length (m)
2007	40	3,222
2008	12	1,779
2009	4	993
2010	27	4,346
2011	23	2,718
Total		13,058

1.6 Drilling

As shown in Table 1-2, a total of 13,058 m were drilled over a five year extent on the Property since 2007. Four major drilling campaigns were performed on the property. The program through the years was principally aimed at evaluating, confirming the resources distribution and homogeneity. It is noteworthy to mention that previous campaigns concentrated solely on the claystone, since, at that time, it was the only material susceptible to produce alumina. In the fall of 2008, the company demonstrated, with lab test work, that a possible cut-off could be as low as 18% Al₂O₃. Ever since, the exploration and drilling works included the mudstone.

In the more recent years, from 2008 to 2010, further exploration work was undertaken to obtain a better knowledge of the behavior of the rocks in view of a future exploitation of the deposit. In 2008, 161 pits were dug and 210 samples taken in the Madeleine Sector. In this same year 64 pits were dug, 1,779 m of drilling completed and 125 samples were sent for assay in the Marin Sector. Over the whole area, structural studies that included RQD (rock quality designation) analyses and an environmental characterization study were completed. The results of this work were published in "Compilation des travaux techniques effectués sur la propriété de Grande-Vallée durant l'année 2008" a report by Mr. Jean-Guy Levaque, Eng. – February 2009.

In 2009 and 2010, some 5,339 m of drilling was done and 1,180 samples assayed for Al₂O₃ and other elements with the purpose of increasing and classifying the resources in the Marin Sector. A NI 43-101 compliant Technical Report (published in March 2011 and amended in August 2011) reporting the work done in 2009 and 2010 indicates that the clay deposit at the Marin deposit contains (using a conservative density estimate of 2 tonnes per cubic metre) 800 million to 1 billion tonnes of "indicated mineral resources".

In 2011, Orbite completed additional diamond drilling (2,718 m in 23 drill holes) and sampling (total of 509 assays) in the Marin Sector to identify the variability of the REO/RMO content throughout the various clays. The remaining work evaluated the continuity of the alumina and other product (Fe, Mg, Si, etc.) resources.

Recovery of the structural integrity of the core is known to be very difficult since the beginning of the property exploration work. The systematic RQD done on the 2008 and 2009 core as well as the sporadic one done in 2010 (see section below) provided an average of 15%. It is the nature of the argillite itself (very friable) that prevents from keeping core sample, especially splitted ones, and the reason (such a low RQD) the whole core was always sent to analysis to external lab. The actual recovery of material varied quite a bit and was mostly affected by the location of holes as well as the lithology.

The results from the drill program of 2010-2011 confirmed the grades defined in former drill programs and met the target set by Orbite.

1.7 Data Verification and Site Visit

The Property was visited by a number of experts during the last two years for the gathering of specific informations and data on the Project. Among others, the property was visited by Mr. Rod Doran, P. Eng, QP from GENIVAR on August 31, 2011. Mr. Doran was accompanied by Mr. Bernard Fournier, M.Sc. Environmental Manager at GENIVAR. They visited the mine site with geology QP Mr. Jean-Guy Levaque, Eng. The site was accessed and the entire day was spent visiting the camp, the core shed, and discussing the project with the site geologist.

The property was also visited by Mr. Bernard Chauvette, Geomorphologist, from GENIVAR (Quebec office), by Mr. Denis Meunier, Forestry Eng., also from GENIVAR (Baie Comeau office) on November 8 & 9, 2011. A team from MRNF also visited the mine site during the course of 2011. All were accompanied by QP Mr. Jean-Guy Levaque, Eng. Parts of the Marin Sector were walked during that last visit and few outcrops were examined. No specific collar location and azimuth verification were performed by GENIVAR; the procedure for the holes location having found to be acceptable and according to best practices in place with hand-held GPS. The location of the holes was found to be well documented. All the GPS coordinates and the orientations measured in the field matched the master database entries and the plot on the maps and sections, within the accuracy of the GPS instrument used and have been validated by QP Mr. Jean-Guy Levaque. The geology of the deposit and the exploration model were discussed with all the people mentioned above, and a series of outcrops and drill sites were examined. They also noted the very special behavior of the claystone and were shown what happens to the uncovered claystone with time, especially in and around the sampling pit. Others geology related persons also visited the site during the course of 2011; including Mr. Guy Béland, M.Sc. in

geology, MBA, Mr. Michel Rheault, P. Geo, M.Sc. from VIASAT GeoTechnologies Inc. and Mr. Guillaume Matton, P. Geo, from VIASAT GeoTechnologies Inc.

Mr. Jean-Guy Levaque, Eng. and QP completed a thorough verification of the Marin Sector database (drill log descriptions) in parallel to Guy Béland, M.Sc. in geology, MBA who performed the same verification on the core logs, meaning the coordinates and the chemical assays of each hole to be entered into the computer data base (Gencom software). This verification of more than 2800 samples was performed manually before entering them into Gencom at the GENIVAR facility. In order to have an independent review of the imported database, the mandate was given to Ms. Nicole Rioux, P. Geo. at GENIVAR and expert on Gencom. The consistency of the assays results was interpreted to reflect the good quality of the assays. GENIVAR found the database to be in good order and adequate to be used for a resource estimate.

1.8 Metallurgical Testwork

The PEA incorporates information generated from the various pilot scale testing programs from Orbite and other technology suppliers in Europe. The focus of these programs was to demonstrate the proper operation of multiple operation unit of a chemical and hydrometallurgical flowsheet, including clay preparation, leaching, calcination of Al_2O_3 and acid recovery while also concentrating elements and extracting these individually, simultaneously to testing the adapted technologies to Orbite's continuous process.

All these steps were demonstrated through various (3) pilot plant operations in different locations of the world. The leaching was optimized through the implementation of semi-continuous leach approach using recovered hydrochloric acid solution as the lixiviant at a temperature of 150-160°C and under pressure conditions. Levels of dissolution for Aluminum (Al), iron (Fe), magnesium (Mg) and other metals in excess of 90% were realized with a 4-6 hr residence times. The pilot plants demonstrated that both alumina, hematite, silicon dioxide could be isolated as relatively pure solutions, which could then be processed for recovery of products and the regeneration of hydrochloric acid (HCl) for re-use. Same approach applies with other elements (Mg, other oxides, rare metals and rare earths) and the acid recovery systems. Details of recovery can be found in Section 17.

1.9 Resource Estimation

The resource estimate was performed in accordance with NI 43-101 Standards and the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM Council (2005). Basic geological interpretation, and resource estimation were modeled using geometric method. An 18% Al_2O_3 equivalent cut-off was given by

process testing. Mineral resources for Orbite based on these interpolation parameters are presented in Table 1-3.

The table shows the Mineral Resource Statement for the Marin Sector of the Grande-Vallée Project belonging to Orbite Aluminae Inc. The average grade is the average grade of all analysis above 18% Al₂O₃, the density used is 2.6 g/cm³. The tonnages are expressed in millions of metric tonnes.

Table 1-3 Mineral Resources Estimate Summary for Marin Sector (using a Al₂O₃-equivalent cut-off of 18%)

Resource	Oxide	Grade	Total Min Mt
Indicated	Al ₂ O ₃	23.37%	1040
Indicated	SiO ₂	52.62%	1040
Indicated	Fe ₂ O ₃	8.42%	1040
Indicated	MgO	1.64%	1040
Indicated	Others	6.90%	1040
Inferred	RM & RE	573 ppm	780

The senior geologist (QP) who constructed the geologic and resource model estimation cautions that mineral resources have no demonstrated economic viability. In addition, there is no certainty that all or part of the mineral resources will be converted into reserves. No mineral reserves were declared in this report.

1.10 In-Pit Resources and Mining

The resource estimate and mining plan as prepared and presented in this report in the sections on Geology and Mineral Resources, has formed the basis of the pit optimization and the determination of the in-pit resources for the Marin Sector for the Project. In accordance with the guidelines of the National Instruments NI 43-101 on Standards of Disclosure for Mineral Projects and the Canadian Institute of Mine Metallurgy and Petroleum Definition Standards for Mineral Resources and Mineral Reserves adopted on August 20, 2000, the open-pit optimization has used all material classified in the measured, indicated and inferred categories.

The mining of Orbite's Grande-Vallée deposit will follow the standard practice of an open-pit shovel/truck operation without the conventional drilling and blasting required in a hard rock open pit mine. It has been shown in the mining of an approximate 3,400 tonnes of bulk sample that the aluminous clay can be mined without the need to drill and blast. The Grande-Vallée mine will operate in a load and haul cycle, using trucks and excavators, and supported by a fleet of auxiliary equipment. The run-of-mine (RoM) aluminous clay will be loaded by hydraulic excavators and delivered by

trucks to the primary sizer/crusher. The crushed clay will be transferred to a conveyor and conveyed to the clay storage bin. Waste rock material will be hauled to the waste disposal area located to the South of the pit.

The mining study was based on Orbite purchasing and maintaining the equipment required to mine the resource. An alternative option would be to contract out all activities related to mining, but this was not incorporated into this study. The final engineered pit geometry was adjusted to include a haulage ramp sized for the selected mining fleet, practical wall positions with appropriate pit slope stability, and benching arrangement as follows:

Table 1-4 Pit General Characteristics

Ramp Width for 2-lane traffic	20-25	(m)
Ramp Width for 1-lane traffic	20	(m)
Maximum Ramp Grade	10	(%)
Inter-Ramp Angle	50	(degree)
Bench Face Angle	75	(degree)
Benching Arrangement	2 x 10	(m)
Berm Width	11.4	(m)

Based on a cut-off grade of 18% Al₂O₃ equivalent, the Marin engineered open-pit design contains a total of 67 Mt of mineral resources in the indicated and inferred categories at an average grade as indicated in Table 1-5. The total in-pit resources are sufficient to cover a mine life of up to 25 years based on the production and construction targets as established by Orbite. Total waste material amounts to 10.3 Mt of waste for a stripping ratio of 0.15 tonne of waste per tonne of resource. The table below presents a detailed summary of the in-pit resources for the Marin Sector project.

Table 1-5 Marin Sector – In-pit Mineral Resources by Category

Resources Category	Tonnage (kt)	Al ₂ O ₃ (%)
Grande-Vallee Pit Design		
Indicated	67,239	23.37
Total In-Pit Resource*		
Rock	10,316	
Stripping Ratio	0.15	

* Notes:

1. In-Pit mineral resources are exclusive of mineral reserves. Mineral resources that are not mineral reserves do not have demonstrated economic viability.
2. In-Pit resources have been estimated using a cut-off grade of 18% Al Equiv
3. In-Pit resources have been estimated using a dilution rate of 5% and anclay loss factor of 5%

1.10.1 Pit Location and Design Based on Resources

This pit is located within the Marin Sector of Orbite's mining claims.

In reviewing the sections used in the overall mineable resource estimation GENIVAR noted that some of the pit slopes, where the final pit wall followed a geological contact, appeared high at first sight. To confirm the overall mineable resource, GENIVAR revised the pit slopes on each section using the following slopes for the referred to geological formation:

- Claystone and mudstone – 30 degree pit slope;
- Shale – 40 degree pit slope;
- Quartzite – 50 degree pit slope.

The revised sections were scaled and a volume resource was calculated using the half-way effective method between the sections used in the 2010 field work study. When a conservative specific gravity of 2.6 was applied to the total volume of claystone and mudstone the resource totaled more than 1,040 million tonnes of indicated resources. The revised pit slopes resulted in the mining of more surface rock (or waste rock) and an overall waste rock:resource ratio of 0.75:1. To support the Grande-Vallée alumina production plant (the Project) a smaller pit design has been created which is within the total resources outlined in the Marin Sector and within the boundaries as approved by the Quebec regulating authorities. The basic pit outline has been placed on 2 north-south geology sections and a pit plan has been created that shows the pit limits for an initial pit that will support plant operations for approximately 25 years. The created 25 year pit plan has a calculated overall waste rock:resource ratio of 0.15:1.

1.10.2 Mining Operation for Project Duration Based on Resources

Mining plans in the Marin Sector have been made to feed the alumina plant for more than 25 years of operation. During the first 11 years of plant operation pit operations will involve mining much of the south slope from the 425 m elevation down to the 355 m elevation, the current surface location at the northwest corner of the planned open pit. Thereafter 15 benches in a conventional open pit will be developed by means of a 10% ramp that will be located on the West wall of the pit.

Mining boundaries within the limits granted by the regulating authorities are essentially governed by the topography at the site. Mining during the first 11 years of

operation will involve leveling the selected open pit location to the 355 m elevation. To eliminate pit slopes within the clay that exceed 30 degrees the South mining limit has been set at the 425 m elevation. From the 425 m elevation 10 m contours have been drawn.

A geology plan of the open pit area shows that the area is mostly comprised of the higher grade claystone. A nose of over burden rock shale protrudes from the west and extends half-way across the mining area. Mudstone is present in the steeply sloping ground to the south and completely surrounds the nose of shale burden rock. Much of the mudstone to the south will be cut-off due to the decision to begin mining north of the 425 m contour. The mineable resource outline in the design pit totals 67.2 million tonnes of aluminous clay. The average grade of the total resource identified by Mr. Levaque is estimated to be 23.37% Al_2O_3 , plus all the other oxides and REE.

Overburden that covers the entire pit mining area has been scaled from geology sections and calculated to average 5.1 m in depth. Calculations show that approximately 37 million tonnes of claystone and mudstone are contained between elevations 355 m and 425 m. The burden rock nose of shale has been calculated to contain approximately 6.3 million tonnes of burden rock based on the assumption that the rock plunge is vertical. Below 355 m down to elevation 316 m, in-pit resource is 30 Mt and 4 Mt of waste in that pit interval.

1.10.3 Mine Production Schedule for the Project and Major Mining Fleet

The mine production schedule includes priority scheduling of the plant/mine access road, mobile equipment procurement and service building construction. These elements are required to provide support for the pit overburden and waste rock stripping program that is projected to last through years 2 and 3. Plant construction is estimated to take one and a half to two years. Overburden stripping is scheduled early to ensure higher grade product and sufficient quantities for plant start-up.

The annual mine production schedule in this PEA is based on 9 months of mining and stockpiling followed by a three month suspension of mine operations due to the heavy snows of winter weather. This schedule may be amended somewhat to avoid periods of heavy precipitation and to ensure mining of a reasonably dry product.

1.11 Process Design, Materials Handling and Processing

The metallurgical alumina Plant is to be located at the mine site on a relatively flat surface of the Marin Sector. This site was retained as the baseline for the purpose of the PEA. Other sites (Murdochville) were also evaluated but discarded due to economical and infrastructure requirements and costs reasons. The primary sized clay will be transferred by truck and conveyors to the chemical plant site. The

crushed clay will then undergo a secondary crushing stage through a vertical roller mill where product is dried, crushed and classified to a specific particle size. Material will then be submitted to a high temperature pressure and leaching stage.

The second step consists, as per pilot plant, in an acid leaching step where are dissolved all the soluble fractions of the clay in an acidic medium except for the silica that is insoluble. This leaching step (batch semi or continuous) is done at high pressure and at high temperature in a concentrated acid medium (hydrochloric acid at sub-azeotropic concentration). The residence time of the leaching is adjusted to maximize the aluminum recovery targets. Leaching breaks the structure of the clay and releases all metal ions present in the clay. Among others are formed: iron (mainly in Fe^{3+} form), aluminum ions (Al^{3+}), and other metal in form of chlorides (including rare earths and rare metals chlorides: RE/RM-Cl) which must then be separated to produce alumina. The slurry leachate is then filtered to separate the insoluble including all of the silica contained in the mother liquor. This silica is then washed, neutralized and directed to storage as value added product.

The separation of aluminum (in the form of chlorides) is done by sparging of highly concentrated and dry hydrochloric acid coming back, among others, from the calcination stage and other Orbite's process acid recovery systems. The increase in HCl concentration relative to their impurities reduces the solubility of AlCl_3 and allows its separation from the mother liquor. Two steps sparging are required to reach purity of the crystal that will lead to the aluminum chloride hexahydrate calcination into metallurgical grade alumina. Calcination will be performed into large CFB (Circulating Fluid Bed) ensuring high quality of metallurgical alumina (low LOI and very low alpha form) and high hydrochloric acid recovery using known and adapted technology as well as high heat recovery. The calcination is one of the main portions of the fundamental acid recovery loop system in Orbite's process.

The second main portion of the hydrochloric acid recovery comes from the hydrolysis at low temperature of the main flow of spent acid after AlCl_3 removal. The spent acid which consists mainly of FeCl_3 is pre-concentrated by evaporating water and free HCl and then hydrolyzed at 160-170°C in order to produce pure hematite while recovering HCl at its azeotropic (20.1% wt.) point. The hydrothermal hydrolyzer acts as a concentrator allowing the concentration in fairly important quantities of the remaining elements (MgCl_2 , RE/RM-Cl and other mixed chlorides) in solution. Known solvent extraction techniques, specifically for RE and RM, are then applied to extract these and convert them in terms of oxides eventually. Hydrothermal approach to produce pure hematite and recover hydrochloric acid is a demonstrated technology developed by SMS-Siemag and actually operating on large scale at Thyssen Krupp in Mobile Alabama, USA. SMS-Siemag also has 2 pilot units actually running in Vienna, Austria where hydrothermal process among others was adjusted and tested with Orbite's spent acid.

Magnesium chloride conversion to magnesium oxide (MgO) is the next basic process step and end of the acid recovery process route where all remaining impurities are converted to oxides and hydrochloric acid is recovered. Magnesium oxide is produced first by removing NaCl and KCl and then spray roasted to produce the oxide and again recover hydrochloric acid at its azeotropic point (20.1% wt.). Same approach for the mixed oxides at the end of the acid recovery section.

No harmful residues (solid and aqueous) are generated with Orbite's chemical process.

1.12 Environmental Considerations

Sustainable operations are planned to occur at the Orbite facility. The project will produce alumina without creating the toxic red mud generated by the traditional Bayer process. In fact, 90-95% of the starting clay mass should produce marketable products, such as alumina, hematite, magnesium oxides, high quality silica, selective oxides, and potentially 12 additional rare earth/metal elements. Other sustainable methods include high acid recovery, no residue generation, and highly performing and proven equipment and technologies. Orbite envisages the extraction and processing of the aluminous clay located within its claims in Grande-Vallée in the Gaspésie region for commercial purposes. The Project is considered to be a mining operation with a refinery (chemical process) given that the ultimate goal is to produce metallurgical (smelter) grade alumina (SGA) to be sold to aluminum smelters.

According to current laws and regulations, the project would not be subject (at the time of signature of this report) to the evaluation procedures as required by article 31.1 of the Quebec Environmental Quality Act (QEQA) (full impact assessment process), since production capacity of the mine does not exceed 7,000 tonnes per day. The project would still be subject to obtaining a Certificate of Authorisation pursuant to article 22 of the QEQA. This usual procedure is much less complex, faster and less costly. The project's activities should therefore be in compliance with the applicable laws and regulations in force at the various levels of government. Federal procedures should not be triggered since no fish habitat has been inventoried on the projected mine site and plant areas.

1.13 Project Permitting

All activities related to such a project must comply with all laws and regulations from the various levels of government having jurisdiction. At the federal level, the project will be subject to the Metal Mining Effluent Regulations (MMER), and it may also be subject to the Canadian Environmental Assessment Act. However, in order for this Act to be enforced on a privately-run project on land not under federal jurisdiction, one of the triggers specified in the Act must be in place. The most likely trigger for

the project at hand would be a Fisheries and Oceans Canada permit to be issued for the disturbance of a fish habitat. Recent studies done by a professional independent consulting firm (Roche, September 2011⁽¹¹⁵⁾) have confirmed absence of fish habitat on the mine and plant site. Streams flowing on the property have many obstacles that fish cannot go through, up into the selected site from the Madeleine River nor the Grande-Vallée River.

The province of Quebec requires that such a project complies with the QEQA as well as the Mining Act. The project's activities are mining in nature, however the commercial plant's activities are again planned to produce less than 7,000 tonnes per day. In addition, even though the site's activities affect on-site rivers which flow into the Saint Lawrence River, they will not affect watercourses having a watershed surface area greater than 25 km². These are the two principal triggers to consider, however neither apply to the project at hand. Therefore at the provincial level, the project will not be subject to a complete environmental impact study, nor to the evaluation process which would have involved the Environmental Public Consultation Bureau. Certificates of Authorisation will nonetheless have to be obtained from the MDDEP under the QEQA. The environmental characterization will therefore have to fulfill the requirements listed in Directive 019 on the Mining Industry, which specifies the MDDEP requirements for this type of project. However, the government is currently looking at a new bill (Bill 14) which may be adopted in 2012. This bill would enforce mining projects to perform a full environmental impact study in virtue of articles 31.1 and following of the QEQA.

As stated in Section 1.4, the application for a mining lease has been received by the Quebec Ministry of Natural Resources and Wildlife registry (Ministère des Ressources naturelles et de la Faune – MRNF) on September 14, 2011. The lease has yet to be granted. The location of the plant and all related infrastructure would have to be submitted to the MRNF for discussion and approval. The MRNF will also be involved in the site restoration plan. Finally, it must be noted that, among others, claims 2038512-515, 2038530-532, 2248809, 2248812, 2248817-18 and 2248824 for the Marin Sector are located in whole or in part in a wildlife habitat, a white-tailed deer preserve along the Madeleine River. No mining activity is currently considered on these two claims.

Note that prior to the pilot plant's start-up, a Certificate of Authorisation from the MDDEP as well as the submission of an environmental study to the Canadian Economic Development Agency were required and granted.

1.14 Estimated Operating Costs (OPEX)

Operating costs for the Project were evaluated based on 2 distinct reference scenarios:

- Reference Scenario 1: Alumina and hematite production combined;
- Reference Scenario 2: Alumina and hematite and other value added products (silicon dioxide, magnesium oxide, mixed oxides, rare earths and rare metals oxides).

Under both scenarios, mine OPEX remains the same. In summary, Figure 1-1 shows the Scenario 2 (Alumina, hematite and other value added products), which is the one evaluated and preferred, overall operating cost – OPEX distribution.

Figure 1-1 Operating Costs Summary (Preferred Scenario)

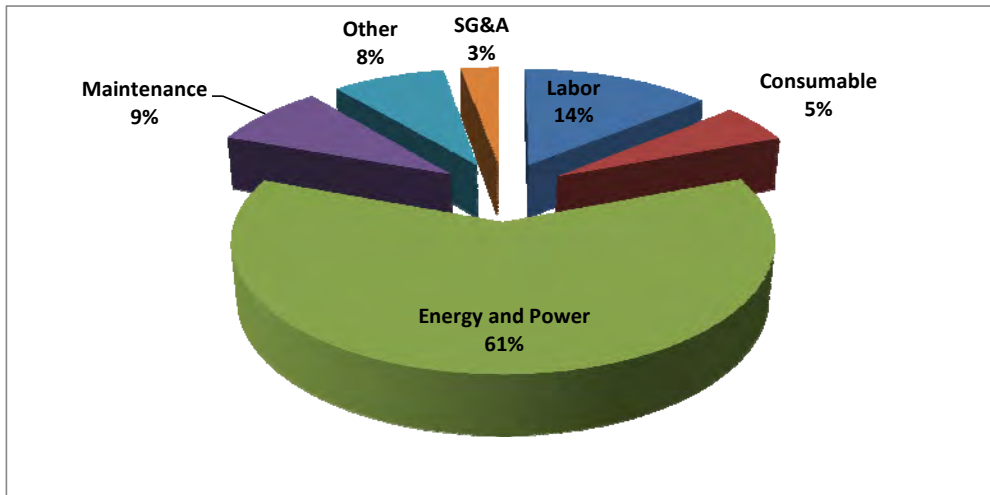


Figure 1-1 shows the cost structure for the production of all products (preferred scenario describe above). The energy and power consumption of the chemical processing account for approximately 61% of the Project's operating costs. Labor and maintenance are the other significant costs, representing 23%. The cost structure was benchmarked with similar chemical processes (pickling, ore leaching, etc.). Table 1-6 shows the detailed cost structure of the OPEX for the whole Plant to produce all products targeted to be extracted.

Table 1-6 Plant and Mining OPEX (Preferred Scenario)

Chemical Processing Costs		\$/tonne Alumina Produced
HCl Regeneration	\$ 30,704,449	\$ 56.89
AlCl ₃ Calcining	32,392,667	60.02
MgO Roaster	2,266,788	4.20
Other oxides pyrohydrolysis	2,532,326	4.69
Clay Drying & Crushing	937,071	1.74
Sub-total Main Plant Heat Input	\$ 68,833,301	\$ 127.54
Fresh HCl make up to process	\$ 476,569	\$ 0.88
NaOH supply for hematite purification	29,814	0.05
Utilities & Power	6,896,086	12.78
Plant Labor Costs	12,688,324	23.51
Plant Maintenance Costs	4,705,500	8.72
Plant Electrical & Instrumentation Controls	1,780,440	3.30
Plant Engineering	891,500	1.65
Plant Operating Consumables	699,960	1.30
Health, Safety and Environmental Costs	499,910	0.93
Laboratory Expenses	799,900	1.48
Plant Building Expenses	1,480,400	2.74
Administration & General Expenses	464,800	0.86
Total Chemical Process Operating Expenses	\$ 100,246,504	\$ 185.74
Mine operating expenses (Mine OPEX)	\$ 11,747,706	\$ 21.77
Marketing Expenses	1,122,500	2.08
Total Plant and Mining Operating Expenses (Scenario 2)	\$ 113,116,710	\$ 209.59

1.15 Estimated Capital Costs

The capital costs (CAPEX) for the process plants have been distributed over a 3 year period (year -1 to year 1) and have been divided into 3 phases (30%-30%-40% plant capacity). The detailed engineering, procurement and construction has been distributed as follows; 35% in Year -1, 55% in Year 0, 10% in Year 1, as Year 1 is the first year of production and Year -1 is the reference year where basic and detailed engineering are accomplished.

The most significant costs of the Project are associated with the chemical processing of the clay (see Section 17). A cost analysis was performed taking into account the main plant constituents. Capital costs breakdown and assumptions are summarized in Table 1-7 (mine) and Table 1-8 (Process Plant). Total plant CAPEX (mine and process plant), for all products (preferred Scenario 2) is estimated at \$500.4 M (\$927/t Al₂O₃) assuming the manufacturing of all other products.

Table 1-7 Mine CAPEX Estimate

Equipment	Number	Unit Cost	Total Costs
Mobile Equipment			
Cat 740 Ejector Articulated Trucks	10	\$ 700,000	\$ 7,000,000
Cat 345DL Hydraulic Excavators	3	525,000	1,575,000
Cat 160M Motor Grader	1	525,000	525,000
Cat 980K Loader	2	500,000	1,000,000
Cat D8T Track-Type Tractor	1	750,000	750,000
Cat D10T Track-Type Tractor	1	1,745,000	1,745,000
Small Trucks	4	40,000	160,000
Other Mobile Equipment	2	500,000	1,000,000
MOBILE EQUIPMENT CAPITAL			\$ 13,755,000
Fixed Equipment			
Primary Crusher (Sizer)			\$ 1,250,000
Feeder			300,000
Conveyor			600,000
Sub-total Fixed Equipment			\$ 2,150,000
Add: Feed Preparation & Mine Services Buildings:			
Clay Storage Building and communications			\$ 4,500,000
Office/Dry Complex (within the plant buildings)			500,000
Shop Complex (within the plant buildings)			500,000
Sub-total Feed Prep. +mine service buildings			5,500,000
Pre-Production Pit Stripping Operations			\$ 12,415,000
TOTAL MINE CAPITAL			\$ 33,820,000

Table 1-8 Chemical Plant Capital Expenditures (CAPEX) Breakdown

Chemical Processing Plant	Area	Sq. Ft.	Cost/Ft ²	Capital Cost
Clay Preparation Plant	900	9,684	200	\$ 1,936,800
Utilities Bldg & Control Room	2,250	24,210	200	4,842,000
Acid Leaching Plant No. 1	9,975	107,331	200	21,466,200
Acid Leaching Plant No. 2	9,975	107,331	200	21,466,200
Acid Leaching Plant No. 3	9,975	107,331	200	21,466,200
Alumina Calcining Plant	4,950	53,262	200	10,652,400
Acid Regeneration Plant	10,000	107,600	200	21,520,000
Sub-total Major Buildings		516,749		\$ 103,349,800
Add Equipment				219,699,600
Sub-total Major Buildings and Equipment				\$ 323,049,400
Add:				
MgO & REE Process Additions				\$ 19,000,000
River Pumphouse & Pipeline				2,500,000
Acid Storage Tank Farm (16 Units)				3,200,000
Alumina Storage Silos (8 Units)				2,400,000
Hematite Storage Silos (3 Units)				900,000
Silica Storage Loadout				4,000,000
Magnesium Oxide Storage Loadout				1,200,000
Mixed Oxides Storage Location				500,000
Parking & Landscaping				500,000
Sub-total				\$ 34,200,000
TOTAL PLANT CAPITAL				\$ 357,249,400
Add 10% contingency				35,725,000
Add 8% Engineering				28,580,000
SUB-TOTAL PLANT FIXED CAPITAL				\$ 421,554,400
Add new 120 kV power line from Murdochville:				
120 kV transmission line (30 km)				\$ 18,000,000
Murdochville substation conversion				5,000,000
Grande-Vallée Alumina Plant substation				12,000,000
TOTAL PLANT FIXED CAPITAL				\$ 456,554,400
Add Allowance for plant mobile equipment:				\$ 10,000,000
TOTAL PLANT CAPITAL COSTS				\$ 466,554,400

1.16 Financial Analysis

1.16.1 Financial Analysis (Projected Annual EBITDA)

A pre-tax cash flow and financial analysis were performed for the PEA study fusing two sets of financial analysis in order to demonstrate the financial strength of the Project. The key assumptions are presented below.

Revenue projections are for the first Plant and are based on the following assumptions:

Reference Scenario 1: Assumes Revenue from 539,711 tonnes of metallurgical grade alumina per year at a price of \$425/tonne (FOB plant) and the revenue from 189,298 tonnes of hematite with an estimated value of \$200/tonne (FOB plant). (See Section 19 for market hypothesis).

Reference Scenario 2: Assumes Revenue from 539,711 tonnes of metallurgical grade alumina per year at a price of \$425/tonne (FOB plant) together with the production of the following elements extracted using Orbite's technology (See Section 19 for market hypothesis):

- 189,298 tonnes of >99% pure hematite (Fe_2O_3) per year with an estimated value of \$200/tonne (FOB plant);
- 1,228,628 tonnes of >95% pure silica (SiO_2) per year with a value of \$25/tonne (FOB plant);
- 27,816 tonnes of >95% pure magnesium oxide (MgO) per year with an estimated value of \$400/tonne (FOB plant);
- 104,089 tonnes of mixed oxides per year that can be sold as a fertilizer with an estimated value of \$5/tonne (FOB plant).

In addition to the above listed products from the Orbite process, the company has the potential to recover twelve rare metals and rare earth elements (RM+RE's) (Gallium (Ga), normally categorized as a rare metal, Scandium (Sc), rare metal or rare earth, Cerium (Ce), Dysprosium (Dy), Erbium (Er), Europium (Eu), Gadolinium (Gd), Lanthanum (La), Neodymium (Nd), Praseodymium (Pr), Samarium (Sm), and Yttrium (Y) that are found to be in recoverable individually in the Project aluminous clays. The preferred Scenario 2 revenues from the rare earths contained in the mining and processing of 2.45 M tonnes of aluminous clay has been projected as follows: 974.5 tonnes in aggregate, of ten >99% pure rare earth elements (oxides) as well as rare metals scandium and gallium with an estimated annual aggregate gross value exceeding \$392 M.

Table 1-9 Annual Projected EBITDA – Scenario 2

		\$/tonne Alumina Produced	\$/tonne Clay Mined
REVENUE			
Alumina	\$ 229,377,175	\$ 425.00	\$ 93.62
Fe ₂ O ₃ (Hematite)	37,859,680	70.15	15.45
SiO ₂ (High Quality Silica)	30,715,708	56.91	12.54
MgO	11,126,400	20.62	4.54
Mixed Oxides	520,443	0.96	0.21
Rare Earth Elements	392,868,097	727.92	160.35
TOTAL REVENUE	\$ 702,467,503	\$ 1,301.56	\$ 286.71
COSTS			
Mining	\$ 11,747,706	\$ 21.77	\$ 4.79
Processing	100,246,504	185.74	40.92
Marketing	1,122,500	2.08	\$ 0.46
TOTAL COSTS	\$ 113,116,710	\$ 209.59	\$ 46.17
Profit before Royalty	\$ 589,350,793	\$ 1091.97	\$ 240.54
3% Net Operating Profit Royalty (first 5 years only)	\$ 17,680,524	\$ 32.76	\$ 7.22
EBITDA	\$ 571,670,269	\$ 1059.21	\$ 233.32

The above table shows that Orbite's manufacturing costs for all products generated are estimated to be \$209.59/tonne of alumina produced (allocating all costs to alumina) or \$46.17 / tonne of clay mined. Each tonne of aluminous clay mined and processed using Orbite's process has the potential to generate an EBITDA of \$1,059.21/tonne.

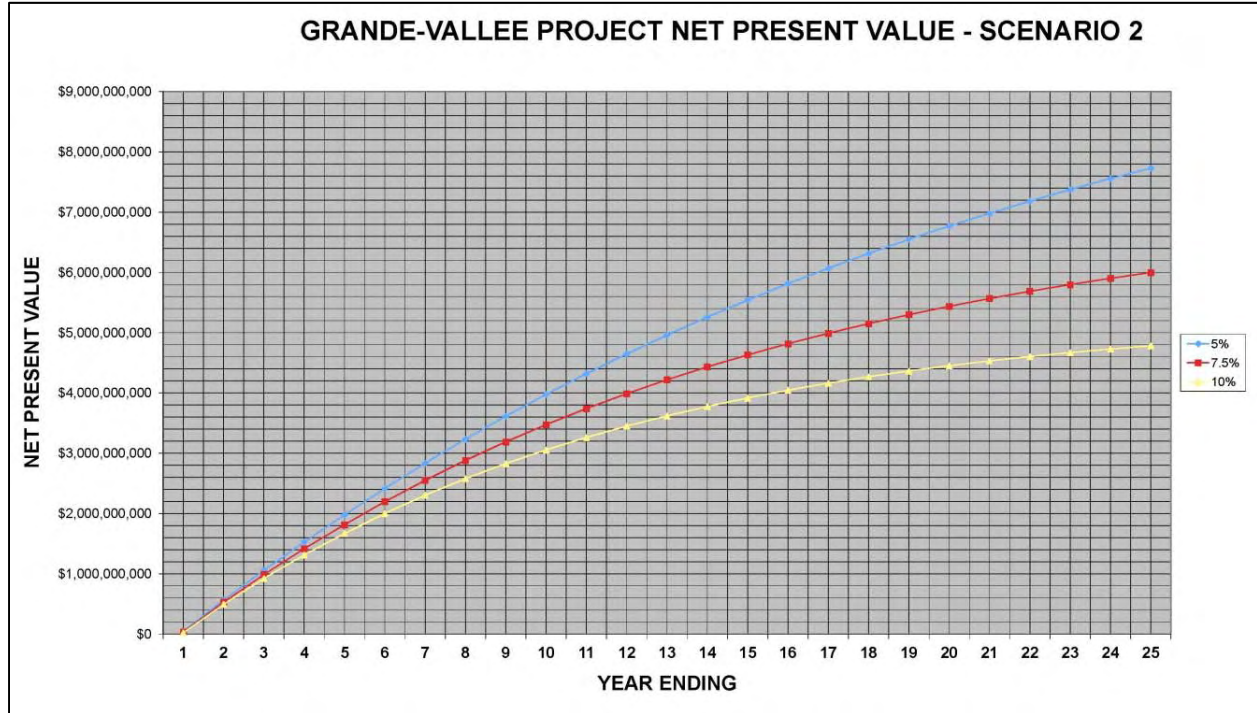
1.16.2 Internal Rate of Return (IRR) and Net Present Value (NPV) of preferred scenario (Scenario 2)

Scenario 2: Alumina + Hematite, Silicon oxides, Magnesium Oxides, Mixed Oxides and RE+RM's in form of Oxides as multiple sources of revenues:

Assuming a Project life of 25 years (operation) requiring a \$500.4 M initial investment, generating annual steady EBITDA of \$572 M (Scenario 2) the calculated IRR would become 114%, and the pre-tax NPV at a 5% interest discount rate would go up to \$7.73 B. The payback period would be less than one year.

The economics of this scenario is illustrated in Figure 1-2.

Figure 1-2 Scenario 2 Pre-Tax Net Present Value



1.16.3 Sensitivity Analysis of Preferred Scenario (Scenario 2)

Scenario 2: Alumina + Hematite, Silicon oxides, Magnesium Oxides, Mixed Oxides and REO+RMO's in form of Oxides as multiple sources of revenues:

This scenario uses an alumina market price of \$425/tonne, high purity hematite price of \$200/tonne, silicon dioxide at \$25/tonne plus magnesium oxide and other oxides revenues of \$11.6 M and REO+RMO's revenues (\$392.9 M) calculated as of August 2011 market price, thus adding up to \$702 M in annual revenues for the first SGA plant in operation out of up to 10 forecasted. The following Table 1-10 presents IRR, NPV and payback period for 3 other market prices scenarios, at 5.0% and 10.0% discount rates.

Table 1-10 Sensitivity Analysis - Scenario 2

Alumina Market Prices (\$/tonne)	Hematite Market Prices (\$/tonne)	Silica Market Prices (\$/tonne)	Magnesium Oxide and other oxides Revenue (Million \$)	Rare Earth and Rare Metals Revenue (Million \$)	Annual Revenue (Million \$)	Annual EBITDA (Million \$)	IRR	Payback (Years)	NPV (Million \$) at a discount rate of		NPV per share * (\$/share) at a discount rate of	
									5%	10%	5%	10%
\$425	\$200	\$25	\$11.646	\$392.9	\$702	\$572	114%	0.9	\$7,729	\$4,782	\$37.74	\$23.35
\$400	\$175	\$20	\$10.646	\$314.3 (-20% RE+RM)	\$599	\$471	94%	1.1	\$6,278	\$3,850	\$30.65	\$18.80
\$350	\$150	\$15	\$9.646	\$235.7 (-40% RE+RM)	\$481	\$357	71%	1.4	\$4,638	\$2,798	\$22.65	\$13.66
\$325	\$125	\$10	\$8.646	\$137.5.1** (-65% RE+RM)	\$358	\$237	48%	2.1	\$2,912	\$1,690	\$14.22	\$8.25

Note: * On a fully diluted basis. Number of shares is estimated at 204.8 million
** For reference, note that: Potential revenue calculated with Nov 23, 2011 Spot prices (107,109) discounted by 40% = \$148.1 million (See Section 19)
Potential revenue calculated with Nov 23, 2011 China Domestic prices (107,109) = \$169.8 million (See Section 19)

The sensitivity analysis of the preferred scenario uses the basis of reference for pricing of alumina and hematite, using alumina prices from \$325/t to \$425/t with hematite prices from \$125/t to \$200/t. Since Orbite intends to market all products extracted and purified from the aluminous clay, revenue for silica, magnesium oxides, other oxides and RE+RM's as oxides were factored in. When adding the revenues from the RE+RM's as oxides, magnesium and other oxides, and high purity silicon dioxide, sensitivity is of course less important due to the important portion of additional potential revenues. RE+RM's as oxides prices are more volatile, GENIVAR has factored a reduction in the revenue from the RE+RM's in reference Scenario 2 varying from 20 to 65%. Consequently, IRR varies from 48% to 114% and NPV for the first SGA plant at 5% discount rate varies from \$2.9 B to \$7.7 B or from \$14.22 to \$37.74/share on a fully diluted basis. At 10% discount rate, the NPV for the first SGA plant varies from \$1.7 B to \$4.8 B or from \$8.25 to \$23.35/share on a fully diluted basis.

In addition to the above scenarios, Table 1-11 presents the sensitivity for each critical element of Scenario 2 independently of the others. The revenue for the marketable products were varied from 60% to 140% off the base scenario except for the rare metals and rare earth revenue stream since the market prices have varied significantly as of the date of this Technical Report and that the revenue scenarios calculated were falling off the 60% to 140% range. Therefore, in the latter case, a sensitivity of 35% to 165% was used. The objective is to ensure that the potential revenue for rare metals and rare earths in the sensitivity analysis includes the estimated revenue from rare metals and rare earths calculated with the November 23, 2011 spot price discounted by 40% and the same calculation made with the China domestic prices at the same date. The capital cost and operating costs were varied from 80% to 120% of the base scenario shown in the first line of the Table 1-10.

Table 1-11 Sensitivity Analysis Scenario 2 at 5% and 10% Discount Rates per SGA Plant – Each element varying

Alumina Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	255	97%	1.0	6,448,129	3,959,764	\$31.49	\$19.33
100%	425	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	595	132%	0.8	9,010,559	5,604,548	\$44.00	\$27.37

Fe ₂ O ₃ (Hematite) Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	120	111%	0.9	7,517,874	4,646,417	\$36.71	\$22.69
100%	200	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	280	117%	0.9	7,940,813	4,917,895	\$38.77	\$24.01

SiO ₂ (Silica) Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	15	112%	0.9	7,557,778	4,672,030	\$36.90	\$22.81
100%	25	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	35	117%	0.9	7,900,910	4,892,282	\$38.58	\$23.89

Magnesium Oxide and other Oxides Revenue							
Factor	Revenue (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	6,988	113%	0.9	7,664,291	4,740,399	\$37.42	\$23.15
100%	11,646	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	16,305	115%	0.9	7,794,397	4,823,912	\$38.06	\$23.55

Rare Earths and Rare Metals Revenue							
Factor	Revenue (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
35%	137,504	65%	1.5	4,163,425	2,493,247	\$20.33	\$12.17
100%	392,868	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
165%	648,232	164%	0.6	11,295,263	7,071,064	\$55.15	\$34.53

Capital Cost							
Factor	Capex (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
80%	400,299	143%	0.7	7,829,419	4,882,231	\$38.23	\$23.84
100%	500,374	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
120%	600,449	95%	1.1	7,629,269	4,682,081	\$37.25	\$22.86

Operating Cost							
Factor	Opex (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
80%	90,493	119%	0.8	8,045,258	4,984,936	\$39.28	\$24.34
100%	113,117	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
120%	135,740	110%	0.9	7,413,430	4,579,376	\$36.20	\$22.36

As an example, when discounting only the projected revenue from REO and RMO by 65% of the preferred scenario, the projected revenue for these products equals to \$138 million. This 65% discount is equivalent to a 20% discount over and above the November 2011 Chinese domestic price. Assuming this hypothesis and a projected 25 years of operations, the pre-tax NPV of the Project would then range between \$4.16 B and \$2.49 B or the equivalent of \$20.33 and \$12.17 per share of Orbite on a fully diluted basis, when applying a discount rate of 5% and 10% respectively, and assuming an initial investment of \$500.4 M. The project would generate an IRR of 65% and a payback of less than one and a half year, thus still demonstrating a positive economic outcome.

1.17 Risks and Opportunities

In the course of completing the preliminary economic analysis and this NI 43-101 report, certain other key elements of risk and opportunity became self-evident. The study that has been carried out is preliminary in nature and to some extent based upon factored estimates. The capital and operating cost estimates are believed to be accurate within +/-30%; however, risks and opportunities that have been identified may impact upon costs. These are summarized as:

1.17.1 Risk and Uncertainties (technical, commercial, etc.)

- Energy supply in the Grande-Vallée area represents one of the key elements and potential risk of the Orbite project, like all mining and heavy industrial projects. For the purpose of this study, natural gas has been used as the reference energy source. There is excellent known potential for natural gas in the vicinity although there currently is no production facility (wells or pipelines) in the Gaspé area or in the general area where Orbite plans to construct its smelter grade alumina production plant. A few oil and gas exploration companies are seriously intending to proceed with extraction wells in the vicinity of Orbite's site. Orbite is currently working on securing long term natural gas supply for its future operation. Orbite is also considering other sources of energy such as biomass electricity, coal, biomethanisation, bunker C, and fuel;
- Integration of all sub system into a common Plant (hematite production, alumina calcination, MgO, other oxides and rare earths and rare metals as oxides production while recovering acid) poses a potential technical risk for the eventual Plant construction and will require good basic and detailed engineering. Individually those sub systems are proven and are adapted technologies with Orbite's process, which need to be correctly inter-connected. On the other hand, Orbite is actually dealing with established and among the best in the industry, in firms such as SMS Siemag and Outotec, among others, for example.

- Bill 14, which seeks to amend the Quebec Mining Act – Status to be adopted in early 2012 – also represents a potential risk. The content and the impact of this bill were described in detail in Section 20. The Amendments, with this Bill 14, propose that all future mining projects whether the construction or operation of a mineral treatment plant or the opening or operation of a mine, be subject to an Environmental impact assessment and review procedure, which includes consultation and public hearings before the BAPE without regard to the production threshold. This Bill could have a significant impact on the project schedule of Orbite. The complete Environmental impact assessment process generally takes one to two years, and represents an additional cost of \$2 M, in professional fees. For Orbite, since there is existing baseline data, we believe the delay could be 12-16 months rather than two years. However, Bill 14 is still not in force, and it will take some time for the Quebec Government to publish and put in force the new Law and related Regulations (between 3 to 12 months from now). There is a window of opportunity for Orbite to file its CoA permit requests, in order to secure a mining lease, within 2012 if Bill 14 is not put in force prior to get the mining lease;
- Another risk to the Project is the marketability of the SiO₂ product. Large volumes will be processed on a daily basis (more than 3,000 tonnes per day) and will need to be introduced on the market. Fall back position is to send back to mine area site (inactive portion to be identified) this purified product upon plant start-up (partially or totally). Cement manufacturing producers (CQL, Lafarge and Holcim) should be interested though, since silicon dioxide will be free from any alkaline, which is a processing issue for them and ends up being a CKD (clinker kiln dust) reject to environment to prevent clogging in their pre-heater stage or directly into their rotary kilns. The potential for Orbite to be able to sell is therefore very high.
- Silica filtration after the leaching stage, its cleaning and recovery of chlorides and any left free hydrochloric acid represents a technical challenge on large scale and such quantities due to the uniqueness of the solid particle size (silicon dioxide) and its tendency to clog band filters. During Feasibility stage, proper final testing with continuous systems shall be performed to validate that very important aspect. The specification on SiO₂ (20 ppm) after the solid/liquid separation, imposes that guard filters (1 micron most probably) are installed prior to the storage area (tank farm) which is not shown actually on the Process Flow Diagram (PFD).
- Since the clay preparation plant and process costs in this study are based on handling a relatively dry product (with final size reduction based on dry grinding) the mining schedule may have to be amended somewhat to include more mining in the dry part of the winter and a suspension of mining during periods of heavy downpour. If scheduling problems and the prevailing climatic conditions result in the requirement to mine a product with moisture contents higher than expected

requiring wet grinding, the expenses involved in drying the product and/or acid distillation would affect the plant economics.

- Although Orbite has taken reasonable measures to ensure proper title to its properties and mining claims, there is no guarantee that title to any of its properties or mining claims will not be challenged or impugned. Third parties may have valid claims underlying portions of Orbite's interests. There can be no assurance that the mining regime currently in place in the Province of Quebec will not be changed in a manner that could adversely affect Orbite, its properties and business plans
- Mineral Exploration is highly speculative and involves a high degree of risk, which even a combination of careful evaluation, experience and knowledge may not be able to avoid. Most exploration efforts are not successful in that they do not result in the discovery of mineralization of sufficient quantity or quality to be profitably mined. There is also no assurance that the mining activities of Orbite will be brought into commercial production. These risk factors include market fluctuations, the proximity and production capacity of mining facilities and processing equipment, the presence or access to required energy at reasonable cost, availability of qualified personnel, doing business in remote areas, possible third party claims and government regulations, including regulations relating to prices, royalties, allowable production, mining leases, environmental protection. The effect of these factors cannot be accurately predicted
- Fluctuations in the Market Price of Alumina and Other Metals is another element to consider in the global Project evaluation. The profitability of mining operations, and thus the value of the mineral properties of Orbite is directly related to the market price of these. The market price of alumina and other metals fluctuates and is affected by numerous factors beyond the control of Orbite. If the market price of alumina and metals should decline dramatically, the value of Orbite's mineral properties could also decrease dramatically and Orbite might not be able to recover its investment in those interests or properties. The selection of a property for Exploration or development, the determination to extract natural resources and place them into production and the dedication of funds necessary to achieve such purposes are decisions that must be made long before first revenues from production are received. Price fluctuations between the time that such decisions are made and the commencement of production can drastically affect the economics of the operations. The PEA, through its market analysis portion tried to define some of the effects (sensitivity analysis).

1.17.2 Opportunities (technical, commercial, etc)

- The sale of valued added products while benefiting from the concentration factors increase within the acid recovery process represents another potential opportunity for enhancing the economics of the Project, while at the same time eliminating any landfill cost. That is most probably of the biggest assets to Orbite's process; totally integrated and unique relative to existing alumina processes;
- Opportunities also exist to further rationalize the unit operations that were assumed in this PEA. One approach is around the number of leaching reactors (size and arrangement) which may be influenced by the process mode (semi-continuous) and leaching concentration which greatly helps reaction kinetics. These elements shall be confirmed during the feasibility study stage to optimize CAPEX especially around the ALP sector.
- One very significant opportunity that is currently associated to Orbite's process is to maximize the alumina recovery. A loss of nearly 7% through all the steps was identified as a result of all sub systems interactions, which is not insignificant. This loss takes place at the grinding, leaching and some into the crystallization stages while recovering hydrochloric acid. For the purpose of the present PEA, this alumina was considered unrecoverable. However, the configuration that was developed would allow maximizing that yield especially around the leaching and crystallization stages. Through simple and basic process design basis optimization, it may be possible to raise the recovery of alumina from 93% to 95% or higher, which would positively impact the net operating cost per tonne of products produced.
- Orbite's SGA project represents an opportunity for exportation of the technology across the world and from other sources of aluminous rich resource.

1.18 Interpretation and Conclusions

GENIVAR believes that the density of geological and analytical data and the understanding and definition of the deposits on the Marin Sector and all Orbite's claims should be adequate for the preparation of a 3D model and for the mineral resources estimate of the deposit. GENIVAR intends to make a full detailed review of the geological data at the Feasibility Study stage, and will recommend to Orbite additional drilling if need be, for compliance with NI43-101F1. The reliability of the data rests on the best quality control practices applied at the exploration stage, under the supervision of Mr. Jean-Guy Levaque, Eng. acting as the QP for Orbite. These have proven to have sufficient merit to warrant Orbite for further exploration and development to fully develop its alumina, silica, hematite, magnesium oxides, other oxides, rare earths and rare metals as oxides potential.

GENIVAR is very satisfied that the lab, pilot plant (local and international) testing programs that have been carried out by Orbite and other third party, have met the requirements of a Preliminary Economic Assessment. Demonstration of the chemistry of the leaching process and other value added products represents an important milestone in the development of the Project. What the pilot plant has demonstrated is that the principal components of the process, namely leaching and individual extraction of ions using bubbling techniques while recovering hydrochloric acid can be operated at pilot scale. The ability to process other type of raw material (bauxite) using Orbite's proprietary process without generating any red mud, has also been demonstrated. Orbite has thus demonstrated its capacity to produce superior quality metallurgical grade alumina from its Grande-Vallée clay deposit, and to do so both more efficiently and without the negative environmental impacts associated with the industry-standard Bayer process. For all intents and purposes, a sufficient body of information has been developed to warrant GENIVAR's recommendation to continue with the next stage of the Feasibility study of the Project.

1.19 Recommendations

Several recommendations are put forward in this Technical Report. The results of the work will help to determine a path for the chemical and metallurgical grade alumina industrial plant.

1.19.1 The following recommendations resulted from this review of the proposed mining operation at the Grande-Vallée aluminous clay deposit

- Creation of a pit block model followed by a pit optimization study should be completed on the outlined resources at the Marin sector of Orbite's land holdings;
- Perform the variographic experiments and drill for REO-RMO in the Marin sector;
- Further investigate in place density and water content;
- Pit production modeling should be performed on the larger outlined aluminous clay resource. This work should include optimizing the claystone and mudstone mining ratios as well as considering the mining grades in the plant feed. This work will support studies to construct a series of metallurgical grade alumina plants to provide local feed for the North shore aluminum smelters;
- A full geotechnical, hydrogeological, and hydrographical study should be done on the Marin Sector to establish pit design properties, dewatering technics, surface water management, as well as infrastructures and plant construction recommendations;

- In order to allow mining operations to proceed, the mining claims in the Marin Sector have to be surveyed and brought to the status of a mining lease. The request was registered at the MRNF on September 14, 2011, with the dossier number 1120559 with the mining lease # 1013
- A physical properties study should be done on the claystone and mudstone crushed plant feed (minus 40 mm) as well as the plant process products (Alumina, Hematite, Magnesium Oxide, Mixed Oxides and High Purity Silica) to determine the angle of repose, flow characteristics and long term storage implications of each component.

1.19.2 The following recommendations resulted from this review of the proposed metallurgical and chemical process developed

- Orbite should investigate the implications of adopting wet grinding as this method of final size reduction may be required if moisture levels in the plant product are higher than expected;
- Orbite should have a marketability assessment of the mixed oxide product done, to determine the demand and a realistic market price for the expected annual production of more than 104,000 tonnes of the material. Same applies for silicon oxides;
- Orbite should have leach and acid/base accounting studies performed on the silica, hematite, magnesium oxide and mixed oxide products to determine the runoff and potential groundwater infiltration characteristics of the material. Although these products are very likely innocuous this has to be proven to the regulating authorities;
- A mineral processing study should be done on the claystone and mudstone to determine the mined products specific gravity, percent moisture, angle of repose and long term storage characteristics (for storage barn and plant bin design). This study should include grindability and lab crushing tests to determine what size reduction equipment is best suited for the plant flow sheet;
- Since the Plant will be a large consumer of fuel, especially for process purposes, Orbite should support initiatives to secure potential large amount of natural gas or biomass, or any source of alternative fuel, identified in the vicinity of the plant;

Optimization study for selecting the final and exact location of the plant site as well as the loading facility and port selection, should also be undertaken at the Feasibility study stage.

2 INTRODUCTION

Orbite Aluminae Inc. (Orbite) commissioned GENIVAR Inc. (GENIVAR) and Mr. Jean-Guy Levaque, Eng., and QP to prepare a Technical Report (the Report) on its wholly-owned Grande-Vallée metallurgical grade aluminae Project (the Project) in the Province of Québec, Canada. Mr. Rheault's, P.Geo., M.Sc. assisted Mr. Jean-Guy Levaque, Eng., QP on the geology portion of the report.

The Project comprises the whole Grande-Vallée deposit, and focuses on the Marin Sector for the first 25 years of the project, and the first of few units of production.

The Report incorporates the latest mineral resource estimate for the Project and provides information on a Preliminary Economic Assessment (PEA) that was based upon those mineral resources. More specifically, the objective of the study was to develop a scoping level assessment of proprietary process developed by Orbite for the metallurgical grade alumina as it would be applied to the Marin Sector for the recovery and purification of alumina (Al_2O_3), suitable for use in aluminum smelters, as well as marketable high purity silica (SiO_2), high purity hematite (Fe_2O_3), magnesium oxide (MgO), mixed oxides rare metals and rare earths (12 elements including Gallium and Scandium) in the form of oxides as value added products. All those have the potential of being highly marketable for different type of industries. The PEA was developed on a pre-tax basis only. No investment tax credit for new equipment, applicable to chemical processing (manufacturing) plants, was applied even though this would apply. These considerations will be taken into account during the Feasibility study stage.

Orbite Aluminae Inc. (formerly known as Exploration Orbite V.S.P.A. Inc.) (the "Corporation" or "Orbite") was incorporated on June 17, 1983 under the laws of the Canada Business Corporations Act. It's share capital is comprised of Class "A" (the "Common Shares"), Class "B" and Class "C" shares, of which only Class "A" share are currently issued and outstanding. The Class A shares of the Company were traded on the TSX Venture Exchange under the symbol "ORT.A" and since October 17, 2011 are traded on the Toronto Stock Exchange under the symbol "ORT".

On October 11, 2011, the Company changed its name to Orbite Aluminae Inc. (formerly known as Exploration Orbite V.S.P.A. Inc.) and reorganized its share structure by cancelling the authorized but unissued Class B and Class C shares. Its Class A shares remain unchanged⁽¹⁾.

The Corporation's head and registered office is located at 6505 Trans-Canada Highway in Montreal, Quebec, H4T 1S3. The Corporation also has a place of business in the industrial park of Cap-Chat, Quebec, at 80 Louis-Landry Street, G0J 1E0 where it operates a 28,000 sq. ft. pilot production facility.

This report has been prepared in compliance with National Instrument 43-101, Standards for Disclosure for Mineral Projects (NI 43-101) and was prepared to support a Preliminary Economic Assessment (PEA).

The report uses the metric system and all dollar figures cited are Canadian dollars, unless otherwise noted. The assumed exchange rate for the report was C\$1 to US\$1.

2.1 Qualified Persons

The independent Qualified Persons (QPs), as defined in NI 43-101 and in compliance with Form 43-101F1 (the Technical Report), who are responsible for the preparation and the review of the Technical Report include:

1. Rod Doran, P. Eng., GENIVAR Inc.;
2. André-Martin Bouchard, Eng., GENIVAR Inc.;
3. Mr. Jean-Guy Levaque, Eng. (Independent Geological Eng.);

2.2 Site Visits

Table 2-1 Qualified Persons (QPs) for the Technical Report

Qualified Person	Site Visits	Report Sections of Responsibility (or Shared Responsibility)
Rod Doran	Yes	1, 2, 13, 16, 17-26 (Report Integrator)
André-Martin Bouchard	No	20, part of 1, 2, 24-26
Jean-Guy Levaque	Yes	1, 2-12, 14, 15

The Property and the Cap Chat pilot plant facility were visited by Rod Doran, P. Eng., Senior mining engineer, GENIVAR, on August 31, 2011. Mr. Doran was accompanied by Orbite representatives and Mr. Bernard Fournier, M.Sc., Environmental Manager, GENIVAR Inc. Orbite has retained Mr. Jean-Guy Levaque, Eng., as its qualified person for the geological part of the Project. Mr. Levaque has been both to the Project mine site and the Cap-Chat pilot plant facility on various occasions over the last year. Mr. Michel Rheault, P.Geo, M.Sc., assisted Mr. Jean-Guy Levaque, Eng., QP on the geology portion of the report. Mr. Rheault visited the

Property in September 2009 for 3 days duration. He was accompanied by Mr. Guillaume Matton, Geo. who was co-author at the time of a report of the on-site geology which served (Appendix) for the Technical Report of 2010 Field work, Grande-Vallée Property, NI43-101 Technical Report, dated March 31, 2011.

The property was also visited by Mr. Bernard Chauvette, Geomorphologist, from GENIVAR (Quebec office), by Mr. Denis Meunier, Forest Eng., also from GENIVAR (Baie Comeau office) on November 8 & 9, 2011.

2.3 Effective Dates

- The effective date of the Report is November 24, 2011, which represents the date of the most recent scientific or technical information included in the Report.
- The effective date of the Mineral Resource estimate is November 23, 2011 which corresponds to the public disclosure date of November 29, 2011.

There have been no material changes to the scientific and technical information of the Project between the effective date of the Report and the signature date of the Report.

2.4 Previous Technical Reports

Previous technical reports submitted by Orbite are as follows:

- Jacob, Henri-Louis, August 22, 2008, National Instrument 43-101 Technical Report. Summer work on the aluminous claystones of the Grande Vallée property in 2008. Technical report prepared for Exploration ORBITE VSPA Inc.⁽²⁾
- Levaque J.G., August 31, 2009, National Instrument 43-101 Technical Report. Technical work compilation or works accomplished on Grande Vallée Property in 2008. Technical report prepared for Exploration ORBITE VSPA Inc.⁽³⁾
- Levaque J.G., March 31, 2011, National Instrument 43-101 Technical Report. 2010 Field work, Grande Vallée Property. Technical report prepared for Exploration ORBITE VSPA Inc.⁽⁴⁾
- Levaque J.G., August 21, 2011, National Instrument 43-101 amended Technical Report. 2010 Field work, Grande Vallée Property. Technical report prepared for Exploration ORBITE VSPA Inc.⁽⁵⁾

2.5 Information Sources

In preparing this report, GENIVAR and Mr. Jean-Guy Levaque, Eng. With the participation of Mr. Michel Rhéault, Geo, M.Sc., relied on geological reports, maps, and miscellaneous papers listed in Section 27 of the Report, as well as on the documentation supporting the information used by various qualified persons in preparation of previous Technical Reports related to the Project (see Section 2.4).

Due to the uniqueness of the deposit type (homogenous claystone), GENIVAR QPs have not developed a block model, at this point in time. The in-pit mineral resource estimate and mine plan for the Marin Sector (Project duration) has been prepared based on Mr. Jean-Guy Levaque, Eng. previous reports. Other information sources included testing results from various pilot plants (Orbite's pilot plant and international ones), process flow diagram (PFD), mass and heat balance, which were provided by Orbite's technical people (Mr. Denis Primeau, Eng. Chief Engineer and Mr. Marc Fillion, Eng., Ph.D. Technical advisor), SMS Siemag and Outotec, GmbH, among others. These data were evaluated and reviewed for the PEA preparation by GENIVAR QPs.

3 RELIANCE ON OTHER EXPERTS

3.1 Introduction

The authors of this Technical Report state that they are independent qualified persons (QPs) for the areas that are identified in the appropriate “Certificate of Qualified Person” attached to this report.

The authors have relied upon, and believe there is a reasonable basis for this reliance, the following reports that provided information regarding mineral rights, surface rights, permitting, metallurgical and chemical testing, marketing and environmental issues in the sections of the Technical Report as noted below.

3.2 Mineral Tenure

The QP for GENIVAR (John Rodney Doran, P. Eng.) has carefully reviewed the available information from the Grande-Vallée property and the immediate surrounding area. The QP has relied largely on the Technical Reports issued by Mr. Jean-Guy Levaque, Eng., acting as the QP on the geology part of the Grande-Vallée Project, and who has previous work experience on similar deposits. Mr. Doran, P. Eng., has relied upon and disclaims the documents, reports and other data available, and assumes that these are substantially accurate and complete in all material aspects.

3.3 Surface Rights, Access and Permitting

Mr. Levaque, Eng., has not researched legal ownership information such as property title and mineral rights, or possible environmental liabilities. Mr. Levaque, Eng. has validated the ownership of the claims. Mr. Levaque, Eng. stated that he had not verified the legality of any underlying agreements that may exist concerning the mineral property of other agreements between third parties. Mr. Doran, P. Eng., wishes to state that an independent verification of the land title, rights was not carried out and they relied on information provided by Orbite’s management.

3.4 Mineral Resources

It should be understood that the mineral resources presented in this report are estimates of the size and grade of the Marin Sector of the Grande-Vallée property, based upon core drilling, sampling, and the assumptions and parameters currently available. The level of confidence in the estimates depends upon a number of uncertainties, which is reflected by the classification of the resources in the various categories. The Genivar QPs and Mr. Levaque, Eng. caution that the mineral resources, while suggesting reasonable prospects of economic viability at the level of Preliminary Economic Assessment (PEA), have not yet been demonstrated to be economically viable and there is no certainty that all part of the mineral resources estimated for the Project deposit will be converted into reserves.

3.5 Metallurgical Process Development

Genivar QP (John Rodney Doran, P. Eng.) has relied among others, and believes that he has a reasonable basis to rely upon Mr. Denis Primeau, Eng., MBA, Chief Engineer of Orbite who has contributed to the plant design, alumina processing issues including the labour and material requirements of the Orbite process and identified the marketable products produced by the process. Mr. Doran, P. Eng. has also relied among others, and believes they has reason to rely upon Dr. Marc Fillion, Eng., Ph.D., MBA, Advisor and member of Orbite Aluminae Inc's Executive Team who has made a major contribution to the rare earth and rare metals component. Both Mr. Primeau and Dr. Fillion are recognized experts in the chemical and mining business. The data received from these experts formed the basis of the financial conclusions reached in the economic studies shown in the specific section of the report. Due to the uniqueness of the project and the specialized chemical/metallurgical issues involved in the Orbite process, some process data (mass and heat balance) were provided, evaluated, verified or confirmed on a preliminary basis (basic engineering) by SMS-Siemag and Outotec GmbH who were mandated by Orbite to support process information and perform process pilot test work and basic engineering around the acid recovery section, value added element concentration and Al_2O_3 calcination. GENIVAR had access and reviewed process data made available by Orbite, such as mass balance and energy requirements. In addition, independent firm SMS-Siemag and Outotec also had prepared, provided and validated these aspects for Orbite as process experts during the PEA report preparation. No further chemical or metallurgical test work was specifically carried out or deemed necessary by GENIVAR, nor was it supervised by the QP responsible for the Mineral Processing and Metallurgical Testwork section of this report. The QP having access to all documentation and test results, results can be considered as independently verified. The GENIVAR QP has visited the mine site and pilot facility in Cap Chat while in operation and is satisfied that all work has been completed as described.

3.6 Market Analysis

John Rodney Doran has relied upon several reliable sources of information as describe in Section 19 for market pricing, demand forecast, etc. These, which were segments of different studies, globally covered the following products (Alumina, silica, hematite, magnesium oxides, mixed oxides as fertilizers, rare metals and rare earths) and raw materials and utilities (hydrochloric acid, sodium hydroxide, other chemical reactants, natural gas electricity, alternative fossil fuels, etc) for the project.

3.7 Permitting and Environment

A Genivar QP (André Martin Bouchard, Eng.) who has experience in all environmental aspects of the mining cycle, from the exploration phase through construction, operation and closure, and post-closure monitoring in Quebec, has provided the environmental baseline data and the permitting process, based on information from Bernard Fournier, M.Sc., Environmental Manager from GENIVAR. Several environmental reports done by ROCHE Ltd., as well as an environmental status review report done by GENIVAR in September 2011⁽⁶⁾ were also made available for the preparation of the Preliminary Economic Assessment (PEA). Mr. Bouchard, Eng., QP, has not visited the mine site and pilot facility, but GENIVAR Environmental Manager, Mr. Fournier, M.Sc., did. GENIVAR QP is satisfied that all work, results, reports are to the best of his knowledge accurate.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 Property Description and Location

The Grande-Vallée property, owned by a third party, is located in the Gaspé peninsula, approximately 20 km south of the town of Grande-Vallée (see Figure 4-1). More specifically, the property is within the south-east quarter of the Denoué township and the northern part of the Champoux and LeFrançois townships.

The property is composed of 115 claims for a total surface of 6441 ha. This property is divided into 3 sectors: to the west, the Simoneau Sector, in the middle, the Madeleine Sector and to the east, the Marin Sector (see Figure 4-2). It is this last sector which has seen the vast majority of field work, especially in the last 2 years of exploration. The property lies within NTS map sheet 22H03 and the Marin Sector centered on the coordinates listed in the Table 4-1 and shown in Figure 4-2.

The coordinate system for the whole property is UTM NAD 83.

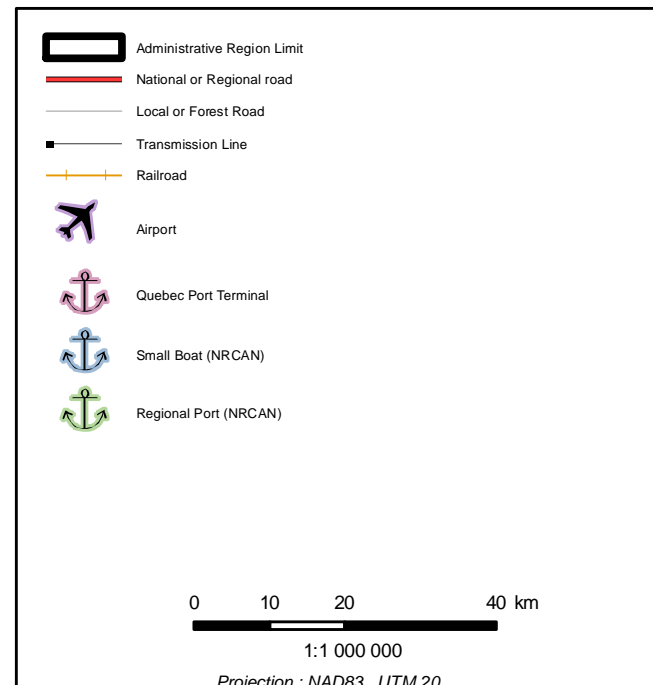
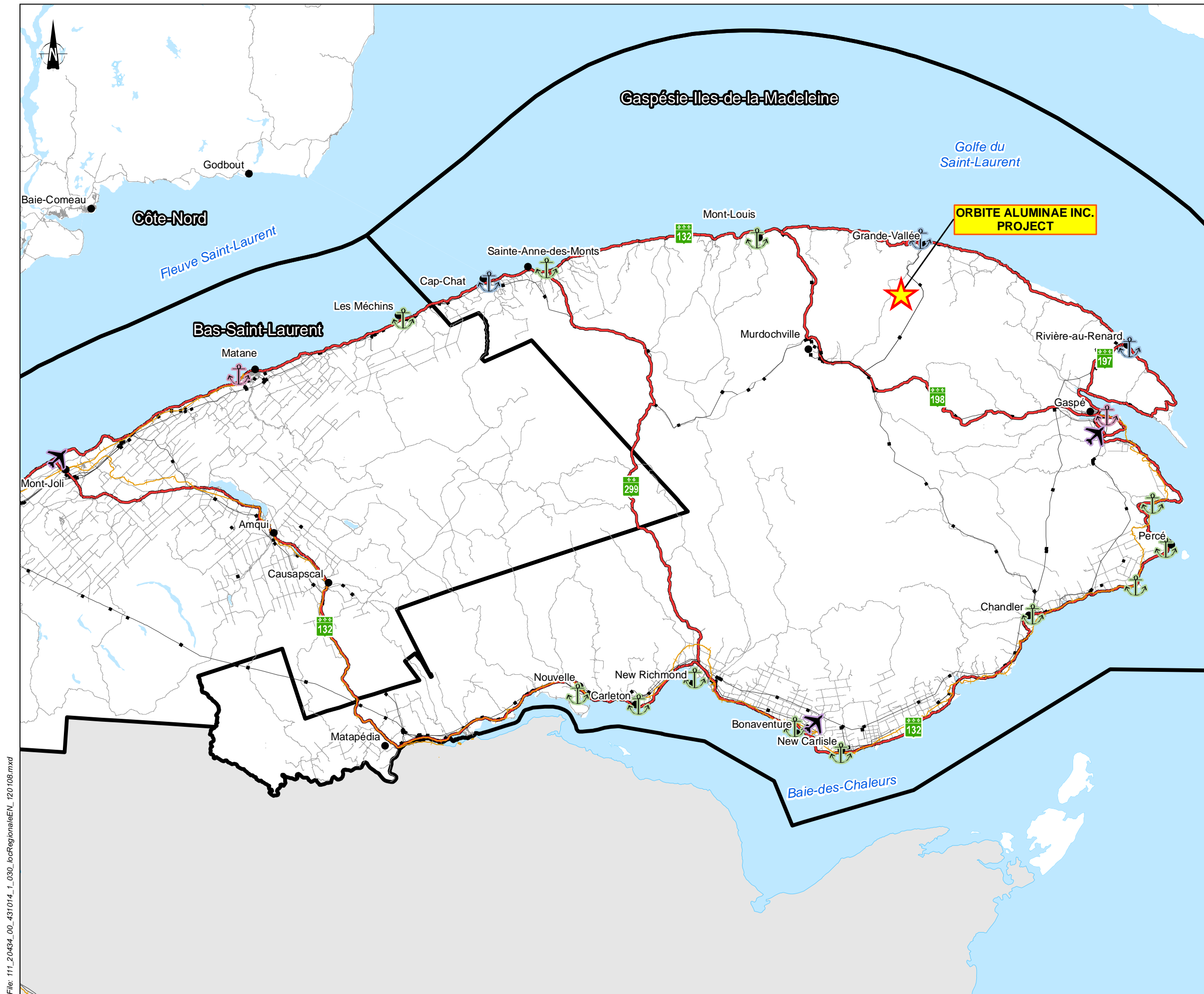
Table 4-1 Marin Sector Central Coordinates – Grande-Vallée Property

Latitude	Longitude	SNRC
338530	5441540	22 H 03

The whole property has not been legally surveyed, but the claims were designated through the MRNF GESTIM claim management system. The Map Designation of Claims (MDC) is defined by an apportionment of the territory into cells whose limits are defined by a system of columns and rows.

All the claims are active, in good standing order and all registered under the name of Exploration Orbite VSPA Inc.

Figure 4.2 also shows the location of each individual claims and Table 4-2 lists the claims of the whole property as well as their characteristics.



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Figure 4.1
Regional Location and Infrastructures
in the Gaspé Peninsula

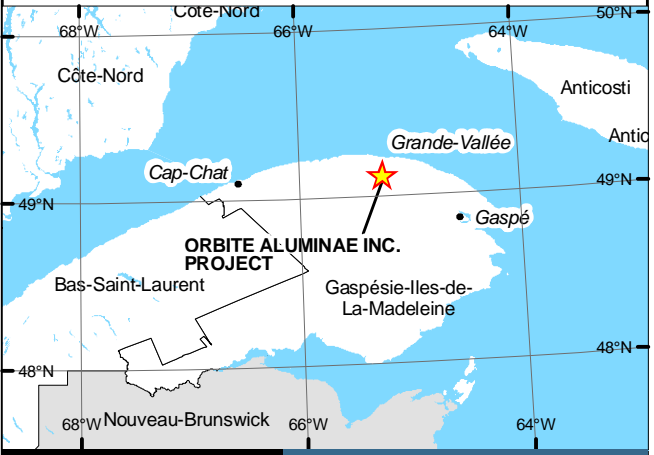
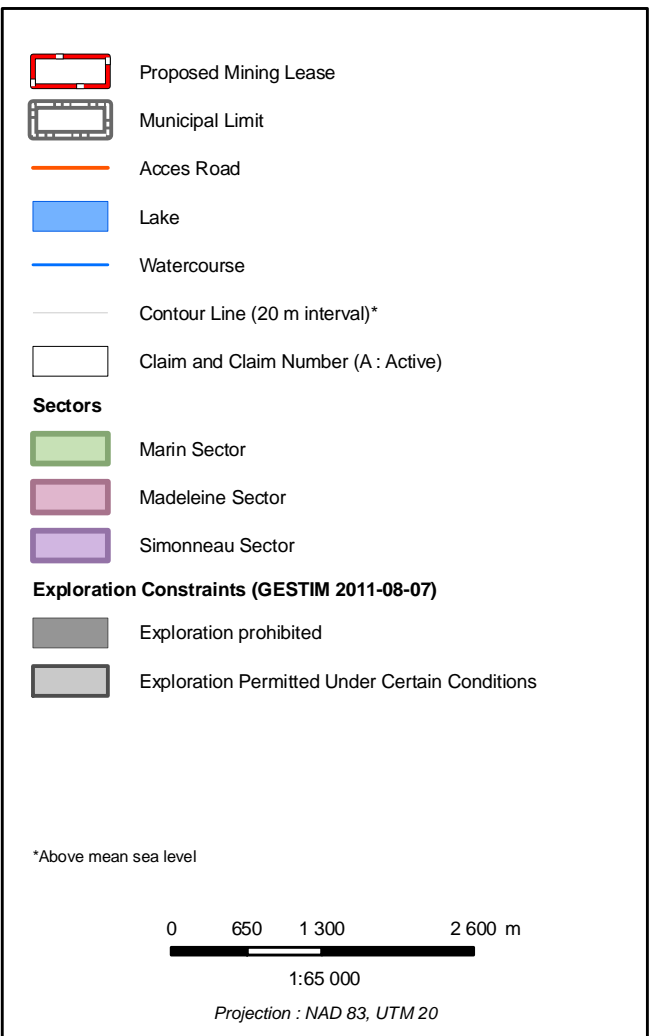
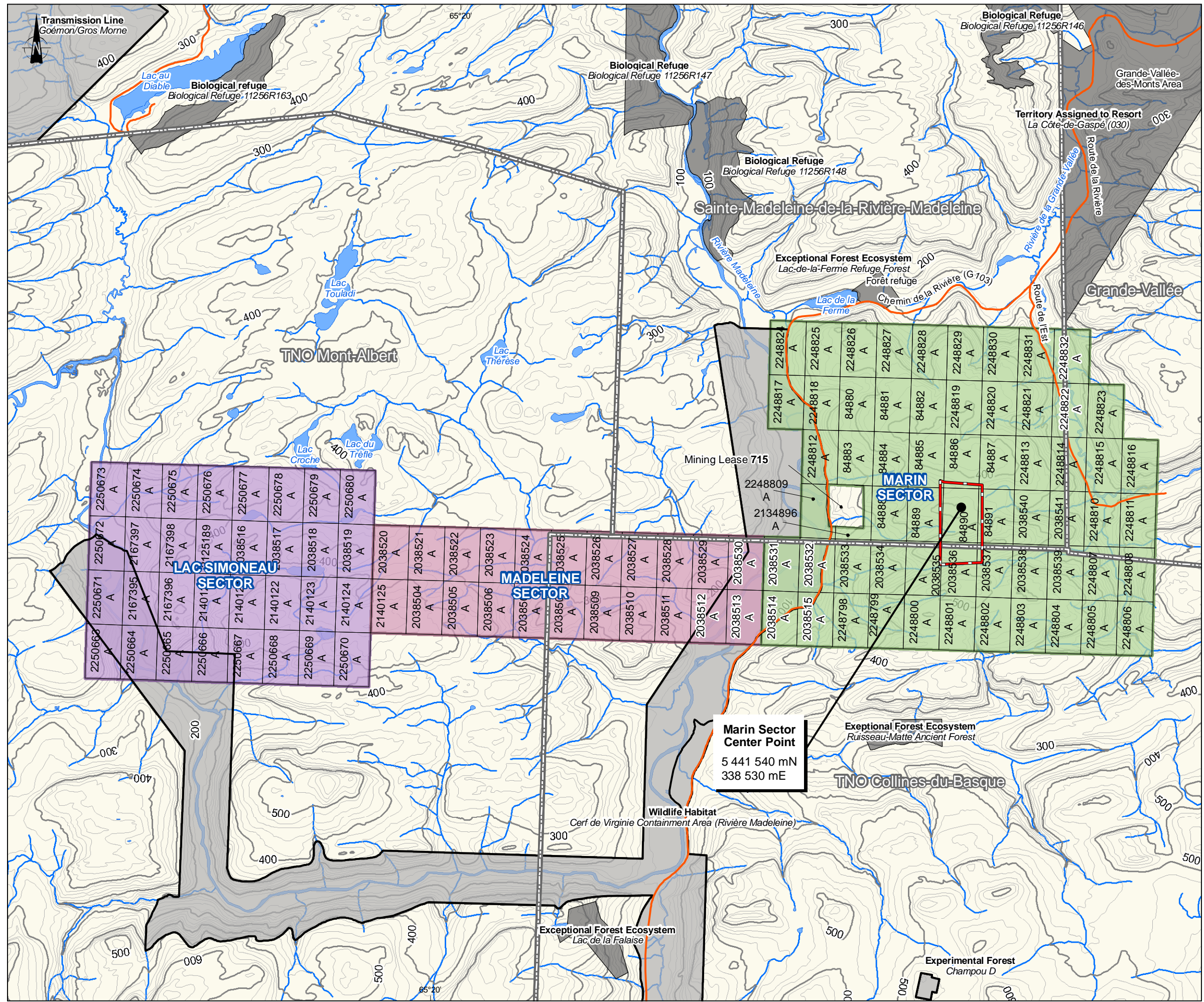
Sources :
 Topographic map :
 -CANVEC

Prepared by: G. Bessette
 Drawn by: C. Thériault
 Approved by: B. Fournier

January 12th, 2012 111-20434-00

File: 111_20434_00_431014_1_030_baRegionaleEN_120105.mxd

File: 111_20434_00_43101F4_2_031_MiningCbaCons_120112.mxd



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PRELIMINARY ECONOMIC ASSESSMENT ON METALLURGICAL GRADE ALUMINA PROJECT

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Figure 4.2
Location of the Three Sectors and the Different Claims

Sources :

Topographic Map :
- Base cartographique CANVEC

Other Source
- GESTIM Data Base- (11-08-08)

Prepared by: É. Gingras
Drawn by: C. Thériault
Approved by: B. Fournier

January 12th, 2012 111-20434-00

GENIVAR

Table 4-2 List of Claims for the Grande-Vallée Property

Claim Number	State	Owner	% owned	Registration Date	Expiration Date	Surplus	Required Work	SNRC
84880	Active	ORBITE	100%	2005-07-08	2013-07-07	0 \$	1 800 \$	22H03
84881	Active	ORBITE	100%	2005-07-08	2013-07-07	0 \$	1 800 \$	22H03
84882	Active	ORBITE	100%	2005-07-08	2013-07-07	0 \$	1 800 \$	22H03
84883	Active	ORBITE	100%	2005-07-08	2013-07-07	1 140 \$	1 800 \$	22H03
84884	Active	ORBITE	100%	2005-07-08	2013-07-07	5 529 \$	1 800 \$	22H03
84885	Active	ORBITE	100%	2005-07-08	2013-07-07	7 095 \$	1 800 \$	22H03
84886	Active	ORBITE	100%	2005-07-08	2013-07-07	2 787 \$	1 800 \$	22H03
84887	Active	ORBITE	100%	2005-07-08	2013-07-07	2 682 \$	1 800 \$	22H03
84888	Active	ORBITE	100%	2005-07-08	2013-07-07	18 343 \$	1 800 \$	22H03
84889	Active	ORBITE	100%	2005-07-08	2013-07-07	83 118 \$	1 800 \$	22H03
84890	Active	ORBITE	100%	2005-07-08	2013-07-07	500 137 \$	1 800 \$	22H03
84891	Active	ORBITE	100%	2005-07-08	2013-07-07	236 989 \$	1 800 \$	22H03
2038504	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038505	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038506	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038507	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038508	Active	ORBITE	100%	2006-12-08	2012-12-07	5 554 \$	1 200 \$	22H03
2038509	Active	ORBITE	100%	2006-12-08	2012-12-07	2 968 \$	1 200 \$	22H03
2038510	Active	ORBITE	100%	2006-12-08	2012-12-07	2 968 \$	1 200 \$	22H03
2038511	Active	ORBITE	100%	2006-12-08	2012-12-07	2 968 \$	1 200 \$	22H03
2038512	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038513	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038514	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038515	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038516	Active	ORBITE	100%	2006-12-08	2012-12-07	12 168 \$	1 200 \$	22H03
2038517	Active	ORBITE	100%	2006-12-08	2012-12-07	4 375 \$	1 200 \$	22H03
2038518	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038519	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038520	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038521	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038522	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03

Claim Number	State	Owner	% owned	Registration Date	Expiration Date	Surplus	Required Work	SNRC
2038523	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038524	Active	ORBITE	100%	2006-12-08	2012-12-07	1 777 \$	1 200 \$	22H03
2038525	Active	ORBITE	100%	2006-12-08	2012-12-07	18 776 \$	1 200 \$	22H03
2038526	Active	ORBITE	100%	2006-12-08	2012-12-07	16 048 \$	1 200 \$	22H03
2038527	Active	ORBITE	100%	2006-12-08	2012-12-07	28 846 \$	1 200 \$	22H03
2038528	Active	ORBITE	100%	2006-12-08	2012-12-07	16 987 \$	1 200 \$	22H03
2038529	Active	ORBITE	100%	2006-12-08	2012-12-07	5 184 \$	1 200 \$	22H03
2038530	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038531	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038532	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2038533	Active	ORBITE	100%	2006-12-08	2012-12-07	1 140 \$	1 200 \$	22H03
2038534	Active	ORBITE	100%	2006-12-08	2012-12-07	2 682 \$	1 200 \$	22H03
2038535	Active	ORBITE	100%	2006-12-08	2012-12-07	2 682 \$	1 200 \$	22H03
2038536	Active	ORBITE	100%	2006-12-08	2012-12-07	2 682 \$	1 200 \$	22H03
2038537	Active	ORBITE	100%	2006-12-08	2012-12-07	23 714 \$	1 200 \$	22H03
2038538	Active	ORBITE	100%	2006-12-08	2012-12-07	2 682 \$	1 200 \$	22H03
2038539	Active	ORBITE	100%	2006-12-08	2012-12-07	1 140 \$	1 200 \$	22H03
2038540	Active	ORBITE	100%	2006-12-08	2012-12-07	145 388 \$	1 200 \$	22H03
2038541	Active	ORBITE	100%	2006-12-08	2012-12-07	0 \$	1 200 \$	22H03
2125189	Active	ORBITE	100%	2007-09-28	2013-09-27	13 134 \$	1 200 \$	22H03
2134896	Active	ORBITE	100%	2007-10-31	2013-10-30	0 \$	500 \$	22H03
2140120	Active	ORBITE	100%	2007-12-14	2013-12-13	1 789 \$	1 200 \$	22H03
2140121	Active	ORBITE	100%	2007-12-14	2013-12-13	2 499 \$	1 200 \$	22H03
2140122	Active	ORBITE	100%	2007-12-14	2013-12-13	2 368 \$	1 200 \$	22H03
2140123	Active	ORBITE	100%	2007-12-14	2013-12-13	0 \$	1 200 \$	22H03
2140124	Active	ORBITE	100%	2007-12-14	2013-12-13	0 \$	1 200 \$	22H03
2140125	Active	ORBITE	100%	2007-12-14	2013-12-13	0 \$	1 200 \$	22H03
2167395	Active	ORBITE	100%	2008-07-24	2012-07-23	0 \$	1 200 \$	22H03
2167396	Active	ORBITE	100%	2008-07-24	2012-07-23	0 \$	1 200 \$	22H03
2167397	Active	ORBITE	100%	2008-07-24	2012-07-23	0 \$	1 200 \$	22H03
2167398	Active	ORBITE	100%	2008-07-24	2012-07-23	0 \$	1 200 \$	22H03
2248798	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248799	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03

Claim Number	State	Owner	% owned	Registration Date	Expiration Date	Surplus	Required Work	SNRC
2248800	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248801	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248802	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248803	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248804	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248805	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248806	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248807	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248808	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248809	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248810	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248811	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248812	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248813	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248814	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248815	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248816	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248817	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248818	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248819	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248820	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248821	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248822	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248823	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248824	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248825	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248826	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248827	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248828	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248829	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248830	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248831	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03
2248832	Active	ORBITE	100%	2010-09-07	2012-09-06	0 \$	1 200 \$	22H03

Claim Number	State	Owner	% owned	Registration Date	Expiration Date	Surplus	Required Work	SNRC
2250663	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250664	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250665	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250666	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250667	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250668	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250669	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250670	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250671	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250672	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250673	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250674	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250675	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250676	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250677	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250678	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250679	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2250680	Active	ORBITE	100%	2010-09-22	2012-09-21	0 \$	1 200 \$	22H03
2256855	Active	ORBITE	100%	2010-10-27	2012-10-26	0 \$	1 200 \$	22H02
2256856	Active	ORBITE	100%	2010-10-27	2012-10-26	0 \$	1 200 \$	22H02
2256857	Active	ORBITE	100%	2010-10-27	2012-10-26	0 \$	1 200 \$	22H02
2256858	Active	ORBITE	200%	2010-10-27	2012-10-26	0 \$	1 200 \$	22H02

4.2 Letter and Purchase Agreements

Poly-Vein Exploration Inc. and the Conseil de développement économique de la ville de Murdochville had custody of part of the site located East of the Madeleine River from 2000 to 2002.

Four surface mineralogical research permits have been authorised for the site.

These permits were issued after the discovery of red clay along the new logging roads located on the east side of the Madeleine River. Laboratory analysis of the samples indicated relatively high alumina content.

These permits were then converted into Map Designation of Claims (MDC), totalling twelve cells numbered 84,880 to 84,891. Following a sale agreement with Poly-Vein Exploration Inc. these Map Designation Claims were transferred from Poly-Vein Exploration Inc. to Orbite in August 2005.

Under the terms of the agreement Exploration Orbite V.S.P.A. Inc. (now Orbite Aluminae Inc.) agreed to pay Poly-Vein Exploration Inc. a royalty of 3% (three percent) on the net operating profit (NPI) before tax and depreciation from the property. The royalty is redeemable for \$500,000 after a period of 5 years of operation.

4.3 Ancestral Territory

The Grande-Vallée property is subject to ancestral rights claims of the Micmac Nation. There have already been a few meetings with their representatives, i.e. the Secretariat of Mi'gma'wei Mawiomí (SMM). The Secretariat did not voice any arguments against the two sampling campaigns for which their agreement was required by the MRNF. Right now, there are negotiations on going for the Mining Lease and will be part of the Feasibility study. In regards of the first meetings between Orbite's representatives and the Micmac Nation, first indications are showing that they are not expected to object. Figure 4-2 shows the different location of historical land occupation.

4.4 Environmental Considerations

Orbite envisages the extraction and processing of the aluminous shale clay located within its claims in Grande-Vallée region for commercial purposes. The project will be considered to be a mine given that the ultimate goal is to produce metallic aluminum via an aluminum smelter or specialty alumina.

According to current laws and regulations, the project would not be subject to the evaluation procedures as required by article 31.1 of the QEQA. The project would still be subject to obtaining in advance a Certificate of Authorisation (CoA) pursuant to article 22 of the QEQA. This procedure is less complex, shorter and less costly.

The project's activities must therefore be in compliance with the applicable laws and regulations in force by the various levels of government. At the federal level, the project would be subject to the Canadian Environmental Assessment Act, as well as the Metal Mining Effluent Regulations (MMER). The project would not be subject to the implementation of a Comprehensive Study, but rather a preliminary Environmental Assessment. The information gathered for the CoA would therefore be sufficient for the Federal Government's requirements. Based on the absence of fish habitat on the Marin Sector to be exploited, it is unlikely that the Federal

Government (Fisheries and Oceans Canada) will have permission trigger on the project.

The Province of Québec requires that such a project meets the requirements of the QEQA as well as the Mining Act. Since the Project would appear to be a mining operation, the application for a CoA would have to meet the requirements of the Directive 019 on the mining industry which specifies the MDDEP' expectations of this type of project.

While the project's activities are related to the mining industry by its nature, the projected capacity (raw material feed) of the plant would be less than 7,000 t/day. In this circumstance the project would not be subject to a Quebec environmental impact assessment. However, Certificates of Authorisation would have to be obtained from the MDDEP pursuant to the QEQA. However, the government is currently looking at a new bill (Bill 14) which may be adopted in 2012. This bill would enforce mining projects to perform a full environmental impact study in virtue of article 31.1 and following of the QEQA.

Orbite has also been negotiating with the MRNF regarding its mining lease, as well as regarding the location of the storage facilities for any value added products that do not have a developed market at the time of production. The MRNF would also be involved with the site closure and restoration plan.

Claims 2038512-515, 2038530-532, 2248809, 2248812, 2248817-18 and 2248824 are located in the Marin Sector, in whole or in part, within a wildlife habitat, specifically the confinement area of the white-tailed deer present along the Madeleine River (see Figure 4-2). Mining operations may be permitted with conditions. An application will have to be submitted to the MRNF. Note that the majority of this deer habitat is not within the Marin Sector, to be first developed.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

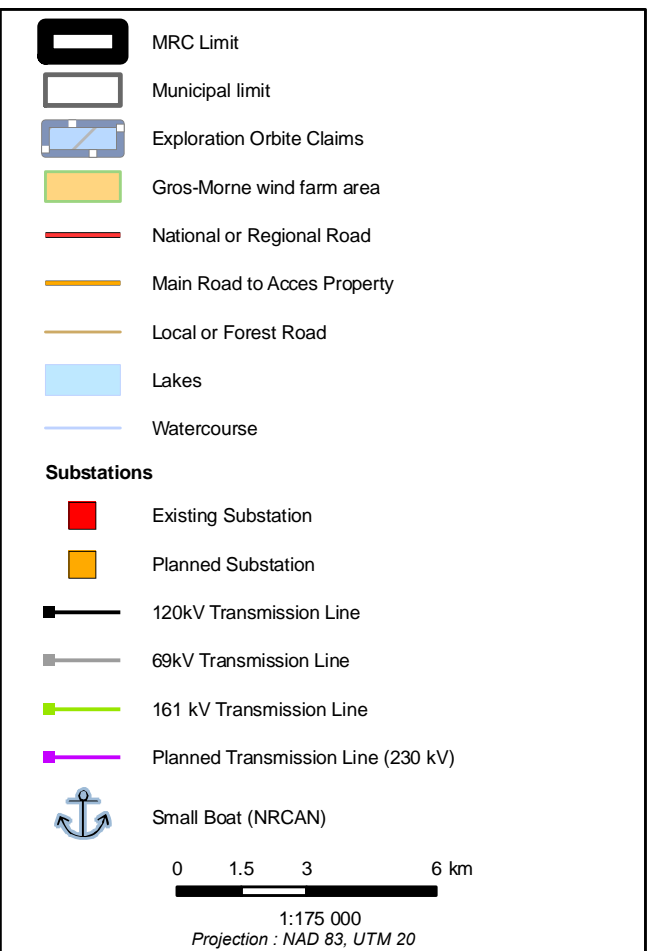
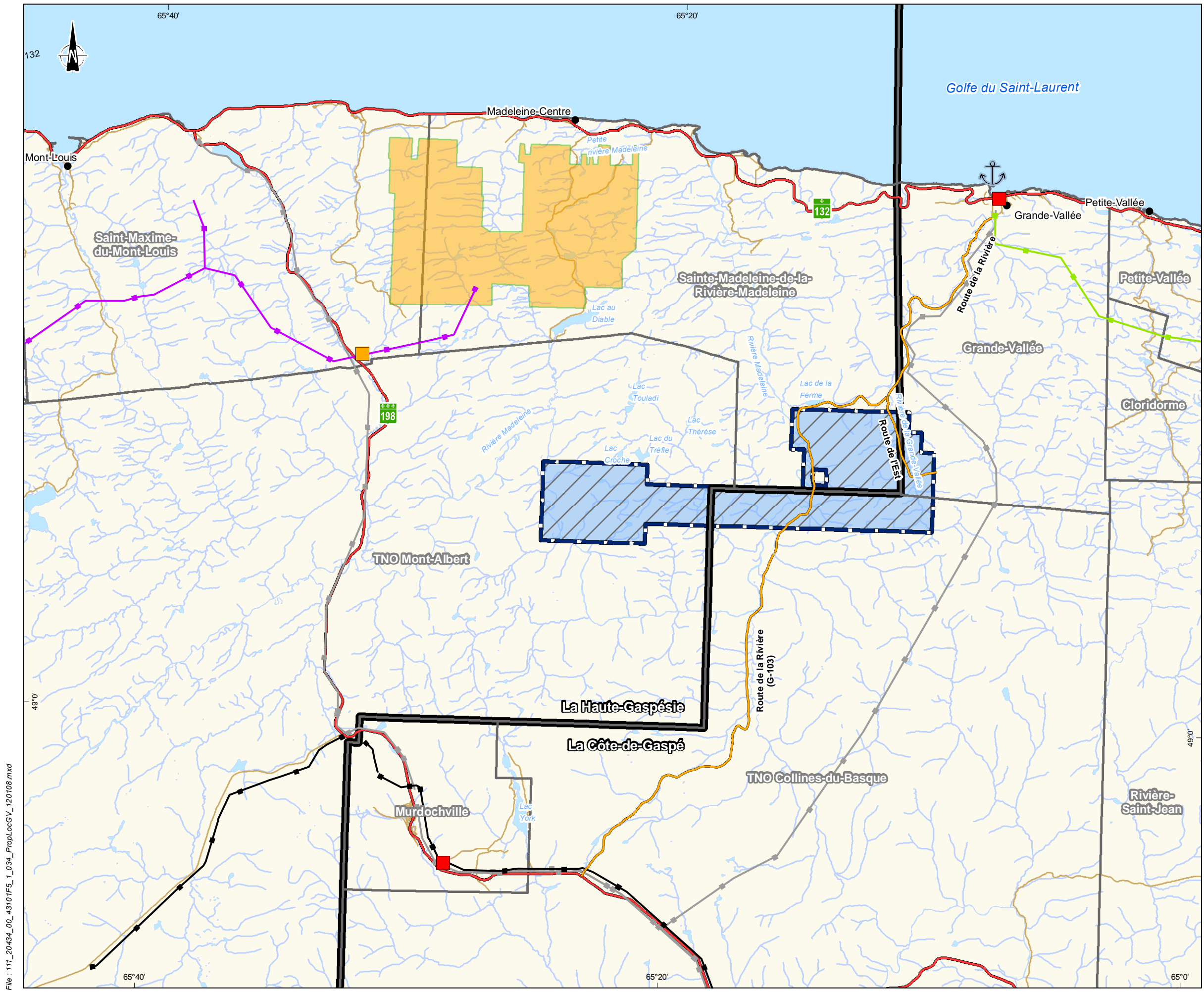
The Grande-Vallée Property is located some 20 km South of the city of Grande-Vallée, along the provincial route G-103 (see Figure 5-1). The first 12 km are asphalted and the following 8 km are gravelled. The property straddles the headwater divide between the Madeleine River in the West and the Grande-Vallée River in the East (see Figure 20-1).

No local resources are available near the property, since the area is uninhabited. The closest neighbour is a farmer 11 km to the North. The closest city is Grande-Vallée, which is a service center with the local health center, post-office, primary and secondary school as well as an intermittent lumber sawmill.

The closest port facilities are located at the Grande-Vallée dock (see Figure 5-1). The dock measures 500 feet in length and is equipped for the docking of 1000-tonne self-loading barges and larger sea going vessels. All year round operations at this base case port will require further analysis during the Feasibility Study.

The site is located on Crown Land, and currently the only listed activities are logging and hunting. A Hydro-Québec 69 kV electrical transmission line, linking Grande-Vallée and Murdochville, is located approximately 4 km East of the site (see Figure 5-1).

There are two Environment Canada meteorological stations located near the Grande-Vallée site^(7,8), the Murdochville station, located approximately 27 km southwest and the Cap Madeleine station, located approximately 15 km northwest. The mean monthly temperatures vary between -14°C in January and 16°C in July at the Murdochville Station, and between -11°C in January and 17°C in July at the Cap Madeleine Station. The Murdochville Station has an average of 586.1 mm of rain and 531.4 cm of snow, while the Cap Madeleine Station has an average of 512.4 mm of rain and 284.0 cm of snow. The statistics for wind for the Cap Madeleine Station show that the prevailing winds originate from the northeast. The average wind speed is relatively high, between 30 km/h and 55 km/h. The average wind speed is highest in December and lowest in July.



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Figure 5.1
Accessibility and Infrastructure

Sources :
 - Topographic Map: CANVEC
 - GESTIM DataBase - (11-08-08)
 - Gros-Morne Map (www.carbide energie.com)
 - HYDRO-QUEBEC, Intégration de la production éolienne au réseau de transport, Information-Décision :
 Ligne à 230 kV au Goumion-Mont-Louis-Gros-Morne, Nov. 2007
 Ligne à 161 kV du parc éolien de la Montagne-Sèche et projet connexe, Mars 2009
 - HYDRO-QUEBEC, Nouveau poste de L'Anse-Pleureuse à 230-25 kV, Avril 2010

Prepared by: É. Gingras
 Drawn by: C. Thériault
 Approved by: B. Fournier

GENIVAR

January 12th, 2012 111-20434-00

The topography of the Marin Sector is characterized by a few summits culminating at 450 m ASL. Generally, the elevation goes from 100 to 400 m with steep slopes between 15 and 30%. The eastern part is crossed from south to north by the Madeleine River, which valley is at 100 m ASL and 750 m wide, and the eastern part, crossed, also from south to north, by the Grande-Vallée River at 100 m ASL and 450 m wide. Between these two rivers, the property is criss-crossed by a series of non-perennial brooks, the main reason for the absence of fish life in the sectors.

The fauna and flora in the territory are covered by forest made of 95% coniferous trees with the balsam fir being the most abundant. Other tree species like balsam fir, larch and pine, and as the sector having been lumbered, birches and alders are also present are also found. The fauna is rich in birds (ducks, Canada geese, snow geese, snowy owls, eagles, falcons, etc) and locally the mammals are characteristic of Canada such as the black bear, the white-tail deer and the moose which has a very important density of 4.16 moose per 10 km². The main reason for this abundance is the lack of predators. The aquatic fauna is mainly represented by salmon and river and brook trout.

A portion of the site in question, corresponding to the Madeleine River Valley, forms part of a white-tailed deer habitat, making it a designated wildlife habitat as defined in the Regulation on Wildlife Habitats (see Figures 4-2 and 20-1). Activities susceptible to modify a biological, physical or chemical component of a wildlife habitat are prohibited by the Loi sur la conservation et la mise en valeur de la faune. An authorisation to proceed with such an activity may still be obtained from the MRNF. The Regulation on Wildlife Habitats prescribes the conditions under which certain activities may be carried out.

6 HISTORY

6.1 Previous Owners

Poly-Vein Exploration Inc. and the Conseil de développement économique de la ville de Murdochville had land rights on part of the site located East of the Madeleine River from 2000 to 2002.

Four surface mineralogical research permits had been authorised for a portion of the Marin Sector of the site. These permits were issued after the discovery of red clay along the new logging roads located on the east side of the Madeleine River. Laboratory analysis of the samples indicated relatively high alumina content.

6.2 Land Rights Purchase Agreement

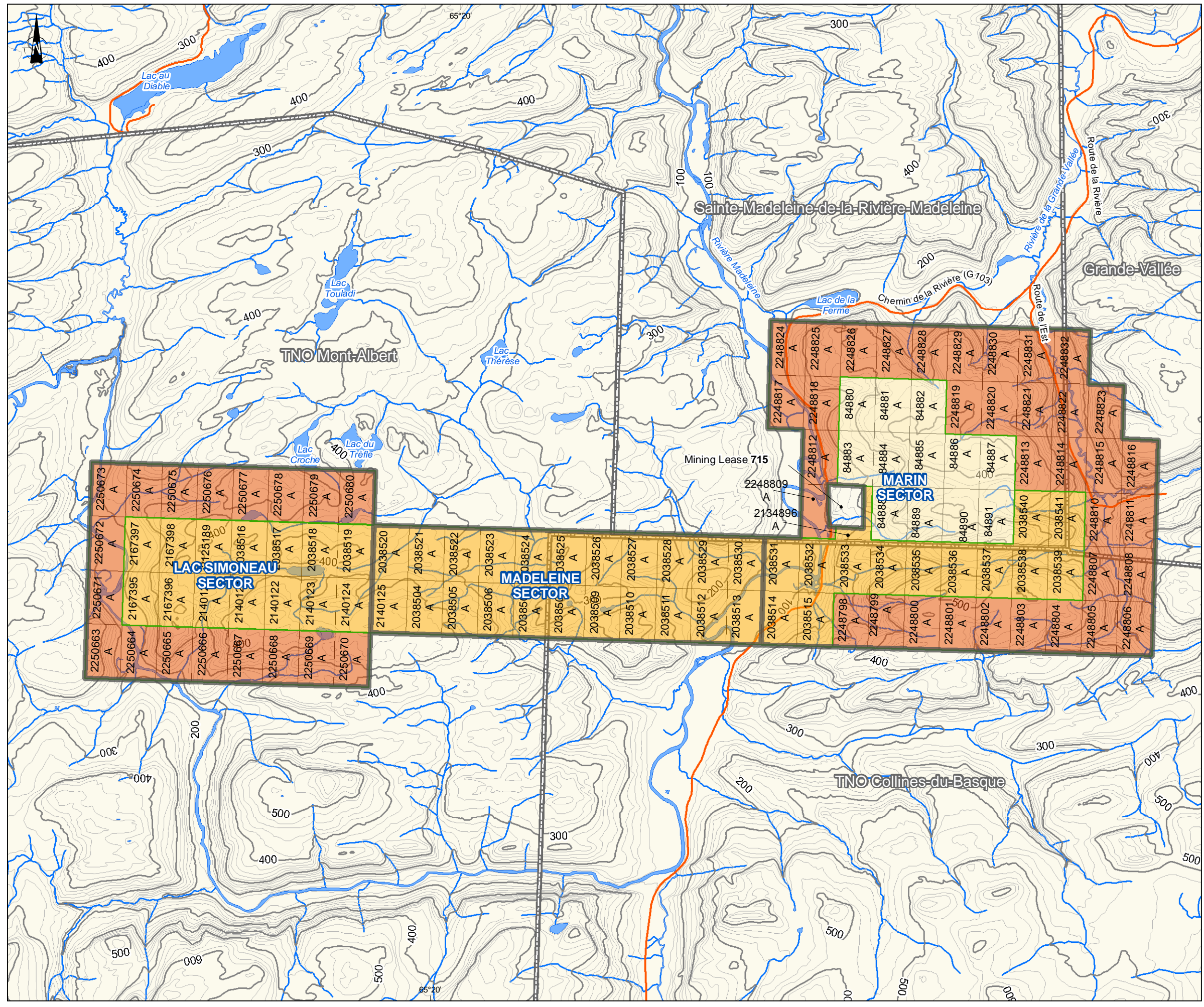
These permits were then converted into Map Designation of Claims (MDC), totalling 12 cells numbered 84,880 to 84,891. These Map Designation Claims were transferred from Poly-Vein Exploration Inc. to Orbite in August 2005.

Under the terms of this transfer Exploration Orbite V.S.P.A. Inc. agreed to pay Poly-Vein Exploration Inc. a royalty of 3% on the net operating profit before tax and depreciation of the property. The royalty is redeemable for \$500,000 after a period of 5 years of operation. Figure 6-1 shows the different stages of the claims acquisition for Orbite's property.

Following the acquisition of the original 12 claims in August 2005, Orbite claimed an extra 50 claims in and around August 2006 to ensure ownership of the totality of the L'Original surface outline with a total surface of 3,457 ha. Finally, in August 2010, the company acquired an extra 53 claims to ensure proprietary surface rights around the main areas of interest, for a grand total of 115 claims for 6,441 ha.

Even though covered into Section 9, the following points do summarize the different exploration work accomplished by Orbite from 2000 to 2011.

File: 111_20434_00_43101\F6_1_032_StagesClaimAcq_120109.mxd



Stages of Claim Acquisition

- Original (12 claims acquired)
- Phase 2 (50 claims acquired)
- Phase 3 (53 claims acquired)
- Lake
- Watercourse
- Contour Line (20 m interval)*
- Access Road
- Claim and Claim Number (A : Active)

*Above mean sea level

Municipal Limit

Sector Limit

0 650 1 300 2 600 m

1:65 000

Projection : NAD 83, UTM 20

PRELIMINARY ECONOMIC ASSESSMENT ON METALLURGICAL GRADE ALUMINA PROJECT

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Figure 6.1

The Different Stages of Claims Acquisition

Sources :

Topographic Map :
- Base cartographique CANVEC

Other Source
- GESTM Data Base- (11-08-08)

Prepared by: É. Gingras
Drawn by: C. Thériault
Approved by: B. Fournier

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6.3 First Exploration Work

The first works were performed in June 2000, on the Eastern portion of the site. At the time, six 15 kg samples were collected from clay outcrops located along the edges of new logging routes. Composite samples yielded Al_2O_3 concentrations varying between 22.3% and 22.6% at the time with the following other mineralogical components: kaolinite, quartz, feldspars, mica and chlorite.

In July 2000, geologist R. W. Turner performed geological cartography and surface deposit sampling works for Poly-Vein (Turner, 2000)⁽⁹⁾. A total of 34 samples were collected for analysis. Following this work, 3 zones of red clay associated with red shale outcrops were delineated with the help of surface sampling. Core analysis, performed at the COREM laboratory, indicated that the component shale and red mudstones had relatively high alumina content, varying from 24% to 25%.

6.4 2005 Orbite Bulk Sampling Work

A lithochemical survey and a bulk sampling were performed by the Institut National de Recherche scientifique (INRS) in November 2005 in the part of the site East of the Madeleine River, specifically on claims MDC 84880 to 84891 (Lafèche et coll., 2006)⁽¹⁰⁾. In total, 88 samples of shale and mudstone were collected. The chemical composition of the fragmentary shale is characterized by relatively elevated alumina and iron contents relative to the surrounding lithological units, which are composed of shale or red, green or occasionally black shale.

The chemical analyses performed on the red fragmentary shale revealed average Al_2O_3 content of 23.36% and 8.95% iron as Fe_2O_3 . For other shale, the average content of Al_2O_3 and Fe_2O_3 respectively varied between 17.17% and 20.74%, and 6.88% and 8.38%.

According to the INRS, the red shale's composition is unusual for this region of Québec, and is characterized by an elevated degree of alteration. Mineralogical analyses also indicate phases containing high levels of Al_2O_3 (up to 41% Al_2O_3) and relatively low K_2O , indicating the presence of kaolinite in the matrix.

6.5 2005 – 2007 Orbite Exploration work

Exploration work have identified 3 zones with red clay deposits or fragmentary shale, associated with units of red shale of the L'Original Formation. At the time these zones were identified with the letters A, B, C.

Zone A (Marin Sector)

Zone A is a body of fragmentary shale below which, up to 2 m deep trenching performed in 2007 exposed a unit of essentially red shale rich in alumina, with interlacing mudstones having lower alumina content. This unit occupies a strip of a maximum width of 350 m, encased in a matrix of mudstones and siltstones.

Zone B (Marin Sector)

In this zone, fragmentary shale occupies the northern flank of a hill, whose summit has outcrops of grey and green mudstones. The fragmentary shale was observed along the length of a strip approximately 150 m to 200 m in width and 1 km in length.

Zone C (Marin Sector)

In this zone, the fragmentary shale occupy the northwest flank of a hill oriented in a North-Eastern direction and on top of which there are outcrops of red and green mudstones. This zone has an approximate width of 200 m and extends at least 600 m.

6.6 2007 Orbite Exploration Work

Orbite conducted exploration work between July and December 2007. These exploration work included prospecting on the Western part of the site, as well as excavations and trenches for the purposes of sampling, as well as drilling in the part of Zone A which is within the site. These activities allowed for the identification of two new zones: Zones D and E.

Zone D (Madeleine Sector)

This zone is located to the west of the Madeleine River, in the Belley Stream Sector. The zone's fragmentary shale was surveyed with the help of an auger. The zone has an approximate width of 100 m and a length of 300 m.

Zone E (Simoneau Sector)

This zone is located at the Western extremity of the site, approximately 1 km West of lac Simoneau. At this location, friable red shale mixed with clay at the surface are exposed along the edges of the logging roads at two important outcroppings located 500 m from each other. The fragmentary shale associated with these outcroppings extends over more than 1 km in length and up to 250 m in width in certain spots.

The analysis results indicated that the red shale, the bedrock in Zone A, has a chemical composition very similar to the non-consolidated fragmentary shale. The shale had Al_2O_3 contents varying between 22.6% and 25.6%, and Fe_2O_3 contents varying between 7.98% and 10.4%. Other lithologies are composed of shale (mudstones or siltstones) having somewhat lower Al_2O_3 (between 20% and 22%).

6.7 2008 Orbite Exploration Work

In 2008, the company was very active on the Grande-Vallée property. The exploration was conducted mostly in the extension of sectors where previous activity had been initiated. 219 trenches or exploration pits were dug and sample. The yearly results confirmed the previously defined geological environment.

6.8 2009-2010 Orbite Exploration Work

In 2009, the company performed relatively low amount of drilling and few data collected were included in the work of 2010 and reported in 2010 Field work, Grande-Vallée Property, NI 43-101 Technical Report, dated March 31, 2011, amended August 21, 2011, prepared for Exploration ORBITE VSPA Inc. by Mr. Jean-Guy Levaque, Eng.⁽⁴⁾.

6.9 2011 Orbite Exploration Work

The exploration drilling done in 2011 was mostly oriented in the better definition of the geological model in order to be ready to launch a mathematical model with reputable software. It also allowed adding to the confidence level on the homogeneity of both the claystone and the mudstone as well as for specific elements (resources).

In 2010, the pilot plant demonstrated the viability of clay containing as little as 18% Al_2O_3 . These elements were evaluated and verified by 2 independent qualified group independent from Orbite in 2011 (see Section 13). It meant that the mudstone, previously considered as waste, could be included with the higher alumina claystone. The yearly results were in line with the previous year's averages and variations.

7 GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The ORBITE mining claims are located within the Gaspé Peninsula which constitutes the Eastern segment of the Quebec Appalachians. This segment is characterized by three tectonostratigraphic domains: 1) an upper Neoproterozoic or Lower Cambrian to Upper Ordovician domain belonging to both the Humber and Dunnage zones; 2) an Upper Ordovician to Middle Devonian domain, the Gaspé Belt, and; 3) a Late Devonian to Carboniferous domain belonging to the Maritime Basin (Malo, 2004)⁽¹¹⁾. The mining concession is located within the upper Neoproterozoic to Upper Ordovician domain corresponding to the Northern rim of the Gaspé Appalachians. It is bounded to the south by the Shickshock Sud Fault and to the west by the Rivière Madeleine Fault (see Figure 7-1).

7.1.1 Stratigraphy and Lithology

The regional lithostratigraphical units recognized over the area strike E-W and are delimited by regional major thrust and strike-slip faults (Slivitzky, 1994^(12,13); Lachambre et Brisebois 1991⁽¹⁴⁾; Brisebois et al. 1992⁽¹⁵⁾). In the vicinity of the permits held by Exploration ORBITE VSPA (now Orbite Aluminae Inc.), those units comprise Late Precambrian to Early Cambrian volcanic assemblages and Cambrian to Ordovician sedimentary assemblages (conglomerate, sandstone, mudstone, and limestone; see Figure 7-1). All these unit packages are unconformably overlain to the south by Silurian to Devonian limestone and sandstone assemblages belonging to the Gaspé-Connecticut-Valley Synclinorium.

The Precambrian to Ordovician assemblages of the region can be divided into 8 specific lithostratigraphic units (Brisebois et al., 1992)⁽¹⁵⁾. From the top to the base of the depositional sequence, these units comprise:

- The Chloridorme Formation (Upper Ordovician), composed of a sequence of mudstone, sandstone, dolostone and silty carbonate;
- The Des Landes Formation (Upper Ordovician), composed of a unit of chert and mudstone, covered with a sequence of turbidites composed of arenite, calcarenite, calcilutite and calcareous claystone;
- The Tourelle Formation (Middle Ordovician), composed of sandstone and mudstone;
- The Rivière Ouelle Formation (Middle to Lower Ordovician), principally composed of mudstone, sandstone, limestone and conglomerate units;

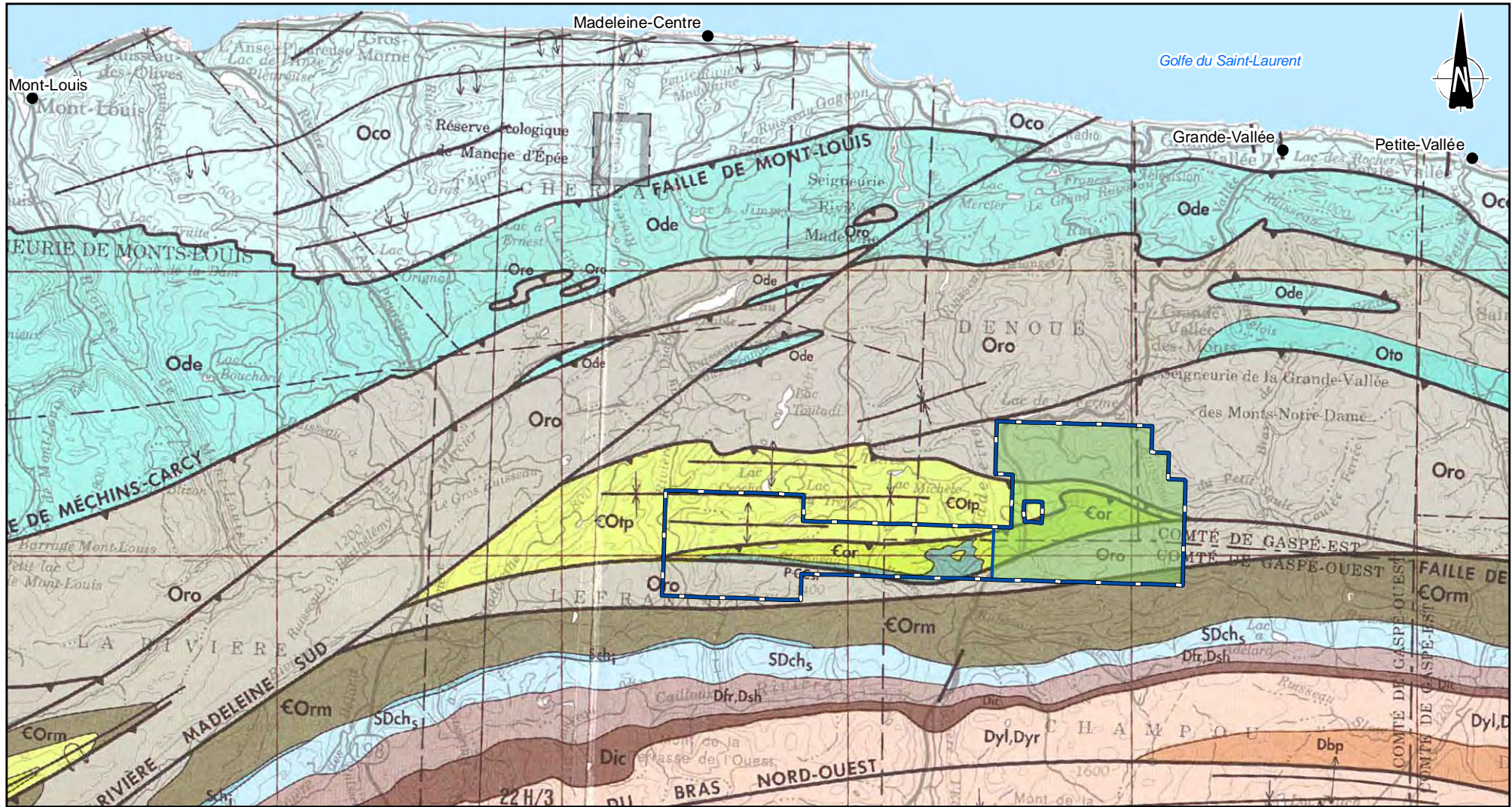
- The Romieu Formation (Middle Cambrian to Lower Ordovician), composed of calcareous claystone and calcilutite;
- The Trois-Pistoles Group (Upper Cambrian to Lower Ordovician), composed of mudstone, sandstone and conglomerate units;
- The L'Original Formation (Middle Cambrian), characterized by a mix of mudstone and siltstone units with red-brown and olive green colour;
- The Shickshock Group (Precambrian to Lower Cambrian), principally composed of basaltic volcanic rock and metasediments.

7.1.2 Structural Geology and Tectonics

The Cambro-Ordovician units were strongly affected during the Taconic Orogeny (Middle to Upper Ordovician), resulting in complex folded and faulted sedimentary packages (St-Julien and Hubert, 1975)⁽¹⁶⁾, and were affected again during the Acadian Orogeny (middle Devonian).

The structural geometry of the area is characterised by the piling of Taconian overthrust nappes. Regional thrusts are ENE- to EW-trending and structural transport along the faults was generally recorded toward the north. Associated ENE to EW overturned and recumbent folds are also recognized throughout the zone. Taconian regional thrusts and folds were later deformed by Acadian open and symmetrical folding event.

Just South of the mining concession, the major and regional Shickshock Sud strike-slip fault zone separates the Romieu Formation from the Rivière Ouelle Formation. This fault represents a major tectonic boundary bordering the northern limit of the Gaspé-Connecticut-Valley Synclinorium. It extends East and West of the area over several kilometers. This fault has been active during both the Taconian and the Acadian deformation events.



Devonian

- Dbp** Battery Point Fm. (Feldspar sandstone; red and green mudstone)
- Dyl,Dyr** York River Fm. (Feldspar sandstone, siltstone and green mudstone)
- Dic** Indian Cove Fm. (Cherty limestone)
- Dfr,Dsh** Forillon and Shiphead Fm. (Siliceous or cherty clayey limestone)

Silurian to Devonian

- SDch_s** West Point Fm. (Nodular reef limestone; conglomerate)

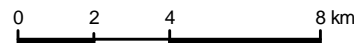
Precambrian to Ordovician

- Oco** Cloridorme Fm. (Mudstone, sandstone, dolostone and limestone)
- Ode** Des Landes Fm. (Sandstone, mudstone, chert, calcareous claystone)
- Oto** Tourelle Fm. (Sandstone and mudstone)
- Oro** Rivière-Ouelle Fm. (Mudstone, sandstone, limestone and conglomerate)
- EOrm** Romieu Fm. (calcareous claystone and calcilutite)
- EOtp** Trois-Pistoles Gr. (Sandstone, mudstone and conglomerate)
- Éor** L'Original Fm. (Red and green mudstone and siltstone)
- PECsi** Shickshock Gr. (Metabasalt and metasediments)

Other

- Anticline
- Syncline
- Overturned anticline
- Fault
- Thrust fault

- Orbite's Mining Claims Limit
- Marin Sector



PRELIMINARY ECONOMIC ASSESSMENT ON METALLURGICAL GRADE ALUMINA PROJECT

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Figure 7.1

Regional Geology

Sources :

Geology Map : Brisebois, D. et al. 1992, MRNF, DP91-21

Gestim Database - (11/08/08)

January 12th, 2012 111-14952-00

Preparation: G. Bessette
Drawing: C. Thériault
Approval: B. Fournier



7.2 Local Geology

The Marin Sector is located in the Southern part of the Lower Paleozoic rock assemblages. The mining claims cover a large sequence of rocks mainly attributed to the L'Original Formation. This layer of rocks, also shown East and West of the mining concession, is in faulted contact to the South and to the North with rocks from the Rivière Ouelle Formation and the Trois-Pistoles Group, respectively.

Field work over the mining concession in 2008⁽¹⁷⁾, including both drill holes and NS trenches, has resulted in the generation of a first version of the detailed geology of the sector. Obtained results highlighted the structural complexity of the area and the difficulty in following the claystone extensions of the L'Original Formation.

Additional drill holes, field work and systematic lithological and structural analysis of airphotos and topographical data in 2009 and 2010, allowed to propose an updated geological map at a local scale (MIR Télédétection, 2009; VIASAT, 2011)^(18,19).

7.3 Geology of the Grande-Vallée Property

7.3.1 Stratigraphy and Lithologies

While the regional geology suggests that the Marin Sector is mostly dominated by the L'Original Formation, detailed mapping shows that the area is characterized by a mix of typical deep marine green and red siltstone, mudstone and claystone of the L'Original Formation and various units of the Trois-Pistoles Group, characterized by black shale, sandstone and conglomerate.

The L'Original Formation, mainly comprised of muddy units, shows a large diversity of lithological specifications when considering the colour, the grain size, the texture and the structure. Within this formation, the rocks are found with variable texture and colour (red, green, purple, brown, black). The red claystone in particular is very friable and disintegrates quickly when subjected to the elements, forming residual deposits of a pronounced red colour. Variations in term of granulometry are also shown, associated to the different silt/clay ratio content. Much of those variations in terms of colour and texture are not necessarily only lithological-related but may also be alteration-, oxido-reduction- and structural deformation-related. Based on field observations and on the latest geological mapping, the different local units and sub-units on the Marin concession are proposed as follow:

Trois-Pistoles Group

- Quartzite: Pink and white massive quartzite with locally hematite traces (1 to 2%);
- Conglomerate: Mainly limestone rock fragments of centimetric to decametric size within a sandy matrix;
- Black shale and alternation of black shale and sandstone beds: Grey-black to brown shale, locally interbedded with laminated sandstone.

L'Original Formation

- Red and green mudstone: Alternation of shale and red to purple to green mudstone/siltstone, with medium alumina content;
- Red claystone: Red claystone with a strong penetrative cleavage, very friable, easily altered and with a high alumina content.

7.3.2 Structural Geology and Tectonics

The Marin Sector appears as an overthrust nappe transporting the assemblages of the Trois-Pistoles Group and of the L'Original Formation northward. The area is characterized by a succession of relatively tight folds to the East gradually becoming more open towards the West. The shale units of the L'Original Formation are exhumed at the hinge of anticlines within topographical valleys, while the residual sandy and conglomerate units of the Trois-Pistoles Group are found over topographic high, consisting of suspended syncline. Field works and drill holes also suggest that the Marin Sector is characterized by a succession of overturned folds in its NNW part.

The Nappe is bounded to the north by a major thrust fault and is separated from the Rivière Ouelle Formation, to the south, by a major strike-slip fault. The latter may have also been reactivated as a backthrust fault (Konstantinovskaya, 2008)⁽²⁰⁾.

A significant fault crosscut the southern part of the concession following an ENE to EW direction. This fault is characterised by a dextral strike-slip component, a high dipping angle and is responsible for the discordant contact between the shale and quartzite units of the Trois-Pistoles Group and the red and green mudstone of the L'Original Formation. Several NW-trending faults are also interpreted on the zone (mainly from airphotos-interpretation) and appear as late apparent sinistral strike-slip faults.

7.4 Mineralization

The mineral deposits presents on the Grande-Vallée property are, in fact, units of claystone or mudstone present in the sedimentary sequence of the L'Original Formation. Those claystones are so crumbly or friable that their outcrops are all covered by an un-consolidated reddish residual layer called "weathered claystones". Those rocks (consolidated and un-consolidated claystones) are characterised by their high content of alumina, varying between 23 and 26% Al_2O_3 compared to the mudstones at 18 to 21% Al_2O_3 also in the L'Original Formation. Thus those rocks cannot be construed as particular type or model of deposit, as is the case with metalliferous deposits. They can only be classified in the very wide category of argillaceous aluminous sedimentary rocks, potentially sources of alumina as an alternative to bauxite. But their high level of reactive silica will render them unfit for the Bayer process. Exploration work has confirmed inferred and indicated resources (see Section 14) of multiple elements that happened to be extractable through the hydrochloric acid portion of the Orbite proprietary process (see Section 17). Apart from alumina (Al_2O_3), these are:

- Silica (SiO_2);
- Hematite (Fe_2O_3);
- Magnesium oxide (MgO);
- Mixed oxides acting as fertilizers;
- Rare materials and rare metals in the form of oxides which are:
 - Scandium (Sc_2O_3);
 - Gallium (Ga_2O_3);
 - Yttrium (Y_2O_3);
 - Dysprosium (Dy_2O_3);
 - Cerium (CeO_2);
 - Praseodymium (Pr_5O_{11});
 - Neodymium (Nd_2O_3);
 - Erbium (Er_2O_3);
 - Europium (Eu_2O_3);
 - Gadolinium (Gd_2O_3);
 - Lanthanum (La_2O_3);
 - Samarium (Sm_2O_3).

8 DEPOSIT TYPES

As mentioned in the previous chapter (see Section 7), the claystone and mudstone cannot be compared, such as in the case of metallic deposits (iron, titanium, copper, magnesium, etc. for example), to any particular deposit types because mineralization is normally the deposition of economically important metals in the formation of ore bodies.

This phenomena is absent in the case of the L'Original Formation. The actual level of concentration of Alumina is very low compared to the "Clay" of alumina which is Bauxite as shown in the following comparaisn Table 8-1.

Table 8-1 Major Elements in Bauxite and in the Grande-Vallée Deposit

Element	Standard Bauxite	Grande-Vallée Claystone	Grande-Vallée Claystone & Mudstone
Al ₂ O ₃	50-60%	24.7%	23.5%
SiO ₂	1-5%	51.4%	52.8%
Fe ₂ O ₃	2-20%	8.7%	8.5%
TiO ₂	2-4%	0.9%	1.0%
CaO	0-4%	0.4%	0.6%
LOI	10-30%	7%	6.5%

This particular case does not preclude, though, strict adherence to the CIM Definition Standards for Mineral Resources and Mineral Reserves.

The exploration model used by Orbite to establish the mineral resources for the Grande-Vallée deposits rests on comparison with similar deposits and experience of Mr. Jean-Guy Levaque, Eng., QP, and the results from surface mapping. The results of these surveys were used by Orbite for the follow-up with the drilling program.

9 EXPLORATION

9.1 Initial Exploration Work

The initial exploration work was conducted in June 2000, on the Eastern portion of the site. At the time, six 15 kg samples were collected from clay outcrops located along the edges of new logging routes. X-ray fluorescence spectrometry analysis and X-ray diffraction analysis, performed by the COREM laboratory, on three composite samples yielded Al_2O_3 concentrations varying between 22.3% and 22.6%, along with the following other mineralogical components: kaolinite, quartz, feldspars, mica and chlorite.

In July 2000, geologist R. W. Turner performed geological cartography and surface deposit sampling work for Poly-Vein (Turner, 2000)⁽⁹⁾. A total of 34 samples were collected for analysis. Following this work, three zones of red clay associated with red shale outcrops were delineated with the help of surface sampling. These zones were named A, B and C. In July, 2001, Poly-Vein carried out vertical drilling work in the central parts of each of these zones in order to evaluate the thickness of the clay deposits. The cores, with respective lengths of 23.46 m (A), 23.16 m (B) and 43.28 m (C), were noted as containing thin clay deposits at the surface. Shale and fractured red mudstones were found at depths of less than 4 m. Core analysis, performed at the COREM laboratory, indicated that the component shale and red mudstones had relatively high alumina content, varying from 24% to 25%.

9.2 Exploration Work 2000 to 2005

A lithochemical survey and a bulk sampling were performed by the Institut National de Recherche scientifique (INRS) in November 2005 in the part of the site east of the Madeleine River, specifically on claims MDC 84880 to 84891 (Lafèche et coll., 2006)⁽¹⁰⁾. In total, 88 samples of shale and mudstone were collected for analysis at 20 m intervals in a section bordering the main road which crosses this part of the site. Three bulk samples of approximately 25 kilograms were also collected in zones A, B and C for detailed mineralogical analysis.

The studies carried out by the INRS on the sampled shale included:

- Chemical analysis by spectral atomic absorption;
- X-ray diffraction;
- Thermo-gravitational analysis;

- Visible-infrared spectroscopic mineralogical determinations;
- Mineralogical chemical phase composition analysis by scanning electronic microscope and electronic micro sensor; and granulometric studies.

Based on these studies, zones A, B and C are comprised of a single lithological unit composed of unconsolidated fragmentary red shale. The chemical composition of the fragmentary shale is characterized by relatively elevated alumina and iron contents relative to the surrounding lithological units, which are composed of shale or red, green or occasionally black shale.

The chemical analyses performed on the red fragmentary shale revealed average Al_2O_3 content of 23.36% and 8.95% iron as Fe_2O_3 . For other shale, the average content of Al_2O_3 and Fe_2O_3 respectively varied between 17.17% and 20.74%, and 6.88% and 8.38%.

According to the INRS, the red shale's composition is unusual for this region of Québec, and is characterized by an elevated degree of alteration. Mineralogical analyses also indicate phases containing high levels of Al_2O_3 (up to 41% Al_2O_3) and relatively low K_2O , indicating the presence of kaolinite in the matrix. The granulometric distribution of the aluminous fragmentary shale is largely composed of pebbles (51%-59%) and sands (26%-37%), suggesting that these material are the result of significant chemical and mechanical weathering of a unit of shale.

9.3 Exploration Work 2005 to 2007

Exploration work (see Figure 9-1) identified 3 zones with red clay deposits or fragmentary shale, associated with units of red shale of the L'Original Formation. At the time these zones were identified with the letters A, B, C.

Zone A is a body of fragmentary shale below which, up to 2 m deep trenching performed in 2007 exposed a unit of essentially red shale rich in alumina, with interlacing mudstones having lower alumina content. This unit occupies a strip of a maximum width of 350 m, encased in a matrix of mudstones and siltstones. The unit extends in an East-West direction for approximately 900 m and was identified by drilling work reaching over 100 m in depth.

Zone B is fragmentary shale and occupies the Northern flank of a hill, whose summit has outcrops of grey and green mudstones. The fragmentary shale was observed along the length of a strip approximately 150 m to 200 m in width and 1 km in length. The red shale associated with these deposits outcrop occasionally in the clear-cut areas of the main road as well as its ditches.

Zone C is the fragmentary shale and occupies the Northwest flank of a hill oriented in a North-East direction and on top of which there are outcrops of red and green mudstones. This zone has an approximate width of 200 m and extends at least 600 m. The southwest part of this zone lies outside of the proposed mining site and is partly occupied by a high-silica stone quarry mining permit not belonging to Orbite.

9.4 2007 Exploration Work

Orbite conducted exploration work between July and December 2007. These work included prospecting on the western part of the site, as well as excavations and trenches for the purposes of sampling, as well as drilling in the part of Zone A which is within the proposed mining site.

Prospecting was conducted in July 2007 on the part West of the Madeleine river. This part of the site, rights to which were acquired in 2007, had not to that point been explored. This prospecting included a survey of the principal outcrops in the region located along the logging roads. Twenty-six representative samples were taken for chemical analysis of the principal lithologies associated with the L'Original Formation. These tasks allowed for the identification of 2 new zones of fragmentary shale associated with outcroppings of red shale, initially surveyed using manual equipment

Zone D is located to the West of the Madeleine River, in the Belley Stream vicinity. The zone's fragmentary shale was surveyed with the help of an auger. The zone has an approximate width of 100 m and a length of 300 m. Outcrops of fragmentary shale and red shale were found lying loose on the road surface and in the ditch of the logging road that crosses the Eastern sector of the zone.

Zone E is located at the Western extremity of the site, approximately 1 km west of lac Simoneau. At this location, friable red shale mixed with clay at the surface are exposed along the edges of the logging roads at two important outcroppings located 500 m from each other. The fragmentary shale associated with these outcroppings extends over more than 1 km in length and up to 250 m in width in certain spots. Everywhere on the property, observed lithologies within the L'Original Formation included red, green or grey mudstones, purple, red or green claystones and brownish purple siltstones.

The analysis of representative samples from the principal lithologies on site was performed by atomic absorption at ALS Chemex Laboratories in Val-d'Or, Quebec. The analytical results indicate that the red argillite's and fragmentary shale are separate formations from the other aluminous rocks in the L'Original Formation, and have greater alumina and iron content while also having low silica content. These results are comparable to those collected by the IRNS litho-geochemical survey on the part of the site located west of the Madeleine River.

Excavation and trenching work were performed in Zone A. The goal of the tasks was to determine the extent and uniformity of the clay deposits in this zone. A total of 50 excavations varying from 1 m to 2.5 m in depth were dug at 30 m to 50 m intervals located on north to south axes spaced 100 m apart. In addition, a 150 m trench was dug in the centre of Zone A. These activities revealed that in Zone A, a sequence of red to brownish-red shale is buried under a cover of 30 cm to 60 cm of either humus or reddish brown clayey soil. The clays were very fissile. The first few metres of shale have been mixed with clay and fragmentary shale, which with depth appear to have been displaced by very friable shale which delaminates along the planes of cleavage. Below 2 m, the shale was more easily excavated with the excavator. Outcrops were observed in a stream at a distance of 100 m from the trenches and extended from East to West along a distance of 900 m, bordering Zone A, as found by Turner (2000)⁽⁹⁾.

However, in the Northeast part of Zone A, the presence of shale could not be confirmed given that the area's bedrock was covered with a thick layer of compact till. Red shale appear to form homogenous units in the area, however at approximately 75 m to the South of the grey and green mudstones, trench work revealed harder rocks which included mudstones and reddish brown or purple siltstones. These harder rocks, which are also found in outcrops along the road, form within the shale a sub-vertical strip 10 m in width and extending out in an east-west direction. Samples of approximately 2 kg in size were collected from the exposed lithologies in the lower portions of each of the excavations.

The samples were analysed for their major chemical components by the IRNS. Results indicated that the red shale, of which the bedrock in Zone A is composed, have a chemical composition very similar to the non-consolidated fragmentary shale. The "shale" had Al_2O_3 contents varying between 22.6% and 25.6%, and Fe_2O_3 contents varying between 7.98% and 10.4%. Other lithologies are composed of mudstones or siltstones having somewhat lower Al_2O_3 (between 20% and 22%).

Details of drilling log's, results and chemical analysis for year 2007 are available⁽²¹⁾ upon request and were reviewed by QP Mr. Jean-Guy Levaque, Eng.

9.5 2008 Exploration Work

In 2008, the company was very active on the Grande-Vallée property, concentrating its effort in 3 sectors identified as Madeleine, Simoneau and Marin. The general mandate was to delimit a tonnage of marketable argillite. The exploration was conducted mostly in the extension of sectors where previous work had been initiated. 219 trenches or exploration pits were dug and sampled, 16 km of lines were stripped within an area of 5.5 sq. km, and 14 drill holes totalling 1,791 m were added to the 3,200 m previously drilled in 2007. These tasks allowed the modification the zone concept into the concept of sector. The former A, B and C zones were now

regrouped under the Marin Sector, zone D became Madeleine Sector and zone E became Simoneau Sector.

The regrouping opened the door to a huge increase in claystone quantity because the exploration, through trenching and drilling, demonstrated a direct link between the former independent zones.

The yearly results confirmed the previously defined geological environment⁽³⁾.

Details of drilling log's, results and chemical analysis for year 2008 are available⁽²²⁾, upon request and were reviewed by QP Mr. Jean-Guy Levaque, Eng.

9.6 Exploration Work 2009-2010

The year 2009 was relatively more difficult because of the combination of a severe draught coupled with inadequate drilling techniques which aborted the season rather abruptly. The few data collected were included in the work of 2010 and reported in 2010 Field work, Grande-Vallée Property, NI 43-101 Technical Report, dated March 31, 2011, amended August 21, 2011, prepared for Exploration ORBITE VSPA Inc. by Jean-Guy Levaque⁽⁵⁾.

The 2010 exploration campaign had a very particular aspect. As of this date the Cap Chat pilot plant demonstrated the viability of rock containing as little as 18% Al₂O₃, it meant that the mudstone, previously considered as waste, could be included with the higher alumina claystone. This meant that the drilling campaign was to include area formerly rejected because of the presence of mudstone. No work was done in the other two sectors.

The yearly results were nevertheless in line with the previous year's averages and variations.

Details of drilling log's, results and chemical analysis for year 2009 and 2010 are available^(23,24) upon request and were reviewed by QP Mr. Jean-Guy Levaque, Eng.

9.7 Exploration Work in 2011

The exploration drilling done was mostly oriented in the better definition of the geological model in order to be ready to launch a mathematical model with reputable software.

The yearly results added to the confidence level on the homogeneity of both the claystone and the mudstone and individual elements⁽⁵⁾.

Details of drilling log's results and chemical analysis for year 2011 are available⁽²⁵⁾ upon request and were reviewed by QP Mr. Jean-Guy Levaque, Eng.

The following table shows the total number of holes drilled in the Marin Sector for every year since 2007, as well as the total meters.

Table 9-1 Holes and Total Length Drilled per Year in the Marin Sector

Year	Number of Holes	Length in Meter
2007	40	3,222
2008	12	1,779
2009	4	993
2010	27	4,346
2011	22	2,718

10 DRILLING

A total of 13,058 m were drilled over five year extent on the Property since 2007. Four major drilling campaigns were performed on the property, and Table 10-1 summarizes the drilling details of those campaigns.

Table 10-1 Different Drilling Campaign on the Property

Year	Company	# Holes	Total Length (m)
2007	Forages Pelletier	40	3,222
2008	Forages Performax	12	1,779
2009	Forages Express, La Baie	4	993
2010	Forages Dibar	27	4,346
2011	Forages Dibar	28	3,909
TOTAL			13,058

The program through the years was principally aimed at evaluating and confirming the resources distribution and homogeneity. As indicated in the table above, drilling was completed by different companies during the different campaigns. It is noteworthy to mention that the first two campaigns concentrated solely on the claystone, since, at that time, it was the only material susceptible to produce alumina. In the fall of 2008, the company demonstrated, with lab test work, that a possible cut-off could be as low as 18% Al₂O₃. Ever since, the exploration and drilling work included the mudstone.

The total footage drilled in the Marin Sector is thus 13,058 m excluding 1,191 m drilled in the Simoneau Sector in 2011. Every hole was located by a handheld GPS (Garmin 60 type) previous to drilling along either cut lines or closed to former abandoned lumber roads. After each campaign, every hole was again re-surveyed by a legal surveyor (Trimble GeoXR type). The surveyor data is included in each geological log sheet⁽²⁵⁾ log sheet. The coordinate system for the whole project is UTM Nad 83 Area 20. Details of each geological log sheet including the chemical analysis associated are available for consultation and were reviewed by the independent QP, Mr. Jean-Guy Levaque, Eng.

10.1 2010 Drilling Program

Orbite's property being divided in 3 sectors: to the West, the Simoneau Sector, in the middle, the Madeleine Sector and to the East, the Marin Sector. The 2010 field work, which completed the work done in 2009, was all done in the Marin Sector. To the already drilled 993 m, 4346 m were added, always on an approximate 500 m grid. Under overburden ranging from a few meters in the West to some fifteen meters in the East, there is now a good knowledge of not only the Claystone extension in the Marin Sector but also of the mudstone in the South and center of the sector. The drill holes also were able to both confirm and modify different part of last year geological interpretation. In February 2011, the pilot plant was able to confirm the economic viability of extracting alumina from the mudstone; being thus representing a double positive. Not only does this mudstone increase the quantity of available material for the future plant, but it also allows going wider, thus also deeper with the open pit.

The Madeleine and Simoneau sectors will be drilled in 2012.

10.1.1 2010 Drilling Work Objectives

The objectives of the 2010 field work were:

- In the Marin Sector, refine the knowledge of the Claystone/Mudstone interface in the South, in the center and in the North-West;
- Develop a better regional geological understanding of the overall Marin Sector in line with all the knowledge acquired to date;
- Drill sufficient holes to fulfill the first 2 objectives.

10.1.2 2010 Drilling Work Sources of Information and Data

- The content of this part of the Technical Report is provided in part by:
- The results of previous field work on the property as reported by the 2008 and 2009 yearly report; ^(2,3,17,18,26)
- The results of the diamond drilling campaign done between June and September 2010;
- A report entitled: "Analyse lithologique en support à l'exploration de shale alumineux, Grande-Vallée, Gaspésie – Phase 2".⁽²⁷⁾

10.1.3 2010 Independent review by QP

Living a short distance from the Project, Mr. Jean-Guy Levaque, Eng. Independent QP was present on site almost every working day, between June 15 and November 15, 2010.

10.1.4 2010 Drilling Works Reliance on Other Experts

- Diamond drill sample chemical analysis was done in the ALS Chemex, Val d'Or, Quebec office under the direction of Mr. Richard Deschambeault;
- Drilling was done by Forages Dibar of Ste-Anne-des-Monts;
- Mr. Michel Rheault, P. Geo, M.Sc., and Guillaume Matton, P. Geo, M.Sc. of VIASAT GeoTechnologies were responsible for the geological interpretation;
- Mr. Gerard Joncas, a.g., was responsible for the final GPS survey of all the drill holes.

10.1.5 2010 Drilling Techniques

Forages Dibar Inc. operated two self-constructed drill rigs. One had greater capacity and was equipped with NQ drilling rods, the other, for shallower drilling was equipped with BQ-TK type rods. This last type is similar to BQ but with thinner walls thus producing a core that is in between BQ and NQ core.

10.1.6 2010 Specific Drilling

10.1.6.1 Continuation of 2009 Activities

The 2010 drill campaign was the continuation of the aborted 2009 campaign with a few added holes in order to help refine the geological interpretation of the Claystone deposit and its mudstone counterpart, more precisely, the location, shape and composition of the different mudstone layers on the side and in the middle of the deposit.

To get a better understanding of the deposit, both the 2008 and 2009 drill holes results are included, not only in the core logs of the appendices, but also used in the interpretation of the 2010 results.

10.1.6.2 Cut-off Grade

Contrary to the 2008 NI 43-101 Technical Report and because of the emphasis on the mudstone, there was be no cut-off grade used to eliminate samples; only sandstone and quartzite samples are kept unanalysed.

10.1.6.3 Stored Core

Similar to previous years, the whole core was sent to the laboratory for chemical analysis after being systematically logged and photographed. All non-sampled cores were regrouped by three meters length and bagged to keep their integrity.

10.1.6.4 2010 Drill Hole Location and Characteristics

Figure 10-1 illustrates drill holes location of the 2010 campaign. Furthermore, Table 10-2 shows the physical characteristics of the 2010 campaign (as well as those of 2009 and 2008).

10.1.6.5 2010 Core Recovery

Recovery of the structural integrity of the core is very difficult. The systematic RQD done on the 2008 and 2009 core as well as the sporadic one done in 2010 (see section below) provided an average of 15%. The actual recovery of material varied quite a bit and was mostly affected by the location of holes as well as the lithology.

In the weathered zone, the core recovery is very low but since the top and bottom of this layer is easily defined, the fact that the analysis are systematically the same as for the “sound” claystone and that the thickness of this layer is rather thin (0 to 2 m), it was not felt that special drilling techniques were warranted to increase the recovery. A last anomaly occurred in with hole 1005: it jammed completely at 151 m and the casing fell in. It was redone some 20 m to the north and went uneventfully down to 348 m.

The other areas where difficulties were encountered were in drilling at a 45° North South of the Shickshock fault; 4 holes hit the fault and were abandoned due to lost rods.

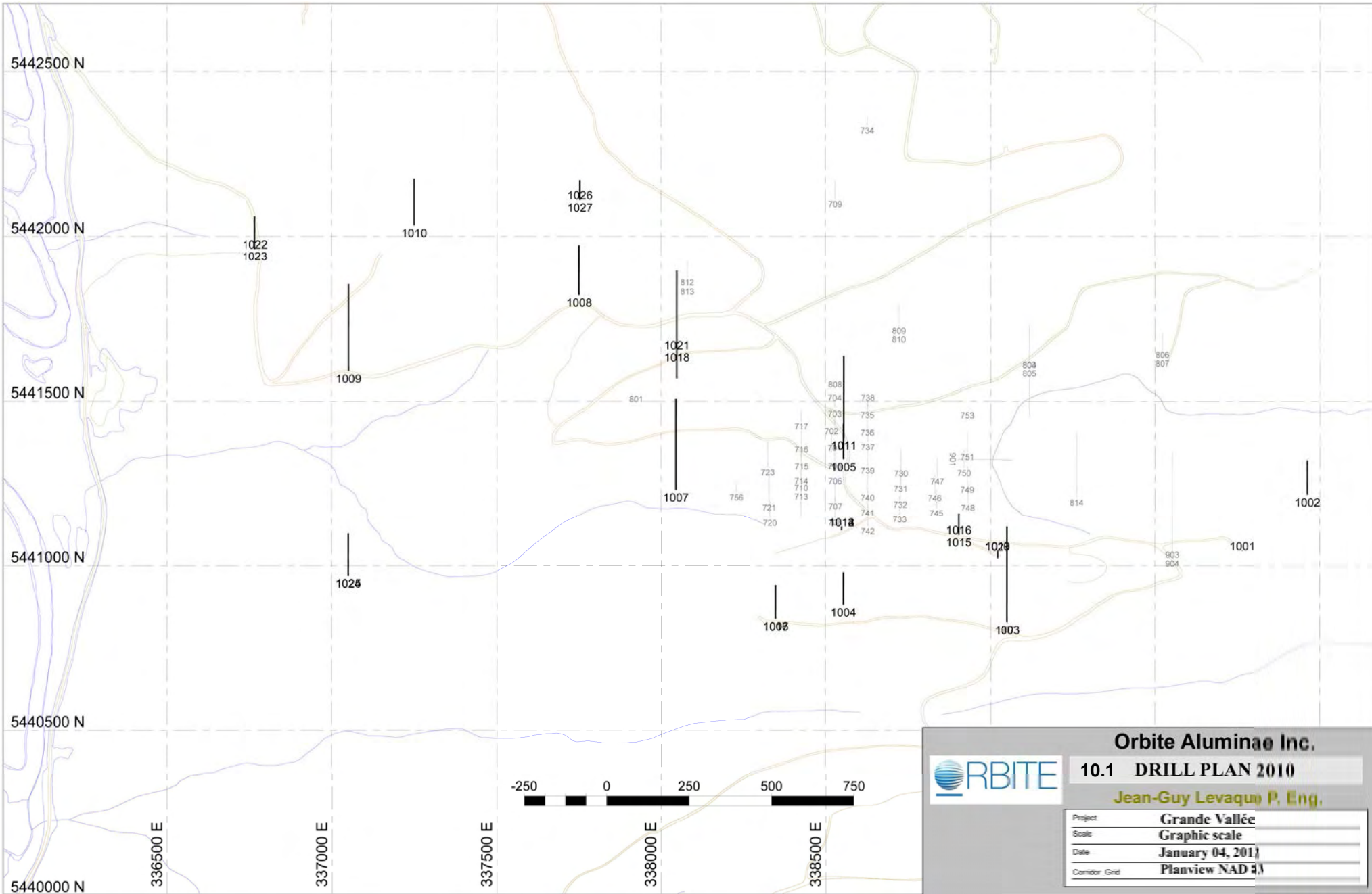
10.1.6.6 2010 Geological Synthesis; Drill Holes

In previous governmental or company reports, many terms were used to define the rocks encountered on the property whether it was Argillite, Claystone, Mudstone, Mudrock, Siltstone, Red Shale, Argillaceous Mudstone, Shale, Clay, all of those mixed by numerous colors like red, green, gray, purple, black, verdigris, etc.

Hole 901 was supposed to enlighten the suspected anomaly just to the East of it; starting in Claystone and remained in it for 234 m. It was stopped and 902 was cancelled. Holes 903 and 904 shared the same set-up on a quartzite outcrop in order to define its shape. Hole 907, started in shale, remained in it for 120 m and was stopped for breach of contract.

Holes 1001 and 1002 were to give us info for the eastern part of the deposit; 1001 remained in Mudstone and 1002 jammed at 147 m still in quartzite. Holes 1003, 1004, 1006 and 1017 helped defined the mountain top to the South. Holes 1015, 1016, 1019 and 1020 detailed the Northern flank of this same mountain. Holes 1012, 1013 and 1014 were used to pinpoint the location of the bulk sampling. Holes 1005, 1007, 1011, 1018 and 1021 located geological contacts in the center of the sector while holes 1009, 1024 and 1025 did the same for the West and holes 1008, 1010, 1022, 1023, 1026 and 1027 for the North-West.

The results from the drill program of 2010 confirmed the grades defined in former drill programs and met the target set by Orbite.



Orbite Aluminao Inc.

10.1 DRILL PLAN 2010

Jean-Guy Levaque P. Eng.

Project	Grande Vallée
Scale	Graphic scale
Date	January 04, 2011
Corridor Grid	Planview NAD 83

Table 10-2 2010 Drill Holes Physical Characteristics (2008 and 2009)

Hole #	Long	Lat	Elev	Lenght	Az	Dip
1001	339764,40	5441045,32	438,52	201	0	-90
1002	339962,83	5441216,75	381,14	147	0	-45
1003	339051,41	5440827,86	478,60	411	0	-45
1004	338554,18	5440881,93	496,48	138	0	-45
1005	338554,33	5441324,67	392,63	151	0	-45
1006	338349,38	5440839,60	497,88	138	0	-45
1007	338044,78	5441231,78	359,75	390	0	-45
1008	337751,21	5441822,31	311,63	213	0	-45
1009	337051,05	5441591,95	236,57	372	0	-45
1010	337249,65	5442034,69	249,46	200	0	-45
1011	338555,44	5441389,77	395,87	348	0	-45
1012	338548,83	5441118,68	397,49	21	0	-90
1013	338548,83	5441118,68	404,75	33	0	-90
1014	338548,88	5441118,66	404,75	15	180	-45
1015	338903,39	5441094,94	443,03	90	0	-45
1016	338903,39	5441094,94	443,03	42	0	-90
1017	338349,36	5440838,92	497,55	204	0	-60
1018	338047,49	5441655,72	377,98	339	0	-45
1019	339021,21	5441045,71	464,97	63	0	-90
1020	339021,22	5441044,41	464,00	30	180	-45
1021	338047,49	5441655,72	377,98	123	180	-45
1022	336768,13	5441962,51	193,82	149	0	-90
1023	336767,41	5441963,62	192,43	138	0	-45
1024	337050,44	5440968,90	249,36	183	0	-45
1025	337050,50	5440969,94	249,36	90	0	-60
1026	337753,48	5442111,96	341,43	33	0	-90
1027	337753,48	5442111,96	341,43	84	0	-45
Total			27 holes	4346		

Hole #	Long	Lat	Elev	Lenght	Az	Dip
801	337924,37	5441497,04	385,00	141	0	-90
803	339119,38	5441600,07	358,00	198	0	-90
804	339119,38	5441599,07	358,00	201	180	-45
805	339119,38	5441601,07	358,00	180	0	-45
806	339522,39	5441630,07	317,00	129	0	-90
807	339522,39	5441631,07	317,00	105	0	-45
808	338529,38	5441540,05	400,00	51	0	-90
809	338722,38	5441703,05	373,00	141	0	-90
810	338722,38	5441704,05	373,00	120	0	-45
812	338079,37	5441850,04	330,00	135	0	-90
813	338079,37	5441849,04	330,00	105	0	-45
814	339262,39	5441210,08	386,00	273	0	-45
901	338902,38	5441323,07	380,00	234	90	-45
903	339552,39	5441023,09	450,00	183	0	-90
904	339552,39	5441023,09	450,00	456	0	-45
907	339052,39	5440823,08	480,00	120	0	-45
Grand Total			16 holes	2,772		

Nad83

10.2 2011 Drilling Works

Again in 2011, the field work was concentrated in the Marin Sector⁽²⁸⁾. Some 28 holes were done for an extra 3909 m. Of these, 6 holes totaling 1,191 m, were drilled at the Simoneau Sector to get a first feeling of the potential of this sector. The report on this campaign will be part of a separate Technical report. The main purpose of that year campaign was to ascertain the geological model updated last year, in particular the Western parts, both North and South, as well as the extremity of the Eastern extension.

10.2.1 2011 Drilling Works Objectives

The 2011 campaign objectives were to:

- Better define the extremities of the deposit;

- Confirm the dip of the Northern contact between L’Orignal Formation and Trois-Pistoles Group;
- Get characteristics samples from all over the Marin Sector to confirm the presence and level of rare metals and rare earth elements;
- Get proper sample to better define the density of the claystone;
- Perform the same thing for water content.

10.2.2 2011 Drilling Works Sources of Information and Data

The content of this part of the Technical Report is provided in part by:

- The results of previous field works on the property as reported by the 2008, 2009 and 2010 yearly report;^(22,23,24)
- The results of the diamond drilling campaign done between June and August 2011.⁽²⁵⁾

10.2.3 2011 Independent review by QP

Living a short distance from the Project, Mr. Jean-Guy Levaque, Eng. Independent QP was present on site almost every working day, between May 15 and November 15, 2011.

10.2.4 2011 Drilling Works Reliance on Other Experts

- Diamond drill sample chemical analysis was done in the ALS Chemex, Val d’Or, Quebec office under the direction of Mr. Richard Deschambeault.
- Drilling was done by Forages Dibar of Ste-Anne-des-Monts.
- Mr. Gerard Joncas, a.g., was responsible for the final GPS survey of all the drill holes.

10.2.5 Drilling Techniques

Forages Dibar Inc. operated a self-constructed drill rig equipped with NQ drilling rods. No major mechanical problems were encountered and the supply of drilling water was always sufficient.

10.2.6 2011 Specific Drilling Campaign

10.2.6.1 Specific Campaign for 2011

The 2011 drill campaign was aimed at confirming or invalidating the updated geological interpretation especially in both East-West extremities of the deposit. The other purpose was to better define the location of the Southern fault delineating the limit of the L'Original Formation as well as the dip of the Northern thrust fault between L'Original Formation and Trois-Pistoles Group. To get a better understanding of the situation of Rare Metals and Rare Earth elements, systematic sampling of both claystone and mudstone was done in each and every hole drilled during the summer. Specifically a 10 cm piece of core was set aside once every 100 to 150 m along each hole. Finally, different samples were also taken to calculate the density of the mudstone and claystone as well as their physical water content.^(29,30)

10.2.6.2 Cut-off Grade

The entire core related to claystone and mudstone was systematically sampled without any exception. As well, when contacts were not very sharp, some 10 meters of waste was also drilled but only the first 3 meters sampled.

10.2.6.3 Stored Core

Similar to previous years, the whole core was sent to the laboratory for chemical analysis after being systematically logged and photographed. All non-sampled cores were regrouped by 3 meters length and bagged to keep their integrity.

10.2.6.4 2011 Drill Hole Location and Characteristics

Figure 10-3 illustrates drill holes location of the 2011 campaign. Furthermore, Table 10-3 shows the physical characteristics of the 2011 campaign.

10.2.6.5 2011 Core Recovery

Recovery of the structural integrity of the core was still difficult this year; for the same reasons as the previous years, i.e. very friable rock. Verifications were done also for RQD and the claystone remains in the 15%.

The 2 experiences in digging for industrial samples confirmed the idea that the contact between the weathered claystone and the more solid claystone is easily marked; the bulldozer, pushing aside the weathered material had no difficulty to follow a very uniform interface between the two claystone.

In the weathered zone, the core recovery is very low but since the top and bottom of this layer is easily defined, and due to the fact that the analysis are systematically the same as for the “sound” claystone and that the thickness of this layer is rather thin (0 to 2 m), it was not felt that special drilling techniques were warranted to increase the recovery.

10.2.6.6 2011 Geological Synthesis; Drill Holes

Holes 1101, 1122 and 1123 were done to define the behavior of the L'Original Formation in the East part of the property; whether it continues towards the Grande-Vallée River or wheter it pinches towards the South. It was pinching out thus cutting any possibility of finding an extension further east.

All the holes from 1104 to 1115 were done to ascertain the low dip contact between the main formation and the Trois-Pistoles Group. Holes 1116 and 1117 were done to increase the knowledge of what was a more precise shape for the syncline; in other words, how far down it was going. Holes 1118, 1120 and 1121, even if they are outside a possible pit, were done to better define the family of traverse faults very present in the South part of the property.

Finally hole 1124 was done to get knowledge of the fault modified stratigraphy in its vicinity.

The data gathered are very positive and will go a long way in enhancing the upcoming geological model, later in 2012.

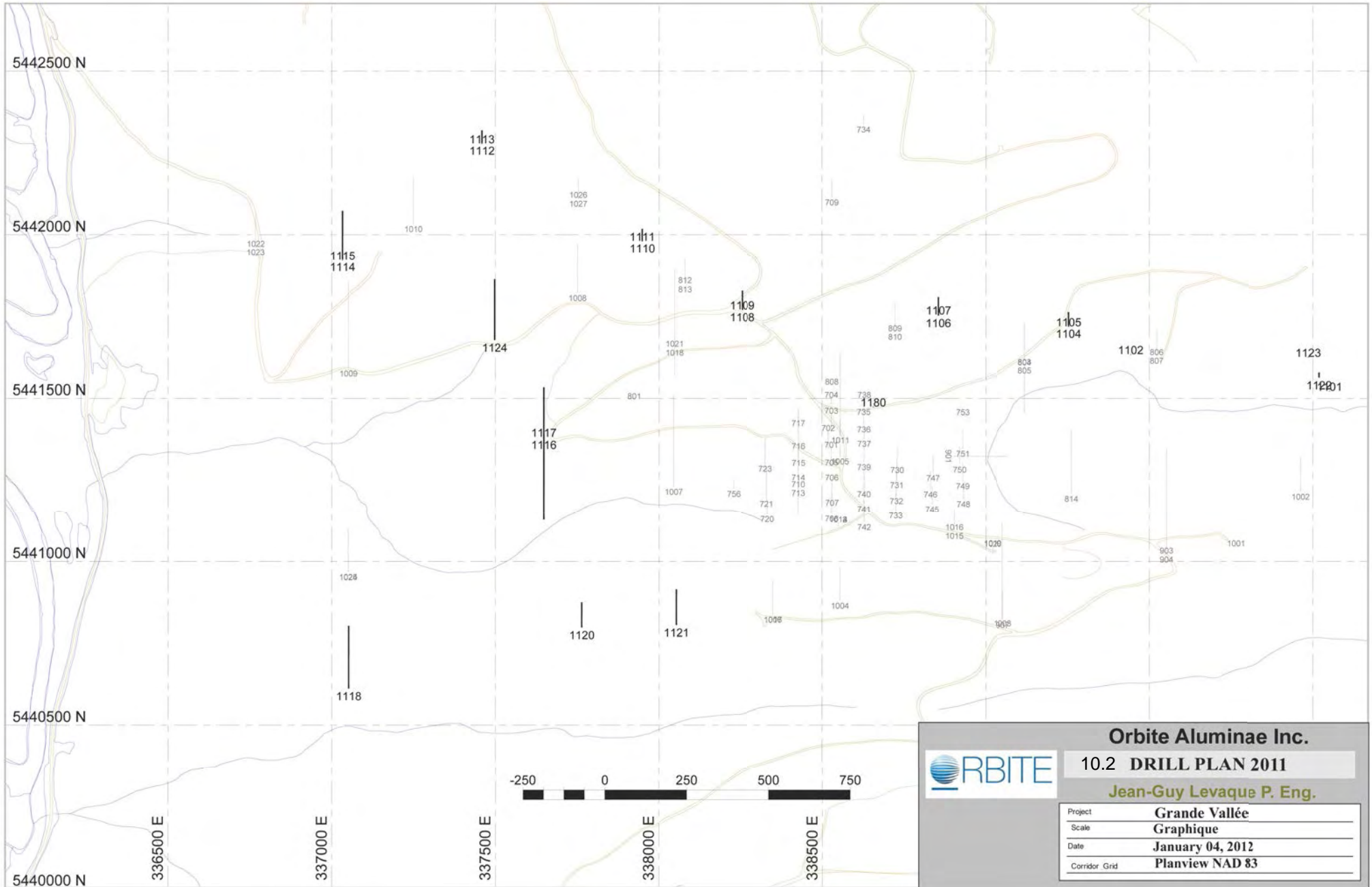


Table 10-3 2011 Drill Holes Physical Characteristics

Hole #	Long	Lat	Elev	Lenght	Az	Dip
1101	340050,31	5441522,86	244,18	33	0	-90
1102	339443,39	5441633,07	260,00	90	0	-90
1104	339253,75	5441719,89	345,07	60	0	-45
1105	339254,01	5441718,05	344,98	75	0	-90
1106	338854,74	5441752,51	361,21	78	0	-45
1107	338855,05	5441754,21	361,06	87	0	-90
1108	338254,58	5441770,52	358,05	81	0	-45
1109	338254,61	5441769,68	358,12	70	0	-90
1110	337948,65	5441981,90	321,72	51	0	-45
1111	337948,53	5441980,42	321,81	126	0	-90
1112	337459,27	5442280,64	279,87	54	0	-45
1113	337459,20	5442278,55	279,64	78	0	-90
1114	337033,13	5441924,23	218,96	210	0	-45
1115	337033,10	5441921,91	219,19	216	0	-90
1116	337648,44	5441381,89	357,63	213	0	-45
1117	337648,44	5441381,89	357,63	358	180	-45
1118	337051,89	5440612,27	263,18	270	0	-45
1120	337764,10	5440798,68	416,49	108	0	-45
1121	338052,78	5440806,35	459,06	153	0	-45
1122	340018,74	5441564,44	256,26	21	0	-45
1123	339985,77	5441626,67	272,79	23	0	-90
1124	337498,10	5441677,43	270,30	262	0	-45
Total			22 holes	2717		

Nad83

10.3 Verification by Independent Parties

10.3.1 Site Visit

The site was visited by a number of experts, especially in the last two years in order, for them, to get specific information on the project.

Among others, the property was visited by Mr. Rod Doran, P. Eng. (independent QP) from GENIVAR on August 31, 2011. Mr. Doran was accompanied by Mr. Bernard Fournier, Environmental Manager GENIVAR. They visited the mine site with geologist engineer and independent QP Mr. Jean-Guy Levaque, Eng. The site was accessed by vehicle and the complete day was spent visiting the camp, the core shed, the field office and discussing the project with the site geologist. No drill rigs were operating at the time of the visit.

The property was also visited by Mr. Bernard Chauvette, Geo., from GENIVAR (Quebec office), by Mr. Denis Meunier, Eng., also from GENIVAR (Baie Comeau office) on November 8 & 9, 2011. A team including manager (Mr. Gaudreau) from MRNF also visited the mine site during the course of 2011. All were accompanied by geologist engineer and independent QP Mr. Jean-Guy Levaque, Eng. Parts of the Marin Sector were walked during that last visit and few outcrops were examined. No specific collar location and azimuth verification were performed by GENIVAR; the procedure for the holes location having found to be acceptable and according to best practices in place with hand-held GPS. The location of the holes is found to be well documented. All the GPS coordinates and the orientations measured in the field matched the master database entries and the plot on the maps and sections, within the accuracy of the GPS instrument used and have been validated by Mr. Jean-Guy Levaque, Eng.

10.3.2 Core Examination

The geology of the deposit and the exploration model were discussed with all the people mentioned above and a series of outcrops and drill sites were examined. They also noted the very special behavior of the claystone and were shown what happens to the uncovered claystone with time, especially in and around the sampling pit.

The core is neither split nor kept in a warehouse for very specific reasons:

- The claystone is extremely difficult to split because of its friability;
- The weathered claystone is impossible to split;
- A digital photograph is taken of every group of 4 to 5 boxes;

- A great care was taken in conserving the returned pulp from the analytical laboratory;
- It takes less than six months to loose completely the structure of the rock left un-split in core boxes;
- The average RQD of claystone is around 15%;
- No structural events were yet discovered which would entails keeping the core intact.

10.4 Conclusions

The field activities were under the supervision of a senior geologist and QP, Mr. Jean-Guy Levaque, Eng., assisted by Mr. Guy Béland, M.Sc. in Geology, MBA, and a qualified technician. A number of independent geologists worked on the site in those last years, namely, H.-L. Jacob, Eng., Serge Massé, Geo., Maryse Dugas, and Guy Béland, M.Sc. in Geology, MBA, as well as Mr. Jean-Guy Levaque, Eng

The field activities are well organised with a thorough planning before the summer, very good communication within the team (geologists, machine operators and drillers), systematic recording of geological information through special Excel log sheets. Core logging was done by entering the observations and measurements directly into a template prepared using a Microsoft Excel spreadsheet.

The database was thoroughly examined by independent QP Mr. Jean-Guy Levaque, Eng and Mr. Guy Beland M.Sc. in Geology, and the collar coordinates for all the drill holes were compared with the GPS readings and checked the entries in the final database.

The observations from the site visit did not indicate any errors associated with the database entries or the plot of the collar locations on the map and drill sections. The positioning on a GPS map of the different hole coordinates prevented any surveying error to go un-noticed, with sufficient accuracy and reliability to be used in a resource estimation.

11 SAMPLE PREPARATION, ANALYSES AND SECURITY

11.1 Introduction

Throughout the different drilling campaigns, the material encountered was identical. The reddish claystone with its greenish spots was readily recognisable and always turned out in high alumina after chemical analysis. The difference between greenish claystone and greenish mudstone was relatively impossible to make, not to mention the sometime reddish mudstone. So, every geologist was asked to systematically sample every three meters of the clayey material whatever the color, structure, tendency to split or overall appearance. Most contacts between L'Original formation and the neighbouring Trois-Pistoles Group were rather sharp. In the event the contact was uneven, three samples of three meters were taken of each of those contacts.

After having laid the core boxes of a whole hole on tables, the geologist proceeded to verify the proper alignment of the core, the proper placement of "footage" blocks inserted by the drilling crew and the overall aspect of the core, like continuity, recovery, cleanliness.

If a problem occurred, right away the drillers were summoned to the core shack to supply the necessary information. When everything was judged acceptable, the geologist proceeded to log the core by making systematic physical tests, like scratching for hardness, acid drops for presence of limestone, etc. While recording in writing the description of what he saw, the geologist also put a sample tag every three meters along the core boxes. Those tags came from special labels booklets supplied by ALS-Chemex laboratory in Val-d'Or, Quebec. The three meter sample was then put in a heavy gage plastic bag with the tag and the bag sealed with a tie-*rap*. The sample number had been previously written on the back with a felt pen, the hole number and footage written in the booklet and the sample number also recorded in the core log.^(22,23,24,25,31) After more than 2800 samples, only two errors were found and the data were discarded.

11.2 Sample Shipment, Chain of Custody

Each sample was assigned a unique number and were inserted into heavy-duty woven plastic bags again closed with tie-*rap* and put on a pallet, heavily wrapped with stretch saran wrap. During the placement on the pallet, the sample numbers of the plastic bags were once again verified to ensure completeness.

The pallets were shipped from Grande-Vallée to the ALS-Chemex facilities in Val-d'Or, Quebec by enclosed commercial vans. Due to the characteristic of the material, it was felt superfluous to conserve the chain of custody. A total of

1,640 samples were selected from the Marin Sector from 2009 to 2011 drilling campaign. Mr. Jean Guy Levaque, Eng., as per NI 43-101F1 certifies that all the necessary measures were taken to ensure that the samples were collected and handled in accordance with the best practices in place.

11.3 Sample Preparation and Assay Method

On arrival at the ALS-Chemex laboratory in Val-d'Or, Quebec, all the core samples were classified in numerical order and a new 8-digit number was assigned to each, preceded by the code letters of the preparation laboratory. This number identified the samples and provided a reference for the lab personnel.

Those sample numbers were then transferred by optical reader (bar code) and each sample was weighed. The samples were dried, if required. Through subsequent grinding stages, each sample was reduced to 70% passing 2 mm. Using a Jones riffle, a representative 250 grams fraction was taken from the sample. The unused remaining portion was returned to the bag and stored for future references. The representative sample was pulverized to 85% passing 200 mesh with a ring pulveriser. The sample was then transferred to a marked bag and sent to the laboratory for analysis. Part of the prepared pulp was analysed for major oxides using the ME-XRF06 method and for LOI using the OA-GRA06. The major Elements Analysis were:

- Sample decomposition with 50% $\text{Li}_2\text{B}_4\text{O}_7$ and 50% LiBO_2 (WEI-GRA06);
- Analytical Method: X-Ray Fluorescence (XRF);
- A burnt sample of 0,9 g is added to 9,0 g of lithium borate flux (50%/50% $\text{Li}_2\text{B}_4\text{O}_7/\text{LiBO}_2$); after being well mixed, it is melted in a crucible between 1050 - 1100°C. A fused bead is poured from the crucible and analysed by XRF.

The range of detection limits for the analytical methods used is shown in Table 11-1.

Table 11-1 Analytical Analysis Limit of Detection

Element	Symbol	Units	Analytical Limit	
Aluminum oxide	Al ₂ O ₃	%	0.01	100
Barium oxide	BaO	%	0.01	100
Calcium oxide	CaO	%	0.01	100
Chrome oxide	Cr ₂ O ₃	%	0.01	100
Iron oxide	Fe ₂ O ₃	%	0.01	100
Potassium oxide	K ₂ O	%	0.01	100
Magnesium oxide	MgO	%	0.01	100
Manganese oxide	MnO	%	0.01	100
Sodium oxide	Na ₂ O	%	0.01	100
Phosphorus oxide	P ₂ O ₅	%	0.01	100
Silicon dioxide	SiO ₂	%	0.01	100
Strontium oxide	SrO	%	0.01	100
Titanium oxide	TiO ₂	%	0.01	100
Loss on Ignition	LOI	%	0.01	100
Total		%	0.01	100

Note: Since sulphur or base metal rich samples can wear out platinum crucible, an alternative method such as ME-ICP06 could be used.

Since 2007, more than 2,800 samples were processed using this method.

11.4 Density Determinations

The density of the rocks on the Grande-Vallée property was determined by ALS Chemex on 44 selected core intervals (Code OA-GRA08B).

SG analysis on pulps was carried out by placing 3 g of pulp into a pycnometer, which was then filled with a solvent. The calculation was made using the weight of the sample and the weight of the displaced solvent. Specific density measured values can be found in Table 11-2.

Table 11-2 Results of Density Tests

	Dry	Wet 10%
Mudstone	2.81	2.63
Claystone	2.78	2.60
Overall	2.79	2.60

11.5 QA/QC Program

11.5.1 Laboratory QA-QC System

ALS Chemex is accredited to ISO standards and operates under the Laboratory Information Management System (LIMS). The QA protocol includes routine insertion of standards, blanks and duplicates, and audits are carried out both internally and by outside parties.

11.5.2 Orbite's QA-QC System reliance on other experts

Orbite relied on the quality control done by the chemical laboratory because it was deemed adequate to determine with sufficient precision the chemical composition of both the Claystone and the Mudstone, particularly their alumina content range.

Further verification methods could be necessary in the future if, for instance, the extraction process was jeopardized by certain critical levels of components in the Claystone or undesirable elements outside those already analysed. As of today, no such components were ever found.

Tables 11-3 and 11-4 show an example of duplicate analysis as well as standards analysis done on a routine basis for each batch of delivered samples. The Certificates of Analysis for every sample are available for consultation and have been reviewed by Mr. Jean-Guy Levaque, Eng. QP.^(22,23,24,25,31)

Table 11-3 Duplicate Analysis Supplied by ALS for each Batch of Sample Analysed

TB11146528 - Finalized															
CLIENT: ORBITE - Exploration Orbite VSPA inc.															
# of SAMPLES: 30															
DATE RECEIVED: 2011-07-15															
PROJECT: GV-2011-07															
CERTIFICATE COMMENTS:															
PO NUMBER:															
ME-XRF06															
Sample	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Cr ₂ O ₃	TiO ₂	MnO	P ₂ O ₅	SrO	BaO	LOI	Total
Number	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
K494280	50,05	25,9	8,81	0,32	1,31	1,57	3,05	0,01	0,88	0,11	0,175	0,02	0,04	7,23	99,48
K494280	49,87	25,71	8,75	0,31	1,3	1,53	3,01	0,01	0,87	0,11	0,175	0,02	0,04	7,27	98,97

Table 11-4 Duplicate Analysis Supplied by ALS for each Batch of Sample Analysed

TB11146528 - Finalized															
CLIENT: ORBITE - Exploration Orbite VSPA inc.															
# of SAMPLES: 30															
DATE RECEIVED: 2011-07-15															
PROJECT: GV-2011-07															
CERTIFICATE COMMENTS:															
PO NUMBER:															
ME-XRF06															
Sample	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Cr ₂ O ₃	TiO ₂	MnO	P ₂ O ₅	SrO	BaO	LOI	Total
Number	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
STSD-4	58,27	11,98	5,67	3,9	2,16	2,61	1,63	0,01	0,75	0,18	0,213	0,03	0,21	11,4	98,97
SY-4	49,62	21,08	6,07	7,95	0,55	6,96	1,63	-0,01	0,29	0,11	0,13	0,13	0,04	4,62	99,18
BLANK	-0,01	-0,01	0,01	-0,01	-0,01	-0,01	0,01	-0,01	-0,01	-0,01	-0,001	-0,01	0,01	0	0,03

11.6 Analyses Basic Statistics

The geology QP., Mr, Jean-Guy Levaque, Eng. believes that the best of proof for quality of the sampling, the sample preparation and the chemical analysis is the result of the homogeneity observed throughout the years, which can found in the following Table 11-5.

Over the past 4 years, some 2069 samples were prepared and analysed (2,822 samples for alumina, since 2007 was only analysed for Al) and the extraordinary similarity between the different yearly data speaks for itself; the deposit is regular and the sampling and analysis were well done. 2011, on top of regular analysis on known elements (Fe, Al, Si, ...), additional focus was also done on rare earths and rare metals analysis for their evaluation inside the Marin Sector. This provides enough confidence to the QP to perform a proper estimating the mineral resources of the Project deposits.

Section 14 shows examples of correlation between the major components analysed.

Table 11-5 Homogeneity of Results throughout the Years

	# of Samples	Al ₂ O ₃	SiO ₂	Fe ₂ O ₃	MgO
2007	753	24.59%	-----	-----	-----
2008	409	24.76%	51.22%	8.76%	1.48%
2009-10	1180	24.73%	51.01%	8.71%	1.45%
2011	480	24.58%	50.92%	8.70%	1.53%
All	2822	24.66%	-----	-----	-----
	2069	24.70%	51.04%	8.72%	1.48%

12 DATA VERIFICATION

Mr. Jean-Guy Levaque, Eng. and QP completed a thorough verification of the Marin Sector database (drill log descriptions) in parallel to Guy Béland, M.Sc., in Geology, MBA, who performed the same verification on the core logs, the coordinates and the chemical assays of each hole to be entered into the computer data base (Gencom software).

This verification of more than 2800 samples was done manually before entering it into Gencom at the GENIVAR facility. In order to have an independent review of the imported database, the mandate was given to Ms. Nicole Rioux, geologist at Genivar and expert on Gencom.

She ran the different programs to produce lists as well as location plans and sections with the help of her assistant Marie Chaussavoine.

The errors found in the database by GENIVAR were very minor and would have had very minor impact on the resources estimate.

As an illustration, the following discrepancies were noted and were corrected immediately:

- Two typo errors on coordinates displaced holes that were rapidly corrected;
- The conversion of data files from .xls to .csv allowed to pick-up three decimal points in error like 2.457 instead of 24.57.

The consistency of the assays results were interpreted to reflect the good quality of the assays.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 Technology

Orbite owns the intellectual property rights to a unique Canada and U.S.-patented process^(32,33,34,35,36) (with a twenty-year life), a radical innovation aimed at extracting alumina from aluminous clays and for which other international patents are also pending in many countries, such as Brazil, Russia, Australia, India, China, Japan, as well as Europe (see Table 13-1).

The patented Orbite process has the potential to become a viable substitute for the industry standard Bayer process resulting in significant revenue when the technology is licensed to qualified alumina producers.⁽³⁷⁾

Orbite is planning on marketing smelter grade alumina (SGA), high purity alumina (HPA), high purity hematite, magnesium oxide, mixed oxides, and silica as well as producing 12 rare metals and rare earths in the form of oxides.

Orbite owns the mining rights to aluminous clay deposits in the Gaspé region with average grades (as determined by 2069 samples and illustrated in this Technical Report) of 52.62% silica (SiO_2), 23.37% alumina (Al_2O_3), 8.42% hematite (Fe_2O_3), MgO (1.66%), other mixed oxides (6.90%) as well as rare metals and rare earths in the form of oxides (573 ppm).

The process developed by Orbite articulates mainly on a pilot scale around leaching ore with acid followed by salt separation techniques as shown on the diagram shown in Figure 13-1.

Table 13-1 Patents and Patent Applications of Orbite Aluminae Inc.⁽³⁸⁾

Orbite Aluminae Inc.			
Patent Family	Country	Application Numbers	Date Filed
1. Processes for extracting alumina from aluminous clays	Australia	2008253545	May 7, 2008
	Brazil	P1081.1938-4	
	Canada	2,684,696 ^(*)	
	Canada	2,711,013	
	China	200880023590.2	
	Europe	08748276.6	
	India	8264/DELNP/2009	
	Japan	2010-508674	
	Russia	2009-147266	
	USA	7,837,961 ^(*)	
	USA	12/900,371	
	Hong Kong	11101811.2	
2. Processes for extracting alumina from aluminous clays	USA	61/415,473	Nov. 10, 2010
3. Processes for extracting rare earths elements from alumina bearing clays	USA	61/454,211	March 18, 2011
4. Processes for extracting rare earths elements from various clays	USA	61/482,253	May 4, 2011
5. Methods for preparing hematite	USA	61/493,018	June 3, 2011
6. Methods for separating iron ions from aluminum ions	USA	61/508,950	July 18, 2011
7. Processes for preparing alumina and various other products	USA	61/535,435	Sept. 16, 2011
<i>* Granted Patent</i>			

Figure 13-1 Orbite Process Description Pilot Plant Testing for Various Clay Types

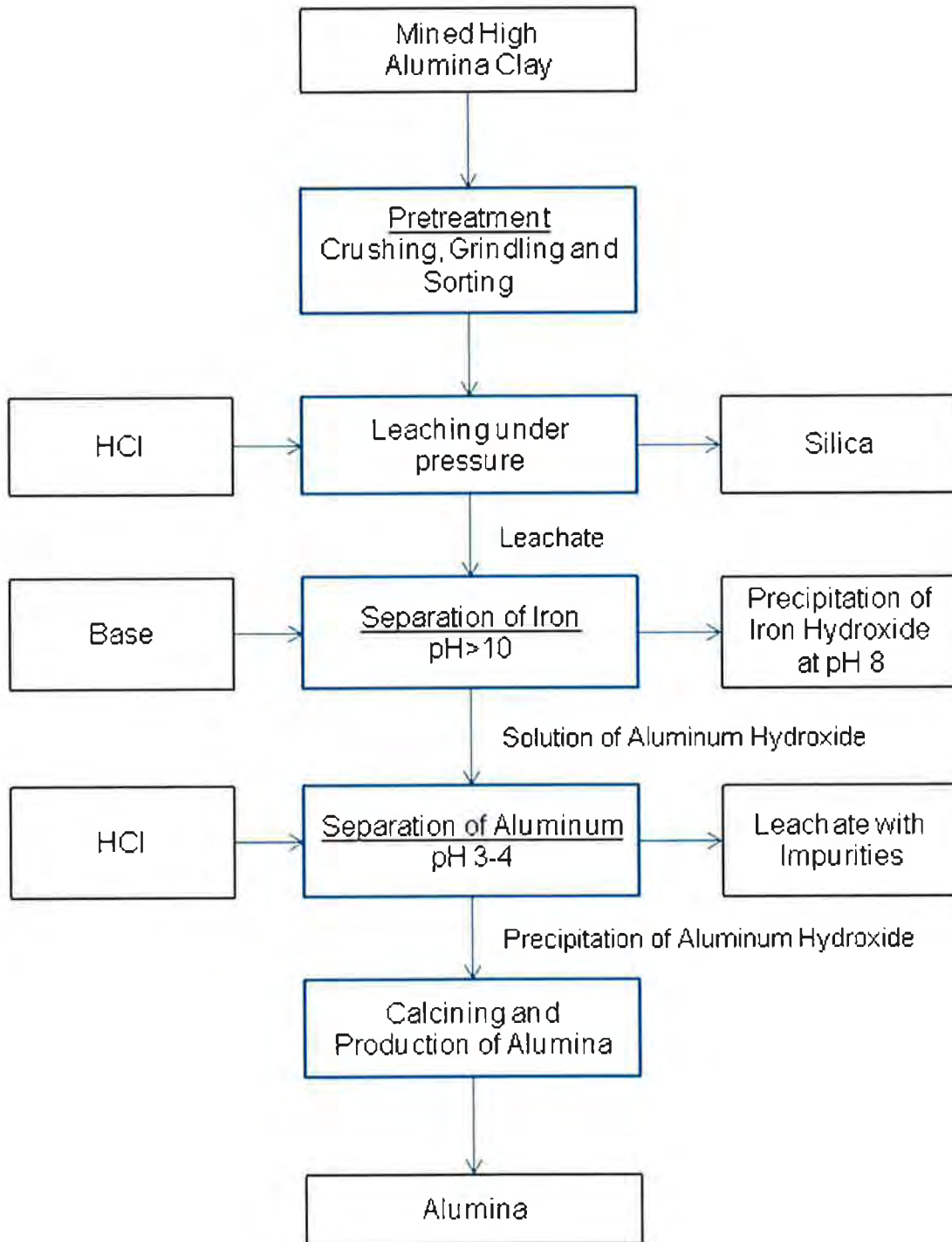


Figure 13-1 represents the basic process flowsheet to demonstrate technology and is technically feasible for both high purity alumina and metallurgical alumina, even though in the last case (see Section 17) a continuous approach to recover reactants (hydrochloric acid) and other value added products at the same time is put forward to improve economics. This figure is the basic principle for the Orbite's proprietary process developed.

The first step of the process consists in a preparation of the clay by crushing crushing in order to meet the particle size specifications for leaching.⁽³⁹⁾ The second stage involves leaching with concentrated hydrochloric acid which can be single stage or semi-continuous, at which time aluminum and iron and other elements present in clays, are dissolved with the exception of silica which can be removed at this stage of the process.

The third step consists in precipitating the iron: one approach among others, by making the reaction medium basic (pH >10). Note that an alternative extraction of iron can also be achieved through a liquid-liquid extraction. Subsequently, the solution separated from the precipitated iron is reduced to an acidic pH and then concentrated in Al^{3+} ions by liquid-liquid extraction. From here aluminum can be precipitated as hydroxide $Al_2(OH)_3$ or into another form $AlCl_3 \cdot 6H_2O$.

The analysis of this process shows that it is, in some instance and to some degree, a succession of common chemical engineering unit operations known and off-the-shelf technologies and used for years, either individually or in combination in the treatment of various types of minerals. The Orbite process is therefore a suitable method to process clays to produce alumina used in aluminum and also to produce other components such as iron ore, silica, etc. Note that the specificity of the deposit in question is its high silica content (53%) against only 3% in bauxite, the conventional aluminum oxide clay process.

With this high level of silica, these clays are unsuitable for processing by the conventional Bayer process since the large quantities of silica-sodium aluminate produced would result in huge aluminum losses and even higher levels of red mud production. Since Orbite has press released its capability to deal with high Si and high Fe, bauxite, as well as low Si and low Fe bauxite, this indicates a significant export potential for the technology.⁽⁴⁰⁾

13.2 Patent Protection

Orbite's unique technology is well protected in several countries as stated in Section 13.1. Other U.S. patent applications, covering process enhancements to improve productivity through higher yield and lower production costs, are also pending.

In July 2011, Orbite announced that it had filed an additional application for a new patent on another radical innovation for separation methods used for iron-aluminum mixtures. The provisional patent application (US 61/508,950) was initially filed with the United States Patent & Trademark Office. Previously, in June 2011, Orbite had filed a US provisional patent application (US61/493,018) concerning the production of hematite.⁽⁴¹⁾ These new patents target the efficient and economical separation of iron from aluminum atoms contained in a solution of dissolved minerals. These patents are a transition to the actual metallurgical grade alumina (SGA), which is the objective of this PEA, continuous and fully integrated process which ensures high hydrochloric acid recovery and value added products using reliable and known techniques adaptable to Orbite's process and rendering it even more economical.

The various patent applications to date expand the patent portfolio of Orbite to 7 different families. Of note is that within these 7 families are 18 patent applications filed with authorities in some 10 different countries.

A separate patent pending designation protects the extraction of rare earths and other materials.

13.3 Origins of the Orbite Alumina Extraction Process

In 2006 and 2007, the Centre d'études des procédés chimiques du Québec (CÉPROCQ) conducted research⁽⁴²⁾ under a development contract aimed at finalizing, through lab scale test work the Orbite's preliminary alumina extraction process for the pilot scale facility design. This contract received several subsidies from the Quebec government under its technological research assistance program (Programme d'aide à la recherche technologique or PART). Orbite won three of this program funding, when normally one is generally allowed by project or by company. The evaluators' positive conclusions supported not only the project's scientific and technological significance, but also its potential economic impact from its application to the aluminous clay deposits in the Gaspé region.

The preliminary extraction process in the lab indicated:

- Extraction and recovery of 90% - 95% of the alumina contained in the aluminous clay;
- Production of very high purity alumina before optimization (99.8%), indicating a high probability of similar results in practice;
- Recycling of leaching solutions (hydrochloric acid) with very low loss of leachate, thereby limiting the environmental impact of the process.

The company concluded a cooperation agreement with Aluminerie Alouette in 2008. This agreement enabled the firm to evolve issues both on technical and commercial terms. More than 1 kg of alumina from the process was analyzed in Aluminerie Alouette's laboratories, following which Alouette and Orbite signed a collaboration agreement.

On the strength of these developments, and with partnerships and support from Aluminerie Alouette, the National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP), Quebec's Ministry of Economic Development, Innovation and Export Trade (MDEIE) and other government and para-government organizations, Orbite implemented a pilot plant in order to pave the way for commercial exploitation of its Grande-Vallée site.

13.4 Orbite Process Subsequent Developments

In 2007, following table-top laboratory experiments, a laboratory-scale pilot line was developed and operated to produce batches of both metallurgical and ultra-pure alumina. Samples were sent for evaluation to potential clients in each market, and were determined to be of excellent quality. Following their evaluations, two world-class companies signed agreements with Orbite.

Aluminerie Alouette Inc. which is a consortium of Rio Tinto Alcan, Austria Metall, Hydro Aluminum (Norway), Investissement Québec, and Marubeni (Japan), located in Sept Isles, Quebec, operates the largest and most modern aluminum smelter in North America, with an annual capacity of 575,000 tonnes. This smelter alone represents a potential annual market of 1.2 million tonne of alumina. An initial agreement, in the form of a letter of intent, offered technical support to Orbite through the initial production phases of its pilot scale production plant project.

A subsequent agreement, signed in November 2009, led to a \$1 M investment by Alouette in the pilot plant project, in the form of a convertible promissory note, repayable in alumina. The agreement also included the supply by Alouette of certain equipment and assistance in developing and optimizing Orbite's alumina for the production of aluminum. Orbite has also entered into an agreement for the preferential supply of alumina to Alouette.

The Amalgamated Metal Corporation, PLC, headquartered in London, England, who is a worldwide supplier of non-ferrous metals and other products signed with its Canadian subsidiary, Amalgamet Canada, to cover the potential distribution of Orbite's ultra-pure alumina (HPA) produced in Cap-Chat throughout the world and plans off take the entire HPA production.

Orbite has worked closely with other Quebec partners to develop its alumina extraction technology, to build market knowledge and to develop its pilot plant. These partners, among others, include le CEPROCQ, the National Optics Institute, INRS, le Centre de technologie minérale et de plasturgie (CTMP), and the engineering services firm Seneca.

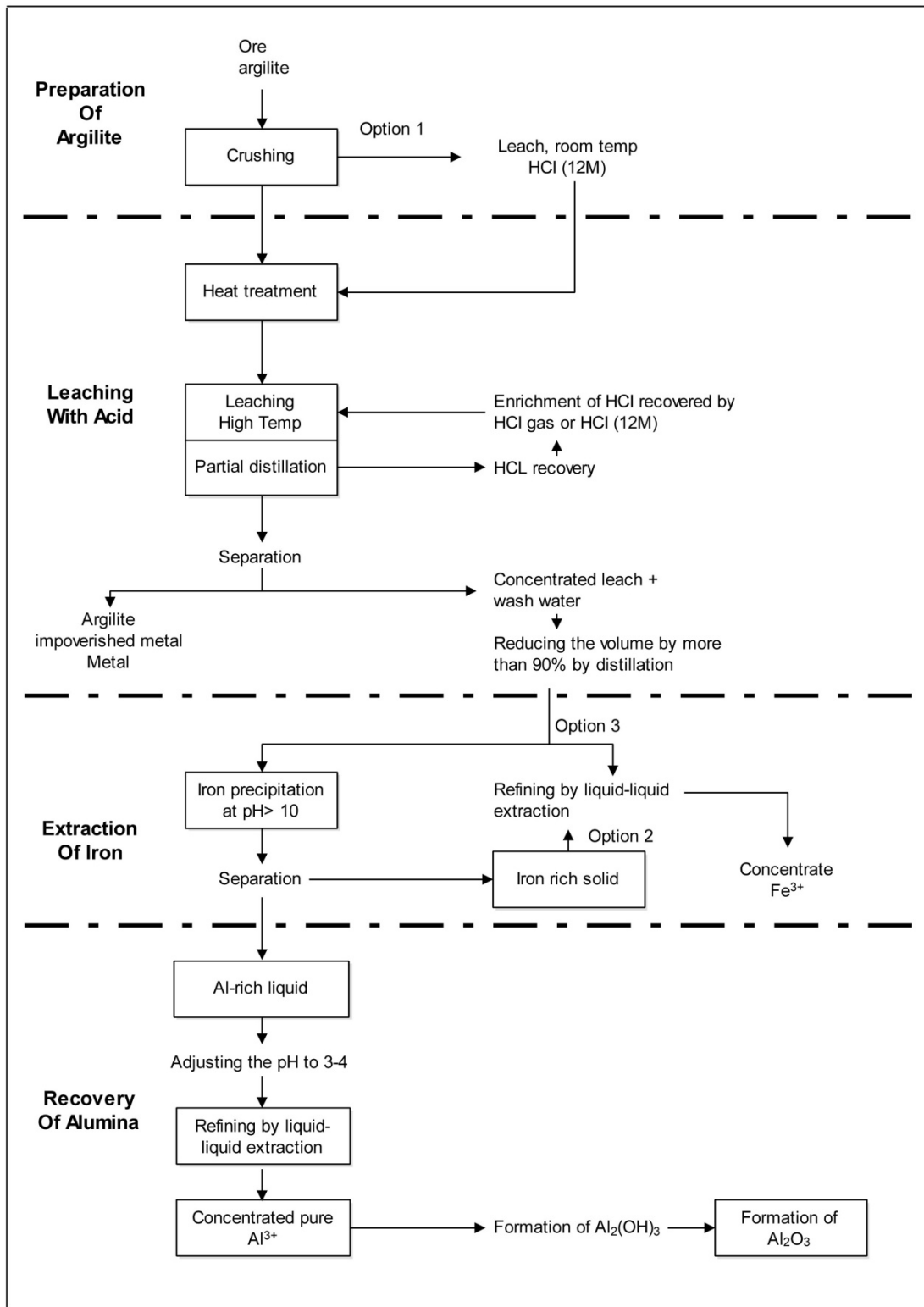
13.5 Orbite Process Subsequent Developments

In 2009 Orbite realized that it needed a pilot scale production plant to confirm its patented process technological viability and to demonstrate its innovative process to extract high grade alumina from aluminous clays. In September 2009 Orbite announced that it was purchasing a 2,345 square m. (approx. 28 000 ft²) building in Cap-Chat, which is located in the Gaspé region of Quebec.

In 2010 following removal of the previous plant equipment and installation of its unique alumina extraction pilot plant equipment, the pilot plant facility began initial testing on January 15, 2011. ⁽⁴³⁾ In February 2011 Orbite announced the production of its first tonne of alumina in a single day at the pilot plant. All metallurgical test works conducted at the Cap-Chat pilot plant were done using clays collected at the mine site. A total of about 400 tons of clays in four distinct families (about 100 tons per family) were collected from its Grande-Vallée aluminous clay deposit located approximately 32 km south of the community of Grande-Vallée, and transported at the Cap-Chat pilot plant and stored on site in 4 independent lots. Clays were submitted to a hydrometallurgical and chemical treatment based on high pressure hydrochloric acid leaching followed by ion precipitation and calcination to produce a metallurgical grade and high purity alumina. A second bulk sample of 3000 tonnes was extracted in September/October 2011⁽⁴⁴⁾ to supply the Cap-Chat plant for 12 months duration in view of commercial scale high purity alumina (HPA) production; thus pilot plant conversion to commercial scale HPA facility.

The pilot scale production plant block flow diagram (BFD) is illustrated in Figure 13-2. This diagram illustrates some of the alternatives existing for the alumina production as per Orbite's patent and is the basic concept behind the evolved process for the eventual metallurgical grade alumina (SGA) which is the subject matter of the Preliminary Economical Assessment.

Figure 13-2 Orbite Alumina from Clay Production Process Canadian Patent No. 2,684,696



13.6 Pilot Plant Specific Process Description

Specific processing steps for the pilot plant are as follows:

13.6.1 Preparation of the Clay

The first step at the pilot plant for producing a lixivate lot is the sieving, crushing and grinding of the clay. The grinding step allows the increase of the clay's surface area to ensure an efficient leaching step.

13.6.2 Acid Leaching

The second step of the pilot plant consists in an acid leaching step where are dissolved all the soluble fractions of the clay in an acidic medium except for the silica that is insoluble. This leaching step is done at high pressure and at high temperature in a concentrated acid medium (hydrochloric acid about 6 M). The residence time of the leaching is a few hours and adjusted to maximize the aluminum recovery targets. Leaching breaks the structure of the clay and releases all metal ions present in the clay. Among others, are formed iron (mainly in Fe^{3+} form), aluminum ions (Al^{3+}), and other metal, all in the in form of chlorides which must then be separated. The slurry leachate is then filtered to separate the insoluble including all of the silica contained in the clay. This silica is then washed, neutralized and directed to a pilot plant storage location.

13.6.3 Separation of Soluble Iron

The third step of the pilot plant consists in a separation of iron from aluminum chlorides in the leachate is done by selective precipitation by manipulating the pH of the leachate using a controlled injection of a base such as sodium hydroxide. The leachate is rapidly increased to a high pH ($\text{pH} > 10$), which allows the selective precipitation of iron and other ions, expect aluminum chlorides, in the form of insoluble hydroxide. This precipitate is then filtered and washed several times in order to recover the soluble aluminum salts that are entrained with the hydroxide. The resulting precipitate containing some iron and other waste products is then neutralized and discarded, in such a way that it is environmentally benign.

13.6.4 Aluminum Hydroxide Synthesis

The supernatant from the precipitation step of iron containing soluble aluminum ions is then acidified to pH 3-4 to precipitate the aluminum as insoluble hydroxide. The slurry is then filtered and washed to isolate a wet aluminum hydroxide cake. The supernatant, free of aluminum ions is then disposed of in such a way that it is environmentally benign.

13.6.5 Alumina Calcining

The resulting smelter grade alumina is then produced by drying and calcining the wet alumina cake at high temperatures.

13.7 Pilot Plant Test Work

13.7.1 Basis of Recovery

Portion of the leachate production batches documented⁽⁴⁵⁾ at the Cap-Chat pilot plant in June and September 2011 were reviewed by an independent engineering firm Seneca⁽⁴⁶⁾ and corroborated by an additional independent mining and processes engineering services firm Bumigene⁽⁴⁷⁾ (16 lots out of the approximate 80 produced since pilot plant commissioning). Each production lot of leachate was prepared from clay stored on the Cap-Chat site (see Section 13.5).

All lots were prepared with only one family of clays (out of the 4 stored on site). These production lots presented about 90% extraction of the aluminum content from the clay. The pilot plant has allowed to vary and optimize several parameters such as operating ratio acid/clay, temperature, pressure, residence time, agitation and product recycling to better understand the kinetics of the reaction. Some of these production lots presented more than 98% extraction of the aluminum contained in clay.

The aluminum content of the leachate produced at the pilot plant of Cap-Chat was analyzed by Orbite and corroborated by Maxxam⁽⁴⁸⁾ (an independent laboratory www.maxxam.ca) to validate the analytical method. The values obtained were then used to calculate the aluminum extraction yield for the entire batch runs. Metallurgical grade alumina (Al_2O_3) that meets smelter alumina content (greater than 98.35 wt% Al_2O_3) was then produced at the pilot plant. Two samples of alumina produced by Orbite in May and July 2011 were analyzed and indicated alumina content of 98.5 wt% and 98.8 wt% Al_2O_3 .

An independent engineering firm (Seneca) then coordinated in May 2011 the production of metal aluminum on a lab scale from this pilot plant sample of metallurgical grade alumina. The test was done in the INRS laboratory (www.inrs.ca) located in Varennes, Québec by Professor Lionel Roué. He used a micro lab scale electrochemical cell with a nominal capacity of approximately 14 g of smelted aluminum per batch. Six batches of aluminum totaling 72 g were produced presenting electrochemical potentials similar to those normally obtained from commercial aluminum cells, indicating a very encouraging result.⁽⁴⁹⁾

A second sample of the metallurgical grade alumina produced at the Cap-Chat pilot plant⁽⁵⁰⁾ was sent to SINTEF (independent testing laboratory located in Norway, report dated June 22, 2011) to produce a demonstration aluminum ingot of 1915 grams. According to SINTEF's⁽⁵¹⁾ report: "There were no processing problems and the aluminum produced was of excellent quality."

These results demonstrated that alumina produced at the Cap-Chat pilot plant is suitable for the synthesis of aluminum metal using lab scale electrochemical cells.

13.7.2 Degree of Representativeness of the Samples used for Testing

13.7.2.1 Collection

To achieve the treatment trials, more than 400 tons of material from the site were extracted and transported to the Cap-Chat pilot plant. This 400 tons collection contains four families of clay found at the site such as 50 tons of black clay, 50 tons of green clay found on the periphery of the site, 200 tons of healthy clay that form the essential of the site and 100 tons of degraded clay found on the surface of the healthy clay. The essential part of the clay collected is from the healthy and degraded family. All four families of clays are stored on the Cap-Chat site in independent heap.

All leaching tests done at the pilot plant used a collection of clays from the four families at approximately 850 kg of clay per lots. The number of pilot runs being approximately 80 using exclusively the 4 clay families. The runs have demonstrated that for all families, the extraction of aluminum were similar being all over 90% and even reached 100% extraction in some instances and under specific conditions. A total of approximately 65 tons of clay was processed at the pilot plant on 80 production lots⁽⁴⁵⁾ since beginning of the testing program at the Pilot Plant in February 2011.

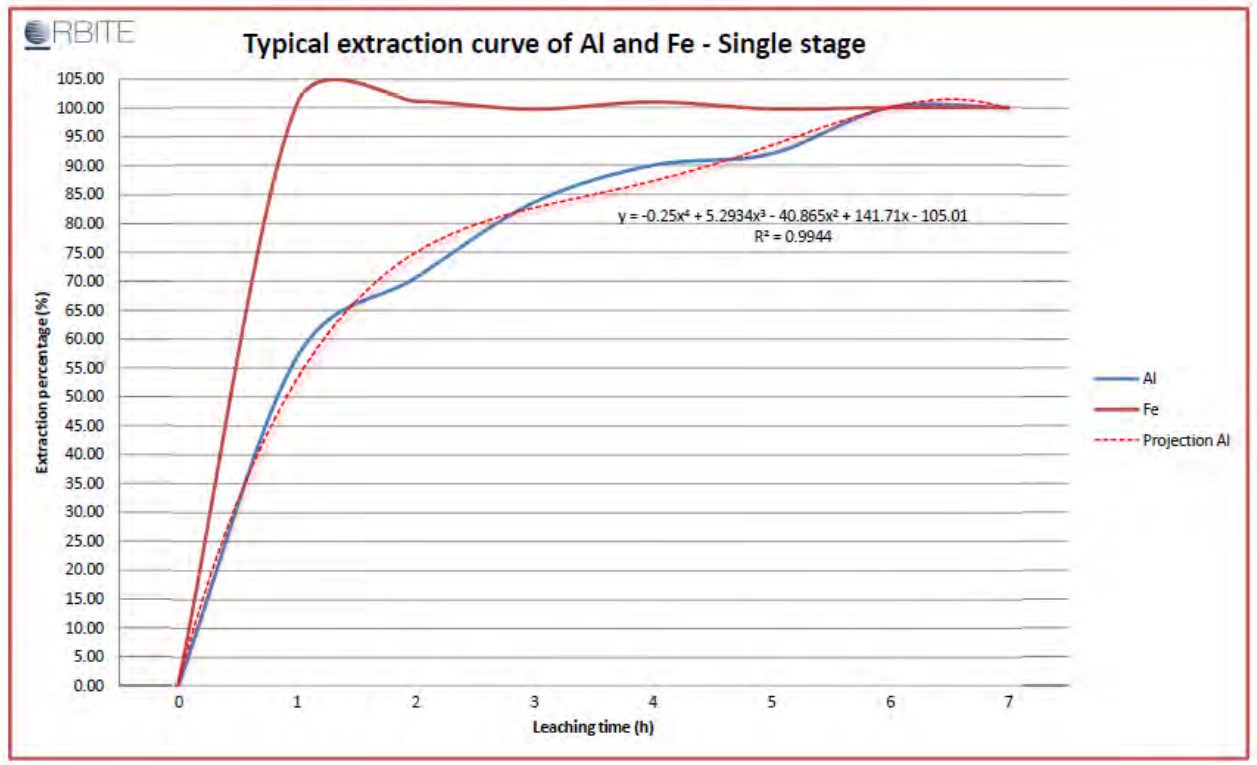
13.7.2.2 Leaching Tests of Clay Families

Leaching tests were also performed on small scale 5 liter, and 40 liter, reactors installed at the Cap-Chat facility to evaluate the aluminum extraction of healthy, degraded, and high and low mudstone families of clays (non-assembled). These tests were designed to measure the aggressiveness of the Orbite method to extract and to leach aluminum from the clays at moderate temperatures and pressures.

The alumina content of these clays ranged from 17 to 23 wt% and iron content varied from 7-8 wt%. All clay families tested were taken out of the 400 t sample at the Cap-Chat site. The results confirm a minimum extraction yield of aluminum of 90% after 5 hours of leaching. Figure 13-3 presents the typical rate of extraction of aluminum as a function of time obtained in tests on four types of clay in five liter reactor.

Figure 13-3 proves the typical kinetic and extraction curve of the main 2 elements for these specific trials on the four family of clays; proving the lower the concentration in metal into the incoming clay, the easier it is to leach under the same operating conditions.^(46,47)

Figure 13-3 Typical Al and Fe Extraction Rates when tested in 5-liter Reactor on Samples of Clay Healthy, Degraded, and Mudstone of High and Low-grade non-assembled



13.7.3 Comminution, Head Assay

The clay, any of the four family, (as received) was crushed and then ground to an 85% passing level of 230 mesh (P85= 63 μm).

The material was assayed for its main constituents as presented in Table 13-2.

Table 13-2 Head Assay of Four Family of Clay used for Test Work at Pilot Plant

Style Clay	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Cr ₂ O ₃	TiO ₂	MnO	P ₂ O ₅	SrO	BaO	LOI	Total
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
# 1 Premium	52.7	22.9	8.3	0.59	1.42	1.02	2.8	0.01	0.84	0.22	0.15	0.02	0.05	7.19	98.2
# 2 Degraded	51.1	23.5	8.71	0.37	1.24	1.09	2.92	0.01	0.86	0.1	0.14	0.01	0.05	7.27	97.4
# 3 Green	59.9	17.55	7.2	0.56	1.64	2.08	3.31	0.01	1.09	0.1	0.11	0.01	0.07	3.88	97.5
# 4 Black	56.8	18.15	7.08	1.25	1.94	0.94	3.66	0.01	0.79	0.11	0.21	0.01	0.07	5.79	96.8

13.7.4 Leaching

Pilot plant leaching were conducted in 5-litre, 40 litre and 6000 litre (95% of 80 produced lots) glass reactors, fitted with agitators. Most leaching took place under pressure and in temperature. The optimum leach conditions on the large scale reactor under a single stage batch mode are presented in Table 13-3.

Table 13-3 Typical Leaching Conditions

Acid/clay Ratio	HCl (% wt)	Temp. (°C)	Pressure (barg)	Reaction time (hours)
Stoichiometry +0% to15%	18.01-26.0%	140-165	4-5	4-6

With these conditions, the extraction of Al was greater than 90% on average, achieving up to 100% (Al) under specific conditions. An improved semi-continuous leach allows improved OEE (Overall Equipment Efficiency: $OEE = \text{rate} \times \text{quality} \times \text{availability}$) by adding high strength regenerated acid at a certain stage of the reaction, which reduces the reaction time by a fairly large amount of time. Multiple tested conditions or reference in the industry of improved leaching arrangement can then be applied to optimize the leaching step (temperature, acid to clay ratio, HCl concentration, etc) and will be implemented during the basic engineering leading to the Feasibility stage in order to minimize even more the number of glass lined reactors.

It is important and normal to note that the improved aluminum recovery was achieved with high acid concentrations.

13.7.5 Iron Removal

The Pilot Plant setup is such that in continuous mode by a patented rapid adjustment of pH iron, is selectively removed from the pregnant leach solution. It is not done with solvent extraction. The optimum conditions on the large scale successive precipitation reactors are presented in Table 13-4.

Table 13-4 Typical Iron Precipitation Conditions Observed

pH	Temp. (°C)	Pressure (barg)	Residence time (hours)
11-13	60-70	Atm	12

The reaction is done using reactants (base) in open loop, thus neutralizing the chlorides as salts. This was done with the objective of proving the technology, thus leading the stage on the commercial stage for the metallurgical alumina to recover hydrochloric acid in closed loop using adaptable techniques and technologies to Orbite's process. This step was accomplished with success at SMS Siemag Pilot plants, is explained in Section 17 of the Technical Report and has been proven with Orbite's spent acid.

The assay of iron under the last conditions at SMS Siemag⁽⁵²⁾ is presented in Table 13-5.

Table 13-5 Hematite Assay

Hematite purity (% wt)	Hydrolysable Chlorides (% wt)	PSD (µm)
> 99.5	< 0.2	25-35

13.7.6 Aluminum Hydroxide Synthesis

The Pilot Plant setup is such that in continuous mode following the iron removal, again by adjustment of pH aluminum is slowly crystallized from the mother liquor using hydrochloric acid. Crystal growth is important at this stage and was obtained using residence time only. The optimum conditions on the large scale successive crystallization reactors to prepare the aluminum hydroxides for the metallurgical grade are presented in Table 13-6:⁽⁴⁸⁾

Table 13-6 Typical Aluminum Precipitation and Crystallization Conditions Observed

pH	Temp. (oC)	Pressure (barg)	Residence Time (hours)
9.5	60-70	Atm	24-30

The reaction is done using reactants (acid) in opened loop. This was again, done with the objective of proving the technology, thus leading the stage on the commercial stage for the metallurgical alumina to recover hydrochloric acid in closed loop using techniques and technologies to Orbite's process. This step of the metallurgical grade alumina Plant design, was accomplished with success at SMS Siemag Pilot plants and is explained in Section 17 of the Technical Report and has been proven with Orbite's spent acid.

13.7.7 Aluminum Hydroxide and/or Aluminum Chloride Hexa-hydrate Calcination

After completing the aluminum hydroxide or aluminum chloride hexahydrate crystallization in the case of the metallurgical plant which is the subject of that Technical Report, the crystals was then calcined in a batch furnace at 950-1000°C for 2 hours to produce an alumina product that meets the smelter grade alumina specification. Independent chemical analysis of the calcined product is presented in Table 13-7. The analysis⁽⁵³⁾ shows a very pure Al₂O₃ product with impurities all within the specifications.

Table 13-7 Assay of Metallurgical Grade Calcined Al₂O₃ Product using Aluminum Chloride Hexahydrate (metallurgical plant design)⁽⁴⁸⁾

	Al ₂ O ₃ (% wt)	Ca (ppm)	K (ppm)	Na (ppm)	Fe (ppm)	SiO ₂ (ppm)
Orbite	99.938	20	53	190	33	32
Specification used	98.5 min	< 300	< 150	< 3700	< 100	< 150

13.7.8 Value Added Product Recovery

The value added products of the commercial smelter grade alumina process will be Fe₂O₃, SiO₂, MgO, mixed oxides and rare earths and rare metals⁽⁵⁴⁾ in oxides. These are described in Section 17 of the current Technical Report. In summary, iron oxide and the associated regenerated hydrochloric acid (hydrothermal technology) will be produced on the commercial scale with proven but adapted to Orbite's process technologies, not by pyrohydrolysis due to the rich ferric chloride solution. SiO₂ will be obtained by continuous solid/liquid separation from the spent acid and silica is neutralized before becoming marketable. Magnesium and mixed oxides will be produced by pyrohydrolysis of the bleed stream solution from the hydrothermal system to recover the chlorides solution and convert them as MgO and mixed oxides, with associated regenerated hydrochloric acid. This, like iron hydrothermal process, is both proven and operated on a commercial scale. Rare earths and rare metals that do concentrate into the process in form of chlorides (hydrothermal process) then undergo specific counter current solvent extraction⁽³¹⁾ known techniques followed by calcination to produce individual oxides as specified and explained in Section 17.

13.7.9 Reagent Recycle

In the Pilot Plant main reactants (sodium hydroxide and hydrochloric acid) have not yet been recycled in the course of the testing, since these techniques are well established and known on commercial scale, again for typical pickling line installation and other mineral extraction.

13.8 METSIM and ASPEN Mass and Heat Balance

METSIM software was originally used by Seneca to develop a general mass balance of the Pilot Plant⁽⁵⁵⁾ and GENIVAR relied on the Orbite's standard operation cost sheet, SMS Siemag METSIM and Outotec ASPEN mass and heat balances for the metallurgical plant. Global mass balance and heat balance were established based on Pilot Plants (Canada and Europe) results.⁽⁵⁶⁾ These were reviewed by GENIVAR QP. METSIM and ASPEN are analytical tools for creating heat, mass and water balances involving multiple unit operations. While Excel can be used to create a simplified mass balance with a limited number of elements, METSIM and ASPEN allows for a more detailed tracking of minor elements in recirculating streams. At this Pilot Plant (Cap Chat) stage, the model was built using many assumptions that will require rigorous evaluation during the Feasibility stage of the metallurgical plant because of the continuous and closed loop on the hydrochloric acid recovery, among others. Used as such, the METSIM or ASPEN model can be applied to scale-up exercises.

The main uses of METSIM or ASPEN for this study were to determine fresh water addition requirements, reagent make-up, and the energy requirements for the hydrothermal (hematite) acid recovery part, for the calcination part (alumina) and pyrohydrolysis of MgO and mixed oxides units. Reagent make-up (HCl) was determined based on assumptions related to best proven practices in the industry in acid recovery (99.75% recovery achievable).⁽⁵⁷⁾ They were in turn used to calculate certain operating expenses presented in Section 21.

13.9 Conclusions on Mineral Processing and Chemical Testwork

The GENIVAR QP responsible for this section is satisfied that the laboratory and Pilot Plant testing, and basic engineering studies, that have been carried out by Orbite, SMS Siemag and Outotec GmbH (calcination), have met the requirements of a Preliminary Economic Assessment. The QP wants to indicate that the Orbite process is unique and patented and that he relied on the deep knowledge of Orbite's representative, Denis Primeau, Eng., and other third parties (SMS Siemag and Outotec work), among others.

Demonstration of the chemistry of the Orbite Proprietary Process on a sustained, batch and continuous basis represents a major milestone in the development of the Project. What the various pilot plants (Canada and Europe) have demonstrated is that the principal components of the chemical process, namely leaching and ion separation (mainly aluminum and iron) are technically valid and that the process can be operated on a large pilot scale. The ability to produce alumina meeting and exceeding the smelter grade specification and even producing aluminum lingots has also been demonstrated. For all intents and purposes, a sufficient body of information has been developed to warrant GENIVAR's recommendation to continue with the next stage of the Project which consists in the basic engineering leading to the Feasibility Study.

14 MINERAL RESOURCE ESTIMATES

The author of this section, Mr. Jean-Guy Levaque, Eng. independent and qualified person as per NI 43-101 F1 was asked by Orbite Aluminae Inc. to make a preliminary estimate of the resources of the whole Marin Sector, prior to an eventual computer simulation (3D model) for part of the deposit that will be related to the Feasibility study. The methodology and results of the resource estimation for the project are described in this chapter.

The resource estimate was performed in accordance with National Instrument 43-101, Standards of Disclosure for Mineral Projects and the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM Council on November 27, 2010.

Basic geological interpretation was done by Guy Béland, M.Sc. in geology, MBA, in collaboration with Michel Rheault, P. Geo., M Sc., as the geometrical modeling was done by Mr. Jean-Guy Levaque, Eng. and resource estimation were also done by Mr. Jean-Guy Levaque, Eng.

The author cautions that mineral resources have no demonstrated economic viability. In addition, there is no certainty that all or part of the mineral resources will be converted into reserves.

14.1 Drill Holes Database

The present resource estimation is based on the data obtained from drill holes completed from the last drill program ended on August 14, 2011. The results from diamond drilling were used in the geological interpretation and the mineral resource estimate. As was previously mentioned, 22 holes were drilled in 2011 to ascertain geological contacts in different part of the deposit but mainly on the outskirts of the L'Original formation. They were all sampled and analysed at ALS Chemex in Val D'Or, Quebec. The 480 samples provided the averages seen in Table 14-1, under the heading 2011. The table shows and confirms the tremendous homogeneity of the claystone throughout the property and throughout the years.

Table 14-1 Comparison of the Claystone Analysis throughout the Years

Oxides	Overall Average	Yearly Average	Overall Average
	2007 to 2010	2011	All
Al ₂ O ₃	24.68%	24.58%	24.66%
SiO ₂	51.09%	50.92%	51.04%
Fe ₂ O ₃	8.73%	8.70%	8.72%
MgO	1.46%	1.53%	1.48%
Other Oxides	6.39%	6.33%	6.38%

A special emphasis was put, in 2011, to find out more about Rare Metals Oxides and Rare Earth Oxides. Preliminary data were extracted from this special program to feed the PEA study. 16 holes were drilled specially for a variographic experiment which results will be forthcoming later in 2012. Also as part of the emphasis, 15 samples were taken, randomly along a hole, on claystone core during the summer 2011. These 2 results are very similar but cannot be added because of major difference in size of support; the variographic experiment samples have a 3 m support whereas the random samples have a 15 cm support. As can be seen in Table 14-2, the 2 lots are extremely similar. The values are in ppm and relate to the metal only, not the oxide.

Table 14-2 Comparison between Two Lots of Samples

	Ce	Dy	Er	Eu	Ga	Gd	La	Nd	Pr	Sc	Sm	Y
Random	172.47	9.28	5.15	2.61	36.47	10.90	86.29	77.20	20.45	16.65	14.72	55.60
Drill	159.39	9.89	5.23	2.60	33.46	11.22	78.99	74.63	19.81	16.99	14.14	51.05

14.1.1 Content of the Database

The present resource estimation is based on the data obtained from drill holes completed since the summer of 2007 and includes the results from the last drill program ended, as stated previously, on August 15, 2011. The results from diamond drilling were used in the geological interpretation and the mineral resource estimate. The 2011 data were essential in producing resources for the Rare Metals Oxides and Rare Earth Oxides.

The company drill holes database contains 105 drill holes which were all used for the geological modeling. Table 14-3 presents a summary of the number of samples in the main files in the database.⁽²⁵⁾ During the course of the 2007 exploration

campaign, core samples were analyzed for exclusively for alumina. From 2008 to the present alumina and all other oxides like Si, Fe, Mg, etc, were analyzed.

Table 14-3 Samples and Assay Results in the Database

	Assays Orbite Number
Drill holes	105
Samples (all)	2822
Al ₂ O ₃ Analysis	2822
SiO ₂ Analysis	2069
Fe ₂ O ₃ Analysis	2069
MgO Analysis	2069
RMO & REO Analysis	1692

14.1.2 Database Validation

The integrity of the drill holes database was validated essentially by using the Gemcom software, solely for its creation. Furthermore, only the analysis related to samples having alumina content greater than 18% were kept in the database. This means the information kept is related only to the claystone and mudstone lithologies, which is the only interest of the company.

14.1.3 Statistical Analysis (all assays)

Since aluminium, silica, iron, magnesium, various oxides, some rare metals and rare earth elements are the major elements of interest for the Project, basic statistical analysis was performed on these. As no excessively high value were found, a capping value was not necessary to get rid of outliers.

As shown on the following graphs, Figure 14-1 and Figure 14-2, the bi-modal feature of the deposit clearly stands out; in the alumina histogram, one can see that the alumina is constantly lower in the mudstone than in the claystone and the exact contrary is shown in the following silica histogram where, of course, the silica is higher in the mudstone than in the claystone.

As for the iron and the magnesia, Figures 14-3 and 14-4, this distinction is not seen as iron and magnesia is evenly distributed in both lithology.

Figure 14-1 Alumina Histogram for All Data of Mudstone and Claystone

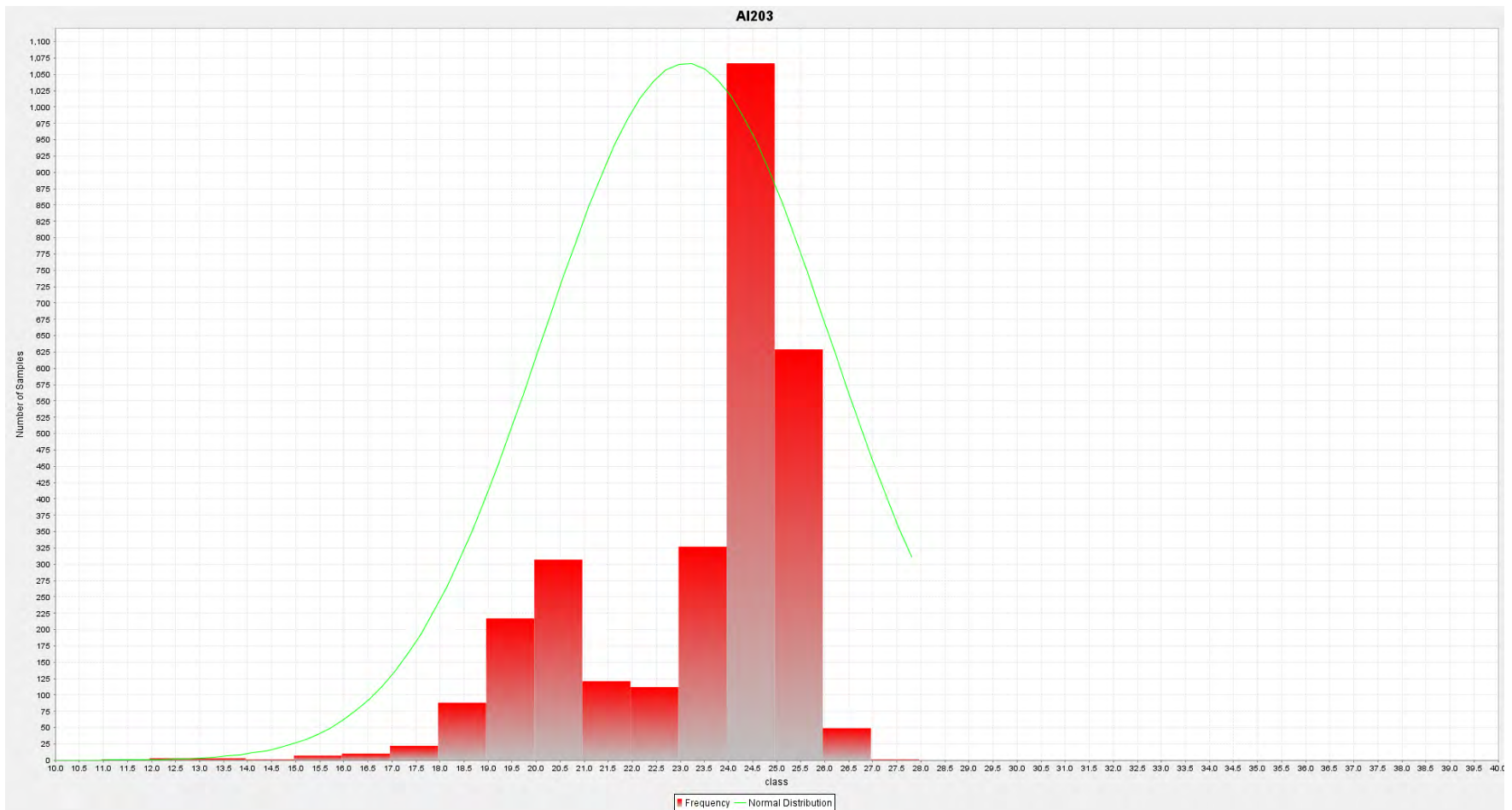


Figure 14-2 SiO₂ Histogram for All Data of Claystone and Mudstone

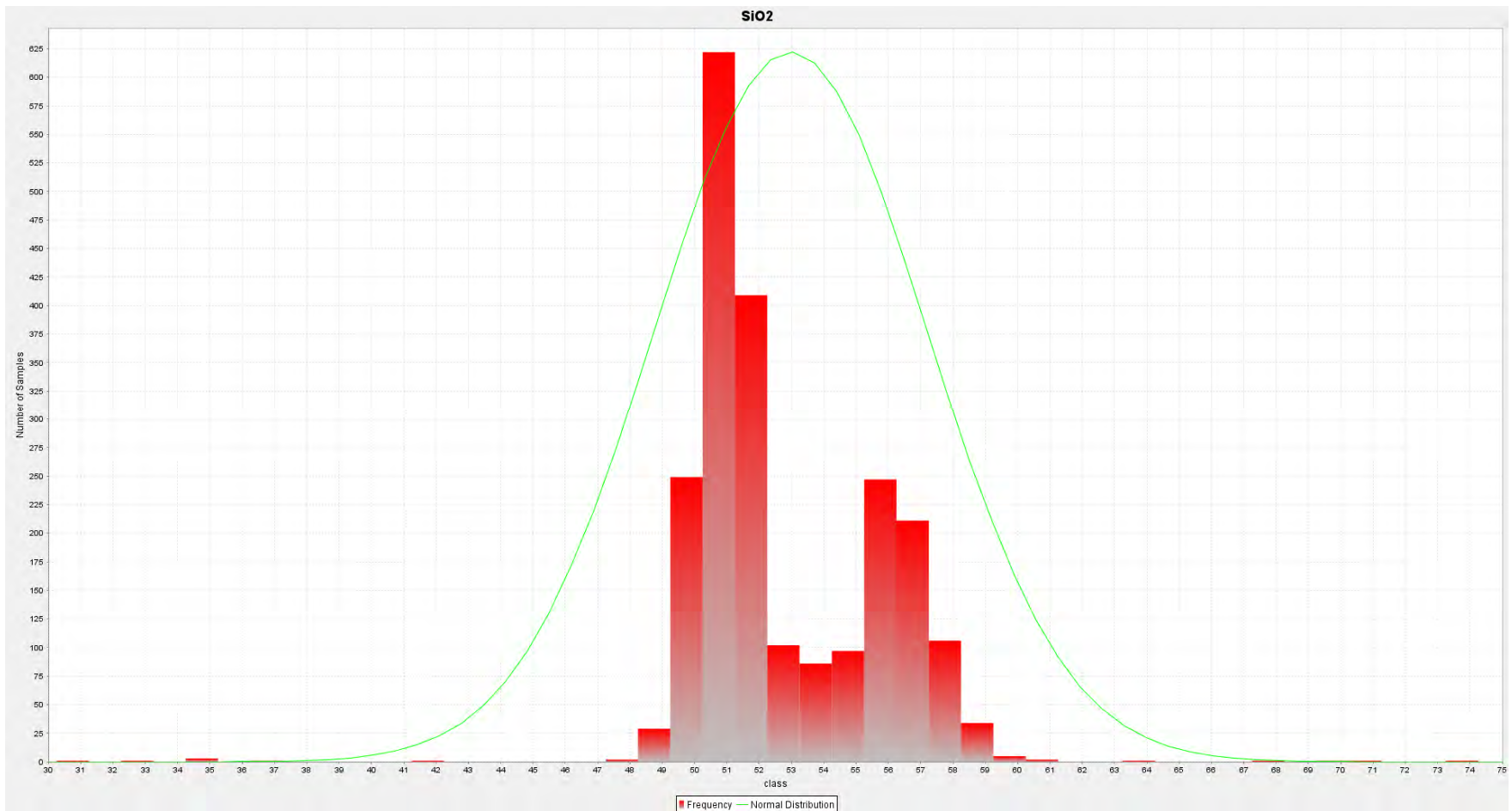


Figure 14-3 Iron Histogram for All Data of Claystone and Mudstone

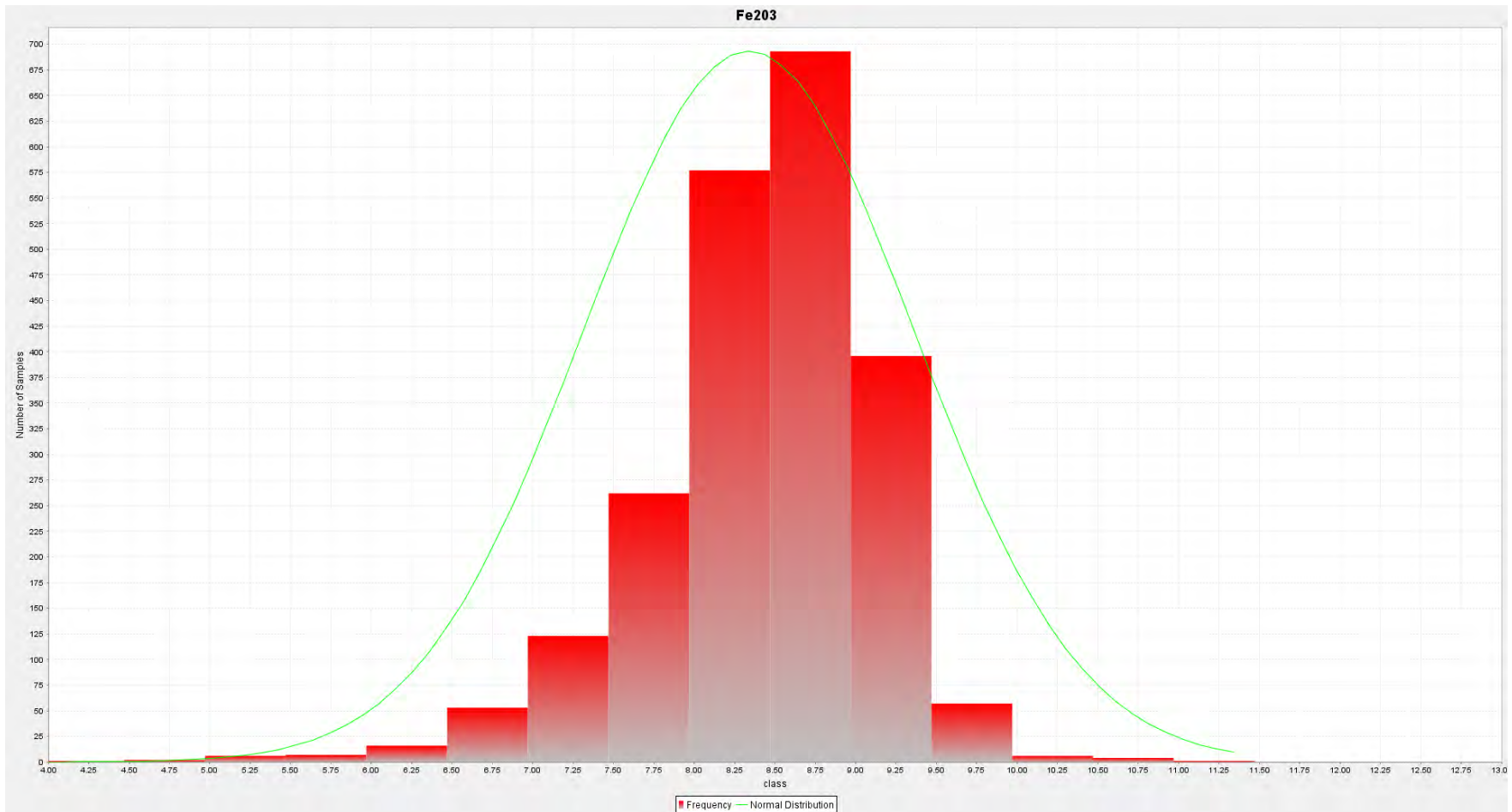
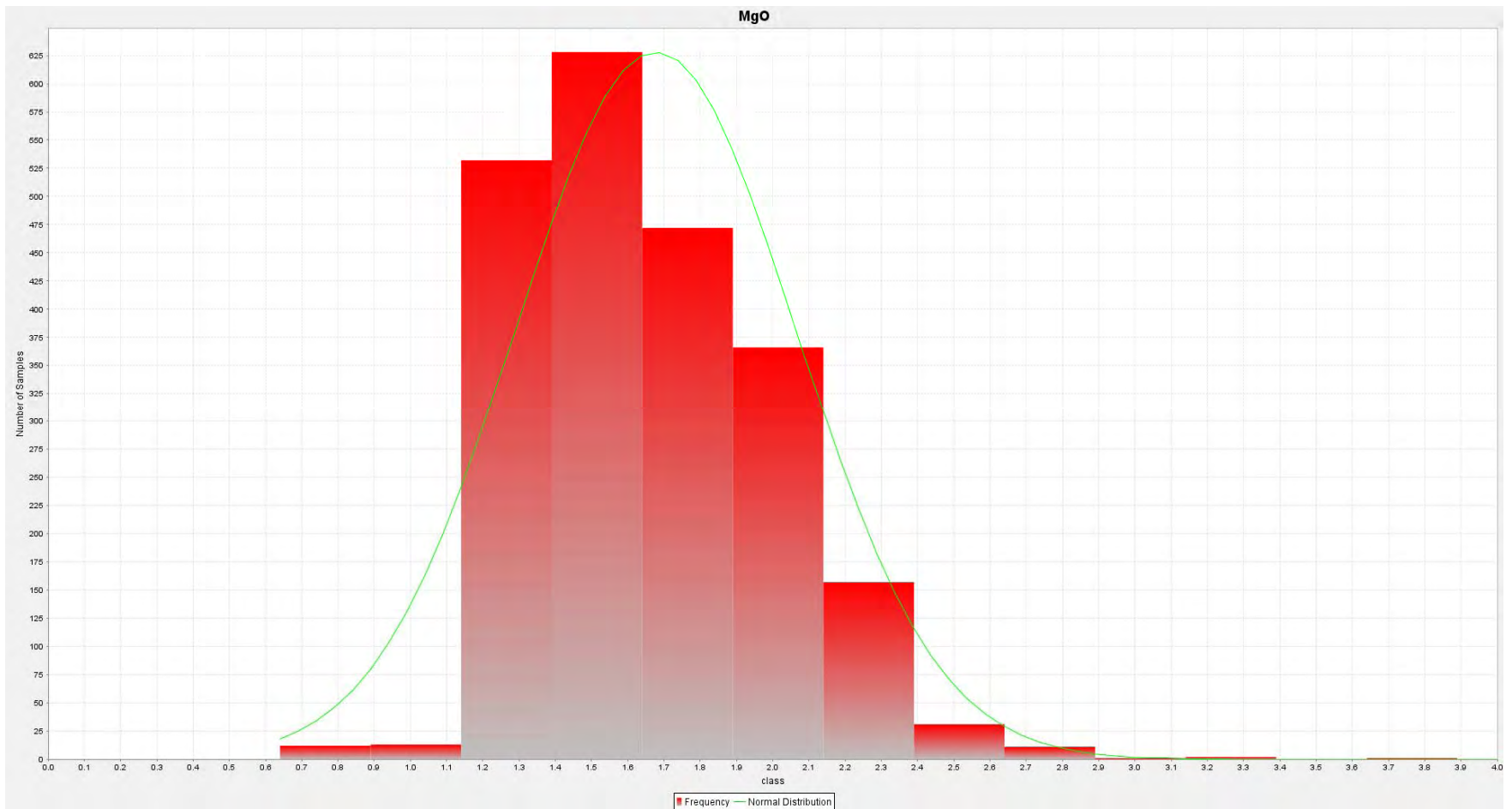


Figure 14-4 MgO Histogram for All Data of Claystone and Mudstone



The scattergrams, shown in Figures 14-5, 14-6 and 14-7, show the importance of alumina in the driving of other element values. For silica it was obvious with a very high correlation coefficient of 0.94 (SQRT of 0.88). But, looking at iron and magnesia, one can see the great homogeneity of the deposit as every chemical element within the clay is extremely closely packed.

Figure 14-5 Correlation Silica vs Alumina

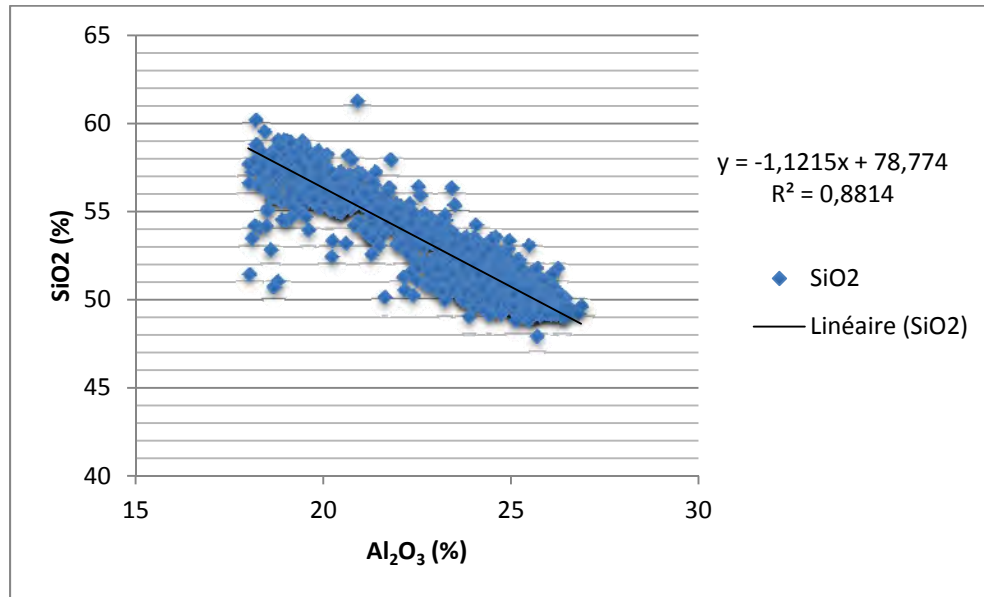


Figure 14-6 Correlation Alumina vs Iron

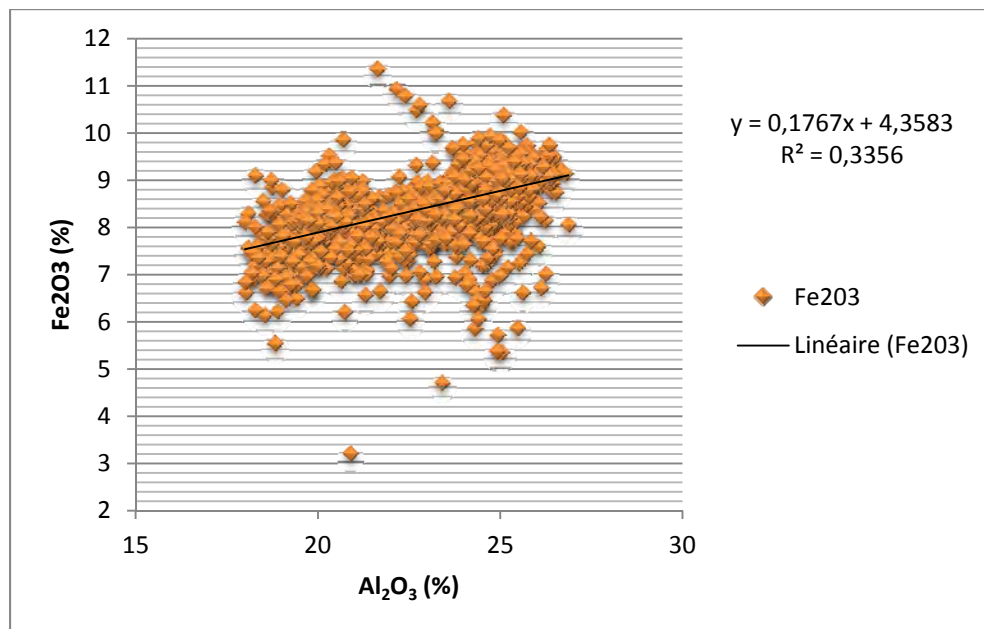
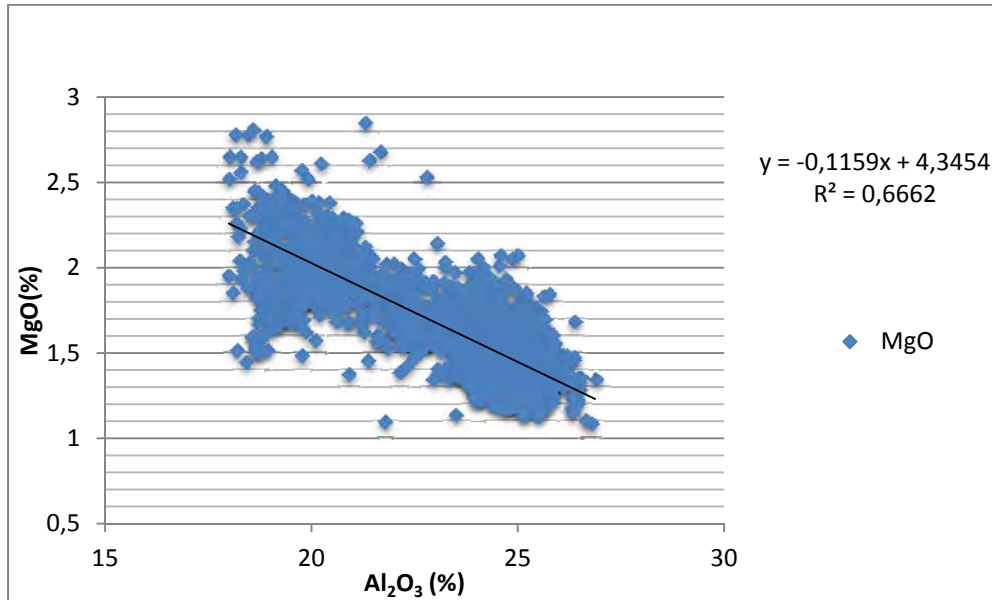


Figure 14-7 Correlation Alumina vs Magnesia



14.2 Compositing

Due to the geometrical estimation method use, compositing was not a requirement. But, since the next level of precision will require computer software, like Gencom, the sampling, since 2008, was oriented at creating equal length samples, in this case 3 m. If the geologist required a particular different interval, he was asked to accommodate the next interval, so that the sum of the two gave 3 m. As an example, let's look at a series of intervals in meters: 3, 3, 3, 2.1, 0.9, 3, 3..... One can see that the 3 m interval is respected by making the following sample length at 0.9 m.

14.3 Variograms

Because of the geometrical method used, creation of variograms was useless at this stage since this effective method is sufficient for preliminary estimation, especially in the case of homogeneous deposits like the one encountered in the Marin Sector.

14.4 Geological Interpretation

14.4.1 Introduction

The geological interpretation was first made on vertical sections and then corrected to fit between them according to a plan view.

The lithological unit logged as Claystone was used to draw the core of the deposit bordered by the mudstone until the contact with neighbouring formations, namely the Trois-Pistoles Formation. The chemical analysis was used as a cross-check because the contacts were in almost all cases very sharp, going from 23% to 21% Al_2O_3 very rapidly between claystone and mudstone.

The bulk of the deposit consists of thick multi-folded layers, elongated in an east-west direction and controlled, north and south, by thrusts faults between neighbouring formations. There are no isolated pods or lenses, no abrupt changes within either the claystone or the mudstone.

14.4.2 Methodology

The whole topographical map was done by Aerophoto (1961) Inc. of Quebec City. They ordered existing black and white 2004 1:15000 aerial photographs already existing; this was deemed more than sufficient since no earth moving jobs were done since so the photographs still presented the reality. They digitized those photos at 1814 dpi and triangulated them. Then they modeled in 3-D the planimetry and generated 2 m levels and finally produce an ortho-mosaic. The ground surveyor had established some 12 control points to ensure accuracy to the planimetry.

14.5 Ressources Estimate Methodology

14.5.1 Model Definition

At this stage of the project, the geometric method of half-distance of sections is sufficient, because of the strong geological formation continuity. Of course this method implies a certain level of uncertainty, given the assumption that the bedding is regular and in straight line between sections as well as the approximation of the topography. This uncertainty translates into a potential variation of volume in the order of 20%.

14.5.2 Density

A density has been calculated from 44 samples selected by the author of this section. A density of 2.60 g/cm^3 for both claystone and mudstone is recommended to convert the volumes into tonnes, based upon testing conducted by ALS Chemex.⁽⁵⁸⁾ Table 14-4 gives the details of this experimentation.

The testing was supposed to calculate also the water content but an error occurred at the laboratory and the prepared samples were left outside the bags to “dry”. Orbite’s pilot plant in 2011, though, made tests⁽⁴⁸⁾ and came up with water content between 6 and 8%. Because of the time elapsed between the Grande-Vallée site

and the pilot plant, approx. 200 km, as a safe measure, the author took 10% for water content. It is strongly recommended to continue experimenting with both the density and the water content in the months to come, during the Feasibility study stage.

Table 14-4 Results of Density Tests

	Dry	Wet 10%
Mudstone	2.81	2.63
Claystone	2.78	2.60
Overall	2.79	2.60

14.6 Common Oxides

The main reason for working on the deposit of Grande-Vallée is, of course, because of its content in alumina. But because, also, of the effectiveness of the patented process, other oxides become available for separation like SiO₂, Fe₂O₃, MgO and the remaining common oxides, like CaO, Na₂O, K₂O, TiO₂, P₂O₅, SrO and BaO, in bulk at the end of the process. The following Table 14-5 gives the average concentration of the different oxides obtained through the analysis of all the campaigns and that are of interest for their extraction within Orbite's process (see Sections 13 and 17).

Table 14-5 Average Concentrations of the Common Oxides in the Marin Sector

	Al ₂ O ₃	SiO ₂	Fe ₂ O ₃	MgO	Other Oxides*
AVERAGE	23.37%	52.62%	8.42%	1.66%	6.90%

* = CaO, Na₂O, K₂O,

14.6.1 Rare Metals and Rare Earth Elements

Another very important aspect of the patented Orbite process is its ability to extract Rare Metals and Rare Earth Elements. Sixteen drill holes were done along two perpendicular lines oriented East-West and North-South. Within each line, a hole was drilled at the origin, plus one at 1 m, 2 m, 5 m, 10 m, 20 m, 40 m, 80 m and 160 m intervals. The total was 16 holes because one was abandoned because of swampy grounds.

The average analysis of each element was correlated with alumina with both lithologies, mudstone and claystone, as shown in Table 14-6. For all elements, except Scandium, the correlation is significantly better with the claystone. Therefore, as a preliminary estimation, the Rare Metals and Rare Earth Elements will be linked to the claystone tonnage only.

Table 14-6 Alumina Correlation with RM and REE

	Ce	Dy	Er	Eu	Ga	Gd	La	Nd	Pr	Sc	Sm	Y
Mudstone	0.17	0.17	0.19	0.03	0.38	0.11	0.22	0.28	0.28	0.36	0.29	0.08
Claystone	0.58	0.31	0.32	0.44	0.62	0.38	0.53	0.61	0.61	0.17	0.55	0.34

Taking the value of the sampling campaign, transforming the metal into oxides, one gets the following Table 14-7 which shows the results of the different oxides, in ppm, taken into consideration by the process people. The sum of every average is 573 ppm.

Table 14-7 Averages for the Marin Sector of the 12 retained RMO and REO

Ce ₂ O ₃	Dy ₂ O ₃	Er ₂ O ₃	Eu ₂ O ₃	Ga ₂ O ₃	Gd ₂ O ₃	La ₂ O ₃	Nd ₂ O ₃	Pr ₂ O ₃	Sc ₂ O ₃	Sm ₂ O ₃	Y ₂ O ₃
186.02	11.31	5.94	3.00	44.86	12.89	92.34	86.78	23.11	25.97	16.36	64.50

14.7 Volume/Tonnage Interpolation & Calculation

In order to calculate a volume, the author of this section created an envelope that would closely resemble a pit outline, given that the Northern slopes are determined by the contacts between the L'Original Formation and the Trois-Pistoles Group, which varies from 45° to 30°. The Southern slopes will be either on the contact between the Trois-Pistoles Formation and the Rivière Ouelle Formation or at 45° in the Trois-Pistoles Group. Eastern and Western slopes should be in Claystone, thus 30° up to when they daylight in the topography. The maximum depth of the envelope is at 100 m A.S.L., to keep it at the level of the Madeleine River and the access to the envelope is from the East. Waste extraction is kept to a minimum and the benches are sloping towards the East. In this envelope, 6 characteristic sections were chosen based on their representativeness and trying to keep regular intervals between sections, when possible.

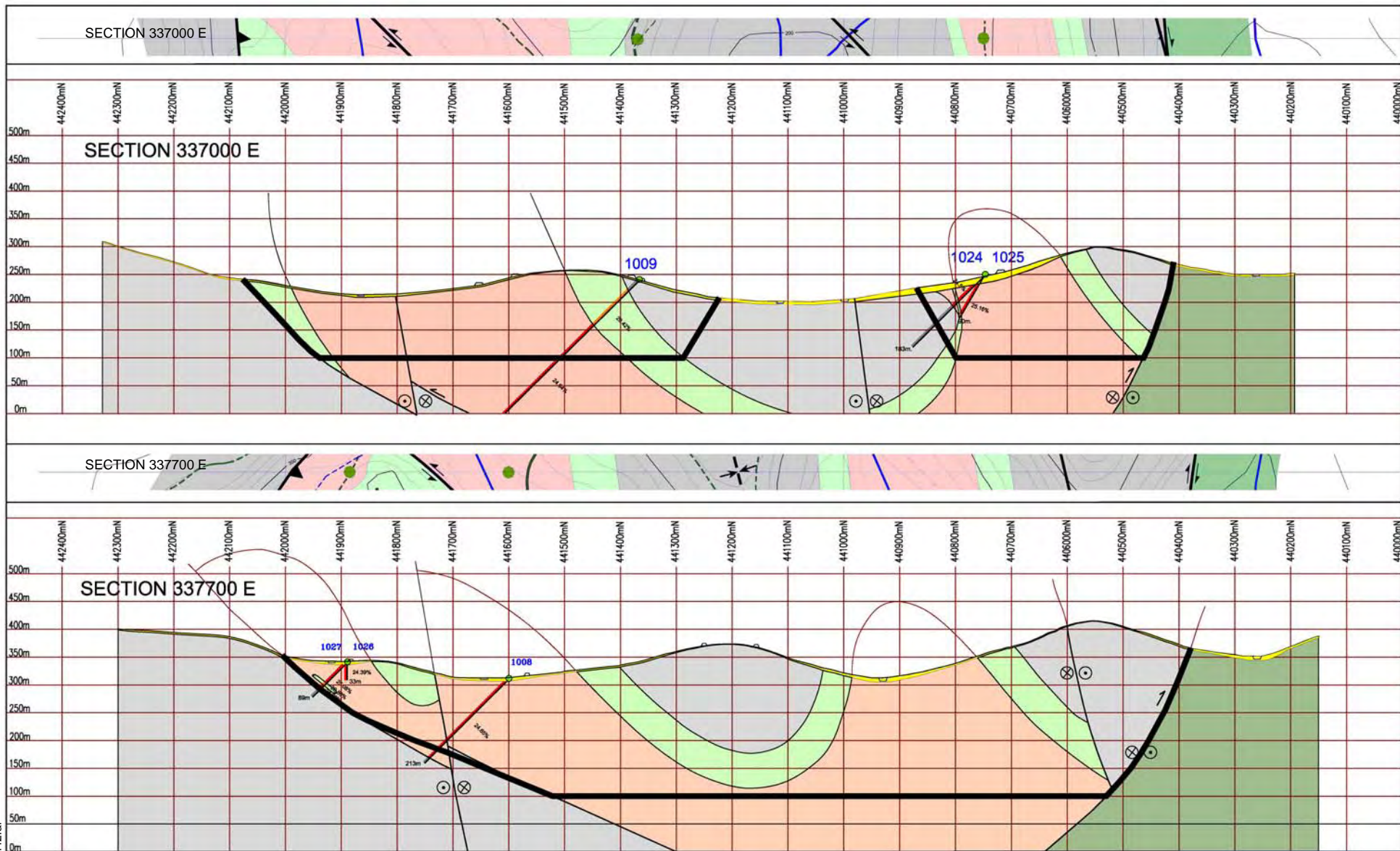
14.7.1 Specific Volume Calculation

The areas on the chosen six sections were measured by three different methods. First, by applying a gridded transparency, we can obtain a rough approximation. Second using a planimeter to calculate the surfaces of Claystone, Mudstone and

waste further refines the data. Finally, those same surfaces were drawn and calculated with AutoCAD. These last results were used in the resource calculation. The appropriate thickness was the sum of the 2 neighbouring half distances; for the most westerly section, the thickness was decreased by 400 meters as required by the geological model. Table 14-8 provides a summary of the calculation by showing a given section, its width of influence, the quantity of overburden to be removed as well as the waste, and the lower and the upper limit of the volume due to the inherent error inscribe in the geometrical method because of its simplification procedure. Redoing, in the next step, the same calculus but with software package specialized in geological model and volume calculation will get rid of this range. As was said before, the geometric method tends to overestimate volumes by approximately 20%. So to be conservative, the lower limit will be the one carried along in the upcoming calculations. The following Figures 14-8, 14-9 and 14-10 represent the outlines of the 6 sections used for the calculation of the volumes.

Table 14-8 Volume Calculation for the six Chosen Sections

Section	Influence	Overburden	Waste	Volume in millions of cubic meters					
				Mudstone Limit		Claystone Limit		Both	
				Inferior	Superior	Inferior	Superior	Inferior	Superior
337000	400	1,83	8,99	9,43	11,79	29,45	36,81	38,92	48,65
337700	400	1,93	33,74	16,70	20,88	65,38	81,72	82,07	102,59
338000	400	1,96	38,20	17,93	22,41	47,16	58,95	65,10	81,37
338500	500	2,60	27,34	9,43	11,79	69,48	86,85	78,94	98,67
339000	500	1,76	34,56	17,28	21,6	55,51	69,39	72,73	90,91
339500	500	2,90	31,24	28,66	35,82	32,69	40,86	61,31	76,64
	TOTAL	12,98	174,07	99,43	124,29	299,66	374,58	399,07	498,83



Rivière Ouelle Fm.

Siltstone, Calcareous conglomerate

Trois-Pistoles Gr.

White and pink quartz sandstone

Conglomerate

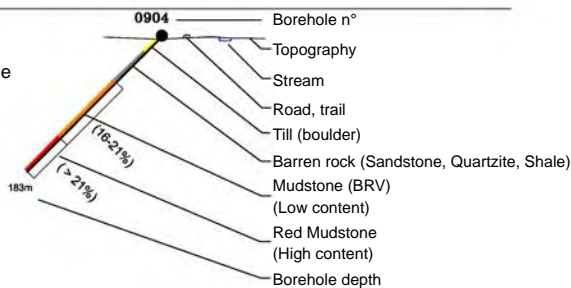
Alternating black shale and sandstone

L'Original Fm.

Red and green mudstone

Red claystone

Pit limit



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Figure 14.8

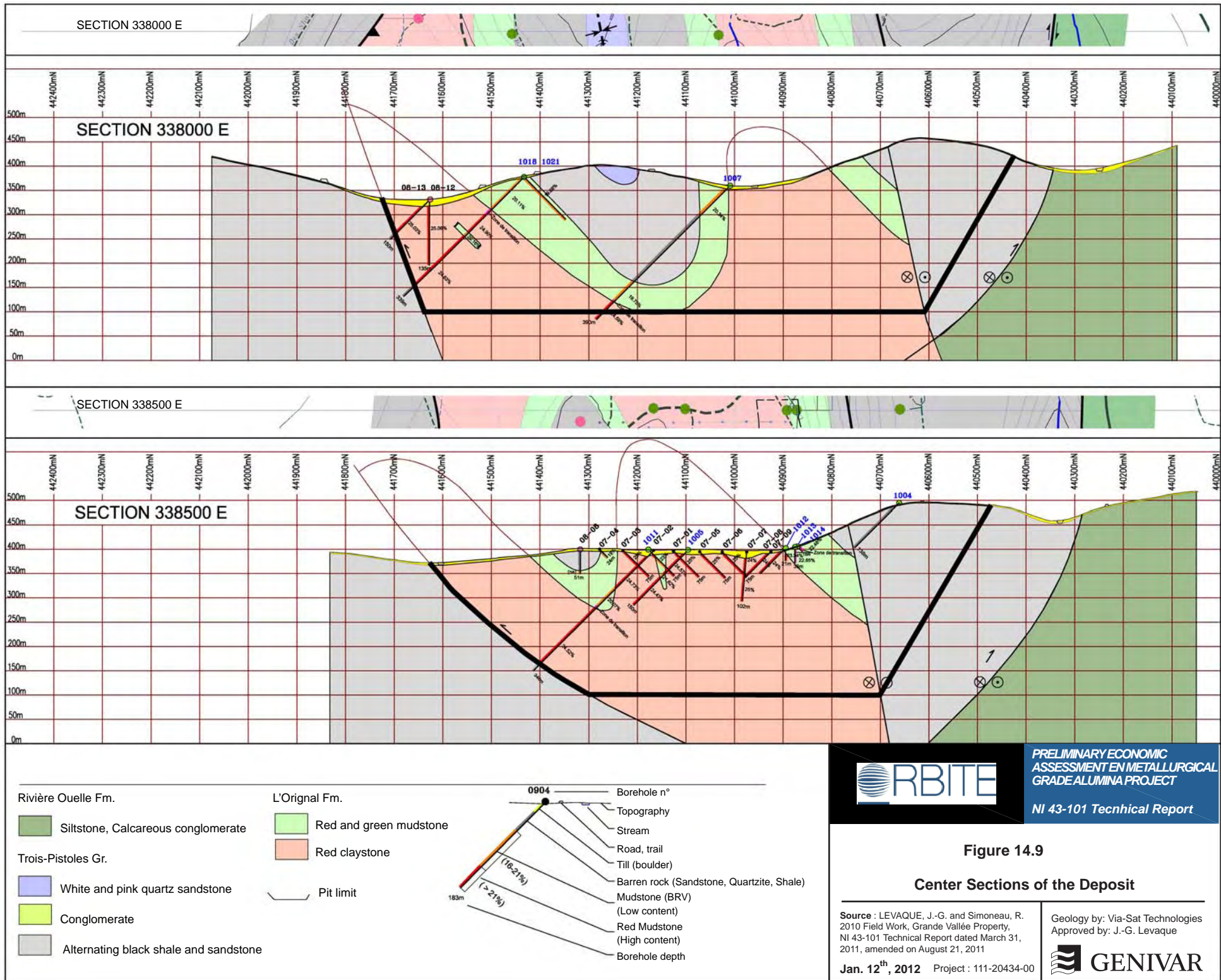
Western Sections of the Deposit

Source : LEVAQUE, J.-G. and Simoneau, R. 2010 Field Work, Grande Vallée Property, NI 43-101 Technical Report dated March 31, 2011, amended on August 21, 2011

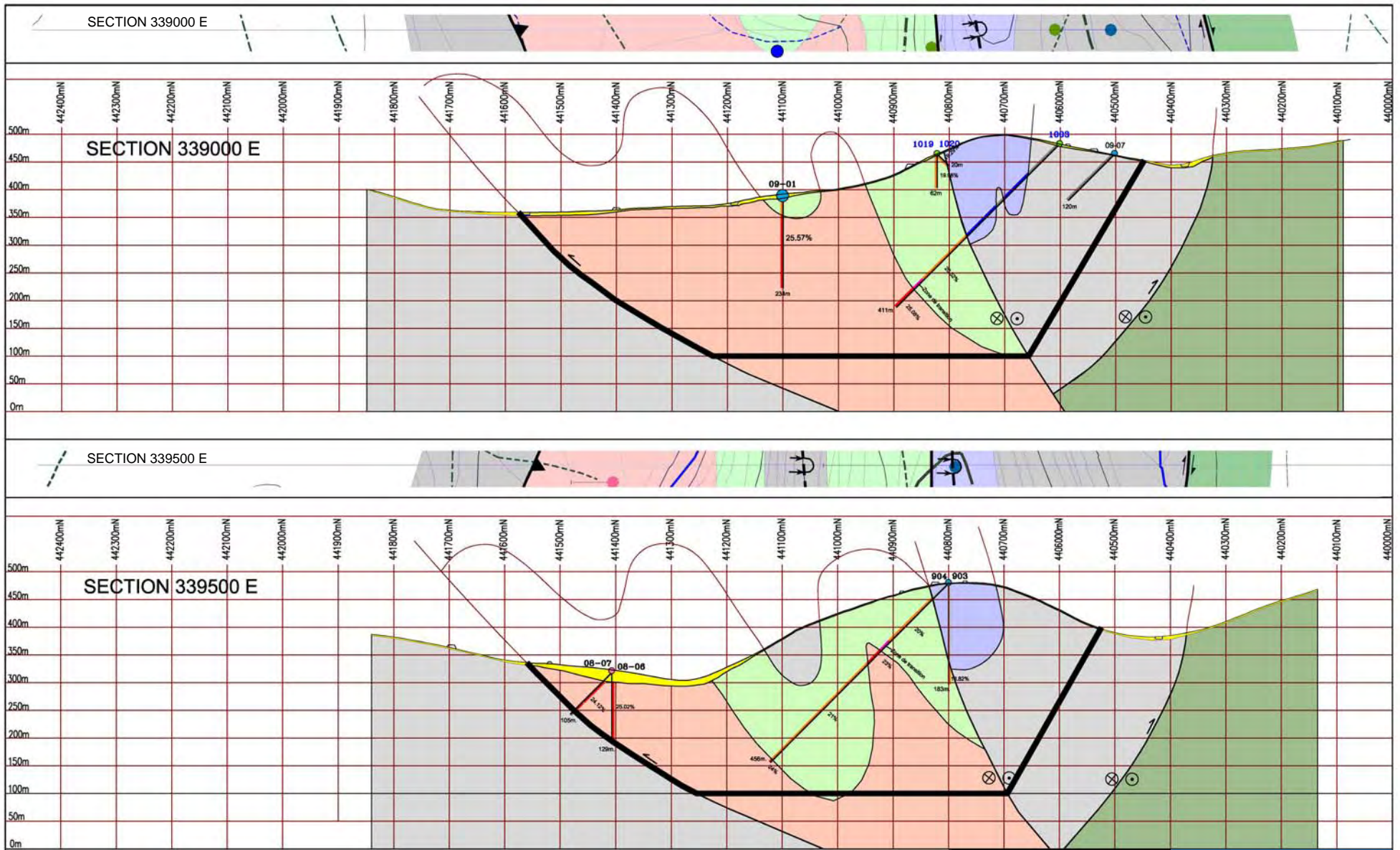
Jan. 12th, 2012 Project : 111-20434-00

Geology by: Via-Sat Technologies
Approved by: J.-G. Levaque





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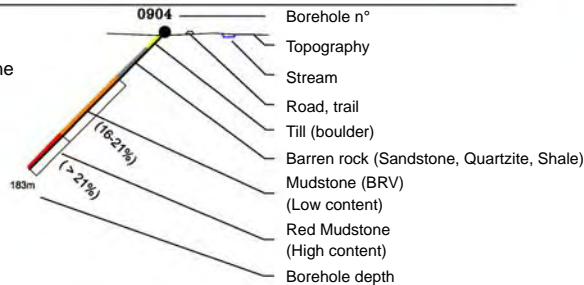


Rivière Ouelle Fm.

- Siltstone, Calcareous conglomerate
- Trois-Pistoles Gr.
- White and pink quartz sandstone
- Conglomerate
- Alternating black shale and sandstone

L'Original Fm.

- Red and green mudstone
- Red claystone
- Pit limit



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Figure 14.10

Eastern Sections of the Deposit

Source : LEVAQUE, J.-G. and Simoneau, R.
2010 Field Work, Grande Vallée Property,
NI 43-101 Technical Report dated March 31,
2011, amended on August 21, 2011

Jan. 12th, 2012 Project : 111-20434-00

Geology by: Via-Sat Technologies
Approved by: J.-G. Levaque



14.7.2 Specific Tonnage Calculation

Given the information on density, the tonnage calculation is simply factoring the volume by the density. Therefore, the tonnage for the potentially recoverable mudstone and claystone in the Marin Sector is 1,040 Million tonnes which includes 780 Million tonnes of claystone.

14.8 Mineral Resources Classification

The Mineral Resources are classified under the categories of Measured, Indicated and Inferred according to CIM guidelines. Classification of the resources reflects the relative confidence of the grade estimates. This classification is based on several factors including; sample spacing relative to geological and geo-statistical observations regarding the continuity of mineralization, data verification to original sources, specific gravity determinations, accuracy of drill collar locations, accuracy of topographic surface, quality of the assay data and many other factors, which influence the confidence of the mineral estimation.

14.8.1 Standard Oxides (Al_2O_3 , SiO_2 , Fe_2O_3 , MgO and other oxides)

The rather simple geological model and the excellent grade continuity positively affect the confidence level. The approximation inherent to the geometric evaluation method, i.e. straight line contacts between sections and simplified topography is the factor responsible for the choice of Indicated Resources.

It is obvious, at this stage, that there are no Measured Resources.

There is no claystone left to the North or South, only negligible amounts East or West; there is claystone left in the “floor” but, since it is below the two major River beds, only a thorough hydrogeological investigation would make this material available. It is for these reasons that there is no Inferred Resources for the main oxides linked directly to the Claystone and the Mudstone, i.e. Al_2O_3 , SiO_2 , Fe_2O_3 , MgO and other oxides.

14.8.2 RMO and REO

The behavior of the rare metals and rare earth oxides is somewhat different than the standard oxides. The average is based on limited information and sampling gathered at the same time as the previous data through assay of diamond drill samples. The definition of Inferred Mineral Resource applies perfectly to this category, i.e. this resource is “part of the Mineral Resource for which quantity and grade can be estimated on the basis of geological evidence and limited sampling and reasonably

assumed, but not verified, geological and grade continuity.” Because of the better correlation of some oxides with the Claystone compared to the Mudstone, the tonnage applied will be that of the Claystone only.

14.8.3 Mineral Resource Statement

The following Table 14-9 shows the Mineral Resource Statement for the Marin Sector of the Grande-Vallée Project belonging to Orbite Aluminae Inc. The average grade is that of all analysis that have at least 18% Al₂O₃, the density used is 2.6 g/cm³. The tonnages are expressed in millions of metric tonnes due to the level of precision. The effective date of these mineral resources estimate is November 23, 2011.

Table 14-9 Table of Resources Estimate Following 2011 Exploration Work

Resource	Oxide	Grade	Total Mt
Indicated	Al ₂ O ₃	23.37%	1040
Indicated	SiO ₂	52.62%	1040
Indicated	Fe ₂ O ₃	8.42%	1040
Indicated	MgO	1.64%	1040
Indicated	Others	6.90%	1040
Inferred	RM & REO	573 ppm	780

The author of this section, cautions that mineral resources have no demonstrated economic viability. In addition, there is no certainty that all or part of the mineral resources will be converted into reserves.

14.8.4 Mineral Resources Sensitivity

Because of the estimation method used, it is impossible to use Grade/Tonnage curves.

14.8.5 Mineral Reserves Estimation

A Feasibility study is required to demonstrate the economic merit of mineral resources in order for their conversion to reserve. At this time, no such study has been completed and therefore the Project currently has no reserves. In the case of REO/RMO additional drilling are required to eventually move from Inferred to Indicated.

14.9 Conclusions

The classification of the mineral resource for the Marin Sector of the Grande-Vallée project was based on the geological and grade continuity of claystone and mudstone of the L'Original Formation. The CIM Definitions, Standards on Mineral Resources and Mineral Reserves (2010) have been used for the resource classification.

Based on verifications in the field and on the information provided for this assessment, the author of this section Mr. Jean-Guy Levaque, Eng. QP believes that the geological interpretation and the data are valid. Overall, it is the author's opinion that the parameters, assumptions, geological model and data reflect a reasonable approach, and are representative of the type and setting of the claystone and mudstone deposit of the Grande-Vallée property. The author believes that the resources estimate is reasonable and appropriate.

The mineral resources described in the Statement above, constitute contained material in the ground and have not been included in any formal plan of exploitation. GENIVAR and Mr. Jean-Guy Levaque, Eng. QP are unaware of any known material issues related to environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant issues which may affect the mineral resources.

Additionally, there are no known material issues related to mining, metallurgy, infrastructure and other relevant issues which may affect the mineral resources.

15 MINERAL RESERVE ESTIMATES

No mineral reserves are declared in this Technical Report.

16 MINING METHOD

The mining of Orbite's Grande-Vallée deposit will follow the standard practice of an open-pit shovel/truck operation without the conventional drilling and blasting required in a hard rock open pit mine. It has been shown in the mining of an approximate 3,400 tonnes of bulk sample that the aluminous clay can be mined without the need to drill and blast. The Grande-Vallée mine will operate in a load and haul cycle, using trucks and excavators, and supported by a fleet of auxiliary equipment. The run-of-mine (RoM) aluminous clay will be loaded by hydraulic excavators and delivered by trucks to the primary sizer/crusher. The crushed clay will be transferred to a conveyor and conveyed to the clay storage bin. Waste rock material will be hauled to the waste disposal area located to the South of the pit.

The mining study was based on Orbite purchasing and maintaining the equipment required to mine the resource. An alternative option would be to contract out all activities related to mining, but this was not incorporated into this study.

16.1 Basic Mine Plan

The Grande-Vallée pit is located in an optimum location within the larger identified aluminous clay resource.

For the PEA the minable resource was based on creation of a simple pit plan. The limits of each boundary of the pit are set as follows:

- The Northern pit limit is the northern extent to the claystone resource;
- The Southern pit boundary was limited by the relief of the topographical surface and the lower grade mudstone;
- The East/West boundaries were provided by the Quebec regulating authorities.

This approach was judged to be prudent for the PEA as the resource geology in the pit area appears to be simplistic in nature and the dilution effects minimal. Most of the mineable resource in this pit is in the higher grade claystone.

The initial pit plan that will be in effect for the first 14 years of operation will mine much of the south slope from the 425m elevation down to the 355m elevation. This plan was developed using the available topographic contour lines that are based on a 2m contour interval. Below elevation 355m a conventional open pit will be developed utilizing 6m benches and an overall pit slope of 30 degrees. To support operations for the 25 year plant operating period the pit will be mined to only a depth of 36 metres (6 benches).

It is envisioned that a computer pit design involving more detailed mining engineering and pit optimization studies should be reserved for the Feasibility stage of project evaluation.

16.1.1 Model Coordinate System

The model coordinate system used in the pit design is UTM NAD83.

16.2 Open-pit Optimization

In accordance with the guidelines of the National Instruments NI 43-101 on Standards of Disclosure for Mineral Projects and the Canadian Institute of Mine Metallurgy and Petroleum Definition Standards for Mineral Resources and Mineral Reserves, blocks classified in the measured, indicated and inferred categories are allowed to drive the pit optimizer for a PEA study.

Pit outlines and preliminary design considerations completed to date should be followed up by creation of a computerized pit block model of the entire pit area. Using this information, a pit optimization exercise should be completed on the outlined resources at the Marin Sector of Orbite's land claims. This work will result in an optimized pit design that can be used for future studies and mining of the aluminous clay resource.

Due to the simple geology, the fact that the Grande-Vallée pit is located (with the exception of a nose of quartzite that protrudes into the pit area from the West) within a very large mineable resource, the East/West pit boundaries are defined by the Quebec regulating authorities and the pit plan is conservative in design, pit optimization studies were judged by GENIVAR to not be required at this stage in the evaluation process. Pit optimization studies will be performed at the Feasibility Study stage of project development. These studies will likely result in the mining fewer tonnes of waste rock in the initial 25 year pit.

16.2.1 Density

A density of 2.6 was used for the mineable resource (claystone and mudstone). This density is based on information within the mineral resource statement.

16.2.2 Mill Cut-Off Grade

At this point, an 18% Al_2O_3 cut off grade is considered for mine planning, although no block model with a cut-off grade or milling cut-off grade (CoG) was used to classify the aluminous resource material (claystone and mudstone) inside the pit limits as all the in-pit resource is consistent in grade.

16.3 Detailed Mine Design

The conservative mine design used in this study was completed using conventional mine planning software. Surface drilling of the overall minable aluminous clay deposit is illustrated on six sections as shown in a report titled, “2010 Field Work, Grande-Vallée Property, 43 101 Technical Report” prepared for Orbite by Mr. Jean-Guy Levaque, Eng. an independent and qualified professional, dated March 2011 that was restated and amended on August 21, 2011⁽⁵⁾ without changing the indicated resources. In this report, Mr. Jean-Guy Levaque calculates a resource volume by using the geometric method of projecting the resource half-way between each sections. Preliminary total resource pit design has been created outlining a resource of approximately 1 billion tonnes of clastone and mudstone averaging 23.37% alumina (Al₂O₃). This pit is located within the Marin Sector of Orbite’s mining claims. In reviewing the sections used in the overall mineable resource estimation GENIVAR noted that some of the pit slopes, where the final pit wall followed a geological contact, appeared excessive. To confirm the overall mineable resource GENIVAR revised the pit slopes on each section using the following slopes for the referred to geological formation:

- Clastone and mudstone – 30 degree pit slope;
- Shale – 40 degree pit slope;
- Quartzite – 50 degree pit slope.

The revised sections were scaled and a volume resource was calculated using the half-way effective method between the sections used in the 2010 field work study.

To support the Grande-Vallée alumina production plant a smaller pit design has been created which is within the total resources outlined in the Marin Sector and within the boundaries as approved by the Quebec regulating authorities. The basic pit outline has been placed on two North-South geology sections and a pit plan has been created that shows the pit limits for an initial pit that will support plant operations for approximately 25 years. The created 25 year pit plan has a calculated overall waste rock:resource ratio of 0.15:1.

The proposed pit design made no attempt to reduce the amount of waste rock mined within the boundaries established by the regulating authorities. Although the geological sections show the quartzite widths in the pit area receding with depth the mine design is based on the surface limits of the quartzite extending vertically to each succeeding pit bench.

A conservative pit slope of 30 degrees (generally used to describe angle of repose of loose wet clay or silt) was judged to be suitable. During the site visit the author witnessed much steeper slopes, even though these slopes were fresh and only 10m, within the small excavations used to mine the initial 400 tonne bulk sample.

Bench heights of 6m were used to allow efficient mucking by hydraulic excavators.

The general parameters used in the pit design are described in Table 16-1.

Table 16-1 Detailed Mine Design Parameters

Parameter	Value
Bench Height	6 m
Berm Width	10.4 m
Secondary Ramp Slope	<15%
Overall Pit Slope	30°
Ramp Width (2-lane main ramp)	20 m
Ramp Width (1-lane secondary)	14 m
Main Ramp Slope	10%

The width of the in-pit haulage ramp is 20 m (5 times vehicle width) to accommodate the 40 tonne articulated off-highway trucks, with allocation for safety berms and a drainage ditch. This ramp will provide sufficient room for two-way traffic to minimize the truck cycle time and maximize productivities. Temporary ramps of 14 m widths (single lane) may be used in the upper benches to add access flexibility in the stripping operations. The main pit ramp has been restricted to a 10% grade and exits the pit on the North side to facilitate an easy and short access to the primary crusher (sizer).

The Grande-Vallée pit is designed to support the plant operation for 25 years and is approximately 750 m long by 700 m wide by 48 m in depth.

16.4 In-Pit Resources Estimate

The mineable resource outline in the design pit totals 67.1 million tonnes of aluminous clay. The average grade of the total resource identified by Mr. Jean-Guy Levaque, Eng. QP is estimated to be 23.37% Al₂O₃ (see Section 14 for mineral resources calculation).

16.4.1 Dilution and Loss Factors

Given the physical characteristics of the clay compared to quartzite, waste rock and overburden, the size of the deposit (overwhelming amount of claystone and mudstone compared to waste rock and overburden) and the care needed to ensure the mined product is free of impurities, mining dilution has been judged to be minimal (less than 5%) for the PEA. Loss of overall grade due to mining does not apply to the

aluminous clay due to the fact that gravity or size differentiation has no effect on the consistent grade of the clay resource.

16.4.2 In-Pit Resources in Engineered Pit Design

Pit mining below the 355m level has been stopped at the minus 36m level (elevation 319m) as at that level the mined resource is sufficient for 25 years of plant operation. It should be noted that at this elevation pit bench six is approximately 575m wide by 485m long.

The total waste material amounts to 10.3 million tonnes of waste rock resulting in a stripping ratio of 0.15 tonne of waste per tonne of RoM.

Table 16-2 presents a detailed summary of the in-pit mineral resources that are planned to be mined at Orbite's Grande-Vallée pit.

Table 16-2 Grande-Vallée In-Pit Resources Estimate

Resources Category	Tonnage (kt)	Al ₂ O ₃ (%)
Grande-Vallée Pit Design		
Indicated	67,239	23.37
Total In-Pit Resource*		
Rock	10,316	
Stripping Ratio	0.15	

Note:

* In-Pit Resource extends down to elevation 319 (6 benches)

16.5 Mine Production Schedule

A mine production schedule was prepared for the development and the operation of the Project. The mining production schedule for the pit is based on a pre-stripping period of approximately 9 months. According to the total in-pit resources available, the life of the mine should extend for well over 30 years, but the financial analysis for the PEA was limited to 25 years and consequently the production schedule was developed for this time period only. The schedule includes priority scheduling of the plant/mine access road, mobile equipment procurement and mine service building construction. These elements are required to provide support for the pit overburden and waste rock stripping program that is scheduled to last through years 2 and 3.

The production schedule is based on the alumina plant taking 3 quarters (nine months) to ramp-up commercial production to full capacity. Mining of the aluminous clay at a rate of 6,960 tonnes per day is scheduled to begin 6 months before commissioning of the alumina plant begins. The production rate of 6,960 tonnes of clay per day extends for 25 years of operation. Following completion of the plant site development construction priority would be placed on the crusher, conveyor and clay storage facilities which would be followed by the alumina plant construction. Plant construction is estimated to take one and a half to two years. Claystone mining is scheduled early to ensure higher grade and sufficient quantities for plant start-up. Mine operations are likely to extend for only 9 months a year due to difficult winter conditions at the site.

Mine operations includes mine site preparation (stripping), clay excavation and transport/conveying to primary crushers, clay stock piling and storage.

The full mine production schedule is presented in Section 24.

Mining plans in the Marin Sector have been made to feed the alumina plant for twenty-five years of operation. During the first eleven years of plant operation, pit operations will involve mining much of the South slope from the 425 m elevation down to the 355 m elevation, the current surface location at the northwest corner of the planned open pit. Thereafter 6 benches in a conventional open pit will be developed by means of a 10 percent ramp that will be located on the west wall of the pit.

Mining during the first eleven years of operation will involve leveling the selected open pit location to the 355 m elevation. To eliminate pit slopes within the clay that exceed 30 degrees the South mining limit has been set at the 425 m elevation. From the 425 m elevation 10 m contours have been drawn on the following plan that shows the current pit area.

A geology plan of the open pit area shows that the area is mostly comprised of the higher grade claystone. A nose of waste rock shale protrudes from the West and extends half-way across the mining area. Mudstone is present in the steeply sloping ground to the South and completely surrounds the nose of shale waste rock. Much of the mudstone to the south will be cut-off due to the decision to begin mining North of the 425 m contour.

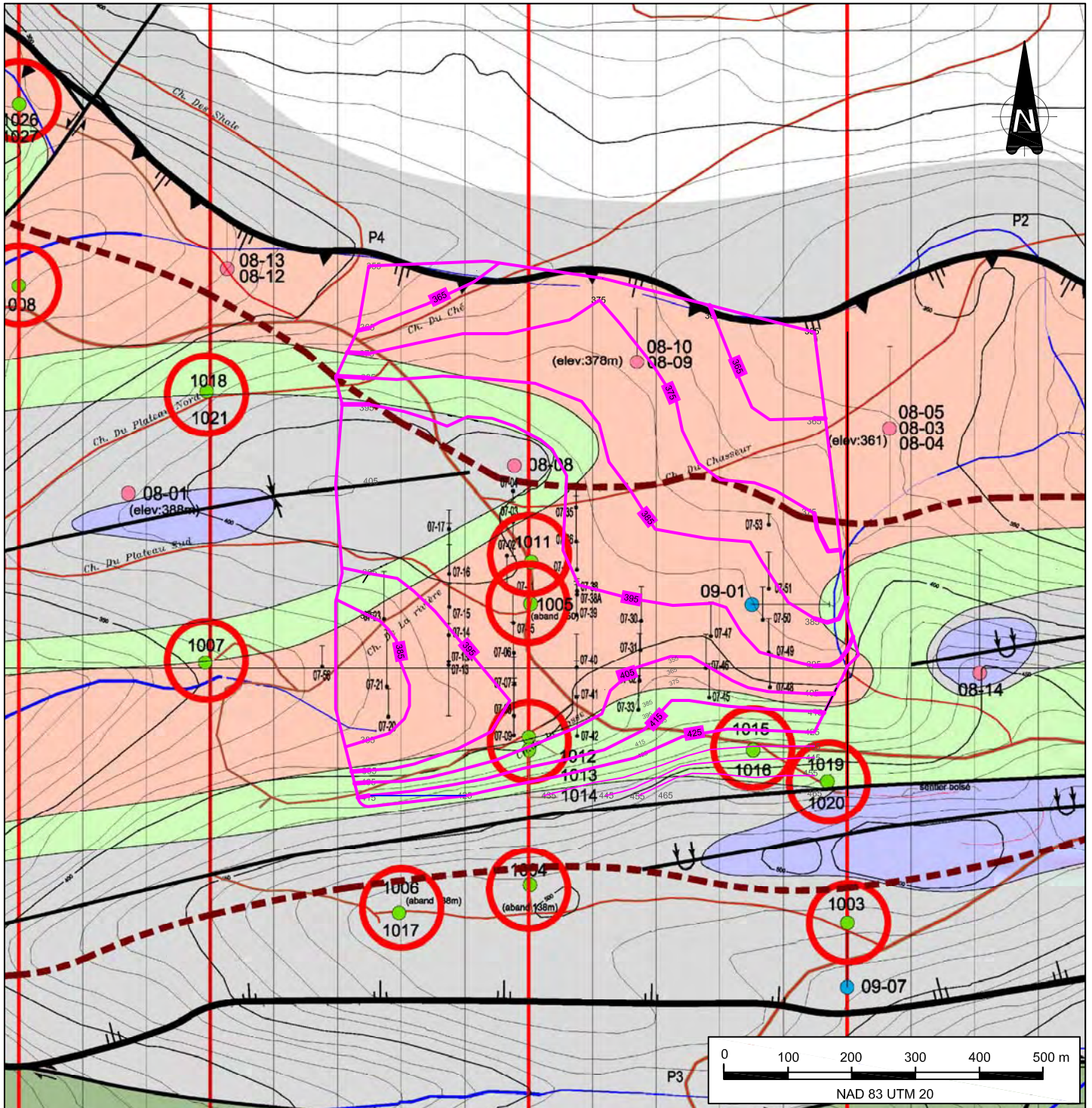
Overburden that covers the entire pit mining area has been scaled from geology sections and calculated to average 5.1 m in depth. Calculations show that approximately 37 million tonnes of claystone and mudstone are contained between elevations 355 m and 425 m. The waste rock nose of slate has been calculated to contain approximately 6.3 million tonnes of waste rock based on the assumption that the rock plunge is vertical.

The tonnage summary of this mining pit is illustrated as follows, in Table 16-3.

Table 16-3 Grande-Vallée Alumina Open Pit above 355 m

Bench	Area			Bench Depth	Tonnes		
	Total	Waste	Ore		Waste	Ore	Overburden
355	427,307	50,689	376,618	10	1,368,603	9,792,068	
365	401,418	50,689	350,729	10	1,368,603	9,118,954	
375	316,519	55,515	261,004	10	1,498,905	6,786,104	
385	221,535	60,488	161,047	10	1,469,858	4,187,222	
395	259,635	47,725	211,910	10	644,288	5,509,660	
405	49,351		49,351	10	0	1,283,126	
415	19,485		19,485	10	0	506,610	
425	34,225		34,225	10	0	0	
TOTALS				80	6,350,257	37,183,744	2,965,869
				Waste:Ore Ratio	0,171		
				Years Production	15		

The following drawing illustrates the 10 m bench contours (shown as purple lines) that have been used in the volume calculations.



- | | |
|---------------------------------------|-----------------------------|
| Rivière Ouelle Formation | L'Original Formation |
| Siltstone, Limestone and Conglomerate | Red and Green Argillite |
| Trois-Pistoles Group | Red Argillite |
| White and Pink Quartzite | 10m Bench Contour |
| Conglomerate | Borehole 2007 |
| Alternating Black Shale and Sandstone | Watercourse |
| Thrust Fault | Intermittent Watercourse |
| Syncline | Contour Line |
| Overturned Syncline | Main Road |
| 08-01 Borehole 2008 | Forest Road and Trall |
| 09-01 Borehole 2009 | |
| 10-0 Borehole 2010 | |



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Figure 16.1

Open Pit Mining above the 355 m Elevation

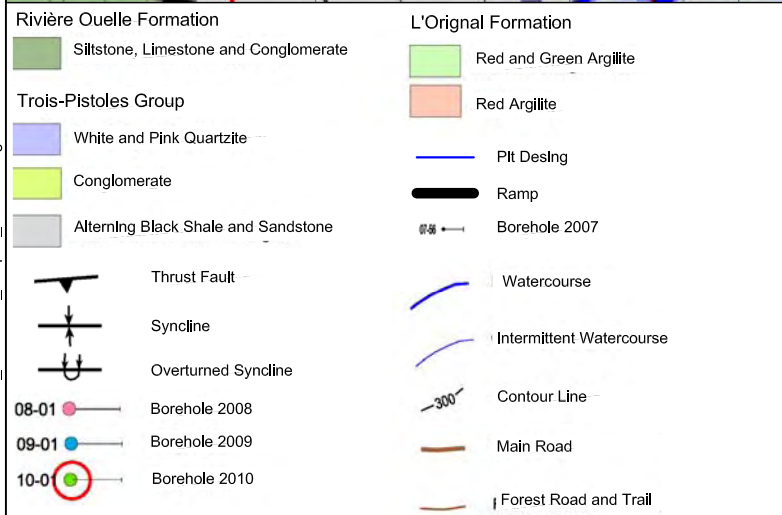
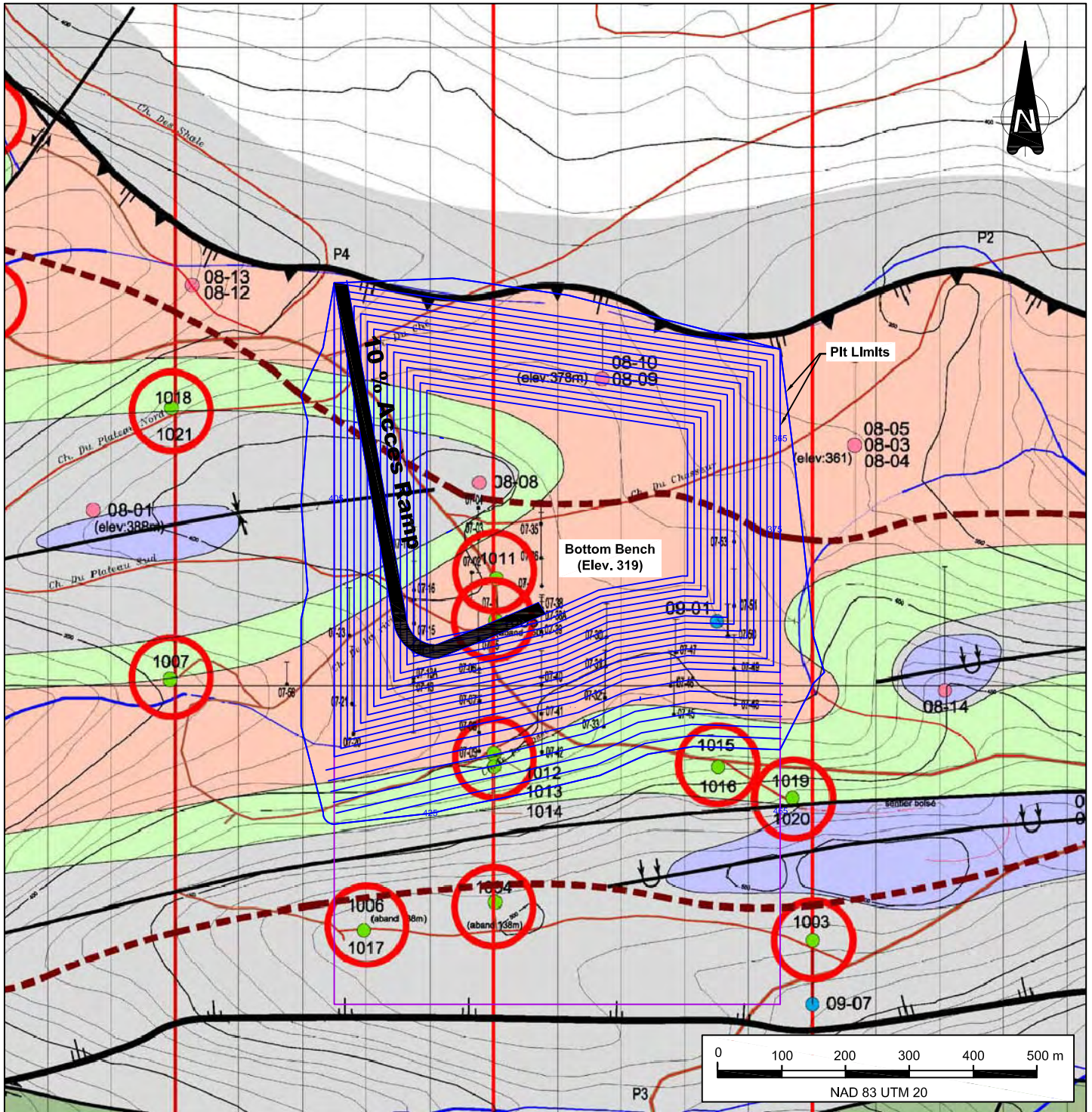
Source :
Levaque J.-G. 2011 - Compilation des Travaux Techniques Effectués sur la Propriété de Grande Vallée - Rapport technique 43-101

Prepared by: R. Doran
Drawn by: C. Theriault
Approved by: B. Fournier

January 12th, 2012 111-20434-00



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PRELIMINARY ECONOMIC ASSESSMENT ON METALLURGICAL GRADE ALUMINA PROJECT

NI 43-101 Technical Report


Figure 16.2

Open Pit Mining below the 355 m Elevation

Source :
Levaque J.-G. 2011 - Compilation des Travaux Techniques Effectués sur la Propriété de Grande Vallée - Rapport technique 43-101

Prepared by: R. Doran
Drawn by: C. Theriault
Approved by: B. Fournier

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A six bench open pit has been designed that allows for the mining of approximately 30 million tonnes of claystone and mudstone. When combined with the 37.2 million tonnes of clay in the levelling cuts the mining provides sufficient plant feed material to support operations for 25 years, 67.2 Mt.

Calculations show that approximately 4.8 million tonnes of waste rock will result during mining of the first six benches within the pit. This waste rock, when combined with the 6.1m tonnes of waste rock that will result during mining of the material above the 355 m elevation results in an overall waste: clay ratio of 0.15:1.

The tonnage summary of this mining pit is illustrated as follows, in Table 16-4:

Table 16-4 Marin Sector Alumina Open Pit Global

Bench	Area			Bench Depth	Tonnes		Cubic Metres Overburden
	Total	Waste	Resource		Waste	Resource	
Bench 1	427,307	47,725	379,582	6	773,145	5,921,479	
Bench 2	399,946	44,978	354,968	6	728,644	5,537,501	
Bench 3	373,488	42,295	331,193	6	685,179	5,166,611	
Bench 4	347,935	39,679	308,256	6	642,800	4,808,794	
Bench 5	323,285	36,887	286,398	6	597,569	4,467,809	
Bench 6	299,541	33,262	266,279	6	538,844	4,153,937	
Sub-Total					3,966,181	30,056,130	
ADD: Mining Above the 355 m Elevation					6,350,257	37,183,744	2,965,869
TOTALS					10,316,438	67,239,874	
					Waste: Resource Ratio	0.15	
					Years Ore Production	26.5	

A 10% ramp is located on the west wall of the pit. The following drawing illustrates the pit design:

Table 16-5 Mine Plan (2.45M tonnes/year)

Year Mined	Bench	Resource		Waste	Strip Ratio
		Bench	Cumulative		
		tonnes	tonnes	tonnes	
1	415	506,610	506,610	0	0
1	405	1,283,126	1,789,736	0	0
1-3	395	5,509,660	7,299,396	644,288	0.09
3-5	385	4,187,222	11,486,618	1,469,858	0.13
5-7	375	6,786,104	18,272,722	1,498,905	0.08
7-11	365	9,118,954	27,391,676	1,368,603	0.05
11-15	355	9,792,068	37,183,744	1,368,603	0.04
15-17	349	5,921,479	43,105,223	773,145	0.02
17-19	343	5,537,501	48,642,724	728,644	0.01
19-21	337	5,166,611	53,809,335	685,179	0.01
21-23	331	4,808,794	58,618,128	642,800	0.01
23-25	325	4,467,809	63,085,937	597,569	0.01
25	319	415,394	63,501,331		0.00
	TOTALS		63,501,331	9,777,594	0.15

16.6 Waste Material Management

During the pre-production and production stages of the Project, waste material will be removed and placed onto a waste rock pile, probably located to the South of the pit mining area. This waste rock stock pile area still have to be verified at Feasibility study. The design of the rock pile for the PEA was carried out on the basis of the total amount of waste rock and overburden excavated from the pit. No assumptions were made in regards to the waste rock being put to other uses.

16.6.1 Waste Pile Design

A total volume of approximately 3.6 million cubic metres of waste rock will be excavated during the life of the Grande-Vallée open pit mine. Another 3.0 million cubic metres of overburden (approximately) will be stripped from the open pit area. Much of the overburden will be temporarily stockpiled for use later on dressing the face of the waste rock pile and for use in mine closure vegetation promoting efforts.

The waste rock pile is located close to the mine to minimize the haulage distance and to reduce costs. The designated waste disposal area is approximately 2,000 metres long by 600 metres wide. The waste rock will be piled in 2m high lifts to form an overall slope of 2:1 (horizontal:vertical). The exposed face of the pile will be dressed with overburden and seeded to establish a vegetative cover to prevent erosion.

The waste rock pile has the following design parameters. The waste rock pile has the following design parameters:

- Face angle: 27°;
- Bench height: 2 m;
- Number of benches: 3.5.

16.7 Mine Operation

Orbite's Grande-Vallee pit will be mined using conventional open-pit mining methods, based on a truck/excavator operation. All equipment will be diesel powered.

The mining fleet requirement was calculated based on the production schedule presented in Table 16-4. All equipment is assumed to be owned by Orbite and operated and maintained by Orbite personnel. The mine will operate on 2 × 10-hour shifts per day, 7 days per week for nine months of the year. In this schedule 12 out of the 14 shifts per week will be covered for operations. The selection of the primary mining fleet is based on the production rate, mechanical availability and utility factors of the equipment, as well as the average cycle time estimates based on annual haulage profiles.

16.7.1 Loading and Hauling

To enable flexible mine operations in a clay resource a conventional shovel/truck operation is planned. Cat 740 (40 tonne) articulated trucks complete with heated hydraulic ejector boxes were selected. These units are four wheel drive trucks that have a proven history of working well in clay conditions. The number of trucks operating at any given time is dependent upon the annual production rate and varies over the course of the life of mine.

Cat 345DL excavators were selected to perform the pit digging and truck loading operations. To ensure capability with the trucks and 6m mining benches these units will be equipped with 3.5 m³ buckets and the R3.4T stick length. Loading operations will also be assisted by a wheel loader to maximize the flexibility of the operation. The loader will be used as a replacement for the excavator in down-time situations

as well as for other tasks involving material displacement, such as assisting with the loading/unloading of material onto transport trucks.

Waste rock stripping will be performed by a Cat D10T dozer with a single shank (deep) ripper that will allow loading and transportation of the relatively soft shale rock to the waste rock storage area. This large dozer will eliminate drilling and blasting operations in the pit as well as the need for cap and powder magazines at the mine.

Cat 980 loaders will be used to perform loading and light dozing duties that are required by the mine operating crew and the loading for local storage of the currently silica and mixed oxide products production, if those happen to be non-marketable; which is assumed no to be the case at this point.

16.7.2 Other Support and Fixed Plant Equipment

A Cat 160M grader will be used to maintain the mine haulage roadways.

General dozing and waste rock pile rock pushing duties will be performed by a Cat D8T dozer.

The feeder downstream of the primary crusher/sizer will load the crushed aluminous clay onto the main conveyor that will feed the plant feed storage building travelling conveyor. This overhead conveyor will distribute the plant feed within the large plant feed storage building

Other mine support facilities will be composed of:

- Orbite's plan is to have the mechanical/electrical shop office/dry complex within an annex portion of the plant;
- Mobile equipment fuelling station;
- A pit dewatering system and pipeline to the mine water settling pond;
- A mine roadway system connecting the pit workings to the plant complex, primary crusher/sizer area and the waste rock storage area.

16.7.3 Equipment - Annual Fleet Requirements

Equipment requirements were based upon truck specifications and productivity guidelines as provided in the Caterpillar Performance Handbook.⁽¹²²⁾ Included in these calculations were equipment availability, haulage distances and production requirements.

The requirements for auxiliary support equipment were determined primarily based on the scale of the operation, the size and location of the active waste rock pile, and

length of haul roads to be maintained. The main auxiliary fleet will consist of the following:

- CAT D8 track type dozer;
- CAT 160M motor graders.

The complete list of major mine and auxiliary support equipment is listed in Table 16-6.

Table 16-6 Annual Major Mine Equipment Requirements

Type	No.	Pre-Prod'n		Production Year																									
		1a	2a	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Excavator	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Haul Truck	10	8	8	8	8	8	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Wheel Loader	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
D8 Dozer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
D10 Dozer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Motor Grader	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Service Truck	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Crew Cab, Pick up 3/4t	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Single Cab, Pick up 1/2t	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lighting Tower	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Fleet	24	22	22	22	22	22	22	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18

16.7.4 Mine Personnel Requirements

The manpower requirements for the mine include all of the hourly staff working in open-pit operations that are required for the operation, and maintenance of all of the equipment involved with or supporting mining activities, as well as the salaried engineering and geology. GENIVAR estimates, that a total of 30 to 50 employees will be required to operate the mining and feeding operations. A maximum total of fifty (50) people are budgeted to perform pit operating, maintenance and engineering duties to support the open pit and plant feed preparation operations. After start up and optimization, should easily go down to 30 employees. Pit operations with up to thirty-three (20 to 33) people is the largest group in the mining department. The maintenance group, with up to thirteen (5 to 13) people is envisioned to support mine and plant feed preparation operations, and 4 people will perform all of the engineering and geological duties in the mine department.

The number of hourly personnel reaches a peak in the early years due to overburden stripping requirements. A complete list of the hourly personnel requirements are listed in Table 16-7.

The number of engineering salaried employees is 4. The mine and maintenance salaried supervisory staff positions will be covered by the plant operations and maintenance salaried personnel

The number of operators required for the major mining equipment (haul trucks, shovels, and dozers) was determined according to the number of operating units and the number of rotations, during which the equipment is in operation. Most of the operators for the major mine equipment are based on a three crew rotation of 10 hours per day. Hourly maintenance employee requirements were determined based on the amount of equipment that must be maintained.

Table 16-7 Annual Hourly Personnel Requirements

	No.	Pre-Prod'n		Production Year																								
		1a	2a	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Pit Operations:																												
Excavator Operators	5	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Haul Truck Operators	18	30	30	30	30	30	30	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Wheel Loader Operators	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
D8 Dozer Operator	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
D10 Dozer Operator	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Motor Grader Operator	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Service Truck Operator	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
General Labourers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sub-total	33	45	45	45	45	45	45	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Mine Maintenance:																												
Crusher Operator	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Conveyor Attendants	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
General Mechanics	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Welders	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mecanics - Mobile	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sub-total	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13

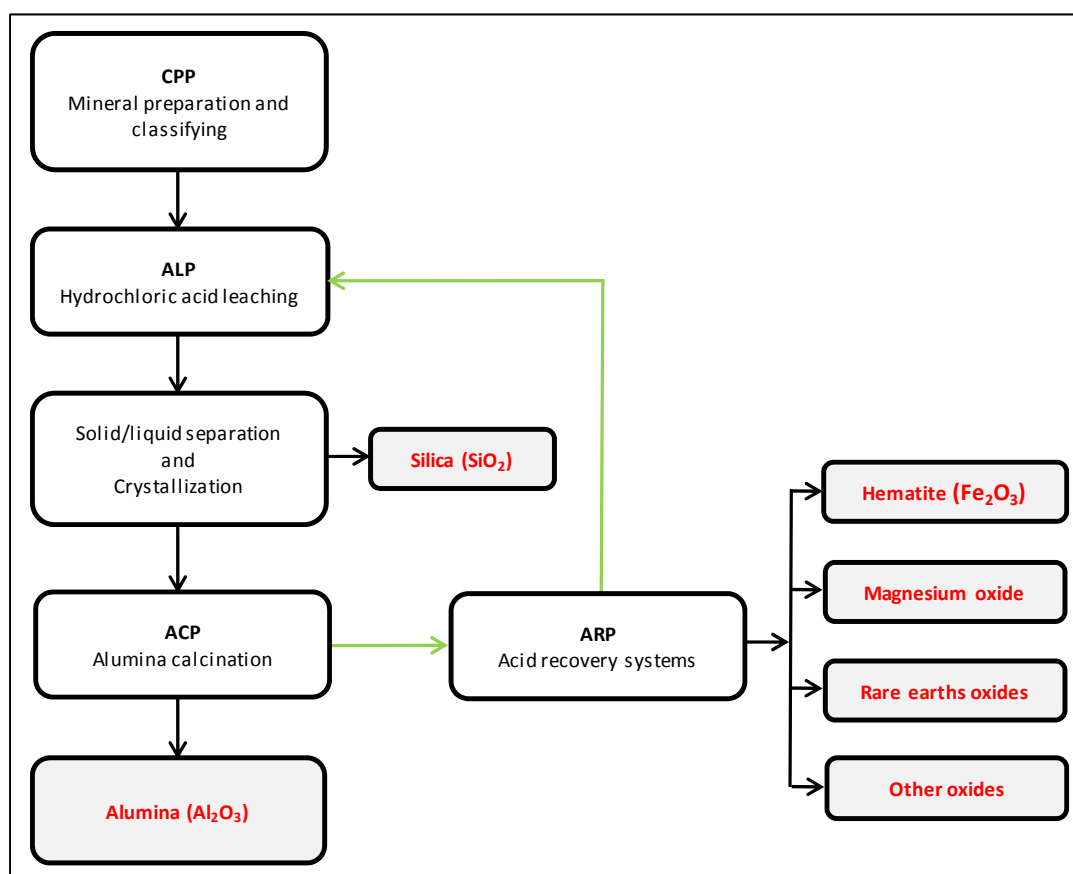
17 RECOVERY METHODS

Orbite's commercial approach to the production of metallurgical grade alumina includes using existing and adapted technology to ensure proper clay preparation and classification and adequate leaching with high hydrochloric acid recovery while purifying other categories of products and producing metallurgical grade alumina.⁽⁵⁹⁾

The plant design intends to use process know how from testing performed at Orbite's pilot plant facility and other associated pilot plants (2) in Europe, and include it into a continuous and highly efficient alumina (and other products) operation.

The alumina plant will be divided into sections as shown on the following figure, in its most simplified block flow diagram form.

Figure 17-1 Orbite Process Simplified Block Flow Diagram



Note that GENIVAR had access to the complete Process Flow Diagram (PFD)^(60,61,62,63,64,65) developed including its mass and heat balance, and that all

verifications and calculations for the Preliminary Economical Assessment (PEA) were done from it.

The main process sections are:

- CPP (Clay preparation plant) with the objective of grinding, drying and classifying the clay in view of the leaching process;
- ALP (Acid leaching plant). The leaching part is also associated with a continuous section where silica is separated after being washed counter currently with water. Objective is to recover all free HCl and chlorides apart from the silica and found into the leachate. Within ALP is where crystallizers are used to separate aluminum chloride from the remaining of the spent acid using bubbling technology with highly concentrated dry gaseous hydrochloric acid from the recovery systems;
- ACP (Alumina calcining plant) passing from the aluminum chloride directly to the oxides while regenerating ultra-highly concentrated acid;
- ARP (Acid recovery plant) with the objective of recovering acid while generating ultra-pure hematite under low hydrolysis temperature. Large amount of water is being evaporated at this step and elements prior removal allows concentration of value added elements (magnesium chloride, rare earths and metals chlorides);
- Pyrohydrolysis of Magnesium chloride following the ARP process is used to generate highly concentrated magnesium oxides, and recovering acid;
- Pyrohydrolysis of other mixed oxides; final stage where impurities building up within the system will be converted in mixed oxides, and recovering acid.

The Orbite process involves hydrochloric acid recovery and leaching at high concentrations (sub-azeotropic) using hydrochloric acid. All process, value added products, will be free from contamination and have the potential of being used as value added products.

This process will therefore allow the plant to meet and exceed the most stringent environmental emission standards always without generating any red mud which is associated with the standard Bayer process used for alumina production.

The first metallurgical alumina plant currently designed, is based on an Overall Equipment Efficiency -OEE ($OEE = Rate \times Quality \times Availability$) of 95% on a yearly basis and is designed to meet and exceed any figures from world class chemical installation on such comparable process.⁽⁶⁶⁾

The following table presents the expected and planned annual production capacity.

Table 17-1 Orbite Aluminae Annual Production Plan

Product	Production (tonne/year)	Percent of Total Production
Silica	1,228,628	58.77
Hematite	189,298	9.06
Alumina	539,711	25.82
MgO	27,816	1.33
Other Oxides	104,089	4.98
Rare Earths and Metals	974.50	0.047
TOTAL	2,090,517	100.00

17.1 General Overview of Recovery Method and Plant Design

As described in Section 16, the claystone/mudstone issued from the mine will be first reduced to 100% passing 40 mm, and will be conveyed to the plant. From the primary sizer the clay will be, using a 800 tph covered conveyor, conveyed into a clay storage building.

Figure 17-2 outlines the simplified and proposed chemical and metallurgical flowsheet. The Orbite proprietary process for recovering alumina (Al_2O_3), hematite, silicon dioxide, magnesium oxide, mixed oxide, rare earths and rare metals as oxides as value added products while recovering very high amount of hydrochloric acid, is based upon a high temperature and pressure leaching of the clay (claystone/mudstone). Following the secondary crusher where clay will have been further crushed and ground to 85% passing 230 mesh ($P_{85} = 63 \mu\text{m}$); leaching takes place in semi-continuous mode at approximately 160-165oC and approximately 4.0-5.0 barg using sub-azeotropic (20.1%-30% wt) concentration of regenerated hydrochloric acid (HCl) for few hours duration. This acid mixture dissolves all the soluble fractions of the clay (aluminum, iron, magnesium and all other metals) as chlorides, except for the silica that is insoluble.

The mother liquor recovered, also called spent acid, is then passed through successive concentration and extraction stages where eventually metal chlorides will be converted to oxides and hydrochloric acid is to be recovered. Coming back to leaching, which breaks the structure of the clay and releases all metal ions present in the clay others, iron (99.5% already into Fe^{3+} form), aluminum ions (Al^{3+}), and other metal in form of chlorides (including REE-Cl) must then be separated to produce alumina.

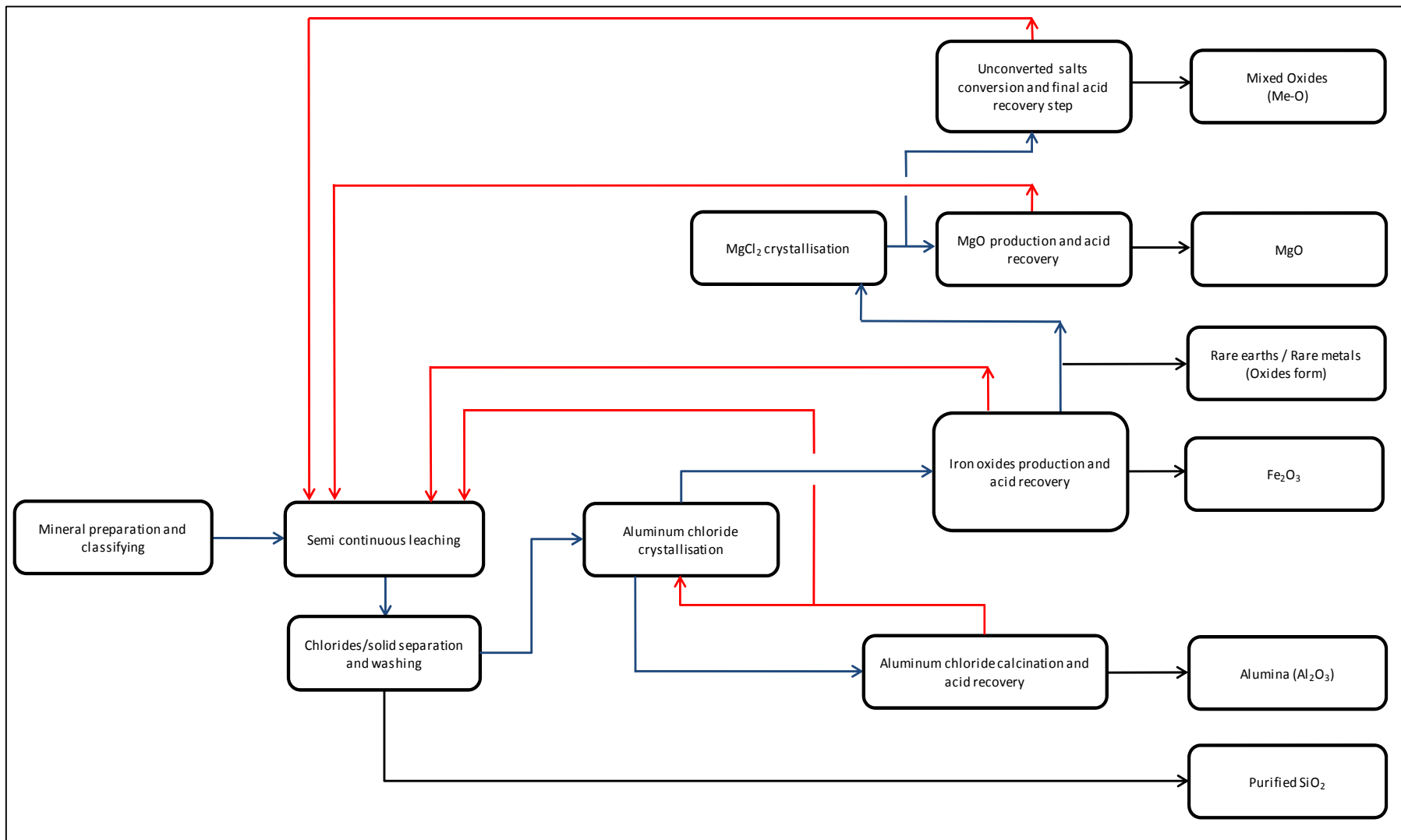
The slurry leachate is first filtered to separate the insoluble including all of the silica contained in the mother liquor, using a solid/liquid separation accomplished in continuous mode in order to clean silica, recover hydrochloric acid and any metal chlorides.

The mother liquor is then filtered to separate the insolubles including all of the silica contained in the clay. This silica is then washed, neutralized with sodium hydroxide and then dried for its marketable usage. The separation of aluminum (in the form of chloride) from the other metal chloride is done by sparging of highly concentrated and dry hydrochloric acid coming back, among others, from the calcination stage and other Orbite's process acid recovery systems. The increase in HCl concentration relative to the different chlorides present reduces the solubility of $AlCl_3$ and allows its separation from the mother liquor, creating aluminum chloride hexahydrate crystals. Aluminum chloride hexahydrate crystals conversion to oxides as Al_2O_3 through a calcination step will then be performed into large CFB (Circulating Fluid Bed) adapted to Orbite's process and currently being designed in coordination with Outotec GmbH ensuring high quality of metallurgical alumina (low LOI and very low alpha form) and high acid recovery of HCl high heat recovery. The calcination is one of the main aspects of the fundamental acid recovery loop in Orbite's process.

The second main component of the hydrochloric acid recovery arises from the hydrolysis at low temperature (hydrothermal process) of the main flow of spent acid after the $AlCl_3$ removal. The spent acid which consists mainly of $FeCl_3$ is pre-concentrated by evaporating water and free HCl and then hydrolyzed at 160-170 OC in order to produce pure hematite while recovering HCl at its azeotropic (20.1% wt.) point. The hydrothermal hydrolyzer acts as a concentrator allowing the concentration in fairly important quantities of the remaining elements ($MgCl_2$, RE-Cl, RM-Cl and other mixed chlorides) in solution. Known solvent extraction techniques, specifically for REE, are then applied to extract these and convert them in individual RE-O, Rm-O, eventually.

Magnesium being present into the raw clay, hydrochloric acid usage and its recovery allows with known techniques the selective extraction of other value added element. Magnesium chloride extraction to magnesium oxide (MgO) is the next basic process step and end of the acid recovery process route where all remaining impurities are converted to oxides and hydrochloric acid is recovered. Magnesium oxide is produced first by removing NaCl and KCl and then spray roasted to produce the oxide and again recover hydrochloric acid at its azeotropic point (20.1% wt.). The same approach then applies for the mixed oxides afterwards.

Figure 17-2 Simplified Flowsheet for the Chemical and Metallurgical Plant



17.2 Process Design

The overall process design criteria is presented in Table 17-2.

Table 17-2 Orbite metallurgical Alumina Process Design Criteria

Global plant Overall Equipment Efficiency		%	
OEE		95.0	
Plant throughput			
	tph	tpd	tpy
Clay feed to CPP (wet basis)	290	6,960	2,436,000
Finished Products			
Al ₂ O ₃	64.9	1,556	539,711
Fe ₂ O ₃			189,298
SiO ₂			1,228,628
MgO			27,816
Mixed oxides			104,089
<i>Rare earths and rare metals</i>			
Ga ₂ O ₃			76.1
Sc ₂ O ₃			48.1
Y ₂ O ₃			109.7
La ₂ O ₃			156.2
CeO ₂			323.3
Pr ₅ O ₁₁			40.4
Nd ₂ O ₃			139.9
Sm ₂ O ₃			26.4
Eu ₂ O ₃			4.9
Gd ₂ O ₃			20.9
Dy ₂ O ₃			18.5
Er ₂ O ₃			10.0
Recovery (design)		%	
Al ₂ O ₃		93.20	
Fe ₂ O ₃		92.10	
SiO ₂		99.95	
MgO		86.60	
Mixed oxides		99.75	
RE/RM-O		75.00	

What follows is a description of each of the operating areas required for the production of metallurgical alumina and other value added products using Orbite's process. Unless otherwise noted, throughputs and volumetric flows are shown for the 540,000 tpy Al_2O_3 reference plant (first production plant designed).

17.2.1 Primary Crushing and Transportation

As described in Section 16, the annual mine production schedule is based on 9 months of mining and stockpiling followed by a three month suspension of mine operations due to local conditions. This schedule may be amended somewhat to avoid periods of heavy precipitation and to ensure mining of a reasonably dry product. At the mine site 40 tonnes (Cat 740) articulated trucks with a conventional shovel/truck operation are planned. These units are four wheel drive trucks that have a proven history of working well in clay conditions of Eastern Canada. Plans call for a self-cleaning feeder to receive the material from the mine haulage trucks and to feed the primary crusher. Front-end loader will be used to transfer the clay to a conveyor that feeds the crusher. The primary crusher/sizer truck dump site with the MMD 500 sizer will reduce the pit mining claystone/mudstone to 100% passing 4 mm. Clay will then be conveyed using a 800 tph per hour conveyor to transfer from the primary sizer to the clay storage building. A heated storage building(s), with a live capacity of approximately 320,000 cubic metres of plant feed will allow suspension of the pit operations due to severe winter conditions. The large storage requirements will be met by either constructing a series of conical units each fed by conveyor from a central transfer point or construction of a single very large storage gallery with overhead conveyors fed from a central feed point as cement facilities have for example.

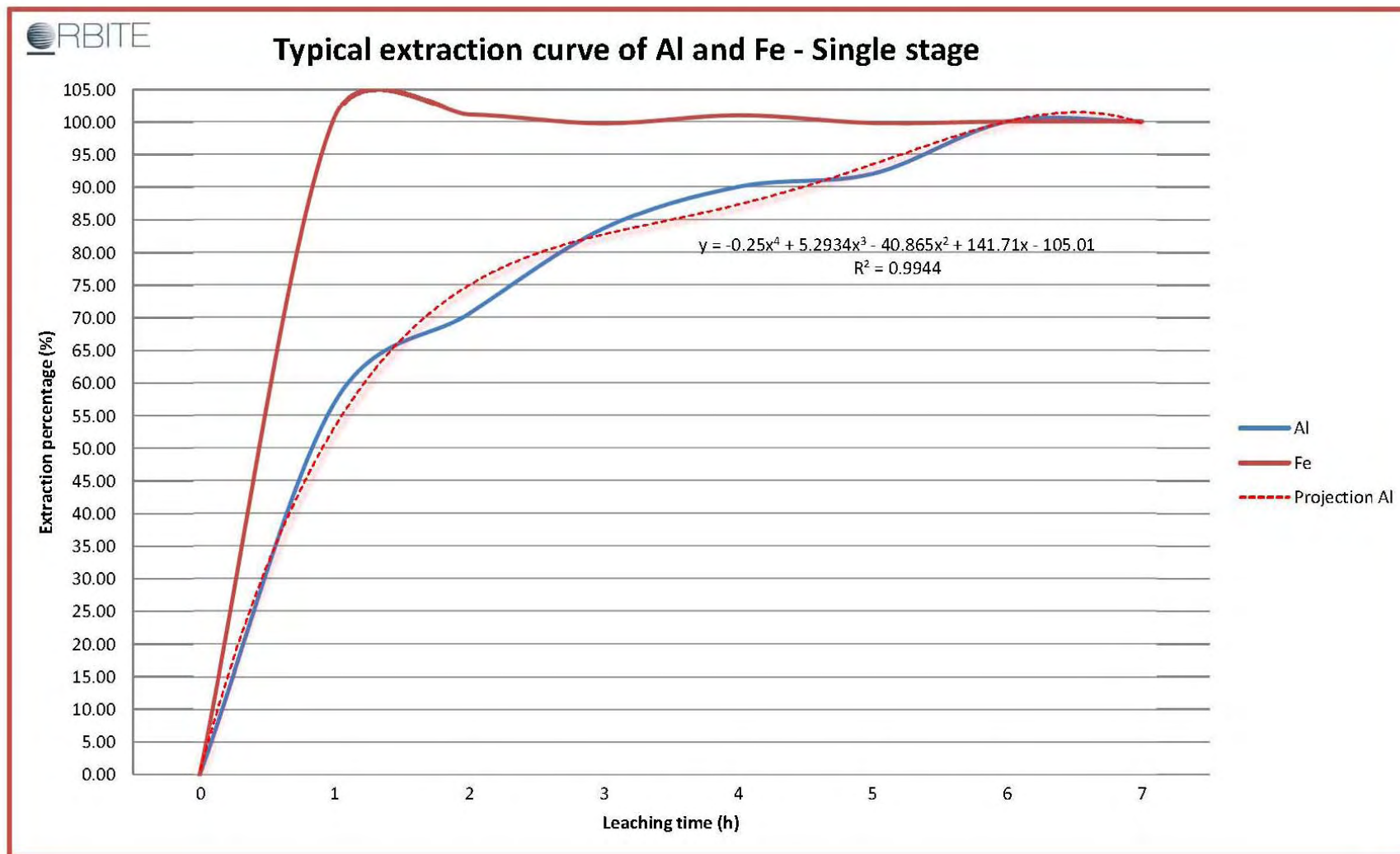
17.2.2 Secondary Crushing and Grinding (Clay Preparation Plant – CPP)

Secondary crushing of the claystone/mudstone is performed through vertical roller mills (Loesche, Raymond, etc. or equivalent) with integrated classifier and drying system operating at an average throughput of 150 tph, that will allow to reduce the clay to 85% passing (P85) 63 μm . A dry process for this steps, as opposed to one that is slurry- based, is favored due to the already high water content into the hydrochloric acid that is intended to be recovered, thus minimizing thermal energy cost to the facility. In the present arrangement, the crushed clay is transferred to an intermediate silo and then transferred to storage bin equipped with load cells, which will feed the leaching process by way of a standard belt conveyor and a special acid resistant double block valves rotary valve mounted on top of ALP reactors. Pneumatic transfer with a baghouse located on top of the storage bins has been considered. Conventional methodology for handling very fine powder in the cement industry is favored and will be detailed at the Feasibility study stage.

17.2.3 Leaching (Acid Leaching plant - ALP)

Following grinding, clay is fed to the leaching circuit, which is comprised of a series of glass lined reactors operated in semi-continuous mode. The global order of reaction is of a second order ($n=2$). The kinetics constant value based on operating conditions at the pilot plant was evaluated at $k = 0.5421 \text{ l/mole-h}^{(67)}$ and provided the typical extraction curve (see Figure 17-2). All compiled results are for a single stage leaching.

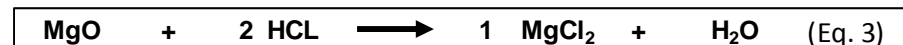
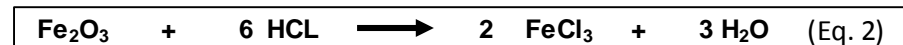
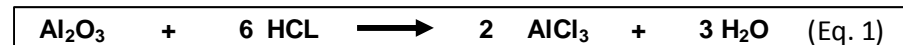
Figure 17-3 Typical Extraction Curve Single Stage Pilot Plant



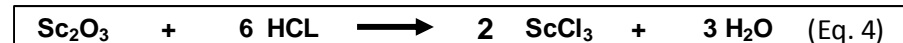
The ground feed material is reacted with the 18-26% wt. regenerated hydrochloric acid at the highest possible temperature (150-165°C) that allows not to exceed reactor's MAWP. A 4-6 hour residence time is needed in semi continuous mode where a series of coupled reactors which are joined together are envisioned.^(68,69) Different approaches do exist but scenario currently being designed will not be typical Cascade mode, since semi-continuous mode is a unique and distinct approach currently being designed to minimize number of reactors. Design of the commercial plant is taking advantage of the high incoming concentration regenerated acid and proprietary reactor arrangement to shorten reaction time.

Design of the commercial ALP plant in semi-continuous is made based on 97.5-98.0% extraction yield on Al. Iron (Fe) yield is 100% under these conditions. All metals from clay yield at ALP, is exceeding 95% in form of Me-Cl. Acid to clay ratio applied is such to ensure AlCl₃ concentration in spent acid of approximately 25-30%.

Some of the reactions describing the leaching can be written as follows:



...



... etc.

Leaching breaks the structure of the clay and releases all metal ions present in the clay. Again among others are formed; iron (mainly in Fe³⁺ form), aluminum ions (Al³⁺), and other metal in form of chlorides (including RE and RM-Cl) chlorides which must then be separated to produce alumina. The underflow from the thickener is pumped through a band filter, which will recover the leach residue. These solids can then be feed to a secondary leaching step of the semi-continuous mode, which recovers residual Al, Mg (Fe is already gone) under more aggressive conditions with higher strength hydrochloric acid (23%+) and still under pressure and temperature.

Leach slurry leaving the leaching reactors will thus be cooled and will be pumped to a surge vessel. The slurry leachate is then filtered to separate the insolubles including all of the silica contained in the mother liquor, called spent acid. The leachate is then pumped through a series of rake classifiers and band filters that allows recovering hydrochloric acid and any metal chlorides while cleaning solids (mainly silicon oxide). Spent acid recovered and wash water are then submitted to

the acid recovery system, and individual elements extraction. This section of ALP (solid/liquid separation) is named ALP continuous part, since separation is done in continuous mode using proven and adapted techniques.

17.2.4 Separation of Aluminum Chloride from Other Chlorides

After leaching and silicon dioxide removal, spent acid will be stored in 650 m³ spent acid storage tanks. The content is then submitted to a precipitation and crystallization stage in view of the aluminum chloride separation from the remaining of the spent acid. As stated, the separation of aluminum (in the form of chlorides) from the main solution is done by sparging of highly concentrated and dry hydrochloric acid coming back, among others, from the calcination stage and other Orbite's process acid recovery systems. The increase in HCl concentration relative to their impurities reduces the solubility of AlCl₃ and allows its separation from the mother liquor. Two sparging steps are required to reach purity of the crystal that will lead to the calcination of the aluminum chloride hexahydrate into metallurgical grade alumina (oxide).^(53,70,71)

Successful pilot test work performed with SMS-Siemag's Pilot Plants in Vienna, Austria⁽⁷²⁾ were undertaken for Orbite's Project. All these test tests were performed using Orbite's spent acid for which approximately 800 liters were sent for testing on the hydrothermal process, crystallization and acid recovery test program continuously over 2 months period. Preliminary results at the time of this Technical Report revealed that 2 steps crystallization stage is required, which yielded more than 95% on the Al₂O₃ recovery in all tests and allowed enhanced purification of the crystals.⁽⁵³⁾

Purity of alumina produced during the pilot test work exceeds the metallurgical grade specification with an aluminum chloride hexahydrate (AlCl₃•6H₂O) concentration greater than 99.97%, thus 99.9% minimum in form of oxide.

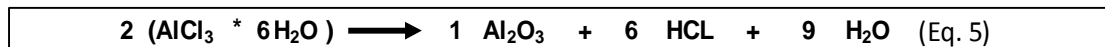
Design of the commercial crystallization stage which needs to process approximately 600 m³/h of spent acid is made based on 96-98% yield AlCl₃ on separation. The optimum and proprietary process parameters (residence time, temperature, pressure and HCl concentration) were established and confirmed, through the test performed with SMS-Siemag pilot plant facilities.⁽³⁷⁾

Under established and tested process conditions, iron and other impurities have proven to be kept principally in the aqueous form after crystallization. The iron-depleted solution leaving the crystallization/precipitation step, then becomes the feed stream to the hydrothermal iron hydrolysis while aluminum chloride hexahydrate is calcined at high temperature to produce metallurgical alumina.

17.2.5 Calcination (Alumina Calcining Plant - ACP)

Aluminum chloride hexahydrate calcination will be performed into large CFB's (Circulating Fluid Bed) adapted technology to Orbite's process by Outotec GmbH. Basic design will be a 2 stages fluid bed with high efficiency pre heating cyclones, thus ensuring high quality of metallurgical alumina (low LOI and very low alpha form) and high acid recovery of HCl using high heat recovery. Such a technology is well proven and relatively easy to adapt (CFB's) to Orbite process. Same applies with the acid recovery part which is also common for this type of application.⁽⁷³⁾

The following reaction is expected to occur within the calcination process:



The calcination is one of the main portions of the fundamental acid recovery loop in Orbite's process and design is made based on the following parameters:

- Residence time in CFB's: Proprietary information actually defined and tested;
- Design temperature: Proprietary information actually defined and tested;
- Alpha form: < 5%;
- Aluminum oxides purity: As per SGA standards;^(53,73)
- Hydrochloric acid regenerated concentration: 23 – 26%.

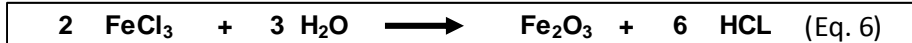
Aluminum oxides produced is then cooled (heat recovered) and pneumatically conveyed to onsite storage. Onsite storage of nearly 10 days (15,000 tonnes) was figured for the purpose of the actual Preliminary Economical Assessment of the Project.

Preliminary thermal energy requirements of 15 GJ/t Al_2O_3 , before any optimization, have been calculated by Outotec using ASPEN and past experience.⁽⁷³⁾ This value is considered conservative and will be validated by Outotec in the next stage of the basic engineering of the Project.

17.2.6 Hydrothermal Acid Recovery/Hematite (Acid Regeneration Plant - APP)

The second main portion of the hydrochloric acid recovery comes from the hydrolysis at low temperature of the main flow of spent acid after the AlCl_3 removal^(57,74) The spent acid which consists mainly of FeCl_3 is pre-concentrated by evaporating water and free HCl and then hydrolyzed at 160-170°C in order to produce pure hematite while recovering HCl at its azeotropic point (20.1% wt.). The hydrothermal hydrolyzer is thus acting as a concentrator allowing the concentration to raise by a few order of magnitude (MgCl_2 , REE-Cl and other mixed chlorides) in the remaining solution.

The principal reaction expected to occur within the hydrothermal process is:



Hematite is neutralized into sodium hydroxide reactor to ensure no traces of chlorides are left. Product is then dried and sent to onsite storage. Onsite storage of nearly 10 days (5,000 tonnes) was figured for the purpose of the actual Preliminary Economical Assessment of the Project.

Hydrothermal approach to produce pure hematite and recover hydrochloric acid is a proven technology developed by SMS-Siemag and actually operating on large scale at Thyssen Krupp's in Mobile Alabama, USA. SMS-Siemag also has a pilot unit in Vienna, Austria where hydrothermal process was operated, adjusted and tested with Orbite's spent acid. Hematite quality, acid strength and recovery yield, heat and mass balance were validated based on spent acid provided by Orbite in August 2011.

The hydrothermal is the second main portion of the fundamental acid recovery loop in Orbite's process and design is made based on the following parameters:

- Flow to be processed: approximately 600 m³/h;
- Number of parallel lines: Proprietary information;
- Design temperature: Proprietary information defined and tested in order to optimize Rm-Cl and RE-Cl among others;
- Hematite purity: > 99.5%;
- Hydrochloric acid regenerated concentration: 18.0-20.1%.

Preliminary thermal energy requirements of 14 GJ/t Al₂O₃, before any optimization, have been calculated by SMS Siemag using METSIM and Pilot plant results.⁽⁵⁶⁾ This value is considered conservative and will be re-validated by SMS Siemag in the next stage of the basic engineering of the Project.

17.2.7 Magnesium and Other Oxides Production

Magnesium being present into the raw clay, hydrochloric acid usage and its recovery allows the concentration and the selective extraction of other value added element. Magnesium chloride extraction to magnesium oxide (MgO) is the next basic process step and consist in the end of the acid recovery process route where all remaining impurities are converted to oxides and hydrochloric acid in recovered. Magnesium oxide is produced first by removing NaCl and KCl (these will not pyro hydrolyze) and then spray roasted to produce the oxide and again recover hydrochloric acid at its azeotropic point (20.1% wt.). Same approach for the mixed oxides.

The following basic reactions are known to occur in standard pyrohydrolysis process:



The reaction takes place at 800°C, generating magnesium oxide (MgO) and at the same time liberating HCl(g). A gas handling system similar to the calcination step will be required for gas cleaning and capture of HCl(g). This system will be equipped with a hot gas cyclone, venturi scrubber, an absorption column and water scrubber, en-route to releasing the combustion gases and water vapor to atmosphere.

These technologies (pyrohydrolysis) were not tested since they are known and off the shelf technologies well developed over the last 40 years. It is understood that spray roaster approach is targeted for MgO and other oxides approach in view of limiting energy requirements to the process.

Magnesium oxide (as per mixed oxides) is then sent to onsite storage. Onsite storage of more than 10 days (5,000 tonnes) was actually figured for the purpose of the actual Preliminary Economical Assessment of the Project.

The pyrohydrolysis is the last portion of the fundamental acid recovery loop in Orbite's process and design is made based on the following parameters:

- Flow to be processed: approximately 25 m³/h;
- Number of parallel lines: 2;
- Design specificity: Part of MgO could be passed as hydroxide and be used for RE and RM extraction (under design and testing) prior to calcination as individual oxides;
- MgO: > 95.0%;
- Hydrochloric acid regenerated concentration: 18.0-20.1%.

Preliminary thermal energy requirements of 1-2 GJ/t Al₂O₃, for all elements (MgO and mixed oxides) before any optimization, have been calculated by using METSIM and past experience.^(53,66) This value is considered conservative and will be validated in the next stage of the basic engineering of the Project.

17.2.8 Rare Earths and Rare Metals Concentration inside Orbite's Process

The hydrochloric acid recovery loop is the main carrier of the rare earths in terms of chlorides through the process. The fact that at each step of the process, elements (Si, Al, Fe, H₂O and free HCl) are removed and that chlorides happen to be following

the iron, the mother liquor through the hydrothermal process (SMS-Siemag) hydrolyzer happens to be highly concentrated in rare earth and rare metals.^(53,75) Those facts (high concentration of REE-Cl) leads then to the usage of know solvent extraction techniques in view of producing rare earths and rare metals in terms of oxides.

We have reviewed results from SMS Siemag⁽⁵³⁾ and throughout the whole Orbite's process yield of chlorides after second crystallization step does exceed 90% recovery on average under certain controlled processing conditions. In one example and under specific conditions, scandium chloride recovery is 99.5% and Erbium chloride is 95.7%. Additional testing leading to basic design activities was actually ongoing at SMS Siemag at the time of this Technical Report to optimize processing parameters and concentrate elements within the acid recovery portion and benefiting from concentration factors.

17.2.8.1 Typical Extraction Technique and Recovery Observed

Orbite, based on the concentration factor expected and realized through actual pilot test work at SMS-Siemag (example scandium expected to be in the 2-4% range in the concentrated phase after all other elements removal) is envisaging the possibility of extracting the rare earths elements individually using known and proven technologies of countercurrent solvent extraction. With the choice of the proper and specific solvents, a typical sequence of extraction elements can be accomplished. For example, Gallium would be extracted first, followed by Cerium, Scandium, etc up to Europium as the last element to be extracted. The sequence of extraction⁽³¹⁾ being developed is confirmed through ongoing test work to be extremely important but known for example for most of these (gallium, scandium, etc).

Based on the preliminary test work accomplished and the results obtained (90% + recovery within process and relatively high concentration factor obtained under continuous work over months period, it is reasonable and conservative to use a 75% global recovery of the rare metals and rare earths elements in the form of oxides, leading to an approximate amount of 974.5 tons per year production (Total Rare Earth Oxide ratio (TREO) equivalent is expected to be: 0.49).

Results from 2011 RM and RE exploration work revealed to be (see section 14) equal to 573 ppm oxides (477 ppm metal). Preliminary data from the study, before final compilation of 2011 test work was 431.62 ppm total RM+RE. In order to be conservative, GENIVAR considered 442 PPM as the reference concentration of the elements with a 75% recovery, which is within 7% of the Inferred resources declared in Section 14. All metal concentration used (hypothesis for PEA 442 PPM, Inferred resources 477 ppm and Preliminary data from PEA study before final Inferred resources confirmation 432 ppm) are within the min / max of 2011 Exploration work. Table 17-3 describes these figures utilized.

Table 17-3 RM + RE Recovery, Yields, Hypothesis

	OXIDES						METAL		
	Chap 17.3 tpy@75%	tpy@100% /,0,75	tpd /350	gpd /1000000	gpt /6960	ppm -	Hypothesis PEA ppm *,80	Data 43-101 PEA	Data Preliminary 28 nov
Ga	76.10	101.47	0.29	289488.23	41.59	41.59	34.52	33.46	30.81
Sc	48.10	64.13	0.18	182974.82	26.29	26.29	21.82	16.98	17.07
Y	109.70	146.27	0.42	417304.32	59.96	59.96	49.76	51.05	47.03
La	156.20	208.27	0.59	594192.66	85.37	85.37	70.86	78.99	72.49
Ce	323.30	431.07	1.23	1229849.47	176.70	176.70	146.66	159.39	143.24
Pr	40.40	53.87	0.15	153683.63	22.08	22.08	18.33	19.81	17.59
Nd	139.90	186.53	0.53	532186.64	76.46	76.46	63.46	74.63	65.28
Sm	26.40	35.20	0.10	100426.93	14.43	14.43	11.98	14.14	12.38
Eu	4.90	6.53	0.02	18639.85	2.68	2.68	2.22	2.60	2.31
Gd	20.90	27.87	0.08	79504.65	11.42	11.42	9.48	11.22	9.89
Dy	18.50	24.67	0.07	70374.93	10.11	10.11	8.39	9.89	8.76
Er	10.00	13.33	0.04	38040.50	5.47	5.47	4.54	5.23	4.77
	974.40	1299.20	3.71	3706666.64	532.57	532.57	442.03	477.39	431.62

The 3 columns of metal are all within min and max of 2011 campaign
 Difference between 442 ppm (actual reference for PEA) ppm metal and 477 ppm (43-101 PEA), is 7%.

Data from November 28 presented in Table 17-3's column is a first hand estimate.

17.2.9 Summary of the Basis of Recovery of the Orbite's Metallurgical Grade Alumina Process

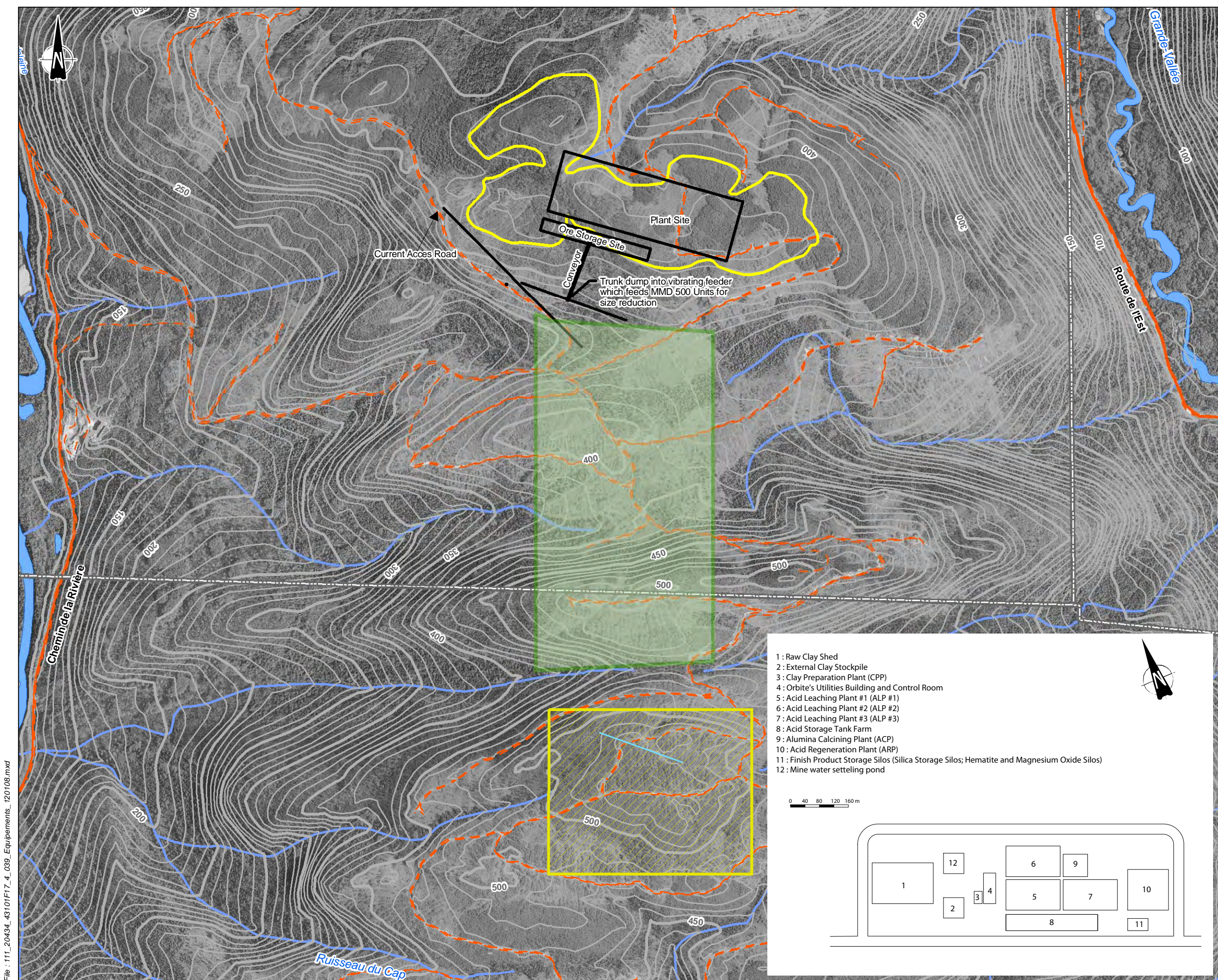
GENIVAR has reviewed the pilot test work and ongoing studies related to the large scale metallurgical alumina targeted plant, performed at Orbite's pilot plant, SMS-Siemag Pilot plants and Outotec GmbH, among others, over the last few months.

Yield on all elements on the test work exceeds 90% mainly due to the approach of leaching with hydrochloric acid and using adapted technologies to thereafter extract selectively value added elements while regenerating acid. Combined operational units yield on average 93.18% Al₂O₃ recovery on the global process while acid recovery system is being designed with 99.75% recovery using adapted acid regeneration to Orbite's process.

SMS-Siemag continuous test program over last 3 months period (crystallization in 2 steps among these) allows more than 95% Al₂O₃ recovery and allows purification of the crystals. Purity of alumina produced during the test work exceeds the metallurgical grade specification with an aluminum chloride hexa-hydrate (AlCl₃•6H₂O) concentration greater than 99.97%, thus 99.9% minimum in form of oxides. All these test tests were performed using Orbite's spent acid. Acid recovery systems using proven technologies in regenerating hydrochloric acid to minimum its azeotropic point and sub-azeotropic, allows the concentration of other elements on form of chlorides which were proven, among others, through testing at SMS Siemag.

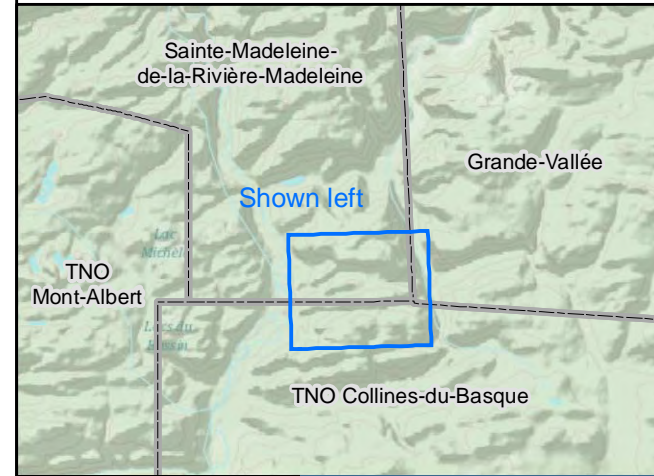
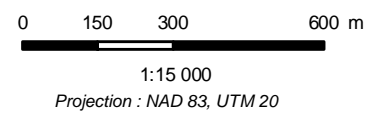
It was demonstrated that those elements tend to follow the iron route (hematite) through the elements separation. Traces elements (ppm) are lost with the aluminum chlorides and internal circulation loops, help to concentrate all elements. Apart from the magnesium and other oxides route, RE and RM which are recovered in large portion with the acid are concentrated to some extent in the hydrolyser reactor of the hydrothermal process: allowing a conservative recovery of these elements of 75% as the basis for this Preliminary Economical Assessment.

Next figures (Figures 17-4 and 17-5) illustrate a general plant layout put together by GENIVAR of the proposed commercial plant. It is of course a Preliminary layout which will guide the future engineering work, and that will be refined during the Feasibility study stage.

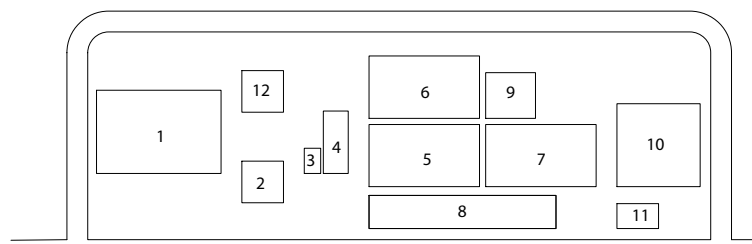
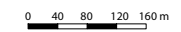


- Municipal Limit
- Proposed Mining Lease
- Main Road
- Acces Road and Trail
- Watercourse
- Contour line (10 m interval)*
- Proposed Tailing and Waste Material Storage
- Proposed Processing Plant
- Plateau (elevation : 420 m)

*Above mean sea level



- 1 : Raw Clay Shed
- 2 : External Clay Stockpile
- 3 : Clay Preparation Plant (CPP)
- 4 : Orbite's Utilities Building and Control Room
- 5 : Acid Leaching Plant #1 (ALP #1)
- 6 : Acid Leaching Plant #2 (ALP #2)
- 7 : Acid Leaching Plant #3 (ALP #3)
- 8 : Acid Storage Tank Farm
- 9 : Alumina Calcining Plant (ACP)
- 10 : Acid Regeneration Plant (ARP)
- 11 : Finish Product Storage Silos (Silica Storage Silos; Hematite and Magnesium Oxide Silos)
- 12 : Mine water settling pond



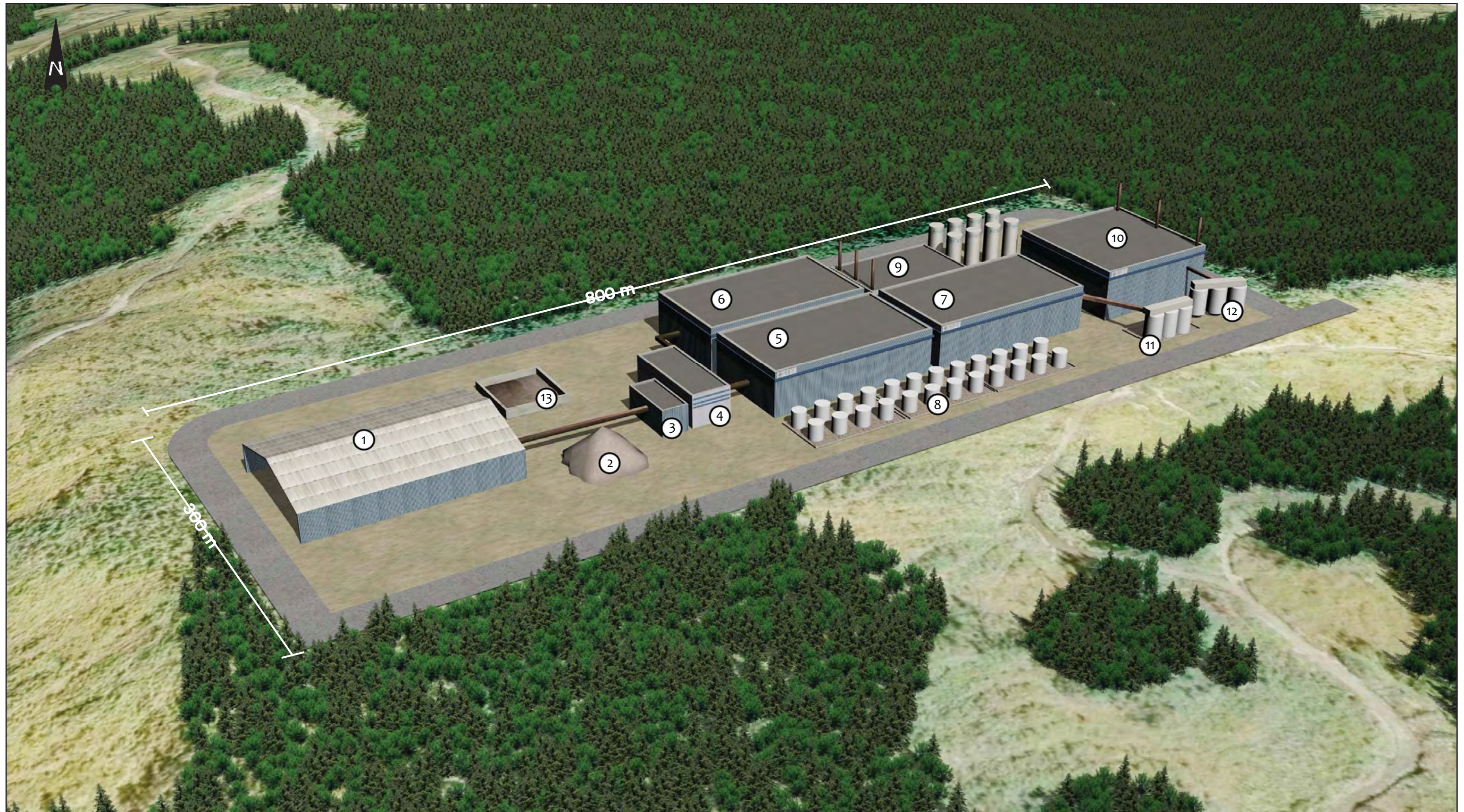
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Figure 17.4
Proposed Site Infrastructure and Topography

Sources :
Topographic Map :
-ESRI World Topographic Map
-CANVEC Data Base
Orthophotography :
-MRNF 2004 - Q04703_091 to 096 and 04708_162 to 166

Prepared by: É. Gingras
Drawn by: C. Thériault
Approved by: B. Fournier

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- | | | |
|---|------------------------------------|--|
| 1. Raw Clay Shed | 6. Acid Leaching Plant #2 (ALP #2) | 11. Silica Storage Silos |
| 2. External Clay Stockpile | 7. Acid Leaching Plant #3 (ALP #3) | 12. Hematite and Magnesium Oxide Silos |
| 3. Clay Preparation Plant (CPP) | 8. Acid Storage Tank Farm | 13. Mine Water Settling Pond |
| 4. Orbite's Utilities Building and Control Room | 9. Alumina Calcining Plant (ACP) | |
| 5. Acid Leaching Plant #1 (ALP #1) | 10. Acid Regeneration Plant (ARP) | |

Prepared by: E. Gingras
 Drawn by: D. Palardy
 Approved by: B. Fournier

GENIVAR Project : 111-20434-00
 January 2012



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 METALLURGICAL GRADE
 ALUMINA PROJECT
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Figure 17.5
Proposed Metallurgical Aluminae Plant Layout

17.2.10 Water Management

Water is used in many areas of the process (mostly at the silica solid liquid separation and at the crystals dissolution) and must be minimized to maintain water balance, thus avoiding unnecessary evaporation. Relatively clean water (containing some HCl) will be generated from the solid liquid separation stage after ALP. This wash water will be collected into the tank farm and rerouted to pyrohydrolysis venture systems, absorption column overhead and crystals dissolution. Many circuits of the acid recovery part can accommodate to process that water, but a proper global mass balance of the whole plant needs to be put together during Feasibility stage. The overall process will require a net input of fresh water (silica cleaning mostly) as water vapor exits the process by way of pyrohydrolysis.

Water that is used in the process for washing operations should be optimized to be circulating in closed loops as much as possible. Any excess wash water bled from these closed loops which should be under unstable conditions, will be transferred to a waste water treatment plant (WWTP). No allowance for a neutralization plant to precipitate metals by pH adjustment was made since all metals in the form of chlorides can eventually be converted to oxides or neutralized within the process.

De-mineralized water is also needed for the boiler system (high pressure with steam condensate recovery) and may be required for the aluminum chloride dissolution after first crystallization stage. In the present concept, an allowance was made anyway for a water de-mineralization package for the steam boiler which will be the big consumer. Note that, during Feasibility study stage, the potential of using thermal oil (indirect furnace) like Therminol 66 in some areas, will be evaluated to see the most cost (OPEX vs CAPEX) efficient heat transfer.

17.2.11 Solid Waste Management

Unlike the standard Bayer process for producing alumina from low silica bauxite, Orbite's does not generate any harmful (hazardous) residues at all. All products apart from the alumina have the very high potential, and are expected to be marketable and further beneficiated in certain cases.

17.2.12 Reagents

Hydrochloric Acid

The acid recovery system is designed to allow to meet the best practices in place and ensuring a recovery of more than 99.75% of the hydrochloric acid. Manufacturer of hypochlorite and hydrochloric acid (Olin and PPG) being fair distance away from the targeted site location, levels of recovery will need to be achieved. That being said

an allowance to receive hydrochloric acid by 32-tonne trucks as a 32% (10.1 N) HCl product has also been made. A storage capacity of 150 m³ reservoir has been made representing approximately 4 trucks allowing for a sufficient freeboard.

Organic Reagents

Only the REE part has the potential of using different organic reagents. The reagents will be delivered to site in 1000 kg intermediate bulk containers (IBC). For the REE plant, one IBC of each of the extractants will be kept by the SX circuit for make-up. The additional IBC containers will be stored near the REE area to minimize handling of the reagents. The organics will be added to the circuit individually with no pre-mixing to allow for concentration control.

Binding Agents

No binding agents are expected to be required as per pilot test work accomplished with SMS Siemag.

Flocculent

Flocculent could be needed eventually in silica acid solid/liquid extraction after ALP. Since this requires further testing during the Feasibility study, no actual accommodations were made for it at the PEA stage.

17.2.13 Services & Utilities

Process Water

All process water for the plant is intended to be supplied from the Madeleine river, which is located by the mine site. Provisions for pumping stations and water softening were made for, in this Technical Report.

Potable Water

The potable water demand of the facilities will be supplied by the fresh water treatment plant to be implemented by the mine site. Design to be accomplished by the company Mabarex. A provision for water purification system has been made for this Technical Report.

De-mineralized Water

An allowance for a de-mineralized water package has been made.

Steam

Medium and high-pressure steam will be required at the plant. An allowance for a package boiler has been made as well as the 25 MW cogeneration plant that will suffice the plant in steam requirement. To be finalized, evaluation, during Feasibility stage.

Plant Air

7 barg compressed air package (3000 scfm) has been made

Instrument Air

6 barg instrument air package (- 40 C Dew Point) has been made.

Power

Total plant power consumption, on a preliminary basis, has been estimated of 20 MW.

Fossil Fuel

Natural gas, biomass, or other source are required and account for approximately 25-30 GJ/t Al_2O_3 for all products produced.

18 PROJECT INFRASTRUCTURE

18.1 Project Infrastructure & Services

Activity at the mine and Plant site amount processing, at capacity, 2.45 M tonne of claystone/mudstone. The infrastructure and services needed at the mine during the initial site preparation are minimal, amounting to a few trailers, camp facilities for 10-15 people, a fuel depot, and a temporary dome structure for a mine garage, plus smaller ancillary buildings. These were considered into the initial mine CAPEX.

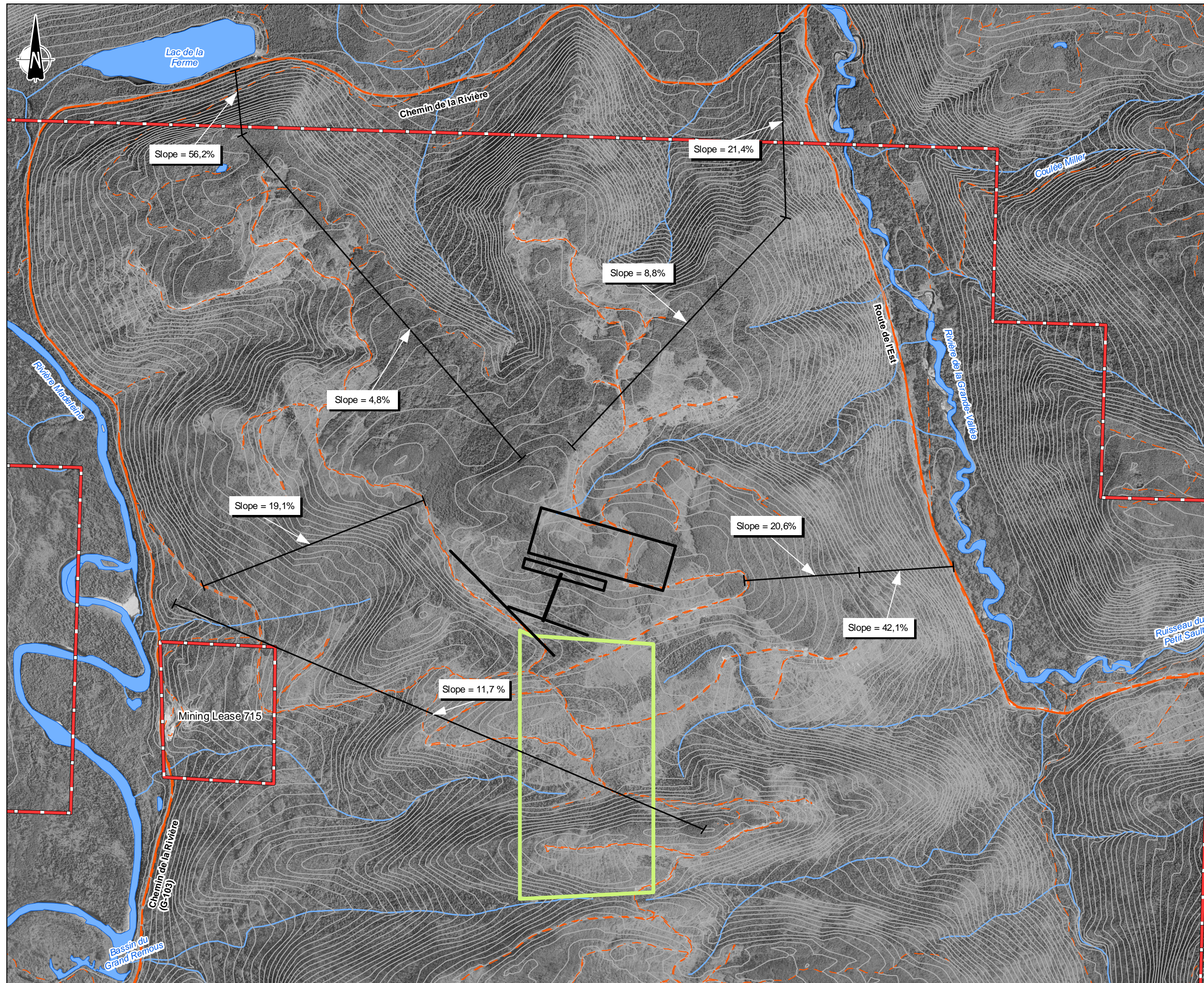
Electricity requirements will be met using a diesel generator set. Explosives management will be done by a contractor (if need be), with the overall intention to minimize capital expense at the mine.

Contract mining may be considered for the first preparation of the mine plan. Once organized and ready for operation, a decision will be made (evaluation to be performed and finalized upon Feasibility stage), whether contract mining or Orbite's direct employees will run the mine. The decision is significant, since this would further reduce capital expenditures, but at a higher operating cost per tonne mined would be encountered. As an assumption for the PEA, all Orbite's direct employees are considered and both CAPEX and OPEX in accordance.

18.1.1 Access Road

Current access to the mine and Plant site is currently gained by means of a 20 km long (12 km pavement and 8 km gravel) road from the coastal town of Grande-Vallée. This road (Route la Rivière or the the G-103 lumber road), connects the Plant to the former mining community of Murdochville, a distance of approximately 32 km to the South. The 8 km gravel section of G-103 Road to the North is expected to be upgraded to a paved surface as the majority of the mine service and support will come from the North.

The roads surrounding the Marin Sector are shown on Figure 18-1. The different site access options in terms of slopes to climb are also shown. Finally, it should be noted that the regional road network from Grande-Vallée and Murdochville can be consulted in Figures 4-1 and 5-1.



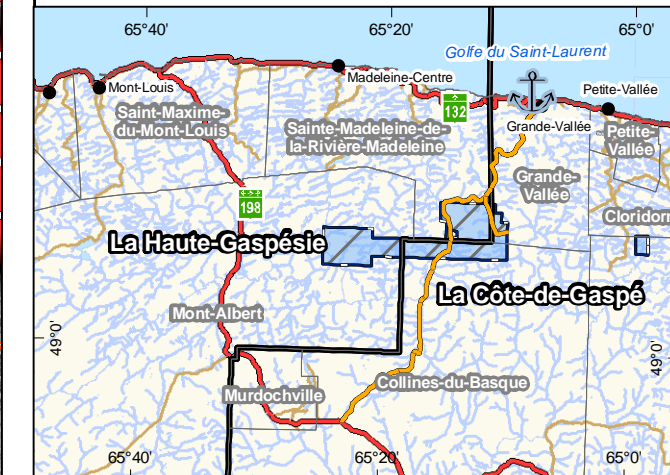
- Marin Sector
- Proposed Mining Lease
- Main Road
- Forest Road and Trail
- Lake
- Watercourse
- Contour Line (10 m intervalle)*
- Proposed Processing Plant

*Above mean sea level

0 200 400 800 m

1:20 000

Projection : NAD 83, UTM 20



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Figure 18.1
Access to the Site and Average Slope
in Marin Sector

Sources :
 Topographic Map :
 - ESRI World Topographic Map
 - CANVEC database
 Other Sources :
 - Étude de caractérisation
 environnementale - Map 4.1 (Roche) 2008-10
 Orthophotographies :
 - MRNF - Q04703_091 to 095 and 04708_162 to 166
 January 12th, 2012 111-20434-00

Prepared by : E. Gingras
 Drawn by : C. Thériault
 Approved by : B. Fournier

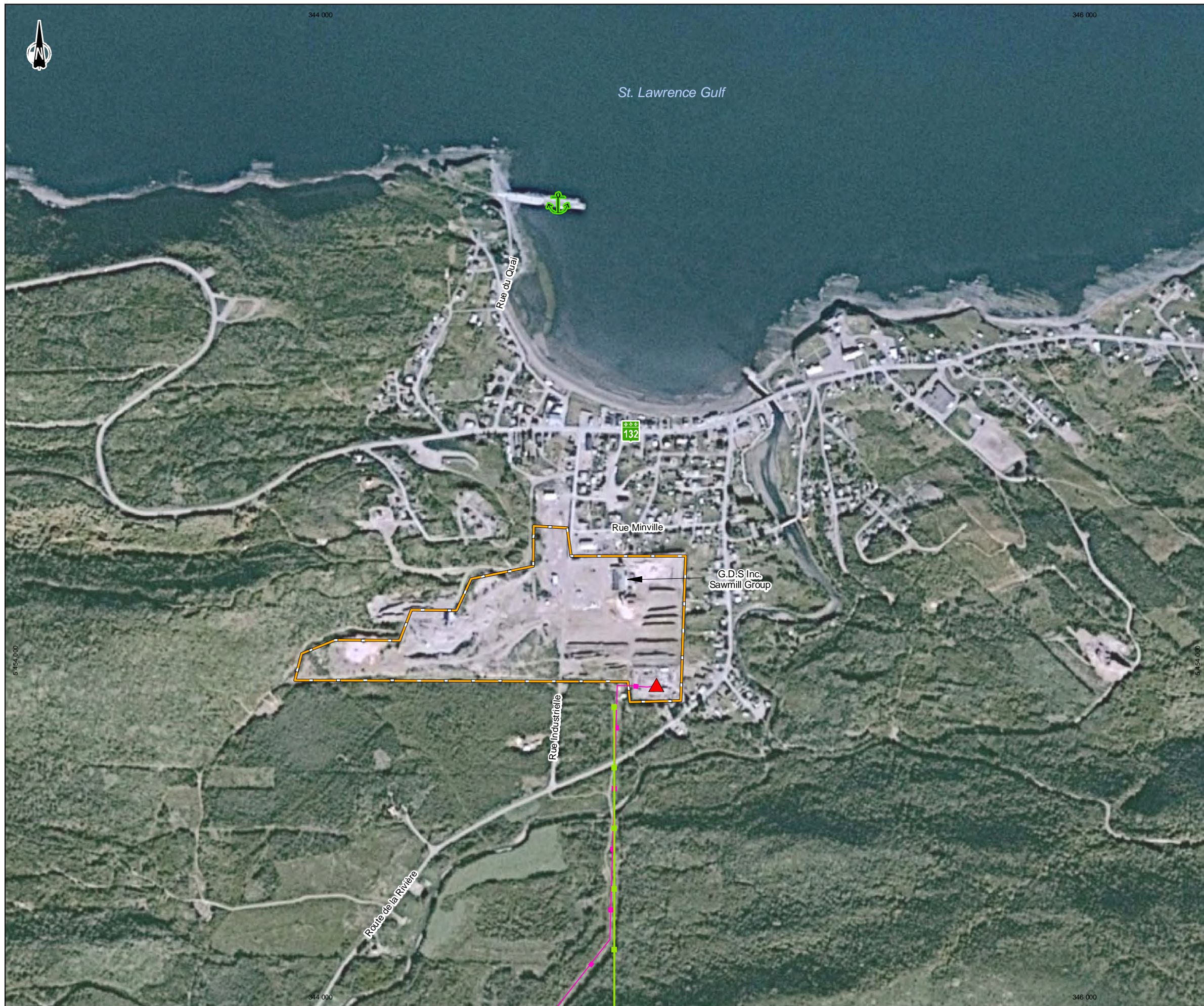
18.2 Grande-Vallée - Infrastructure & Services







At Grande-Vallée, trucks will carry from the produced alumina plant storage area (main product that will be produced at the Plant and that will be barged to aluminum smelters) into storage silos in the Grande-Vallée industrial park. The estimated 50 000 tonne storage area considered in this PEA and near the port of the same city, will allow storage (over 30 days), or until such a time that a sufficient amount has been collected for transfer to a self-loading barge. Transfer from silos to barge will be done pneumatically with pipeline that is setup to go North-West of Grande-Vallée to prevent interfering with existing area environment. The Grande-Vallée industrial area and port are localized on Figure 18-2. It has been assumed that the industrial area is available for storage silos installation.

18.3 Port, Rail and Road Network

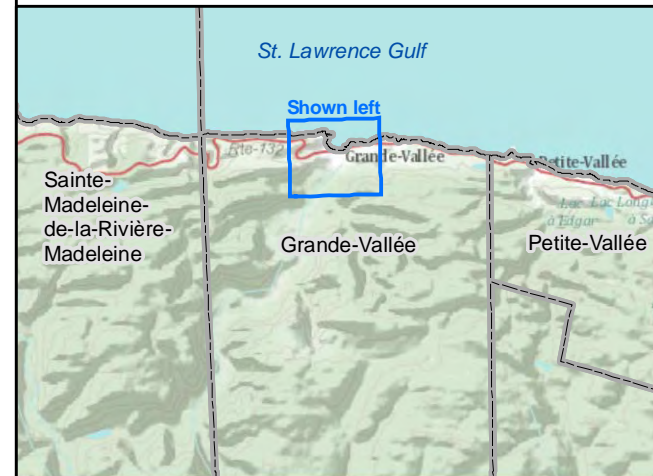
At Grande-Vallée, the industrial park is close to the port (Federally operated) and well connected to transportation networks (road), even though transport will be limited in the Grande-Vallée neighbourhood (see Figure 18-2). The park includes access relatively close to the port facilities, which are accessible year round.

The site area (mine, plant and Grande-Vallée areas) are not served by railway services. The railway is located on the south side of the Gaspesian peninsula and ends in Gaspé (see Figure 4-1).



-  MRC Limit
-  Approximative Limit - Industrial Area
-  Transformer Substation
-  Transmission line (69kV)
-  161 kV Transmission Line
-  Grande-Vallée Port

0 100 200 400 m
 1:10 000
 Projection : NAD83, UTM 20



PRELIMINARY ECONOMIC ASSESSMENT ON METALLURGICAL GRADE ALUMINA PROJECT
 NI 43-101 Technical Report

Figure 18.2
Grande-Vallée Urban Sector Overview

Sources :
 Topographic Map:
 -CANVEC database
 Orthophotography
 -CNES 2007 - From Google Earth Pro

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 Drawn by: C. Thériault
 Approved by: B. Fournier

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From the Plant site, Orbite has access to 4 deep water ports (Federally operated). Access to the deep water port at Gaspé is 139 km to the South East; travel on approximately 20 km of gravel road is required to reach paved highway number 198. This port was previously used by Gaspé Mines (closed in 2002) for shipping their copper concentrate and sulphuric acid. The port is currently used for the shipping aggregates and receiving of petroleum products from Ultramar and Irving oil companies.

Access to Matane, a deep water port on the south shore of the Saint Lawrence River is approximately 163 km to the Northwest. Matane is approximately 70 km west of Orbite's actual pilot plant at Cap-Chat.

The Federal port facilities at Mont-Louis, located approximately 51 km East of Grande-Vallée, and 70 km from the mine site, have not been used since 1995 and are currently classified as unstable, requiring considerable upgrading to regain operational status.

Access to the 500 foot long dock and barge capable facility at Grande-Vallée is approximately 22 km from the mine. This location has a breakwater that would provide protection from rough seas. The location is capable of bulk tonnage shipments with infrastructure upgrades and no major capital expenditures at this PEA stage. This is the preferred scenario considered for this Technical Report.

18.4 Mine and Chemical Plant Infrastructure

A few sites in the area have been evaluated, including the Murdochville location.

Studies have been done comparing the transportation costs for transporting mineral products over various distances. These studies support the following facts:

- Truck options are generally best suited for relatively short distances (up to 75 km) between mine and the Plant;
- As the distance between mine and refinery increases the more permanent overland conveyor, rail and pipeline transportation modes are generally employed to reduce the operating costs of hauling to the refinery.

The following comments are generally true when considering overland conveyors, pipelines and rail transportation systems:

- Overland conveyor systems are specifically designed to transport large quantities of material and are cost effective over distances of 15-100km. Although considerable, the 2.45 M tonnes of aluminous clay requiring transport in the Grande-Vallée project does not compare to the 10-20 M tonnes per year that is considered to be a large quantity. The costs of a conveyor system were not

considered as the annual tonnage involved was judged to be uneconomical for installation of such a system;

- In general terms pipeline transport does not become economical until transport distances of a few hundred km are reached;
- Rail transport is feasible for distances exceeding 100 km and excel in gentle terrain with only a few stream crossings. In considering the transportation of the mined aluminous clay from the mine to Murdochville by rail transportation a few negative considerations are obvious:
 1. The mine is located much higher than the Madeleine River along which the railway will be constructed. Since rail operations are restricted to 1 percent slopes this elevation distance will likely require a roadway down to a major truck dump/rail load-out facility.
 2. The truck dump/rail load-out facility will add to the mine capital and operating costs.
 3. Capital cost of the 30-35 km railway is estimated to total of approximately \$60M depending upon soil conditions, roadbed slopes and the number of river crossings.
 4. The sticky clay will cause build-up problems in the rail cars that can only be solved by additional labour that will be required to regularly clean the clay buildup in the rail cars. A tipple dump that provides a full 360 degree rotation will likely be required to take maximum advantage of gravity dumping. Ejector boxes in the mine trucks will eliminate clay build-up in the mine truck boxes.
 5. Back haul considerations are likely insignificant as the clay build-up in the rail cars will lead to product dilution problems.

Rail transportation capital and operating costs to transport the mined clay from the mine to Murdochville are estimated as follows (Table 18-1):

Table 18-1 Murdochville Rail Transportation Evaluation

RAIL TRANSPORTATION CAPITAL COST:		
	Number	Estimated Cost
Mine Load out Facility		\$ 3,500,000
Roadbed Construction (kms)	33	49,500,000
Major River Crossings	2	6,000,000
Smaller River Crossings	17	17,000,000
Murdochville Plant Rotary Tipple		3,500,000
TOTAL CAPITAL COST		\$ 79,500,000
Less plant Site Capital Savings*		\$ 34,000,000
NET ADDITIONAL CAPITAL COST		\$ 45,500,000

RAIL OPERATING COSTS:		
Rail Operational Costs @ \$1.50/tonne**	2,450,400	\$ 3,810,600
Extra Mining Costs @ \$0.10/tonne	2,450,400	254,040
TOTAL ADDITIONAL OPERATING COSTS		\$ 4,064,640

Rail Transportation to Murdochville Considerations

* Plant site capital savings are estimated to be plant site preparation \$1.5 million, plant site foundations \$2.5 million, 120kV power line \$18 million and mine/plant electrical sub-station \$12 million.

** Rail transportation operating costs have been estimated to be approximately \$1.50/tonne.

Based on the above evaluation and for the purpose of this PEA, the Grande-Vallée area by the mine site on a plateau at proximity was selected as the baseline and is actually shown on Figure 18-4 in its proper environment.

18.4.1 Location

The current mine and Plant site is located 20 km long inland from the coastal town of Grande-Vallée, on the South shore of the Saint Lawrence River where aluminum smelters can be easily reached.

18.4.2 Labor

The Gaspésie region used to rely on a large pool of qualified workers due to the Gaspé Mines that used to be present in the area. Expertise will need to be rebuilt and special training will need to be put in place by Orbite. Specialized operations technicians for chemical processes will be required to operate this large scale facility.

Specific training programs have been developed on chlorides operations by the Institut de Chimie et Petrochimie of Montreal, Quebec, and these will be adapted to Orbite's process. Mining, mechanics and electrician and instrumentation technicians are not an issue in building this facility.

The work environment is a positive one and industrial workers are awaiting such a Project; the region has one of the highest unemployment levels in the Quebec province. Orbite and educational institutions (college) of the region, along with the university, are already working together to ensure a workforce adapted to the needs of this very specific industry.

18.4.3 Electricity

The projected plant's power requirements have been evaluated at 300 kWh/t, equivalent to 20 MWh, which is typical of large-scale industrial clients receiving preferential industrial rates. Hydro-Québec does not normally give preferential industrial rates for electricity drawn from its 69 kV transmission lines, normally doing so only for electricity drawn from its 120 kV or 230 kV network. Under these circumstances, there appear to be 4 options available to the projected plant: The construction of a new 120 kV line leading from the Murdochville substation, or converting the existing 69 kV transmission line (see Figure 5-1) to a 120 kV transmission line. In both cases, modifications would have to be made to the existing substations, and a new substation would have to be built on the plant site.

A new 120 kV transmission line leading from the Murdochville substation would involve building over a distance of 30 km as described above over rough terrain. According to information at GENIVAR's disposal, such a project would cost approximately \$600,000/km over land that is forested and having rough terrain. Under the worst conditions such a project would cost approximately 18 M\$ meaning, CSA/NEMA regulations instead of Hydro-Quebec regulations, wooden poles with H frame, deforestation, drilling, dynamiting, access road material and construction of the line, quality insurance, as built plans and environmental permitting.

In addition, other costs such as \$5,000,000 for the necessary conversions at the Murdochville substation and \$8,000,000 for the site's substations would have to be taken into account. A second transformer could be required few years later for the up-grade of the plant. If the 2 transformers are built at the same time, \$12,000,000 have to be required for this work (two transformers, 120 kV isolating switches, circuit breakers, 120 kV measurements, a 4 160 volts distribution station and five 600 volts substations). The total cost for this option would therefore be approximately \$35,000,000.

The second option, the conversion of the existing 69 kV transmission line (see Figure 5-1) to 120 kV, would have to be the subject of intensive discussions with

Hydro-Québec in order to determine its feasibility. It is expected that the project would have lower associated costs. If the existing transmission lines are suspended by wooden poles and depending on the condition of the transmission lines, costs of \$100,000/km to \$200,000/km should be expected. Given that the transmission line is approximately 50 km long (from Murdochville to Grande-Vallée), the initial estimated cost would be approximately \$10,000,000 to convert the line voltage and perform any necessary line rehabilitation and upgrades. In addition, approximately 10 km of new transmission line leading to the site would have to be installed, with an estimated worst-case estimate of \$600,000/km, for a total of \$6,000,000 for the extension. Finally, approximately \$6,000,000 in existing infrastructure upgrades as well as to build a substation at the plant site would have to be taken into account. This would represent a total cost of approximately \$22,000,000 for this option.

The third option which can become the preferred option, involves the construction of cogeneration natural gas to electricity unit. A used 25 MW cogeneration unit (model GE LM 2500), would cost approximately \$8 M installed. This represents a major capital expenditure saving (\$27 M) when compared with the 120 kV power line construction. But this option is again subject to securing natural gas availability to the site.

A fourth option would be to have Hydro-Québec provide power from the 230 kV network (Anse Pleureuse substation) currently being revamped by Hydro-Québec (see Figure 5-1) and within 15-20 kilometer radius from the mine and plant site.^(76,77)

Regardless of the selected option, discussions with Hydro-Québec are already underway and best scenario will be chosen during the Feasibility study stage. First option, describe above, was considered as the baseline for the purpose of the PAE. Other options such as biomass to electricity, or biomass to flame unit are actually being looked at⁽⁷⁸⁾ by Orbite and will be complementary to the outcome of Hydro-Québec recommendations.

18.4.4 Fossil Fuel

Fossil fuel, or alternative fuels, are required to operate the plant. Even though the subject is detailed into Section 21, energy supply in the Grande-Vallée area represents one of the key elements of the Orbite project, like all mining and heavy industrial projects. For the purpose of the PEA, local natural gas is envisioned to provide the plant fuel requirements. At this time, there is no natural gas, in the Gaspésie area, that has been identified/classified as reserves under the NI 51-101 Standards of Disclosure. Gas exploration companies have identified the potential of several hundred billions of cubic feet of natural gas in the direct vicinity of the project but nothing again under NI 51-101 Standards of Disclosure.

Nevertheless, there is excellent known potential for natural gas and fuel in the vicinity although there is currently no production facility (wells or pipelines) in the Gaspésie area or in the general area where Orbite plans to construct its metallurgical grade alumina plant. A few oil and gas exploration companies are seriously intending to proceed with extraction wells in the vicinity of Orbite's site. For the purpose of this PEA, GENIVAR has assumed natural gas would be available and serviced by a approximate 2 400 kPag high-pressure natural gas pressure line, and that a short distance pipeline (within 15 km radius) would be built with reducing pressure station as required per code.

Several other energy sources are currently being assessed by Orbite and will be incorporated into the Feasibility study stage, including electrical with a biomass cogeneration plant and different fuel options, including extraction wells, bunker C, coal, fuel, etc.

18.4.5 Steam

Low, Medium and High-Pressure steam network will be required for the process and local heating areas. A steam condensate recovery will be built in order to minimize energy requirements. As will be stated into Section 21, an allowance for a package boiler package boiler and demineralization plant, for both was included in the capital cost estimate.

18.4.6 Water

No private water intake is located within the project's immediate zone of influence, as well, the closest residences are approximately 6 km to the North. No other use of groundwater has been registered within the same zone. Any lowering of the water table as a result of the project's operations is unlikely to affect other groundwater users, as long as the pit's depth does not exceed the expected 100 m.

In addition, the municipality of Grande-Vallée is served by a public water distribution system as well as a public sewer system. These networks extend along the first 12 km of Route 132 under the Municipality's jurisdiction, parallel to de la Rivière Road. The water distribution system's intake is a well drilled into the water table, located approximately 8 km along de la Rivière Road. The municipality of Sainte-Madeleine-de-la-Rivière-Madeleine also possesses a public water distribution network. However, their system's water intake is not located within the Madeleine River watershed, but rather in that of the Little Madeleine River, which directly discharges into the Saint Lawrence River.

Therefore, an alternative needed to be established to provide raw water to the mine and Plant site. The Marin Sector and the projected Project site, happen to be located between the Madeleine River and Grande-Vallée River watersheds. Both rivers flow

into the Saint Lawrence River, approximately 15 km North of the project. The Grande-Vallée River has an average flow of 2.7 m³/s, a maximum flow of 50.8 m³/s and a dry-season flow of 0.124 m³/s. The Madeleine River has an average flow of 28.4 m³/s, a maximum flow of 640 m³/s and a dry-season flow of 2.0 m³/s. It would appear that both rivers are able to provide the water flows required by the project. The plant is expected to require approximately 20 t/h of water. This flow represents 0.28% of the Madeleine River's hourly flow and 4.48% of the Grande-Vallée's hourly flow.

The raw water intake, once defined will need to be equipped with screened system and adequate pumping capacity in order to meet the industrial requirements for cooling and other various processes (demineralization, etc). An allowance for such an installation (pumping network, water intake, backup diesel pump, etc) was included in the capital cost estimate.

18.4.7 Hydrochloric Acid

Olin located in Bécancour, Quebec and PPG Canada Inc. Located Beauharnois, Quebec both operate processes with significant hydrochloric acid (HCl) production capabilities. The HCl purchased, for makeup purpose, which is expected to be minimal, will be stored onsite in a tank farm area with enough inventory to prevent risk of supply interruption.

18.4.8 Waste Material and Effluent

There are no waste material (hazardous) expected to be generated from the process. Should there be a large portion of material coming back to the mine area (SiO₂ purified for example), Orbite will need to have the written authorization of the MDDEP, before landfilling.

The location for the project's effluent treatment plant is planned to be on the boundary between the Madeleine River and the Grande-Vallée watershed. The decision for this location was taken given the sensitive nature of the Madeleine River's status as a salmon breeding river (a controlled zone). Negotiations will have to be entered into with the Madeleine River's management body and the MDDEP in order to determine the consequences that any spill may have on the river. Even though the Madeleine River represents a larger receiving matrix for the effluent produced by site operations, therefore presenting a higher rate of dilution for any such effluent than would the Grande-Vallée River, the latter should be chosen to receive the effluent produced by site operations given the former's sensitive status.

Agreements would nonetheless have to be entered into with the MDDEP regarding the determination of the effluent's environmental targets in order to avoid being subject to stricter targets given the receiving matrix' lower dilution rate. In conformity

with the regulations of the MDDEP, Orbite is committed to treat all wastewater generated before evacuation to eliminate all risks of pollution. Best practices on that side will be implemented and basic and detailed engineering will be done by Mabarex Inc., a leader in effluent treatments.

18.4.9 Telecommunications and Process Control System

There are several multi-purpose towers in the area which could be used for communication purposes, as well as cellular telephone service which has been available in the Grande-Vallée region since the end of 2010. Plant internal controls will be serviced by fiber optic cable, though a Delta V (Emerson) DCS operating system using charms and marshaling technology, therefore minimizing the wiring requirements during construction.

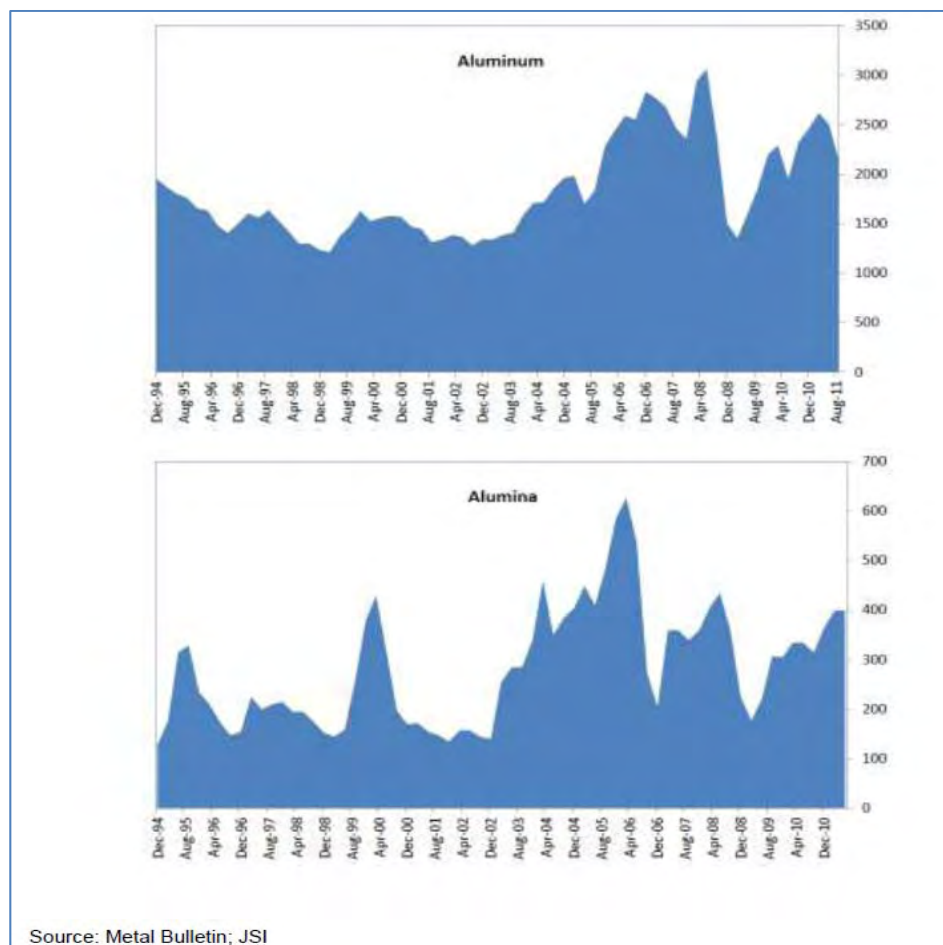
19 MARKET STUDY & CONTRACTS

This section prepared by GENIVAR QP, with the input of Orbite's representative, Dr. Marc Fillion, outlines the pricing assumption and market data for the products that will be manufactured from Orbite's process. The data presented in this report are for a single plant whereas Orbite's strategy is to build multiple plants to ultimately capture about 50% of the Quebec's alumina needs and initiate exports overseas.

Orbite's technology was principally developed to extract alumina from aluminous clay. The other elements contained in the clay will be extracted from the recovery of spent acid and have the potential to be marketed, but Orbite's primary focus is low-cost alumina processing.

Over the past decade the world economy fluctuated in cycles up and down. The aluminum and alumina prices followed the same trend.

Figure 19-1 Aluminum and Alumina Historical Prices (US\$/tonne)



The economy in the second half of 2011 showed a downtrend and so did the aluminum and alumina prices due to a weak global demand including Asia and India and economic uncertainty in Europe. As the economy strengthens and demand for aluminum increases, the price of alumina should follow the same trend and should be back to level before the last slowdowns in the economy (i.e. \$350-\$600/tonne).

Today's main sustainability challenges for the aluminum industry are natural resource extraction, habitat impacts, energy use, emissions and waste disposal. The companies have developed their internal environmental policy and are continuing to take measures to reduce their environmental footprint and to minimize the impact of their operations on global warming.

The economic analysis of the first SGA plant is presented in Section 22 with a sensitivity analysis using variations of +/- 40% in revenues for alumina, hematite, silica, magnesium oxide and other oxides, +/- 65% for rare metals and rare earths and +/- 20% for capital and operational expenses to take into account the potential fluctuations in revenue that could result from the usual economic cycles and the market price variations over the last 6 months.

19.1 Expected Quantities by Product

Table 19-1 Expected Annual Production from the Project Alumina Plant

Product	Production (tonne/year)	Percent of Total Production
Alumina	539,711	25.82
Hematite	189,298	9.06
Silica	1,228,628	58.77
Magnesium Oxide	27,816	1.33
Other Oxides	104,089	4.98
Rare Earths and Metals Oxides	974.50	0.047
TOTAL	2,090,517	100.00

Note: GENIVAR is basing the expected annual production for the proposed alumina plant on test work, as stated in Section 17 on the following expected recoveries:

- Alumina: >93%
- Hematite: >92%
- Silica: >99%
- Magnesium Oxide: >86%

- Mixed Oxides: >99%
- Rare Metals and Rare Earth as Oxides: >75%

19.2 Alumina Market

The challenge in extracting alumina from aluminous clay is to eliminate iron, silicium and other impurities, in both an economically viable and environmentally acceptable manner. Orbite's metallurgical alumina is expected to have a minimum Al_2O_3 content of 98.5%, while meeting or exceeding all other chemical and physical characteristics of the industry (minimum breakage <2%, alpha form <5%, minimal chloride content, adequate bulk density, etc.)

The alumina demand is driven by the aluminum production as the great majority of this material is converted to metallic aluminum. About 10% of the production capacity is used for other applications.

According to CRU International Limited, the market for SGA material is expected to grow from 80 million tonnes in 2010 to 120 million tonnes by 2016, growing at a rate of 6.6% a year compounded annual growth average (CAGR).⁽⁷⁹⁾

CRU International Limited is also foreseeing new demand for alumina production facility at a rate at some 4.6 million tonnes /year (or an additional 87.3 M tonnes) from 2017 until 2035 in order to maintain market balance.⁽⁸⁰⁾

19.2.1 Aluminum Applications⁽⁸¹⁾

At roughly 1/3 the weight of an equivalent volume of steel, aluminum is lightweight yet strong enough for a wide range of uses. It is a good conductor of heat and electricity, resistant to corrosion, and non-toxic, making aluminum suitable for a variety of industries. Major markets for aluminum include various consumer and commercial end markets such as transportation, construction and building, and packaging.

Buildings and Structures

Around one-fifth of the world's aluminum consumption is accounted for by the construction industry. Bridges, domes and roofing of markets and sports stadiums are among typical applications. Aluminum is highly suited for roofing, cladding, stairways, railings and the like. Its malleability and stylish appearance make it ideal for a variety of uses in window frames, doors and interior paneling.

Transportation

Around one-quarter of aluminum use is in transportation. Increasing priority is being given today to reducing the weight of transportation hardware such as aircraft, trains, ships and motor vehicles in order to reduce energy consumption and pollution. In this respect aluminum has overwhelming advantages because of its combination of lightness and strength. In aircraft construction, aluminum is used for frames, exteriors, wiring and electrical systems; and in the automotive industry it is used for frames, bodies, blocks, pistons, valves, bumpers, wheels and other parts. The use of aluminum in trains, buses and boats is also steadily increasing.

Packaging

Packaging accounts for around one-fifth of all aluminum use. Because of its qualities, aluminum has few rivals when it comes to the packaging of food, beverages and pharmaceuticals. Aluminum packaging is light and unbreakable but not bulky. Lower energy consumption is achieved and there are reduced distribution and recycling costs because transportation costs are kept to a minimum. The high thermal conductivity of aluminum also spells energy savings when drinks in aluminum cans are refrigerated.

Electrical Equipment

Some 10% of aluminum use is connected with electricity usage. In electric wiring systems, aluminum has almost entirely replaced copper. Aluminum is also increasingly replacing copper in transformers. Because of its malleability and other properties, aluminum can also be used in casing, mountings and other parts or equipment used in communications and electronics. Other applications include general office equipment, fuse boxes, satellite dishes, household appliances, television sets and sound systems.

Consumer Products

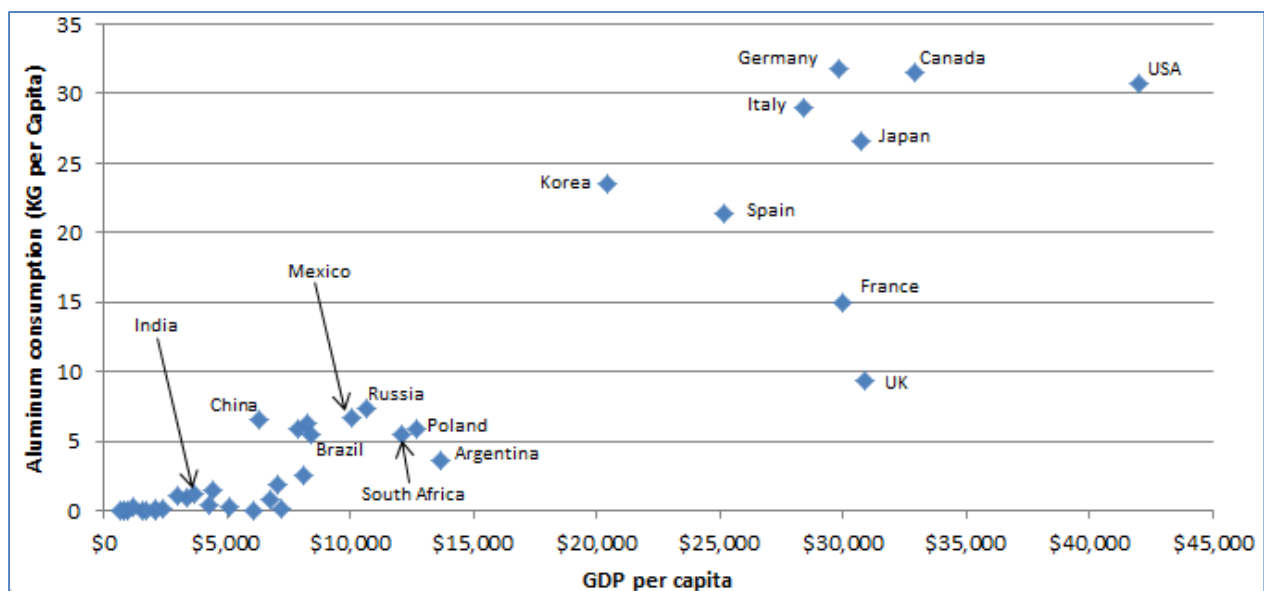
About a quarter of world aluminum consumption is accounted for by a wide variety of consumer products including furniture and household fittings, as well as sundry manufactured goods such as transportation containers, gas cylinders, masts, bicycles and caravans. In addition, aluminum is used in marine applications such as the bodies of ships, helicopter pads, gangways, handrails and firewalls. This long list of uses for aluminium is constantly growing, as new ideas become reality

19.2.2 Aluminum Demand Drivers

China plays a large role in the global demand of both aluminum and alumina. The country's rapid economic growth has fueled the need for aluminum and has therefore increased demand for alumina. Because alumina production in China is costly due to high energy prices and low quality bauxite reserves, alumina imports have been very important. An increase in Chinese domestic production of alumina could have a negative impact on alumina producers. While the country is the world's largest aluminum producer and a net exporter of the metal, cost pressures could change this and move the country back into a net importer position. India is also a large consumer of aluminum and the country dynamics and cycles impact the aluminum demand.

The amount of aluminum consumed per capita is highly correlated with economic development. People in developed countries consume an average of 20 to 30 kilograms (45-65 pounds) of aluminum per year, whereas people in developing countries (countries with a per capita GDP of less than \$15,000) consume less than 10 kilograms (22 pounds) per year, on average. As emerging countries become more developed, aluminum consumption in these countries will likely increase significantly. Considering the size of developing countries such as the ones forming the “BRIC” (Brazil, Russia, India and China), these emerging markets could cause substantial increases in both aluminum demand and prices.

Figure 19-2 Aluminum Consumption per Capita versus Gross Domestic Product per Capita for the 20 Most Populous Countries in 2006⁽⁸³⁾



Energy costs can impact the aluminum production process. Smelting alumina into aluminum requires a constant, large supply of electricity, which accounts for around 25% of the costs of the entire smelting process. If energy costs become too high, smelters may be forced to shut down or move to a location where energy costs are lower. On the other hand, a decrease in energy costs can allow previously closed smelters to reopen, which would increase the supply of aluminum and lower prices.

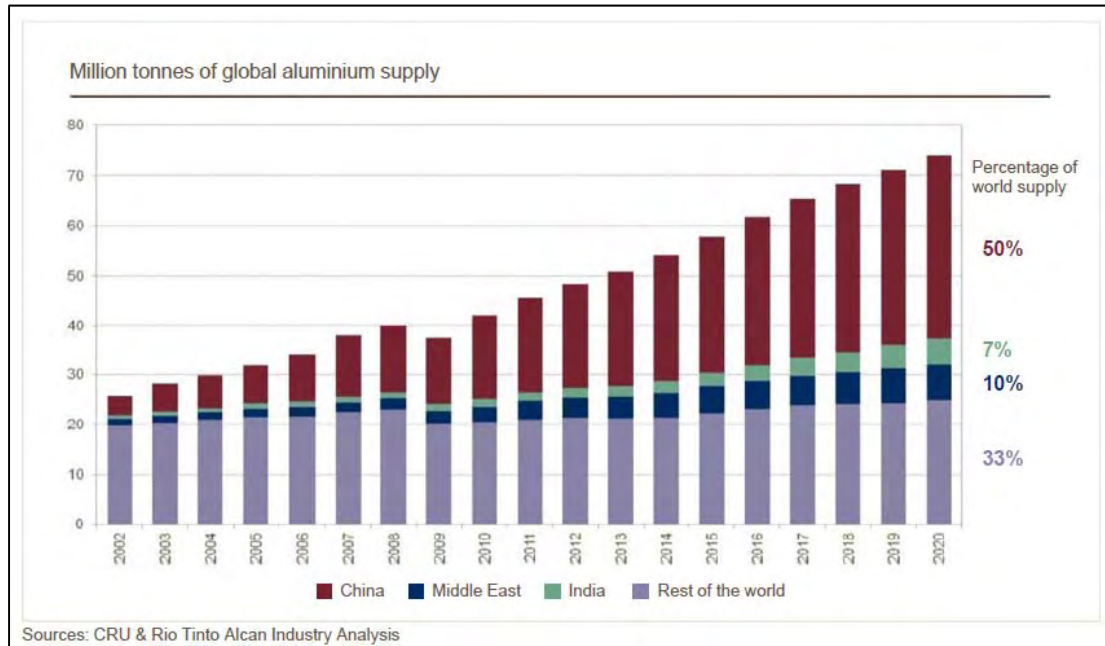
Recycling scrap aluminum requires only 5% of the energy used to make new aluminum since the process involves simply re-melting the metal, which is far less expensive and energy intensive than creating new aluminum through the electrolysis of alumina which must be first mined from bauxite ore and the refined using the Bayer process. Therefore the majority of aluminum produced is still in use because of its low recycling cost.

19.2.3 Global Aluminum Market Supply

Many key players of the industry predict a significant growth ranging from 60% to 100% in aluminum over the present decade.

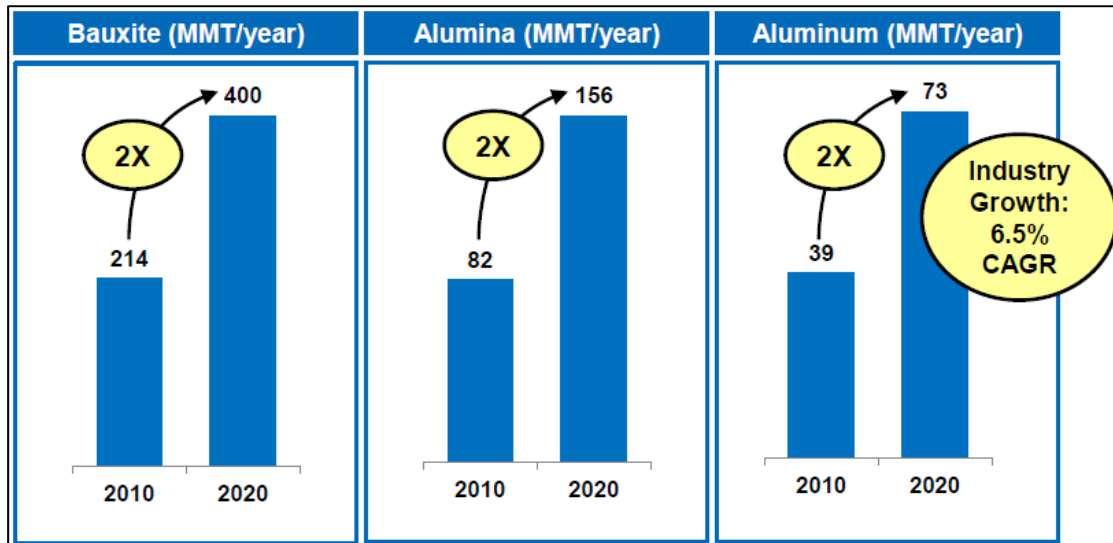
Rio Tinto Alcan⁽⁸²⁾ predicts that the global annual supply of aluminum will reach about 46 million tonnes in 2011. It is expected to grow by over 60% or to about 75 million tonnes in 2020.

Figure 19-3 Global Historical and Expected Aluminum Supply 2002-2020



Alcoa on its end predicts a CAGR of 6.5% for the aluminum demand over the next decade resulting in a doubling aluminum demand from 2010 to 2020. Consequently, the alumina demand will also double by 2020 as shown below:

Figure 19-4 Bauxite and Alumina Demand 2010-2020⁽⁸⁸⁾

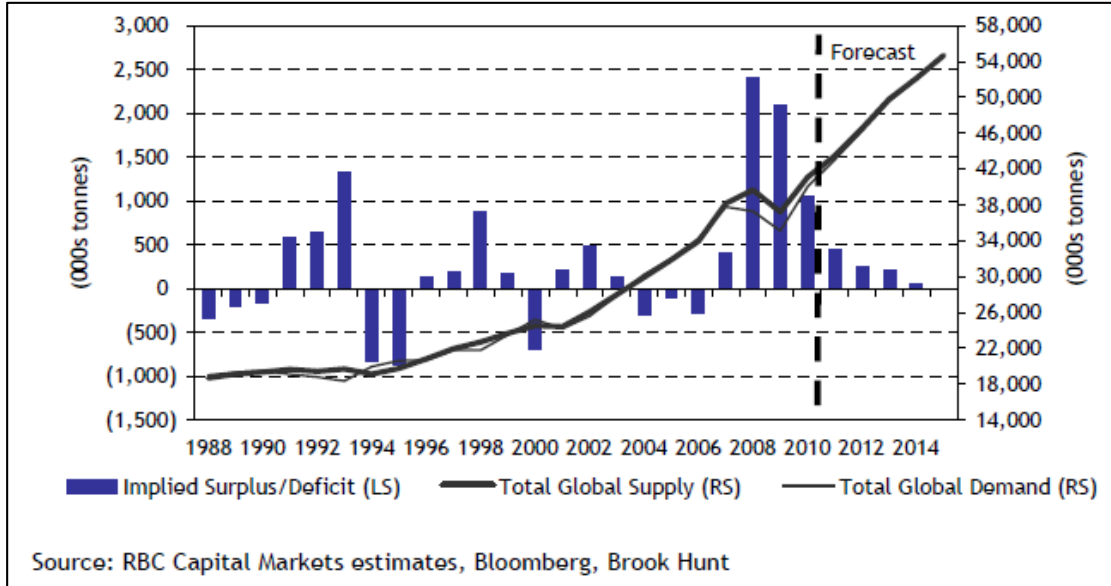


Source: Alcoa

19.2.4 Global Aluminum Supply and Demand

RBC Capital Markets Information⁽⁸⁴⁾ shows a trading surplus of aluminum in the recent years that is supposed to decrease significantly in the coming years primarily driven by China's forecasted growth in consumption of 13.7% in 2011 and 12.9% in 2012. The strength of the global economic growth is the biggest risk for these expectations.

Figure 19-5 Global Aluminum Supply/Demand 1988-2015



19.2.5 Orbite’s Opportunity for its Metallurgical Grade Alumina

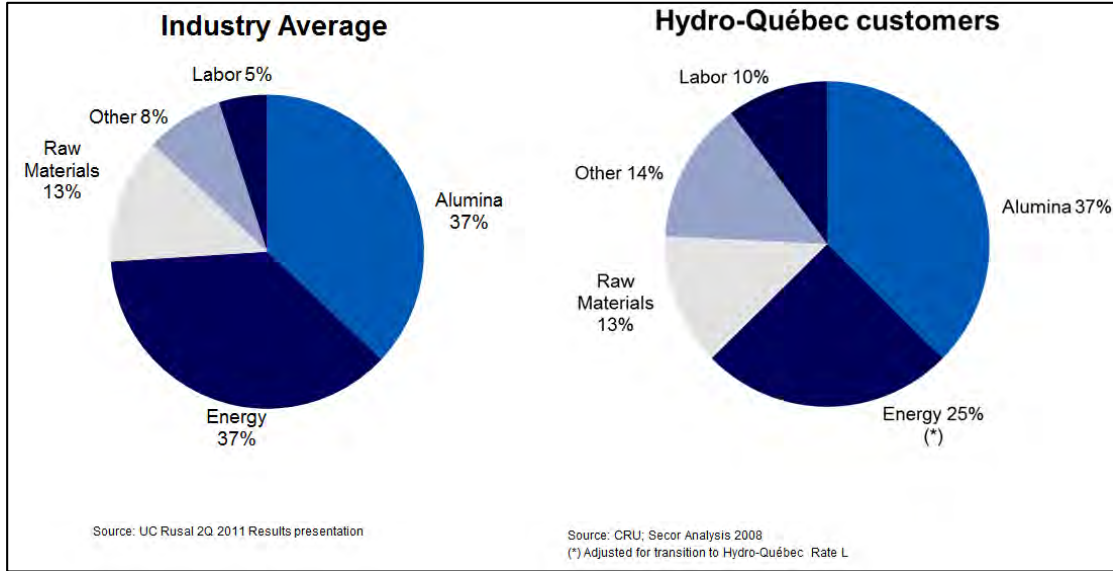
The Quebec province is the third largest producer of aluminum worldwide after China and Russia with 9 smelters producing annually about 3 million tonnes. As each ton of aluminum requires about 2 tons of alumina, the total demand of alumina is about 6 M tons growing at a CAGR of 6.5% until the end of the decade (see Figure 19-5).

There are other aluminum smelters accessible by sea or by the St-Lawrence seaway. Alcoa operates 2 aluminum smelters in New York state, USA that produce about 250,000 tonnes per year⁽⁸⁵⁾ and Iceland has an annual aluminum production capacity of about 750,000 tonnes per year⁽⁸⁶⁾. So overall, the smelters within reach by boatload and thus a targeted direct customer for Orbite represent an annual demand of about 8 million tonnes of alumina.

Greenland could also become a significant producer of aluminum due to its low hydroelectricity cost as the country is gradually shifting its electricity production from fossil fuel to hydropower. Alcoa entered a memorandum of understanding with the Greenland government for a feasibility study of a 340,000 Mt/year aluminum smelter in Greenland⁽⁸⁷⁾. Therefore, should this project materializes; Orbite could also ship alumina to Greenland from its Grande-Vallée’s operation.

All, except one aluminum smelter mentioned above fill their alumina requirements from the equatorial belt where bauxite processors are located. Significant direct (freight and logistics) and indirect cost (Carbon credits cost, greenhouse gases) are implied. The cost breakdown of aluminum producers is shown in the figure below.

Figure 19-6 Aluminum Cost Structure



Alumina represents about 37% of the operating costs for an aluminum smelter. Based on data from Platts⁽⁸⁸⁾, the transportation cost of alumina represents about 7-12% of the FOB price depending on the sourcing location and the supply/demand situation. By realizing important direct savings in transportation, Quebec and other aluminum smelters within reasonable distance of Orbite’s plant would increase their operational profitability accordingly.

For the smelters out of reach from Orbite’s production facility, licensing opportunity exists for Orbite’s technology. Furthermore, Orbite’s technology allows the extraction of alumina and other valued by-products from a variety of sources such as aluminous clay and bauxite, using an innovative and continuous acid-leaching process that does not generate the toxic red mud.

19.3 Hematite Market

Hematite, also spelled as haematite, is the mineral form of iron(III) oxide (Fe_2O_3), one of several forms of iron oxides. Hematite has several industrial applications, including its use for rubber, plastics, metallurgical iron, as a pigment for paint and in electrical engines. Orbite’s Grande-Vallée plant is expected to produce approximately 189,298 tonnes per year of higher grade hematite from the Grande-Vallée argillite. Iron is recovered in the Orbite process by performing a low temperature hydrolysis from the rich Fe^{3+} composition. Pure hematite is produced as an end product (as described in Sections 13 and 17).

The expected specifications are: >99.5% Hematite, <0.2% Hydrolysable Chlorides, black Powder with an average particle size (PSD) of approximately 25-35 micron and a bulk density of 2-3 kg/l.

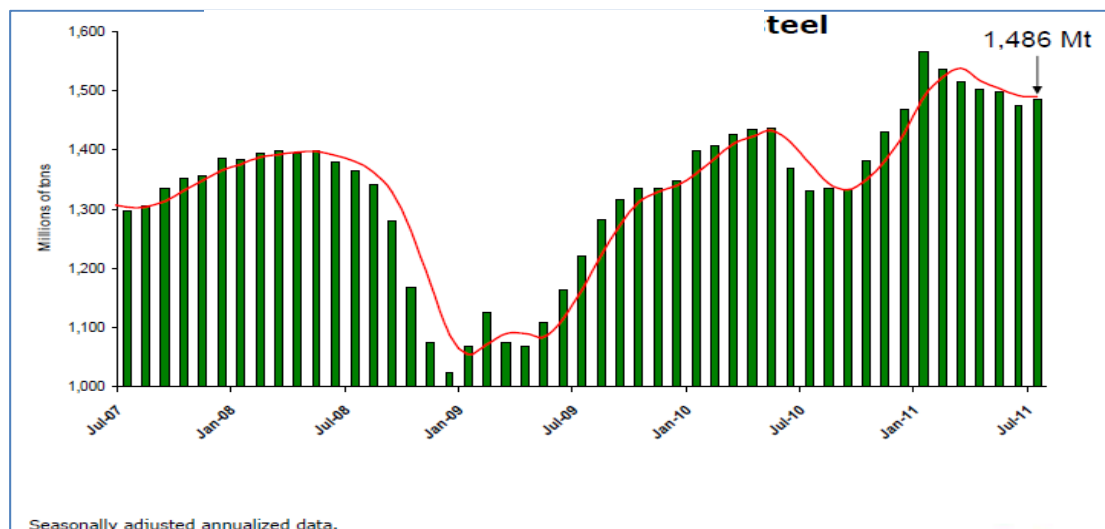
The overwhelming application of Iron(III) oxide is as the feedstock of the steel and iron industries, e.g. the production of iron, steel, and many alloys. The raw materials used to produce pig iron in a blast furnace are iron ore, coke, sinter, and limestone. Iron ores are mainly iron oxides and include magnetite, hematite, limonite, and many other rocks. The iron content of these ores ranges from 70% down to 20% or less. Market prices for iron ores are calculated, referenced and reported using a standard 62% iron concentration.

Orbite's hematite will have a higher degree of purity and thus part or all of it can be sold in value added markets such as: magnet fabrication, electrical motor manufacturing, etc. thus increasing the revenue and margin on this product.

19.3.1 Global Carbon Steel Market Supply

According to Vale and World Steel, carbon steel output runs at 1.5 billion tons per year, expanding by 7.6% over 4Q 2010. Although China is the main growth driver with 50% of the production, expansion has broadened.⁽⁸⁹⁾

Figure 19-7 Global Carbon Steel Production⁽⁹⁰⁾



19.4 Silica Market⁽⁹¹⁾

Following crushing/grinding the plant feed is fed to the leach reactors after being submitted to a chemical reaction where large portion of metals are passed as chlorides, while silica remains insoluble. Subsequently the silica settles out in the rake classifier following which it is subjected to a dual filtration process.

Silicon (Si) is an element that does not exist in its original form in nature. In order to exist it always needs the assistance of another element. For instance, even the most abundantly found form of silicon is silicon dioxide (SiO₂). Apart from sand, it is also found in its quartz form and also as diatoms. These are the naturally occurring forms. There are various forms of silicon dioxide, or silica, as it is commonly referred to, like silica gel, silicic acid (hydrated silica used in toothpastes to remove plaque from teeth), etc. that are synthetically manufactured. The various forms of silicon dioxide have various uses.

Glass

When silica is heated long enough and hot enough, even without any other external factors, it turns into glass all on its own. This property of turning itself into glass is honed and used to make different types of glass objects.

Food

Using silicon dioxide in food helps in many ways. The main use of silicon dioxide being used in food is the health it renders to our bones and joints. Regular intake of silicon dioxide is helpful in maintaining the strength and density of bones, thus reducing the risk of diseases like arthritis and osteoarthritis.

Ceramics

Since silica is found in sand form, its use in the ceramics industry is quite obvious. Silica is one of the main constituents of ceramic glaze that is produced. Without silica, the other ingredients would not be able to bind themselves because silica is the one that when heated forms glass. This is what keeps the other ingredients together. However, only melted silica has no real use by itself.

Telecommunication

In the world of telecommunication, use of silica is made in the form of optical fibers prepared using silica based glass. These fibers have a high level of heat conductivity, plus, they can withstand a lot of high optical damage before they are rendered useless. This gives it a low rate of transmission loss and more and more ways of using and improving such silica based fiber optics are being devised.

Cement

Silica can be found in sand form. This form of the element is very useful in the production of cement, which is used in the construction of infrastructure.

Micro-electronics

Silica is used in its purest form in the manufacture of electronics, especially micro-electronics. Chips are prepared and embedded in electronics to monitor and regulate the level of electrical activity within the electronic item. Such regulation is important so that the item is protected from damage.

DNA Extraction

Silica is also very useful in scientific laboratories. It has binding properties which help to isolate the strands of DNA, but in the presence of chaotropic agents. A chaotropic agent, also known as a denaturing agent is a substance which assists in the process of disturbing the structure of the DNA, thus making them identifiable and available for study.

Drying Agent

Among the various forms of silica, its gel is the one that is most widely used for protection against moisture and humidity. Silica gel, made from sodium silicate, using a synthetic production method is one of the most permeable substances that can be used to safely protect almost anything from foodstuffs to jewelry to even musical instruments and paper. It not only protects it from moisture in the air, but also from mold.

Orbite's process is expected to produce approximately 1.23 million tonnes of high purity silica per year. It is anticipated that the high purity silica will be sold into the high purity quartz for the electronics industry. In a worst case scenario the high purity silica could be sold to local cement manufactures as an aggregate or in other applications mentioned above.

19.4.1 High Purity Quartz⁽⁹²⁾

Quartz (SiO_2) is one of the most abundant minerals and is easily found in many different geological deposits at low purity (> 300 ppm). The picture is very different for medium purity (50 to 300 ppm), and high purity (< 50 ppm) quartz. Processing raw quartz for high purity involves several steps to lower the specific impurities in line with end-use applications. As a result, high purity quartz with impurity levels less than 20 ppm may be achieved so creating a valuable material which commands up to 5 Euros/kilogram (\$7,000 per metric tonne).

High purity quartz is a specialized and, in many ways, very secret market. It refers to material of ultra high purity, generally higher than 99.99 % SiO₂, ideally with less than 50 ppm impurities. Scientifically speaking, natural/untreated quartz having less than 50 ppm of impurities (99.995 % pure) is called « high purity quartz ». However, quartz having 500 ppm of impurities (99.95 % pure) can also be called « high purity quartz » if adequate processing technologies (such as flotation) succeed in lowering the impurity level to less than 50 ppm. The highest purity product based on natural quartz that is currently available has a purity of 99.9992 % with boron as low as 40 ppb (parts per billion). The term « high purity » is also used to refer to some quartz fillers used in the semiconductor industry that have a lower SiO₂ content of about 99.8 %.

Note: Since the term « high purity quartz » is not regulated, it is often used incorrectly by many corporations for marketing purposes. For example, some suppliers use the term « high purity quartz » for product with as low as 99.7 % purity.

19.4.1.1 High Purity Quartz Uses

The market for high purity quartz is developing very rapidly because of the increasing demand from industries such as lighting, semiconductor, optical glass, crucible production, and fiber optics.

Lighting

Quartz tubes are used for high-temperature mercury, halogen, xenon and UV lamps, thermocouples, quartz tubes with titanium oxide additive for blocking intense UV radiation in bactericidal lamps, etc.

Semiconductor

Tubes made of high purity quartz are used for the production of silicon wafers. The best and latest cylinders have a diameter of up to 550 mm and contain less than 25 ppm of impurities. Holders for silicon wafers are also made from high purity quartz.

Optical Glass

Lenses for telescopes and laboratory optical instruments are made with very pure quartz. Other products include diffraction lenses, ultra-flat TV screens, optics for lasers, projection displays, etc. High purity quartz is the basic material for the photo mask used to etch the ultra fine circuit patterns on the LCD display panels (televisions, computer displays).

Crucible Production

Quartz crucibles are an important part of the semiconductor manufacturing process but the products are so specialized they are in a category of their own. They are widely used for producing polycrystalline silicon (polysilicon) and monocrystalline silicon (monosilicon). Quartz is one of the very few materials that provides both high purity and heat resistance for this particular process. General Electric produces crucibles with diameters from 12 to 32 inches, and they make wafers from 100 to 300 mm in diameter.

Fiber Optics

The high purity and transparency of quartz makes it ideal for light transmission. With ordinary glass, light can travel only about two meters before it is diffused by impurities. High purity quartz glass, however, can transport light up to 100 km with no diffusion. It is also heat resistant, with the ability to withstand 1,000°C without expansion. Ordinary glass would melt at that temperature.

Table 19-2 Uses of High Purity Quartz by Industry

Industry	%	Industry	%
Semiconductor	40	Semiconductor	50
Lighting	35	Lighting	30
Fiber Optics	10	Fiber Optics	10
Optical Glass	5	Optical Glass	5
Special Glass	5	Others	5
Scientific Instruments	5	TOTAL	100
TOTAL	100		

Estimated by Polar Quartz (Russia) *Estimated by InfoMine (in Hermes Prom Ltd).*

19.4.1.2 High Purity Quartz Market Size and Value

Market estimations of high purity quartz are based on the analysis of data of world and European sales of quartz and quartz concentrate and calculations of utilization of concentrates of various fields of industry and by large consumers. Currently, world production of high quality quartz is about 40 to 43 thousand tons per year. On the assumption of average annual price for high quality quartz exported from USA at the rate of \$3500 thousand per ton, global market value can be estimated to be about 140 to 150 million US dollars (Hermes Prom Ltd.) Another source (Norway Geological Survey– NGU, 2008), says the world market for quartz with purity ≥ 99.99 % is 30,000 tons per year. Dorfner Minerals, Germany, believes that market is 50,000 tons per year. The average value of those various estimations is about 40,000 tons per year.

The high purity quartz industry is extremely profitable and the demand grows 5 to 8% per year (Hermes Prom Ltd).

From a product point of view (excluding external factors such as dollar value, economic situation, etc.), the two main factors driving the price of HPQ are:

1. Level of purity: the higher the purity level, the higher the price of high purity quartz
2. Consistency in purity: this is more difficult to achieve because the purity of natural quartz varies a lot.

19.5 Magnesium Oxide Market⁽⁹³⁾

The majority of magnesium oxide produced today is obtained from the processing of naturally occurring minerals such as magnesite (magnesium carbonate), magnesium chloride rich brine, and seawater. Large mineral deposits of magnesite are located in Austria, Brazil, Canada, China, the Commonwealth of Independent States (CIS), former Czechoslovakia, Greece, Turkey, North Korea, former Yugoslavia, and the U.S.

When heated from 700°C to 1000°C, magnesium carbonate thermally decomposes to produce magnesium oxide and carbon dioxide: $MgCO_3 \xrightarrow{\text{heat}} MgO + CO_2(\text{gas})$.

About 9.6 M tonnes per year of magnesium oxide are consumed annually.

Table 19-3 Magnesium Oxide Applications

Applications	World Total consumption (MT / Year)	Percentage (%)
Refractories (shaped & unshaped)	8.000.000	83,10
Agricultural (animal feed & fertilizers)	500	5,20
Environmental	550	5,70
Pulp & Paper	50	0,50
Construcion (Flooring - Abrasives - Panels)	120	1,20
Heating Elements	55	0,60
Welding Fluxes	30	0,30
Ceramics	40	0,40
Magnesium Metal	200	2,10
Chemicals	80	0,80
Total	9.625.000	100

Orbite's process is expected to produce approximately 27,816 tonnes of MgO annually which represents less than 0.5% of the market. It is anticipated that this product will be sold to the refractory manufacturing industrial market which occupies more than 80% of the magnesium oxide market.

19.6 Mixed Oxides Market

Orbite's process is expected to produce approximately 104,089 tonnes of mixed oxides rich in of potassium among others. This product can be sold as a low cost fertilizer to local farmers and has a potential market as cattle feed supplements. Any income from these by-products will lower the overall cost of manufacturing of Orbite.

19.7 Rare Metals and Rare Earths Market

Orbite's unique technology has the capability to extract high-value elements and rare earths from the claystone/mudstone. Future demand for these elements is expected to grow at a CAGR of 8.4% between 2010 and 2015⁽⁹⁴⁾, as they are essential to the high technology and alternative energy sectors.

The United States Department of Energy ("US DOE") and the European Union ("EU") have placed the gallium and rare earths on their critical materials list and have developed strategies to ensure sustainable supply and less dependency on China.

The presence of these high-value elements and rare earths was independently confirmed as Inferred resources (Section 14). Orbite has also filed two new provisional U.S. patent applications to protect these processes (US 61/454,211 filed March 18, 2011, US 61/482,253 filed May 4 2011).

The argillite of the Grande-Vallée deposit contains a variety of rare metals and rare earths elements that are extracted from Orbite's process. A minimum of twelve elements are qualified under 43-101 as Inferred resources. They are listed as follows: Gallium (Ga), normally categorized as a rare metal, Scandium (Sc), rare metal or rare earth, Cerium (Ce), Dysprosium (Dy), Erbium (Er), Europium (Eu), Gadolinium (Gd), Lanthanum (La), Neodymium (Nd), Praseodymium (Pr), Samarium (Sm), and Yttrium (Y).

19.8 Rare Earths Applications

Rare earth elements are critical to the functionality of many of today's most advanced and sought-after technologies like: clean energy, advanced vehicles, batteries technology, defense and aerospace technologies, consumer electronics, etc. The table below summarized the key applications by element.

Table 19-4 Rare Earth Applications⁽⁹⁴⁾

Rare Earth Applications:										GS&PA Investment Research	
	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Y	
	Light Rare Earths					Heavy Rare Earths					
	Lanthanum	Cerium	Praseodymium	Neodymium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Yttrium	Other*
Magnets			••	••	•		•	•	•		
Batteries	••	••	•	••	•						
Metallurgy	••	••	•	••							
Autocatalysts	•	••	•	•							
Petroleum catalysts	••	•									
Polishing Powders	••	••	•								
Glass Additives	••	••	•	•						•	•
Phosphors	•	••				•	•	•		••	
Ceramics	••	••	•	••						••	
Other	••	••	•	••	•		•			••	••

Source: CRU International; USGS; Company Data *Other: Includes Erbium, Ytterbium, Thulium, Lutetium, Holmium

19.8.1 Rare Metals and Rare Earths Market Demand

Rare earths are in increasing demand by many of the highest-growth sectors of the world economy. At the same time, supply is being increasingly constrained as China, the dominant global supplier (>95%), dramatically decreased exports, citing domestic needs and environmental concerns⁽⁹⁵⁾. Overall, the consumption is expected to grow at a CAGR of 8.4% between 2010 and 2015⁽⁹⁴⁾. The largest growth will come from the Battery Metal Alloy and Magnets market segments according to the Lynas Group.

Table 19-5 Rare Earth Demand 2005-2015⁽⁹⁴⁾

Rare Earths: Global Market Summary (tonnes REO equiv.)													
	2005	2006	2007	2008	2009	2010	2011f	2012f	2013f	2014f	2015f	CAGR ('10-'15)	CAGR ('05-'10)
Consumption by Region													
China	52000	60000	70000	75000	60000	83000	91000	100000	109500	119500	130000	9.4	9.8
% annual growth rate	57.6	15.4	16.7	7.1	-20.0	38.3	9.6	9.9	9.5	9.1	8.8		
Other Asia (incl. Japan)	23000	24650	25000	24750	15000	23925	25262	26627	28329	30433	33010	6.6	0.8
% annual growth rate	-19.4	7.2	1.4	-1.0	-39.4	39.5	5.6	5.4	6.4	7.4	8.5		
USA	14720	15776	16000	15750	9600	15312	16168	17042	18131	19477	21126	6.6	0.8
% annual growth rate	-19.3	7.2	1.4	-1.6	-39.0	59.5	5.6	5.4	6.4	7.4	8.5		
Rest-of-World	8280	8874	9000	10000	5400	8613	9094	9586	10199	10956	11884	6.6	0.8
% annual growth rate	-19.3	7.2	1.4	11.1	-46.0	59.5	5.6	5.4	6.4	7.4	8.5		
Global	98000	109300	120000	125500	90000	130850	141524	153255	166159	180366	196020	8.4	6.0
% annual growth rate	8.9	11.5	9.8	4.6	-28.3	45.4	8.2	8.3	8.4	8.6	8.7		
Consumption by Application													
Catalysis	19000	21500	24500	26500	18000	28000	29540	31165	32879	34687	36595	5.5	8.1
% annual growth rate	5.6	13.2	14.0	8.2	-32.1	55.6	5.5	5.5	5.5	5.5	5.5		
Glass Additives	13500	13000	12500	12000	5500	7500	7650	7803	7959	8118	8281	2.0	-11.1
% annual growth rate	-3.6	-3.7	-3.8	-4.0	-54.2	36.4	2.0	2.0	2.0	2.0	2.0		
Polishing Powders	12500	14000	15000	15000	12000	18200	19747	21425	23247	25223	27367	8.5	7.8
% annual growth rate	8.7	12.0	7.1	0.0	-20.0	51.7	8.5	8.5	8.5	8.5	8.5		
Battery Metal Alloys	16000	17000	17000	18500	14000	18700	21318	24303	27705	31584	36005	14.0	3.2
% annual growth rate	6.7	6.3	0.0	8.8	-24.3	33.6	14.0	14.0	14.0	14.0	14.0		
Other Metal Alloys	8500	10000	11000	11500	8000	11700	11934	12173	12416	12664	12918	2.0	6.6
% annual growth rate	6.3	17.6	10.0	4.5	-30.4	46.3	2.0	2.0	2.0	2.0	2.0		
Magnets	16000	20500	25000	27000	22000	33500	37185	41275	45816	50855	56449	11.0	15.9
% annual growth rate	28.0	28.1	22.0	8.0	-10.5	52.3	11.0	11.0	11.0	11.0	11.0		
Phosphors	7000	7800	8500	9000	6000	7750	8293	8873	9494	10159	10870	7.0	2.1
% annual growth rate	16.7	11.4	9.0	5.9	-33.3	29.2	7.0	7.0	7.0	7.0	7.0		
Ceramics & Other	5500	5500	6500	6000	4500	5500	5858	6238	6644	7076	7535	6.5	0.0
% annual growth rate	10.0	0.0	18.2	-7.7	-25.0	22.2	6.5	6.5	6.5	6.5	6.5		
Production:													
Australia	0	0	0	0	0	0	846	8984	15300	21100	24500		
China	99000	110000	100000	115000	110000	115000	112000	115360	118821	122385	126057		
USA	0	0	0	1000	1400	2000	3000	12000	25000	35000	39000		
Other (incl. recycling)	3500	5500	6500	7000	6500	9000	9450	10000	12500	13500	15000		
Disruption allowance (%)	--	--	--	--	--	--	2.0	3.0	3.0	3.0	3.0		
Disruption allowance (t)	0	0	0	0	0	0	-2506	-4390	-5149	-5760	-6137		
Global Production	102500	115500	106500	123000	117900	126000	122790	141954	166472	186226	198420	9.5	4.2
% annual growth rate	12.6	12.7	-7.8	15.5	-4.1	6.9	-2.5	15.6	17.3	11.9	6.5		
Notional Surplus / (Deficit)													
	4500	6200	-13500	-2500	27900	-4850	-18734	-11301	313	5860	2401		
"Basket Prices" (US\$/kg REO)													
Mt Weld	5.00	6.66	11.42	14.39	10.54	31.81	160	227	196	113	82		
Mountain Pass	2.92	4.25	7.78	10.18	7.21	27.06	n.f.	n.f.	n.f.	n.f.	n.f.		
Baotou	3.94	5.81	10.37	12.58	8.65	29.73	n.f.	n.f.	n.f.	n.f.	n.f.		
Long Nan	12.28	16.02	21.41	30.85	25.26	47.55	n.f.	n.f.	n.f.	n.f.	n.f.		

Source: IMCOA; Company Data; GS&PA Research estimates

19.9 Gallium Applications⁽⁹⁶⁾

The rapidly growing high-brightness LED industry was also a significant driver for GaAs- and GaN-based technologies. The backlighting of computer notebook screens, flat-screen computer monitors, and flat-screen televisions was the driving force for high-brightness LED consumption in 2010. The market share of LED-backlit computer notebooks was estimated by one analyst to have increased to 89% in 2010 from 46% in 2009, while LED-backlit computer monitors increased to 12% in 2010 from 2% in 2009, and LED-backlit flat-screen televisions increased to 22% in 2010 from 3% in 2009. The market for high-brightness LEDs reached \$5.3 billion in 2009 and was expected to increase to \$8.2 billion in 2010.

19.9.1 Gallium Market Production and Capacity⁽⁹⁶⁾

In 2010, world primary (refinery) production was estimated to be 106 metric tons, 34% greater than the revised 2009 world primary production of 79 tons. China, Germany, Kazakhstan, and Ukraine were the leading producers; countries with lesser output were Hungary, Japan, Russia, and Slovakia. Refined gallium production was estimated to be about 161 tons; this figure includes some scrap refining. China, Japan, and the United States were the principal producers of refined gallium. Gallium was recycled from new scrap in Canada, Germany, Japan, the United Kingdom, and the United States.

In 2010, world primary gallium production capacity was estimated to be 184 tons; refinery capacity, 177 tons; and recycling capacity, 141 tons for a total worldwide capacity of 502 tons.

19.10 Scandium Applications

There are currently three (and few other) major applications for scandium:⁽⁹⁷⁾

- *Fuel Cells*: Scandium is used as a dopant of zirconia (ScSZ) in Solid Oxide Fuel Cells (SOFCs). Used thus, the metal increases both the lifespan and efficiency of the cells, and reduces their operating temperature. Such cells have the “*highest output potential of all electrolyte-supported fuel cells,*” not least because ScSZ cathodes have the highest ionic conductivity of any of the options available for use in low temperature SOFCs.
- *Lighting*: The addition of scandium iodide (ScI₃) to mercury vapor lamps enables their light to resemble natural sunlight closely. With the increasing use of LEDs, though, there is a good possibility that the future of such lamps is not assured.
- *Aluminum-Scandium (Al-Sc) Alloys*: While most of the Al-Sc alloy used today is to be found in leisure and sporting goods, e.g., bicycle frames, baseball bats, golf clubs, hand guns, tent poles and lacrosse sticks, other environments for its use continue to be actively researched. The aircraft industry is one particular example. It was, once, used in both Soviet fighter planes and the nose cones of Soviet missiles. Not only are Al-Sc alloys suitably strong, they are also lighter and more corrosion-resistant than other, comparable aluminum alloys. In addition, using weld wires incorporating scandium has some significant attractions, especially because of the increased strength and reduced susceptibility to heat cracking. With both its strength and lightness, there are probably also some interesting opportunities for scandium in the automotive market, such as in the manufacturing of both engines and bodies. The action of scandium is much stronger compared to other modifiers of aluminium alloys such as titanium, boron, zirconium. Thus, scandium containing alloy brand 1975

(Al-Zn-Mg-Cu-Sc) have strength properties $\sigma = 530-550$ MPa, allowing to increase the inarticulate length of a drill pipe column before onset of plastic deformation body weight from 4.85 km for steel to 17.5 km for the alloy 1975⁽⁹⁸⁾.

19.10.1 Scandium Market Production and Capacity⁽⁹⁹⁾

Scandium's ability as a strengthening agent when alloyed with aluminum is what makes this metal truly valuable.

According to various sources, namely Avalon Rare Metals Inc., the world production of scandium is in the order of 4 to 8 tonnes per year in the form of scandium oxide. The primary production is 400 kg while the rest is from stockpiles of Russia generated during the Cold War.

In 2003, only three mines produced scandium: the uranium and iron mines in Zhovti Vody in Ukraine, the rare earth mines in Bayan Obo, China and the apatite mines in the Kola Peninsula, Russia. In each case, scandium is a by-product from the extraction of other elements⁽¹⁰⁴⁾ and is sold as scandium oxide.

The production of metallic scandium is in the order of 10 kg per year.^(100,101) The oxide is converted to scandium fluoride and reduced with metallic calcium. Madagascar and Iveland-Evje region in Norway have the only deposits of minerals with high scandium content, thortveitite $(Sc,Y)_2(Si_2O_7)$ and kolbeckite $ScPO_4 \cdot 2H_2O$, but these are not being exploited.⁽¹⁰¹⁾

Furthermore, It is obvious that with such high prices the use of Sc-Al alloys is very limited and that further uses of scandium in aluminum alloy (for aerospace and marine applications) largely depends to a large degree on a development of less expensive sources for scandium⁽¹⁰²⁾ which Orbite will make available in significant quantity with its project.

Orbite's yearly estimated production of Scandium oxide amounts to 48 tonnes per SGA plant. This will result in a significant increase in availability and usage of Scandium. The market prices will also go down but as Orbite's low production cost of rare elements and rare earths will allow it to be well positioned in the Scandium market as an important player.

19.11 Price Assumptions

The price assumptions used for the PEA calculations are summarized in the table below.

Table 19-6 GENIVAR PEA Annual Production and Initial Revenue Estimate

	Estimated tonnes	Price per tonne	Estimated Revenue
Metallurgical Grade Alumina	539,711	\$ 425.00	\$ 229,377,175
Hematite	189,298	\$ 200.00	\$ 37,859,680
High Purity Silicon dioxide	1,228,628	\$ 25.00	\$ 30,715,708
Magnesium Oxide	27,816	\$ 400.00	\$ 11,126,400
Mixed Oxides	104,089	\$ 5.00	\$ 520,443
Rare Earths and Metals as Oxides	975	N/A	\$ 392,868,097
	<u>2,090,517</u>		<u>\$ 702,467,503</u>

Reference scenarios in Section 22 were calculated using the above market prices.

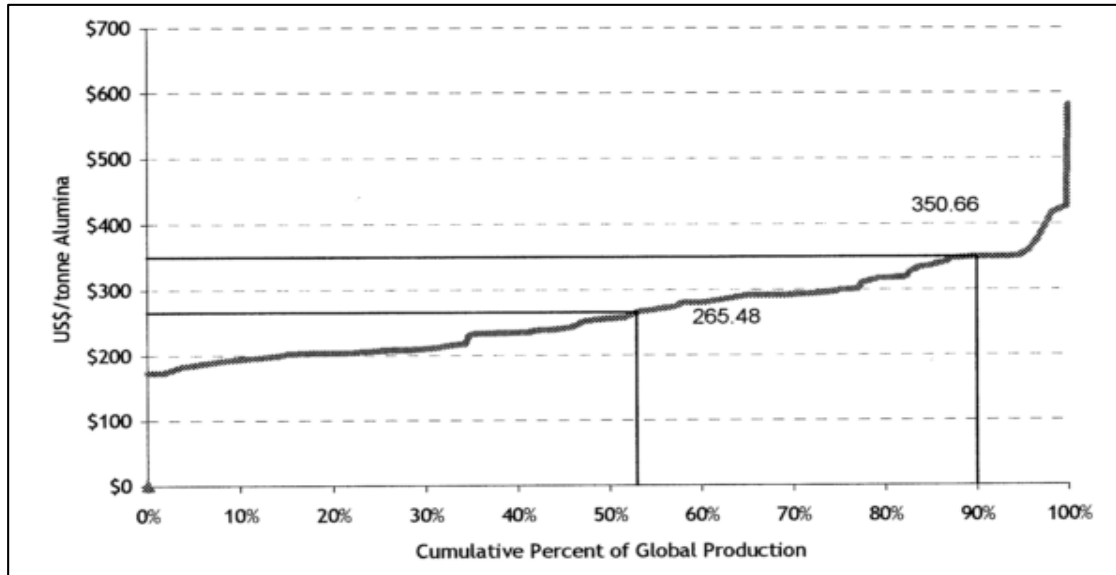
In the past 6 to 8 months, the market dynamics have changed quite significantly in alumina and the rare earths segments with prices that fluctuated rapidly and significantly, therefore the need to update the basis of calculations for the economic analysis to make sure that the sensitivity analysis covers the range between the initial assumptions and today's prices.

For the sensitivity analysis presented in Section 22, the following variation in sales prices and revenue forecast were used: +/- 40% in revenues for alumina, hematite, silica, magnesium oxide and other oxides, +/- 65% for rare metals and rare earths and +/- 20% for capital and operational expenses is presented.

19.11.1 Alumina Price Assumptions

RBC Capital Markets estimates the 2011 alumina total manufacturing costs to vary between about \$185 to \$225 per tonne with an average of \$265.48 in the industry.

Figure 19-8 Global Alumina Cost curve⁽⁸⁴⁾

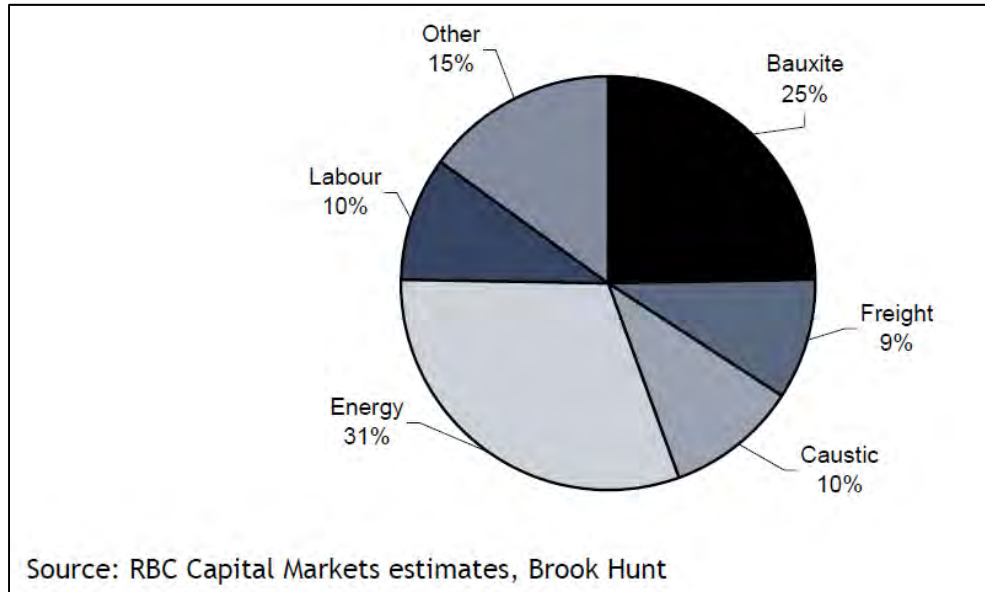


On that curve, Australian producers tend to be on the lower part while China, primarily due to the high energy cost tend to be amongst the upper part of the curve. With Australia's proposed Minerals Resource Rent Tax bill that will tax coal and iron profits starting in July 2012, the cost of production of the energy-intensive alumina manufacturing processes will most likely go up accordingly.

Furthermore many countries will eventually tax the Greenhouse gases which will also put an upwards pressure on alumina manufacturing costs. Creeping oil barrel price will also drive the production cost of alumina upwards. Some other indirect costs like environmental cost and carbon credit cost are not taken into account in the above calculations. The alumina producers also have cost related to bauxite being either vertically integrated or purchasing it on the open market.

RBC Capital Markets⁽⁸⁴⁾ estimates bauxite to represents 25% of the overall manufacturing cost of alumina in average, therefore an average cash cost (OPEX for mining and SG&A expenses) of \$66.37/tonne .

Figure 19-9 2011 Alumina Cash Cost Components⁽⁸⁴⁾



Recent market price for Bauxite destined to the USA varied between US\$25 and US\$40/tonne, average US\$35/tonne on an FOB basis.⁽¹⁰³⁾ Orbite’s raw material cost for its clay is much smaller, thus representing a big competitive advantage over the typical bauxite Bayer proces.

In their latest alumina report, CRU International Limited expects the SGA alumina average annual spot price, FOB Australia to extend from about US\$ 388 actually to US\$ 443 in 2016.⁽⁷⁹⁾

CRU International Limited forecast the average cash cost average for the entire alumina industry to be approximately:

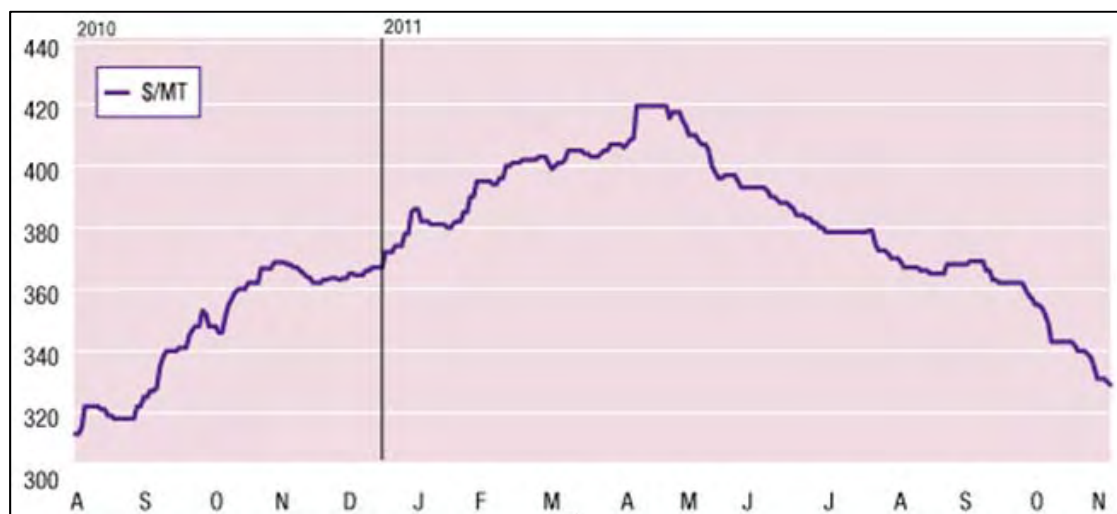
Table 19-7 Estimated Average Site Costs Average for the World Alumina Industry⁽¹⁰⁴⁾

Year	US\$/tonne
2010	243
2011	265
2013	275
2022	320-325

These values are higher than Orbite's expected manufacturing costs. For all products generated in Scenario 2 Orbite's manufacturing costs are estimated to be \$207.99/tonne of alumina (see Section 21 for details) when allocating all of these costs to alumina. The cost of producing alumina is reduced to about \$91.26/tonne of alumina when apportioning the manufacturing cost to all marketable products manufactured being sold and based on energy consumed. The latter scenario is the preferred one and is being pursued by Orbite's management.

Alumina selling prices have cycled over the last 8-9 months ranging from \$420/tonne FOB Australia to \$330 lately in November 2011.

Figure 19-10 Platts Alumina FOB Australia (August 16, 2010 –November 18, 2011)



A price variation of +/- 40% has been used for the sensitivity analysis (Section 22) of both Scenario 1 (Alumina and Hematite revenues only) and Scenario 2 (Revenue from all marketable products manufactured). This variation represents an alumina selling price ranging from \$255 to \$595/tonne on an FOB basis.

Since Orbite's manufacturing cost for alumina itself can potentially be as low as \$91.26/tonne (when all by-products are sold) the low market price situation does not prevent Orbite from generating significant and healthy margins on the smelter grade alumina. At a selling price of \$330/tonne, Orbite would still generate a gross margin of over 70% on its alumina, equivalent to \$128.8 M annually for the first SGA unit envisaged.

19.11.2 Hematite Price Assumptions

The major usage for hematite is in steel production. A conservative approach would be to use as a price reference the 2-year average market price for iron ore pro-rated for iron content^(105,106).

Figure 19-11 Iron Ore Monthly Price⁽¹⁰⁷⁾



Description: China import Iron Ore Fines 62% FE spot (CFR Tianjin port), US Dollars per Metric Ton

The above chart translates to a 2-year average selling price of \$158.16 for 2010 and 2011. As the final concentration of iron in Orbite's hematite will be over 99%⁽⁵²⁾, a calculation based on the prorated iron concentration of Orbite's 99% purity hematite translates to a selling price of \$252.55/tonne. This figure correlates well to a confidential information obtained from a producer of 99% pure hematite.

Furthermore, Goldman Sachs and Partners Australia Pty ("GSPAP") recently forecasted⁽¹⁰⁸⁾ for the ore at 62% iron concentration, an average selling price of \$150/tonne for 2012, \$165/tonne for 2013, \$150/tonne for 2014 and \$120/tonne for 2015 driven by the concern that Brazil, the second biggest exporter will have lower than anticipated supplies.

The calculation of the reference scenarios were performed using an average selling price of \$200/tonne. The sensitivity analysis in Section 22 will have a range of +/- 40% or a range from \$120 to \$280/tonne.

Orbite could also potentially a higher price market for part of its hematite since its purity will be in the 99%+.

19.11.3 Silica Price Assumptions

Orbite's process is expected to produce 1.23 million tonnes of silica having a purity >95%.

According to USGS over 26 million tons of silica sand was produced in the USA in 2010 with an average selling price of \$29.17 per short ton equating to \$32.15 per tonne. 2009 average selling price was \$31.20/short ton or \$34.39/tonne.

An average selling price of \$25/tonne was used in the initial calculations of the PEA assuming the worst case scenario with an industrial use of the silica produced.

The sensitivity analysis in Section 22 will use a range of +/- 40% or an average selling price of \$15 to \$35/tonne

The price assumption does not factor in the possibility for Orbite to further beneficiate its silica and sell part of its production into value-added applications like optical, glass making, semiconductors or quartz manufacturing as an example. Average selling price for such applications ranges from \$440/tonne for 99% purity to \$2500 for a 4N purity (99.99%)⁽⁹²⁾.

19.11.4 Magnesium Oxide Price Assumptions

Magnesium oxide prices vary greatly with purity and quantity purchased. For grade with purity of 95% and above, selling prices ranged from \$400 to \$1460/tonne in September 2011⁽⁹³⁾.

An average selling price of \$400/tonne was used in the initial PEA calculations. 27,816 tonnes are expected to be produced annually and the sensitivity analysis in Section 22 will use a range +/- 40% or an average selling price of \$240 to \$560/tonne.

19.11.5 Other Oxides Price Assumptions

In the reference scenarios 1 and 2 of Section 22, the other oxides price was set at a conservative price \$5/tonne in the initial calculations. These oxides will mainly be potassium oxide for which a market already exist with an average selling price higher than this amount.

104,089 tonnes are expected to be produced annually and the sensitivity analysis in Section 22 will use a range of +/-40% or an average selling price of \$3 to \$7/tonne.

19.11.6 Rare Metals and Rare Earths Price Assumptions

Initial calculations were made using the preliminary clay composition, assuming a conservative 75% recovery rate and the August 2011 spot prices. The figures used for calculations were 974.5 tonnes of rare metals and rare earths as oxides with anticipated revenue of \$392.8 million, and were based on received confirmation of the average composition of the rare earths and rare metals which were evaluated as Inferred Mineral Resource (see Section 14).

Using the price data from Metal-Page⁽¹⁰⁹⁾, estimated revenue at spot prices and China domestic prices as of November 23, 2011 were calculated respectively at \$246.8 million and \$169.8 million. Updated detailed calculations based on current market price, at the signature date of this Technical Report are shown in Tables 19-8 and 19-9.

Table 19-8 Rare Earth and Rare Metals Estimated Revenue at Nov. 23, 2011 Spot Prices⁽¹⁰⁹⁾

Atomic Number	Element	Purity	Oxide Spot Price Nov 23, 2011 (\$/kg)		Tonnes/year	Effective REO Annual Value
31	Gallium	99,99%	600 \$ *		76,1	33 968 025 \$
21	Scandium	99,99%	1 500 \$ **		48,1	72 142 088 \$
39	Yttrium	99,999%	105 \$		109,7	11 523 484 \$
57	Lanthanum	99%	63 \$		156,2	9 841 580 \$
58	Cerium	99%	53 \$		323,3	17 136 032 \$
59	Praseodymium	99%	207 \$		40,4	8 362 033 \$
60	Neodymium	99%	230 \$		139,9	32 180 743 \$
62	Samarium	99%	87 \$		26,4	2 294 911 \$
63	Europium	99,9%	3 780 \$		4,9	18 578 053 \$
64	Gadolinium	99%	130 \$		20,9	2 723 042 \$
66	Dysprosium	99%	1 950 \$		18,5	36 023 967 \$
68	Erbium	99,9%	200 \$ ***		10,0	2 004 448 \$
	Total				974,5	246 778 406 \$

*: Metal price

** : Few data available. References(91,97)

***: Few data available: based on reference(102) \$386.50/kg and reference (103) (\$1,000/kg) a conservative value of \$200/kg was used

**Table 19-9 Rare Earth and Rare Metals Estimated Revenue at Nov. 23, 2011
China Domestic Prices⁽¹⁰⁹⁾**

Atomic Number	Element	Purity	Oxide China Domestic Price Nov 23, 2011 (\$/kg)		Tonnes/year	Effective REO Annual Value
31	Gallium	99,99%	569 \$ *		76,1	32 213 010 \$
21	Scandium	99,99%	1 500 \$ **		48,1	72 142 088 \$
39	Yttrium	99,999%	44 \$		109,7	4 828 889 \$
57	Lanthanum	99%	18 \$		156,2	2 811 880 \$
58	Cerium	99%	20 \$		323,3	6 466 427 \$
59	Praseodymium	99%	103 \$		40,4	4 160 819 \$
60	Neodymium	99%	111 \$		139,9	15 530 706 \$
62	Samarium	99%	13 \$		26,4	342 918 \$
63	Europium	99,9%	2 133 \$		4,9	10 483 330 \$
64	Gadolinium	99%	36 \$		20,9	754 073 \$
66	Dysprosium	99%	980 \$		18,5	18 104 353 \$
68	Erbium	99,9%	200 \$ ***		10,0	2 004 448 \$
	Total				974,5	169 842 940 \$

*: Metal price

** : Few data available. Reference (91,97)

***: Few data available: based on reference (102) \$386.50/kg and reference (103) (\$1,000/kg) a conservative value of \$200/kg was used

The following table summarizes a few of the scenarios considering the fact that rare earths and rare metals prices have changed significantly since the reference scenarios were set in last August 2011.

Table 19-10 Rare Earth and Rare Metals Revenue Scenarios Summary including Scandium and Gallium

	Annually		Average basket price per tonne
	Tonnes oxides	Revenue	
Initial PEA Calculations + Spot Prices (Aug 2011)	819.9*	392,851,069 \$	479,128 \$
Average ppm + Spot Prices (Nov 23, 2011)	974.5	246,778,406 \$	253,227 \$
Average ppm + Spot Prices (Nov 23, 2011) Discounted 30%	974.5	172,744,884 \$	177,259 \$
Average ppm + Nov 2011 Spot Prices (Nov 23 2011) Discounted 40%	974.5	148,067,044 \$	151,936 \$
Average ppm + Domestic Chinese Prices (Nov 23, 2011)	974.5	169,842,940 \$	174,281 \$

*: Tonnes of metal

A fourth and a fifth scenarios were calculated using November 23, 2011 spot prices discounted by respectively 30% and 40%. This translates into a respective potential revenue of \$172.7 million and \$148 million for rare metals and rare earths.

The sensitivity analysis in Section 22 will use a range of +/-65% from the initial price scenario of August 2011 showing a revenue of \$392.9 million. This range will cover an estimated annual revenue varying from \$137.5 million to \$648.2 million for the rare earths and rare metals thus encompassing all the previous variations scenarios listed in Table 19-10.

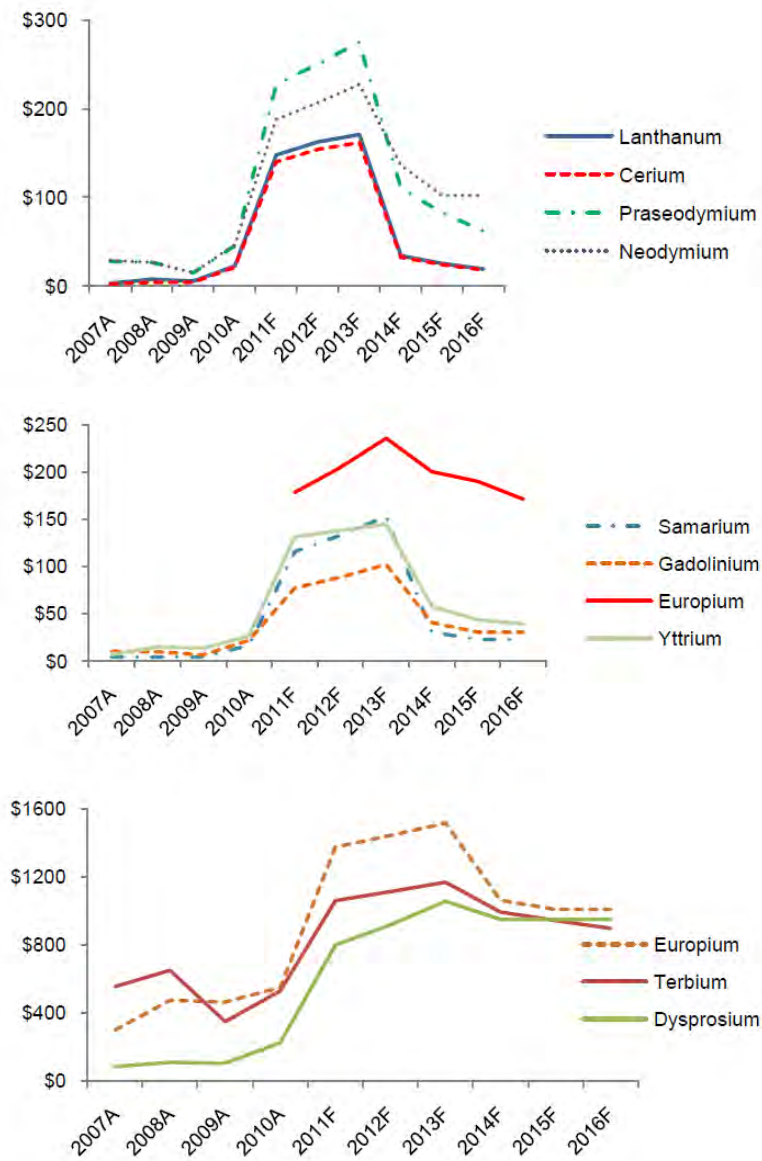
Since Orbite's process removes elements from the clay in its process aiming at a pure alumina and other components, the recovery of spent acids left containing a very high concentration of rare earths and rare metals with very little contaminants in it. As described in section 17, the process benefits from the natural concentrating factors applied during the extraction process and acid regeneration. Therefore, it is expected that the processing cost to extract and separate the rare earths and rare metals in this stream will be much lower than a typical extraction process starting with clays.

Orbite has low mining cost and when apportioning the overall operating costs based on energy, the estimated processing cost, excluding capital expenditures, is estimated to be at \$14.60/tonne of alumina for the rare earths and rare metals which give an estimated cost of \$8.10/kg for the basket of rare earths and rare metals produced when again all by-products and alumina are sold. Therefore Orbite should

be in a situation to “play” the market elasticity and generate a healthy profit margin even at low market selling prices.

Rare earth and rare metal selling price have hit their record high price in mid-2011 and have come significantly down since then. As China continues to play an important role by setting export quotas, many rare earth projects, in addition to Orbite’s will bring significant capacity in the market place over the coming years. Many of these projects have been announced to come in line beyond 2015 while Orbite’s will start producing rare earths and rare metals as they start up the first smelter grade alumina. These combined effects coupled with the growth of the users of rare earth will place a downwards pressure on prices in the coming years as reported by Jacobs Securities Inc.^(95,110) and observed in the graphs below.

Figure 19-12 Rare Earth Element Historical and Forecasted Pries (US\$/kg)⁽⁹⁵⁾



Note: Average annual prices for a 'standard' 99% purity of individual elements.
 Source: IMCOA; Asian Metal; JSI

All of the scenario above as well as the sensitivity analysis in Section 22 assume that rare earths and rare metals will be processed and sold separately as oxides. Another option would be to sell the mixed cake which would involve less capital investment and lower potential revenue for Orbite. The choice has not been made yet and will depend on a future potential partnership and/or the outcome of the Feasibility study.

World economy has always operated in cycles and we are entering 2012 in what is believed to be one of the toughest historical low. Therefore the current pricing for rare earth, alumina and also other products manufactured by Orbite will continue to vary up and down with the economic constraints. Due to its low manufacturing cost, Orbite will be well positioned to realize a good financial performance even is the economy and prices remain where they are and will definitely benefit from the anticipated recovery in world economy and prices when they occur.

20 ENVIRONMENTAL AND SAFETY CONSIDERATIONS

The preliminary environmental baseline conditions of the project area were assessed by the engineering firm ROCHE during the years 2008^(111,112,113,114) and 2011,⁽¹¹⁵⁾ while GENIVAR undertook a review of the environmental considerations of the Project in the summer/fall of 2011.⁽⁶⁾ Orbite Aluminae Inc. intends to develop and operate at Grande-Vallée in a sustainable manner which includes being sensitive to the local environment and its biodiversity. For this reason, environmental aspects will be a primary concern during each stage of development, operation and mine closure.

Sustainable operations are planned at the Orbite facility. The project will produce alumina without creating the toxic red mud⁽¹¹⁶⁾ generated by the traditional Bayer process. In fact, more than 95% of the starting clay mass will produce marketable stable products, such as alumina, hematite, high quality silica, selective oxides, and 12 additional rare earth/metal elements. Other sustainable methods include high acid recovery, no residue generation, and performing equipment and technologies. Orbite envisages the extraction and processing of the aluminous clay located within its claims in Grande-Vallée in the Gaspésie region for commercial purposes. The project is considered to be a mining operation with a refinery given that the ultimate goal is to produce metallurgical (smelter) grade alumina (SGA) to be sold to aluminum smelters.

The studies undertaken to date have addressed the following key environmental disciplines:

- Aquatic resources;
- Soil quality;
- Forest resources;
- Presence of threatened, endangered or vulnerable species;
- Archaeological, cultural or sites of interest;
- First Nations;
- Global Environmental impact;
- Environmental Management System;
- Environment and community;
- Environmental specificity;
- HSE End Product and safety considerations.

The preliminary findings are summarized in the following sections. Furthermore, aspects associated with necessary permit applications as well as those associated with the management of Controlled Products and the mine closure are discussed

20.1 Environmental Components

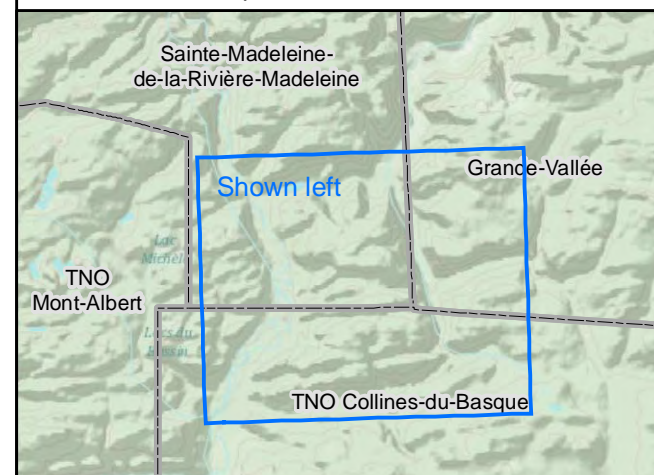
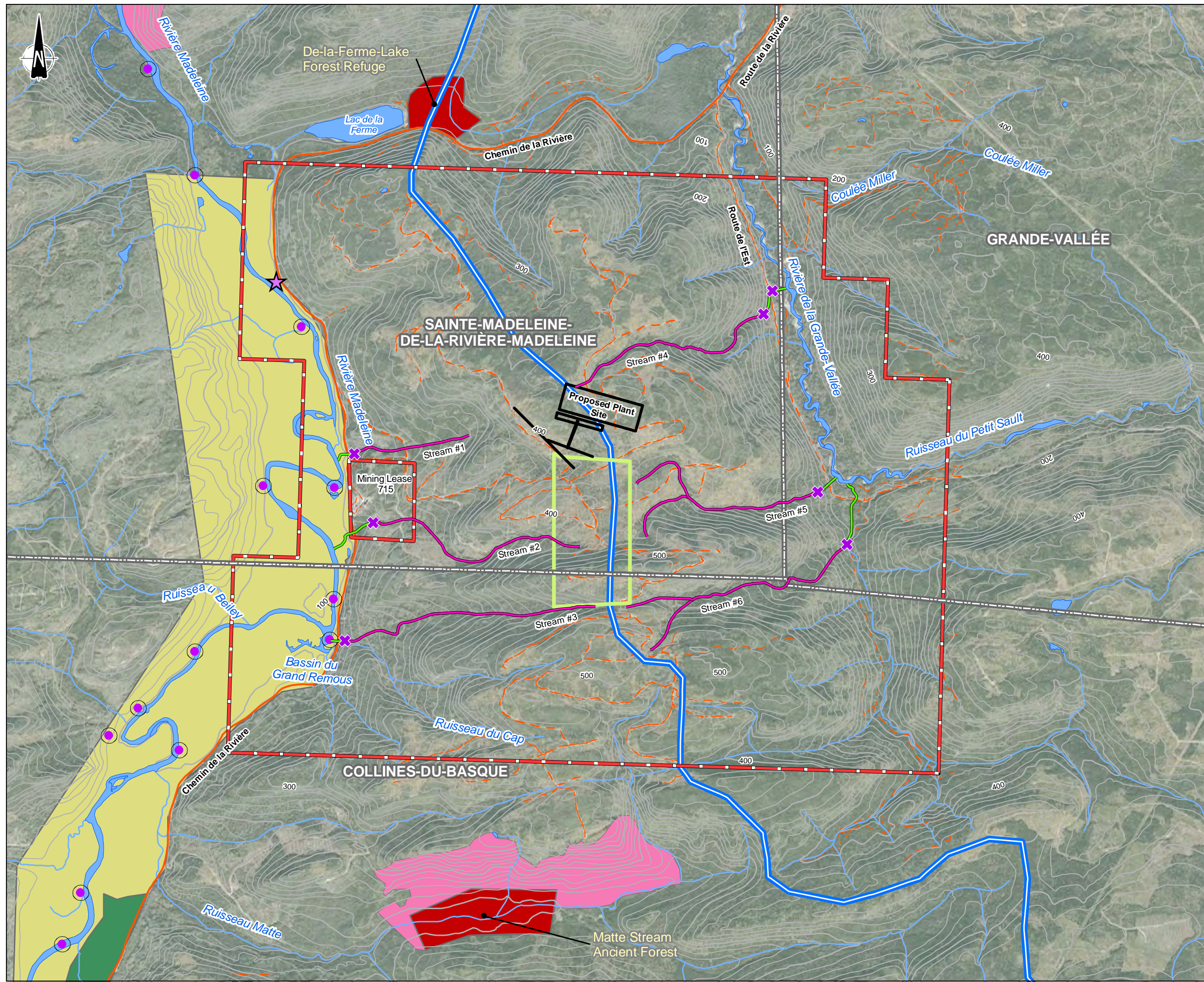
20.1.1 Aquatic Resources

The Marin Sector and the projected project site are located between Madeleine River and Grande-Vallée River watersheds (see Figure 20-1). Both rivers empty into the Saint Lawrence River, approximately 15 km to the north of the project. The Madeleine River is an Atlantic salmon (*Salmo salar*) spawning site.

Orbite mandated an independent consulting firm in August 2011⁽¹¹⁵⁾ to undertake fish habitat survey on the site. Results indicate that no fish habitat is present on the mine/plant project site. Insurmountable obstacles at the mouth of the small streams emptying into the Madeleine and Grande-Vallée rivers (see Figure 20-1) make it impossible for fish to swim up. Brook trout was captured at the mouth of four of the six small streams in question.

Water quality analyses were performed in these small streams. Results show certain exceedences of the Canadian recommendation for protection of aquatic life (Canadian Council of Ministers of the Environment - CCME) as well as of the Quebec criteria for the protection of aquatic life (chronic effects) for total phosphorus. Phosphorus criteria should be applied wisely and adapted to the particularities of the evaluated environment. In the present case, the studied streams do not empty into bodies of water with environmental concerns. The objective is to therefore limit modifications to downstream habitats, in particular by limiting growth of algae and aquatic plants. Moreover, the environment downstream does not appear to have been impacted by concentrations already present in the water streams. Therefore, during subsequent development steps of the mine, particular attention should be paid to phosphorus levels such that they do not significantly increase due to the proposed activities.

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Figure 20.1
Biological and Physical Components
in the Main Sector

Sources :
 Topographic Map :
 - ESRI World Topographic Map
 - Base de données CANVEC
 Other Source :
 - ROCHE : Étude de caractérisation environnementale - Carte 4.1 (2008-10) et carte 3 (2011-09)
 Orthophotography :
 - Image Cnes/SpotImage from Google EarthPro
 January 12th 2012 111-20434-00

Prepared by: É. Gingras
 Drawn by: C. Thériault
 Approved by: B. Fournier

GENIVAR

There were also exceedences of these criteria upstream of the six small water streams in question for aluminum. However, these results are not surprising in an area where it is proposed to valorize aluminous clay deposit. Furthermore, it is important to specify that certain high quality surface water can contain natural levels higher than water quality criteria. In these situations, the natural levels must be considered as reference values as opposed to quality criteria. Quality criteria for the site can also be determined case by case in discussions with the MDDEP.

Sediment analyses were performed in the six water streams. Overall, exceedences of the criteria for threshold concentration producing an effect (TCE) were noted for arsenic in all six water streams. Furthermore, an exceedence of arsenic concentration producing frequent effects (CFE) was noted upstream of one of the six streams. It must be noted that the concentrations were measured prior to the installation of the future mine. These are therefore «natural» concentrations. In the operation phase, particular attention will nonetheless be paid to arsenic in the wastewater (with respect to the Directive 019 on the mining industry put in place by the MDDEP) and the sediments in order to ensure that the proposed activities do not cause an increase in the «natural» levels. With regards to this element, a characterization of the benthic community in the receiving body of water will have to be performed prior to the start of the mine's operation.

20.1.2 Soil Quality

Five soil sampling stations were put in place in 2011 in the areas where the pit and mining complex are expected to be located (see Figure 20-1). None of these stations presented exceedences of criteria C of the MDDEP's Soil Protection and Rehabilitation of Contaminated Sites Policy. However, certain exceedences of criteria A and B were found for arsenic, cobalt and magnesium.

Level A of the Policy refers to background levels for inorganic parameters and to the quantification limit for organic parameters. The quantification limit is defined as the minimum concentration which can be quantified with an analysis method of defined reliability.

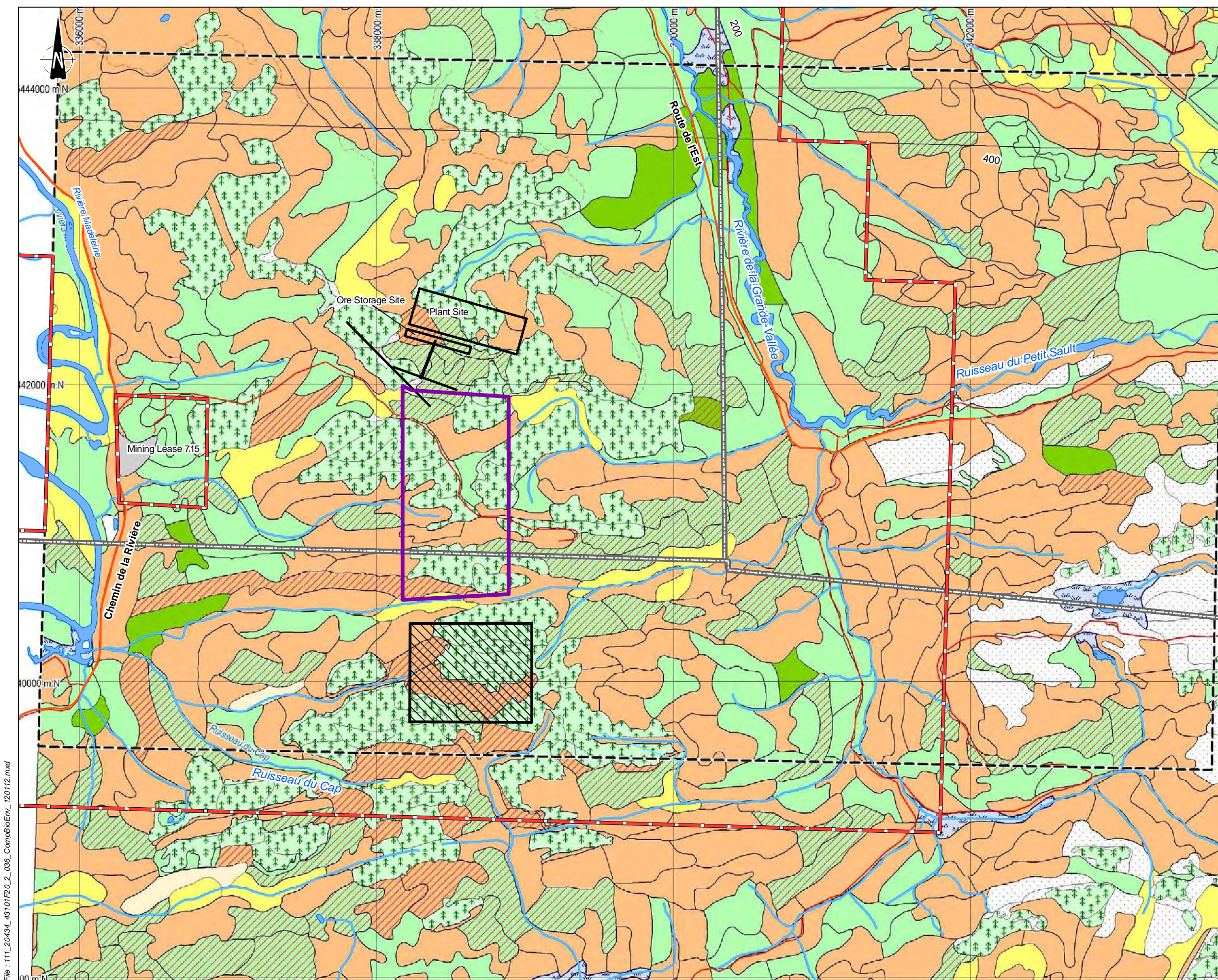
Level B on the other hand defines the maximum acceptable limit for residential, recreational and institutional sites. This also includes commercial land located in a residential district.

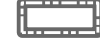


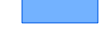

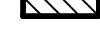
In the present case, level C applies to the project as it determines the maximum acceptable limit for commercial sites, not located in a residential area, and for industrial, such as the site to be used for the mining project.





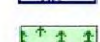
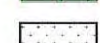

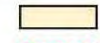


20.1.3 Forest Resources

The fauna and flora in the region are typical of the boreal forest. Coniferous trees dominated by sparse spruce cover the Project area. Other tree species such as balsam fir, larch and pine, as well as clumps of broadleaved birch, poplar, willow, alder and mountain ash, are also found. The forest in the area of the project is primarily composed of black spruce, balsam fir, white birch and trembling aspen. Plantations are also found in the Project area as a result of historic silvicultural works. Figure 20-2 represents the vegetation of the Project area which characterizes the Marin Sector.

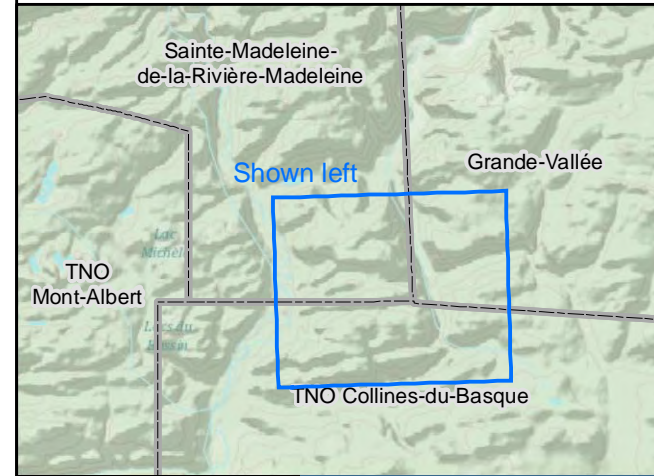
The project area also allows the high potential of forest by-products (i.e sawdust) that would allow biomass as a source of energy for eventual cogeneration within the site vicinity. A study conducted by Activa Environnement⁽⁷⁸⁾ reveals the potential in the area of Murdochville for such an energy source.



-  Municipal Limit
-  Marin Sector
-  Proposed Mining Lease
-  Main Road
-  Lake
-  Watercourse
-  Proposed Processing Plant
-  Tailing and Waste Material Storage

- Vegetation**
-  Deciduous
 -  Mixed
 -  Dry Coniferous
 -  Wet Coniferous
 -  Swamp
 -  Plantation
 -  Logging
 -  Unproductive
 -  Dry Bare
 -  Serious Epidemic

0 250 500 1 000 m
 1:25 000
 Projection : NAD 83, UTM 20




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 NI 43-101 Technical Report

Figure 20.2
Marin Sector Vegetation

Sources :
 Topographic Map :
 -ESRI World Topographic Map
 -CANVEC Data Base
 Other Sources :
 -Figure extracted from the Étude de caractérisation environnementale (Roche) - carte 4.1 - Communautés végétales - 2008-10 (SIEF 22H03-NE-SE)

Prepared by: É. Gingras
 Drawn by: C. Thériault
 Approved by: B. Fournier

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20.1.4 Presence of Threatened, Endangered or Vulnerable Species

According to the information obtained from the Centre de données sur le patrimoine naturel du Québec (CDPNQ), there is no mention of the presence of any threatened, endangered or vulnerable plant species or likely to be so designated within the Project area.

Certain vulnerable species were however reported within a 1 to 2 km radius of the future installations, in the area corresponding to the Lac-de-la-Ferme Refuge Forest (see Figure 20-1). This sanctuary is an exceptional forest ecosystem according the MRNF. It is home to three orchid species which appear on the list of vulnerable or endangered species of Quebec. Another exceptional forest ecosystem is found at approximately 2 km south of the future pit, the Ruisseau Matte ancient forest. The species in question is an over 500 year old pine cedar.

Furthermore, according to the CPDNQ, no observations identified the presence of any vulnerable bird species or other animal species within the Project area. Nevertheless, inventories must be taken prior to the start of the Project in order to confirm the presence or lack of vulnerable animal or plant species.

Note that Claims 2038512-515, 2038530-532, 2248809, 2248812, 2248817-18 and 2248824 for the Marin Sector (see Figure 4-2) are located in whole or in part within a wildlife habitat, specifically the confinement area of the white-tailed deer present along the Madeleine River (see Figure 20-1). Mining operations may be permitted with conditions. An application as part of future work will have to be submitted to the MRNF in that regards. Nevertheless, the majority of this deer habitat is not within the Marin Sector, to be first developed.

It must also be noted that the future Project area is used for moose hunting. It is a free territory in which about thirty hunting shelters were found during a site visit in the summer of 2011, along the different forest trails and paths on the Project site.

20.1.5 Archaeological, Cultural or Sites of Interest

No archaeological sites have been identified to date on the proposed mine site and plant proposed location for the Project. There is no significant heritage or cultural site on the proposed mine site that would require the relocation of any infrastructure at this time. These assumptions will be covered during the Feasibility study stage.

Figure 20.3 shows the potential archeological zones present in the Project site's surroundings. This figure also shows the only inventoried archeological site in the area, found at over 4 km from the proposed plant location.

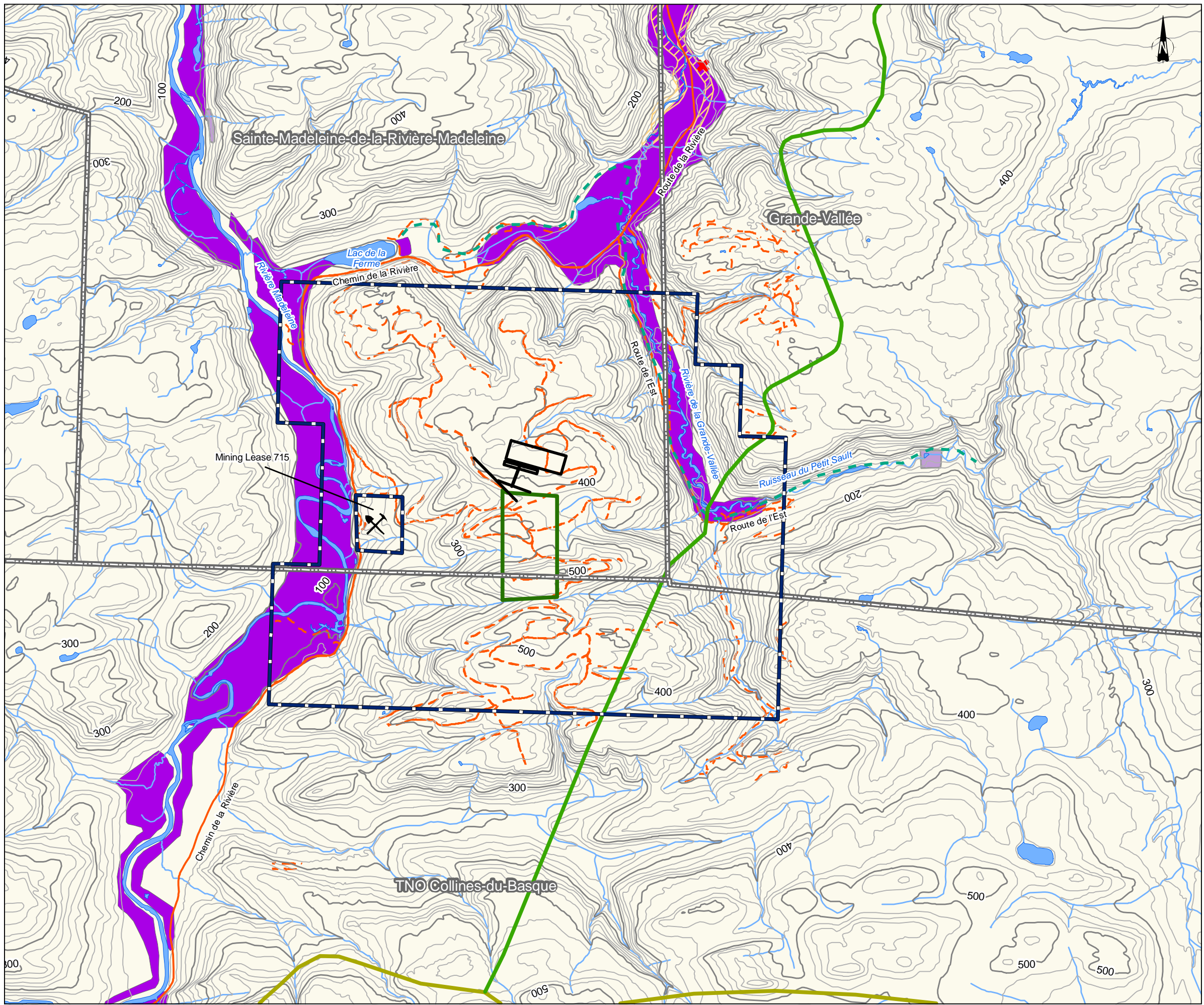
Finally, Figure 20-3 indicates other recreational elements of interest, in particular hiking trails and snowmobile and quad trails.

20.1.6 First Nations

The Project property is subject to ancestral rights claims of the Micmac Nation. There have already been a few meetings with their representatives, i.e. the Secretariat of Mi'gma'wei Mawio'mi (SMM). The Secretariat did not voice any arguments against the two sampling campaigns for which their agreement was required by the MRNF. As of now, there are negotiations going on for the Mining Lease and will be part of the Feasibility study.

Recently (fall 2011), an executive person from Orbite has been appointed to lead relations with local communities in order to favour harmonious relationships in the Gaspésie region (RCM, municipalities, first nations, interest groups, local residents, etc.). The objective is to present a project that will minimize the impact on the environment as well as be socially accepted and provide the biggest benefits for the region. A consultation group has been set up in that regard and will be combined with the feasibility study stage as well during 2012. Orbite has also appointed an executive person in charge of sustainability development.

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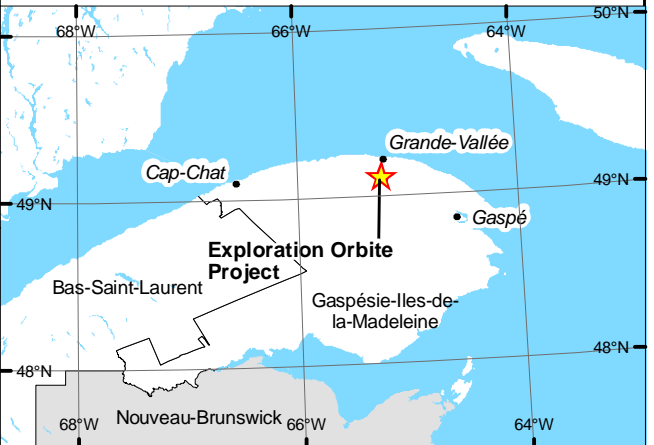
	Marin Sector
	Proposed Mining Lease
	Main Road
	Access Road and Trail
	Lake
	Watercourse
	Contour Line (20 m interval)*
	Proposed Processing Plant
Other Human Environment Elements	
	Quarry
	Approximate Location - Snowmobile Trail
	Approximate Location - Snowmobile and Quad Trail
	Approximate Location - Walking Trail
Archeology	
	Archaeological Site
	Area of Amerindian Archaeological Potential
	Area of Eurocanadian Archaeological Potential
	Area where an Archaeological Inventory has Already Been Done

*Above mean sea level

0 500 1 000 2 000 m

1:50 000

Projection : NAD 83, UTM 20



PRELIMINARY ECONOMIC ASSESSMENT ON METALLURGICAL GRADE ALUMINA PROJECT
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Figure 20.3
Components of the Human Environment
In or Near the Marin Area

<p>Sources :</p> <p>Topographic Map : - CANVEC</p> <p>- Compilation des travaux sur les argilites aluminieuses - Rapport technique, Exploration Orbite VSPA inc. Figure 3 - Dessiné par Gaspécor 08-08-08</p> <p>- GESTIM Data Base- (11-08-08)</p> <p>January 12th, 2012 111-20434-00</p>	<p>Prepared by: É. Gingras Drawn by: C. Thériault Approved by: B. Fournier</p> <p></p>
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20.1.7 Global Environmental impact

The environmental emissions from the Grande-Vallée alumina production plant will be authorized and regulated by Provincial authorities in order to control environmental impacts to current acceptable limits.

Orbite intends to become a leader in the relationship between mining and sustainability. For this reason, environmental aspects will be primary concerns during each stage of development, operation and mine closure.

As mentioned previously, the major environmental significance of the Orbite process is its advantage over the significant environmental impacts associated with the Bayer process. The Orbite process aims to have all the solid products which remain after the extraction of alumina marketed as value added products. This process avoids the caustic nature of the red mud which results from the extraction of alumina from bauxite with the Bayer process. Unlike the Bayer process Orbite is identifying attractive markets for the solid value added products (high grade silica, hematite, etc) from their process. The commercial metallurgical grade alumina process developed by Orbite includes high hydrochloric acid recoveries that eliminate potential environmental impacts from acidic products.

Orbite's process can potentially capture the carbon dioxide produced by thermal reactions with natural gas resulting in negligible amounts of carbon to the atmosphere.

20.1.8 Environmental Management System

An Environmental Management System will be implemented to provide systematic approaches for effectively managing the expected and potential interactions of the Project (mine and Industrial Plant) with the receiving environment.

This plan which will be developed by Orbite in collaboration with GENIVAR will use the best practices of the chemical industry, and will incorporate two key elements:

1. An Environmental Management Plan;
2. An Environmental Monitoring Program.

The Environmental Management Plan will identify how the mine and the commercial metallurgical alumina Plant will be operated to manage the interactions between project components, activities, and the receiving environment to prevent or mitigate potentially significant adverse impacts.

The Environmental Monitoring Program will be integrated into the Environmental Management Plan as a tool to provide feedback on how well impacts have been

predicted and to allow appropriate corrective actions to be taken in the event that unexpected or unacceptable impacts occur. In addition, the monitoring program will allow Orbite to fulfill the federal and provincial regulatory compliance monitoring that will be required. Orbite is committed to produce on a yearly basis a Health, Safety & Environment (HSE) activity report with performances and KPI's (Key performance indicators) associated.

20.1.9 Environment and Community

Due to the local environment and its biodiversity, the environmental aspects will be a primary concern during each stage of development, operation and up to the mine closure. Orbite intends to have a collaborative approach concerning the potential apprehensions, concerns or comments from the different communities where it will operate. In addition to protecting the environment, the company will prioritize the health and safety of its employees and the general public as it relates to its operations. In order to achieve its sustainable growth goals, Orbite intends to lay the ground work of a sustainable growth policy in the near term so it can be made public. Finally, periodic reports regarding the sustainable growth conducted by Orbite is scheduled to be produced starting in 2012.^(117,118,119)

20.1.10 Environmental Specificity

20.1.10.1 Raw water Intake to Chemical Plant

The Marin Sector and the projected project site is located between Madeleine River and Grande-Vallée River watersheds. Both rivers empty into the Saint Lawrence River, approximately 15 km to the North of the project. The Grande-Vallée River has an average flow of 2.7 m³/s, a maximum flow of 50.8 m³/s and a dry-season flow of 0.124 m³/s. The Madeleine River has an average flow of 28.4 m³/s, a maximum flow of 640 m³/s and a dry-season flow of 2.0 m³/s.

It would appear that both rivers are able to provide the water flows required by the project. The plant is expected to require, even though figures will be determined during the feasibility study, approximately 15 t/h to 20 t/h of water. This flow represents 0.28% of the Madeleine River's hourly flow and 4.48% of the Grande-Vallée's hourly flow. The MDDEP's minimum requirement in this regard is that a maximum of 20% of the dry-season flow may be extracted from a river, an amount far exceeding the project's requirements. The hydrological impacts of such a water use must be evaluated during the permitting process through the commissioning of the feasibility study, notably to determine the best option, given that the Madeleine River is a salmon river and that all changes to the hydrological regime must be evaluated.

It is worth to be noted that no private water intake is located within the Project's immediate zone of influence; and that the closest residences are approximately 6 kilometres to the north. No other use of groundwater has been registered within the same zone. Any lowering of the water table as a result of the project's operations is unlikely to affect other groundwater users, as long as the pit's depth does not exceed the expected 100 metres.

In addition, the municipality of Grande-Vallée is served by a public water distribution system as well as a public sewer system. These networks extend along the first 12 km of Route 132 under the Municipality's jurisdiction, parallel to de la Rivière Road. The water distribution system's intake is a well drilled into the water table, located approximately 8 kilometres along de la Rivière Road. The municipality of Sainte-Madeleine-de-la-Rivière-Madeleine also possesses a public water distribution network. However, their system's water intake is not located within the Madeleine River watershed, but rather in that of the Little Madeleine River, which directly discharges into the Saint Lawrence River. Both are too far away from the projected Plant site.

20.1.10.2 Mine Tailings Management and further Related Studies

Mine tailings produced by the Project must be characterised in order to determine an appropriate management program. The sedimentary deposit in question is unlikely to produce either acidic or leachable compounds. However, the potential to valorise the tailings appears limited given the expected low production volume of tailings. It is also expected that several years will pass before a significant volume of tailings will be produced. Tailing management is expected to not be a significant issue for this Project.

Any mining residues which are produced should be characterised. The characterisation should concentrate on identified elements and on various leachate analyses. It is very likely that the residues are not acidic; however they are expected to not be at high-risk level. In this case, Level A seal measures are required, as specified in Directive 019.

Mine tailing management should be designed so as to allow for a maximum flow of 3.3 l/m² of tailings stockpile surface area. This flow has been established according to a tailings management model having the following characteristics:

- A clay lining of at least 3 m thick;
- Ahydraulic conductivity of 10-6 cm/s;
- An average hydraulic load of 10 m in height.

A modelling study demonstrating that the sealing measures in place will protect against any significant decrease in groundwater quality must be performed. In the context of the current project, the study should include:

- A water balance study over the mine tailings storage area demonstrating an infiltration rate of less than 3.3 l/m²;
- Presentation of results obtained during the infiltration tests;
- A cartographic representation of all Type 1 aquifers present in the site's periphery, including a representation of the groundwater flow downstream from the mine tailing storage area;
- A hydrogeochemical demonstration that the storage of the mine tailings will not significantly impact the quality of local surface water and Type 1 aquifer groundwater.

The mine tailings storage area should be at least 60 m from the high water mark of any bodies of water on the site, and the surrounding dike should be at least 1.5 m high in order to protect any sensitive components downstream of the storage site which could be affected by a spill.

20.1.10.3 Water Management - Mine Site

The water collection ditch will be surrounded by separate ditches in order to capture any runoff water before it may join the main water to be treated, and hence avoiding the treatment of any parasitic waters. Wells may also be installed around the collection channel in order to reduce the groundwater level.

Water collected in the collection ditch should be treated and monitored in order to ensure that it meets the requirements set out in Directive 019 and eventually the requirements of the ERO (Environmental Reject Objective).

Mine tailing dump sites will also be surrounded by ditches. Any water percolating through the tailings should be analysed and treated accordingly.

As a function of the final design of the pit, the location of the collection ditch, waste dumps and the mine tailings storage area, the modification of a water body or wetland may be necessary. In such a case, a statement to this effect must appear in the request for the site's Certificate of Authorisation before the start of any Works in water body or wetlands, as specified in the MDDEP's "Politique de protection des rives, du littoral et des plaines inondables". All works in a watercourse may trigger applicable federal environmental processes evaluation and studies if the body of water is considered to be a fish habitat.

20.1.10.4 Water Management – Effluent Treatment Plant

The location for the project's effluent treatment plant is planned to be on the boundary between the Madeleine River watershed and the Grande-Vallée watershed. The decision for this location was taken given the sensitive nature of the Madeleine River's status as a salmon breeding river (a controlled zone); negotiations will have to be entered into with the Madeleine River's management body and the MDDEP in order to determine the consequences that any spill may have on the river. Even though the Madeleine River represents a larger receiving matrix for the effluent produced by site operations, therefore presenting a higher rate of dilution for any such effluent than would the Grande-Vallée River, the latter should be chosen to receive the effluent produced by site operations given the former's sensitive status. Agreements will nonetheless have to be entered into with the MDDEP regarding the determination of the effluent's environmental targets in order to avoid being subject to stricter targets given the receiving matrix' lower dilution rate. A complete characterisation of the final effluent will be performed annually. The analytical programme will be more rigorous and would be a function of the effluent's nature.

Effluent Environmental Targets

In addition to general requirements stated above, the MDDEP prescribes effluent environmental targets, effluent parameter concentrations toward which the effluent quality should tend where feasible. The effluent environmental targets allow for the evaluation of the environmental quality of the expected effluent, while targeting the substances most problematic for the receiving matrix. The determination of the effluent environmental targets takes into account the usage of the receiving matrix and the dilution rate of the effluent in the receiving matrix. When the effluent flow is well known and it is not possible to buffer the flow such as with the use of a retention basin, different effluent flows may be considered as a function of the season (ie. summer low flow).

Less restrictive effluent environmental targets are obtained when the effluent flow/receiving matrix flow is low. It would be preferable, as stated, to send any final effluent to the Grande-Vallée River even though it has a lower flow than the Madeleine River given that it is likely to be less environmentally sensitive than the Madeleine River, this last being a ZEC (zone d'exploitation contrôlée in French) managing the salmon stocks.

Final Effluent Regularisation

Directive 019 specifies that in the case of an ore concentration plant in which wastewater is stored for long periods of time, it is recommended that flows are reduced to a minimum and to progressively distribute the rate of release over the longest possible time period so as to adjust flow to flows in the receiving matrix.

Effluent environmental targets are less restrictive if flows are at a maximum during the spring melt and at their lowest during dry periods. In the context of the current project, it would be possible to store all wastewater during the winter period, allowing for release proportional to the receiving matrix flow.

20.1.10.5 Other Environmental Parameters and Mine Infrastructure

All other environmental parameters (air emissions, waste, etc) will be managed according to all relevant legislations federal and provincial.

The Mining Act (Loi sur les mines) will apply to the Project. Under this Act, the final and exact chosen site for the processing plant must be approved by the Government during the Feasibility study stage. For now, the processing plant should normally be located in the immediate surroundings of the mining site, on Crown Land, but this will be determined officially at the feasibility study stage.

Drilling works must be undertaken on the site selected for process wastes, mine tailings storage, and overburden. These boreholes will be performed in view of demonstrating that the underlying bedrock below the storage areas presents no economic potential.

In addition, the designated waste storage sites may be located, in whole or in part, outside the limits of the mining claims held by Orbite. In such a case, the specified geological studies would still have to be performed. The surveying programme would have to determine the necessary surface area for the storage of the mine wastes, and therefore to be used in the determination of the royalties due on the use of Crown Land. All these specific aspects will also be referred to in the feasibility study stage.

20.1.11 HSE End Product and Safety Considerations

Orbite's proprietary process and the alumina produced from its clays is free of any product that may be harmful to workers such as beryllium (Be). This is a distinctive advantage compared to the industry standard Bayer process.

20.2 Mine Closure

The Project will be developed, operated and closed in accordance with the Quebec Mining Act (L.R.Q., C. M-13.1) guidelines for preparing a mining site rehabilitation plan, and according to generally accepted mining site rehabilitation requirements. It requires the preparation of a site restoration plan, an estimation of the restoration costs, and a progressive payment plan toward a restoration guarantee fund (bond) held in trust. The restoration fund is to be valued at 70% of the estimated costs of the restoration costs associated with the ore storage areas, mine tailing storage areas,

and the treatment wastes. The Grande-Vallée mine site rehabilitation and restoration plan will have to be prepared and submitted to the Quebec MRNF for approval, prior to commencing mining activities.

Whenever possible, the rehabilitation and restoration activities will be carried out concurrently with the mining operations and final closure and reclamation measures will be implemented at the time of final mine closure. Mine closure will require pit revegetation work, reusing the stripped site organic top soil previously removed during the mine preparation work. Long term slopes stability will have to be secure. Water level in the pit will rise up to stable levels and lakes are likely to be created.

Progressive restoration of certain parts of the mine tailings storage areas would allow for the reduction in the value of the bond given that the restoration works would already have been performed. Given that the mine tailings are not expected to be acidic, the restoration costs associated with the mine tailing storage areas should be limited to and to the order of \$10,000 per hectare

The following sections highlight some of the main activities that will be included in the final mine closure plan submitted to the MRNF. This is by no means an exhaustive list.

20.2.1 Site Security

To ensure the safety of the site, Orbite will manage its mining site according to best practices and legislations to insure that it is safe for workers and potential visitors. Access roads to the open pit will be prevented by building berm according to the best practices in place. Signs that indicate the danger will be posted on these berms. No fences or barriers will be installed around the open pits as these areas are not generally visited.

During the site restoration work and environmental monitoring, barricades will be set up to secure potentially dangerous areas and to minimize the risks by reducing the traffic flow to areas of the site that are infrequently visited. The barricades will be concrete Jersey barriers or blocks of waste rock combined with gravel.

20.2.2 Open Pit Wall Stability

Mine closure will require pit revegetation work, reusing the stripped site organic top soil previously removed during the mine preparation work. Long term slopes stability will have to be secure and before flooding the open pit, the pit walls will be evaluated for their physical stability. Any risk of walls collapsing will be reduced by securing the sections of pit wall that are at risk.

20.2.3 Flooding

After the mining operations have ceased, the dewatering of the pit will stop; this will allow the water in the pits to return up to stable levels and lakes are likely to be created.

Surface water drainage ditches will be constructed just outside and upstream of the pits to direct the surface water to the open pit. Directing the surface water to the open pit will allow the suspended solids to settle to the bottom of the pit. Confirmation of this will be done through the surface water quality monitoring program at the discharge points.

20.2.4 Waste Rock Piles

The mining operation will generate very small amount of waste rock. Waste rock piles will be progressively built through the course of mining operations and restored when mining operations are completed. Exact location of minimal piles will be established during the Feasibility study stage.

Measures to protect the groundwater will be specified once the geochemical analyses of the non-acid generating waste rock have been completed.

Orbite will implement a progressive closure strategy during mining operations to reduce the overall closure costs at the end of the mine's life. Following confirmation of the method of waste rock placement, the waste rock dumps will be covered with at least 300 mm of loose materials removed during mining operations and seeded to restore the site to a visually acceptable condition. In addition, the slope stability will be verified, validated and corrected, if required.

Surface water collector ditches will not be dismantled to allow for environmental monitoring of the water quality during the first 5-10 years following mine closure.

Proper natural installations will be maintained to ensure that the open pit water quality meets the effluent discharge limits, before being discharged to the environment.

20.2.5 Dismantling of Buildings and Supporting Infrastructure

The Plant is likely to be dismantled and recycled. Dismantling will be done unless some new use can be found either for Orbite or a new user. An offer could be made to local authorities and/or industries to use partially or totally the buildings and infrastructures. Dismantling will be performed by certified contractor(s). Waste will be buried on site and/or transported to authorized recycling centers in Québec according to all relevant legislation. In the eventuality plant needs to be totally

dismantled, process buildings, storage area, as well as infrastructure such as any conveyors or pumping stations that were built for the mining operation will be dismantled to leave the site in a state that is compatible with the existing environment. Some key infrastructure, for example camp and security buildings, will either be maintained for the benefit of the local communities or to prevent any actions that could have a negative impact on the receiving environment.

As part of the phase of the dismantling and disposal of the mine site buildings, all the buildings and infrastructure on the project site that will not be used for post-closure monitoring will be dismantled by a certified contractor.

Buildings and Infrastructure

The demolition of the buildings and all surface infrastructures will include the following:

- Recyclable materials and equipment will be put aside and either given away or sold for their recovery and/or re-use;
- If there is an interest in these materials and equipment by the local people, Orbite will promote the creation of an organization that will give a second life to these recyclable materials;
- All the process production and service equipment, such as silos, tanks, pipes and pumps will be drained and cleaned. The wash waters will be collected and treated (sedimentation, oil and water separation, and pH adjustment), if necessary, before being discharged to the environment;
- All the equipment containing oil or any other liquids that have the potential to contaminate, such as electrical equipment and vehicles, will be drained of their fluids before being disposed of. The recovered oils will be used for heating the remaining buildings or recovered by vacuum truck and sent to an authorized recycler.

Management and disposal of all chemical waste and hazardous materials will be done safely, while respecting the applicable standards and regulations in place at the time of closure. Any solids, liquids, and mud found within the buildings on site will be characterized as required.

The walls and floors of the buildings will be cleaned, if necessary, prior to dismantling. The wash waters will be collected and processed (sedimentation, oil and water separation, and pH adjustment), if necessary, before being discharged to the environment.

Foundations

- Foundations constructed of backfilled rock and gravel and/or triangular supports for light industrial use buildings, such as the water treatment plant, plant process sections and services building, will be levelled to blend in with the site topography.
- Any concrete slabs for buildings that require more stability will be broken up with a mechanical jackhammer, crushed and then levelled to blend in with the site topography.
- Any contaminated concrete will be scarified and the layer of contamination removed so that the remaining concrete meets the existing regulations and can be left in place.
- All crushed and/or broken concrete is to be levelled then covered with 1 m of overburden, followed by seeding to establish the vegetation.

Demolition of Transportation Infrastructure

The main access roads to the Property are located on Crown lands and are connected to the public road system administered by the MRNF. These main access roads will not be restored following the closure of the mining and processing operations. Only the roads that access the various mining operations will be re-graded, capped with top soil where needed, and fertilized and seeded with native species.

Heavy machinery and Mobile Equipment

Wherever possible, all mobile equipment and heavy machinery will be sold as used surface equipment and removed from the site prior to final closure. Any unsold equipment will be sold for scrap or disposed of.

The mobile mining equipment, for example trucks, loaders, shovels as well as heavy surface machinery located in the open pit will be returned to the surface, emptied of all liquids and identified as being saleable or recyclable. All liquids will be recovered and transported to a certified site. Used equipment and machinery parts that are too worn or old will be sent for scrap.

Borrow Pit and Quarries

All borrow pits and quarries used for construction, maintenance and restoration work of the Project site will be re-profiled and restored. The restoration measures will meet the requirements of the MDDEP borrow pit and quarry restoration regulations.

All debris, inoperable equipment, pieces of machinery and any other wastes will be collected and disposed of onsite during the restoration work or sent for recycling. The slopes of the borrow pit and quarries will be stabilized to prevent any land subsidence and erosion.

20.3 Controlled Products

20.3.1 Petroleum Products

The use of petroleum products for the mine operation, including gasoline, diesel fuel, hydraulic oils and grease will be planned to ensure that there are minimum quantities on site at the end of mining operations. Suppliers will be responsible for recovering all remaining volumes on site after operations have ceased and restoration work is completed.

There will be no permanent fuel storage tanks on mine site. Only fuel tanks, due to proximity, will be at the Plant itself. Tanks and associated piping will be drained, cleaned and dismantled. The soils adjacent to the storage tanks will be characterized, and the contaminated soils will be rehabilitated as required by The Quebec Environmental Quality Act (QEQA), Section IV.2.1 - Soil Protection and Rehabilitation of Contaminated Sites Policy. All storage facilities will be built and maintained according to regulations and good industrial practices. Any residual petroleum products after mine or plant closure will be recuperated and transported off site to be reused or treated as waste by an appropriate contractor.

20.3.2 Chemicals

The use of all reagents and other chemicals will be planned to ensure that there are minimum quantities on site at the end of mining operations, with the exception of water treatment chemicals if ever required. All storage facilities will be built and maintained according to regulations and good industrial practices. Any residual chemical products after mine or plant closure will be recuperated and transported off site to be reused or treated as waste by an appropriate contractor.

20.3.3 Hazardous Wastes

The management of hazardous waste disposal is regulated in Quebec and must meet the Quebec Environmental Quality Act (Hazardous Materials Regulations). No hazardous material will be present at the mine site after the cessation of Orbite's mining and refining operations of the Project. All remaining hazardous waste will be collected and disposed of by a certified hazardous waste disposal contractor.

20.3.4 Financial Guarantee

Under the Quebec Mining Act (RSQ, c M-13.1 Sections 96.5 to 96.16), Orbite will prepare a site restoration plan, an estimation of the restoration costs, and a progressive payment plan toward a restoration guarantee fund (bond) held in trust. The restoration fund is to be valued at 70% of the estimated costs of the restoration costs associated with the ore storage areas, mine tailing storage areas, treatment wastes, and post-closure environmental monitoring. The Project mine site rehabilitation and restoration plan will have to be prepared and submitted to the MRNF for approval, prior to commencing mining activities.

20.4 Permitting

20.4.1 Federal Government

The federal environmental review procedures are incorporated into the Canadian Environmental Assessment Act (S.C. 1992, c. 37) (CEAA). Application of the federal environmental assessment process is only required under certain conditions. The Metal Mining Effluent Regulations (MMER) applies to the Project given that its goal is to produce aluminum. At this time, the extraction of the aluminous shale is considered to be a mining operation given that the extraction operations will be designed and operated to produce an ore from which metal may be produced. The MMER specifies parameters for final effluent quality. These requirements are generally identical to the requirements listed in the MDDEP's Directive 019 on the Mining Industry.

The MMER also requires that an environmental monitoring study be performed, beginning with a study prior to the operations (background study) and then every five years. The environmental monitoring study shall include an effluent characterisation, as well as a characterisation of the receiving matrix. Environment Canada is the governmental agency involved in the completion of the study.

According to the Canadian Environmental Assessment Act (CEAA) the project could have components which would trigger the federal environmental assessment procedure. According to the Act, a metal mine, other than a gold mine, with a capacity of 3,000 tonnes or more per day, would require a detailed environmental evaluation, however only if, as previously mentioned, a trigger is in place. For the project at hand, the most probable trigger would possibly be the disturbance or loss of a fish habitat; Fisheries and Oceans Canada would in all likelihood have already issued a permit or authorisation for operations near such a habitat. There are small watercourses near the projected locations for operations. Orbite mandated an independent consulting firm⁽¹⁵⁾ in August 2011 to undertake fish habitat survey on

the site. Results indicate that no fish habitat is present on the mine/plant project site, therefore, it is not likely that the federal trigger would apply to Orbite's project.

20.4.2 Provincial Government

Orbite is planning to install the Plant by the mine site in the Grande-Vallée area in the Gaspésie area. The province of Quebec requires that such a project comply with the Quebec Environmental Quality Act (QEQA) as well as the Mining Act. The project's activities are mining in nature, however the commercial plant's activities are planned to produce less than 7,000 tonnes per day. In addition, even though the site's activities affect on-site rivers which flow into the Saint Lawrence River, they will not affect watercourses having a watershed surface area greater than 25 km². These are the two principal triggers to consider, however neither apply to the project at hand.

Therefore, as of the date of signature of this report, at the provincial level, the project will not be subject to a complete environmental impact study, nor to the evaluation process which would have involved the Environmental Public Consultation Bureau (BAPE – Bureau d'audiences publiques en environnement), in conformity with articles 31.1 and following of the QEQA. Certificates of Authorisation (CoA) will nonetheless have to be obtained from the MDDEP under the QEQA. The environmental characterisation will therefore have to fulfil the requirements listed in Directive 019 on the Mining Industry, which specifies the MDDEP requirements for this type of project.

Nevertheless, Provincial Government is actually looking at a new bill (Bill 14) which seeks to amend the Quebec Mining Act (QMA) and the Environmental Quality Act (QEQA), which once officialised could impact Orbite's Project timeline.

Pursuant to environmental legislation that is currently applicable in Southern Quebec, an environmental impact assessment and public hearings before the BAPE is required for metal and asbestos mine with a production capacity of 7,000 tonnes per day or more, for all uranium mines and for any other mine whose production capacity is 500 tonnes per day or more. In the territory covered by the James Bay and Northern Quebec Agreement an Environmental and social impact assessment and review procedure must be completed for any mining development.

Instead, the Amendments contained in the new Bill 14, propose that all mining projects whether the construction or operation of a mineral treatment plant or the opening or operation of a mine, be subject to an Environmental impact assessment and review procedure, which includes consultation and public hearings before the BAPE without regard to the production threshold.

The new Bill 14 being considered, and not currently approved as of the signature of the present Technical Report, provides that the holder of a claim must proceed with public consultation before applying for a mining lease in accordance with a process controlled by the MNRF.

In fact, the Amendments provide that no mining lease can be concluded unless the claim holder has obtained approval of its mine restoration and rehabilitation and a CoA issued by the government after completing the Environmental impact assessment and review procedure.

As a result, this Bill 14, once adopted, could have a significant impact on the project schedule of Orbite. It means that if the Bill is adopted and related Regulation in force before Orbite gets a mining lease, then the full Quebec Impact Assessment process including potential public hearings will be mandatory before the project goes ahead. Compared to conventional certificates of authorization under the application of the article 22 of the QEQA, this process is more complex, generally taking one to two years, and represents an additional cost of \$2 M, in professional fees. For Orbite, since there is existing baseline data, GENIVAR believes the delay could be 12-16 months rather than 2 years.

Orbite's specific application for a mining lease has been received by the MRNF on September 14, 2011. The lease has yet to be granted. The final exact location of the Plant during the feasibility stage and all related infrastructure would have to be submitted to the MNRF for discussion and approval. The MNRF will also be involved in the site restoration plan.

In summary, to bring the Plant into construction and operation at this time, a CoA will be required under Article 22 of the QEQA, and be issued by the Regional office of the MDDEP. The CoA application will include a site environmental assessment with soil characterization studies, air and noise modelling, biological complements on fauna and flora and effluent characterizations, sufficiently detailed for the MDDEP to issue the CoA. Regulation of the effluents in the area falls under the responsibility of the MDDEP; therefore Orbite will prepare a precondition notice for an off-network industrial discharge, including the waste water release environmental targets for the metallurgical grade alumina Plant.

In addition, the following provincial and municipal permits and certificate of approvals will be required for the Plant, which can be requested in parallel to or after the submission of the CoA to operate. Note that none of these applications will affect the critical timing of the project:

- Plant construction;
- Plant Operations;
- Effluent treatment facility;

- Water/oil separation system;
- Dust collectors, scrubbers, etc;
- City construction permit;
- Petroleum products storage;
- Others to be defined.

21 CAPITAL AND OPERATING COST

21.1 Capital Expenditure Costs (CAPEX)

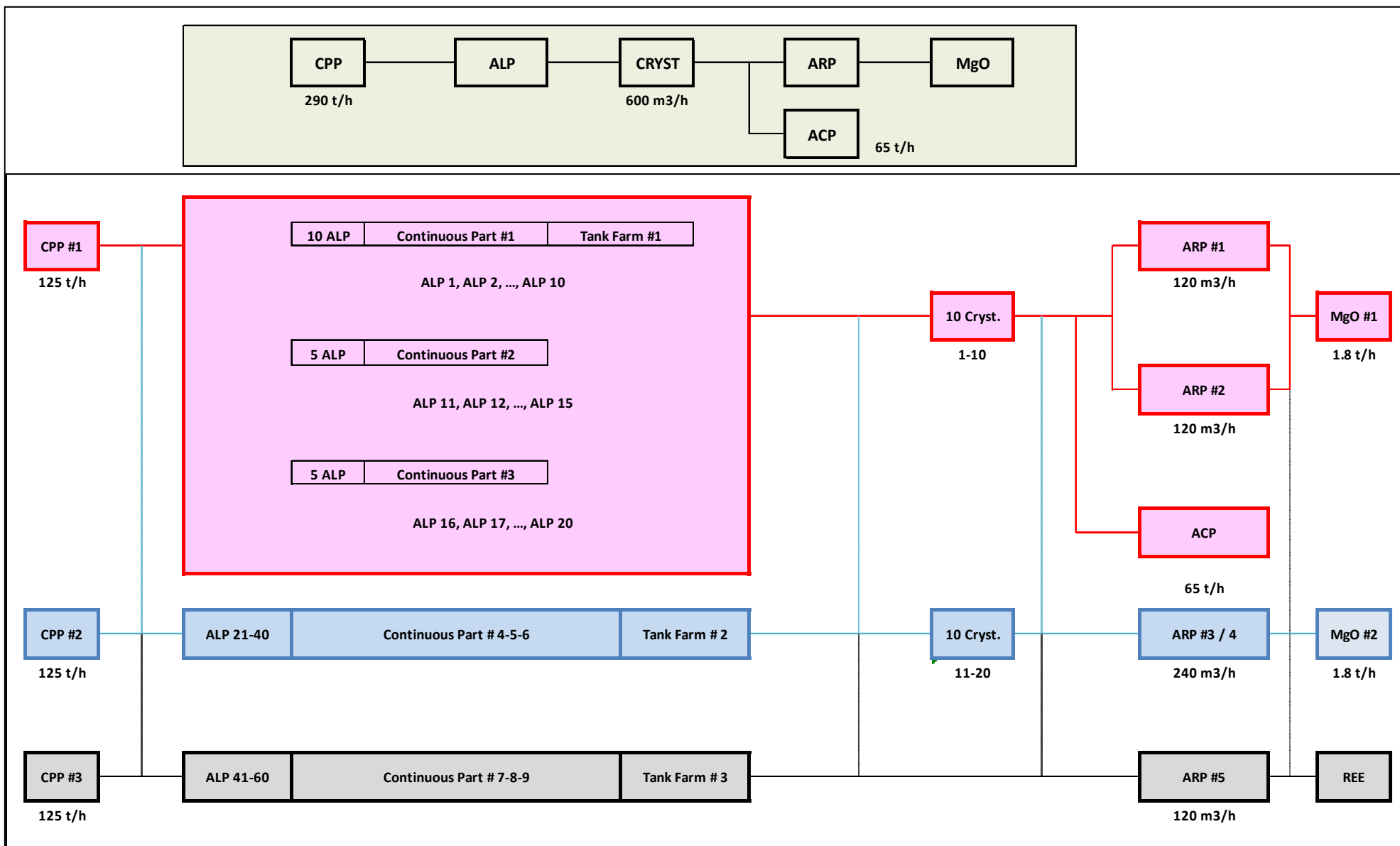
GENIVAR established a main equipment list and developed a preliminary cost estimate based on detailed Orbite's process flow diagram, mass and heat balance associated and provided in part among others by Orbite, SMS Siemag and Outotec Pilot plant's or preliminary studies with equipment suppliers (Pfaudler, De Dietrich, Thaletec, IPPE (used)). GENIVAR worked closely with Orbite to perform preliminary sizing (reactors, mills, mine equipment, etc.) of the equipment. Good used equipment (glass lined reactors 64-80 m³, roller mills, steam boiler, 20MW cogeneration plant, etc.) were also evaluated to a certain extent, in order to control CAPEX. The pricing as a first was all evaluated based on new equipment and then after verification with large plant and equipment reseller, some main equipment's were adjusted based on their actual availability on the market and pricing. In this last case, a provision was considered to perform a mechanical evaluation and revamp.

Process flow schematics having been provided from the beginning of the study and specific revision were submitted by Orbite's Chief Engineer.^(60,61,62,63,64,65) The final process flow diagram (PFD) revision is No. 5 and dated October 7, 2011.⁽⁶⁵⁾ These were provided to GENIVAR and the QP responsible for this section is satisfied that the major cost items have been captured through this exercise.

At full capacity, the production objective of the Project is approximately 540,000 tpy of Al₂O₃. Other value added products marketable are in addition to this, and the Preliminary Economical Assessment reference remains on alumina production. The risk associated with the implementation of this new process remains the integration of series adapted and proven technologies and their associated interaction. As a whole the acid recovery part and inter connection between sub-systems, even though well-known over the last 40 years, represents the engineering challenges of the Project.

As a result, the CAPEX for the chemical processing plant has been distributed over a 3 year period (-1 to 1) and have been divided into 3 phases (30%-30%-40% plant capacity). The detailed engineering, procurement and construction has been distributed as follows; 35% in Year -1, 55% in Year 0, and 10% in Year 1, where Year 1 is the first year of production and Year -1 is the reference year where basic and detailed engineering is accomplished. Figure 21-1 shows the proposed chemical processing plant construction phase approach.

Figure 21-1 Chemical Processing Plant Construction Phasing Scheme (30%-30%-40% capacity)



21.1.1 Mine Capital Cost (Mine CAPEX)

The mine's capital cost estimate is based upon budget prices submitted by equipment suppliers and GENIVAR's own database. Assuming the mine equipment list presented in Section 16, the total mine initial CAPEX is estimated to be \$33.8 M, which includes \$12.4M for the pre-production (pre-stripping) operations in Year 0. Table 21-1 describes the details around the Mine specific CAPEX. Sustaining mine equipment Capex amounted to \$0.5 M.

Table 21-1 Mine CAPEX Estimate

Equipment	Number	Unit Cost	Total Costs
Mobile Equipment			
Cat 740 Ejector Articulated Trucks	10	\$ 700,000	\$ 7,000,000
Cat 345DL Hydraulic Excavators	3	525,000	1,575,000
Cat 160M Motor Grader	1	525,000	525,000
Cat 980K Loader	2	500,000	1,000,000
Cat D8T Track-Type Tractor	1	750,000	750,000
Cat D10T Track-Type Tractor	1	1,745,000	1,745,000
Small Trucks	4	40,000	160,000
Other Mobile Equipment	2	500,000	1,000,000
MOBILE EQUIPMENT CAPITAL			\$ 13,755,000
Fixed Equipment			
Primary Crusher (Sizer)			\$ 1,250,000
Feeder			300,000
Conveyor			600,000
Sub-total Fixed Equipment			\$ 2,150,000
Add: Feed Preparation & Mine Services Buildings:			
Clay Storage Building and communications			\$ 4,500,000
Office/Dry Complex (within the plant buildings)			500,000
Shop Complex (within the plant buildings)			500,000
Sub-total Feed Prep. +mine service buildings			5,500,000
Pre-Production Pit Stripping Operations			\$ 12,415,000
TOTAL MINE CAPITAL			\$ 33,820,000

21.1.2 Process Plant Capital Costs (Plant CAPEX)

The most significant costs of the Project are associated with the chemical processing of the clay as described in Section 17. A cost analysis was done by GENIVAR taking into account the main plant constituents. Capital costs breakdown and assumptions are found in Table 21-2. Total plant CAPEX (mine and process plant), for all products is estimated at \$500.4 M (\$927/t Al_2O_3) assuming the manufacturing of all other products.

Basis of Estimate

The mechanical equipment costs for each plant sections (CPP, ALP, ACP, ARP and pyrohydrolysis), including services and utilities formed the basis of the CAPEX estimate. The equipment costs for the Plant were preliminary scaled for size based on Orbite's PFD. Various Assumptions (see below) were considered since basic engineering will come during the Feasibility study stage. All civil, structural, electrical, automation and piping costs, including installation costs, were factored based on the mechanical equipment cost. The building size was based on a factored estimate and a preliminary layout (area of building) was initiated in this phase of the study.

Budget for hydrothermal process, figures for MgCl_2 and other oxides spray roaster unit was obtained from discussions with known such technology provider (SMS Siemag among others), and benchmark from the industry. The Plant will require in between 2 or 3 spray roasters depending upon the final design incoming flowrate. EP (not EPCM) for these units is included in the direct costs and not in the indirect costs.

CAPEX scenario with rare earths production is presented here and they account for approximately 27 M\$ additional capital expenditures for their individual extraction from the hydrothermal process as presented in Section 17. The amount is based on the concentration factor applied through the acid recovery part and the fact they are already present in the form of chlorides at this stage of the process. Fallback position would be to produce rare earths and rare metals in the form of mixed ("cake") REE through standard spray roasting, but this is unlikely to happen at this stage of the Orbite's process development. Initial plant filling were calculated on the basis of equipment sizing (ALP reactors) and prices for the hydrochloric acid (37%wt), required to start the plant.

Table 21-2 Chemical Processing Plant Capital Cost Breakdown

Processing Plant	Area	Sq. Ft.	Cost/Ft ²	Capital Cost
Clay Preparation Plant	900	9,684	200	\$1,936,800
Utilities Bldg & Control Room	2,250	24,210	200	4,842,000
Acid Leaching Plant No. 1	9,975	107,331	200	21,466,200
Acid Leaching Plant No. 2	9,975	107,331	200	21,466,200
Acid Leaching Plant No. 3	9,975	107,331	200	21,466,200
Alumina Calcining Plant	4,950	53,262	200	10,652,400
Acid Regeneration Plant	10,000	107,600	200	21,520,000
Sub-total Major Buildings		516,749		\$103,349,800
Add Equipment				219,699,600
Sub-total Major Buildings and Equipment				\$323,049,400
Add:				
MgO & REE Process Additions				19,000,000
River Pumphouse & Pipeline				2,500,000
Acid Storage Tank Farm (16 Units)				3,200,000
Alumina Storage Silos (8 Units)				2,400,000
Hematite Storage Silos (3 Units)				900,000
Silica Storage Loadout				4,000,000
Magnesium Oxide Storage Loadout				1,200,000
Mixed Oxides Storage Location				500,000
Parking & Landscaping				500,000
Sub-total				34,200,000
TOTAL PLANT CAPITAL				357,249,400
Add 10% contingency				35,725,000
Add 8% Engineering				28,580,000
Sub –total Pant fixed capital				\$421,554,400
Add new 120 kV power line from Murdochville:				
120 kV transmission line (30 km)				18,000,000
Murdochville substation conversion				5,000,000
Grande-Vallée Alumina Plant substation				12,000,000
TOTAL PLANT FIXED CAPITAL				\$456,554,400
Add				
Allowance for plant mobile equipment				10,000,000
TOTAL PLANT CAPITAL COSTS				\$466,554,400

Note: Figures have been rounded and as a result, some rounding errors have been introduced.

Assumptions

The following assumptions were made when calculating the capital expenditure costs for the mine and processing plants:

- The crushing will be done by a mobile crusher at the mine site as defined in Section 16. The initial crusher will be sized for full capacity of 2.5 M tpy;
- The CPP part will be done using vertical roller mills (as described in Section 17); 3 in total in order to allow relative free time for maintenance without affecting plant availability;
- ALP will be done using 64 or 80 m³ glass lined vessels with special coating that allows reactors to last for the life of the project. Semi continuous leaching approach minimizing the number of reactors is what the plant will be designed for. As a preliminary evaluation, 65 reactors are considered;
- 20 reactors for crystallization are being considered for the crystallization/precipitation phase;
- 5 hydrothermal (SMS Siemag) lines in parallel are being considered for the PEA phase CAPEX evaluation;
- 2 pyrohydrolysis systems (MgO and mixed oxides) are being considered for the PEA CAPEX evaluation;
- 1 CFB calcination stage (Outotec GmbH) for the alumina (availability of 100% for 36 consecutive months) was considered for the PEA CAPEX evaluation. Rotary kiln was also evaluated but energy consumption calculated was 15% higher than CFB;
- Tank farm will be designed (and was considered as such) for 24 hours buffer on average;
- Product storage, except for purified SiO₂, will be designed (and was considered as such) for 7 days (1 week) inventory on average;
- \$35 M cost for the transmission/power line & substation could become a \$8 M cost by using a cogeneration natural gas to electricity plant on site, resulting in a net \$27 M decrease in project capital cost;
- Provisions were taken on the services & utilities part based on known past experience and ratios applicable in a chemical plant. This includes the WWTP. Adequate provisions for engineering (some already included in specific package) and contingencies have been considered at this stage of the PEA and are also according to ratios applicable in a chemical plant;

- An allowance for sustaining capital of 50 \$M for the mine and plant Site was assumed for the life of the Project, which was evenly spread over a 25 year period, starting in Year 2;
- No applicable tax credit to new mechanical, electrical and instrumentation in a chemical and manufacturing plant has been included the financial analysis.

21.2 Operating Costs (OPEX)

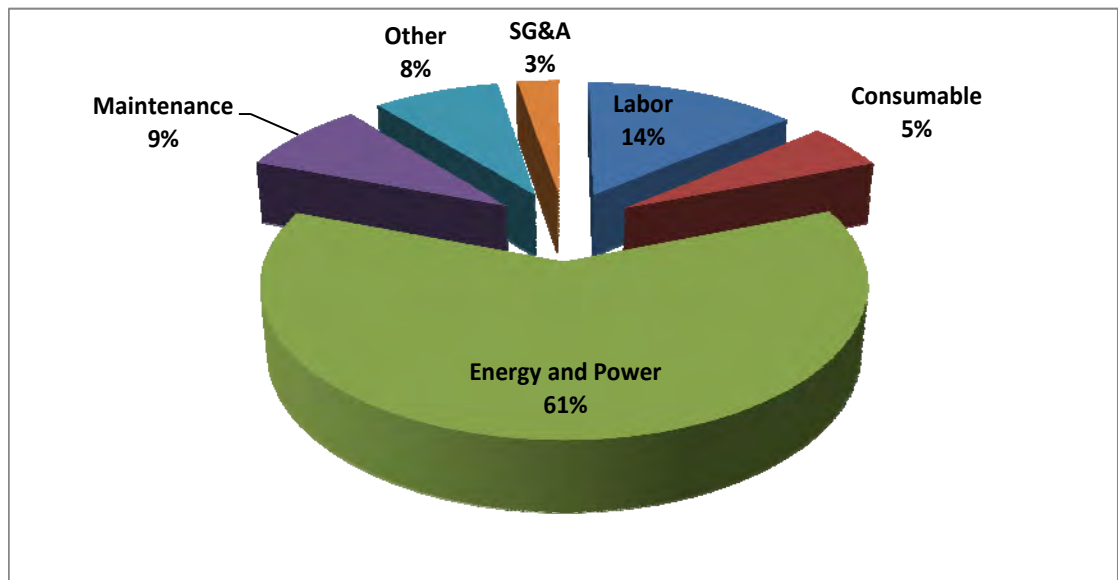
Operating costs for the Project were evaluated by GENIVAR based on two (2) distinct scenarios:

- **Reference - Scenario 1:** Alumina and hematite production combined.
- **Reference - Scenario 2:** Alumina and hematite and other value added products (silicon dioxide, magnesium oxide, mixed oxides, rare earths and rare metals oxides).

Under both scenarios, mine OPEX (see Table 21-3) remains the same. Details of the specific scenarios (1 and 2) are presented into Tables 21-4 and 21-5.

In summary, Figure 21-2 shows the Scenario 2 (Alumina, hematite and other value added products), which is the one evaluated and preferred, overall operating cost – OPEX distribution.

Figure 21-2 Operating Costs Summary (preferred scenario)



The energy and power consumption estimate for the chemical processing accounts for approximately 61% of the Project's operating costs. Labor and maintenance are the other significant costs, representing an additional 23%; which was benchmarked with similar chemical process.

21.2.1 Mine Operational Costs (OPEX)

The mine operating costs (OPEX) for the open pit mine and clay preparation plant have been estimated as follows (Table 21-3).

Table 21-3 Mine Opex for the Open Pit operation (2.45 M tonne/yr. of clay)

		\$/tonne All Products Produced	\$/tonne clay Mined
Mine Production Costs			
Operating Labour	\$ 3,000,000	\$ 5.56	\$ 1.22
Fuel & Lubricants	1,424,977	2.64	0.58
Tires	435,267	0.81	0.18
Mine Services	1,882,436	3.49	0.77
Total Mine Production	6,742,680	12.50	2.75
Mine Maintenance Costs			
Maintenance Labor	\$ 1,000,000	\$ 1.85	\$ 0.41
<i>Mobile Equipment:</i>			
Articulated Trucks	642,785	1.19	0.26
Other Surface Equipment	281,186	0.52	0.12
Contingency	1,793,972	3.32	0.73
Fixed Equipment & Services	143,333	0.27	0.06
Total Mine Maintenance	3,861,276	7.15	1.58
Engineering & Geology Costs			
Engineering Labour	\$ 393,750	\$ 0.73	\$ 0.16
Operating Supplies	150,000	0.28	0.06
Contracted Services	600,000	1.11	0.24
Total Engineering & Geology	1,143,750	2.12	0.46
TOTAL MINE OPERATING COSTS	\$ 11,747,706	\$ 21.77	\$ 4.79

Assumptions: Main assumptions from GENIVAR on the manpower side were described in Section 16. GENIVAR estimates that a total of 30-50 employees

(maximum) will be required to operate the mining and feeding operations (pit operating, maintenance and engineering duties).

21.2.2 Chemical Processing Operational Costs (OPEX) – Scenario 1

The costs for the chemical processing of the clay (OPEX) for Scenario 1 (alumina and hematite as only main products) have been estimated as follows (Table 21-4).

Table 21-4 Plant OPEX (Scenario 1)

Processing Costs		\$/tonne Alumina Produced
HCl Regeneration	\$ 32,971,237	\$ 61.09
AlCl ₃ Calcining	29,252,336	54.20
Other oxides pyrohydrolysis	2,532,326	4.69
Clay Drying & Crushing	937,071	1.74
Sub-total Main Plant Heat input	\$ 65,692,970	\$ 121.72
Fresh HCl make up to process	476,569	0.88
NaOH supply for hematite purification	29,814	0.05
Utilities & Power	6,723,684	12.46
Plant Labor Costs	11,501,155	21.31
Plant Maintenance Costs	4,705,500	8.72
Plant Electrical & Instrumentation Controls	1,780,440	3.30
Plant Engineering	846,925	1.57
Plant Operating Consumables	699,960	1.30
Health, Safety and Environmental Costs	499,910	0.93
Laboratory Expenses	719,910	1.33
Plant Building Expenses	1,480,400	2.74
Administration & General Expenses	464,800	0.86
TOTAL CHEMICAL PROCESS OPERATING EXPENSES	\$ 95,622,037	\$ 177.17
Reported mining OPEX	\$ 11,747,706	\$ 21.77
Marketing Expenses	\$ 1,122,500	\$ 2.08
TOTAL PLANT OPERATING EXPENSES	\$ 108,492,243	\$ 201.02

21.2.3 Chemical Processing Operational Costs (OPEX) – Scenario 2

The costs for the chemical processing of the clay (OPEX) for Scenario 2 (Alumina, hematite, silicon dioxide, magnesium oxide, mixed oxides, rare earths and rare metals oxides) have been estimated as follows (Table 21-5):

Table 21-5 Plant and Mining OPEX (Scenario 2)

Chemical Processing Costs		\$/tonne Alumina Produced
HCl Regeneration	\$ 30,704,449	\$ 56.89
AlCl ₃ Calcining	32,392,667	60.02
MgO Roaster	2,266,788	4.20
Other oxides pyrohydrolysis	2,532,326	4.69
Clay Drying & Crushing	937,071	1.74
Sub-total Main Plant Heat Input	\$ 68,833,301	\$ 127.54
Fresh HCl make up to process	\$ 476,569	\$ 0.88
NaOH supply for hematite purification	29,814	0.05
Utilities & Power	6,896,086	12.78
Plant Labor Costs	12,688,324	23.51
Plant Maintenance Costs	4,705,500	8.72
Plant Electrical & Instrumentation Controls	1,780,440	3.30
Plant Engineering	891,500	1.65
Plant Operating Consumables	699,960	1.30
Health, Safety and Environmental Costs	499,910	0.93
Laboratory Expenses	799,900	1.48
Plant Building Expenses	1,480,400	2.74
Administration & General Expenses	464,800	0.86
Total Chemical Process Operating Expenses	\$ 100,246,504	\$ 185.74
Mine operating expenses (Mine OPEX)	\$ 11,747,706	\$ 21.77
Marketing Expenses	1,122,500	2.08
Total Plant and Mining Operating Expenses (Scenario 2)	\$ 113,116,710	\$ 209.59

21.2.4 Plant Processing OPEX Evaluation and Assumptions

Should all value added products (silicon dioxide, hematite, magnesium oxide mixed oxides, RMO and REO) be sold, allocating per energy consumed per product, the cost to produce alumina would be \$91.26/t Al₂O₃. When all operating costs are allocated to alumina, the cost is \$209.59.

21.2.5 Assumptions OPEX Mine and Chemical Processing

The following assumptions were made when calculating the operational expenditure costs for the mine and processing plants:

- GENIVAR estimates, as defined in Section 16, that a total of 30 to 50 employees will be required to operate the mining and feeding operations. A maximum total of fifty (50) people are budgeted to perform pit operating, maintenance and engineering duties to support the open pit and plant feed preparation operations. After start up and optimization, it should easily go down to 30 employees. Pit operations with up to thirty-three (20 to 33) people is the largest group in the mining department. The maintenance group, with up to thirteen (5 to 13) people is envisioned to support mine and plant feed preparation operations, and four (4) people will perform all of the engineering and geological duties in the mine department;
- Major mining supplies are listed as mining parts and supplies, mine services, fuel and lubricants. Mining parts and supplies costs include all the majority of the parts and supplies needed to run the mine operation. Mobile equipment tires are the largest element within this cost group;
- Mine services include all of the support services required in the operation of a large tonnage mining operation. The largest element within this group is expected to be the contracted and analytical services costs;
- Fuel and lubricant costs are based on unit consumption figures as presented by the manufacturer using a bulk diesel fuel cost of \$1.05 per litre consumed. This price is based on a \$0.15/L handling cost in addition to current average Halifax/Montreal wholesale diesel prices of \$0.868/L and a crude oil futures escalation factor October 2014/October 2011 of 1.041 (88.83/85.30);
- The blasting requirements are expected to be very minimal (less than 10%); therefore this activity will be sub-contracted to third party. Cost, including explosives magazine cap and ANFO magazine and related blasting equipment's. These fees (again very minimal) were evaluated under Contracted Services.

- Chemical process (Plant) plant manpower organization.⁽¹²⁰⁾ A total of one hundred and seventy-one (171) people are budgeted to perform plant operations, maintenance, laboratory and engineering duties to support the alumina processing plant. Plant operations with one hundred and twenty-seven (127) people is the largest group in the processing plant. Maintenance group, with 30 people is envisioned to support the plant operations. Plant lab, with eight (8) people will perform all of the analytical services required to support the plant and mine operations groups. Plant Manager will be responsible for all activities in both the plant and the mine. Technical Services Manager will be responsible for all engineering and geological activities in both the plant and the mine. Health, Safety and Environmental Coordinator will be responsible for Health, Safety and Environmental activities in both the plant and the mine;
- Average salaries (mine and Plant) are based on typical chemical plant operation remuneration, and include an average of 35% fringe benefits. Equipment unit operating and maintenance costs were developed from quotations received from Supplier cost estimation guides and from experience and personal contacts within the chemical industry; other sources of information are from an internal database on similar projects;
- Plant supplies: The total annual fuel cost is estimated to be \$60 M (55.5% of total plant operating expenses) that is required to support the plant process and plant heating functions. Energy supply in the Grande-Vallée area represents one of the key elements of the Orbite project, like all mining and heavy industrial projects. For the purpose of this study, natural gas has been used as the reference energy source. For the purpose of the PEA, local natural gas is envisioned to provide the plant fuel requirements. At this time, there is no natural gas, in the Gaspésie area, that has been identified/classified as reserves under the NI 51-101 Standards of Disclosure. Gas exploration companies have identified the potential of several hundred billions of cubic feet of natural gas in the direct vicinity of the project but nothing again under NI 51-101 Standards of Disclosure.
- Nevertheless, there is excellent known potential for natural gas in the vicinity although there currently is no production facility (wells or pipelines) in the Gaspésie area or in the general area where Orbite plans to construct its metallurgical grade alumina plant. A few oil and gas exploration companies are seriously intending to proceed with extraction wells in the vicinity of Orbite's site.
- For the purpose of this PEA, GENIVAR has assumed natural gas would be available at the plant location, where the potential for securing a natural gas supply exists, but where there is actually no natural gas supplier/producer. North American natural gas prices are currently quoted (August 2011) at slightly below \$4.00 per MCF (1,000 cubic feet) which equates to \$3.61/GJ (Source: Henry Hub Index).⁽¹²¹⁾ Orbite is also considering other source of energy such as biomass,

coal, bunker C, and fuel. A cost of \$4.00/GJ delivered to the plant was judged to be reasonable. Plant costs are very sensitive to fuel costs. In the event of a 10% fuel cost boost relative to the \$4.00/GJ reference, the plant costs increase by approximately 5% to 6% in plant operating expenses (\$6 M or about \$12/t of alumina produced);

- Several other energy sources will have to be assessed at the Feasibility study stage, including electrical with a biomass cogeneration plant and different fuel options, including piped natural gas, extraction wells, bunker C, coal, fuel etc
- Plant supplies: Plant electrical power needs are projected to be approximately \$5.7 M per year. Note that with the cogeneration unit, this number would easily be under that cost and equivalent to the maintenance of the cogeneration unit. Electricity cost was taken as \$0.037/kWh, which was confirmed to be accurate based on the location and power consumption of the plant;
- Chemical supplies: Reactants (HCl, NaOH, flocculants, organics for REE, etc) have been assumed based on known consumption relative to flowrate and expected recovery. These are very minimal and for HCl, for example a recovery in closed loop of 99.75% is currently being designed for and proven into similar processes;
- Maintenance parts were estimated as being 15% of the total maintenance costs, which is due to nature of equipment's (materials) required to properly handle hydrochloric acid at high temperature for example (tantalum, zirconium, etc);
- General and administrative costs were factored from similar projects. These costs include: Human resources; Administration and management; Health and safety; Laboratory costs; Information technology; Security; Insurance and legal.

21.2.6 Waste Product Handling

There are no residues to be handled from the Orbite's process compared to standard alumina processes (Bayer). All products have the potential of being marketable. Purified SiO₂ being the highest in terms of daily quantities, should there be an excess not sold to the market, would be brought back to the mine site. There are currently no provisions in the capital expenditures for a holding facility which will be covered in the Feasibility stage. It has been assumed that all SiO₂ was sold and that these can be handled by the proposed infrastructure.

21.2.7 Product Shipping

The alumina and all other value added products marketable are assumed to have been sold at the Plant location (i.e. FOB – Plant).

21.2.8 Royalties

Land Rights Purchase Agreement from Poly-Vein Exploration Inc. and the Conseil de développement économique de la ville de Murdochville was converted into Map Designation of Claims (MDC), totaling 12 cells numbered 84,880 to 84,891 as described into previous sections. These Map Designation Claims were transferred from Poly-Vein Exploration Inc. to Orbite in August, 2005. Under the terms of this transfer Orbite Aluminae Inc. agreed to pay Poly-Vein Exploration Inc. a royalty of 3% (three percent) on the net operating profit before tax and depreciation of the property. The royalty is redeemable for \$500,000 after a period of 5 (five) years of operation starting Year 1.

21.2.9 Environmental and Closure Costs

GENIVAR estimated the environmental and closure cost of the mine and process plant to be (see Table 21-6) in the order of magnitude of \$7.6 M.

Table 21-6 Closure Costs

	Estimated Cost
Mine	\$ 962,900
Process Plant	\$ 6,625,500
TOTAL CLOSURE COSTS	\$ 7,588,400

21.2.10 Road Maintenance

Maintenance costs have been taken into consideration for the mine site and plant access roads connecting to the existing roads. For the purpose of this study, it has been assumed that Orbite will cover 100% of the road maintenance cost of these.

22 ECONOMIC ANALYSIS

This section outlines the pricing assumption and market data for the products that will be manufactured from Orbite's process. The data presented in this report are for a single plant whereas Orbite's strategy is to build multiple plants (5 to 10) to ultimately capture a significant portion of the Quebec's alumina market, and initiate exports overseas.

The 2 reference scenarios outlined in this section have been calculated, in part, with August 2011 market prices. An actualisation of the market information as of November 23, 2011 highlighted significant differences in projected revenue, especially with regards to rare metals and rare earth oxide as well as smelter grade alumina is also provided.

The sensitivity analysis on the previous reference pricing scenarios is presented hereafter using variations of +/- 40% in revenues for alumina, hematite, silica, magnesium oxide, +/- 65% for rare metals and rare earths and +/- 20% for capital and operational expenses from the reference scenarios. These variations take into account the potential fluctuations in revenue that could result from economic cycles and more specifically covers the variation in pricing of rare metals and rare earths as well as alumina seen between August and November 2011 and the Net Present Values were calculated using discount rates of 5% and 10%.

22.1 Preliminary Project Economics: Two Scenarios

Revenue projections are based on two reference scenarios:

Reference Scenario 1: Revenue from 539,711 tonnes of metallurgical grade alumina and hematite production per year with an estimated value of \$425/tonne (FOB plant) and the revenue from 189,298 tonnes of hematite with an estimated value of \$200/tonne. See section 19 for market hypothesis.

Reference Scenario 2: Revenue from 539,711 tonnes of metallurgical grade alumina production per year with an estimated value of \$425/tonne (FOB plant) together with the revenue of the following listed elements extracted using Orbite's technology (See Section 19):

- 189,298 tonnes of >99% pure hematite (Fe_2O_3) per year with an estimated value of \$200/tonne (FOB plant).
- 1,228,628 tonnes of >95% pure silica (SiO_2) per year with an estimated value of \$25/tonne (FOB plant).

- 27,816 tonnes of >95% pure magnesium oxide (MgO) per year with an estimated value of \$400/tonne (FOB plant).
- 104,089 tonnes of mixed oxides per year that can be sold as a fertilizer with an estimated value of \$5/tonne (FOB plant).

In addition to the above listed products from the Orbite process the company has the potential to recover twelve rare metals and rare earth elements (RMO+REO's) (Gallium (Ga), normally categorized as a rare metal, Scandium (Sc), rare metal or rare earth, Cerium (Ce), Dysprosium (Dy), Erbium (Er), Europium (Eu), Gadolinium (Gd), Lanthanum (La), Neodymium (Nd), Praseodymium (Pr), Samarium (Sm), and Yttrium (Y) that are found to be recoverable quantities in the Project aluminous clays. The reference Scenario 2 revenue from the rare earths contained in the mining and processing of 2.45 M tonnes of aluminous clay has been projected as follows: 974.5 tonnes in aggregate of ten >99% pure rare earth elements (oxides) as well as rare metals scandium and gallium with an estimated annual aggregate gross value exceeding \$392 M. The variations and sensitivity on this reference scenario have been discussed in section 19. The calculations based on these sensitivity analyses are presented further down in this section.

The following tables present two preliminary economic reference scenarios. Scenario 1 is based on metallurgical grade alumina production and high grade hematite as the sources of revenues. The Scenario 2 presents the economics of metallurgical grade alumina added to the revenues from hematite, silicon oxides, magnesium oxides, other oxides and rare metals and rare elements (REO+RMO's) in the form of oxides, that Orbite's patented technologies can recover.

The latter scenario is the preferred 1 and is being pursued by Orbite.

22.2 Annual Projected EBITDA

Table 22-1 Annual Projected EBITDA– Scenario 1

		\$/tonne	\$/tonne
		Alumina	Clay
		Produced	Mined
Revenue:			
Alumina	\$ 229,377,175	\$ 425.00	\$ 93.62
Hematite	37,859,680	70.15	15.45
TOTAL REVENUE	\$ 267,236,855	\$ 495.15	\$ 109.07
Costs:			
Mining	\$ 11,747,706	\$ 21.77	\$ 4.79
Processing	95,622,037	177.17	39.03
Marketing	1,122,500	2.08	0.46
TOTAL COSTS	\$ 108,492,243	\$ 201.02	\$ 44.28
Profit Before Royalty	\$ 158,744,612	\$ 294.13	\$ 64.79
3% Net Operating Profit Royalty (first 5 years only)	\$ 4,762,338	\$ 8.82	\$ 1.94
EBITDA	\$ 153,982,274	\$ 285.31	\$ 62.85

The above table shows that metallurgical grade alumina (SGA) and hematite production costs as main products alone are estimated at \$44.28 per tonne mined and \$201.02 per tonne of alumina when allocating all costs to the latter. Each tonne of metallurgical grade alumina (SGA) sold is projected to result in an EBITDA of \$285.31 per tonne.

Table 22-2 Annual Projected EBITDA– Scenario 2

		\$/tonne Alumina Produced	\$/tonne Clay Mined
REVENUE			
Alumina	\$ 229,377,175	\$ 425.00	\$ 93.62
Fe ₂ O ₃ (Hematite)	37,859,680	70.15	15.45
SiO ₂ (High Quality Silica)	30,715,708	56.91	12.54
MgO	11,126,400	20.62	4.54
Mixed Oxides	520,443	0.96	0.21
Rare Earth Elements	392,868,097	727.92	160.35
TOTAL REVENUE	\$ 702,467,503	\$ 1,301.56	\$ 286.71
COSTS			
Mining	\$ 11,747,706	\$ 21.77	\$ 4.79
Processing	100,246,504	185.74	40.92
Marketing	1,122,500	2.08	\$ 0.46
TOTAL COSTS	\$ 113,116,710	\$ 209.59	\$ 46.17
Profit before Royalty	\$ 589,350,793	\$ 1091.97	\$ 240.54
3% Net Operating Profit Royalty (first 5 years only)	\$ 17,680,524	\$ 32.76	\$ 7.22
EBITDA	\$ 571,670,269	\$ 1059.21	\$ 233.32

The above table shows that Orbite's manufacturing costs for all products generated are estimated to be \$209.59/tonne of alumina produced (allocating all costs to alumina) or \$46.17/tonne of clay mined. Each tonne of aluminous clay mined and processed using Orbite's process has the potential to generate an EBITDA of \$1,059.21/tonne. It can be expected that alumina prices would eventually increase and high quality silica up by more than \$100/t for the photovoltaic industry.⁽¹⁰⁵⁾ However this scenario has not been taken into consideration in the PEA in order to provide a conservative analysis.

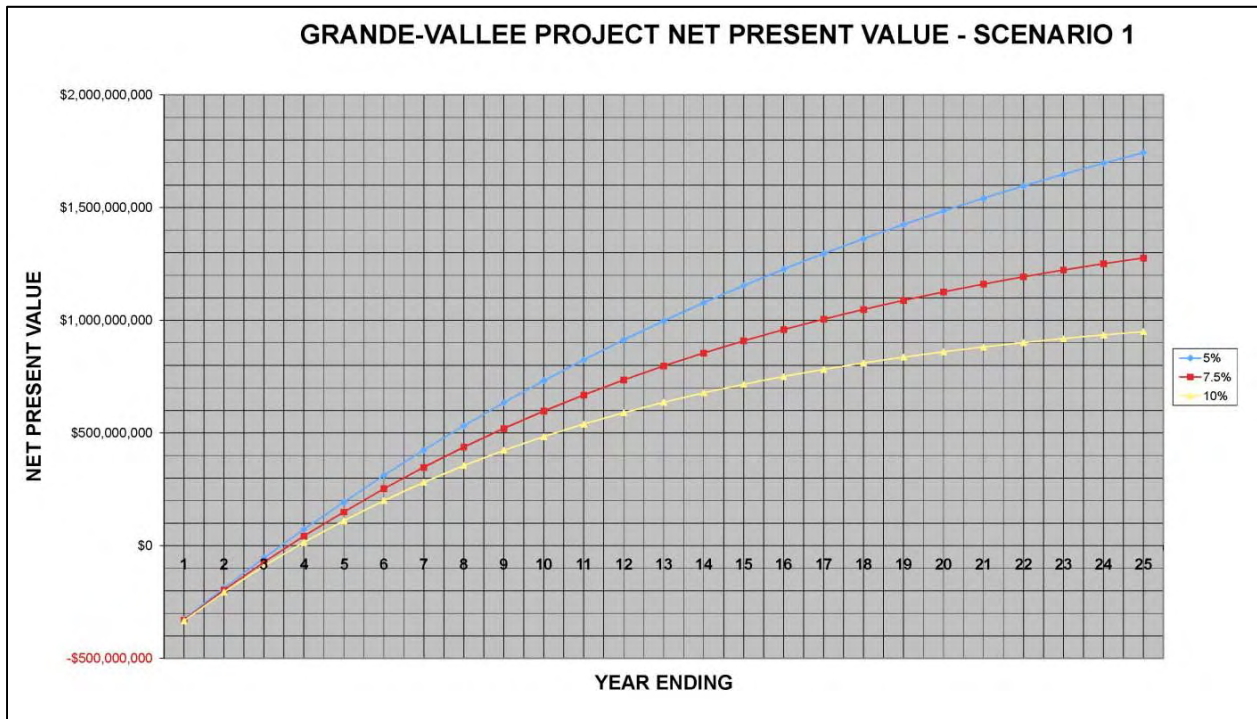
22.3 Internal Rate of Return and Pre-Tax Net Present Value

Scenario 1: Alumina plus hematite as a source of revenues (for the first SGA plant):

Assuming a Project life of 25 years (operation) requiring a \$473 M initial investment, generating annual steady EBITDA of \$154 M (Scenario 1) the calculated internal rate of return (IRR) would be 33% and the pre-tax Net Present Value (NPV) at a 5% discount rate would be \$1.7 B. The payback period would be 3.1 years.

The economics of this scenario with various discount rates is illustrated in Figure 22-1 for the first operational SGA plant

Figure 22-1 Scenario 1 Pre-Tax Net Present Value per SGA Plant

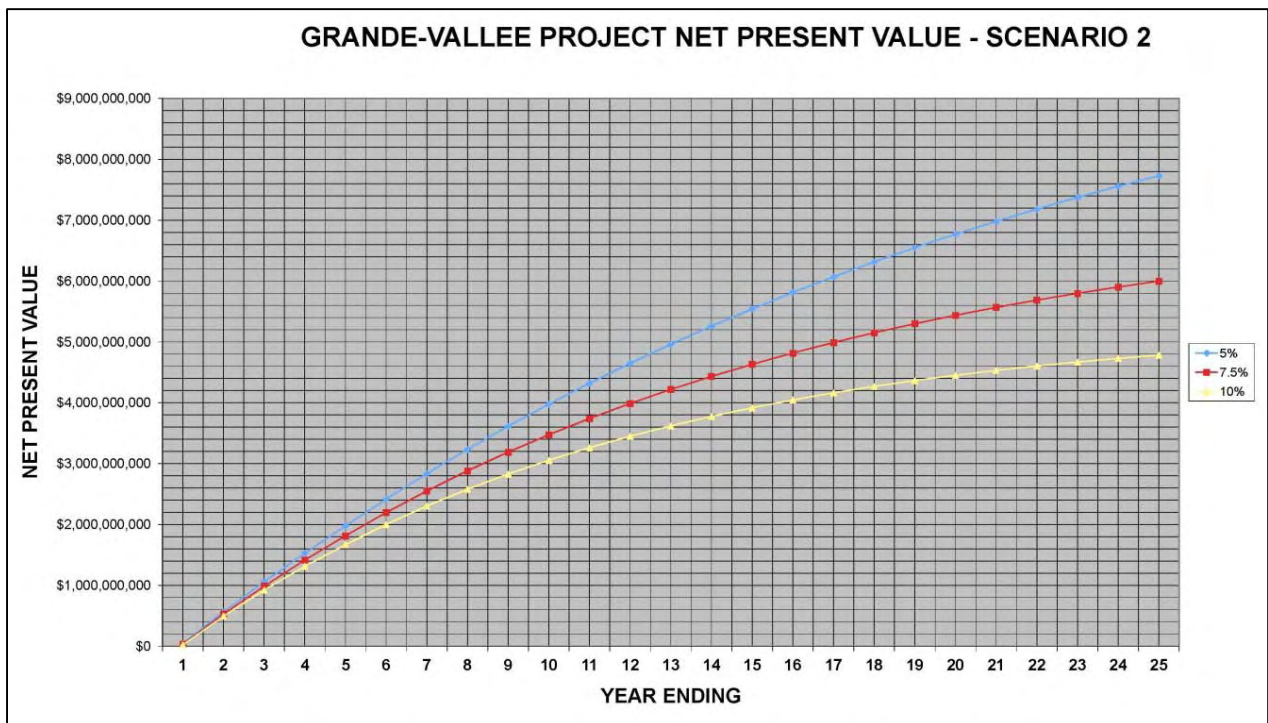


Scenario 2: Alumina + Hematite, Silica, Magnesium Oxides, Mixed Oxides and REO+RMO's in form of Oxides as multiple sources of revenues:

Assuming a Project life of 25 years (operation) requiring a \$500.4 M initial investment, generating annual steady EBITDA of \$572 M (Scenario 2) the calculated IRR would become 114%, and the pre-tax NPV at a 5% interest discount rate would go up to \$7.73 B. The payback period would be less than one year.

The economics of this scenario with various discount rates is illustrated in Figure 22-2 for the first operational SGA plant

Figure 22-2 Scenario 2 Pre-Tax Net Present Value per SGA Plant



22.4 Sensitivity Analysis – Scenario 1

Scenario 1 uses an alumina market price of \$425/tonne and high purity hematite price at \$200/tonne. The following table presents IRR, NPV and payback period for 3 other market prices scenarios, at 5% and 10% discount rates.

Table 22-3 Sensitivity Analysis (Scenario 1) on Reference Scenario 1 (First SGA plant)

Alumina Market Prices (\$/tonne)	Hematite Market Prices (\$/tonne)	Annual Revenue (Million \$)	Annual EBITDA (Million \$)	IRR	Payback (Years)	NPV (Million \$) at a discount rate of		NPV per share * (\$/share) at a discount rate of	
						5%	10%	5%	10%
\$425	\$200	\$267	\$154	33%	3.1	\$1,743	\$949	\$8.51	\$4.64
\$400	\$175	\$249	\$136	29%	3.5	\$1,489	\$786	\$7.27	\$3.84
\$350	\$150	\$217	\$106	22%	4.5	\$1,046	\$502	\$5.11	\$2.45
\$325	\$125	\$199	\$88	19%	5.4	\$791	\$338	\$3.86	\$1.65

* Note: On a fully diluted basis. Number of shares is estimated at 204.8 millions

The sensitivity analysis of Scenario 1 shows that using alumina prices from \$325/t to \$425/t with hematite prices following the same trends (\$125/t to \$200/t) and a 5% discount rate generates an IRR varying from 19% to 33%, and the NPV from \$791 M to \$1.74 B or an NPV per share varying from \$3.86 to \$8.51 on a fully diluted basis. At 10% discount rate, the NPV varies between \$338 M to \$947 M or from \$1.65/share to \$4.64/share on a fully diluted basis. All those figures are for the first operational plant.

Market alumina prices have varied between \$325 and \$425 over the last 12 months, but are expected to rise with the economic recovery.

In addition to the above scenarios, Table 22-4 presents the sensitivity for each critical element of Scenario 1 independently from the others at 5% and 10% discount rate. As an example, when the alumina price varies by a factor of 60% to 140% vs. the reference scenario, all the other elements of the analysis remain at a factor of 100%.

The revenue for the marketable products were varied from 60% to 140% of the reference Scenario 1 and the capital cost and operating costs were varied from 80% to 120% of the reference Scenario 1 shown in the first line of Table 22-3. Figures 22-3 and 22-4 show the interaction between variables in the sensitivity analysis at different discount rates simultaneously and individually respectively.

Table 22-4 Sensitivity Analysis Scenario 1 @ 5% and 10% Discount Rate – Each element varying independently

Alumina Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	255	13%	7.3	462,034	127,016	\$2.26	\$0.62
100%	425	33%	3.1	1,743,249	949,408	\$8.51	\$4.64
140%	595	52%	1.9	3,024,463	1,771,800	\$14.77	\$8.65

Fe ₂ O ₃ (Hematite) Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	120	30%	3.4	1,531,779	813,669	\$7.48	\$3.97
100%	200	33%	3.1	1,743,249	949,408	\$8.51	\$4.64
140%	280	36%	2.8	1,954,718	1,085,147	\$9.54	\$5.30

Capital Cost							
Factor	Capex (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
80%	378,776	41%	2.5	1,837,943	1,044,102	\$8.97	\$5.10
100%	473,469	33%	3.1	1,743,249	949,408	\$8.51	\$4.64
120%	568,163	27%	3.7	1,648,555	854,714	\$8.05	\$4.17

Operating Cost							
Factor	Opex (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
80%	86,794	37%	2.7	2,046,247	1,143,898	\$9.99	\$5.59
100%	108,492	33%	3.1	1,743,249	949,408	\$8.51	\$4.64
120%	130,191	28%	3.6	1,440,250	754,918	\$7.03	\$3.69

Figure 22-3 Sensitivity Analysis for Element Varying Independently at 5% (Scenario 1)

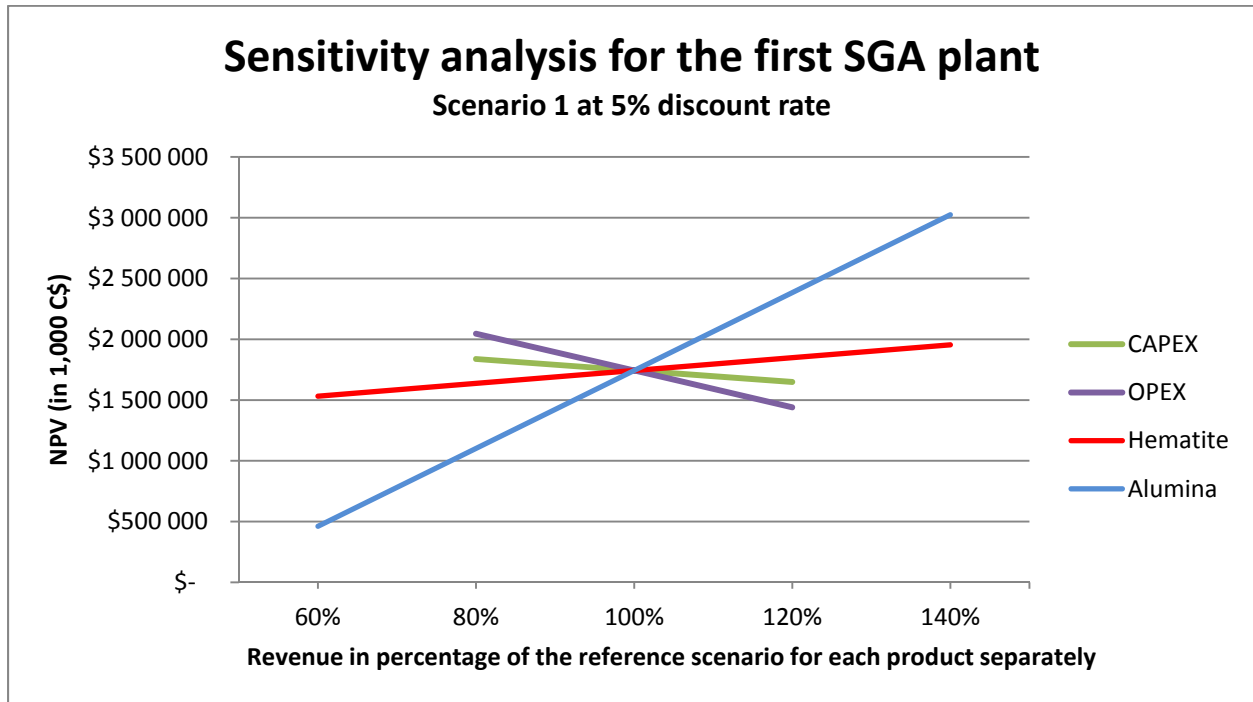
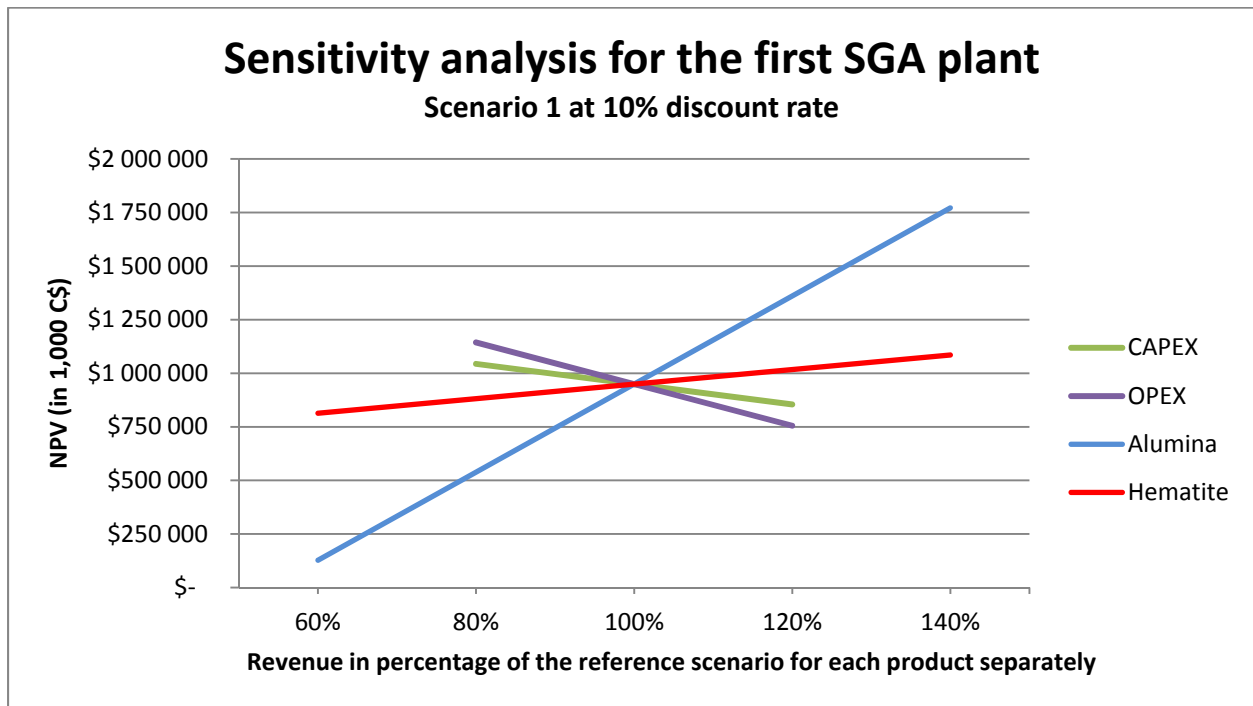


Figure 22-4 Sensitivity Analysis for Element Varying Independently at 10% (Scenario 1)



22.5 Sensitivity Analysis – Scenario 2

Reference Scenario 2 uses an alumina market price of \$425/tonne, high purity hematite price of \$200/tonne, silicon dioxide at \$25/tonne plus magnesium oxide and other oxides revenues of \$11.6 M and REO+RMO's revenues (\$392.9 M) calculated using August 2011 market prices, thus adding up to \$702 M in annual revenues for the first SGA plant in operation out of up to 10 forecasted. The following Table 22-5 presents IRR, NPV and payback period for 3 other market prices scenarios, at 5.0% and 10.0% discount rates.

When adding the revenues from the RE+RM's as oxides, magnesium and other oxides, and high purity silicon dioxide, sensitivity is of course less important due to the important portion of additional potential revenues. Since, RE+RM's as oxides prices are more volatile, GENIVAR has factored a reduction in the revenue from the RE+RM's in reference Scenario 2 varying from 20 to 65%. Consequently, IRR varies from 48% to 114% and NPV for the first SGA plant at 5% discount rate varies from \$2.9 B to \$7.7 B or from \$14.22 to \$37.74/share on a fully diluted basis. At 10% discount rate, the NPV for the first SGA plant varies from \$1.7 B to \$4.8 B or from \$8.25 to \$23.35/share on a fully diluted basis. In addition to the above scenarios, Table 22-6 presents the sensitivity for each critical element of Scenario 2 independently of the others. The revenue for the marketable products were varied from 60% to 140% of the reference Scenario 1 except for the rare metals and rare earth revenue stream since the market prices have varied significantly as of the date of this Technical Report and that the revenue scenarios calculated in Section 19 were falling outside the 60% to 140% range.

Therefore, in the latter case, a sensitivity of 35% to 165% was used in Tables 22-5 and 22-6. The objective is to ensure that the potential revenue for rare metals and rare earths in the sensitivity analysis includes the estimated revenue from rare metals and rare earths calculated with November 23, 2011 spot price discounted by 40% and the same calculation made with the China domestic prices at the same date (see Section 19). The capital cost and operating costs were varied from 80% to 120% of the base Scenario 2 shown in the first line of the Table 22-6.

Figures 22-5 and 22-6 are showing the effect of each individual variable on the pre-tax NPV at 2 different discount rates (5%, 10%).

Table 22-5 Sensitivity Analysis - Scenario 2

Alumina Market Prices (\$/tonne)	Hematite Market Prices (\$/tonne)	Silica Market Prices (\$/tonne)	Magnesium Oxide and other oxides Revenue (Million \$)	Rare Earth and Rare Metals Revenue (Million \$)	Annual Revenue (Million \$)	Annual EBITDA (Million \$)	IRR	Payback (Years)	NPV (Million \$) at a discount rate of		NPV per share * (\$/share) at a discount rate of	
									5%	10%	5%	10%
\$425	\$200	\$25	\$11.646	\$392.9	\$702	\$572	114%	0.9	\$7,729	\$4,782	\$37.74	\$23.35
\$400	\$175	\$20	\$10.646	\$314.3 (-20% RE+RM)	\$599	\$471	94%	1.1	\$6,278	\$3,850	\$30.65	\$18.80
\$350	\$150	\$15	\$9.646	\$235.7 (-40% RE+RM)	\$481	\$357	71%	1.4	\$4,638	\$2,798	\$22.65	\$13.66
\$325	\$125	\$10	\$8.646	\$137.5.1** (-65% RE+RM)	\$358	\$237	48%	2.1	\$2,912	\$1,690	\$14.22	\$8.25

Note: * On a fully diluted basis. Number of shares is estimated at 204.8 million
** For reference, note that: Potential revenue calculated with Nov 23, 2011 Spot prices (107,109) discounted by 40% = \$148.1 million (See Section 19)
Potential revenue calculated with Nov 23, 2011 China Domestic prices (107,109) = \$169.8 million (See Section 19)

Table 22-6 Sensitivity Analysis Scenario 2 at 5% and 10% Discount Rates per SGA plant – Each element varying independently

Alumina Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	255	97%	1.0	6,448,129	3,959,764	\$31.49	\$19.33
100%	425	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	595	132%	0.8	9,010,559	5,604,548	\$44.00	\$27.37
Fe ₂ O ₃ (Hematite) Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	120	111%	0.9	7,517,874	4,646,417	\$36.71	\$22.69
100%	200	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	280	117%	0.9	7,940,813	4,917,895	\$38.77	\$24.01
SiO ₂ (Silica) Market Price							
Factor	Price (C\$/tonne)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	15	112%	0.9	7,557,778	4,672,030	\$36.90	\$22.81
100%	25	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	35	117%	0.9	7,900,910	4,892,282	\$38.58	\$23.89
Magnesium Oxide and other Oxides Revenue							
Factor	Revenue (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
60%	6,988	113%	0.9	7,664,291	4,740,399	\$37.42	\$23.15
100%	11,646	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
140%	16,305	115%	0.9	7,794,397	4,823,912	\$38.06	\$23.55
Rare Earths and Rare Metals Revenue							
Factor	Revenue (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
35%	137,504	65%	1.5	4,163,425	2,493,247	\$20.33	\$12.17
100%	392,868	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
165%	648,232	164%	0.6	11,295,263	7,071,064	\$55.15	\$34.53
Capital Cost							
Factor	Capex (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
80%	400,299	143%	0.7	7,829,419	4,882,231	\$38.23	\$23.84
100%	500,374	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
120%	600,449	95%	1.1	7,629,269	4,682,081	\$37.25	\$22.86
Operating Cost							
Factor	Opex (C\$' 000's)	IRR (%)	Payback (Years)	NPV (C\$' 000's)		NPV/share (\$/share)	
				5%	10%	5%	10%
80%	90,493	119%	0.8	8,045,258	4,984,936	\$39.28	\$24.34
100%	113,117	114%	0.9	7,729,344	4,782,156	\$37.74	\$23.35
120%	135,740	110%	0.9	7,413,430	4,579,376	\$36.20	\$22.36

As an example, when discounting only the projected revenue from rare earths and rare metals by 65% of the reference Scenario 2 (see Table 22-7), the projected revenue totals for these products equals to \$137 million. This 65% discount is equivalent to a 20% discount over and above the November Chinese domestic price (see Section 19). Assuming this hypothesis and a projected 25 years of operations, the pre-tax NPV of the project would then range between \$4.16 billion and \$2.5 billion or the equivalent of \$20.33 and \$12.17 per share of Orbite on a fully diluted basis, when applying a discount rate of 5% and 10% respectively, and assuming an initial investment of \$500.4 M (see Figures 22-5 and 22-6). The project would generate under this scenario, an IRR of 65% and a payback of less than one and a half year, thus demonstrating a positive economic outcome.

It should be noted that high purity silica could also be marketed at a price as high as \$200-\$500/t depending on the quality grade (purity). This possibility has not been considered in the PEA but could have a significant positive impact on the revenue stream, and EBITDA line, since silicon dioxide is the most important quantity of product produced by Orbite.

Figure 22-5 Sensitivity Analysis for Element Varying Independently at 5% (Scenario 2)

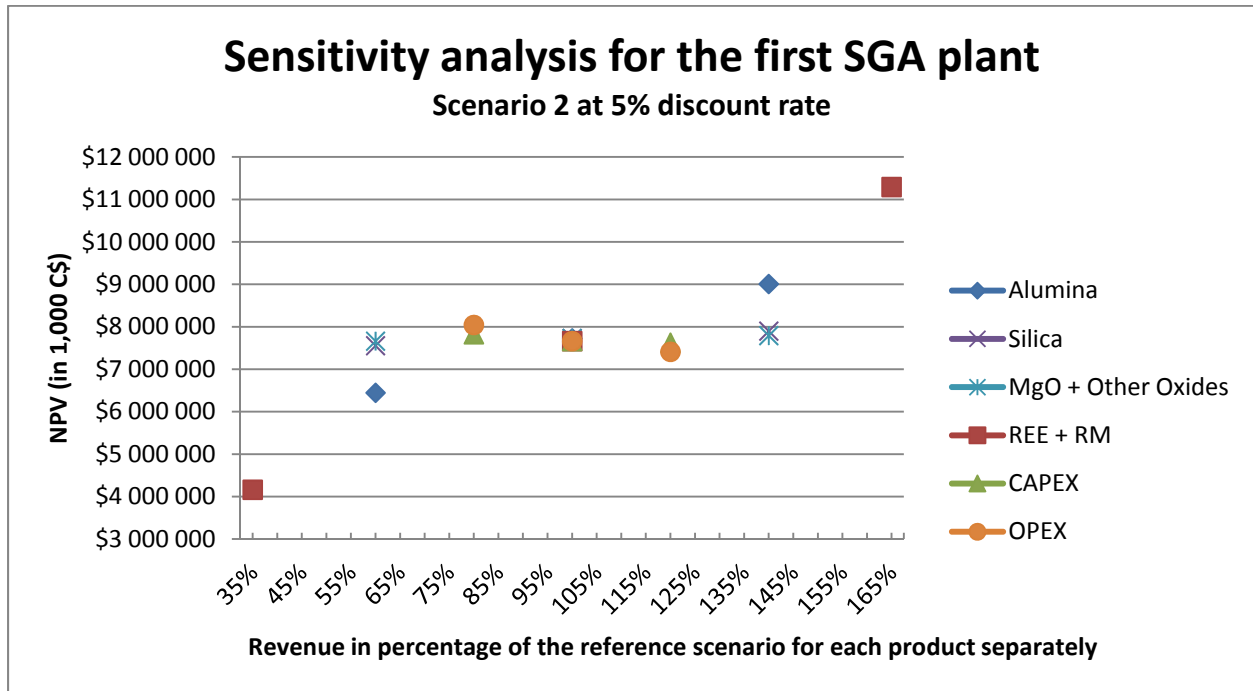
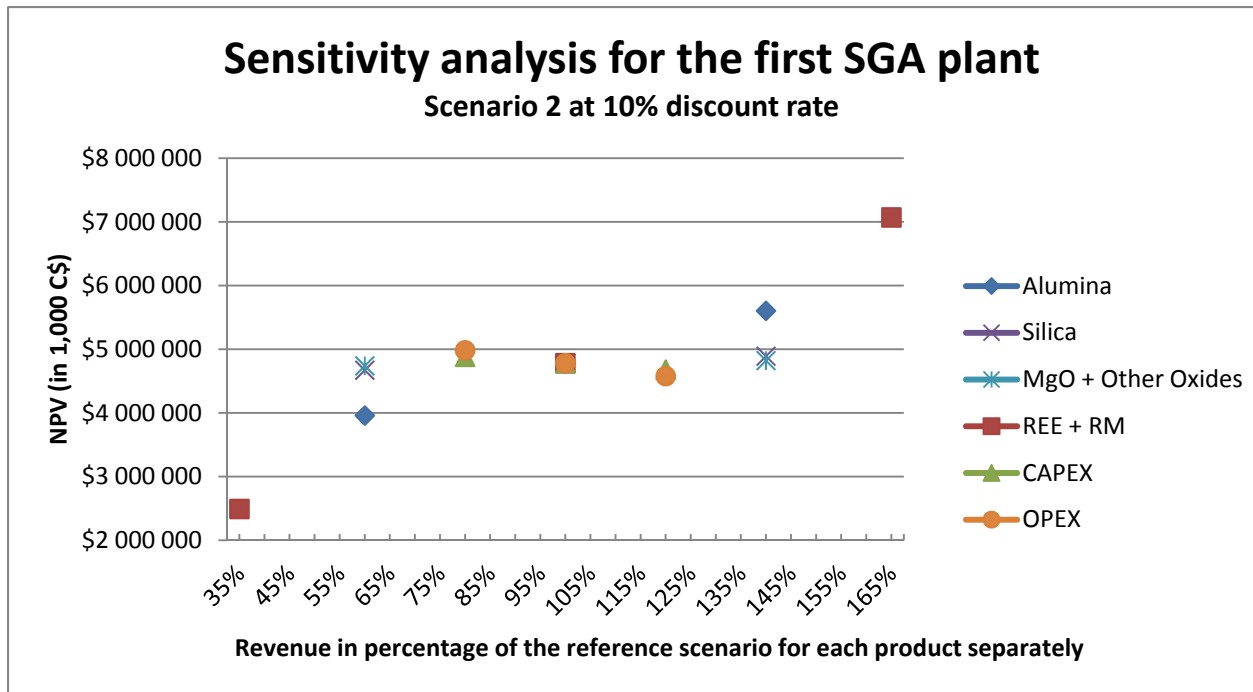


Figure 22-6 Sensitivity Analysis for Element Varying Independently at 10% (Scenario 2)



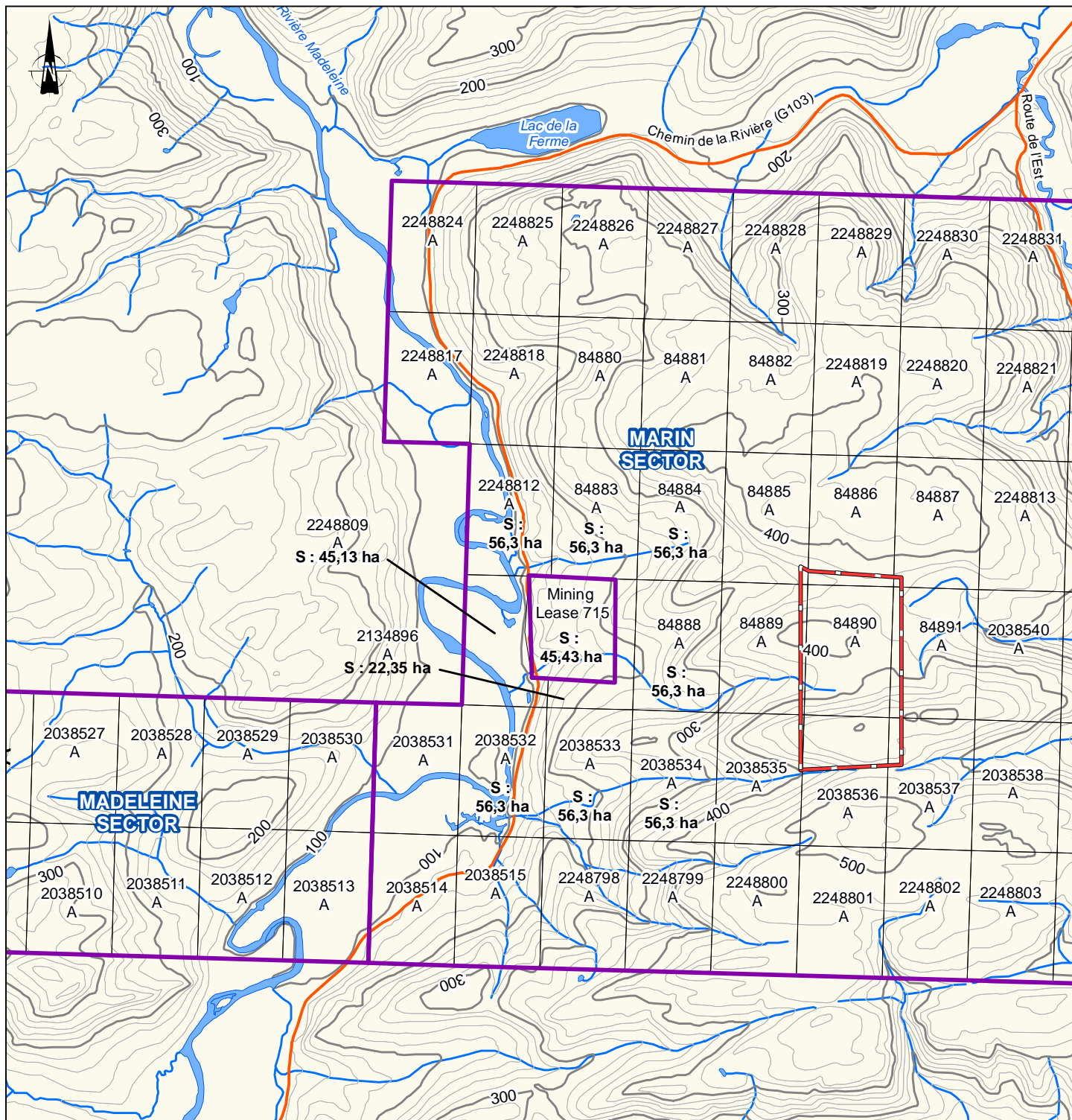
22.6 Economical Analysis Conclusions








In conclusion, the World economy has always operated in cycles and we are approaching 2012 in what is believed to be one of the toughest historical low. Therefore the current pricing for RM and REO, alumina and also other products manufactured by Orbite will continue to vary up and down with the economic constraints. Due to its low manufacturing cost, Orbite will be well positioned to have a good financial performance, even is the economy and prices remain where they are, and will definitely benefit of the expected and anticipated recovery in world economy and prices when they occur.

23 ADJACENT PROPERTIES

The Company's 6,441 hectares property was all claimed on public land and, still today, is surrounded by kilometers of Crown land. This property is made of 115 contiguous claims with no voids.

There exists however a small parcel that predated the coming of the company. As can be seen on Figure 23-1, there is a small mining lease completely imbedded within Orbite's property, and referred as BM 715, centered on 336353 and 5441560, that belongs to Real Rioux of Rivière à Claude. It was registered on January 6, 1984 and is due for renewal on January 5, 2014 for the amount of \$1,998.92. This lease (BM 715) was formerly and aggregate quarry in sandy quartzite that has been abandoned for a long time. The owner kept the permit valid in the hope of re-starting the operation. There is a very small part, to the North-East, that may contain some claystone but it would have very little effect on the resources of the company. The Qualified Person, Mr. Jean-Guy Levaque, Eng. has been unable to verify the claystone presence, under this imbedded claim. Again the information would not impact significantly the resources evaluation under this Technical Report.



-  Sector Limit
-  Proposed Mining Lease
-  Lake
-  Watercourse
-  Contour Line (20 m interval)*
-  Acces Road
-  Claim and Claim Number (A : Active)

*Above mean sea level

ORBITE ALUMINAE INC. TO BE DETERMINED

Figure 23.1
Location of Small Mining Lease
in Orbite's Property

Sources :

Topographic Map :
 - Base cartographique CANVEC

Other Source
 - GESTIM Data Base- (11-08-08)

Prepared by: É. Gingras
 Drawn by: C. Thériault
 Approved by: B. Fournier

January 12th, 2012 111-20434-00



24 OTHER RELEVANT DATA AND CONCLUSIONS

24.1 Future Work

As part of future activities leading to the construction of the commercial alumina plant, there are some clearly identified project milestones that must be reached. Orbite is already working with local and international partners and technology suppliers to complete the basic engineering, which includes the process design basis of the plant sub-sections. This is the main objective of the Feasibility Study which will allow establishing Capex at +/- 15% and Opex within 10%.

Another significant milestone to accomplish is to refine the individual REE extraction techniques through piloting in identified location throughout the world in view of establishing final basic engineering and process parameters on that specific subject.

Setting aside issues that deal primarily with any outstanding issues of a chemical nature, the chemical engineering design of the process and especially integration of all sub systems will be the element taking precedence in these next stages of work. The selection of materials of construction does not represent an important milestone in the design phase since Orbite is already dealing with knowledgeable leaders in this domain and that specifications dealing with high temperatures in hydrochloric acid conditions have been known (corrosion factors, valves materials, protective surface coatings etc) for decades. The expertise from equipment manufacturers familiar with chloride-based chemical operations and processing plants will be sought. In Europe, exists a level of operational and fabricating expertise that will be tremendously helpful in the design process. Leach reactor design (glass lined with special anti-wear coating identified) must be initiated and long lead-time items must be identified.

During the Feasibility stage and coupled with these activities will be the development of an Environmental Management Plan, along with the development and execution of a plan for completing all requirements for permitting the plant construction and operation. GENIVAR has already listed the list of permits that are required. The Environmental Management Plan will cover such segments as procedures for managing and containing spills, training of plant personnel, an occupational Health & Safety program, chemical handling procedures, fire protection, start-up procedures, emergency shutdown procedures, among a list of many other items. Orbite will start instructing its personnel during 2012 and early 2013. Additional work is also required to better characterize plant emissions and the means of protecting both plant personnel and the environment. A basic design for ventilation and capture of dusts, aerosols containing HCl, and volatile organic compounds (VOCs) must also be elaborated. GENIVAR, within the Feasibility study is expected to provide the details of such with European's group actually performing the process design basis and the

basic engineering of the acid recovery part. GENIVAR will be responsible for the ALP design and tank farm system where hydrochloric is susceptible to be present. The Environmental Management Plan will involve, as per Orbite's standards and procedure in place, a HAZOP level 2 review (major risk) of the whole plant, including the mine.

Market understanding and evaluation of all products must also be accomplished as per schedule by Orbite. Acceptability of products shall not be an issue since all have met actual known specifications. Relations with the community are already in place, even if at an early stage, and emphasis shall be made at ensuring that Project's acceptance is properly addressed.

On the geology side, additional drillings campaigns are scheduled in early 2012 to focus on the mine site resources estimate within the Marin Sector and to refine even furthermore the rare earths and rare metals behavior (actually classified as Inferred Resources) within the targeted deposit, for the lifetime of the Project.

24.2 Project Schedule

The design stages leading to the plant will include the 3 mains aspects that are:

1. Process design basis and basic engineering;
2. Feasibility study;
3. Detailed engineering design.

Each naturally leads to progressively more detail, more precision on costs (CAPEX and OPEX), and further precision of the implementation schedule. Construction, successful start-up, and operation of the plant will point to very good detailed engineering around the interaction of the hydrochloric acid recovery systems especially. The technical challenge of this plant is an engineering one of integration. The Feasibility study is expected to be completed by GENIVAR within 6 months after the date of this Technical Report, since basic engineering is already well advanced with European parties among others, especially on the hydrochloric acid recovery part.

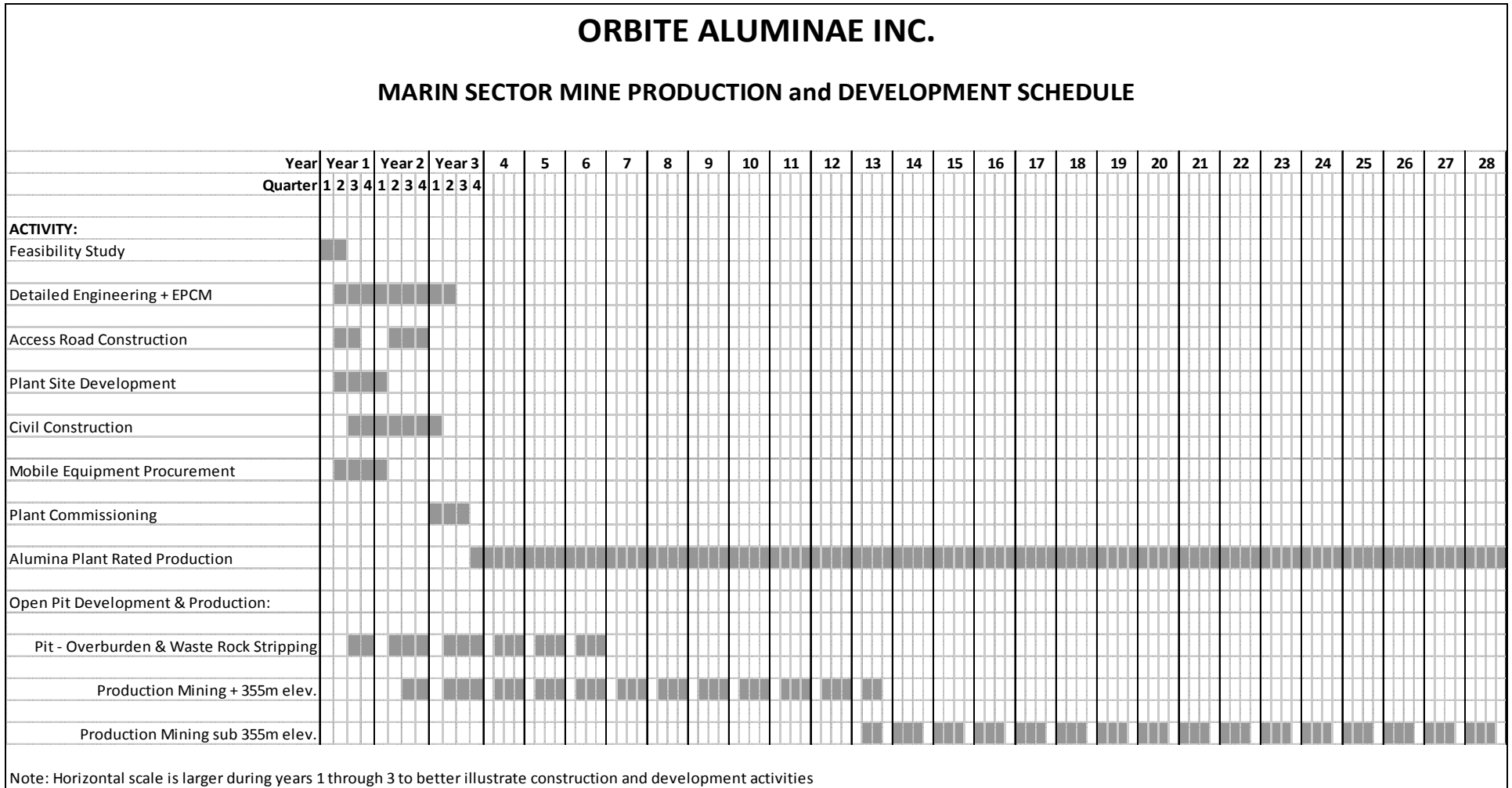
Permitting typically proceeds through the Feasibility study stage, with all necessary permitting completed prior to the start of mine development and construction of the Plant. An allocation for gradual permitting process during the different stages has been made such that no delays are associated with these. This assumes that no Environmental Impact Assessment will be required for the Project; even though new provincial Bill 14 (see Section 20) could impact project schedule. An allocation of one year has also been made to complete the Environmental Management Plan, which

will be done by Orbite personnel in most part and required for the Plant commissioning.

The entire EPCM cycle is anticipated to take two years approximately to complete. A reasonable estimate would be that the commissioning and start-up of the plant would be approximately 2.5 years from the date that this report has been issued. Opportunities may be identified to shorten this schedule and reduce start-up costs; however, de-risking of the process will not occur through the elimination of any of the steps noted; and that especially with such a “fast-track” approach by Orbite.

Execution of the project and the avoidance of delay will only come about through detailed planning and by correctly timing the involvement of the vendor/suppliers, coupled with clear definition of the handover points between all parties involved. Every opportunity to shorten the schedule will be explored and Orbite is already in discussions with vendor/suppliers (SMS Siemag, Outotec, Emerson, etc) who are familiar with the hydrochloric acid manufacturing industry as well as specialists who are familiar with other segments of the process. A preliminary schedule outlining the above is presented in Figure 24-1.

Figure 24-1 Project Preliminary Timeline



25 INTERPRETATION AND CONCLUSIONS

25.1 Generic Analysis and Conclusions

The density of geological and analytical data and the understanding and definition of the deposits on the Marin Sector and all Orbite's claims may be adequate for the preparation of a 3D model and for the mineral resources estimate of the deposit, if all data is found to be adequate after the detailed review at the Feasibility Study stage. It is planned that additional drilling would be performed in 2012, and data would be used in a future block model. The reliability of the data rests on the best quality control practices applied at the exploration stage, under the supervision of Mr. Jean-Guy Levaque, Eng. acting as the independent QP for Orbite, in close collaboration with Mr. Rheault, Geo (ViaSat technologies). These have been demonstrated to have sufficient merit to warrant Orbite for further exploration and development to fully develop its alumina, silica, hematite, magnesium oxides, other oxides, rare earths and rare metals as oxides potential. The resources as per Table 25-1 are thus as follows, following 2011 Exploration work on the Marin Property:

Table 25-1 Table of Resources Estimate following 2011 Exploration Work

Resource	Oxide	Grade	Total Min Mt
Indicated	Al ₂ O ₃	23.37%	1040
Indicated	SiO ₂	52.62%	1040
Indicated	Fe ₂ O ₃	8.42%	1040
Indicated	MgO	1.64%	1040
Indicated	Others	6.90%	1040
Inferred	RM & RE	573 ppm	780

Additional Exploration campaign are scheduled during the course of 2012 and will focus mainly, at first sight, on the Marin Sector in order to understand even better the rare earths and rare metals behavior for the Project life (25 year extent) in the Marin Sector.

GENIVAR had access to installation and/or data, and is satisfied of the laboratory, pilot plants testing programs and studies that have been carried out by Orbite, SMS Siemag, Outotec and others. These elements have met the requirements of a Preliminary Economic Assessment. Demonstration of the chemistry of the leaching process and other value added products represents an important milestone in the

development of the Project. What the pilot plants (3) have demonstrated is that the principal components of the process, namely leaching and individual extraction of ions using bubbling techniques while recovering acid can be operated at the pilot level. The ability to process other types of raw material (bauxite) using Orbite's proprietary process without generating any red mud has also been demonstrated. Orbite has thus demonstrated its capacity to produce quality smelter grade alumina from its Grande-Vallée clay deposit, and to do so both more efficiently and without the negative environmental impacts associated with the industry-standard process. For all intents and purposes, a sufficient body of information has been developed to warrant GENIVAR's recommendation to continue with the next stage of the Feasibility study of the Project.

25.2 Further Summarized Analysis

- Orbite appears to be positioned to produce metallurgical alumina, hematite, high quality silica, magnesium oxide, mixed oxides, rare earth and rare metal as oxides elements from Grande-Vallée clay, all without producing toxic residues, notably the toxic red mud produced by the Bayer process.
- The mine high production rate of approximately 11,000 tonnes per day and the use of covered conveying/storage should minimize the effects of rain and snow precipitations on the mined product (mining 9 months a year for a yearly mining rate of 6,960 tpd of clay).
- Since the clay preparation plant (CPP) and process costs in this study are based on handling a relatively dry product (with final size reduction based on dry grinding) the mining schedule may have to be amended somewhat to include more mining in the dry part of the winter and a suspension of mining during periods of heavy downpour. If scheduling problems and the prevailing climatic conditions result in the requirement to mine a product with moisture contents higher than expected requiring wet grinding, the expenses involved in drying the product and/or acid recovery would affect the plant economics.
- Orbite's metallurgical smelter grade alumina Project is sensitive to fossil fuel prices as per all large scale chemical processes. A 25% increase in natural gas prices (baseline taken for the PEA) results in a 15.8% increase in the cost of alumina production. Under these conditions, the processing cost of all products considered goes up to \$225/t for alumina and other value added products. At this time, there is no natural gas in the Gaspésie area, which has been identified/classified as reserves under the NI 51-101 Standards of Disclosure. That being said, due to the relatively high potential of supply in the area of the Project, Orbite should actively try to secure a long term natural gas supply contract for its future operation. Several other competing energy sources will have to be assessed at the Feasibility Study stage, including electrical with a

biomass cogeneration plant and different fuel options, including piped natural gas biomethanisation, extraction wells, bunker C, light fuel, other solid alternative fuels (tire fluff, carpet fluff), etc.

- Consideration was given to establishing Orbite's smelter grade alumina plant at the site of the former Gaspé Mine in Murdochville. An analysis of costs showed that the considerable savings in capital costs, due to plant site preparation and the existence a power line was more than offset by the annual costs of transporting the clay to Murdochville (32 km) and the extra transportation costs in shipping the plant products to market. It was concluded that it is more economical to establish the plant adjacent to the mine which became the baseline of the Preliminary Economical Assessment.
- Internal rate of return (IRR) is calculated at 33%, with a net present value (NPV) of \$1.7 B after 25 years (5% interest rate), for the scenario of selling alumina at \$425/t and hematite at \$200/t. Actual payback period for the project under these conditions is approximately three years. Sensitivity analysis was also performed under that reference scenario identified as Scenario 1 and based on known variations of market price (see Section 22). The sensitivity analysis of this Scenario 1 shows that using alumina prices from \$325/t to \$425/t with hematite prices following the same trends (\$125/t to \$200/t) and a 5% discount rate generates an IRR varying from 19% to 33%, and the NPV from \$791 M to \$1.74 B. At 10% discount rate, the NPV varies between \$338 M to \$947 M. All those figures are considered for the first operational plant.
- If Orbite succeeds in selling all other valuable products derived from its process (High quality Silica, Hematite, magnesium oxides, mixed oxides, rare metals and rare earth oxides) the IRR goes up to 114% and NPV at \$7.7 B after 25 years (5% interest rate). Actual payback period for the project under these conditions is less than a year, and consist in the preferred (or retained) option by Orbite. Sensitivity analysis was also performed under that reference scenario identified as Scenario 2, and based on known variations of market price (see section 22). When adding the revenues from the REO+RMO's, magnesium and other oxides, and high purity silicon dioxide; sensitivity is of course less important due to the important portion of additional potential revenues. Since, REO+RMO's market prices are more volatile, GENIVAR has factored a reduction in the revenue from the REO+RMO's in this scenario varying from 20 to 65%. Under such conditions, IRR varies from 55% to 114% and NPV at 5% discount rate varies from \$3.4 B to \$7.7 B. At 10% discount rate, the NPV varies from \$2.0 B to \$4.8 B. All those figures are considered for the first operational plant.

25.3 Other Risks, Uncertainties and Opportunities

In the course of completing the preliminary economic analysis and this NI 43-101F1 report, certain other key elements of risk and opportunity became self-evident. The study that has been carried out is preliminary in nature and to some extent based upon factored estimates. GENIVAR states that the preliminary economic assessment is preliminary in nature, since it includes in some part inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary economic assessment will be realized.

The capital and operating cost estimates are believed to be accurate within +/-30%; however, risks, uncertainties and opportunities that have been identified may impact upon costs. These are summarized as:

25.3.1 Risk and Uncertainties (technical, commercial, etc)

- Integration of all sub system into a common Plant (hematite production, alumina calcination, MgO, other oxides and rare earths and rare metals as oxides production while recovering acid) poses a technical risk for the eventual Plant construction and will require good basic and detailed engineering. Individually those sub-systems are proven and are adapted technologies with Orbite's process, which need to be correctly inter-connected. On the other hand, Orbite is actually dealing with established and among the best in the industry;
- Another risk to the Project is the marketability of such large volumes of SiO₂ product. Important quantities will be processed on a daily basis (more than 3,000 tonnes per day) and will need introduced on the market. The fallback position is to send back to mine site, this purified product upon plant start-up (partially or totally). It is actually in the plans of Orbite to really establish marketability. Volume is the actual challenge encountered, not quality of product. This should ease the marketability process to some extent and the risk should be overcome;
- Silica filtration after the leaching stage, its cleaning and recovery of chlorides and any left free hydrochloric acid represents a technical challenge on large scale and such quantities due to the uniqueness of the solid particle size (silicon dioxide) and its tendency to clog band filters. During Feasibility stage, proper final testing with continuous systems shall be performed to validate that very important aspect;
- Although Orbite has taken reasonable measures to ensure proper title to its properties and mining claims, there is no guarantee that title to any of its properties or mining claims will not be challenged or impugned. Third parties may have valid claims underlying portions of Orbite's interests. There can be no

assurance that the mining regime currently in place in the Province of Quebec will not be changed in a manner that could adversely affect Orbite, its properties and business plans;

- Mineral Exploration is highly speculative and involves a high degree of risk, which even a combination of careful evaluation, experience and knowledge may not be able to avoid. Most exploration efforts are not successful in that they do not result in the discovery of mineralization of sufficient quantity or quality to be profitably mined. There is also no assurance that the mining activities of Orbite will be brought into commercial production. These risk factors include market fluctuations, the proximity and production capacity of mining facilities and processing equipment, the presence or access to required energy at reasonable cost, availability of qualified personnel, doing business in remote areas, possible third party claims and government regulations, including regulations relating to prices, royalties, allowable production, mining leases, environmental protection, . The effect of these factors cannot be accurately predicted;
- Fluctuations in the Market Price of Alumina and Other Metals is another element to consider in the global Project evaluation. The profitability of mining operations, and thus the value of the mineral properties of Orbite is directly related to the market price of these. The market price of alumina and other metals fluctuates and is affected by numerous factors beyond the control of Orbite. If the market price of alumina and metals should decline dramatically, the value of Orbite's mineral properties could also decrease dramatically and Orbite might not be able to recover its investment in those interests or properties. The selection of a property for Exploration or development, the determination to extract natural resources and place them into production and the dedication of funds necessary to achieve such purposes are decisions that must be made long before first revenues from production are received. Price fluctuations between the time that such decisions are made and the commencement of production can drastically affect the economics of the operations. The PEA, through its market analysis portion tried to define some of the effects (sensitivity analysis);
- Energy supply in the Grande-Vallée area represents one of the key elements and potential risk of the Orbite project, like all mining and heavy industrial projects. For the purpose of this study, natural gas has been used as the reference energy source. There is excellent known potential for natural gas in the vicinity although there currently is no production facility (wells or pipelines) in the Gaspé area or in the general area where Orbite plans to construct its smelter grade alumina production plant. A few oil and gas exploration companies are seriously intending to proceed with extraction wells in the vicinity of Orbite's site. Orbite is currently working on securing long term natural gas supply for its future operation. North American natural gas prices are currently quoted (August 2011) at slightly below \$4.00 per MCF (1,000 cubic feet) which equates to \$3.61/GJ. Orbite is also

considering other source of energy such as biomass, coal, biomethanisation, bunker C, and fuel;

- Bill 14, mentioned earlier, which seeks to amend the Quebec Mining Act – Status to be adopted in early 2012, represents also a potential risk. The content and the impact of this bill were described in detail in Section 20. The Amendments, with this Bill 14, propose that all future mining projects whether the construction or operation of a mineral treatment plant or the opening or operation of a mine, be subject to an Environmental impact assessment and review procedure, which includes consultation and public hearings before the BAPE without regard to the production threshold. This Bill could have a significant impact on the project schedule of Orbite. The complete Environmental impact assessment process generally takes one to two years, and represents an additional cost of \$2 M, in professional fees. For Orbite, since there is existing baseline data, we believe the delay could be 12-16 months rather than two years;

25.3.2 Opportunities (technical, commercial, etc)

- The sale of valued added products while benefiting from the concentration factors increase within the acid recovery process represents another potential opportunity for enhancing the economics of the Project, while at the same time eliminating any landfill cost. That is most probably of the biggest asset to Orbite's process, totally integrated and unique relative to existing alumina processes;
- Opportunities also exist to further rationalize the unit operations that were assumed in this PEA. One approach concerns the number of leaching reactors (size and arrangement) which may be influenced by the process mode (semi-continuous) and leaching concentration which can greatly improve reaction kinetics. These elements shall be confirmed during the feasibility study stage to optimize CAPEX especially in regards to the ALP sector.
- One very significant opportunity that is currently associated to Orbite process is to maximize the alumina recovery, which is common to any chemical process optimization. A loss of nearly 7% through all the steps was identified as a result of all sub systems interactions. This loss takes place at the grinding, leaching and some into the crystallization stages while recovering hydrochloric acid. For the purpose of the present PEA, this alumina was considered unrecoverable. However, the configuration that was developed would allow maximizing that yield especially around the leaching and crystallization stages. Through simple and basic process design basis optimization, it may be possible to raise the recovery of alumina from 93% to 95% or higher, which would positively impact the net operating cost per tonne of products produced.

26 RECOMMENDATIONS

Several recommendations are put forward in this Technical Report. The results of the work will help to complete the path for the metallurgical grade alumina industrial plant.

26.1 Mining and Geological Related Recommendations

- Full geological data review or completion (through potential additional drilling) and creation of a pit block model on Gencom, followed by a pit optimization study should be completed on the outlined resources at the Marin Sector of Orbite's land holdings.
- Pit production modeling should be performed on the larger outlined aluminous clay resource. This work should include optimizing the claystone and mudstone mining ratios as well as considering the mining grades in the plant feed. This work will support studies to construct a series of metallurgical grade alumina plants to provide local feed for the North shore aluminum smelters.
- A full geotechnical, hydrogeological, and hydrographical study should be done on the Marin Sector to establish pit design properties, dewatering technics, surface water control, as well as infrastructures and plant construction recommendations.
- A Physical properties study should be done on the claystone and mudstone crushed plant feed (minus 40 mm) as well as the plant process products (Alumina, Hematite, Magnesium Oxide, Mixed Oxides and High Purity Silica) to determine the angle of repose, flow characteristics and long term storage implications of each component.
- In order to allow mining operations to proceed, the mining claims in the Marin Sector has to be brought to the status of a mining lease. The request was registered at the MRNF on September 14, 2011, with the dossier number 1120559 with the mining lease # 1013.
- Even though Bill 14 is not still adopted, we recommend that Orbite undertake full Environmental Baseline Studies, as well as producing an Environmental & Social Impact Assessment Report of the project.
- Orbite shall perform additional Exploration work on the Marin Sector in order to have an even better understanding of the REO and RMO behavior within that sector; these resources (REO and RMO) being classified as Inferred resources as per this NI 101F1 Technical Report.

26.2 Metallurgical and Chemical Processing Related Recommendations

- Orbite should investigate the implications of adopting wet grinding as this method of final size reduction may be required if moisture levels in the incoming claystone/mudstone are higher than expected; even though there will be a negative impact on OPEX.
- Orbite should have a marketability assessment of the mixed oxides product done to determine the demand and a realistic market price for the expected annual production. Same applies for silicon oxides. Actually PEA is being positioned on the very conservative side on pricing for these because of the uncertainty relative to market behavior.
- Orbite should have leach and acid/base accounting studies performed on the silica, hematite, magnesium oxide and mixed oxide products to determine the runoff and potential groundwater infiltration characteristics of the material. Although these products are very likely innocuous this has to be proven to the regulating authorities.
- Mineral processing study should be done on the claystone and mudstone to determine the mined products' specific gravity, percent moisture, angle of repose and long term storage characteristics (for storage barn and plant bin design).
- Since the Plant will be a large consumer of fossil fuel especially for process purposes, Orbite should support initiatives to secure potential large amounts of natural gas or biomass identified in the vicinity of the plant and investigate potential installation of cogeneration plant as well. Other sources of fossil fuel, or alternative fuels, should be evaluated at the Feasibility stage (bunker, propane, diesel, rubber fluff, carpet fluff, biomethanisation and liquefaction plant, etc).
- Optimization study for selecting the exact location of the plant by the mine site as well as the storage facility, loading and unloading facility and port selection, should also be completed during the Feasibility study stage.

27 REFERENCES

- (1) MARKETWIRE news release, October 13, 2011, Orbite changes its name to Orbite Aluminae and confirms trading date on the Toronto Stock Exchange.
- (2) JACOB, H-L., August 22, 2008, National Instrument 43-101 Technical Report. Summer work on the aluminous claystones of the Grande Vallée property in 2008. Technical report prepared for Exploration ORBITE VSPA Inc.
- (3) LEVAQUE J.G., August 31 2009, National Instrument 43-101 Technical Report. Technical work compilation or works accomplished on Grande Vallée Property in 2008. Technical report prepared for Exploration ORBITE VSPA Inc.
- (4) LEVAQUE J.G., March 31, 2011, National Instrument 43-101 Technical Report. 2010 Field work, Grande Vallée Property. Technical report prepared for Exploration ORBITE VSPA Inc.
- (5) LEVAQUE, J.G. and Simoneau R. 2010 Field Work, Grande Vallée Property, NI 43-101 Technical Report dated March 31, 2011 amended on August 21, 2011.
- (6) GENIVAR. September 2011. Bilan des considérations environnementales du projet d'extraction d'alumine et des terres rares de la propriété Grande-Vallée, Gaspésie. État de situation au 3^{ième} trimestre 2011. Préparé pour Exploration Orbite Inc. 84 pages et annexes.
- (7) ENVIRONNEMENT CANADA, 2008b. Données climatiques en ligne.
- (8) ROCHE INGÉNIEURS–CONSEILS (ROCHE), 2008, Stations météo de Cap Madeleine et de Murdochville. Étude de caractérisation environnementale – Propriété Grande-Vallée (N/Réf : 50169-100). Rapport préparé pour Exploration Orbite VSPA Inc. 131 pages et annexes.)
http://www.climate.weatheroffice.ec.gc.ca/climateData/canada_f.
- (9) TURNER, R. W., 2000. Preliminary report on the geology and clay sampling programme. Grande-Vallée Alumina Project of Jean-Marc Marin and Jean-Yves Lavoie, NTS 22H/3, Denoue Township, Gaspe Region, Province of Quebec.
- (10) LAFLÈCHE, MARC R., Nzangou, Omer S. et Monette Yves, 2006. – Études géochimique, minéralogique et hydro-métallurgique des argilites alumineuses de la propriété Grande-Vallée de Orbite VSPA, Institut de la Recherche Scientifique, INRS-Eau, Terre et Environnement, Rapport de Recherches No R-909, GM-62960.
- (11) Malo, M. 2001. The Late Silurian – Early Devonian tectono-sedimentary history of the Gaspé Belt in the Gaspé Peninsula: from a transtensional Salinic basin to an Acadian foreland basin. Bulletin of the Canadian Society of Petroleum Geologist, v. 49, p. 202-216.

- (12) SLIVITZKY, A., SAINT-JULIEN, P. et LACHAMBRE, G., 1991- Synthèse géologique du Cambro-Ordovicien du Nord de la Gaspésie, Ministère de l'Énergie et des Ressources du Québec, ET 88-14, 61 pages.
- (13) SLIVITZKY, A., 1994- Géologie de la région de Grande-Vallée (Gaspésie), Ministère des Ressources naturelles, MB-94-53.
- (14) LACHAMBRE, G. et BRISEBOIS, D., 1991- Géologie de la Gaspésie – Grande-Vallée, 22H/03 et 22H/06, Ministère de l'Énergie et des Ressources du Québec, DV 91-06.
- (15) BRISEBOIS, D., LACHAMBRE, G. et PICHÉ, G., 1992- Carte géologique, Péninsule de la Gaspésie, Ministère de l'Énergie et des Ressources, DP 91-21.
- (16) St-Julien, P. and Hubert, C. 1975. Evolution of the Taconian Orogen in the Québec Appalachians. American Journal of Science, v. 275, p. 337-362.
- (17) LEVAQUE, J-G., 2008- Rapport de travaux 2008 sur la Propriété Grande-Vallée, préparé pour Exploration Orbite VSPA Inc.
- (18) RHEAULT, M., 2009- Analyse lithologique en support à l'exploration de shale alumineux, MIR Télédétection Inc.
- (19) MIR Télédétection, 2010, Analyse lithologique en support à l'exploration de shale alumineux, Grande Vallée, Gaspésie. Rapport confidentiel soumis à Exploration ORBITE VSPA Inc., décembre 2010, pp. 22.
- (20) KONSTANTINOVSKAYA, E., 2008- Contribution en Géologie Structurale au Projet Grande-Vallée, Gaspésie, Institut National de la Recherche Scientifique, Eau, Terre et Environnement. Rapport de Recherches No R-909.
- (21) LEVAQUE, J-G., 2007, Orbite Aluminae Inc., Drill logs and analysis.
- (22) LEVAQUE, J-G., 2008, Orbite Aluminae Inc., Drill logs and analysis.
- (23) LEVAQUE, J-G., 2009, Orbite Aluminae Inc., Drill logs and analysis.
- (24) LEVAQUE, J-G., 2010, Orbite Aluminae Inc., Drill logs and analysis.
- (25) LEVAQUE, J-G., 2011, Orbite Aluminae Inc., Drill logs and analysis.
- (26) LEVAQUE, J-G., 2008- Trois rapports d'étapes internes sur l'avancement des travaux d'exploration (Août 2008, Septembre 2008 et Octobre 2008).
- (27) MATTON G., RHEAULT, M., VIASAT (2011) Analyse lithologique en support à l'exploration de shale alumineux, Grande-Vallée, Gaspésie – Phase 2: Intégration des forages, mise à jour de la carte géologique et production de sections géologiques, Rapport soumis à Exploration Orbite VSPA Inc., 20 pages.

- (28) MARKETWIRE news release, October 20, 2011, Orbite brilliantly completes its 2011 drilling program, signalling another step towards commercialization of its products.
- (29) RICHARD, D., BENHOUHOU, Y., 2011 - Caractérisation hydrogéologique préliminaire des environs du site d'excavation projeté rapport d'expertise étape 1, Projet argile alumineuse de Grande-Vallée, Secteur Marin.
- (30) RICHARD, D., BENHOUHOU, Y., 2011 - Caractérisation hydrogéologique préliminaire des environs du site d'excavation projeté rapport d'expertise étape 2, Projet argile alumineuse de Grande-Vallée, Secteur Marin.
- (31) PRIMEAU, D., November 10, 2011, Orbite REE individual extraction techniques and diagram (BFD and PFD). Confidential internal report by third party.
- (32) BOUDREAU et al., United States Patent no. US 7,837,961 B2, November 23rd 2010.
- (33) BOUDREAU, RICHARD; ALEX, SERGE; BIASOTTO, FABIENNE; Canadian Patent #2 684 696, 2010/10/12.
- (34) MARKETWIRE news release, July 27, 2011, Filing of New Patent Application for an Innovative Method to Separate Efficiently Iron from Aluminum.
- (35) MARKETWIRE news release, December 7, 2010, Exploration Orbite Files a New Provisional Patent Application in the United States.
- (36) MARKETWIRE news release, October 5, 2010, Orbite Gets Green Light From United States Patent and Trademark Office.
- (37) GILSIG, TOBY. A Report on the Production of Metallurgical and High Purity Alumina, and Other High-Value Elements, Using a New Patented Process, Update: June 2011.
- (38) MARKETWIRE news release, September 29, 2011, Orbite, in accordance to its original timeline, takes another significant step towards the industrialization of its smelter grade alumina plant.
- (39) OUELLET, V. October 2004, Extraction de l'alumine de l'argile de la région de Murdochville, Quebec, Canada. 158 pages.
- (40) MARKETWIRE news release, July 21, 2011, Orbite successfully applies its alumina extraction process to bauxite.
- (41) MARKETWIRE news release, May 11, 2011, Exploration Orbite Files a New Patent Application that Covers the Extraction of Rare Earths.
- (42) ALEX, S., BIASOTTO, F., FOURNIER, J, POMETOVA, F. (CEPROCQ). June 6, 2007, Rapport d'avancement pour le projet mise au point d'une méthode sélective d'extraction de l'aluminium à partir de lixiviats d'argilite de Grande-Vallée. Rapport confidentiel. 5 pages.

- (43) MARKETWIRE news release, February 2, 2011, Orbite's Pilot Production Facility in Cap-Chat Becomes Operational.
- (44) MARKETWIRE news release, September 22, 2011, Orbite receives authorization from the Ministère des Ressources naturelles et de la Faune to extract 3,000 tonnes of aluminous clay.
- (45) ORBITE, 2011. 2011 pilot plant log reports. Confidential internal report, 169 pages (3 documents).
- (46) GARCIA, M.C., PICARD, F., (Seneca), June 30, 2011, Production d'un échantillon de terres rares Exploration Orbite VSPA. 12 pages.
- (47) BARIL, F. (Bumigene), October 24, 2011, Rapport d'évaluation du procédé de valorisation du gisement d'argile alumineuse de la société Orbite Aluminae Inc. En Gaspésie. 13 pages.
- (48) ORBITE, November 2011. 2011 analytical log reports. Confidential internal and external reports, 548 files.
- (49) ROUÉ, L., May 30, 2011, (INRS), Production d'aluminium a partir de l'alumine fournie par Exploration Orbite, 8 pages.
- (50) MARKETWIRE news release, June 21, 2011, Orbite Produces for a Second Time Excellent Quality Aluminum Metal Ingot from Its Cap-Chat Alumina.
- (51) SKYBAKMOEN, E., GUDBRANDSEN, H., DARELL, O. STORE, (SINTEF), June 14, 2001, A., Amenability of Orbite Alumina to produce Aluminum. Confidential report. 14 pages.
- (52) WEISSENBAECK, H. (SMS Siemag), November 3, 2011, Hematite characteristics out of hydrothermal process from Orbite spent acid. Internal communication and confidential note prepared for Orbite.
- (53) HAINDINGER, C., VOGL, D., SCHIESSER, R., (SMS Siemag), November 10, 2011, REE concentration factors, crystallization and hematite yields. Confidential reports; process design basis and pilot facilities results prepared for Orbite Aluminae Inc.
- (54) MARKETWIRE news release, April 12, 2011, Orbite Identifies Rare Earth Elements in Its Grande-Vallée Deposit, Further Enhancing Its Offering to the Aluminum and High-Technology Industries.
- (55) SENECA, September 29, 2011, Pilot plant mass balance, PFD and P&ID. Confidential information, rev PD, PE, 25 pages
- (56) VOGL, D., (SMS Siemag), November 7, 2011, ARP mass and heat balance. Confidential report process design basis and pilot facilities results prepared for Orbite Aluminae Inc.
- (57) MACH, M. SMS Siemag, Hydrothermal Hydrochloric Acid Regeneration: The Cost Saving Eco Friendly Alternative.

- (58) ALS CHEMEX, August 31, 2011, Claystone density measurement on Orbite material.
- (59) JOHNSON, P., PETERS, (USA Bureau of Mines), 1973, Revised and updated cost estimates for producing alumina from domestic raw materials. 52 pages.
- (60) PRIMEAU, D., July 10, 2011, Orbite Aluminae Inc., Process Flow Diagram (PFD) rev. 0. Confidential and proprietary information Orbite Aluminae Inc.
- (61) PRIMEAU, D., July 12, 2011, Orbite Aluminae Inc., Process Flow Diagram (PFD) rev. 1. Confidential and proprietary information Orbite Aluminae Inc.
- (62) PRIMEAU, D., July 20, 2011, Orbite Aluminae Inc., Process Flow Diagram (PFD) rev. 2. Confidential and proprietary information Orbite Aluminae Inc.
- (63) PRIMEAU, D., August 23, 2011, Orbite Aluminae Inc., Process Flow Diagram (PFD) rev. 3. Confidential and proprietary information Orbite Aluminae Inc.
- (64) PRIMEAU, D., September 6, 2011, Orbite Aluminae Inc., Process Flow Diagram (PFD) rev. 4. Confidential and proprietary information Orbite Aluminae Inc.
- (65) PRIMEAU, D., October 7, 2011, Orbite Aluminae Inc., Process Flow Diagram (PFD) rev. 5. Confidential and proprietary information Orbite Aluminae Inc.
- (66) PRIMEAU, D., September 20, 2011, Orbite Aluminae Standard Operating cost master file with mass and heat balance rev. 6. Confidential and proprietary information Orbite Aluminae Inc.
- (67) COURCY, R, November 20, 2011, ALP kinetic of reaction and number of reactors Preliminary evaluation of semi continuous mode. Internal communication and confidential note prepared for Orbite.
- (68) EISELE, J.A., SHANKS, D.E. (Reno Research Centre, U.S. Dept. of the Interior, U.S.A), August 28 1988, HCl Process for the production of Alumina From Clay. 7 pages.
- (69) HUNTER, D, SAWYER, D., TURNER. T. (U.S. Dept. of the Interior, U.S.A, Bureau of Mines), 1979, Alumina mini plant operations: Influence of reactor design on the attrition of calcined kaolin during HCl leaching. 25 pages.
- (70) ALCOA. (Alcoa for U.S. Dept. of the Interior, U.S.A Bureau of mines), January 12, 1979, Direct calcination of Aluminum chloride hexahydrate with off gas use to crystallisation. 29 pages.
- (71) MOYSILLES, J.H., SOWYER, L., TROUT, E. EISELE, J.A., SHANKS, D.E. (U.S. Dept. of the Interior, U.S.A, Bureau of Mines), 1979, Aluminum chloride hexahydrate crystallisation by HCl gas sparging. 41 pages.
- (72) MARKETWIRE news release, September 27, 2011, Orbite's advanced and state of the art Smelter Grade Alumina (SGA) projected plant keeps progressing on schedule.

- (73) CHARITOS, A., KLETT, C., (Outotec GmbH), November 15, 2011, Calcination process design basis preliminary mass and heat balance of aluminium chloride hexahydrate. Confidential report prepared for Orbite Aluminae Inc.
- (74) ADHAM, K. et LEE, C. and SMALL, D., 2006, Energy Consumption for Iron Chloride Pyrohydrolysis: A Comparison Between Fluidized Beds and Spray Roasters, MetSoc: Iron Control Technologies, pp. 815-829.
- (75) VOGL, D. (SMS Siemag), October 14, 2011, Weekly report REE analytical results. Confidential report from pilot facilities results prepared for Orbite.
- (76) HYDRO-QUÉBEC (TRANS-ÉNERGIE). November 2007. Intégration de la production éolienne au réseau de transport. Ligne à 230 kv au Géomon-Mont-Louis-Gros-Morne. Bulletin No. 3 – Information.
- (77) HYDRO-QUÉBEC. September 2011. Hydropresse.
- (78) HUDON, J.F. (Activa Environnement Inc.). Avril 2010. Étude sur la valorisation de la biomasse forestière disponible dans la région de Murdochville, 77 pages.
- (79) CRU, Q3 2011, Bauxite and alumina market outlook 2011, Powerpoint Presentation.
- (80) CRU International Limited, 2011, Bauxite and Alumina Market Outlook 2011 Edition, Executive Summary
- (81) RIO TINTO ALCAN website, <http://www.riotintoalcan.is/?PageID=122>.
- (82) RIO TINTO ALCAN, November 28, 2011 – Investors Seminar.
- (83) OECD Environment Directorate, OECD, 2010-OECD global Forum on Environment, Focusing on Sustainable Materials Management, October 25-27, 2010, Mechelen, Belgium.
- (84) PHILLIPS, H. F., 2011 - RBC Capital Markets, 2011 – Metals Prospects, Aluminum Market Outlook – Fourth Quarter 2011.
- (85) ALCOA Website.
- (86) WIKIPEDIA Web site – Economy of Iceland.
- (87) Greenland Hydro Power.
- (88) Platts cout transport alumina.
- (89) VALE INC., May 24, 2011 – Presentation at the Goldman Sachs Basic Materials Conference – New York.
- (90) VALE INC., September 5, 2011 – Presentation at the Deutsche Bank GEMs Conference – New York.

- (91) IYER, S., Retrieved November 4, 2011 (Original March 6 2011) - Silicon Dioxide uses: <http://www.buzzle.com/articles/silicon-dioxides-uses.html>.
- (92) BOILY, R., PhD (Inforex) – High Purity Quartz, The purest silicon dioxide for optical glass, semi-conductors and fiber optics, Confidential report.
- (93) BOILY, R., PhD (Inforex) – Magnesium Oxide, Confidential report.
- (94) GOLDMAN SACHS & PARTNERS AUSTRALIA, 2011 – Commodities-Rare Earths: Too Late To The Party?
- (95) MORENO, L., Ph.D, Jacobs Securities Inc., 2011– Rare Earth Elements-Our Top Picks, The Tight Race to Finish Line.
- (96) UNITED STATES GEOLOGICAL SURVEY, January 2011 - Mineral Commodity Summaries-Gallium.
- (97) VULCAN, T., 2011 - Scandium, A Rare Earth That's Not Really A Rare Earth?
- (98) PANOV, A. and KLIMENTENOK, G., UC Rusal Engineering and Technology Centre – Directions for large scale utilization of bauxite residue.
- (99) WIKIPEDIA – Scandium (<http://en.wikipedia.org/wiki/Scandium>).
- (100) DESCHAMPS, Y., Retrieved 2008-10-21, "Scandium" (<http://www.mineralinfo.org/Substance/Scandium/Sc.pdf>). mineralinfo.com.
- (101) UNITED STATES GEOLOGICAL SURVEY, Retrieved 2008-10-20, "Mineral Commodity Summaries 2008: Scandium" <http://minerals.usgs.gov/minerals/pubs/commodity/scandium/mcs-2008-scand.pdf>.
- (102) RÖYSET, J., Hydro Aluminum R&D Sunnal, Norway – Scandium Aluminium alloys overview: Physical Metallurgy, Properties and Applications, Metallurgical Science and Technology.
- (103) AUSTRALIAN BAUXITE LIMITED, Retrieved on January 5, 2012 <http://www.australianbauxite.com.au/marketindustry3.html>.
- (104) CRU International Limited, 2011, Alumina Refining Costs, 2011 Edition, Executive Summary.
- (105) BLOOMBERG, September 21, 2011, <http://www.bloomberg.com/news/2011-09-21/iron-ore-s-four-year-slide-hitting-mining-earnings-commodities.html>.
- (106) JP MORGAN, September 21, 2011, <http://www.marketwatch.com/story/jp-morgan-cuts-iron-ore-price-forecasts-2011-11-22>.
- (107) MUNDI – Iron Ore Monthly prices, Retrieved Jan 4, 2012, <http://www.indexmundi.com/commodities/?commodity=iron-ore&months=60>.

- (108) BUSINESS WEEK, Retrieved on Jan 3, 2012, <http://www.businessweek.com/news/2011-12-15/iron-ore-price-forecasts-from-2012-raised-by-goldman-on-brazil.html>.
- (109) Metal-Pages Web Site- <https://www.metal-pages.com>.
- (110) MORENO, L. (Jacobs Securities), November 23, 2011, Orbite Aluminae initial coverage, 66 pages.
- (111) ROCHE INGÉNIEURS–CONSEILS (ROCHE). 2008. Étude de cadrage environnementale – Propriété Grande-Vallée (N/Réf : 50169-100). Rapport préparé pour Exploration Orbite VSPA Inc. 36 pages.
- (112) ROCHE INGÉNIEURS–CONSEILS (ROCHE). 2008. Étude de caractérisation environnementale – Propriété Grande-Vallée (N/Réf : 50169-100). Rapport préparé pour Exploration Orbite VSPA Inc. 131 pages et annexes.
- (113) ROOD, M., VACHON, A., 2008—Étude de caractérisation environnementale, Propriété Grande-Vallée, Roche Ingénieurs-Conseils.
- (114) MDDEP, 2008, Portrait régional de l'eau - Gaspésie–Îles-de-la-Madeleine (Région administrative 11), in ROCHE INGÉNIEURS–CONSEILS (ROCHE). 2008. Étude de caractérisation environnementale – Propriété Grande-Vallée (N/Réf : 50169-100). Rapport préparé pour Exploration Orbite VSPA Inc. 131 pages et annexes. <http://www.mddep.gouv.qc.ca/eau/regions/region11/index.htm>.
- (115) ROCHE LTÉE – GROUPE CONSEIL (ROCHE). September 2011. Étude de caractérisation environnementale - 2011 – Propriété Grande-Vallée (N/Réf : 65038-100). Rapport préparé pour Exploration Orbite Inc. 39 pages et annexes.
- (116) SCHMITZ, C., 2006- "Red Mud Disposal". Handbook of aluminium recycling. pp. 18. ISBN 9783802729362.
- (117) MARKETWIRE news release, October 19, 2011, Orbite opens an information and consultation office in the Gaspé.
- (118) SECOR, July 2011. Évaluation des retombées économiques de la première phase industrielle du projet Orbite en Gaspésie. 33 pages.
- (119) AUDACE, March 31, 2011. Analyse de la perception du projet de valorisation des gisements d'argile alumineuse d'Exploration Orbite dans la région, MRC de La Haute-Gaspésie et MRC de La Côte-de-Gaspé. 17 pages.
- (120) PRIMEAU, D., November 2011. Orbite Aluminae Plant organization chart. Confidential communication.
- (121) CME GROUP www.cmegroup.com/trading/energy/natural-gas/natural-gas.html.