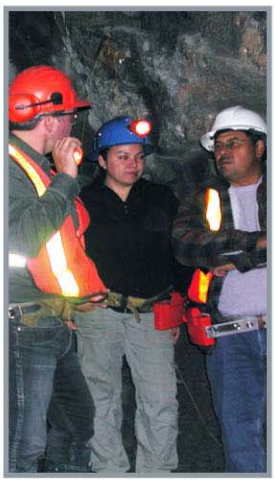
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Renard Diamond Project

VOLUME 2 - APPENDICES

File number: 061470.001-400

December 2011



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Appendix 1.1.1

List of Mining Projects in the Nord-du-Québec Region in 2010

Appendix 1.1.1: List of mining projects in the Nord-du-Québec Region in 2010

MRNF No.	Company	Project	Mineral	Work
107	Stornoway Diamond Corporation / SOQUEM INC.	**Foxtrot**	Diamond	D (91:7830), Env, FM, Re
108	Dios Exploration, inc.	33 Carats	Diamond -Au	G, Gs(t), Pr
109	Eastmain Resources Inc.	Eastmain Mine	Au-Ag-Cu	D (46:14584), G, Gs(r,sl), Pr, S
110	Cameco Corporation	Otish South	U	D (11:3400), GpEm(A), GpMa(A), GpGr(G)
111	Ditem Explorations, Inc	Otish Uranium	U	D (4:479), GpEm(G), GpRa(G)
112	Strateco Resources Inc.	Matoush	U	D (18:10268), Gp(A)
113	Strateco Resources Inc.	Matoush Extension	U	Gp(A), Pg
114	Strateco Resources Inc.	Éclat	U	D (47:27589), Gp(A)
115	Strateco Resources Inc./ Pacific Bay Minerals Ltd.	Pacific Bay	U	D (3:1989), Gp(A), Pr
116	Dios Exploration Inc.	Hotish	U-Diamond	Pg
117	Western Troy Capital Resources Inc.	Macleod Lake	Cu-Mo-Ag-Au	Env, FE, Rcd(20:65)
118	Virginia Energy Resources Inc.	Magneron Lake	U	S, T
119	Virginia Energy Resources Inc.	Redgreen	U	S, T
120	Abitex Resources Inc.	Epsilon	U-Au-Ag-Pb	D (21:1159), G, GpMa(G), GpRa(G), Pr, T, S
121	Abitex Resources Inc. /Areva NC Inc. / SOQUEM Inc.	Lavoie	U-Au-Ag-Pb	Gs, Re, TE
122	Majescor Resources Inc. /Virginia Energy Resources Inc.	Lappare Lake	U	S, T
123	Globestar Mining Corporation /SOQUEM Inc.	Moblan Lithium	Li-Na-K feldspar	D (99:13456), Met, Re
124	Beaufield Resources Inc. / Melkior Resources Inc.	Troilus JV	Cu-Zn-Au-Ag	D (22:7132), GpGr(A)
125	Western Troy Capital Resources Inc.	Troilus	Cu-Mo	Pg
126	Western Troy Capital Resources Inc.	Eider	Cu-Au-Ag-Pd	Pr, S
127	Canadian Royalties Inc.	Foreurs	Cu-Ni	GpEm(G), GpMa(G)
128	Canadian Royalties Inc.	Horden	Cu-Ni	GpEm(G), GpMa(G)
129	Nemaska Exploration Inc.	Whabouchi	Li-Rb-Be	D (82:15670), Er, G, Pr, Re, S, T, TE
130	Nemaska Exploration Inc.	Levac Lake	Cu-Ni-Co-PGE-Au-Ag-Zn	D (2:1200), G, Pr
131	Nemaska Exploration Inc.	Arques Lake (Bouvier, Rupert Complex)	Cu-Ni-Co-PGE-Au-Ag-Zn	D (2:400), G, Gs(sl), GpEm(A), GpMa(A), Pr, S, T
132	Nemaska Exploration Inc.	Lac des Montagnes (Duval)	Cu-Ni-Co-PGE-Au-Ag-Zn	G, GpEl(G), Pr, S, T
133	Virginia Mines Inc.	Auclair	Au	D (13:4033)
134	Goldcorp Inc./ Azimut Exploration Inc.	Wabamisk	Au-Ag-Cu-Zn-Pb-Mo	D (8:1976), G, Pr, S, T
135	Eastmain Resources Inc.	Clearwater	Au-Bi-Te	D (39:9255), G, Gs(sl), Met, Re, S, T
136	Nemaska Exploration Inc.	Sirmac	Li	Pg
137	Sirios Resources Inc. / Dios Exploration Inc.	Pontax-Lithium	Li-Rb-Be-Ta-	S(x:x)
138	Dios Exploration Inc.	PAM	U-Au	Pg
139	Dios Exploration Inc.	U33	Au-Ag-Pb-Zn-Diamond	G, GpEl(G), GpMa(A), Gs(t), Pr
140	Eastmain Resources Inc	Reservoir	Cu-Au-Ag	Pg
141	Jourdan Resources Inc.	Pivert East/Stairs	Li-REE	GpMa(A), GpRa(A), Pg, S
142	First Gold Explorations,Inc.	Pivert/Rose Lithium	Li-Ta-Rb-Cs-Be	D (139:17000), G, Pg, Re, S, T
143	Sirios Resources Inc. / Dios Exploration Inc.	Pontax- Diamond	Diamond	G, Pr
144	Sirios Resources Inc. / Dios Exploration Inc.	Pontax	Au-Ag-Cu-Zn-Pb	D (x:x), Gp, Gs, S
145	Arianne Resources Inc.	Opinaca	Au	Pr, S
146	Arianne Resources Inc. / Lithium One Inc.	Wabamisk / Komo	Au-Cu-Zn-Li	Pr, S
147	Virginia Mines Inc.	Anatacau / Wabamisk	Au	D (30:4215),G,GpEl(G), GpMa(G), Gs(t), Pr, S, T
148	Lithium One Inc. / Galaxy Resources Ltd	James Bay Lithium	Li	Met, Re, S
149	Rock Tech Lithium Inc.	Kapiwak	Li-REE	Pg
150	Y. Lemelin	Val Joe Lin	Au-Cu	Pg
151	Goldcorp Inc. (Opinaca Mines Ltd)	Éléonore	Au	D (50:24000), G, Re, S, T
152	Golden Valley Mines Ltd / Sirios Resources Inc.	Cheechoo B	Au	G, GpMa(G), Gs(sl), Pr, S
153	Eastmain Resources Inc. / Goldcorp Inc. (Opinaca Mines Ltd) / Azimut Exploration Inc.	Eleonore South JV	Au	D (17:3622), G, Gs(r), Pr, T
154	Midland Exploration Inc.	James Bay Eleonore	Au	Gs(r), Pr, S
155	Beaufield Resources Inc.	Opinaca	Cu-Au-Ag-Mo	GpEl(G), Pg, S
156	G. L. Géoservice inc.	Langelier	Au-Cu-Ni-Pd-Pt	Pg, S
157	Vanstar Mining Resources Inc.	Patica	Au-Cu-Zn	D (9:1090)
158	Augyva Mining Resources Inc./ Canadian Century Iron Ore Corporation	Duncan Lake	Fe	Env, Met, Re
159	Pro-Or Mining Resources Inc./ Everett Resources Inc.	Ménarik	Cr-Ni-Cu-Au-Pt-Pd	TE
160	Virginia Mines Inc.	La Grande Sud	Au	D (3:409), G, Gs(t)
161	Sirios Resources Inc. / Dios Exploration Inc.	Upinor	U	Pr, S
162	Virginia Mines Inc.	Poste Lemoyne Extension	Au	D (x:1043), GpEl(G), GpMa(G), Gs(t), Pg, T
163	Virginia Mines Inc. / Goldcorp Inc.	Corvet East	Au	D (7:3361)
164	Virginia Mines Inc.	FCI	Au	D (11:3035), G
165	Sirios Resources Inc.	Tilly	Mo-Cu-Au	G, Gs(r), Min
166	Midland Exploration Inc. / Agnico-Eagle Mines Ltd	James Bay Gold	Au	D (10:1520), Gs(r)
167	Virginia Mines Inc.	Nichicun-Escale	Au	Pr, S, T
168	Sirios Resources Inc. / Virginia Mines Inc.	Escale	Au-Zn	Gp, Gs
169	Somdra Inc.	Duhesme Lake	Au-Cu-Ag	S, T
170	Golden Tag Resources Ltd / Sirios Resources Inc.	Aquilon Main	Au	Met, D (x:1400)
171	Stornoway Diamond Corporation / Virginia Mines Inc./ SOQUEM INC. / Aurizon Mines Ltd	LG-4 Diamond Consorem	Diamond	GpMa(G), Gs(t), Pg
172	Virginia Mines Inc.	Pau Lake	Au	D (28:3612), G, GpEl(G), GpMa(G), S, T

Appendix 1.1.1 List of mining projects in the Nord-du-Québec Region in 2010

Prospecting and Geology Work

Bs	Block sampling for dimension stones
B (mt:g/t)	Bulk sampling including tonnage and grade (metric tons:gram per ton) or (metric tons: % Xx)
Ct	Characterization tests and analysis (peat)
D (#h:m)	Diamond drilling (number of holes:total meters)
G	Geological mapping
Min	Mineralogical studies
Pg	Unspecified prospecting and geological works
Pr	Prospection
Pt	Polishing test
Rcd (#h:m)	Reversed circulation drilling (number of holes: total meters)
Rsi	Remote sensing interpretation
S	Sampling
T	Trenching and stripping

Geochemical Surveys

Gs	Unspecified geochemical surveys
Gs(e)	Esker geochemical survey
Gs(h)	Humus geochemical survey
Gs(l)	Lake sediments geochemical survey
Gs(r)	Lithogeochemical survey (rock)
Gs(s)	Stream sediments geochemical survey
Gs(sl)	Soils geochemical survey
Gs(t)	Till geochemical survey

Geophysical Surveys

Gp	Unspecified geophysical survey
GpEl	Electric survey
GpEm	Electromagnetic survey
GpGr	Gravimetry survey
GpMa	Magnetometric (magnetic) survey
GpMt	Magnetotelluric survey
GpRa	Radiometric survey
GpSi	Seismic
	(A) aerial, (B) borehole, (G) ground

Autres types de travaux

Env	Environmental studies
FM	Feasibility and/or market studies
M	Mining site rehabilitation
Met	Metallurgical test
Re	Reserve and resource evaluation
TE	Technical evaluation

Substances

Ag	Silver
Au	Gold
Be	Beryllium
Bi	Bismuth
Co	Cobalt
Cr	Chrome
Cs	Cæsium
Cu	Copper
Fe	Iron
Ga	Gallium
Li_2O	Lithium oxide
Mg	Magnesium
Mo	Molybdenum
Nb	Niobium
Nb_2O_5	Niobium oxyde
Ni	Nickel
P	Phosphorus
P_2O_5	Phosphorus oxyde
Pb	Lead
Pd	Palladium
PGE	Platinum Group Elements
Pt	Platinum
Rb	Rubidium
REE	Rare earth elements
REE_2O_3	Rare earth elements total oxydes
Ta	Tantalum
Ta_2O_5	Tantalum oxyde
Te	Tellurium
Th	Thorium
Ti	Titanium
U	Uranium
U_3O_8	Uranium oxide
V	Vanadium
V_2O_5	Vanadium oxide
W	Tungsten
Y	Yttrium
Y_2O_3	Yttrium oxide
Zn	Zinc
Zr	Zirconium
ZrO_2	Zirconium oxyde

Measurement Units

G	Billion
c/t	Carat/ton
g/t	Gram per ton
K	Thousand
M	Million
tm	Metric ton
tm/d	Metric ton per day

Architectural Stone Products and Use

BS	Building stone and landscaping
CS	Curbstone
DeS	Decorative stone
DS	Dimension stone
MO	Monument stone
RS	Refractory stone
RT	Roofing tiles

Other Abbreviations

CA	Certificate of Authorization
MDDEP	Ministère du Développement durable, de l'Environnement et des Parcs du Québec
Na	Non available
Italic	Exploration work done on mine properties
Bold	Advanced exploration project

Appendix 1.1.2

List of Non-exclusive License Outfitters on the General Location Map (map 1.1.1)

Annexe 1.1.2 List of Non-exclusive Licence Outfitters on the General Location Map (map 1.1.1)

Reference No.*	Outfitter	Vicinity
10525-1	Dream Catcher Adventures S.E.N.C.	Théodat Lake
10526-2	Mirage Outfitters, Inc	Rosée Lake
10526-3	Mirage Outfitters, Inc	Rossignol Lake
10526-5	Mirage Outfitters, Inc	Pluto Lake
10526-6	Mirage Outfitters, Inc	La Grande River
10526-7	Mirage Outfitters, Inc	Roz Lake
10536-1	Nouchimi Tourism Inc.	Km 509 Transtaïga Highway
10536-2	Nouchimi Tourism Inc.	Km 395 Transtaïga Highway
10536-3	Nouchimi Tourism Inc.	Km 516 Transtaïga Highway
10537-1	Nouchimi Tourism Inc	Km 305 Transtaïga Highway
10537-2	Nouchimi Tourism Inc	Km 440 Transtaïga Highway
10549-1	Oujé-Bougoumou Enterprises Inc.	Assinica Lake
10552-1	Robert D. White (Square-Tail Lodge Pavillon)	Frotet Lake
10552-2	Robert D. White (Square-Tail Lodge Pavillon)	Troilus Lake
10553-1	J.C.-Bou. Outfitters (2003) Inc.	Chibougamau Lake
10554-1	Mistassini Lake Outfitters Association	Rupert (Ls-Jolliet) River
10554-2	Mistassini Lake Outfitters Association	Mistassini (Vieux P.) Lake
10554-3	Mistassini Lake Outfitters Association	Woollett Lake
10554-4	Mistassini Lake Outfitters Association	Pépeshquasati (1) River
10554-5	Mistassini Lake Outfitters Association	Pépeshquasati (2) River
10554-6	Mistassini Lake Outfitters Association	Chéno River
10554-7	Mistassini Lake Outfitters Association	Takwa (Toqueco) River
10554-8	Mistassini Lake Outfitters Association	Pépeshquasati (3) River
10554-9	Mistassini Lake Outfitters Association	Témiscamie River
10554-10	Mistassini Lake Outfitters Association	Birch Island
10554-11	Mistassini Lake Outfitters Association	Cocomenhani River
10565-1	Pomerleau Fishing Camp, Inc.	Chibougamau Lake
10580-3	Americree Ltd	Weakwaten Lake
10605-1	Nouchimi Tourism, Inc.	Katatipawasakakamaw Lake (Bottine)
10609-1	Donat Asselin Outfitters	Km 382 Transtaïga Highway
10610-0	Caniapiscau Outfitters, Inc.	NO LODGING
10612-1	Manicouagan Outfitters, Inc.	Sureau Lake
10613-1	Wabannutao Eeyou development corporation	Kamwakuskach Lake
10616-1	Jimmie Neacappo	Tilly Lake
10619-1	Awashish Outdoor Adventures Inc.	Rupert River
10620-1	Kiskimaastakin Camps, Inc.	LA 1 Highway
10621-1	Aigle PêCheur Outfitters	Mistassini Lake

***The number following the five-digit code is the camp identification number.**

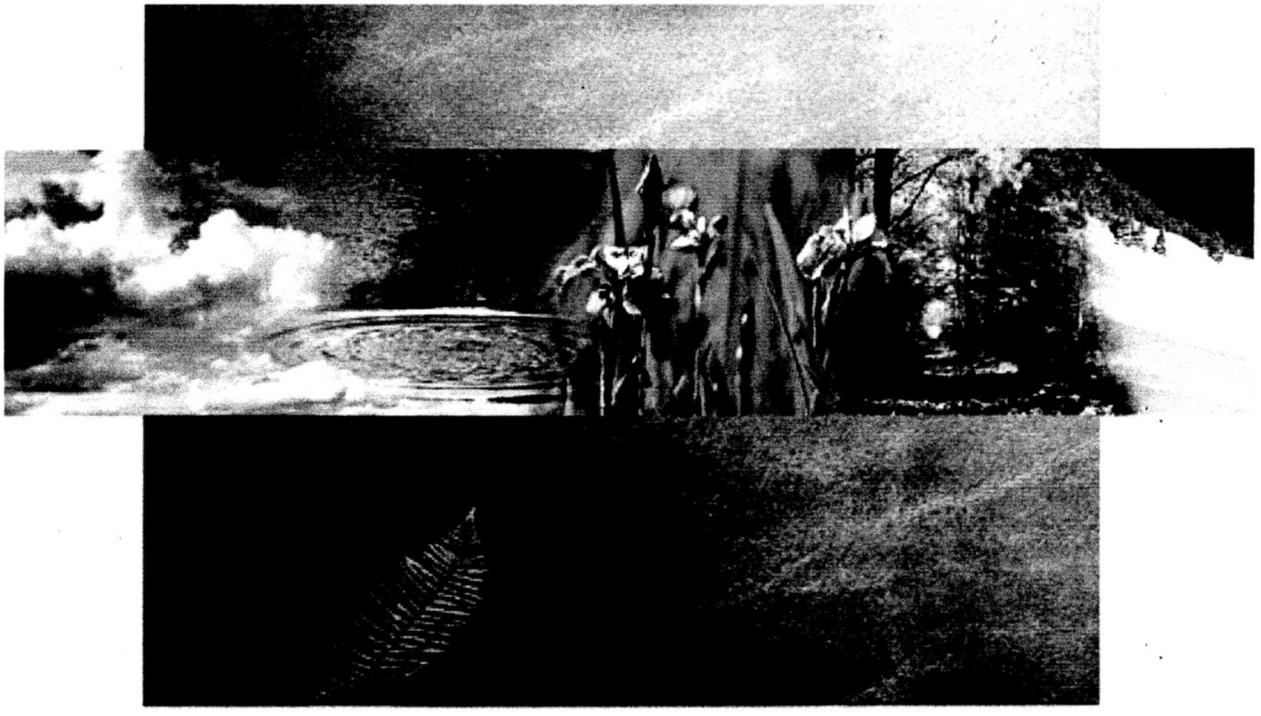
Appendix 2.2.1

COMEV Directive for the Renard Project

ÉVALUATIONS ENVIRONNEMENTALES

Procédure d'évaluation et d'examen des impacts sur l'environnement et le milieu social

Directive pour le projet minier diamantifère Renard
par
Les Diamants Stornoway (Canada) inc.



Québec

DIRECTION DES ÉVALUATIONS ENVIRONNEMENTALES

Directive pour le projet minier diamantifère Renard

par

Les Diamants Stornway (Canada) inc.
3214-14-041

Juin 2010

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INTRODUCTION

Le Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) a reçu le 17 février 2010, les renseignements relatifs à l'implantation du projet minier diamantifère Renard par Les Diamants Stornoway (Canada) inc. Ces informations ont été transmises au Comité d'évaluation (COMEV) afin qu'il formule ses recommandations sur la portée de l'étude d'impact à effectuer par le promoteur. Ce projet minier est obligatoirement assujetti à la procédure d'évaluation et d'examen des impacts sur l'environnement et le milieu social en vertu de l'article 1 de l'Annexe 1 du Chapitre 22 de la *Convention de la Baie-James et du Nord québécois* (CBJNQ) et du paragraphe *a* du chapitre II de la *Loi sur la qualité de l'environnement* (LQE).

Ce projet vise l'exploitation d'un gisement diamantifère sur la propriété Foxtrot située sur des terres de catégorie III, dans les limites du territoire d'application du chapitre 22 de la CBJNQ et du chapitre II de la LQE.

L'extraction de ce gisement localisé dans des cheminées et des dykes kymberlitiques se fera à la fois à ciel ouvert et de façon souterraine. Une exploitation à ciel ouvert est proposée pour les kimberlites de Renard 2, Renard 3 et Renard 4 qui pourraient atteindre jusqu'à 130 mètres de profondeur. L'extraction souterraine qui supposera la mise en place de galeries d'accès et de puits, est prévue pour les cheminées de kimberlite de Renard 2, 3, 4 et 9.

Le projet d'exploitation comprendra principalement outre les fosses, un puits de mine vertical et des galeries d'accès inclinées, des aires d'accumulation de résidus de traitement de kimberlite, de stériles et de mort-terrain, des systèmes de traitement des eaux industrielles et sanitaires, une centrale électrogène, un complexe d'habitation, une route secondaire sur le site et une piste d'atterrissage.

L'étude d'impact devra prioritairement porter sur les impacts liés à la gestion des stériles et des rejets provenant du traitement du minerai diamantifère, mais également sur ceux reliés aux aspects sociaux et économiques de l'exploitation minière. Le promoteur devra donc tenir compte de tous ces éléments dans son étude d'impact qui devra refléter ces problématiques de manière complète et approfondie.

Les différents éléments de la présente directive référeront à la description du projet et à une caractérisation adéquate des milieux biophysiques et sociaux à l'intérieur de l'aire d'étude. L'ensemble de ces informations permettra de déboucher sur l'analyse des répercussions environnementales de chacune des composantes du projet après avoir procédé aux différents choix technologiques. Cette analyse devra permettre une appréciation globale de l'acceptabilité de ses impacts environnementaux et sociaux.

Le projet pourra à la fois être encadré par la Directive 019 sur l'industrie minière, mais également par une approche plus adaptée aux effets environnementaux du projet, tant au niveau du rejet des effluents que du programme de suivi lors de l'exploitation des gîtes miniers. Dans ses choix de variantes, le promoteur devrait faire montre de son souci de réduction de son empreinte sur le milieu. Il faut souligner que cette directive ne doit pas être considérée comme étant exhaustive. Le promoteur devra inclure dans son étude d'impact toute information additionnelle qu'il jugera pertinente.

CONTENU DE L'ÉTUDE D'IMPACT

Les sections suivantes décrivent les éléments devant être présentés dans l'étude d'impact du projet.

MISE EN CONTEXTE

Cette section de l'étude d'impact doit exposer les éléments à l'origine du projet. Elle comprend une courte présentation du promoteur, le contexte d'insertion et la raison d'être du projet, les solutions de rechange. L'exposé du contexte et de la raison d'être du projet doit permettre d'en dégager les enjeux environnementaux, sociaux, économiques et techniques à l'échelle locale et régionale, ainsi que nationale et internationale, s'il y a lieu.

Présentation du promoteur

L'étude doit présenter le promoteur du projet et ses consultants, s'il y a lieu. Cette présentation inclut des renseignements généraux sur ses antécédents en relation avec le projet envisagé et le secteur d'activité dans lequel se situe le projet.

L'étude doit de plus clairement identifier la structure administrative de l'entreprise qui permet d'offrir les garanties financières requises lorsque des mesures de restauration environnementale ou de même nature devront être prises.

Contexte du projet

Le promoteur devra fournir une description du projet comprenant la localisation et les principales caractéristiques techniques telles qu'elles apparaissent au stade initial de la planification. Il insistera sur le contexte général d'insertion du projet, les buts visés, les composantes connexes, le calendrier de construction et d'exploitation du projet, son coût et si un agrandissement éventuel du projet est prévu. Le promoteur devra également détailler les principales contraintes du milieu à l'implantation du projet ainsi qu'un portrait des baux miniers et des claims miniers possédés par le promoteur et d'autres compagnies minières aux abords de la propriété.

Le promoteur tracera ensuite un historique en faisant un rappel des principales étapes qui ont conduit à la définition du projet proposé et traitera, à ce sujet des différentes phases d'exploration qui y sont liées. Il indiquera les structures physiques qui ont alors été mises en place et tous les problèmes environnementaux ou sociaux rencontrés lors de ces opérations. Il fera également état des ententes déjà établies pour l'utilisation de certains services.

Le cadre légal d'insertion du projet devra être décrit en précisant les conventions, les lois et les règlements pertinents, pour tous les niveaux de gouvernements (*c.-à-d.* municipal, régional, provincial et fédéral). De plus, les politiques gouvernementales et les directives concernant le secteur d'activité devront être présentées. En ce sens, le projet doit refléter les grandes orientations en matière de protection de l'environnement relativement à la protection des milieux récepteurs et en favorisant l'élimination des contaminants à la source plutôt qu'au traitement des effluents a posteriori.

Il devra également considérer une approche plus adaptée aux effets environnementaux du projet compte tenu de l'absence de précédent québécois relatif à l'exploitation diamantifère tant à l'étape de l'exploitation qu'à celle de la restauration.

Raison d'être du projet

L'exposé de la raison d'être du projet doit permettre de comprendre la nécessité de réaliser le projet et doit permettre d'en dégager les enjeux environnementaux, sociaux, économiques et techniques.

Le promoteur devra situer le projet à l'intérieur des activités de son entreprise et discutera de l'incitatif qui lui a permis d'aller de l'avant avec ce projet. Dans un contexte de marché nord-américain et international, il trace un portrait de l'utilisation actuelle et future du minéral récupéré en présentant toutes les données économiques à l'appui.

À une échelle plus régionale, il expliquera dans quel contexte environnemental et socio-économique s'inscrit le développement minier de cette région et il abordera la question des retombées économiques locales et régionales de son projet en établissant un parallèle avec la durée de vie du projet.

D'autre part, le projet tel que présenté par le promoteur est directement lié à la construction par le Ministère des Transports d'un tronçon routier prolongeant la route 167. À ce sujet, le promoteur devra fournir l'information permettant de juger de la réalisation possible de ce dernier dans un avenir réaliste ou dans le cas contraire préciser ses intentions à l'égard de son projet.

Compte tenu de l'augmentation récente de l'exploration minière dans cette portion de territoire et d'après les connaissances géologiques actuelles, le promoteur discutera de l'éventualité que son projet entraîne le développement d'autres projets miniers diamantifères ou d'autre nature dans ce secteur du territoire.

Il fera également un lien avec les spécifications relatives au développement minier intégrées dans l'entente concernant une nouvelle relation entre le gouvernement du Québec et les Cris du Québec du 7 février 2002 et la *Stratégie minérale du Québec – Préparer l'avenir du secteur minéral du Québec*, publiée en 2009.

Solutions de rechange

Le promoteur doit présenter les solutions de rechange envisagées en ce qui concerne les modes de prélèvement du minerai, les systèmes de gestion des résidus miniers dont les stériles et leurs lieux d'entreposage et les infrastructures connexes nécessaires notamment en ce qui concerne les infrastructures de transport. Le promoteur doit justifier les choix retenus en tenant compte des objectifs poursuivis et des enjeux environnementaux, sociaux, économiques et techniques. Il doit présenter le raisonnement et les critères utilisés pour en arriver à ces choix.

CHOIX DES VARIANTES D'EMPLACEMENTS ET DE TECHNOLOGIES

Variantes d'emplacements et de tracés

Le promoteur décrira les différents emplacements considérés pour la mise en place des infrastructures nécessaires à l'exploitation de la mine, notamment pour l'implantation de l'usine de traitement du minerai, l'aménagement des aires d'accumulation de stériles et de résidus de traitement et de systèmes de traitement des eaux. Cet exercice est également requis pour les tracés routiers partant de la route du MTQ mentionnée dans les renseignements préliminaires. Cette description doit être suffisamment détaillée pour permettre de comparer les différents emplacements envisagés et d'évaluer leurs avantages respectifs, tant sur les plans biophysique, social que technique et économique.

Dans ses choix, appuyés par un dossier photographique illustrant chacun des sites potentiels et ses environs, le promoteur devra, notamment, tenir compte des considérations physiques et biologiques du milieu, des contraintes techniques et financières possibles et de l'ampleur de certains impacts associés aux choix retenus.

Il présentera par la suite le raisonnement et les critères pour arriver aux choix des emplacements retenus, en indiquant précisément comment les critères ont été considérés. Dans l'éventualité où le choix d'un seul site est physiquement possible, le promoteur justifiera son raisonnement. Le promoteur présentera les informations géographiques pertinentes pour permettre de bien localiser les éléments du projet, ainsi que les variantes et les infrastructures temporaires le cas échéant, notamment en précisant les noms des plans d'eau et leur position géographique.

Variantes technologiques

Le promoteur présentera succinctement les avantages et les inconvénients des principales technologies envisagées notamment pour l'extraction et le traitement du minerai et pour la protection de l'environnement et il comparera ses choix technologiques avec ceux retenus par les autres exploitations au Canada.

Le promoteur indiquera comment la minéralogie du gisement influence le choix des technologies. Il présentera, par la suite, la ou les technologie(s) privilégiée(s) et les critères justifiant ce choix, sur les plans technique, économique et environnemental. Lors de son choix, il considérera également les objectifs de rejets liquides, les normes d'émissions à l'atmosphère et les règles de gestion des matières résiduelles afin d'assurer la protection des milieux aquatique, terrestre et atmosphérique.

En ce qui concerne l'approvisionnement énergétique du site minier, le promoteur décrira les avantages et les inconvénients ainsi que la faisabilité technique et économique à être relié au réseau de transport d'énergie québécois. Il comparera cette analyse avec la variante d'approvisionnement en énergie qui consisterait à produire localement l'énergie à l'aide de génératrices.

DESCRIPTION DU PROJET

Dans cette section, le promoteur devra procéder à la description des différentes infrastructures minières liées à son projet. Il fera également les liens requis avec son approvisionnement énergétique et son utilisation des infrastructures de transport (routières ou aéroportuaires). Il fournira un niveau de détails suffisant pour permettre de bien en comprendre les enjeux notamment en précisant si certaines infrastructures devront être aménagées à proximité d'emplacements devant affecter le milieu hydrique. Dans le cas où la construction d'infrastructures de confinement telles des digues était nécessaire au projet, le promoteur devra préciser l'état des discussions qu'il a eues auprès de la Direction de la sécurité des barrages du Centre d'expertise hydrique (CEHQ) concernant la sécurité des installations prévues et les autorisations requises.

Le promoteur précisera l'échéancier de réalisation de son projet, identifiera les dates ou périodes prévues pour la réalisation des travaux et précisera la durée anticipée des travaux.

Compte tenu du fait que l'exploitation du diamant ne compte pas de précédents au Québec, le promoteur présentera les informations pertinentes concernant les particularités de ce type d'exploitation lors de son extraction et de son traitement ainsi que ses effets sur l'environnement.

Description du gisement et des installations

Selon les renseignements fournis par le promoteur, l'exploitation de la mine se fera à ciel ouvert et de façon souterraine et le traitement du minerai se fera sur place. Le promoteur présentera ainsi, de façon synthétique et cartographique, quand les informations s'y prêtent, les renseignements suivants :

- la description sommaire (géologique et structurale) du gisement et des lithologies desquelles seront extraits le minerai et les stériles en décrivant leurs caractéristiques minéralogiques et les associations métalliques retrouvées;
- les plans et profils du gisement, en situant ces profils par rapport aux plans d'eau jouxtant le projet;
- les différentes phases d'exploitation du gisement, leur superficie et leur emplacement;
- la localisation, la superficie, la tenure des terres et les titres, dont les baux miniers, des portions de territoire devant servir à l'implantation des infrastructures nécessaires à l'exploitation minière et la présentation, si possible, d'une photographie aérienne récente du secteur;
- le ou les types de minéraux exploités;
- la durée prévue de l'exploitation et la possibilité d'autres phases de développement;
- les points de transfert et lieux d'entreposage du minerai, des stériles, du produit fini, des résidus de traitement et des différents matériaux et produits à l'intérieur du site minier;
- le mode et le lieu d'acheminement du produit fini;
- les installations d'approvisionnement en eau;
- le nombre et les dimensions des galeries d'accès, et la taille du puits vertical;
- l'emplacement des unités de traitement des eaux résiduaires (eaux de mine, eaux du procédé de traitement, eaux sanitaires);
- les équipements générateurs d'énergie, en précisant leur puissance et leur localisation;

- les garages, ateliers d'usinage et d'entretien des équipements et entrepôts des matières dangereuses (réactifs, hydrocarbures, explosifs, etc.);
- l'estimation de la superficie et l'emplacement des bancs d'emprunt requis.

Le promoteur décrira les activités et travaux préparatoires requis à l'implantation des installations qu'il s'agisse notamment de déboisement (en précisant les superficies et les caractéristiques des peuplements forestiers déboisés), de dynamitage, de détournement de cours d'eau, de dénoyage et de rejet d'eau, de terrassement, de remblayage, de déplacement de bâtiments. Il indiquera les lieux, les limites approximatives, les volumes approximatifs de même que les modes de collecte, de transport et d'élimination des matériaux déplacés. Il fournira la description de la nature, des volumes approximatifs, du mode et du lieu d'entreposage du sol végétal et du mort-terrain.

Le promoteur identifiera les sources de nuisances et les équipements et installations de traitement qui y sont associés.

Extraction

Dans le cas spécifique de l'extraction, le promoteur décrira la ou les technologie(s) utilisée(s) et indiquera le taux moyen d'extraction en tonnes/jour. Il justifiera également la possibilité d'une exploitation éventuelle en bordure de plan d'eau ou en plan d'eau. Il décrira notamment, en précisant les travaux requis :

- les rampes d'accès, puits et autres excavations (ouvertures de surface, etc.) et leur localisation en plan et en coupe;
- les aménagements de digues;
- les équipements d'extraction;
- l'utilisation d'explosifs et, le cas échéant, les informations relatives à leur entreposage et fabrication;
- les lieux d'entreposage du minerai;
- un estimé des quantités et du débit des eaux de mine générées et les composantes du système de maintien à sec de la mine, le cas échéant;
- l'évaluation de la qualité des eaux de mine susceptibles d'être générées et, à partir des renseignements disponibles sur la minéralogie du gisement, de leur qualité physico-chimique probable.

Traitement du minerai

Le promoteur fournira les informations suivantes sur la technologie retenue :

- les taux moyen et maximal de traitement;
- la liste et la composition des produits requis et le tableau de leur consommation annuelle;
- la description des différentes étapes du procédé de traitement (points d'entrée et de sortie, recirculation, points d'ajout des produits et leur représentation sur un schéma;
- les quantités et caractéristiques physiques et chimiques détaillées des rejets liquides, solides et gazeux des activités et la localisation de leurs points de rejet;

- les sources de bruit et autres sources de nuisance, ainsi que les équipements et installations qui y sont associés (captage, épuration, traitement, dispersion, diffusion, élimination, contrôle, réception, entreposage, manipulation, etc.).

Gestion des résidus miniers

Une fois que le ou les emplacement(s) pour les aires d'accumulation des stériles et des résidus de traitement du minerai auront été identifiés, des études plus détaillées doivent être élaborées et doivent comprendre :

- une cartographie détaillée du terrain décrivant la topographie et localisant les affleurements rocheux, les dépôts de sable, gravier, silt et argile, les cours d'eau et les plans d'eau, le ou les bassin(s) de drainage, les milieux humides et la végétation;
- le résultat des investigations géotechniques et hydrogéologiques permettant d'établir l'épaisseur et les propriétés du sol à l'emplacement des aires d'accumulation (conductivité hydraulique, densité et résistance au cisaillement, etc.);
- le mode de gestion des aires d'accumulation des résidus;
- les critères de conception des infrastructures de retenue des aires d'accumulation des résidus : analyse de la stabilité des digues, des conditions de fondation, contrôle de la percolation et imperméabilité;
- la possibilité et les modalités du retour des résidus dans les fosses ou en souterrain en cours d'exploitation ou lors de la fermeture.

En ce qui concerne les stériles, le promoteur s'appliquera particulièrement à documenter ce qui suit :

- les quantités totales de stériles à éliminer (ordre de grandeur en milliers de m^3);
- les durées d'entreposage minimale et maximale des stériles;
- la description minéralogique des différents types de stériles et la détermination de tous les éléments majeurs et en trace à partir d'échantillons représentatifs; la détermination du potentiel de génération d'acide et de la lixiviabilité de certains métaux pour chacune des lithologies dont sont issus les stériles à partir d'échantillons représentatifs et d'autres aspects; la détermination des particularités physico-chimiques liées à la kimberlite;
- l'évaluation de la superficie des haldes requises et la présentation des conditions hydrogéologiques et de drainage et la description détaillée des modalités de gestion et de contrôle plus particulièrement dans le cas de stériles générateurs d'acide ou lixiviables;
- le mode de déposition;
- le cas échéant, les modalités d'utilisation des stériles comme matériau de remblai.

Dans le cas des résidus de traitement, le promoteur fournira les renseignements suivants :

- la quantité approximative de résidus devant être générés;
- leur composition chimique et physique;
- la détermination du potentiel de génération d'acide ou de lixiviabilité possible de certains métaux ou la détermination des caractéristiques particulières liées à la kimberlite à partir d'échantillons représentatifs;

- le détail de la conception des infrastructures de retenue : stabilité, imperméabilité et hauteur maximale des digues, la capacité d'emmagasinement, le mode de gestion (par cellule ou conventionnel) et le schéma de remplissage;
- la proximité de l'usine de traitement et l'accessibilité au pourtour de l'aire d'accumulation.

Le promoteur expliquera également la façon dont seront ségrégés les résidus de kimberlite traitée dans les aires d'accumulation.

Gestion des eaux

Dans un contexte de développement durable, la réduction de l'utilisation de l'eau fraîche et la protection et la conservation des eaux souterraines sont privilégiées. Dans cette section, le promoteur devra démontrer qu'il a favorisé la recirculation des eaux en ayant comme objectif un rejet minimal dans l'environnement. Il devra également décrire les mesures qui seront prises pour protéger les eaux propres entrant sur le site d'un contact avec des secteurs contaminés de l'exploitation minière.

Bilan hydrique

Le promoteur présentera un bilan complet de l'utilisation de l'eau pour les besoins des opérations minières et des services sur l'ensemble du site minier. Ce bilan devra être établi et détaillé sur une année complète pour prendre en compte les variations saisonnières.

De façon plus précise, le promoteur fournira les renseignements suivants :

- les sources d'approvisionnement en eau en précisant les volumes requis et la description des travaux dans le cas où un endiguement de cours d'eau s'avère nécessaire;
- les besoins en eau pour les usages domestiques;
- la description du circuit et des débits des eaux requises pour les opérations d'extraction et de traitement du minerai en décrivant les circuits de recirculation et en présentant le tableau de la consommation journalière et annuelle des eaux reliées à ces activités et leur usage;
- les eaux de ruissellement et les eaux de mine qui pourraient être pompées devant être incluses dans le système de gestion de l'eau du site minier.

Traitement et évacuation des eaux contaminées

Traitement des eaux

Le promoteur présentera les caractéristiques physico-chimiques des eaux usées industrielles à être traitées incluant les eaux de mine et une description détaillée des techniques utilisées pour leur traitement comprenant notamment :

- les points d'entrée et de sortie des eaux;
- la liste et la fiche technique des produits (chimiques) utilisés, leurs points d'addition et les quantités utilisées;

- l'efficacité anticipée en termes de pourcentage de réduction des contaminants ou de niveau de toxicité du traitement;
- les volumes approximatifs et le mode de gestion des boues et des sous-produits résultant du traitement.

Effluent(s)

Le promoteur décrira :

- les volumes et les débits moyens quotidiens prévus du ou des effluents;
- la description des modalités de déversement (conduites, canalisations, pompage, diffuseur);
- la localisation du ou des points de déversement et le tracé menant vers le milieu récepteur;
- l'aménagement du milieu récepteur au point de déversement de l'effluent final (enrochement, endiguement, etc.);
- les caractéristiques attendues des effluents en insistant sur la qualité de l'effluent, leur concentration et le pH.

Les informations seront reportées sur un plan à une échelle appropriée.

Le promoteur s'assurera également qu'un calcul des objectifs environnementaux de rejet (OER) soit effectué.

Aménagements et projets connexes

Infrastructures routières et aéroportuaires

Le promoteur décrira le réseau routier existant et le patron actuel d'utilisation Le promoteur décrira les autres usagers des accès routiers et justifiera ses besoins en indiquant si ceux-ci sont évalués en fonction d'un usage temporaire ou permanent et comment les besoins du projet s'intègrent parmi les besoins régionaux pour ce type d'infrastructures, incluant l'utilisation des infrastructures par les Cris. Il précisera si, et dans quelle mesure, il sera responsable de leur entretien. Le promoteur doit faire mention de l'état de ces infrastructures et des problématiques qui y sont associées.

Le promoteur discutera des accès routiers à construire dans la zone du projet et précisera l'utilisation qu'il compte en faire. Il devra décrire toutes les activités ou travaux nécessaires pour la construction et l'exploitation d'une route d'accès au site et des autres chemins, incluant les chemins temporaires. Plus spécifiquement, il indiquera comment se fera l'intégration de son projet en fonction de son utilisation de la route multiservices reliant les communautés de Chibougamau et de Mistissini à la région des Monts Otish que le MTQ prévoit construire et quelle sera la portion prévisible de l'achalandage relié à ses propres activités. Il présentera un échéancier réaliste par rapport à son projet et fera état de ses échanges avec le MTQ à ce sujet.

Le promoteur présentera des alternatives en cas de non-réalisation à court ou moyen terme de ce projet routier et des conséquences sur la définition actuelle de son projet. Cette description devra inclure, sans s'y limiter, l'installation d'ouvrages de traversées de cours d'eau, les travaux ou activités prévus sous la ligne naturelle des hautes eaux.

Le promoteur décrira également les infrastructures aéroportuaires à construire ou existants tant dans la zone du projet que ceux présents dans l'aire d'étude et précisera l'utilisation qu'il compte en faire. Le promoteur décrira et justifiera ses besoins en indiquant si ceux-ci sont évalués en fonction d'un usage temporaire ou permanent. Dans la mesure où ces infrastructures seront partagées avec d'autres utilisateurs, il précisera comment la responsabilité de l'entretien sera partagée entre les différents utilisateurs.

Infrastructures d'hébergement

Le promoteur devra identifier ce que comprend ce volet de son projet, et ce, aux étapes de construction et d'exploitation. Il devra indiquer ce qui a déjà été mis en place à la phase exploration et privilégiera, dans la mesure du possible, la réutilisation de sites existants.

Le promoteur précisera la localisation exacte de ces installations et présentera les plans d'aménagement de celles-ci, leur capacité d'accueil, leur durée et leurs périodes d'utilisation.

Pour les composantes de ces installations d'hébergement, le promoteur fournira une description des travaux requis et des précisions sur :

- les installations de traitement et d'approvisionnement en eau potable;
- le mode de gestion des eaux usées domestiques et les zones de rejet en précisant, s'il y a lieu, les taux de dilution après traitement;
- les types et les volumes de matières résiduelles produits;
- les modes et lieux d'élimination des déchets, la localisation et les conditions des sites existants ou futurs permettant leur gestion en indiquant à ce propos les volumes anticipés, la durée prévue du site proposé et les aménagements qu'on y prévoit;
- le mode de gestion des boues septiques provenant des systèmes de traitement des eaux usées;
- les dispositions favorisant le système de recyclage des déchets et de réduction à la source;
- dans le cas de l'utilisation d'un système d'incinération, on justifiera le choix des équipements et on indiquera les programmes de suivi où les équipements de contrôle qui y seront installés;
- la nature et le mode de gestion des matières dangereuses;
- le mode d'approvisionnement énergétique d'urgence ou intérimaire dans le cas où l'approvisionnement électrique ne serait pas disponible;
- la gestion de toute autre infrastructure nécessaire au fonctionnement des campements et pouvant avoir un impact sur l'environnement.

Sites d'entreposage de carburant ou de matières dangereuses

Le promoteur indiquera la localisation et la nature des ouvrages, équipements et installations pour l'entreposage et le confinement des produits chimiques, les hydrocarbures et les explosifs et le mode de récupération ou d'élimination de certains produits, équipements ou matériaux pouvant constituer un risque pour l'environnement.

Il précisera les quantités et les concentrations de ces produits qui y transiteront et leur mode d'entreposage ainsi que la capacité d'entreposage des réservoirs utilisés, démontrera que ceux-ci

respectent la législation et la réglementation en vigueur et indiquera les mesures préventives et d'urgence élaborées.

Bancs d'emprunt

Dans cette section, le promoteur devra définir précisément ce qu'il entend faire relativement à l'exploitation des bancs d'emprunt requis par le projet, et ce, tant pour les différentes étapes de la construction et de l'exploitation minière elle-même que pour les accès routiers ou pour tout autre aspect du projet.

Il devra localiser et cartographier l'ensemble des exploitations existantes et prévues pour les besoins du projet en précisant leur proximité par rapport à l'emplacement des routes, des cours d'eau et des aires protégées projetées de façon à tenir compte de la réglementation et des particularités et des possibilités du milieu. Il évaluera les superficies et les volumes requis et, au besoin, il présentera les rapports de sondage décrivant la stratigraphie et fournira les courbes granulométriques. Le promoteur indiquera comment s'est faite l'optimisation de l'évaluation des matériaux d'emprunt requis. Finalement, un aperçu des mesures de réaménagement et de désaffectation de ces sites devra également être fourni.

DESCRIPTION DU MILIEU

Dans cette section, en prenant en compte le savoir traditionnel et les valeurs culturelles cries, le promoteur décrira le contexte environnemental, culturel et socio-économique dans lequel s'inscrit le développement minier de cette région et de ce secteur. Il délimitera sa zone d'étude afin d'y décrire les composantes des milieux biophysique et humain pertinentes au projet.

Délimitation de la zone d'étude

Le promoteur doit circonscrire une zone d'étude dont l'étendue devra pouvoir englober l'ensemble des activités projetées et leurs effets directs et indirects sur les milieux biophysique et humain sur lesquels le projet et ses infrastructures connexes sont susceptibles d'avoir des effets. Le promoteur devra justifier les limites de cette aire d'étude et son étendue et devra faire part des contraintes biophysiques, techniques, économiques et sociales qui ont permis d'en établir l'étendue.

En plus de l'exploitation minière elle-même, l'aire d'étude englobera les accès au projet minier et l'approvisionnement en énergie et définira les patrons actuels de l'utilisation du territoire et de son développement futur en tenant compte des communautés autochtones et allochtones. Selon les impacts étudiés, qu'ils soient d'ordre biophysique ou social, l'aire d'étude peut être composée de différentes aires délimitées. Ainsi, elle devra tenir compte du fait qu'une bonne partie des impacts directs du projet sur le milieu biophysique pourront impliquer plus directement les lots de piégeage de la communauté de Mistissini alors que les possibilités d'emploi et d'autres retombées économiques pourront se répercuter sur d'autres communautés du territoire.

Description des composantes pertinentes

Le promoteur devra décrire l'état de l'environnement tel qu'il se présente dans la zone d'étude avant la réalisation du projet. À l'aide d'inventaires tant qualitatifs que quantitatifs, il doit décrire de la façon la plus factuelle possible les composantes des milieux biophysique et humain

susceptibles d'être touchées par la réalisation du projet. Si les données disponibles chez les organismes gouvernementaux, municipaux, autochtones ou autres sont insuffisantes ou ne sont plus représentatives, le promoteur complétera la description du milieu par des inventaires conformes aux règles de l'art. Ci-après est proposée une liste des principales composantes devant être décrites dans l'étude d'impact.

Le promoteur doit indiquer la provenance de toutes les données ayant servi à la description du milieu ainsi que les fins pour lesquelles elles sont utilisées. De plus, il doit commenter la qualité et la fiabilité des données disponibles.

Milieu biophysique

Le promoteur décrira, pour la zone d'étude, les composantes suivantes à l'aide de cartes précises où les infrastructures existantes et proposées seront indiquées. Lorsque cela s'y prête, les informations seront cartographiées et des photographies seront fournies :

- la géologie et la topographie générale de l'aire d'étude ainsi que les zones instables ou sensibles à l'érosion;
- les cours d'eau et les plans d'eau susceptibles d'être affectés par le projet, leurs caractéristiques physiques (la bathymétrie, le substrat, la largeur, la profondeur, les obstacles au libre passage du poisson et les niveaux d'eau) leur qualité physico-chimique, leur régime hydrique, leurs usages notamment en aval des points de rejet et les caractéristiques des sédiments (matière organique, granulométrie et teneur en métaux) du ou des cours d'eau récepteurs;
- les rives, les zones inondables et les milieux humides, notamment les tourbières réticulées;
- le contexte hydrogéologique, incluant notamment les aires de recharge, les limites des unités stratigraphiques, l'utilisation de l'eau souterraine ou son potentiel d'utilisation et les liens avec les eaux de surface ou les milieux humides;
- le contexte climatique : valeurs de température annuelle, périodes de gel, hauteur des précipitations moyennes et maximales, estimation de l'évaporation annuelle (mm), carte des vents dominants et conditions particulières observées;
- le couvert végétal, incluant la végétation aquatique et riveraine, en indiquant la présence de peuplements fragiles ou exceptionnels dans la zone d'étude, ainsi que les peuplements forestiers et leurs caractéristiques (type, âge, superficie);
- les espèces fauniques (mammifères, oiseaux, reptiles, amphibiens) et leurs habitats et les espèces d'intérêt pour les communautés autochtones et non-autochtones plus particulièrement dans les plans d'eau potentiellement affectés par l'exploitation minière et plus spécifiquement par l'extraction du minerai;
- les espèces de poissons présentes ainsi que l'emplacement et les superficies des habitats, potentiels ou confirmés, pour la reproduction, l'alevinage, la croissance, l'alimentation et la migration;
- les espèces rares, menacées ou vulnérables selon le statut de protection accordé à ces espèces par les gouvernements, ou susceptibles d'être ainsi désignées, en décrivant les espèces fauniques et floristiques (terrestres ou aquatiques) et les habitats de ces espèces.

Potentiel archéologique et culturel

Le potentiel archéologique et culturel du secteur, principalement aux sites retenus pour les composantes du projet, sera décrit en identifiant les sites archéologiques connus, les zones à potentiel archéologique et les autres éléments d'intérêt patrimonial protégés ou non par la législation (site culturel). Le promoteur présentera quelle approche sera mise de l'avant pour recueillir et rassembler le savoir traditionnel des Cris (tallymen et communautés) sur la faune terrestre et aquatique, ainsi que l'utilisation des plantes médicinales, s'il y a lieu.

Milieu social

Le promoteur devra élaborer sur le milieu social touché par le projet en expliquant les limites inhérentes aux données qu'il possède et qu'il aura recueillies. La description du milieu social devra permettre une évaluation globale des transformations probables des modes de vie des diverses communautés affectées par le projet. Il présentera notamment :

- les profils socio-économique de la ou des populations concernées (caractéristiques démographiques, mode de vie, etc.);
- l'économie locale et régionale;
- les préoccupations, opinions et réactions des communautés locales et plus particulièrement des collectivités directement concernées en incluant une présentation des consultations effectuées par l'initiateur;
- l'utilisation actuelle et prévue du territoire notamment pour les infrastructures suivantes :

    - les sources d'alimentation en eau;
    - les zones de pêche et de chasse, incluant les espèces visées et leur importance;
    - les aires protégées ou projets d'aires protégées;
    - les routes et autres infrastructures de transport;
    - les pourvoiries et autres activités récréatives, touristiques, baux de villégiature ou autres;
    - La localisation et la description des divers bâtiments et infrastructures (habitation, services, lignes de transport, etc.) situés à proximité.

Une attention particulière sera accordée à l'occupation du territoire par les Cris en tenant compte de l'identification des territoires de chasse et des voies de déplacement traditionnelles (terrestres ou navigables) et les périodes d'utilisation par les familles et à l'impact qu'aura le projet sur l'accès et l'occupation des territoires de chasse, de pêche, de piégeage et de cueillette.

Le promoteur décrira également le bassin de main-d'œuvre et d'entreprises qualifiées pour occuper des postes ou remplir des contrats en rapport avec les activités minières prévues et celles liées à la construction du projet. Le promoteur devra rendre disponibles la politique corporative sur la formation au travail, l'embauche et l'intégration d'autochtones dans le bassin de main-d'œuvre. Il devra tenir compte d'expériences analogues dont celles reliées au projet Troïlus. Il devra également présenter les cibles d'embauche pour les Cris.

ANALYSE DES IMPACTS

L'analyse portera sur les impacts à court, à moyen et à long terme de manière à couvrir les périodes de préparation, de construction, d'installation des infrastructures et d'exploitation du gisement et de la route. L'identification des répercussions devrait se faire en concordance avec la section « Description du milieu ». En prédisant et en évaluant les conséquences du projet, le promoteur doit indiquer les détails importants et énoncer clairement quels éléments et quelles fonctions du milieu peuvent être affectées, à quel endroit, dans quelle mesure, durant combien de temps et avec quel effet global. Il présentera les méthodes utilisées ainsi que leurs limites et les biais possibles.

L'évaluation du projet devra tenir compte des ressources renouvelables qui pourraient être touchées de façon importante. Il convient donc que l'ensemble de la démarche d'analyse des impacts soit élaborée et conduite en prenant en compte la capacité de support du milieu qui permettra d'assurer la pérennité des espèces floristiques et fauniques. Par ailleurs, le promoteur identifiera les changements de l'environnement pouvant entraîner des effets sur le projet et documentera ces effets et les risques qu'ils entraînent.

Le promoteur décrira également les effets de l'ouverture de nouveaux territoires liés à ce projet sur l'implantation d'autres projets d'exploitation des ressources présentes ainsi que sur les populations humaines qui les fréquentent.

Cette évaluation portera notamment sur les enjeux identifiés par le promoteur et concernera vraisemblablement des secteurs principaux des activités minières : zones d'extraction, aires d'accumulation des résidus miniers, importance du transport (routier et aérien).

En fonction des ressources du milieu, de l'occupation du territoire, de son utilisation, de la vocation des sites et de la capacité de support des différents milieux, le promoteur doit évaluer les pertes environnementales et les modifications des conditions naturelles d'équilibre. Il doit mettre de l'avant, au niveau de la protection des habitats sensibles, le principe « éviter et minimiser » et ce, tout particulièrement pour le milieu aquatique, les zones inondables et les milieux humides. De plus, il doit déterminer les seuils d'irréversibilité pour tout impact. Le promoteur accordera une attention particulière aux impacts qu'aura son projet sur l'utilisation actuelle et future du territoire.

L'évaluation du promoteur portera entre autres sur :

- la qualité du ou des cours d'eau récepteurs du ou des effluent(s) et le maintien à court et à long terme des habitats et des usages;
- le maintien des habitats et des populations de poissons en tenant compte de la toxicité possible des effluents et du cycle de vie des espèces concernées;
- les risques d'accumulation des métaux dans la chair des poissons;
- les conséquences de la perte ou de la modification de cours d'eau et de plans d'eau en phase de construction et d'exploitation;
- la survie et les déplacements de la faune terrestre, aquatique et avienne, en particulier le caribou forestier, ainsi que la destruction ou la modification de leurs habitats ou la destruction et la modification possible d'habitats pour les espèces à statut précaire;

- les effets sur les espèces floristiques, en particulier sur celles ayant un statut précaire ou d'intérêt spécial pour les Cris (ex. plantes médicinales);
- une analyse des répercussions du rejet des eaux de mine sur les milieux terrestres et aquatiques, et ce, tant durant les périodes de construction que d'exploitation;
- les répercussions sur le milieu aquatique ou terrestre liés à l'usage des fondants et d'abrasifs sur la route et sur les ponts ou à un déversement accidentel d'un produit pétrolier ou de tout autre produit chimique utilisé;
- le drainage, l'érosion par ruissellement ou par le vent, notamment en ce qui concerne les résidus miniers;
- les répercussions sur les ressources fauniques tant en terme de dynamique de population, de comportement et le cas échéant de toxicité sur celle-ci ou sur celle induite à partir de la contamination du milieu;
- les effets sur les milieux visuels par l'intrusion de nouveaux éléments dans le champ visuel et le changement de la qualité esthétique du paysage;
- la pollution de l'air en ciblant les problématiques ayant un impact significatif sur le milieu et ses utilisateurs.

En ce qui concerne le milieu social, le promoteur devra considérer tous les impacts sociaux du projet pour en faire ressortir les enjeux majeurs. Il s'agira d'évaluer globalement les transformations probables des modes de vie des diverses communautés habitant ou utilisant le territoire visé par le projet et leur capacité à gérer des changements découlant du projet. Le promoteur devra, à ce sujet et dans la mesure du possible, référer à d'autres projets analogues sur le territoire nord québécois. Il référera tout particulièrement à l'expérience qu'il a acquise à la phase exploration de ce projet et en dressera le bilan.

On abordera notamment les impacts liés à :

- l'utilisation par le promoteur des accès routiers, le maintien des usages d'utilisation par les communautés locales et les conflits possibles entre les usagers;
- les possibilités d'embauche ou d'obtention de contrats pour des individus ou des entreprises cries;
- un déversement accidentel de produit pétrolier ou de tout autre produit chimique sur le milieu;
- les risques de nuisance (bruit, poussières) et leurs effets sur les utilisateurs du territoire à proximité;
- les modifications ou les adaptations que le(s) maître(s) de trappe devra(ont) apporter à l'exploitation du ou des lot(s) de piégeage affecté(s) par le projet;
- l'utilisation des ressources fauniques par les chasseurs et pêcheurs sportifs en regard des modifications de l'accessibilité;
- les impacts d'un tel projet d'une durée limitée qui, à la fin de l'exploitation, entraînera des changements du tissu social;
- les effets des absences prolongées des travailleurs cris sur leur vie familiale en se référant à la littérature existante générée par les projets de développement situés dans le territoire de la Baie James;
- l'aspect visuel après la réalisation des travaux;
- l'économie locale et régionale (la nature et le nombre d'emplois temporaires et permanents créés par le projet pour les autochtones et les allochtones locaux et, le cas échéant, pertes

économiques pour des entreprises affectées par la construction ou l'exploitation de la mine);

- les impacts et retombées économiques prévues à court et à long terme pour les entreprises locales (la nature et le nombre d'emplois temporaires et permanents créés par le projet pour les autochtones et ceux provenant de l'extérieur de la région ou les emplois perdus le cas échéant) incluant les perspectives de développement dans les secteurs connexes pour les communautés locales ou régionales ainsi que les impacts potentiels sur des perspectives de développement qui seraient négativement affectées par le projet (par exemple, potentiel récréo-touristique);
- la modification des habitudes de vie dues aux craintes d'une contamination possible du milieu dans le cadre de l'exploitation du projet;
- la compétition possible pour certains services (santé, communication, approvisionnement, etc.) offerts en région;
- le phénomène des cycles d'expansion et de ralentissement (*boom and bust economy*) en expliquant la portée de ce phénomène et des changements qu'il est susceptible de représenter pour les Cris et la région.

Impacts cumulatifs

Tenant compte de la proximité et de l'expérience vécue au site minier Troïlus, le promoteur traitera des rapprochements à faire concernant les impacts connus de ces projets. Plus particulièrement en ce qui concerne les impacts cumulatifs applicables aux éléments des milieux environnemental et social affectés par le projet, le promoteur identifiera et évaluera ceux liés aux effets d'autres travaux ou activités réalisés ou connus et de ceux pouvant être réalisés dans un proche avenir dans le même secteur ou raisonnablement prévisibles, par exemple en lien avec les projets de route et les autres projets envisagés (Matoush, Lac MacLeod, etc.), notamment ceux liés à l'exploration minière en cours ou à un développement minier intensif du secteur et ceux liés au développement récréo-touristique (pourvoirie, plein air, création de parc, etc.).

Le promoteur présentera une justification concernant la délimitation géographique de l'étude des impacts cumulatifs. Il est à noter que ces limites peuvent varier en fonction des composantes retenues pour évaluer les impacts cumulatifs. Il proposera et justifiera le choix des projets et activités retenus pour l'analyse des impacts cumulatifs, qui devront comprendre les activités ou projets passés, en cours et futurs (dont la probabilité de réalisation est grande).

Ainsi, le promoteur devra identifier les composantes valorisées sur lesquelles portera l'évaluation des effets cumulatifs. Les composantes du milieu pour cette analyse devront être celles liées aux enjeux du projet, entre autres : le mode d'utilisation du territoire par les Cris, le contexte socioéconomique de la région, la fréquentation du secteur par la communauté pour des fins culturelles, les activités récréo-touristiques, notamment la chasse et la pêche sportives, les espèces fauniques et floristiques en péril, la faune et son habitat.

MESURES D'ATTÉNUATION ET DE RESTAURATION

Le promoteur décrira les mesures qu'il mettra en vigueur pour accentuer au maximum les effets favorables sur l'environnement ainsi que les mesures correctrices qu'il compte mettre de l'avant afin de réduire les impacts négatifs du projet. Le promoteur devra privilégier les mesures permettant d'éviter les impacts négatifs, puis celles visant à réduire l'importance des impacts et,

pour les impacts résiduels qu'il n'aura pas pu atténuer, proposer des mesures de compensation ou de restauration.

Une attention particulière devra être accordée à l'insertion des mesures suivantes :

- clauses spécifiques de protection de l'environnement dans les différents contrats octroyés;
- choix des périodes de travaux lors de la construction des infrastructures;
- méthodes proposées pour la construction d'infrastructures près des plans d'eau et des zones humides;
- modes de restauration de certains tronçons de route existants ou de traversées des cours d'eau sujets à problèmes;
- la protection des milieux aquatiques et l'habitat du poisson;
- normes de restauration et réhabilitation des bancs d'emprunt et, le cas échéant, des portions de routes désaffectées et des sites perturbés;
- modalités de démantèlement des infrastructures d'hébergement;
- information pour le personnel de chantier aux droits et coutumes de pêche et de chasse en territoire conventionné;
- protection de la saison de nidification des oiseaux migrateurs
- protection des espèces à statut précaire au sens des législations provinciales et fédérales ou de toute espèce d'intérêt pour la communauté;
- protection des sites archéologiques;
- participation de la main-d'œuvre crie dans la force ouvrière ou comme contractants lors de la construction du projet et de son exploitation;
- facilitation de la cohabitation des travailleurs allochtones et autochtones.

En ce qui a trait aux mesures d'atténuation relatives à l'exploitation minière elle-même, le promoteur départagera les mesures prises en cours d'exploitation et celles applicables lors de la désaffectation de la mine. En particulier, le programme décrira :

- le programme de restauration progressive pendant l'exploitation, le programme de confinement et de contrôle lors d'une fermeture temporaire et le programme de restauration finale incluant la restauration des parcs à résidus miniers de même que la sécurisation des ouvertures de surface à la fin du projet;
- les modalités de réaménagement des aires d'accumulation et leur stabilisation afin de lutter contre l'érosion éolienne ou par ruissellement;
- les possibilités d'utilisation du mort-terrain dans la restauration de sites désaffectés;
- la récupération de certains équipements et aménagements.

Finalement, le promoteur indiquera la nature et l'envergure des impacts résiduels susceptibles de demeurer après l'application des mesures d'atténuation. Des propositions d'aménagements, des engagements et des mesures compensatoires pour suppléer à la perte d'habitats devront être fournis. On traitera des mesures de compensation pour des modifications ou des pertes liées à la pratique des activités traditionnelles. On devra également faire part de toutes garanties financières ou autres de nature environnementale pouvant être utilisées au cours des phases de construction, exploitation et désaffectation du projet.

GESTION DES ACCIDENTS

Compte tenu de l'éloignement du site minier, le promoteur devra appliquer les premières mesures d'urgence en cas d'accident technologique, de déversement, etc. Il fournira notamment les renseignements sur sa capacité d'intervention et ses méthodes de manipulation dans les cas suivants :

- transport de produits chimiques (pétroliers, explosifs, etc.) ou jugés potentiellement dangereux;
- déversement de produits pétroliers et/ou dangereux le long de la route ou au site minier en insistant sur la rapidité et les moyens sur place d'intervention;
- entreposage des produits chimiques, explosifs, pétroliers et dangereux;
- risques d'explosions ou d'incendies le long de routes, sur le site minier ou lors de transport sur des plans d'eau ou sur les différents campements lors des phases de construction et d'exploitation;
- risques de bris ou de fuite des digues.

Le promoteur devra évaluer l'incidence ou la probabilité de tels accidents. Les versions préliminaires des plans et les mesures prévues pour répondre aux situations urgentes doivent être présentées.

PROGRAMMES DE SURVEILLANCE ET DE SUIVI

Le promoteur devra expliquer les mécanismes de surveillance qu'il entend mettre de l'avant pour s'assurer que les mesures d'atténuation identifiées soient mises en œuvre, qu'elles soient fonctionnelles et qu'elles permettent une protection adéquate telle qu'anticipée. On indiquera d'ailleurs, à ce sujet, si ces travaux de surveillance seront effectués par le promoteur ou par une firme spécialisée et dans quelle mesure les Cris seront impliqués.

Les limites de détection obtenues pour la mesure des métaux dans les eaux de surface doivent permettre de faire une comparaison valable avec les critères de qualité de l'eau de surface en vigueur. Il est maintenant admis que, dans la plupart des cas, les concentrations de métaux-traces générées par les méthodes usuelles de collecte et de mesure sont sujettes à caution. Il appert que les niveaux mesurés de cette façon par les grands réseaux nationaux peuvent être de un à deux ordres de grandeur plus élevés que les niveaux détectés avec des méthodes dites « propres ». Donc, lorsque des dépassements de critères sont constatés dans un cours d'eau, sans que des méthodes propres aient été employées, il est difficile de conclure sur la qualité réelle du milieu en conditions naturelles. Les dépassements peuvent être le résultat d'une contamination liée à la collecte ou à l'analyse des échantillons. Des précautions particulières doivent donc être prises pour éviter la contamination à toutes les étapes de l'échantillonnage, du traitement et de l'analyse des échantillons. Les méthodes « propres » permettent également d'obtenir des limites de détection très faibles, qui permettent la comparaison avec les critères de qualité des eaux de surface.

Le promoteur détaillera les protocoles qu'il prévoit mettre en place pour la caractérisation des eaux usées, des émissions à l'air et des sols, il tiendra compte notamment du potentiel de génération d'acide et de lixiviation et des problématiques de toxicité et d'érosion éolienne aux aires d'accumulation des résidus miniers. Dans tous les cas, le promoteur devra spécifier la

fréquence, les méthodes d'échantillonnage, les paramètres analysés et la durée. Il y aurait lieu d'utiliser les résultats de l'étude de bruit de fond pour l'élaboration du suivi.

Le promoteur définira deux secteurs exposés (proche et éloigné) et des zones témoins pour le suivi des effets de l'exploitation. Dans la mesure du possible, il y a lieu de retenir des milieux « exposés et témoins » comparables sur le plan hydraulique et hydrologique. Le promoteur fournira dans son étude une évaluation biologique des secteurs « exposés et témoins ». Le choix d'organismes (ou de communautés) qui serviront d'indicateurs est à la discrétion du promoteur qui, toutefois, doit l'expliquer et le justifier dans son étude d'impact.

Les eaux de ruissellement provenant du site minier et des aires d'accumulation seront soumises à des analyses. En ce qui concerne les eaux traitées, on suivra aussi leur influence dans le milieu récepteur. Cet effort d'échantillonnage permettra de bien cerner l'envergure des impacts prévus ou non prévus et l'efficacité des mesures d'atténuation mises en place contre les effets nocifs des résidus miniers. Le promoteur précisera également les mesures de contrôle de la qualité des analyses effectuées dans le cadre de ce suivi.

Ces mesures feront partie intégrante du projet et devront être conçues de façon à fournir une connaissance des phénomènes réels qui surviennent à l'occasion d'un semblable développement en territoire nordique.

COMMUNICATION ET CONSULTATIONS

Un chapitre de l'étude d'impact devrait être consacré à la présentation et à l'analyse des consultations menées par le promoteur dans le cadre de la planification de ce projet. Il s'agit de traiter à la fois des résultats obtenus dans les milieux autochtones et non-autochtones intéressés au projet, et d'y inclure une section portant sur les communications avec les Cris qui exploitent le secteur du projet minier projeté afin d'évaluer les perceptions du projet, y compris les mesures d'atténuation.

Il est souhaitable que le promoteur du projet adopte un plan de communication à l'égard de son projet, débute le processus de consultation dès le dépôt des renseignements préliminaires et y associe toutes les parties concernées, tant les individus, les groupes et les collectivités que les ministères et autres organismes publics et parapublics et, particulièrement, ceux basés dans la région administrative concernée. Il est important que s'amorce la consultation le plus tôt possible dans le processus de planification du projet pour que les opinions des parties intéressées puissent réellement influer sur les questions à étudier, les choix et les prises de décision. Le promoteur doit également expliquer comment ces communications se feront éventuellement tout au long de la construction et de l'exploitation du projet.

PRÉSENTATION DE L'ÉTUDE D'IMPACT

L'étude d'impact doit être présentée d'une façon claire et concise et se limiter aux éléments pertinents à la bonne compréhension du projet et de ses impacts. Ce qui peut être schématisé ou cartographié doit l'être, et ce, à des échelles appropriées. Les composantes du projet doivent figurer autant sur les cartes thématiques que sur les cartes synthèses. Autant que possible, l'information doit être analysée à la lumière de la documentation appropriée.

Nous encourageons le promoteur à illustrer, à l'aide de photographies les points saillants de son étude. La disponibilité et la qualité des données utilisées devraient également être évaluées par le promoteur. Toutes les sources de renseignements doivent être données en référence. De plus, les méthodes utilisées au cours de la réalisation de l'étude d'impact (inventaire, analyse comparative, etc.) doivent être présentées et explicitées.

Lors du dépôt de son étude d'impact, le promoteur devra fournir au moins 15 exemplaires de tous ses documents ainsi que 2 copies sur support informatique en format PDF (Portage Document Format). Une traduction anglaise de l'étude d'impact devrait être rendue disponible afin d'en favoriser la consultation par les Cris.

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Appendix 2.2.2

Updated Directive Defining the Scope of the Detailed Study for the Renard Project (2010 and 2011)

RENARD DIAMOND MINE PROJECT

CANADIAN ENVIRONMENTAL ASSESSMENT ACT
SCOPE OF THE FEDERAL ENVIRONMENTAL ASSESSMENT

FISHERIES AND OCEANS CANADA
NATURAL RESOURCES CANADA

AUGUST 2010

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1.0 PURPOSE

Stornoway Diamond Corporation wants to develop a diamond mine on the Foxtrot property on Category III land within the territory covered by section 22 of the *James Bay and Northern Quebec Agreement (JBNQA).* According to the latest mineral resources estimate, the mine life could be 25 years, with a good possibility of extending the extraction period of this resource.

This document describes the federal environmental assessment process as it applies to this project under the *Canadian Environmental Assessment Act* (the Act) and presents the scope of that assessment, as well as the information required to carry it out.

2.0 BACKGROUND

2.1 Description of the proposed project

This project involves the development of the mine and local infrastructure, such as open pits, shafts, mine adits, processing plant, kimberlite tailing impoundments, a housing complex, a secondary road, an airstrip and associated facilities.

Given the nature of the deposit, two kimberlite extraction methods will be used: open-pit mining and underground mining. For the open-pit mining, the technique essentially consists of blasting and shovelling the ore. These open pits could be up to some 130 metres deep. For the underground mining, a vertical shaft or mine adit is first built underground, and then the extraction of the ore can be done by means of various techniques, depending on the size and shape of the kimberlite pipes and the properties of the rock. The anticipated extraction rate from this operation is between 5,000 and 7,000 tonnes per day.

The ore processing will be done by means of mechanical crushing, followed by gravity separation. Other steps will follow to extract all the fine fractions. No chemicals are needed for the processing. A final sort is done using x-rays and grease to isolate the diamonds from the other materials.

2.2 Application of the *Canadian Environmental Assessment Act*

The Act applies to projects for which the federal government holds decision-making authority in relation to section 5 of the Act, whether as proponent, land administrator, source of funding, or regulator.

In connection with this project, Fisheries and Oceans Canada (DFO) and Natural Resources Canada (NRCan) plan to exercise the following duties:

- in the case of DFO, issuing an authorization under subsection 35(2) of the *Fisheries Act* (FA); and
- in the case of NRCan, issuing a licence under paragraph 7(1)(*a*) of the *Explosives Act*.

According to the analysis of the project notice, the aspects of the proposed project which will result in the destruction, harmful alteration or disruption of fish habitat and for which there must be authorization under the FA are as follows:

- dewatering of an approximately 4-ha unnamed lake and realignment of a stream caused by the operation of open pits R-2 and R-3; and
- dewatering of an approximately 2-ha bay of Lac Lagopède caused by the operation of open pit R-4.

According to the project notice, mixer trucks will be used to prepare the blasting agents. This explosives factory and the related activities must be the subject of an authorization under the *Explosives Act*.

On the basis of the information that will be provided in the impact assessment, other project components causing loss of fish habitat might be added. Also, the review of the impact assessment by the proponent might reveal other components that must be the subject of other approvals or authorizations under the FA or the *Explosives Act*.

These regulatory duties are triggers for the federal environmental assessment process. Thus, DFO and NRCan, as "responsible authorities", must ensure that an environmental assessment in compliance with the Act is carried out.

The project will also require approval under subsections 5(1) and (3) of the *Navigable Waters Protection Act* (NWPA). However, that approval does not trigger the *Canadian Environmental Assessment Act*. Transport Canada will therefore participate in the environmental assessment as an expert department.

Following the filing of additional information by the proponent, other components might require approvals from Transport Canada under the *Navigable Waters Protection Act* (NWPA). The role of that department with regard to the environmental assessment might therefore change.

Environment Canada (EC), although it does not have a power to exercise or a duty or function to perform, will participate in the environmental assessment as an expert department in its areas of expertise.

Pursuant to subsection 18(1) of the Act, this project is subject to a screening-level environmental assessment.

Federal coordination will be provided by the Canadian Environmental Assessment Agency (the Agency). As such, the Agency will serve as primary contact for the proponent and ensure that requests for information are transmitted between it and the federal authorities involved. Since the project is also subject to the environmental and social impact assessment and review procedure under the *JBNQA*, the Agency will facilitate exchange of the relevant information with the Provincial Review Committee (COMEX) in connection with the latter's assessment and review of the environmental and social impacts.

The proposed project is eligible as a natural resource project, as defined by the federal government's Initiative for Improving the Performance of the Regulatory System for Major Resource Projects. This process includes developing a project agreement between the interested federal departments, while committing to the timelines for the environmental assessment (EA) and regulatory processes. Once the project agreement has been signed by the deputy ministers, the Major Projects Management Office (MPMO) will provide follow-up and report on the progress of the environmental assessment and regulatory processes. The MPMO will work in collaboration with the Agency and responsible authorities throughout the federal regulatory process. For more information on the initiative and the MPMO process, the proponent is encouraged to consult the following site: http://www.mpmo-bggp.gc.ca.

2.3 Public consultation

The public will have opportunity to participate in the federal environmental assessment. It is anticipated that the public and the affected Aboriginal groups will be consulted at various stages in the environmental assessment of the project, with, for example, the opportunity to comment on the impact assessment and the screening report.

3.0 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The scope of the environmental assessment determines the project components that will be described and for which the environmental impacts will be analyzed, as well as the environmental components that must be taken into account and their scope.

3.1 Selected project components (scope of the project)

The scope of the project includes the activities and facilities that will be considered in the federal environmental assessment. For the purposes of application of the Act, the scope of the project includes all components of the project submitted by the proponent, as well as any other facility, temporary structure of activity directly related to the project (e.g. temporary access roads, clearing, cofferdams, filling and revegetation).

3.2 Factors to review

The environmental assessment will include the study of the following factors set out in paragraphs 16(1)(*a*) to (*e*) of the Act:

- the environmental effects of the project, including the environmental effects of accidents or malfunctions that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- the significance of the effects referred to in the previous point;
- comments from the public that are received during the environmental assessment;
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and

- any other matter relevant to the screening.

An environmental effect, as defined in subsection 2(1) of the Act, is any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in sub-section 2(1) of the *Species at Risk Act*, any effect of such changes on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes by Aboriginal persons, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, as well as any change to the project that may be caused by the environment.

3.3 Scope of the factors to be reviewed

In light of the information available, the environmental components likely to be affected by the project include, but are not limited to:

- water quality
- air quality
- soil quality
- water regime
- land and aquatic vegetation
- wetlands
- fish and their habitats,
- birds and their habitats
- terrestrial fauna and their habitats
- special-status floral and fauna species, including woodland caribou
- health of users of the territory, including through accumulation of metals in flora and fauna
- current use of lands and resources for traditional purposes by Aboriginal persons
- effects the environmental changes on socio-economic activities
- archaeological site

3.3.1 Study area

The study area includes all the project components and their entire area of influence, i.e. the area within which the direct and indirect environmental effects will be felt.

3.3.2 Temporal boundaries

The period covered by the environmental assessment includes the start-up, operation and closure of the project, with a view to review all the short-, medium- and long-term impacts.

4.0 PREPARATION OF THE IMPACT ASSESSMENT

The Evaluating Committee (COMEV) established pursuant to Section 22 of the **JBNQA** has produced a directive for the carrying out of the impact assessment by the proponent. The directive includes the components determined by COMEV with a view to meeting the requirements of the environmental protection regime provided for in the JBNQA. The components listed in the COMEV directive are reproduced herein, with the addition of components or requests specifically needed for the federal analysis.

Therefore, the purpose of this section is to help the proponent prepare its impact assessment, in order that the latter may meet the needs of the federal departments in their analysis of the project in accordance with the requirements under the Act referred to in Section 3. The proponent is encouraged to produce a single impact assessment that meets the requirements established by COMEV and the federal process. The proponent must provide the Agency with twelve (12) hard copies of the impact assessment, as well as an electronic version in a suitable format.

On receipt of the impact assessment, the federal authorities will analyze it to determine its compliance and, if necessary, may request further information from the proponent.

On the basis of the information provided by the proponent, their own expertise and the expertise of the experts consulted, where applicable, a screening report will be produced. The report will present the conclusions of the environmental assessment, i.e. whether there is a risk that the carrying out of the project will have significant adverse environmental effects, taking into account the appropriate mitigation measures.

4.1 Biological and physical components

The biological and physical components referred to in Section 3.3 and the environmental effects of the project on those components must be documented.[1] The information that the proponent must present includes, but is not limited to, the following:

- a list of all species likely to be present in the study area, as well as the priority areas and habitats that may be affected (identify the species which have legal status or are of special interest);
- a description of the inventories done or data used to determine the presence of species and their habitats (i.e. present and justify the methodology, results and conclusion);
- a description of the anticipated effects (direct and indirect) of the project on the species likely to be present and their habitats;
- the determination as to the applicable mitigation measures to minimize the impact and of the means put in place to ensure application of the mitigation measures. For species at risk, demonstrate that the project and the proposed mitigation measures are compatible with any applicable action plan and recovery program; and
- if necessary, a description of the proposed follow-up program for verifying the accuracy of the assessment of the effects.

1 For example, the proponent may refer if necessary to Environment Canada to obtain the guides and documents developed for inventorying or analysing impact on migratory birds, species at risk and wetlands.

It is strongly suggested that the proponent contact DFO during the preparation of its impact assessment and the carrying out of the plans, in order that a determination may be made as soon as possible as to acceptable harmful alteration, destruction or disruption (HADD) of fish habitat that may be authorized.

It is important to note that DFO prefers above all to avoid HADD of fish habitat or, if that is not possible, to reduce it to the maximum extent possible. The proponent must justify HADD of fish habitat by demonstrating that it is reduced to the maximum extent possible and that it is impossible to avoid it entirely. If these residual losses of fish habitat are acceptable, and do not threaten the resource or species at risk, DFO may issue an authorization to modify fish habitat under subsection 35(2) of the *Fisheries Act*. This authorization allows harmful alteration, destruction or disruption of fish habitat by the means or under the circumstances authorized by DFO.

4.2 Current use of lands and resources for traditional purposes by Aboriginal persons

The federal environmental assessment must assess the possibility of adverse environmental effects on the current use of lands and resources for traditional purposes by Aboriginal persons. For this purpose, the following must be done:

- describe the current uses for traditional purposes likely to be affected by the project;
- indicate how the current use by Aboriginal persons was verified, and provide the information sources;
- describe the effects of the project on the current use by Aboriginal persons, as well as any mitigation measures; and
- summarize the consultations or exchanges with the Cree using the territory, and identify the concerns expressed and the extent to which these elements were reflected in the project design and in the impact assessment.

4.3 Socio-economic activities

The socio-economic components mentioned in Section 3.3, including the archaeology and the impact of environmental changes on them must be documented. The proponent must provide, but not limited to, the following:

- a description of the current land use, such as outfitting operations and other recreational activities, tourism, vacation leases and others, potentially impacted by the project;
- the effects of the project on these uses and any appropriate mitigation measures;
- a summary of the consultations and exchanges with the users of the land. The concerns voiced must be identified and the extent to which this information was incorporated in the project design, as well as in the environmental impact statement; and
- the known sites and archaeological remains, and a description of the mitigation measures that will be implemented, if necessary.

4.4 Navigation

The proponent must describe the main navigation features in the project area (type of boats, areas of use, importance, etc.), as well as the disruptions, caused by the project, on the navigation activities.

With regards to applications for approval under the *Navigable Waters Protection Act* (NWPA), the proponent must present the following information and documents:

- Create a table of the undertakings (including backfilling and dewatering, if necessary) in the aquatic environment and indicate:
  a. The type of work;
  b. The main geographic coordinates, crossing mid-watercourse (Dms.d, nad 83);
  c. The addition of the geographic coordinates at either end (Dms.d, nad 83);
  d. The characteristics of the watercourse:
     i. Width,
     ii. Minimum and maximum depth during the summer,
     iii. Bottom type (ex. sediments, rocks),
     iv. Flow type (ex. lake, stream, river, calm, flowing, fast, etc.), and
     v. If possible, reference a photo taken of the watercourse in that area during the summer; and
- Present a plan for each one of these undertakings by indicating the main dimensions and characteristics:
  a. Plan views and elevation;
  b. Minimum and maximum watercourse levels during the summer, before and after the work period; and
  c. Indicate, if appropriate, the navigation protection measures during the work period and operations phase.

It is noted that during a more complete analysis of the project, it could be determined that other components require further approvals from Transport Canada under the NWPA.

For more information on the specific requirement of the application of approval under the *Navigable Waters Protection Act*, the proponent is encouraged to consult the following guide:

www.tc.gc.ca/eng/quebec/nwp-menu-1424.htm

4.5 Accidents and malfunctions

The federal environmental assessment must assess the potential of adverse environmental effects due to accidents or malfunctions associated with the construction and operations of the components in the environmental assessment. Above all, specific attention will be given to accidents and malfunctions that are reasonably plausible.

The probability of accidents or malfunctions associated with the construction and operations of the components included in the environmental assessment, as well as the potential of adverse environmental effects that may result from these events, must be identified and described

Other than the mitigation measures implemented for the accidents and malfunctions that could occur, it is preferable to indicate the measures that will reduce the risk of possible accidents and malfunctions from occurring.

4.6 Any change to the project that may be caused by the environment

Any environmental risks that may affect the project must be described and the anticipated impacts of these environmental risks documented.

4.7 Cumulative effects study of the project

Cumulative effects are defined as changes to the environment caused by the project in combination with other present and future human actions. The cumulative effects assessment should be based on the valued environmental components (VECs) for which cumulative effects are likely to occur. This should be components for which the project has an adverse residual effect.

For each VEC, the spatial and temporal boundaries must be defined. These boundaries may be different depending on the components reviewed. The spatial boundaries must be established based on the VEC considered and the geographic area that it occupies, which often extend beyond the impact area of the project under study.

4.8 Public consultations

Under the Act, the proponent is encouraged to provide details of the consultations and the information sessions that it will hold or that it has already held within the context of the project at the local and regional levels. The expected information should include the identification of Aboriginals groups met and the extent to which this information was incorporated in the project design, as well as in the environmental impact statement.

5.0 PUBLIC REGISTRY

With the implementation of the Act, the Government of Canada is committed to facilitating public participation in the environmental assessment of projects, and providing access to the information on which those environmental assessments are based. It is pursuant to this commitment that section 55 of the Act requires the maintenance of a public registry by the responsible authority in relation to each project for which an environmental assessment is conducted.

Any relevant document in relation to the evaluation of the project submitted by the proponent will be recorded in the Canadian Environmental Assessment Registry (CEAR) and made available to the public on request. Certain confidential or sensitive documents that should be protected and not made public may be excluded from the CEAR. In such cases, the proponent must provide the authority responsible for the CEAR with arguments demonstrating a likely risk of probable harm.

The Canadian Environmental Assessment Agency is responsible for maintaining the Canadian Environmental Assessment Registry.

The Canadian Environmental Assessment Registry can be accessed at: http://www.acee-ceaa.gc.ca/050/index_e.cfm , reference number: 10-01-55169

The project will also be posted on the Major Projects Management Office's Web site under the Project List section.

http://www.mpmo-bggp.gc.ca

6.0 CONTACTS

With regard to the current project, the contact information for the federal assessment is the following:

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Natural Resources Canada

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Telephone: 613-995-4434

7.0 DOCUMENT CONSULTED

Stantec, 2010. Avis de projet – projet de la mine de diamant Renard. 29 pages + annexe.

RENARD DIAMOND MINE PROJECT

CANADIAN ENVIRONMENTAL ASSESSMENT ACT
SCOPE OF THE FEDERAL ENVIRONMENTAL ASSESSMENT
(UPDATE)

CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY

JUNE 2011

Canada

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Canada

1 PURPOSE

Stornoway Diamonds Inc. (the proponent) wants to develop a diamond mine on the Foxtrot property on Category III land within the territory covered by section 22 of the *James Bay and Northern Quebec Agreement* (JBNQA). According to the latest mineral resource estimates, the mine life could be 25 years, with a good possibility of extending the extraction period of this resource.

This document is an update of the scope of the federal environmental assessment released in August 2010 following the submission of an amendment to the initial notice of intent by the proponent. In light of the proponent's proposed amendments, it was determined that the environmental assessment provided for under the *Canadian Environmental Assessment Act* (the Act) would change from a screening to a comprehensive study. The purpose of this document is therefore to provide the proponent with the necessary information to prepare an environmental impact statement (EIS) for the Renard Diamond Mine Project, which will be assessed through a comprehensive study process in accordance with the Act.

This document presents the scope of this assessment, as well as the nature, scope, and extent of the information required. The proponent will prepare and submit an EIS that defines the project's potential adverse environmental effects, including cumulative effects, suggests technically and economically feasible measures for mitigating these effects, and indicates whether the proposed project will have significant adverse environmental effects.

While this scoping document provides a framework for the preparation of a complete EIS, it is the responsibility of the proponent to supply sufficient data and analyses on all of the project's potential environmental effects to allow the Canadian Environmental Assessment Agency (the Agency), which is acting as the responsible authority, expert and regulatory departments, Aboriginal groups, and the public to conduct an adequate assessment. The scoping document describes the minimum information requirements, but gives the proponent the flexibility to choose the most appropriate methods for compiling and analyzing data for the EIS.

The federal environmental assessment process includes three opportunities for the public and Aboriginal communities to participate by submitting comments and feedback regarding the project and the environmental assessment. The first participation opportunity invites the public and Aboriginal persons to submit comments on the project and on the conduct of the comprehensive study. This scoping document and the proponent's notice of intent are the primary documents submitted for the purposes of this consultation.

2 BACKGROUND

2.1 Description of the proposed project

The Renard Diamond Mine Project is located in the James Bay area, approximately 70 kilometres north of the Otish Mountains. The project coordinates are 72°11' west longitude and 52°49' north latitude. It is located approximately 150 kilometres southeast of the Hydro-Québec LG-4 hydroelectric complex and approximately 200 kilometres northeast of Lake Mistassini (Figure 1, Appendix A). The site lies near the head of the Eastmain River watershed, more than 275 kilometres upstream of the Eastmain-1 reservoir.

The closest infrastructure is located at Témiscamie, which lies approximately 210 kilometres south at Lake Albanel and is connected to the Cree community of Mistissini by Route 167. The town of Chibougamau, 360 kilometres south of the site, is the main supply centre for local natural resource industries.

The project proposed by the proponent involves the development of the mine and local infrastructure, such as open pits, vertical shafts, inclined adits, a mill, a processed kimberlite (tailings) containment area, a housing complex, a secondary road on the site, an airstrip, an explosives storage facility, a pumping plant and associated facilities.

Given the nature of the diamond deposit, the proponent plans to use two kimberlite extraction methods: open-pit mining and underground mining. For the open-pit mining, the technique would essentially consist of blasting and shovelling the ore. These open pits could be up to some 130 metres deep. For the underground mining, a vertical shaft or adit would first be built underground. The ore could then be extracted using various techniques, depending on the size and shape of the kimberlite pipes and the properties of the rock. The anticipated extraction rate from this operation is between 5000 and 7000 tonnes per day.

The development of the diamond resources can be divided into three steps: extraction, processing and sorting. All three steps will be carried out at the Renard diamond mine. The ore processing would be done by means of mechanical crushing, followed by gravity separation. The separation process would generate fine (-0.25 milimetres) and coarse (+0.25 milimetres) fractions of processed kimberlite (PK), which would be stored in PK (tailings) containment areas. Subsequent steps would be carried out to extract all of the fine fractions. No chemicals are needed for the processing. Final sorting would be done using X-ray and grease technology to separate the diamonds from the other materials.

Four main underground pumping stations would be installed around the mine. Pump sizes would range from 40 to 100 horsepower, with capacities from 94 metres of head to 351 metres of dynamic head at a pumping rate of 0.75 cubic metres per minute. The proponent anticipates that the average flow rate from the mine would be approximately 20 cubic metres per hour.

The mine water would be pumped to the settling pond. The mine water discharge rate would be 200 000 cubic metres per year or more. Open pit dewatering would take place during the pre-production and post-production periods.

2.2 Application of the Canadian Environmental Assessment Act

The Act applies to projects for which the federal government holds decision-making authority pursuant to section 5 of the Act, whether as proponent, land administrator, source of funding, or regulator.

In connection with this project, Fisheries and Oceans Canada (DFO) and Natural Resources Canada (NRCan) plan to exercise the following duties:

- Issue an authorization under subsection 35(2) of the *Fisheries Act* (FA)
- Issue a licence under paragraph 7(1)(*a*) of the *Explosives Act*

These regulatory duties trigger the federal environmental assessment process.
According to information received from the proponent, the following aspects of the proposed project will result in the harmful alteration, disruption or destruction (HADD) of fish habitat and will require authorization under the FA:

- Drainage of lake F3302 (approximately 4 hectares) and its outlet, as well as drainage of a tributary of lake F2607 (unnamed stream), caused by the operation of open pits R-2 and R-3

- Drainage of lake F3303 (approximately 1.15 ha, containing brook trout habitats) and its outlet (stream F3303V), as well as drainage of a segment of the tributary of Lac Lagopède (stream F3298V), caused by the operation of pit R-65

- Potential encroachment on the bed of Lac Lagopède and Lac Poisson (F2606), which are fish-bearing lakes, caused by the installation of water intakes for the mine

Mixer trucks will be used to prepare the blasting agents. This type of equipment is considered an explosives factory under the *Explosives Act*, and the related activities must receive approval under subsection 7(1) of the Act.

Furthermore, approval under subsections 5(1) and (2) of the *Navigable Waters Protection Act* (NWPA) is required for the following components:

- Encroachment by pits R-2 and R-3 on lake F3302
- Water intake at lake F2606
- Outfall to Lac Lagopède

The review of the impact assessment by the proponent may reveal additional components that are subject to other approvals or authorizations under the FA, NWPA, or *Explosives Act*.

2.3 Comprehensive study process[1]

The submitted project will be subject to the comprehensive study process, because one of its components is covered by section 10 of the *Comprehensive Study List Regulations*, which reads as follows:

The proposed construction, decommissioning or abandonment of a facility for the extraction of 200 000 m^3/a or more of ground water or an expansion of such a facility that would result in an increase in production capacity of more than 35 per cent.

In accordance with section 11.01 of the Act, the Agency will perform the duties and functions of the responsible authority in relation to the environmental assessment of the Renard Diamond Mine Project. The Agency will work closely with the federal authorities to coordinate their participation in the environmental assessment process and facilitate communication and co-operation between them and the other participants for the purpose of preparing the Comprehensive Study Report (CSR).

To perform the analysis of the project, the Agency has established a federal environmental assessment committee (the federal committee) made up of representatives of DFO, Environment Canada, Transport Canada, NRCan, the Cree Regional Authority (CRA) and the Major Projects Management Office (MPMO). Other departments may be added if necessary.

The federal committee has established the scope of the environmental assessment to guide the analysis of the proponent's impact assessment. The scope that will be considered is set out in Section 3 below. The proponent, Stornoway Diamonds (Canada) Inc., will present its impact assessment evaluating the environmental effects of the project to the Agency for review and comment. During this analysis, the Agency will offer the public a second opportunity for consultation. A CSR detailing the conclusions of the Agency and the federal committee on the environmental effects of the project will then be prepared. This report will be submitted to the

[1] See Appendix 2 for diagrams of the comprehensive study and public consultation process.

Minister of the Environment (the Minister) and will also be made available for public review and comment.

The Minister will review the CSR, the summary of the Aboriginal consultation, the assessment of the adequacy of the consultation, and public concerns. If the Minister is of the opinion that additional information or specific actions are needed to address the concerns of the public or Aboriginal groups, the Minister may require the Agency or proponent to ensure that additional information is gathered or that measures are taken to resolve those issues.

Once all necessary information has been provided, the concerns of the public have been addressed, and the Aboriginal consultation has been deemed sufficient for a decision, the Minister will issue an environmental assessment decision statement. This statement sets out the Minister's opinion as to whether the project is likely to cause significant adverse environmental effects, taking into account the implementation of the mitigation measures and follow-up program that the Minister considers appropriate.

Once the Minister has issued an environmental assessment decision statement, the project is referred back to the federal authorities for their respective decisions under section 37 of the Act. The federal authorities can then take appropriate regulatory actions, such as issuing permits, licences or approvals, depending on the outcome of the environmental assessment.

Since the project is also subject to the environmental and social impact statement and review procedure under the JBNQA, the Agency will facilitate exchange of the relevant information with the Provincial Review Committee (COMEX) in connection with the latter's assessment and review of the environmental and social impacts.

2.4 Major resource projects initiative

The proposed project is considered a natural resources project, as defined by the federal government's Initiative for Improving the Performance of the Regulatory System for Major Resource Projects. This process includes the development of a project agreement between the interested federal departments to establish the roles and responsibilities and the timelines for the environmental assessment (EA) and regulatory processes. Once the project agreement has been signed by the relevant deputy ministers, the MPMO will provide follow-up and report on the progress of the EA and regulatory processes. The MPMO will work in collaboration with the Agency and responsible authorities throughout the federal regulatory process. For more information on the initiative and the MPMO process, the proponent is encouraged to consult the following site: http://www.mpmo-bggp.gc.ca.

2.5 Environmental assessment process under the *James Bay and Northern Quebec Agreement*

The project is also subject to a provincial environmental and social impact assessment pursuant to section 22 of the JBNQA. Since the project is provincial in nature, the Provincial Administrator, following the recommendations of the Evaluating Committee (COMEV), issued a directive in June 2010 for the conduct of impact assessments by the proponent.

To enable the proponent to produce a single EIS, this scoping document is based largely on the directive of the Provincial Administrator, with the addition of federal requirements specific to the Act.

3 SCOPE OF THE PROJECT AND ENVIRONMENTAL ASSESSMENT

The scope of the project includes the activities and works that will be considered in the federal environmental assessment. For the purposes of the application of the Act, the scope of the project encompasses all project components submitted by the proponent, which are described in section 2 above. It also includes any other facility, temporary structure, or activity directly related to the project (e.g. temporary access roads, clearing, cofferdams, filling, and revegetation).

The scope of the environmental assessment determines the project components that must be described and for which the environmental impacts will be analyzed, as well as the environmental components that must be taken into account and their scope.

3.1 Study area

The study area includes all project components and the entire area within which their direct and indirect environmental effects will be felt. The project proponent must determine the areas of influence of each component covered in the analysis. The boundaries considered may vary depending on the components of the environment under study. The scope of the impacts may also vary depending on the type of environment and environmental components affected by the project. The proponent will clearly identify and justify the spatial boundaries determined for each component of the environment under study. A summary table indicating these boundaries and the rationale must be included in the impact assessment to facilitate the reader’s understanding.

3.2 Temporal boundaries

The period covered by the environmental assessment includes, at a minimum, start-up, mine infrastructure installation, deposit development, project modifications, site decommissioning, and closure of the project, with a view to reviewing all short-, medium- and long-term impacts.

3.3 Factors to be considered

The environmental assessment will include consideration of the following factors, listed in paragraphs 16(1)(*a*) to (*e*) and subsection 16(2) of the Act:

- The purpose of the project
- Alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means
- The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities
- The significance of the effects referred to above
- The capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future
- Comments from the public that are received during the environmental assessment process
- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects
- A follow-up program in respect of the project, and its terms
- Any other matter relevant to the comprehensive study

3.3.1 Purpose of the project

The “purpose of” and “need for” the project must be established from the perspective of the proponent. The project will be designed to meet specific objectives, and those objectives must be described. If the project objectives are related to or contribute to broader private- or public-sector policies, plans or programs, this information must also be included.

The proponent must clearly state the need for the project. The proponent must establish the fundamental rationale for the project, namely the problem or opportunity that the proposed project is intending to solve or satisfy.

3.3.2 Alternatives

The EIS must define and describe alternative means of carrying out the project that are technically and economically feasible (paragraph 16(2)(*b*) of the Act).

The Agency recommends using the following approach for the analysis of alternative means of carrying out the project:

- Identify the alternative means of carrying out the project:
  - Develop criteria to determine the technical and economic feasibility of the alternative means
  - Describe each alternative means in sufficient detail
  - Identify those alternative means that are technically and economically feasible
- Identify the environmental effects of each alternative means:
  - Describe, in sufficient detail, those elements that could produce environmental effects to compare them with the environmental effects of the project
- Identify the preferred means:
  - Identify the preferred means based on the relative consideration of environmental effects, and of technical and economic feasibility
  - Determine and apply criteria that identify alternative means as unacceptable on the basis of significant adverse environmental effects
  - Determine criteria to examine the environmental effects of each remaining alternative means to identify a preferred alternative

All potential adverse effects of technically and economically feasible alternative means on treaty rights must also be identified.

3.3.3 Environmental effects

An environmental effect, as defined in subsection 2(1) of the Act, is any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*, any effect of any such changes on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes by Aboriginal persons, or any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance, as well as any change to the project that may be caused by the environment.

According to the information available, the components to be considered in the environmental assessment include, but are not limited to, the following.

Biological and physical environmental components that may be affected by the project:

- Surface water and groundwater quality
- Air quality
- Soil quality
- Water regime (hydrology and hydrogeology)
- Geology of the environment
- Land and aquatic vegetation
- Wetlands
- Fish and their habitats
- Birds and their habitats
- Terrestrial wildlife and its habitats
- Plant and animal species at risk within the meaning of subsection 2(1) of the *Species at Risk Act* and their habitats, including woodland caribou

- Socio-economic components that may be affected by the project:[2]
  - Current use of lands and resources for traditional purposes by Aboriginal persons
  - Health of users of the territory, including through accumulation of metals in plants and animals
  - Boating and boater safety
  - Socio-economic activities and heritage, historical, cultural, and archaeological resources
  - Safety concerns regarding explosives manufacturing and magazines

This information must be compiled, integrated, and presented in map form at an appropriate scale for impact analysis.

[2] An environmental effect, as defined in subsection 2(1) of the Act, is any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*, any effect of such changes on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes by Aboriginal persons, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, as well as any change to the project that may be caused by the environment.

3.3.4 Malfunctions and accidents

The probability of possible malfunctions or accidents during construction, operation, modification or any other undertaking in relation to the project, and the potential significant adverse environmental effects of such events, will be identified and described in the environmental assessment. The description will include, but not be limited to, the following:

- Accidental spills of hazardous materials
- Risks related to the handling and storage of hazardous or explosive materials
- Contingency plans and measures for responding to emergencies that may involve risks to environmental components

3.3.5 Effects of the environment on the project

Any environmental risks that may affect the project will be described, and the anticipated impacts and consideration of these risks in the design of the project will be documented. The proponent will address the following factors:

- Seismic activity
- The influence of climate conditions, such as the impact of precipitation and temperature during construction and operation

3.3.6 Cumulative environmental effects

Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions. The cumulative environmental effects that may result from the project in combination with other projects or activities that have been or will be carried out will be identified and assessed. The cumulative effects assessment will be carried out on the valued environmental components for which the project has an adverse residual effect and for which cumulative effects are likely to occur.

The proponent will submit a rationale for the geographic and temporal boundaries of the cumulative effects assessment. It should be noted that these boundaries may vary depending on the components selected for cumulative effects assessment. The proponent will propose and justify the projects and activities selected for cumulative effects assessment; these projects should be from the past, present, and future (with a high likelihood of implementation).

3.3.7 Public and Aboriginal consultation by the proponent

The proponent is encouraged to consult the public and Aboriginal persons by producing a consultation/participation plan and to provide details on the project consultations and information sessions it will be offering or has already offered at the local and regional levels. The information required in this regard includes the identification of the groups with which the proponent has met, the concerns they expressed, and the extent to which these concerns were incorporated into the project design and impact assessment.

The federal environmental assessment process includes participation and consultation opportunities for the public and Aboriginal peoples (see section 6 below).

3.3.8 Sustainability of the resource

The environmental assessment will consider the renewable resources that may be significantly affected by the project and the criteria used to determine whether their sustainable use will be compromised.

3.3.9 Mitigation measures

The Act defines “mitigation” as the elimination, reduction or control of the adverse environmental effects of a project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means. Every comprehensive study conducted under the Act must take into account technically and economically feasible measures that would mitigate any significant adverse environmental effects of the project.

The EIS must specify the actions, works, minimal disturbance footprint techniques, best available technology, corrective measures or additions planned during the project’s various phases (construction, operation, modification, decommissioning, closure, or other undertakings related to the project) to eliminate or reduce the significance of adverse effects. The impact assessment must also present an assessment of the effectiveness of the proposed technically and economically feasible mitigation measures. The reasons for judging whether the mitigation measure reduces the significance of an adverse effect must be made explicit.

3.3.10 Follow-up program

An environmental follow-up program for the project must be developed. The purpose of a follow-up program is to verify the accuracy of the assessment of the adverse environmental effects or to determine the effectiveness of the mitigation measures for the environment and resources.

The follow-up program should be finalized prior to the implementation of the project and mitigation measures.

4 PREPARATION OF THE IMPACT ASSESSMENT

The purpose of this section is to help the proponent prepare its impact assessment in order to meet the needs of the federal departments for their analysis of the project in accordance with the requirements under the Act referred to in Section 3 above.

Under section 22 of the JBNQA, the Provincial Administrator has issued a directive for the proponent to conduct an impact assessment that includes the components needed to meet the requirements of the environmental protection regime set out in the JBNQA. Some of the components listed in the directive also appear in this document, along with components or requirements specific to the needs of the federal analysis under the Act.

The proponent is encouraged to produce a single impact assessment that meets the requirements established by the Provincial Administrator and the federal process under the Act. The proponent must provide the Agency with fifteen (15) French hard copies and ten (10) English hard copies of the impact assessment, as well as electronic versions in an appropriate format.

On receipt of the impact assessment, the federal authorities will analyze it to determine its compliance and, if necessary, may request further information from the proponent.

On the basis of the information provided by the proponent, the public and Aboriginal peoples and the expertise of any experts consulted, the Agency will produce a CSR. The CSR will present the conclusions of the environmental assessment, i.e. whether there is a risk that the carrying out of the project will have significant adverse environmental effects, taking into account the appropriate mitigation measures.

The proponent must, to the extent possible, demonstrate that the proposed mitigation measures are technically feasible and will achieve the targeted objectives. The proponent may, for example, refer to comparable diamond mine projects.

4.1 Biological and physical components

The proponent must describe the environment within the study area and the biological and physical components referred to in Section 3.3 above, and the environmental effects of the project on those components must be documented.[3] The information to be provided by the proponent includes, but is not limited to, the following:

- A list of all avian, terrestrial and aquatic wildlife species of interest likely to be present in the study area, and the priority areas and habitats that may be affected. Identify species that have special legal protection status, particularly species that are listed in Schedule 1 to the *Species at Risk Act* or are of special interest.
- A description of the inventories done or data used to determine the presence of species and their habitats (i.e. present and justify the methodology, results and conclusion). Present the abundance, spatial distribution by season and habitat used at each life stage (breeding, moulting, migratory route, etc.).
- A description of the anticipated effects (direct and indirect) of all project components on the identified environmental components and on the species likely to be present and their habitats.
- The determination of the applicable mitigation measures to minimize the impact and of the means put in place to ensure application of the mitigation measures. For species at risk, demonstrate that the project and the proposed mitigation measures are compatible with any applicable action plan and recovery program.
- A description of the proposed follow-up program for verifying the accuracy of the assessment of the effects.

It is strongly suggested that the proponent contact DFO when preparing its impact assessment and carrying out the plans, in order that a determination may be made as soon as possible as to acceptable HADD of fish habitat that may be authorized.

It is important to note that DFO prefers above all to avoid HADD of fish habitat or, if that is not possible, to reduce it. The proponent must justify HADD of fish habitat by demonstrating that it is reduced to the maximum extent possible and that it is impossible to avoid it entirely. If these residual losses of fish habitat are acceptable and do not threaten the resource or species at risk, DFO may issue an authorization to modify fish habitat under subsection 35(2) of the FA. This authorization allows HADD of fish habitat by the means or under the circumstances authorized by DFO.

[3] For example, the proponent may refer if necessary to Environment Canada to obtain the guides and documents developed for inventorying or analyzing impact on migratory birds, species at risk and wetlands.

4.2 Socio-economic components

The federal environmental assessment must above all assess the repercussions of changes that the project is likely to cause in the environment on socio-economic components.

4.2.1 Current use of lands and resources for traditional purposes by Aboriginal persons

For this purpose, the EIS must:

- Describe the current uses for traditional purposes likely to be affected by the project. Identify key species and species valued for hunting or traditional fishing purposes
- Indicate how current use by Aboriginal persons was verified. Provide the information sources
- Describe the effects of the project on current use by Aboriginal persons, as well as any mitigation measures
- Summarize the consultations or exchanges with the Cree who use the territory. Identify the concerns expressed and the extent to which these elements were reflected in the project design and in the impact assessment

4.2.2 Socio-economic activities

The socio-economic components mentioned in Section 3.3, including archaeology, and the impact of environmental changes on these components must be documented. The information to be provided by the proponent includes, but is not limited to, the following:

- A description of current land uses, such as outfitting operations and other recreational activities, tourism, vacation leases and others, that are likely to be affected by the project
- The effects of the project on these uses and any appropriate mitigation measures
- A summary of the consultations and exchanges with the users of the land. Identify the concerns voiced and the extent to which they were incorporated into the project design and into the environmental impact statement
- Currently known sites and archaeological remains, and a description of any mitigation measures that will be implemented

4.2.3 Navigation

The proponent must describe the main navigation features in the project area (type of boats, areas of use, importance, etc.), as well as the disruptions caused by the project on navigation activities. If applying for approval under the NWPA, the proponent must present the following information and documents:

- A table of the undertakings (including backfilling and drainage, if necessary) in the aquatic environment. Indicate:
  a. the type of work
  b. the main geographic coordinates, crossing mid-watercourse (Dms.d, nad 83)
  c. the addition of the geographic coordinates at either end (Dms.d, nad 83)
  d. the characteristics of the watercourse:
     i. width
     ii. minimum and maximum depth during the summer
     iii. bottom type (e.g. sediments, rocks)
     iv. flow type (e.g. lake, stream, river, calm, flowing, fast)
     v. if possible, reference a photo taken of the watercourse in that area during the summer

- A plan for each of these undertakings, indicating the main dimensions and characteristics:
  a. Plan views and elevation
  b. Minimum and maximum water levels during the summer, before and after the work period
  c. If appropriate, the navigation protection measures during the work period and operations phase

Note that during a more in-depth analysis of the project, it could be determined that other components require further approvals from Transport Canada under the NWPA.
For more information on the requirements for application for approvals under the NWPA, the proponent is invited to consult the following guide:
www.tc.gc.ca/eng/quebec/nwp-menu-1424.htm

5 PUBLIC AND ABORIGINAL PARTICIPATION AND CONSULTATION

5.1 Public and Aboriginal participation

Public and Aboriginal participation is a crucial component of the federal environmental assessment process. When the public has the opportunity to participate fully in the process, the quality and credibility of the environmental assessment are enhanced. Observations, comments and concerns expressed by the public following the consultation will be listed in the Canadian Environmental Assessment Registry (CEAR) and made available to the public on request. Personal information will be protected under the *Privacy Act*.

Documents will be made available to the public through the CEAR and at specific locations, including Chibougamau and Mistissini. Meetings may be held with target groups during the second participation and consultation opportunity.

The public and Aboriginal communities will have three opportunities to submit comments:

First consultation (in progress)
At this stage of the environmental assessment of the project, the public is invited to submit its observations, comments and concerns on the following aspects:

- The project
- The conduct of the comprehensive study

Following the submission of comments by the public, the Agency may, if necessary, amend this environmental assessment scoping document to take into account comments received.

Second consultation during the comprehensive study (pending)
During this stage, the public is invited to comment on the results of the environmental assessment of the project. In this context, the presence of the proponent is required. The proponent must contribute by preparing appropriate material (executive summaries, visual aids, map products, tables, etc.) for facilitate consultation.

Third consultation on the Comprehensive Study Report (pending)
Once the Agency has submitted the CSR to the Minister of the Environment, the public has a final opportunity to submit feedback and comments to inform the Minister’s decision on the environmental assessment.

5.2 Aboriginal consultation

As part of its regulatory capacity, the federal government has an obligation to consult First Nations whose rights may be adversely affected. The Aboriginal community identified for this consultation is Mistissini. Since the proponent's co-operation is crucial to ensure that the consultation proceeds smoothly, the proponent's impact assessment must:

- produce a list of potential impacts on the above-mentioned community and on all other communities if, during the assessment, the proponent believes that other communities may be affected
- provide clear maps and tables that can be used during a consultation to explain the identified impacts
- clearly explain the impacts of the project on plant and animal species of interest that are present in the study area

The impact assessment must also describe any other concerns expressed by Aboriginal persons, including members of the Mistissini community, who may contribute to the environmental assessment.

Furthermore, to ensure effective Aboriginal participation, it is suggested to submit the impact assessment and prepare a summary of the impact assessment in both official languages. It is also recommended to prepare material to facilitate public and Aboriginal consultation, such as PowerPoint presentations, maps, and other informational material.

6 PUBLIC REGISTRY

With the implementation of the Act, the Government of Canada is committed to facilitating public participation in the environmental assessment of projects and to providing access to the information on which those environmental assessments are based. It is pursuant to this commitment that section 55 of the Act requires the maintenance of a public registry by the responsible authority in relation to each project for which an environmental assessment is conducted.

Any document submitted by the proponent that is relevant to the environmental assessment may be posted on the CEAR and made available to the public on request. Certain confidential or sensitive documents that should be protected and not made public may be excluded from the CEAR. In such cases, the proponent must provide the Agency, which is responsible for maintaining the CEAR, with arguments demonstrating a likely risk of probable harm.

The Canadian Environmental Assessment Registry can be accessed at:
http://www.acee-ceaa.gc.ca/050/index_e.cfm
Reference number: 11-03-55169.
The project will also be posted on the MPMO website at:
http://www2.mpmo-bggp.gc.ca/MPTracker/Project-Projet-01.aspx?pid=154

7 CONTACTS

With regard to the current project, the contact information for the federal assessment is the following:

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8 DOCUMENTS CONSULTED

Stantec, 2010. Notice of Intent: Renard Diamond Mine. 28 pages + appendices.

ROCHE, 2011. Les Diamants Stornoway (Canada) inc. Modification à l'avis de projet – Projet diamantifère Renard. 57 pages + appendices.

Directive of the Provincial Administrator. June 2010. Document présentant les instructions pour la préparation du rapport d'étude d'impacts pour le projet d'exploitation minière diamantifère Renard.

Appendix 2.3.1

Register of Permits, Authorizations, Approvals, Attestations, and Leases that May Be Required

Annexe 2.3.1 Registre des permis, autorisations, approbations, attestations et baux susceptibles d'être requis

Description	Ministère	Règlement/Loi/Code	Commentaires
Gouvernement provincial			
Autorisations			
Certificat d'autorisation pour la réalisation d'un projet minier *Construction d'une piste d'atterrissage* *Installation d'une prise d'eau dans le lac Poisson et le lac Lagopède* *Entreposage des sédiments dragués* *Détournement de cours d'eau* *Construction et exploitation d'une centrale électrogène* *Exploitation minière (fosses, haldes et parc à résidus)* *Exploitation de l'usine de traitement du minerai* *OER - eaux industrielles traitées (exploitation minière)* *Entrepôt d'explosifs et bâtiment de service* *Installation et opération d'un séparateur d'hydrocarbures-Garage-Centrale électrogène* *Lieux d'enfouissement en tranchées* *Gestion et entreposage des matières dangereuses* *Incinération des huiles usées à des fins énergétiques* *Incinérateur - Gestion des déchets* *Usine de béton mobile Lagopède* *Exploitation de sable et de gravier (bancs d'emprunt)*	MDDEP	Article 22 de la *Loi sur la qualité de l'environnement* (L.R.Q., C. Q-2)	Le nombre de demandes de certificat d'autorisation dépendra de l'échéancier du projet et des lots de travail qui y sont prévus.
Autorisation pour réaliser une activité susceptible de modifier un habitat faunique *Les activités touchant à l'habitat du poisson (détournement de cours d'eau, assèchement de plans d'eau et de cours d'eau, etc.)* *Ne s'appliquent pas aux quais, sentiers, chemins, ponceaux et ponts qui sont construits conformément aux conditions de la section VI du* Règlement sur les habitats fauniques	MRNF - Faune	Article 128.7 de la *Loi sur la conservation et la mise en valeur de la faune* (L.R.Q., c.C-61.1) Section VI de la *Loi sur les habitats fauniques*	Art. 128.7. Le ministre peut autoriser la réalisation d'une activité qui modifie un habitat faunique. Dans le cas présent, le seul habitat faunique visé est l'habitat du poisson. Ainsi, cette demande d'autorisation sera faite conjointement à la demande de certificat d'autorisation en vertu de l'article 22 de la LQE. En effet, pour les activités prévues dans les milieux aquatiques et humides, le MRNF a établi avec le MDDEP un guichet unique pour la délivrance des autorisations requises en vertu de la *Loi sur la qualité de l'environnement* et de la *Loi sur la conservation et la mise en valeur de la faune* .
Autorisation d'échantillonnage en vrac *Échantillonnage en vrac de plus de 50 tonnes métriques*	MRNF - Mines	Article 59 de la *Loi sur les mines (L.R.Q., chapitre M-13.1)*	Le contenu d'une requête d'échantillonnage en vrac est spécifié à l'annexe 5 du «Guide et modalités de préparation du plan et exigences générales en matière de restauration des sites miniers au Québec».
Autorisation relative à l'installation d'appareil ou équipement destiné à prévenir, diminuer ou faire cesser le dégagement de contaminants dans l'atmosphère	MDDEP	Article 48 de la *Loi sur la qualité de l'environnement* (L.R.Q., C. Q-2)	S'applique aux sources d'émissions ponctuelles. Pour l'installation de dépoussiéreurs aux installations de concassage, de filtres à l'usine électrogène, etc. Art. 48. Quiconque a l'intention d'installer ou poser un appareil ou équipement destiné à prévenir, diminuer ou faire cesser le dégagement de contaminants dans l'atmosphère, doit en soumettre les plans et devis au ministre et obtenir son autorisation. Restriction: Le présent article ne s'applique pas aux véhicules automobiles ni aux embarcations à moteur. Il ne s'applique pas au titulaire d'une attestation d'assainissement qui a l'intention d'installer ou de poser, dans un établissement industriel pour lequel une attestation lui a été délivrée, un appareil ou un équipement destiné à prévenir, à diminuer ou à faire cesser le dégagement de contaminants dans l'atmosphère.
Autorisation relative à l'aménagement de prises d'eau, de dispositifs de traitement de l'eau potable et des eaux usées *Campement- permanent (eaux usées)* *Campement - permanent (eau potable)* *OER - eaux sanitaires traitées (campement permanent)*	MDDEP	Article 32 de la *Loi sur la qualité de l'environnement* (L.R.Q., C. Q-2)	
Autorisation relative à la construction de barrage à forte contenance *Barrage du Lac Lagopède*	Centre d'expertise hydrique du Québec - MDDEP	Article 5 de la *Loi sur la sécurité des barrages* (L.R.Q., chapitre S-3.1.01) Section VI du *Règlement sur la sécurité des barrages* (c. S-3.1.01, r. 1)	**Barrages à forte contenance** • Barrage d'une hauteur de 1 mètre ou plus dont la capacité de retenue est supérieure à 1 000 000 m^3 • Barrage d'une hauteur de 2,5 mètres ou plus dont la capacité de retenue est supérieure à 30 000 m^3 • Barrage d'une hauteur de 7,5 mètres ou plus, sans égard à la capacité de retenue **Barrages à faible contenance** • Barrage d'une hauteur de 2 m ou plus qui n'est pas à forte contenance. Les principales mesures s'appliquent aux barrages à forte contenance. La *Loi sur la sécurité des barrages* instaure une série de mesures encadrant la construction, la modification et l'exploitation des barrages à forte contenance. En outre, elle exige des propriétaires qu'ils assurent une surveillance et un entretien réguliers de leurs ouvrages. De concert avec les municipalités et les MRC concernées, des plans d'urgence devront également être produits pour les barrages présentant des risques pour la sécurité des personnes. Les propriétaires de barrages à forte contenance devront faire réaliser, par un ingénieur, une évaluation de la sécurité de leurs ouvrages.
Approbation			
Approbation relative à la localisation de l'usine de concentration et la disposition des résidus miniers	MRNF - Mines	Articles 240 et 241 de la *Loi sur les mines* (L.R.Q., chapitre M-13.1) Articles 124 et 125 du *Règlement sur les substances minérales autres que le pétrole, le gaz naturel et la saumure* (c. M-13.1, r. 2)	
Attestation			
Attestation d'assainissement (Programme de réduction des rejets industriel)	MDDEP	Article 31.10 de la *Loi sur la qualité de l'environnement* (L.R.Q., C. Q-2) *Décret 515-2002, 1er mai 2002 Concernant l'application de la sous-section 1 de la section IV.2 du chapitre I de la Loi sur la qualité de l'environnement au secteur de l'industrie minérale et de la première transformation des métaux*	L'attestation d'assainissement diffère du certificat d'autorisation délivré en vertu de l'article 22 de la *Loi sur la qualité de l'environnement*, car ce certificat est un acte statutaire préalable à la réalisation d'un projet ou d'une activité, tandis que l'attestation d'assainissement s'applique spécialement à l'exploitation d'un établissement industriel. L'attestation d'assainissement contient, pour chaque établissement industriel assujetti, des conditions d'exploitation qui concernent autant les rejets dans l'eau, les émissions atmosphériques et les matières résiduelles que les milieux récepteurs. Le document regroupe donc l'ensemble des exigences environnementales d'exploitation auxquelles l'établissement doit se conformer.

Annexe 2.3.1 Registre des permis, autorisations, approbations, attestations et baux susceptibles d'être requis

Description	Ministère	Règlement/Loi/Code	Commentaires
Permis			
Permis d'intervention en milieu forestier pour des activités minières *Toutes les activité de déboisement*	MRNF- Forêts	Chapitre I, Section I et II de la *Loi sur les forêts* (L.R.Q., chapitre F-4.1) *Règlement sur les normes d'intervention dans les forêts du domaine de l'État* (c. F-4.1, r. 7)	Un permis d'intervention est accordé pour une période d'au plus 12 mois. Art. 20 de la *Loi sur les Forêts* . Le ministre délivre un permis d'intervention au titulaire d'un droit minier qui lui en fait la demande par écrit aux fins d'exercer les droits que lui confère la Loi sur les mines (chapitre M-13.1). Art. 21 de la *Loi sur les Forêts* . Le permis autorise son titulaire à réaliser, selon les modalités qui y sont prévues, les activités d'aménagement forestier requises pour l'exercice de ses droits.
Permis d'occupation pour un ouvrage permettant le captage ou le rejet d'eau *Prise d'eau dans le lac Poisson* *Prise d'eau dans le lac Lagopède*	Centre d'expertise hydrique du Québec - MDDEP	Article 10 du *Règlement sur le domaine hydrique de l'État* (c. R-13, r. 1.1)	
Permis d'explosifs (permis général, permis de dépôt et permis de transport)	Sûreté du Québec	*Loi sur les explosifs* (L.R.Q., c. E-22, a. 22) Section II du *Règlement d'application de la Loi sur les explosifs* (c. E-22, r. 1)	
Permis d'utilisation pour des équipements pétroliers à risque élevé *Site minier* *Piste d'atterrissage*	Régie du bâtiment du Québec	Article 120 du *Code de sécurité* (c. B-1.1, r. 0.01.01.1) Article 8.12 du *Code de construction* (c. B-1.1, r. 0.01.01)	Pour les systèmes d'entreposage souterrains : • 500 litres et plus contenant de l'essence, du diesel; • 4 000 litres et plus contenant de l'huile à chauffage et du mazout lourd à l'exclusion des équipements utilisés pour le chauffage résidentiel de type unifamilial; Pour les système d'entreposage hors sol : • 2 500 litres et plus contenant de l'essence; • 10 000 litres et plus contenant du diesel; • 10 000 litres et plus contenant de l'huile à chauffage et du mazout lourd à l'exclusion des équipements utilisés pour le chauffage résidentiel de type unifamilial; • réservoirs utilisés à des fins lucratives contenant de l'essence, du carburant diesel, de l'huile à chauffage et du mazout lourd, quelle que soit leur capacité.
Baux			
Baux Miniers	MRNF - Mines	Article 100, Section V de la *Loi sur les mines* (L.R.Q., chapitre M-13.1)	
Bail non-exclusif pour l'exploitation de substances minérales de surface *Bancs d'emprunt, carrières et sablières*	MRNF - Mines	Article 140, Section VII de la *Loi sur les mines* (L.R.Q., chapitre M-13.1)	Si les sites sont inclus dans les baux miniers, ce bail n'est pas nécessaire. S'ils sont à l'extérieur, il faut le demander: Art.109 de la *Loi sur les Mines* . Le locataire et le concessionnaire peuvent utiliser, pour leurs activités minières, le sable et le gravier faisant partie du domaine de l'État, sauf si le terrain qui fait l'objet du bail fait déjà l'objet, en faveur d'un tiers, d'un bail exclusif d'exploitation de substances minérales de surface.
Bail d'occupation du domaine de l'État *Haldes et parc à résidus* *Campement* *Piste d'atterrissage* *Poudrière* *Lieu d'enfouissement en tranchées*	MRNF - Territoire	Article 239 de la *Loi sur les mines* (L.R.Q., chapitre M-13.1) Article 47 Section II de la *Loi sur les terres du domaine de l'État* (L.R.Q., chapitre T-8.1) Article 35 du *Règlement sur la vente, la location et l'octroi de droits immobiliers sur les terres du domaine de l'État* (c. T-8.1, r. 7)	Si les sites sont situés à l'extérieur des baux miniers.
Avis au ministre			
Avis au ministre pour l'établissement d'un campement industriel	MDDEP	Article 2 du *Règlement sur les conditions sanitaires des campements industriels ou autres* (c. Q-2, r. 11)	Art. 2. Avis au ministre: Tout employeur qui se propose d'établir un campement permanent, un campement permanent d'été ou un campement temporaire, doit aviser le ministre, des campements anciens et nouveaux qu'il projette d'utiliser durant la prochaine saison d'exploitation. Le ministre doit être avisé au moins 3 semaines avant le début de la construction ou de l'installation des campements ou de la réouverture des campements anciens.
Gouvernement fédéral			
Autorisation			
Autorisation de modifier l'habitat du poisson *Toutes les activités touchant à l'habitat du poisson*	Pêches et Océans Canada	Article 35 de la *Loi sur les Pêches* (L.R.C., 1985, ch. F-14)	
Licence			
Licence pour fabriques d'explosifs	Ressources naturelles Canada	Article 7(1)a) de la *Loi sur les explosifs* (L.R.C., 1985, ch. E-17) Article 25 du *Règlement sur les explosifs* (C.R.C., ch. 599)	
Enregistrement			
Enregistrement d'un aérodrome[1]	Transports Canada	Article 301.03 du *Règlement de l'aviation canadien*, Partie III, Sous-partie 1 - Aérodromes	Ce processus est laissé à la discrétion du client. L'enregistrement de l'aérodrome est une procédure facultative qui offre l'avantage d'être publié dans le *Supplément de Vol du Canada* et d'être publié sur les cartes de navigation aérienne. L'objectif est d'assurer aux usagers un niveau minimal de sécurité, rencontrant les exigences de la réglementation ainsi que la diffusion et la reconnaissance des informations publiées aux usagers reliées aux caractéristiques de l'aérodrome. (http://www.tc.gc.ca/fra/quebec/aerodromes-certification-1491.htm)
Municipalité de Baie-James (municipalité hors MRC)			
Certificats			
Certificat de conformité aux réglementations municipales - Infrastructures de services	–	*Loi modifiant la Loi sur le développement de la région de la Baie James et d'autres positions législatives* (Projet de loi n°40)	
Certificat de conformité aux réglementations municipales - Route	–		
Certificat de conformité aux réglementations municipales - Campement	–		
Certificat de conformité aux réglementations municipales - Infrastructures Piste d'atterrissage	–		
Permis			
Permis pour ouvrage individuel de captage des eaux souterraines (Piste d'atterrissage)	–	*Loi modifiant la Loi sur le développement de la région de la Baie James et d'autres positions législatives* (Projet de loi n°40)	
Permis pour installation septique (Piste d'atterrissage)			

[1] *Aérodrome : Toute étendue de terre ou d'eau (y compris la portion du plan d'eau qui est gelée), ou une autre surface d'appui utilisée ou conçue, aménagée, équipée ou tenue en disponibilité pour servir, dans son intégralité ou en partie, aux arrivées, aux départs, aux mouvements ou à l'entretien courant des aéronefs, et comprend tous les bâtiments, installations et équipements connexes.*

Appendix 3.2.1

Site Selection Study for the Processed Kimberlite Containment Facility for the Renard Project **(Golder, February 18, 2011)**

Appendix 3.2.1

Available in digital format on the CD at the end of Volume 2

Appendix 3.6.1

Static and Kinetic Testing of Waste Rock, Kimberlite and Processed Kimberlite of Renard Project, Quebec
(Golder, November 17, 2011)

Appendix 3.6.1

Available in digital format on the CD at the end of Volume 2

Appendix 3.7.1

Feasibility Design Report for Processed Kimberlite Containment Facility (Golder, October 14, 2011)

Appendix 3.7.1

Available in digital format on the CD at the end of Volume 2

Appendix 3.10.1

Dispersion Plume Modelling for the Domestic and Mine Effluents (Environnement Illimité Inc., 2011)

ENVIRONNEMENT ILLIMITÉ INC.

Renard Project
Mine and Domestic Effluent Modeling
Final Version

Presented to *Roche Ltd., Consulting Group*

By *Environnement Illimité*

Version/Revision	Date	Prepared by	Reviewed by	Approved by	Revision Date
Final	2011/12/21	Maud Demarty Patrick Lafrance	Patrick Lafrance	Stephane Lorrain	2011/12/21

Project Director

Project Lead

December 2011

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B) Operation Phase

1 INTRODUCTION

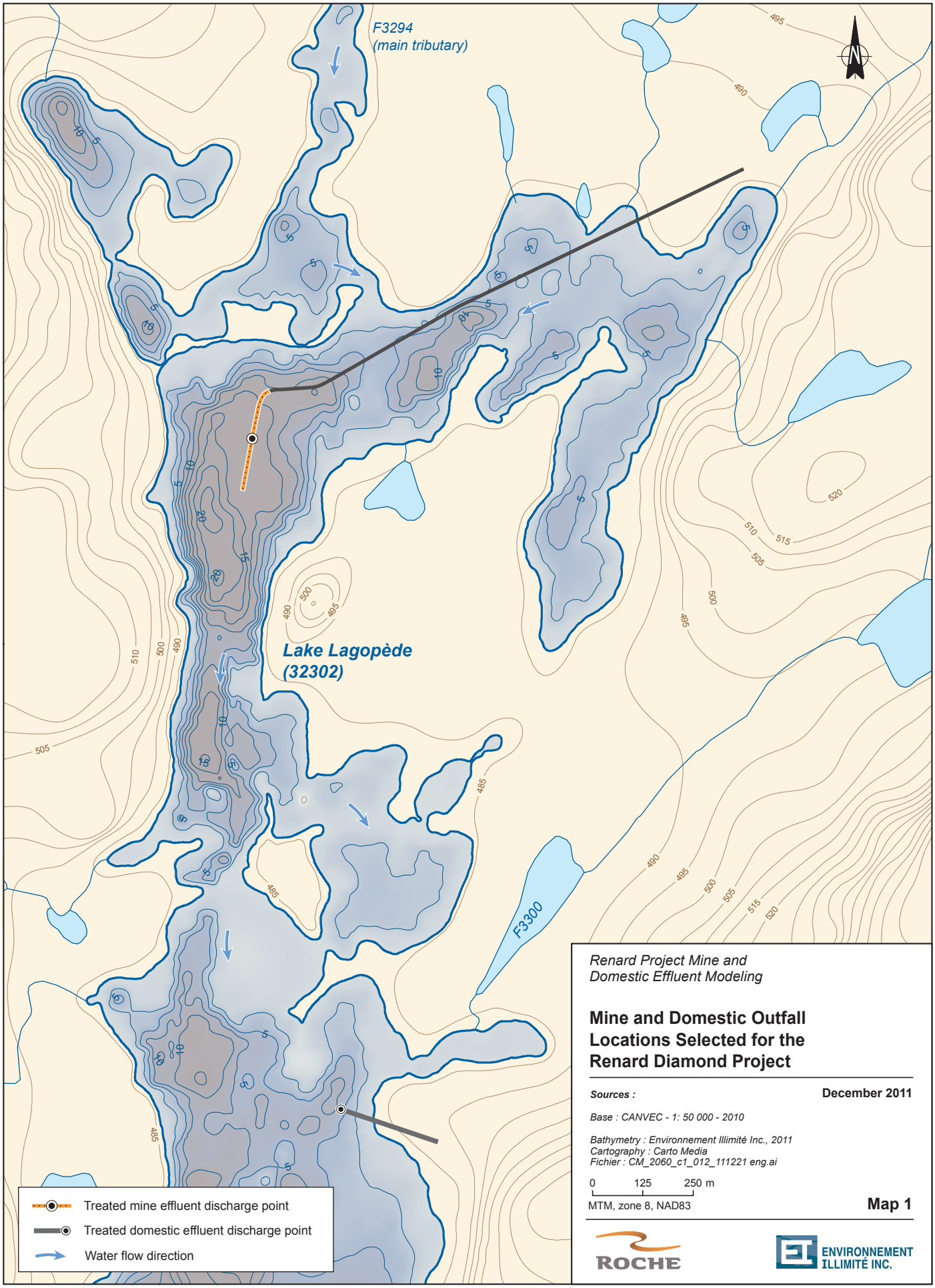
1.1 Context

Stornoway Diamonds Canada, Inc. wishes to develop the diamond deposit at the "Foxtrot Property" located in the James Bay area in the Nord-du-Quebec region. As part of the Renard diamond project environmental and social impact assessment, Roche Ltd, Consulting Group awardedthe firm Environnement Illimité, Inc. the manadate to carry out a plume dispersion modeling of the treated mine and domestic effluents in order to evaluate their dilution in the environment.

1.2 Assessment Area

The site selected by Stornoway Diamonds Canada, Inc. for the mine effluent outfall is located 340 m downstream from Lake Lagoped's main tributary (F3294) , at a depth of approximately 11 to 13 m (Map 1). The treated effluent discharge point was selected based on a site alternative analysis carried out as part of the the impact assessment. The outfall pipe runs 1.0 km underwater and has a diameter of 0.25 m. A diffuser will be installed on the downstream end of the pipe. The diffuser will have a length of 250 m and have 50 discharge ports of 0.04 m in diameter approximately 5 m apart. The ports are on the top of the diffuser. The position of the outfall was optimized to take advantage of the current from the lake's main tributary and to maximize dispersion of the treated effluent. In addition, the diffuser will spread the effluent over a larger area and facilitate dilution.

The site selected for the domestic effluent outfall is located approximately 45 m from the left bank of Lake Lagopede, approximately 250 m downstream from the mouth of the F3300 subwatershed tributary, at a depth of approximately 7 m (Map 1). Similar to the mine effluent outfall site, the domestic effluent discharge point was selected based on a site alternative analysis carried as part of the impact assessment. The outfall pipe runs 100 m underwater and has a diameter of 0.2 m.



Renard Project Mine and Domestic Effluent Modeling

Mine and Domestic Outfall Locations Selected for the Renard Diamond Project

Sources :

December 2011

Base : CANVEC - 1: 50 000 - 2010

Bathymetry : Environnement Illimité Inc., 2011
Cartography : Carto Media
Fichier : CM_2060_c1_012_111221 eng.ai

0 125 250 m

MTM, zone 8, NAD83

Map 1

ROCHE

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1.3 Objectives

The first objective of the modeling is to evaluate the initial dilution levels around the project's planned mine and domestic effluent discharge points. The second objective of the modeling is to evaluate the mine and domestic effluent mixing zones in the receiving environment. In the mixing zone, the water quality criteria can be exceeded providing there is no risk of acute toxicity for the aquatic organisms. At the limit of this zone, the water quality criteria for the protection of use apply (drinking water, fish consumption, recreational activities, aquatic life, etc.). According to the *Calculation and Interpretation of Effluent Discharge Objectives for Contaminants in an Aquatic Environment Guide*[1] from the Ministère du Développement Durable, de l'Environnement et des Parcs (MDDEP) the mixing zone in a lake, reservoir, or enclosed bay is determined by the most constraining of the following limits:

- for all contaminants, with the exception of phosphorus and fecal coliform, a length corresponding to the distance between the discharge point and the plume surfacing point; if the plume does not surface, the length of the mixing zone is limited to the zone with concentrations from the initial dilution (which corresponds to the boundary of the near-field region in a modeling).
- for all contaminants, with the exception of phosphorus and fecal coliform, a modelled dilution estimate does not exceed a dilution that would be allowed at the lake outlet during low-flow periods; if it is exceeded, the dilution at the lake outlet will be used for the EDO calculation;
- for all contaminants, with the exception of phosphorus and fecal coliform, a maximum dilution of 1 in 10.

Roche, Ltd, proposed environmental discharge objectives (EDO) for the preliminary design of the mine wastewater treatment facilities based on initial discussions with the MDDEP. For all parameters, except total phosphorus, these discharge objectives correspond to a theoretical concentration equal to five (5) times the chronic toxicity criterion of the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP). The dilution required to respect the water quality criteria for the theoretical EDO must be greater than 5. For total phosphorus, a general approach was used to establish the EDO in order to account for the domestic outfall that will discharge treated domestic wastewater downstream from the mine outfall, in the south part of the lake. The EDO, the water quality criteria, and the anticipated concentrations at the mine effluent discharge point as a function of the mine water treatment facilitiess are detailed in Section 3.1 of the report.

[1] Ministère du Développement Durable, de l'Environnement et des Parcs (MDDEP). 2007. *Calculation and Interpretation of Effluent Discharge Objectives for Contaminants in an Aquatic Environment*, 2nd edition, Quebec, Ministère du Développement Durable, de l'Environnement et des Parcs, State of Environment Branch, ISBN-978-2- 550-49172-9 (PDF), 56 p. and 4 appendices.

2 METHODOLOGY

2.1 Modeling and Analysis Approach

To obtain the best profile of the mine and domestic effluent plume dispersion and dilution in Lake Lagopede, three approaches were used: a dilution limit calculation, an initial dilution modeling using the CORMIX numerical model, and finally a plume dispersion modeling using the CE-QUAL-W2 hydrodynamic model. A description of the three approaches is presented in the following sections.

2.1.1 Dilution Limit

The ratio between the ambient flow rate and the effluent flow rate is the simplest way to evaluate the possible dilution in the environment. It allows for the evaluation of the dilution that would be obtained if the treated effluent was only mixed with the clean water input calculated at the discharge point. This estimate allows to refine the discussion on the modelling result used in this project.

The dilution limit for the treated mine effluent was determined by calculating the ratio between the ambient flow rate (lake inflow is upstream from the planned discharge point site, the F3294 tributary) and the mine effluent flow rate.

For the treated domestic effluent, the same approach was used by calculating the ambient flow rate ratio (lake inflow from the F3300 tributary, Map 1) and the planned flow for the operation phase.

2.1.2 CORMIX Modeling

The Cornell Mixing Zone Expert System (CORMIX) numerical model was used to calculate the initial dilution in the area surrounding the proposed discharge points and the length of the mixing zone. The model is supported by the US Environmental Protection Agency and is recommended by the MDDEP for this type of project.

The discharge modeling in a lake environment poses several constraints and could be more complex than for a river environment. For Lake Lagopede, the lake morphology translates to a confined area with low current velocity , making the geometry of the outfall (outfall location and orientation, pipe diameter, use of a diffuser, etc.) an important criteria that will impact the initial dilution of the effluent in the receiving environment.

It is important to note that the results obtained are specific to the premises used for the modeling and a modification to one of the premises is likely to generate different results.

2.1.3 CE-QUAL-W2 Modeling

2.1.3.1 The CE-QUAL-W2 Model

CE-QUAL-W2 is a 2D hydrodynamic model (longitudinal - vertical, Figure 1) that simulates water quality. The US Army Engineers Research Development Centre supports it, and a group of scientists at the Water Quality Research Group at the University of Portland continues to develop the model. The scientific community recognizes the use of this model that has been used in numerous reservoir, lake, river, and estuary studies.

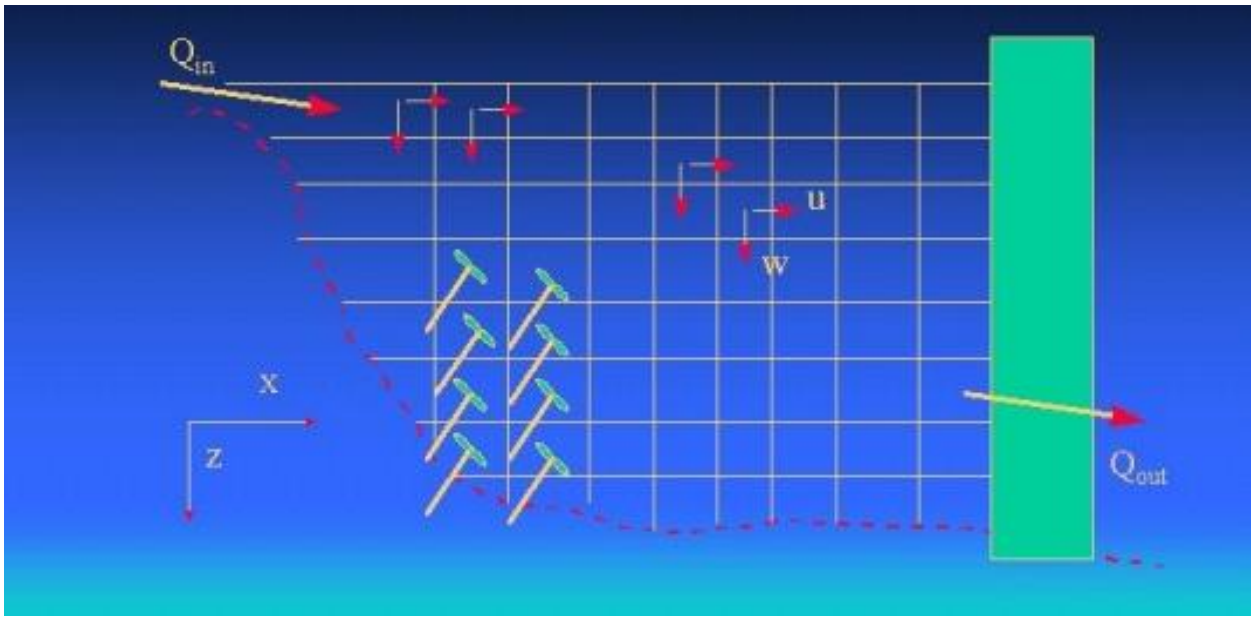


Figure 1: 2D Hydrodynamic Model Schematic Representation
(adapted from http://www.ce.pdx.edu/w2/download_model_information.html)

This model integrates all the hydrological lake inflows, the meteorological conditions (wind direction and velocity, air temperature, dew point and solar radiation) as well as the following lake water quality parameters: basic physico-chemical parameters (dissolved oxygen, temperature, pH, alkalinity, etc.), major ions, nutrients, and generic parameters such as potential contaminants.

2.1.3.2 Input for the Lake Lagopede Modeling

For the Renard Project, the model was used to evaluate the treated mine and domestic effluent plume dispersions over a period of approximately four months. The detailed depth analysis of Lake Lagopede was first used to give a 2D (longitudinal and vertical) representation of the

domain for the simulations. The lake was divided into four branches totalling 47 segments (Map 2). Branch 1 constitutes the main section of the study. The main tributaries were also integrated into the model and contribute to the water inflow in their respective segments (Map 2).

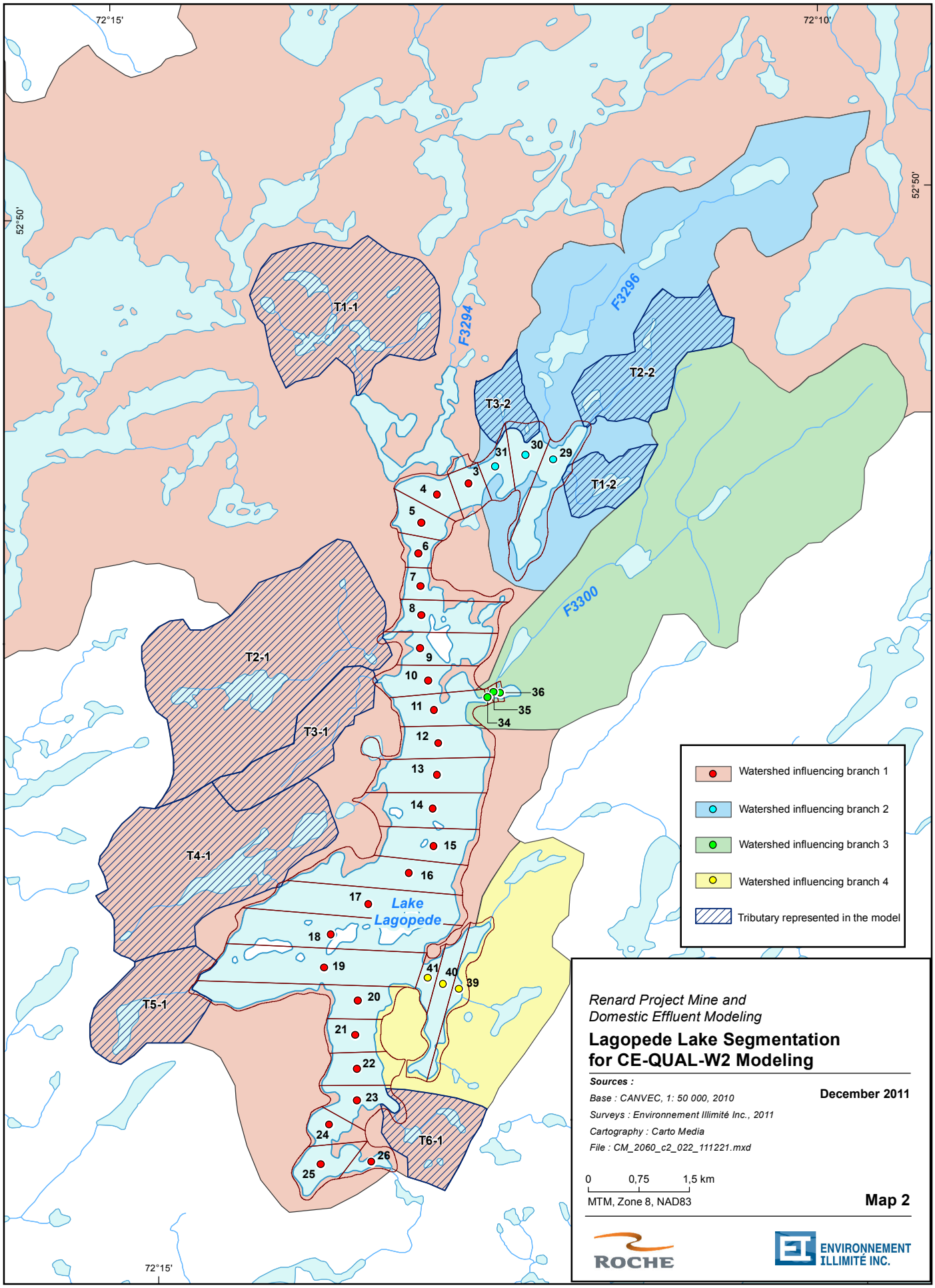
The flow data for the various tributaries was estimated based on data from an hydrological station installed on Lake Lagopede's main tributary. The data from these stations were used to estimate the flow per surface unit and thus allowed to calculate the flow of the various sub-watersheds that drain the lake over the simulation period.

The water temperature of the tributaries was obtained from nine thermistors installed in the main tributaries of Lake Lagopede. However, it is important to note that no time series of water temperature was available for Lake Lagopede for the summer of 2011. Only a few profiles dating from May 31 to September 22, 2011 were available. The meteorological data (air temperature, dew point, wind velocity, wind direction, and solar radiation) were obtained from the weather station at Camp Lagopede.

The main data for the water quality parameters comes from monitoring done in the summer of 2010, with measurements taken on July 9 and September 4, 2011 (see Appendix 1). The values from the AQR1, AQR9, AQR10, AQR11, AQR12 stations were used to create the time series for each variable.

Certain data (e.g.: water temperature of the tributaries from August 18 to September 22, 2011 and certain water quality parameters) were not available to build the model. Therefore, certain premises were established to compensate for the missing data. The details of all the premises are presented in Appendix 1.

The modeling input (hydrology, meteorological conditions, and water temperature) corresponds to that observed between June 5 and September 22, 2011.


72°15'
72°10'
52°50'
52°50'
T1-1
F3294
F3296
T2-2
T3-2
T1-2
F3300
T2-1
T3-1
T4-1
T5-1
T6-1
Lake
Lagopede
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Watershed influencing branch 1
Watershed influencing branch 2
Watershed influencing branch 3
Watershed influencing branch 4
Tributary represented in the model
Renard Project Mine and
Domestic Effluent Modeling
Lagopede Lake Segmentation
for CE-QUAL-W2 Modeling
Sources :
Base : CANVEC, 1: 50 000, 2010
Surveys : Environnement Illimité Inc., 2011
Cartography : Carto Media
File : CM_2060_c2_022_111221.mxd
December 2011
0
0,75
1,5 km
MTM, Zone 8, NAD83
Map 2
ROCHE
ENVIRONNEMENT
ILLIMITÉ INC.

2.1.3.3 CE-QUAL-W2 Model Calibration

Generally speaking, the model was calibrated in three steps. The first step consisted of verifying that the input of the tributaries into Lake Lagopede accurately represented the water level variations in the lake for the simulation period (June 5 to September 22). The results of the water level calibration are available in Figure 2. The second step was to verify that the modelled temperature of the lake corresponds to the temperatures measured over the summer 2011. In general, the modelled temperatures correspond relatively well to the water temperature data obtained from May 31 to September 22, 2011 (Figure 3). Ideally, a time series of data for the entire summer would be available to ensure the model accurately represents the forming of the thermocline.

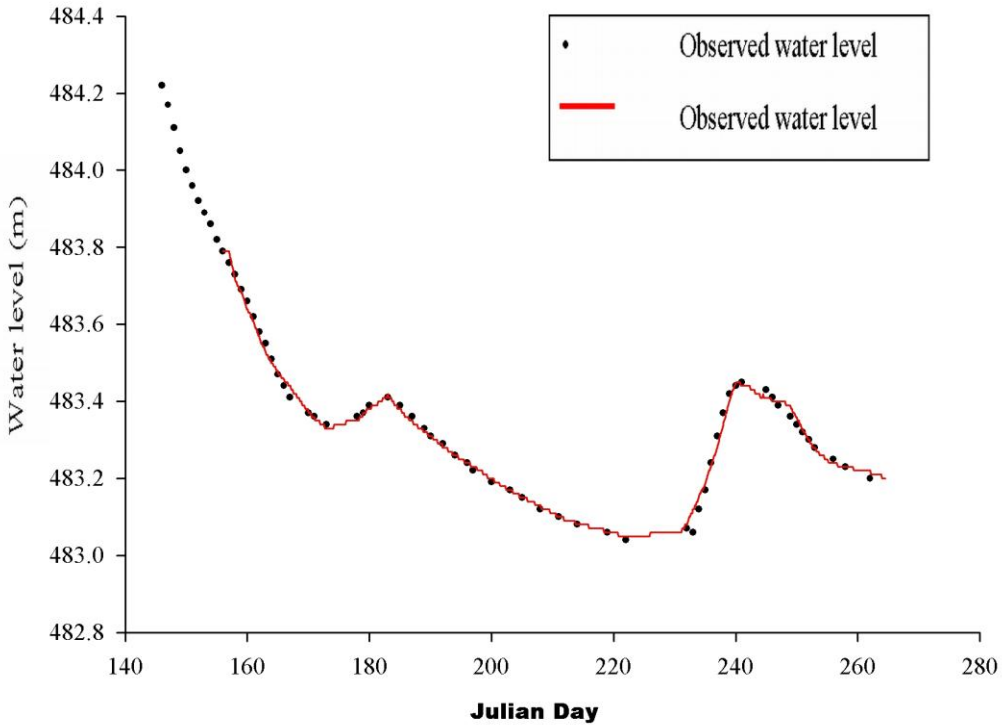


Figure 2: CE-QUAL-W2 Model Calibration: Modelled Water Level - June 5 to September 22, 2011

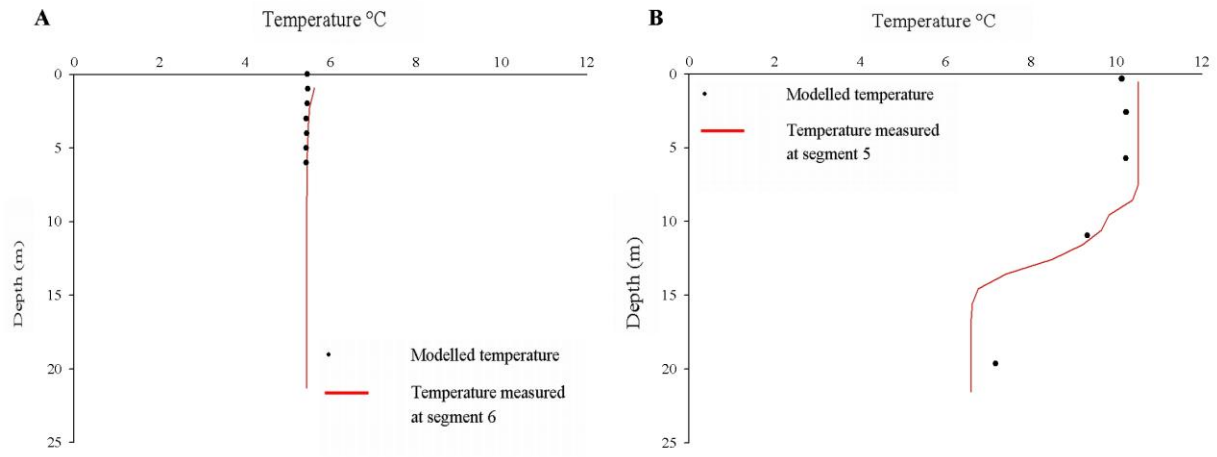


Figure 3: CE-QUAL-W2 Model Calibration: Water Temperature - June 5, 2011 (A), Water Temperature - September 22, 2011 (B)

The final step consisted of ensuring that the model realistically represented the water quality parameters measured in Lake Lagopede. Therefore, the results of the model were compared to the median values measured during the project's various water quality campaigns (Table 1). The water quality data for all the parameters corresponds relatively well to the median values obtained during the campaign carried out in September 2010. Ideally, a time series of water quality data for the summer 2011 would be available to compare the precise values obtained on a given day with the measurements carried out in the field.

Once these three steps were completed, the treated mine effluent and domestic effluent were added independently to the model to evaluate their dispersion.

It is important to note that the results obtained are specific to the premises used for the modeling and a modification to one of the premises is likely to generate different results.

Table 1: Comparison between the median values measured and the modelled values for the main water quality parameters for Lake Lagopede

Basic Physico-Chemical Parameters	**Parameter**	**Oxygen**	**Water Temperature**	**pH**	**Total Alkalinity**	**Total suspended solids**	**Total Dissolved Solids**				
	Unit	**ppm**	**°C**		**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**				
	Measured data*	7.9	15.5	5.75	2.00	2.00	17.00				
	Modelled data**	8.9	15.0	6.54	2.02	1.06	24.0				
Ions and Major Nutrients	**Parameter**	**Total Kjeldahl nitrogen**	**Nitrates and Nitrites**	**Ammonia nitrogen**	**Total Phosphorus**	**Ortho-phosphates**	**Calcium**	**Magnesium**	**Sodium**	**Sulphates**	**Chlorides**
	Unit	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**
	Measured data*	0.39	0.02	0.02	0.006	0.003	0.75	0.20	0.50	1.1	0.30
	Modelled data**	0.37	0.02	0.03	0.004	0.001	0.73	0.21	0.46	1.04	0.20
Metals and Metalloids	**Parameter**	**Aluminum**	**Cadmium**	**Copper**	**Lead**	**Iron**					
	Unit	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**	**mg/L^{-1}**					
	Measured data*	0.100	0.002	0.001	0.004	0.001					
	Modelled data**	0.082	0.001	0.003	0.001	0.035					

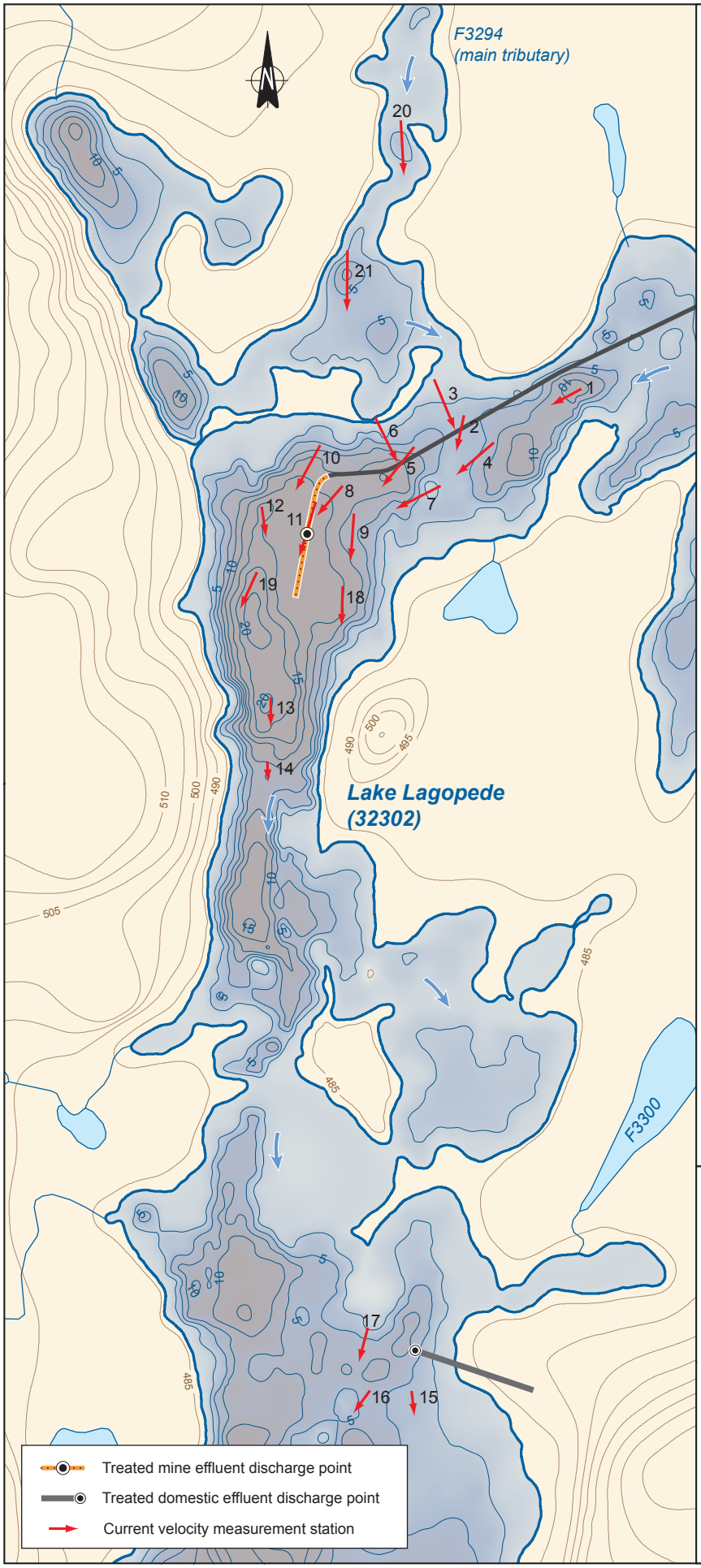
* The measured data comes from 2010 water quality monitoring, with measurements taken on September 4, 2010. The values from the AQR1, AQR9, AQR10, AQR11, AQR12 stations were used to create the time series for each variable.

** The modelled values are from segment 5.

2.2 Field Surveys

Current velocity measurements were carried out at various potential outfall locations (Map 3). The current velocities were measured on September 21 and 22, 2011. When the measurements were taken, the total inflow into Lake Lagopede was estimated at 2.39 m³/s of which 1.2 m^3/s originated from the main tributary (F3294) and 0.06 m^3/s from the F3300 tributary.

The current velocities were measured with two types of instruments, either an Acoustic Doppler Current Profiler (ADCP) from RD Instruments (model: Sentinel 600kHz) or a Vector-type Doppler current meter. The RD Instruments current meter was set up at the bottom of the lake with the transducers facing the surface of the water. The Vector current meter was affixed to the RD Instruments current meter. The instruments were installed at each of the stations for a period of at least 20 minutes. The average current velocity calculated by the RD Instruments current meter represents the speed measured at approximately 1.0 to 1.5 m from the bottom at the first valid cell near the transducers. The measurement obtained by the Vector current meter represents the speed 0.40 m from the bottom. The results obtained from the various stations are available on Map 2. In general, the current velocities measured by the Vector current meter are lower than those measured by the RD Instruments current meter. Therefore, these results were used for the modeling in order to have a more conservative scenario.



Station	Current Velocity (m/s)	Direction (°)	Measurement depth (m)
600 kHz Rio Grande ADCP Current Meter			
1	0.06	241.40	10.48
2	0.06	191.89	3.09
3	0.09	157.63	0.97
4	0.07	229.12	3.94
5	0.07	218.78	9.15
6	0.09	153.51	1.08
7	0.07	242.86	2.62
8	0.06	220.58	11.09
9	0.07	184.04	6.83
10	0.07	208.53	10.59
11	0.07	197.00	10.53
12	0.05	171.94	14.14
13	0.05	179.99	18.96
14	0.04	178.23	7.41
15	0.05	173.28	3.14
16	0.05	215.41	4.64
17	0.06	194.00	3.78
18	0.06	181.77	11.47
19	0.06	203.93	18.08
20	0.07	176.62	2.95
21	0.08	180.52	6.94
VECTOR Current Meter			
1	0.02		11.18
2	0.01		3.79
3	0.02		1.67
4	0.03		4.64
5	0.03		9.85
6	0.01		1.78
7	0.02		3.32
8	0.02		11.79
9	0.01		7.53
10	0.01		11.29
11	0.05		12.73
12	0.00		14.84
13	0.01		19.66
14	0.02		8.11
15	0.01		3.84
16	0.01		5.34
17	0.00		4.73
18	0.00		12.17
19	0.00		18.78
20	0.01		3.65
21	0.01		7.64

Renard Project Mine and Domestic Effluent Modeling

Current Velocities Measured in Lake Lagopede

Sources :

December 2011

Base : CANVEC - 1: 50 000 - 2010
Bathymetry and current velocities measurements : Environnement Illimité Inc., 2011
Cartography : Carto Media
File : CM_2060_c3_013_111221 eng.ai

0 125 250 m

MTM, zone 8, NAD83

Map 3

ROCHE

ENVIRONNEMENT ILLIMITÉ INC.

3 MINE EFFLUENT OUTFALL

3.1 Anticipated Concentration of the Treated Mine Effluent

Roche Ltd proposed environmental discharge objectives (EDO) for the preliminary design of the mine wastewater treatment facilities based on initial discussions with the MDDEP. For all parameters, except total phosphorus, these effluent discharge objectives correspond to a theoretical concentration equal to five (5) times the chronic toxicity criterion of the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP). To respect the water quality criteria for the theoretical EDO, the required dilution must be greater than 5. For total phosphorus, a general approach was used to establish the EDO to account for the domestic effluent outfall that will discharge treated domestic wastewater downstream from the mine outfall, in the south part of the lake. The EDO proposed by Roche Ltd is 0.075 mg/L.

According to the latest water treatment system alternative proposed by Golder Associates (Golder 2011, 10-1427-0020/5012 no. 061 Rev.0), the anticipated concentration at the discharge site for the various parameters respects the EDO proposed by Roche Ltd and is even lower in several cases. Table 2 presents the effluent discharge objectives proposed by Roche Ltd for each parameter as well as their anticipated concentrations based on the last water treatment system alternative.

3.2 Scenario Premises for the Dilution Limit Calculation

To evaluate the dilution capacity of the ambient environment, the ambient flow rate ratio (lake inputs located upstream from the planned discharge point, F3294 tributary) of the effluent flow rate was calculated. According to the Golder Associates report (Golder 2011, 10-1427-0020/5012 no. 061 Rev.), the anticipated flow rate of the treated mine effluent for the period from May to September is as follows:

- May 20 to June 30: 2,400 gallons (US)/minute or 0.151 m^3/s;
- July 1 to July 31: 2,000 gallons (US)/minute or 0.126 m^3/s;
- August 1 to September 30: 1,450 gallons (US)/minute or 0.091 m^3/s.

The flow rate of the main tributary (F3294) for the period from May to September 2011 was then used to calculate the ratio of the ambient flow rate over the effluent flow rate.

3.3 Scenario Premises for the CORMIX Modeling

The outfall discharge point selected for the project is located 340 m downstream from the F3294 tributary (Lake Lagopede's main tributary), at a depth of approximately 13 m (Figure 4). The outfall pipe runs 1.0 km underwater and has a diameter of 0.25 m. A diffuser will be installed on the downstream end of the pipe. The diffuser will have a length of 250 m and have 50 discharge ports of 0.04 m in diameter approximately 5 m apart. The ports are on the top of the diffuser. The position of the outfall was optimized to take advantage of the current from the lake's main tributary and to maximize dilution. In addition, the diffuser will spread the effluent over a larger area and facilitate dilution.

Two scenarios were modelled for the proposed alternative: scenario 1 corresponds to spring discharge conditions and scenario 2 corresponds to summer discharge conditions. In both cases, the current velocity used to perform the simulations and to represent the conditions in the ambient environment corresponds to the current measurements carried out on September 21 and 22, 2011 with the Vector type current meter.

3.3.1.1 Scenario 1 Premises: May - June

- The anticipated mine effluent flow rate is 2,400 gallons (US)/minute, or 0.151 m^3/s;
- The lake shows no thermal stratification and the water temperature is approximately 6°C;
- The effluent temperature at the discharge point is set at 6°C;
- The flow speed at the planned discharge point corresponds to the average velocity measured with the Vector current meter (near the bottom) at stations 9, 11, 12, 13, 14, 18, and 19 (Map 2). The velocity used for the modeling is 0.02 m/s.

3.3.1.2 Scenario 2 Premises: August

- The anticipated mine effluent flow rate during low-flow periods is 1,450 gallons (US)/minute, or 0.091 m^3/s;
- The water quality data taken during the summer 2010 indicate lake stratification and a thermocline at an approximate depth of 4 to 6 m. The surface water temperature is 17°C, and the bottom water temperature is 5°C;
- The effluent temperature at the discharge point is set at 18°C;
- The currentvelocity at the planned discharge point corresponds to the average velocity measured with the Vector current meter (near the bottom) at stations 9, 11, 12, 13, 14, 18, and 19 (Map 2). The velocity used for the modeling is 0.02 m/s.

Table 3.10.5 Theoritical Effluent dicharge objectives for the mine effluent compared to the design standards for mine wastewater treatment facilities, the water quality criteria for the protection of aquatic life and the current water quality of Lake Lagopede and the overall study area

Parameter	Unit	*Water quality recommendations and criteria for the Protection of aquatic life - Chronic effect*[1]				Technology standards		Theoretical EDO[3]	Projected quality of mine effluent (Design standards) (Golder, 2011)	Surface water quality (2009-2011)						
		Federal recommendations (CCME)		*Provincial criteria (MDDEP)*	Date[2]	Directive 019	MMER[3]			Method detection limit (MDL) for the analysis	Lake Lagopede			Streams and waterways in the study area		
											No. of values	Median	95th percentile	No. of values	Median	95th percentile
Basic physico-chemical parameters																
Water temperature	°C	-	-	statement[l]	1992	-	-	-	4.0	*in situ*	24	15.4	23.2	61	15.8	24.8
pH	pH unit	6.5-9	1987	6.5-9[m]	2006	6 - 9.5	6 - 9.5	**>5.9**	6.5	*in situ*	26	6.71	7.59	64	6.12	7.47
Total suspended solids	mg/l	< from 5 to 25[c]	1999	< from 5 to 25[p]	1999	15	15	**26**	≤15	2	6	<2	<2	44	<2	<2
Ions and major nutrients						-	-	-								
Nitrates and nitrites	mg/l	NO_3: 13, NO_2: 0.197	1987, 2003	NO_3: 2,9[q]; NO_2: 0.02[r]	2003, 2001	-	-	**NO_3: 14.5 NO_2: 0.1**	-	0.02	10	<0.02	0.04	48	<0.02	<0.02
Ammoniacal nitrogen	mg/l	-	-	1.23[s]	1986	-	-	**6.15**	-	0.02-0.05	26	<0.05	0.10	64	<0.05	0.07
Total phosphorus	mg/l	0.004-0.01[d]	2004	0.02[t], 0.03[u] or >50 %[v]	1998;1994 & 2000	-	-	**0.075**	0.07	0.005	6	<0.005	0.007	44	0.006	0.011
Calcium	mg/l	-	-	statement[w]	1995	-	-	-	10.2	0.1-1	28	<1	<1	66	<1	2
Magnesium	mg/l	-	-	-	-	-	-	-	11.9	0.02-1	28	<1	<1	66	<1	<1
Total sodium (Na)	mg/l	-	-	-	-	-	-	-	10	0.2-0.03	13	0.48	1.64	51	0.52	1.15
Potassium	mg/l	-	-	-	-	-	-	-	9.0	0.1	6	0.2	0.2	44	0.2	0.9
Sulphates	mg/l	-	-	500[x]	2008	-	-	**2500**	1.6	0.1	6	1	1.1	44	0.9	5.3
Fluoride	mg/l	0.12		0.2	1989	-	-	**1**	0.8	0.1	4	<0.1	<0.1	4	<0.1	<0.1
Chloride	mg/l	-	-	230[y]	2006	-	-	**1150**	-	0.05	13	0.26	0.31	51	0.23	0.48
Metals and metalloids						-	-	-								
Total aluminium (Al)	mg/l	0.005 to 0.1[e]	1987	0.087[z]	2006	-	-	**0.115**	0.10	0.01-0.03	10	0.08	0.13	48	0.12	0.46
Total antimony (Sb)	mg/l	-	-	0.24	2008	-	-	**1.20**	≤0.004	0.006-0.03	10	<0.03	<0.03	48	<0.03	<0.03
Total arsenic (As)	mg/l	0.005	1997	0.15	2006	0.2	0.5	**0.2**	≤0.001	0.001-0.002	10	<0.002	<0.002	48	<0.002	<0.002
Total barium (Ba)	mg/l	-		0.038 [M]		-	-	**0.19**	0.086	0.03	4	<0.03	<0.03	4	<0.03	<0.03
Total boron (B)	mg/l	1.5		5		-	-	**25**	0.008	0.05	4	<0.05	<0.05	4	<0.05	<0.05
Total cadmium (Cd)	mg/l	0.000005[f]	1996	0.000049[aa]	2006	-	-	**0.0002**	≤0.0001	0.0005-0.001	10	<0.001	<0.001	48	<0.001	<0.001
Chrome III	mg/l	0.089	1997	0.013[bb]	1998	-	-	**0.065**	≤0.001	-	-	-	-	-	-	-
Total cobalt (Co)	mg/l	-	-	0.1	2008	-	-	**0.5**	≤0.001	0.001-0.03	10	<0.03	<0.03	48	<0.03	<0.03
Total copper (Cu)	mg/l	0.02[g]	1987	0.0013[cc]	1998	0.3	0.3	**0.007**	≤0.001	0.001-0.003	10	<0.003	0.007	48	<0.003	0.004
Tin	mg/l	-		-		-	-	-	≤0.0005	-	-	-	-	-	-	-
Total iron (Fe)	mg/l	0.3	1987	1.3[dd]	2000	3.0	-	**3.0**	0.05	0.02-0.1	13	<0.1	0.1	51	0.2	0.5
Lithium	mg/l	-		0.44		-	-	**2.2**	0.00022	-	-	-	-	-	-	-
Total manganese (Mn)	mg/l	-	-	0.26[ee]	2008	-	-	**1.30**	0.007	0.001-0.003	13	0.004	0.005	51	<0.003	0.006
Mercury	mg/l	0.000026[h]	2003	0.00091[ff]	1998	-	-	**0.0046**	-	0.0001	10	<0.0001	<0.0001	48	<0.0001	<0.0001
Total molybdenum (Mo)	mg/l	0.073	1999	3.2	2008	-	-	**16**	0.006	0.001-0.2	10	<0.2	<0.2	48	<0.2	<0.2
Total nickel (Ni)	mg/l	0.025[i]	1987	0.0074[gg]	1998	0.5	0.5	**0.037**	0.003	0.001-0.01	10	<0.01	<0.01	48	<0.01	<0.01
Total lead (Pb)	mg/l	0.001[j]	1987	0.00017[hh]	1998	0.2	0.2	**0.0009**	0.001	0.001	10	<0.001	<0.001	48	<0.001	<0.001
Total selenium (Se)	mg/l	0.001	1987	0.005	2008	-	-	**0.025**	0.00048	0.001	10	<0.001	<0.001	48	<0.001	<0.001
Strontium	mg/l	-		21		-	-	**105**	0.0248	-	-	-	-	-	-	-
Uranium	mg/l	0.015		0.014		-	-	**0.07**	≤0.00009	0.02	4	<0.02	<0.02	4	<0.02	<0.02
Vanadium	mg/l	-		0.012		-	-	**0.06**	0.0011	-	-	-	-	-	-	-
Total zinc (Zn)	mg/l	0.03	1987	0.017[ii]	1998	0.5	0.5	**0.085**	≤0.001	0.002-0.005	10	<0.005	0.010	48	<0.005	<0.005
Other parameters						-	-	-								
Phenols	mg/l	0.004		0.45		-	-	**2.25**	≤0.004	-	-	-	-	-	-	-
Silicone	mg/l	-		-		-	-	-	9.1	-	-	-	-	-	-	-
Petroleum hydrocarbons (C_{10}-C_{50})	mg/l	-	-	0.1[jj]	1996	2	-	**0.5**	-	100	8	<100	<100	45	<100	<100

[1] The table notes are available in Appendix 3.10.2. A hardness of 10 mg/l of $CaCO^3$ was used to calculate the criteria that vary relative to the hardness of the water.

[2] The most recent reference document date cited for the criteria or a given recommendation.

[3] The theoretical environmental discharge objectives (EDO) correspond to the lowest value between the technological standard (Directive O19 and MMER) and five times the MDDEP's aquatic life protection criterion (chronic effect), except for phosphorus where the EDO calculation was done following MDDEP's method (2007).

[4] Metal mine effluent regulation

- : no value.

Sources:

CCME (Canadian Council of Ministers of the Environment). 2007. "Canadian Water Quality Guidelines for the Protection of Aquatic Life – Summary Table," updated December 2007. In Canadian Water Quality Guidelines. 1999. Winnipeg. The Council.

MDDEP (Ministère du Développement durable, de l'Environnement et des Parcs). 2009. Surface Water Quality Criteria. Environmental monitoring branch. Government of Quebec.

MDDEP (Ministère du Développement durable, de l'Environnement et des Parcs). 2007. Calculation and interpretation of environmental discharge objectives for contaminants in an aquatic environment. 2nd editon.

Golder, 2011. Water Treatment Evaluation. 18 October 2011. 10-1427-0020/5012 no. 061 Rev.0

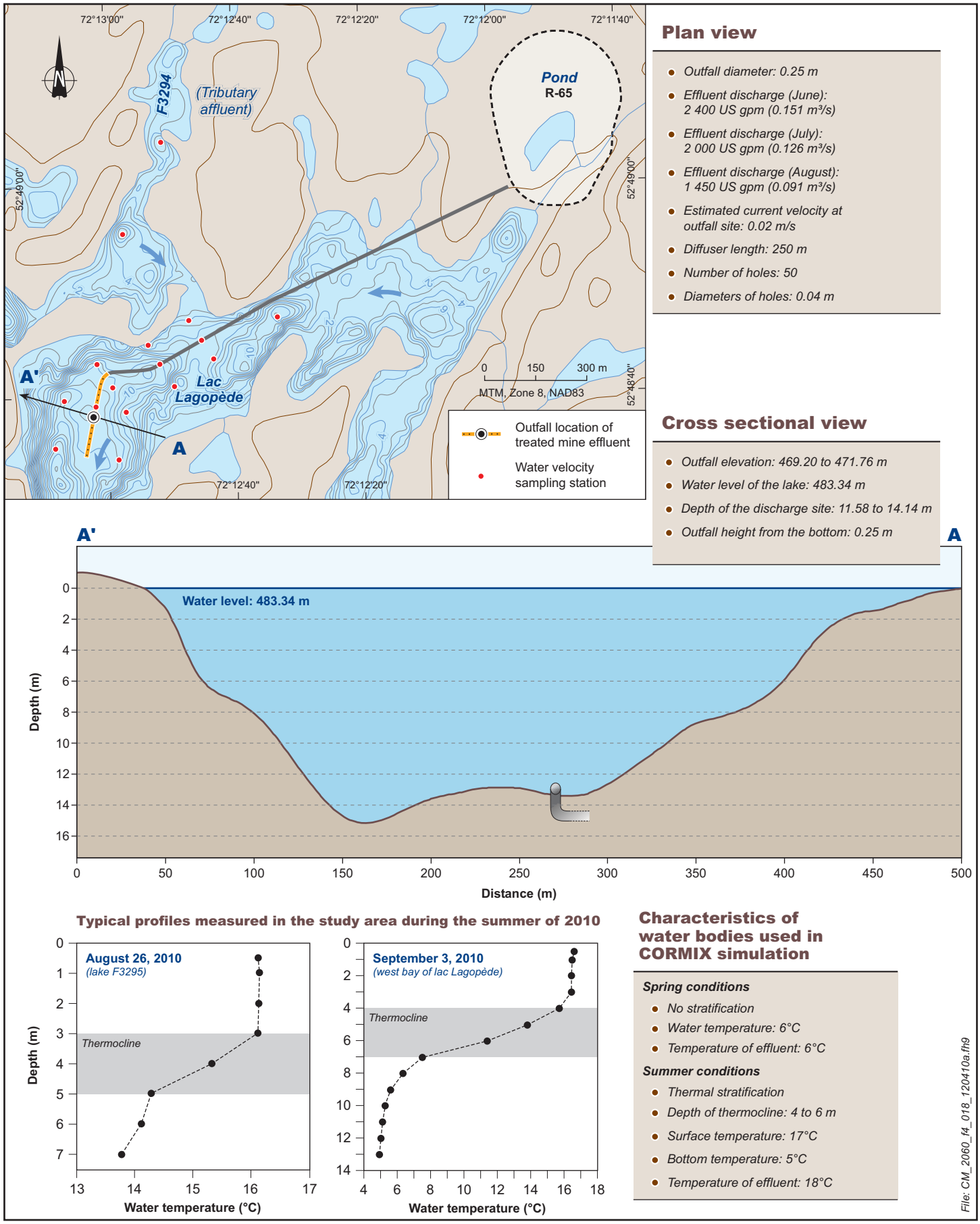


FIGURE 4 – Mine outfall and selected assumption for modeling of the mixing zone

3.4 Scenario Premises for the CE-QUAL-W2 Modeling

The scenario modelled with the CE-QUAL-W2 model took place over a period of around 100 days between June 5 and September 22. This scenario was selected because it allowed for the representation of the following three distinct periods:

- Spring, during which time the treated effluent flow rate would be the highest (2,400 gallons (US)/minute or 0.151 m^3/s) in the year; this time of the year is also when the lake inputs are highest.
- Summer, allows to represent the plume dispersion when the effluent flow rate is 1,450 gallons (US)/minute (0.091 m^3/s), lake inputs are very low (<1.0 m^3/s), and thermal stratification is present in the lake.
- The period corresponding to the beginning of fall turnover (end of September) when the effluent flow rate is 1,450 gallons (US)/minute (0.091 m^3/s). The effect of the gradual disappearance of the thermocline on plume dispersion can be evaluated during this period.

The mine effluent was added to the calibrated model by positioning the outfall at the downstream limit of segment 4 ranging from 469 to 471 m. The effluent flow rate corresponds to the estimate in the Golder Associates report (Golder 2011, 10-1427-0020/5012 no. 061 Rev.0) for the period between the months of May and September 2011. The effluent flow rate in the model is divided among the months of May to September as follows:

- May 20 to June 30: 2,400 gallons (US)/minute or 0.151 m^3/s;
- July 1 to July 31: 2,000 gallons (US)/minute or 0.126 m^3/s;
- August 1 to September 30: 1,450 gallons (US)/minute or 0.091 m^3/s.

The concentrations of the various parameters for water quality correspond to the concentrations presented in the Golder Associates report (Golder 2011, 10-1427-0020/ 5012 no. 061 Rev.0). The parameters for which the values were not available were estimated based on data from recent literature. The premises are detailed in Appendix 1.

3.5 Mine Effluent Results

3.5.1 Dilution Limit

The treated mine effluent dilution limit in the lake corresponds to the ratio between the ambient flow rate (equivalent to clean water input in the lake) and the effluent flow rate. It is possible to estimate this dilution value by using the available flow rate data (May to September 2011) likely to contribute to the treated mine effluent dilution. The estimated inputs for the sub-watershedslocated in the north part of Lake Lagopede varied between 0.44 and 13.91 m^3/s for the

period of May 24 to September 23, 2011. The dilution limit varied in the following proportions (Figure 5):

- June: from 10.1 to 110.4;
- July: from 3.7 to 27.2;
- August-September: from 4.8 to 64.7.

Based on these results, a dilution of 10 or more would have been attained 70% of the time during the period between May 24 and September 23 (Figure 6). The minimum dilution of 5, required for all the parameters except phosphorus, would not have been attained (dilution: 3.0 to 4.8) at the end of July and the beginning of August taking into account the low lake inputs (< 1.0 m^3/s).

3.5.2 CORMIX Modeling

In the spring, when the treated effluent flow rate will be 0.151 m^3/s, the model indicates that the initial dilution (near-field region) would extend to approximately 90 m downstream from the discharge point (measurements taken from the diffuser region, Table 3), while the 1:10 dilution limit would be attained at approximately 163 m downstream from the discharge point. During this period of the year, when the water column shows no thermal stratification and the effluent temperature is similar to that of the lake, the model also indicates there would be no plume intrusion upstream and that the plume would mix with the water column.

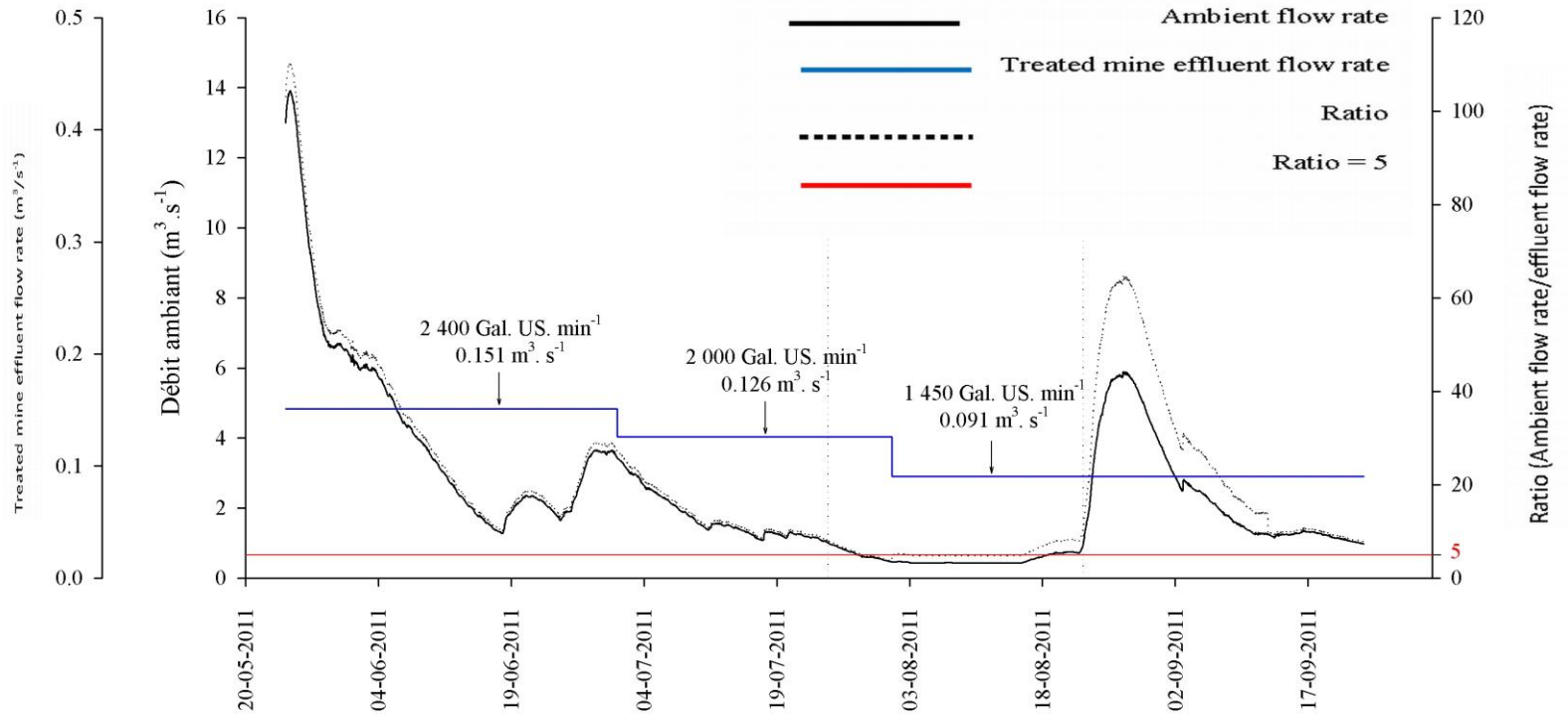


Figure 5 Ambient flow rate (AF in m^3/s) of the sub-watersheds in the north part of Lake Lagopede (F3294 tributary), estimated flow rate (EF in m^3/s) for the treated mine effluent, and AF/EF ratio

Table 3: CORMIX Simulation Results Summary for Spring and Summer Conditions

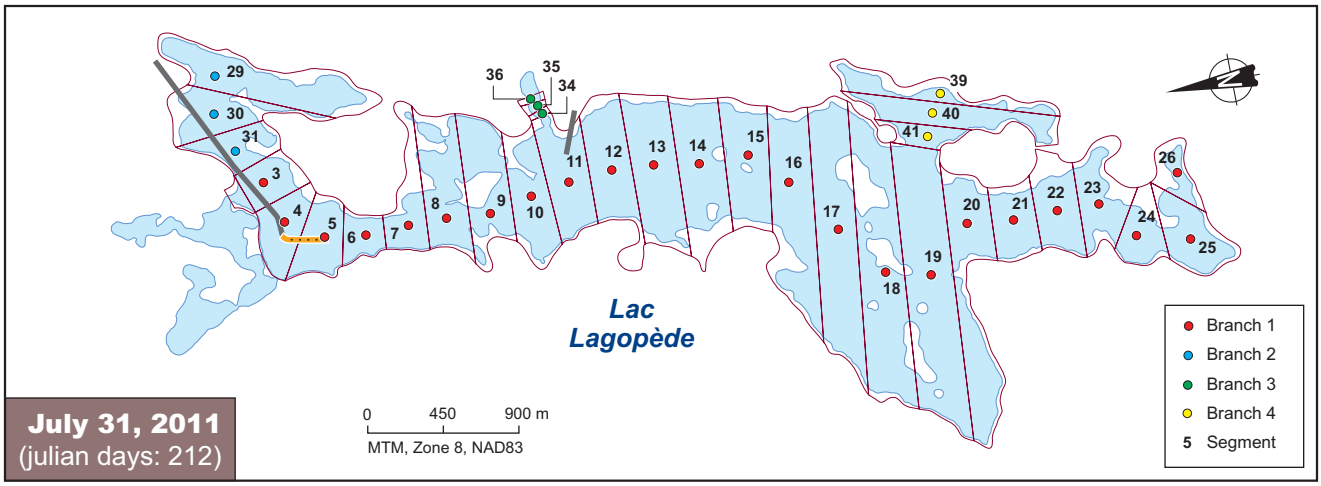
June	**Outfall with Diffuser** **Distance from Discharge Point***	**Obtained Dilution (S)**
Upstream Plume Intrusion	O	
Initial Dilution (near-field region)	90.0	9.6
1:10 Dilution Limit	162.7	10
August-September	**Outfall with Diffuser** **Distance from Discharge Point***	
Upstream Plume Intrusion	40.56	
Initial Dilution (near-field region)	46.71	46.9
1:10 Dilution Limit	< 5	10

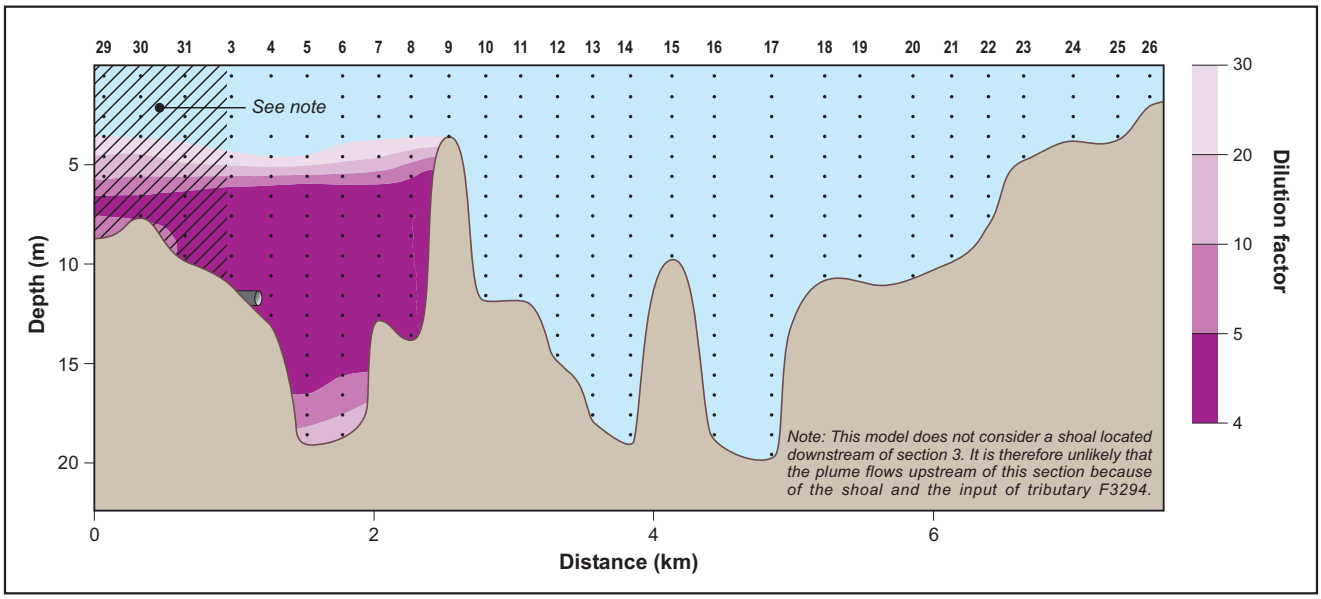
* The distance is measured from the diffuser region.

During low-flow periods (August), the treated effluent flow rate will be reduced (0.091 m^3/s) and a thermocline will be present. In this situation, the near-field region (dilution of 47) will extend to approximately 47 m downstream from the discharge point and the 1:10 dilution limit will occur quickly, at the diffuser level. Because of current densities due to the temperature differences between the effluent and the water at the bottom of the lake, the model indicates that upstream plume intrusion will occur at a distance of approximately 41 m. The plume will not rise to the surface in the near-field region and will remain at a depth of approximately 5 m. The simulation reports and prediction files generated by the CORMIX model are presented in Appendices 3A and 3B.

3.5.3 CE-QUAL-W2 Modeling

The CE-QUAL-W2 model results analysis took place mainly from July 31 (Julian Day 212) to September 22 (Julian Day 262), 2011. July 31 corresponds to the period when the inflows from the lake's tributaries are lower than 1 m^3/s, which represents the worst case scenario for the plume. September 22 illustrates the effect of the beginning of the fall turnover on plume dispersion.





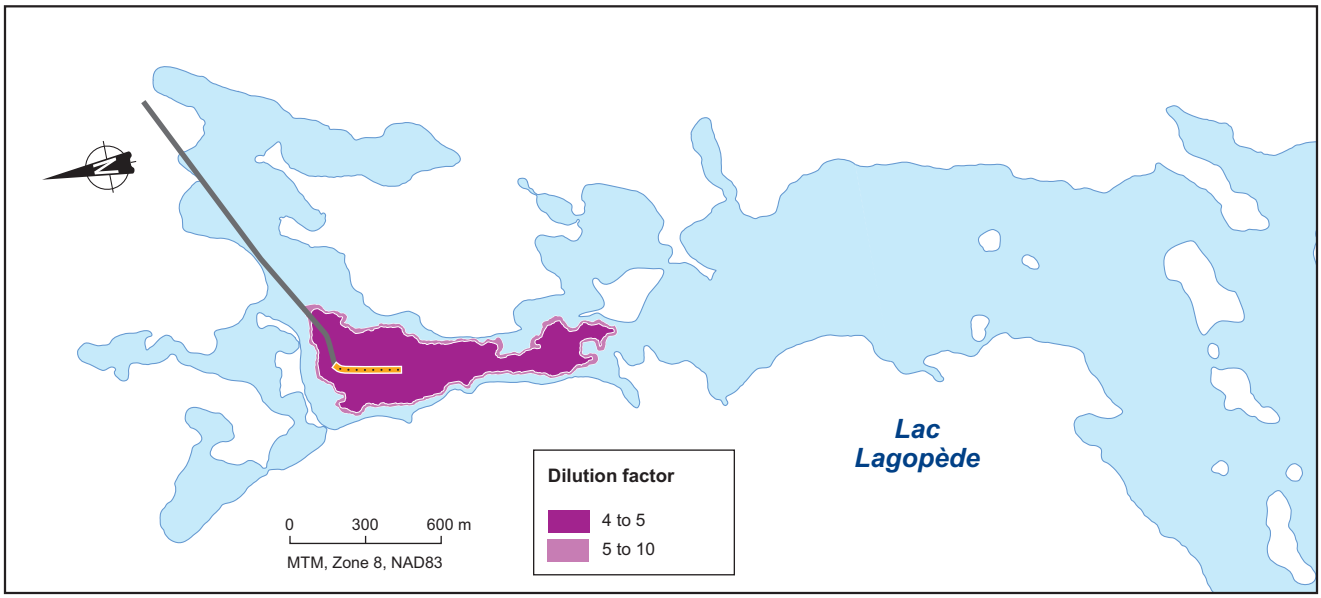


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FIGURE 6 – Plume of treated mine effluent modeled using CE-QUAL-W2 and contours of 1:5 and 1:10 dilution limits–July 31, 2011

On July 31, after 56 days of discharge, the model indicates a strong thermocline that, added to the particular bathymetry of the lake (2 distinct basins), results in a large amount of low-dilution water (3 to 5 dilution factor) in the basin receiving the mine effluent (Figure 6). In this basin, the 1:5 dilution limit (required for most of the parameters) is met only at thermocline depth and spreads up to segment 9 (750 m downstream). Therefore, this corresponds well with the calculated dilution limit results that gave a dilution of 3.8 on July 31. The treated mine effluent discharge has little effect on Lake Lagopede's second basin during this period, and a dilution greater than 30 was observed for the entire basin.

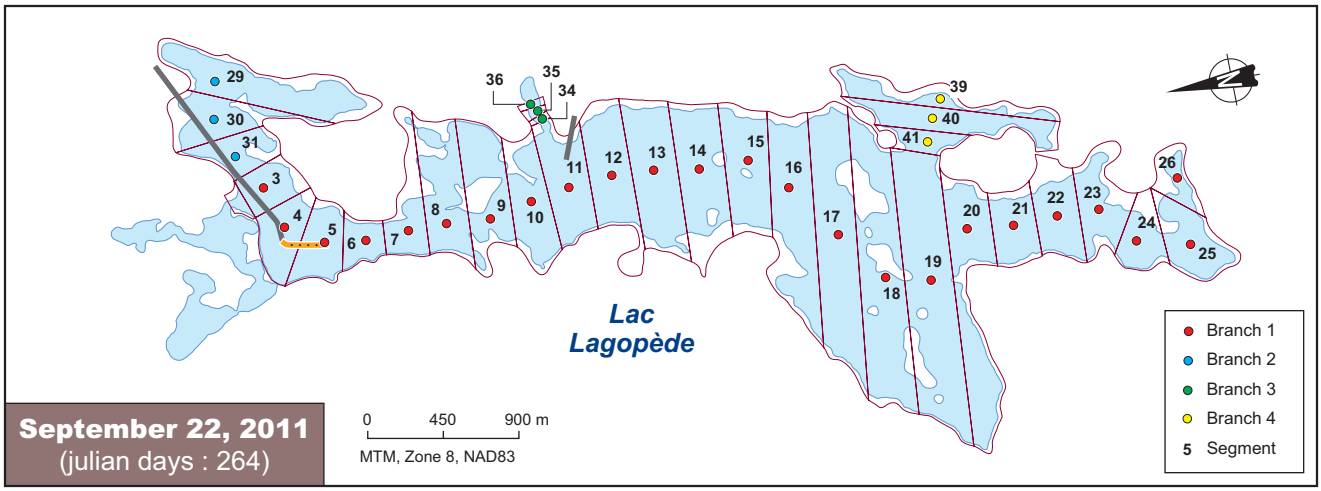
During low-flow periods, the thermocline and bathymetric effects are accentuated by low inflows into the lake, which translate to lower current velocity at the discharge point and consequently a reduction in the ambient environment's dilution capacity and possible recirculation. This phenomenon occurs when the eddies from the plume are brought back to the mixing system (e.g.: mixed water is redispersed) and used instead of clean receiving water, which results in a reduced dilution and an increased mixing zone boundary. Dilution does occur at the diffuser level, but the absence of advection and new inflow in the area results in a low dilution and an increase in concentrations in the ambient environment. The increase in concentrations is temporary and a function of the intensity and duration of the low-flow period and the presence of a thermocline.

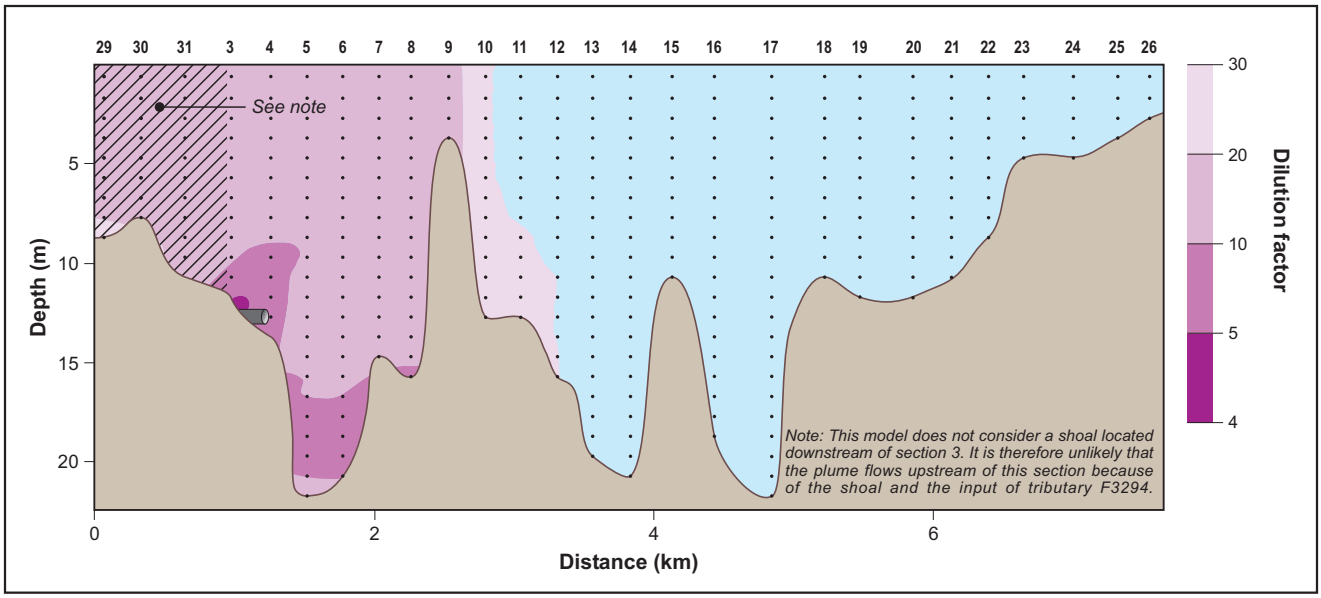
On September 22, after 108 days of discharge, the reduction in water temperature allowed lake water mixing (10.2°C on the surface, 7.2°C to 21.5°C, Figure 7). Therefore, the 1:10 dilution is reached quicker downstream from the discharge point. The 1:10 plume limit extends 300 m downstream, or half the distance that was calculated for July 31. The maximum dilution attained in the basin receiving the effluent is 1:15. Therefore, this corresponds well with the calculated dilution limit results that gave a dilution of 7.8 on September 22. In comparison, the CORMIX model results are much more optimistic. The treated mine discharge has little effect on Lake Lagopede's second basin during this period, and a dilution greater than 30 was observed for the entire basin.

In general, it was observed that the plume moves upstream to segment 3, but this result must be carefully interpreted for segments 29, 30, 31 because the shoal is not detailed enough in the model and should in reality block most of the plume.

From a biological perspective, the mine effluent inflows would likely translate to a local increase (lake's north basin) in the algal population due to an increase in the average total phosphorus concentration in the water column (Figure 8). The maximum concentrations obtained in segment 5 (representative of the first basin) are presented in Table 4. Therefore, the model tends to indicate that the first basin will attain total phosphorus concentrations corresponding to those of an oligo-mesotrophic lake (typically between 0.007-0.013 mg/L of total phosphorus; MDDEP, 2007[2]).

2 MDDEP (Ministère du Développement durable, de l'Environnement et des Parcs), 2007. Voluntary monitoring network of resort lakes - Methods. Internet site visited on June 10, 2008. [http://www.mddep.gouv.qc.ca/eau/rsvl/methodes.htm]





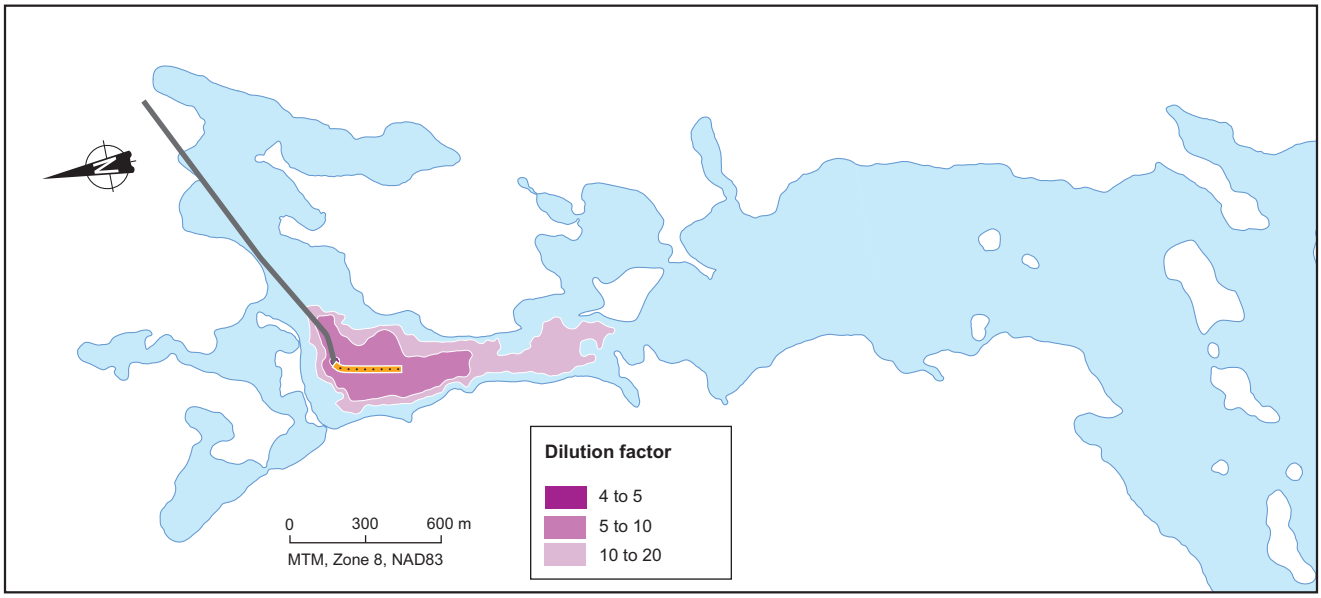


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FIGURE 7 – Plume of treated mine effluent modeled using CE-QUAL-W2 and contours of 1:5 and 1:10 dilution limits–September 22, 2011

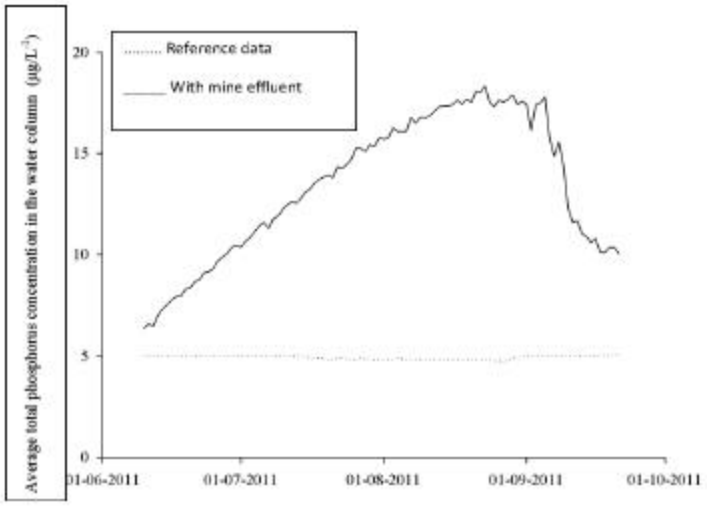


Figure 8: Reference data and modelled increase of average total phosphorus concentrations in the water column

Table 4: Maximum Concentrations of Chlorophyll *a* and Total Phosphorus

Description		Total Phosphorus (µg/L)	Chlorophyll *a* (µg/L)
Modelled Maximum	Date	07/09/2011	28/07/2011
	Depth (m)	14.8	4.6
	Value	38	6.4
Modelled Maximum for the Entire Water Column (average)	Date	22/08/2011	18/09/2011
	Value	18	2.51

3.5.4 Results Summary

The CE-QUAL-W2 model results are more consistent with the dilution limit values obtained than with the CORMIX model results. Indeed, the CE-QUAL-W2 model accurately represents the relatively low dilution obtained during the low-flow period (July 31) as well as the effect of an increased flow rate and the disappearance of the thermocline on plume dispersion. The model indicates that the plume's mixing zone boundary (determined by 1:10 dilution that represents the most constrained mixing zone estimate in this case; see paragraph 1.3) would be located approximately 750 m and 300 m downstream from the discharge point, in July and September respectively (Figures 6 and 7). During low-flow periods, in the mixing zone boundary, all parameters would respect the water quality criteria with the exception of total phosphorus, whose

concentration would be slightly higher (0.01 mg/L at segment 9, while the criterion is 0.009 mg/L).

Enhanced primary productivity in the north part of the lake is possible during the summer due to an increased phosphorus concentration in the first basin, with a generalized increase along the water column when lake mixing occurs in September. The CE-QUAL-W2 model indicates that the water quality of Lake Lagopede's two basins evolves differently during the summer due to the presence of the thermocline and the lake's particular bathymetry. Consequently, only Lake Lagopede's first basin will undergo the effect of the mine effluent and the total phosphorus concentration could attain values corresponding to an oligo-mesotrophic lake (MDDEP, 2007[3]).

3 MDDEP (Ministère du Développement durable, de l'Environnement et des Parcs), 2007. Voluntary monitoring network of resort lakes - Methods. Internet site visited on June 10, 2008. [http://www.mddep.gouv.qc.ca/eau/rsvl/methodes.htm]

4 DOMESTIC EFFLUENT OUTFALL

4.1 Anticipated Concentration of the Treated Domestic Effluent

In the SNC-Lavalin report on wastewater collection and treatment, total phosphorus and total suspended solids concentrations in the domestic effluent after treatment were presented (SNC 2011, 504-5800-41ER-0001). The report also presented the ammonium concentration (NH_4) before treatment. The NH_4 concentration in the effluent was calculated as a function of temperature, taking into consideration a treatment efficiency of 80% at 22°C and 1% at 10°C. Table 5 presents the expected concentrations in the effluent as well as the total phosphorus discharge objective proposed by Roche Ltd. The dilutions required to respect the water quality criteria are presented in Table 6.

Table 5: Anticipated Concentrations in the Treated Domestic Effluent

Parameters	Construction Phase					Operation Phase					EDO
	kg/day	Input mg/L	Output mg/L	m^3/day	m^3/s	kg/day	Input mg/L	Output mg/L	m^3/day	m^3/s	
F330 Average Daily Flow Rate				165	0.0019				101	0.0012	
Total Suspended Solids (TSS)	30	181.8	29.3			13.8	136.6	11.4			
Total Phosphorus	1	6.1	1.0			0.5	5.0	1.0			0.075
Ammonium	2.5	15.2	3.0 to 11.8			1.2	11.9	3.8 to 15.1			

Table 6: Treated Domestic Effluent: Required dilutions to respect the protection of aquatic life criteria

	Construction Phase	Operation Phase
TSS	5	2
Total Phosphorus	333	333
NH_4	3.1 to 11.8	2.4 to 9.6

4.2 Scenario Premises for the Calculation of the Dilution Limit

To evaluate the dilution capacity of the ambient environment, the ambient flow rate ratio (lake inputs located upstream from the planned discharge point, F3300 tributary) of the effluent flow rate was calculated. Based on the SNC-Lavalin report (SNC 2011, 504-5800-41ER-0001), the treated domestic effluent's anticipated flow rate will be as follows:

4.2.1.1 Construction Phase

- Average flow rate of the domestic effluent: 0.0019 m^3/s;
- Peak hour flow rate of the domestic effluent: 0.0076 m^3/s.

4.2.1.2 Operation Phase

- Average flow rate of the domestic effluent: 0.0012 m^3/s;
- Peak hour flow rate of the domestic effluent: 0.0047 m^3/s.

The F3300 tributary flow rate for the months of May to September 2011 was then used to calculate the ratio of the ambient flow rate over the effluent flow rate giving the dilution limit for this time period.

4.3 Scenario Premises for the CORMIX Modeling

For this project, the proposed outfall location point is positionned approximately 250 m downstream from the F3300 tributary at a depth of approximately 7 m (Figure 9). The outfall pipe runs 100 m underwater and has a diameter of 0.2 m.

Four scenarios were modelled to characterize the anticipated flow rates during the construction and operation phases:

- Construction Phase
  a) Average flow rate of the domestic effluent: 0.0019 m^3/s;
  b) Peak hour flow rate of the domestic effluent: 0.0076 m^3/s.

- Operation Phase
  c) Average flow rate of the domestic effluent: 0.0012 m^3/s;
  d) Peak hour flow rate of the domestic effluent: 0.0047 m^3/s.

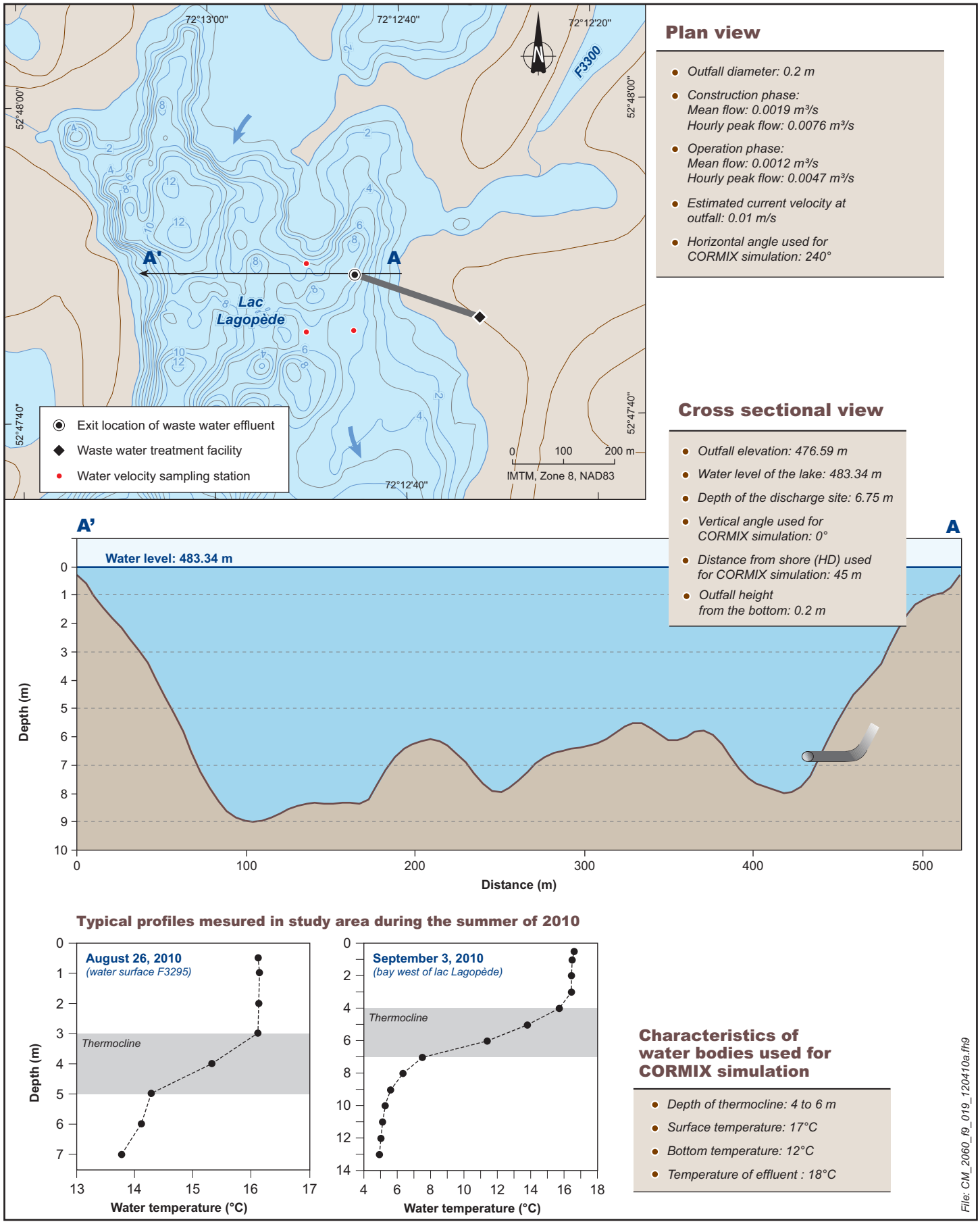


FIGURE 9 – Domestic outfall and selected assumptions for modeling of the mixing zone

The currentvelocity at the planned discharge point corresponds to the average velocity measured with the Vector current meter (near the bottom) at stations 15 and 16 (Map 2), September 21-22, 2011. The velocity used for the modeling is 0.01 m/s.

The water quality data collected in the summer 2010 indicate lake stratification in the summer period (Figure 10). The thermocline is located at a depth of approximately 4 to 6 m. The surface water temperature is 17°C, and the bottom water temperature is 12°C. The effluent temperature at the discharge point is set at 18°C.

4.4 Scenario Premises for the CE-QUAL-W2 Modeling

The scenario modelled with the CE-QUAL-W2 model took place over a period of around 100 days between June 5 and September 22. This scenario was selected because it allowed for the representation of the plume dispersion during spring, the low-flow summer period, as well as the beginning of fall turnover (end of September).

The treated domestic effluent was added to the calibrated model by positioning the outfall at segment 11 ranging from 476 to 477 m. The effluent flow rate corresponds to the average daily flow rate estimated in the SNC-Lavalin report (SNC 2011, 504-5800-41ER-0001) for the operation phase (0.0012 m^3/s, 101 m^3/day).

The concentrations of the various parameters for water quality correspond to the concentrations presented in the SNC-Lavalin report (SNC 2011, 504-5800-41ER-0001). The parameters for which the values were not available were estimated based on data from recent literature. The premises are detailed in Appendix 1.

4.5 Results

4.5.1 Dilution Limit

The treated domestic effluent dilution limit in the lake corresponds to the ratio between the ambient flow rate (equivalent to clean water input from the F3300 tributary) and the effluent flow rate. It is possible to estimate this dilution value by using the available flow rate data (May to September 2011) for the F3300 tributary. The estimated inputs for the F3300 tributary varied between 0.024 and 0.759 m^3/s for the period of May 24 to September 23, 2011.

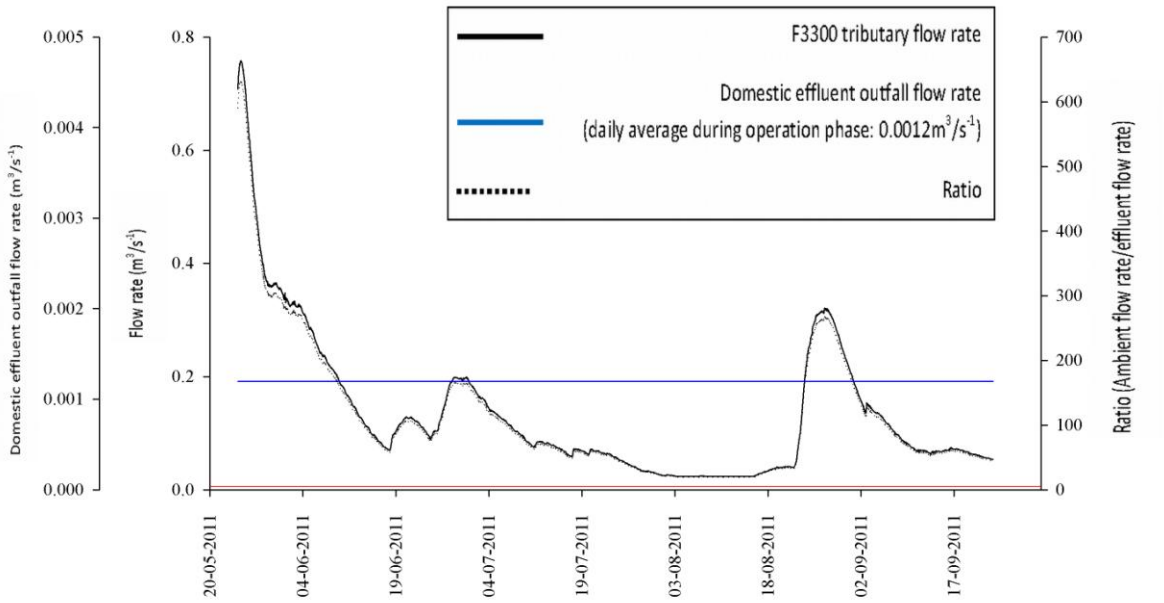


Figure 10: F3300 tributary ambient flow rate (AF in m^3/s), estimated flow rate daily average: EF in m^3/s) for the treated domestic effluent, and AF/EF ratio.

Taking into account the anticipated treated effluent flow rate (construction phase - daily average: 0.0019 m^3/s; operation phase - daily average: 0.0012 m^3/s), and the available data in 2011, it is important to note that the dilution limit for the construction and operation phases will have varied respectively between 12 and 399, and 20 and 632.

Considering the minimum dilution limit at the discharge point, the total suspended solids and ammonium concentrations will therefore have been below the federal and provincial water quality recommendations, contrary to the total phosphorus concentration (Table 5).

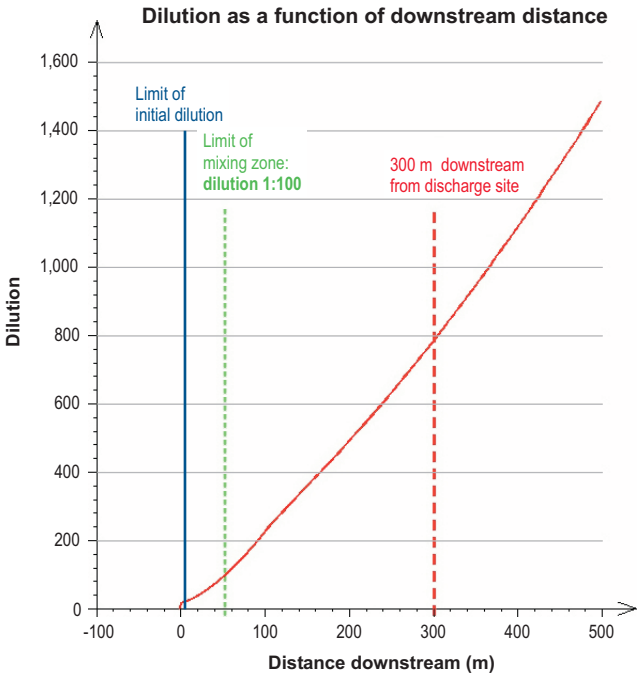
4.5.2 CORMIX Modeling

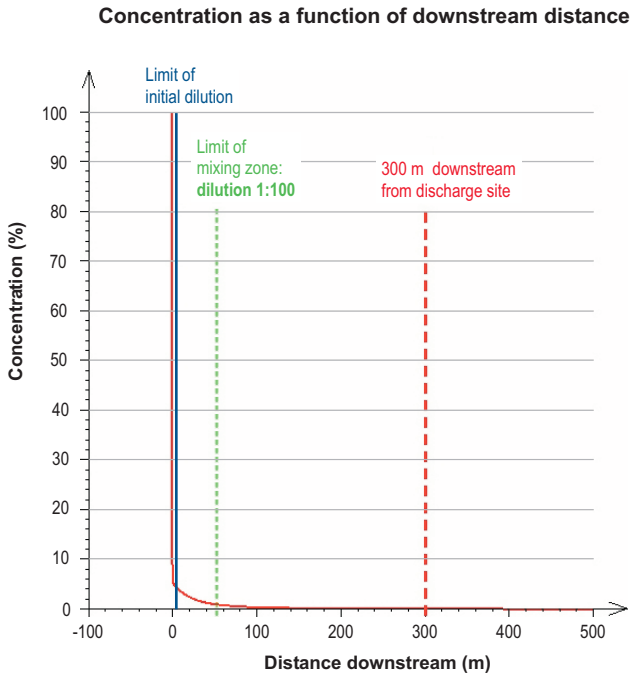
The anticipated domestic effluent flow rate is relatively low for all the scenarios. Consequently, the 1:10 dilution will be reached quickly (< 2 m) downstream from the discharge point (Figures 11 and 12, Table 7).

During the construction phase, the model indicates that the initial dilution (near-field region) will spread approximately 2 (average flow rate) to 16.37 m (peak hour flow rate) downstream from the discharge point (Figure 11). The 1:100 dilution limit will be reached 52 m downstream from the outfall for the average flow rate while it could spread up to 130 m downstream from the discharge point for the peak hour flow rate.

CONSTRUCTION PHASE

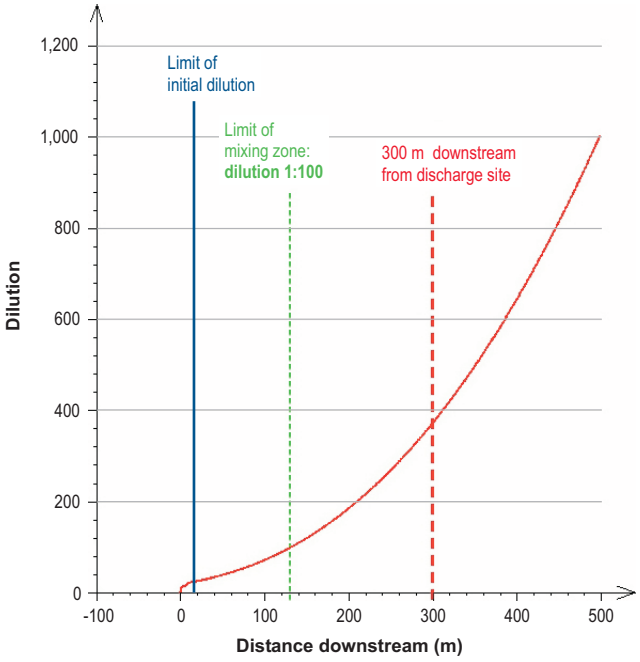
Mean flow (0.0019 m³/s)

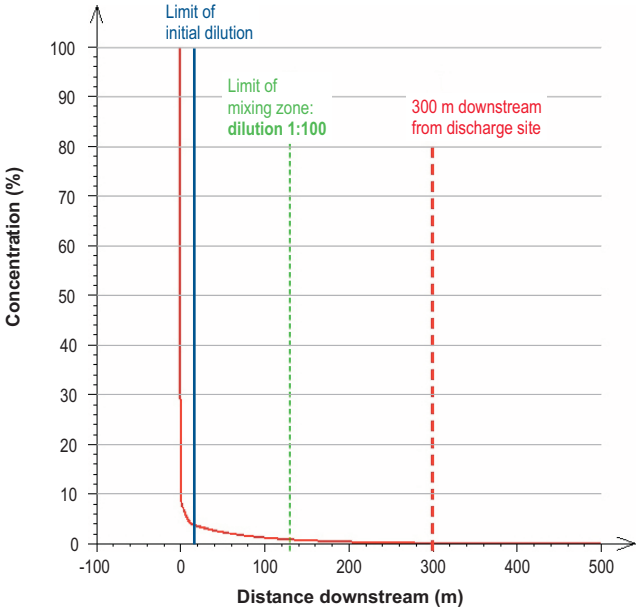




- Outfall discharge: 0.0019 m³/s
- Intrusion of the plume upstream from the discharge site: < 2 m
- Downstream limit of initial dilution (*near-field region*): < 2 m
- Downstream limit of mixing zone 1:100 = 52.64 m

Hourly peak flow (0.0076 m³/s)





- Outfall discharge: 0.0076 m³/s
- Intrusion of the plume upstream from the discharge site: 20.19 m
- Downstream limit of initial dilution (*near-field region*): 16.37 m
- Downstream limit of mixing zone 1:100 = 130.44 m

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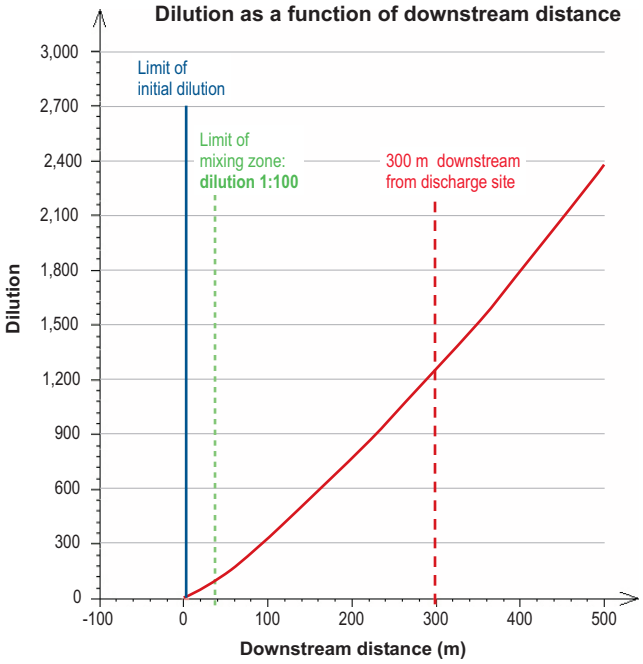
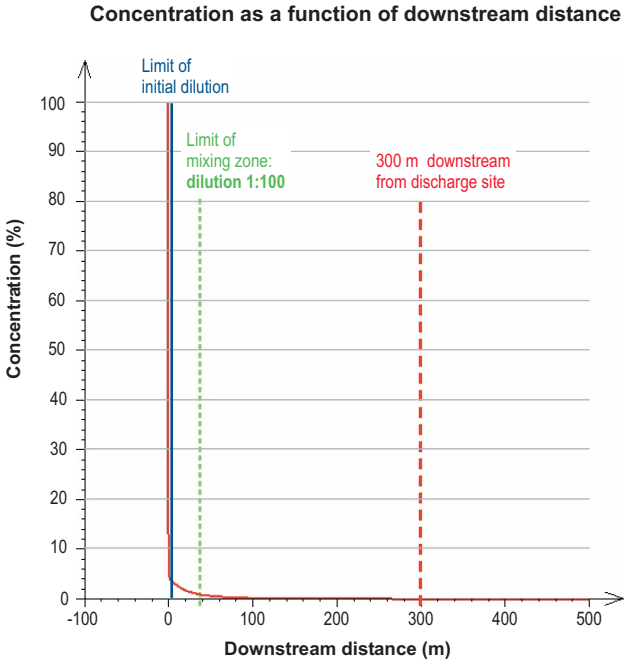
FIGURE 11 – Dilution and concentration as a function of downstream distance from the outfall location during the construction phase

OPERATION PHASE

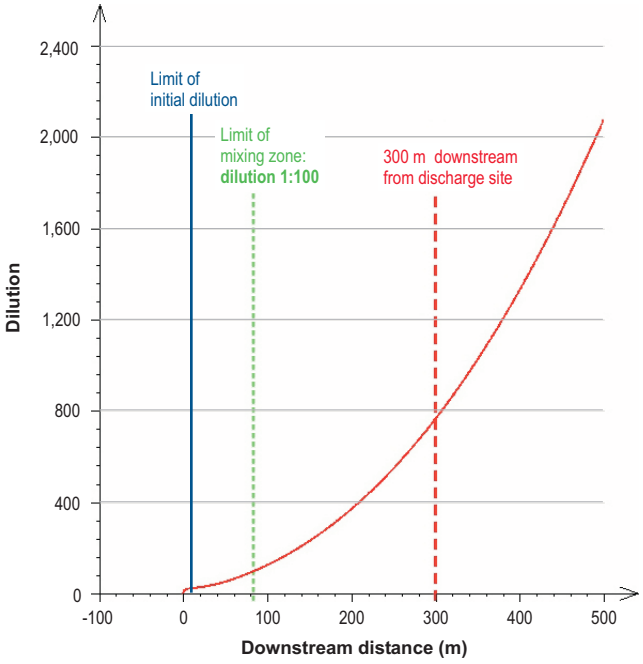
Mean flow (0.0012 m³/s)

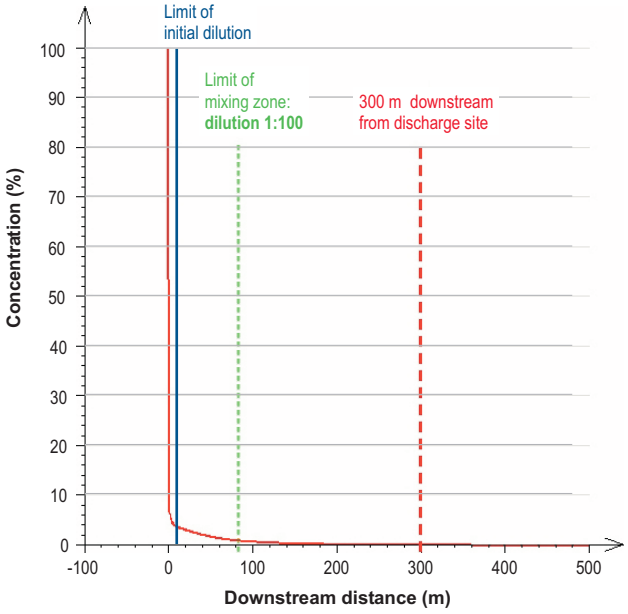




- Outfall discharge: 0.0012 m³/s
- Intrusion of the plume upstream from the discharge site: < 2 m
- Downstream limit of initial dilution (*near-field region*): < 2 m
- Downstream limit of mixing zone 1:100 = 37.51 m

Hourly peak flow (0.0047 m³/s)





- Outfall discharge: 0.0047 m³/s
- Intrusion of the plume upstream from the discharge site: 13.20 m
- Downstream limit of initial dilution (*near-field region*): 9.40 m
- Downstream limit of mixing zone 1:100 = 82.74 m

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FIGURE 12 – Dilution and concentration as a function of downstream distance from the outfall location during the operational phase

Table 7: Treated Domestic Effluent: Required dilutions to respect the protection of aquatic life criteria

Period	Parameters	1:10 Dilution Limit		1:100 Dilution Limit		Provincial and Federal Recommendations (mg/L)
		Distance from Discharge Point (m)	Obtained Concentration (mg/L)	Distance from Discharge Point (m)	Obtained Concentration (mg/L)	
Construction Phase	Total Suspended Solids	< 2	2.9	52	0.3	Maximum increase of 5 mg/L (chronic effect) with respect to the natural concentration (e.g.: 6 mg\L total)
	Total Phosphorus		0.100		0.010	Maximum increase of 50% with respect to the natural concentration without exceeding 0.01 mg/L (e.g.: increase of 3 µg/L)
	Ammonium		0.3 to 1.5		0.03 to 0.15	1.23
Operation Phase	Total Suspended Solids	< 2	1.1	38	0.1	Maximum increase of 5 mg/L (chronic effect) with respect to the natural concentration (e.g.: 6 mg\L total)
	Total Phosphorus		0.100		0.010	Maximum increase of 50% with respect to the natural concentration without exceeding 0.01 mg/L (e.g.: increase of 3 µg/L)
	Ammonium		0.3 to 1.2		0.02 to 0.12	1.23

During the operation phase, the effluent flow rates are lower than those predicted during the construction phase. As such, the initial dilution limits and the 1:100 dilution will be closer to the discharge point (Figure 12). The initial dilution (near-field region) will vary from 2 to 9.4 m respectively downstream from the discharge point for the average flow rate and the peak hour flow rate (Figure 4). The 1:100 dilution will be reached approximately 38 m downstream from the discharge point for the average flow rate while it could reach 83 m during peak hour flow rates.

The plume will not surface inside the 1:100 dilution zone. It will remain in the water column at a depth of approximately 4 to 6 m. The upstream plume intrusion will be limited (< 20 m) for all scenarios (Figures 10 and 11). The simulation reports and prediction files generated by the CORMIX model are presented in Appendices 4A and 4B. Figure 13 presents a view of the extent of the treated domestic effluent plume modelled with CORMIX software.

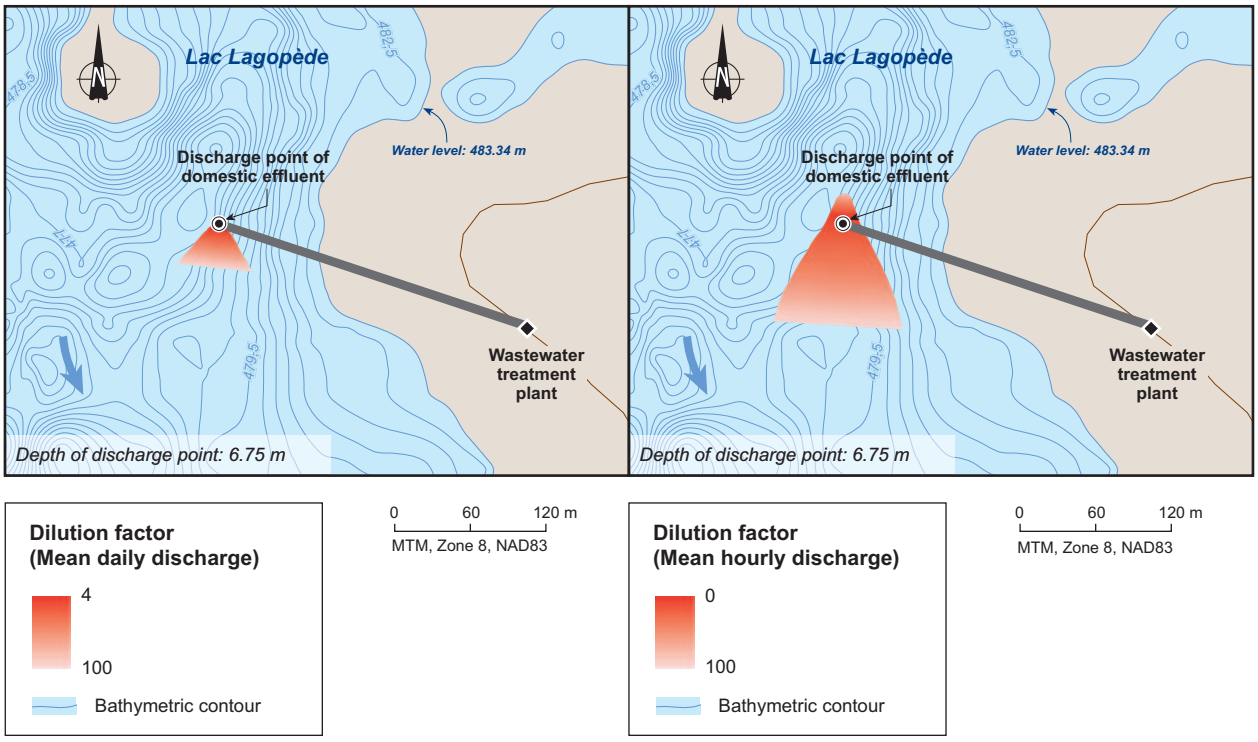

FIGURE 13 – Representation of the treated domestic effluent plume modeled using CORMIX software

4.5.3 CE-QUAL-W2 Modeling

The modeling was only done for the construction phase, using the average flow rate on June 10, July 31, and September 22, 2011. The model confirms the results obtained from the CORMIX model, that is, a 1:100 dilution was attained near the discharge point over the entire study period (June 5 to September 22, 2011). The minimum dilution factor obtained was 1042 at the discharge point for July 31, which was during the low-flow period.

4.6 Results Summary

The initial dilution calculations and the two models agree that the effect of the effluent will be limited to the area around the discharge point. Indeed, the CORMIX model evaluates the extent of the near-field region to be 16.4 m while the 1:100 mixing zone boundary is estimated at 130 m downstream from the discharge point (peak hour flow rate during the construction phase, equivalent to the worst case scenario).

Therefore, the water quality criteria will be respected, even for total phosphorus, according to both the CORMIX and CE-QUAL-W2 models.

5 CONCLUSION AND RECOMMENDATIONS

According to the dilution limit and CE-QUAL-W2 calculation results, the domestic effluent will not have a significant influence on the lake's water quality. Its influence will be limited to the area around the discharge point. The mine and domestic effluent plumes will not overlap. Therefore, the general conclusions refer to the mine effluent simulation results.

Thus, during the summer low-flow period, particular attention will need to be given to the first basin in Lake Lagopede because the thermocline and bathymetry will reduce mixing. The dilution in this basin could occasionally be insufficient and not attain a dilution of 5 (theoretical EDO, see Table 2). However, the mixing of the waters in the fall will allow the effluent dilutionn objectives to be obtained for all the parameters except total phosphorus.

Water quality monitoring will be necessary throughout the year to confirm the CE-QUAL-W2 modeling results. Winter flow rate and water quality parameter data will notably allow to simulate conditions during winter. In winter, the effluent flow rate is lower than in the summer (500 gallons(US)/minute, 0.032 m^3/s). The winter lacustrine stratification should be less pronounced than the summer stratification and, moreover, should allow mixing of the mine effluent. In addition, the effluent temperature should be higher than that of the lake water at discharge depth, which would also favour mixing.

A long-term modeling could be considered to anticipate the behaviour of the total phosphorus concentrations and to confirm the long-term status of the lake's food web.

It is important to note that the results obtained are specific to the premises used for the modeling and a modification (e.g.: water quality parameter in the effluent, effluent flow rate, etc.) to one of the premises is likely to generate results different than those presented herein.

Finally, a water quality and effluent monitoring program will be applied within the framework of the environmental and social management plan of the project (see Chapter 11 of the ESIA) in order to validate the assessment of the impacts and adapt the environmental management of the project.

APPENDIX 1

Premises Used for the CE-QUAL-W2 Modeling

The table below presents the data required and the data available for the CE-QUAL-W2 model for the period between June 5 and September 22, 2011. The unavailable data was estimated from a review of existing information or an additional modeling. The approaches used to estimate the values of the different parameters for unavailable data are presented in this appendix.

Table A: Data necessary for water quality modeling - CE-QUAL-W2 Model

Parameters	Necessary for the modeling	Data available for the modeling period (June 5 to September 22, 2011)
Meteorological Conditions	Air temperature, dew point, wind velocity, wind direction, cloud cover, solar radiations	▪ Air temperature, dew point, wind velocity, wind direction, cloud cover, solar radiations
Hydrological Conditions	Flow rate of main tributaries, flow rate at lake outlet	▪ Water temperature of main tributaries (until August 18) ▪ Flow rate of main tributaries (estimated from three gauging stations and from the watershed surface area flow rate for the others)
Chemical Descriptors	Dissolved oxygen, pH, alkalinity, total dissolved solids, total suspended inorganic solids	▪ Dissolved oxygen, pH, alkalinity, total dissolved solids
Biological Descriptors	Algae concentrations	
Nutritive Substances	Organic matter, total inorganic carbon, Cl, Ca, Mg, Na, SO_4, PO_4^-, NH_4^+, NO_3^-, dissolved silica, particulate silica	▪ NH_4^+, NO_3^-, PO_4^-, Cl, Ca, Mg, Na, SO_4
Metals and Metalloids	Al, Cd, Cu, Pb, Ba, Fe	▪ Al, Cd, Cu, Pb, Fe

Water Temperature Modeling

The water temperature data from the main tributaries was available for the period from May 31 to August 18, 2011. To extend the water quality modeling, the water temperature modeling, for the period from August 18 to September 22, had to be carried out. The main steps to regenerate the water temperature data until September 22 are as follows:

Step 1: Use of field data from temperature thermistors installed from May 31 to August 18 2011. Modelled using concurrent values of water temperature, air temperature, and flow rate, from June 5 to August 18, 2011. The following model was applied:

$$T_{water}(i) = a*T_{air}(i) + b*T_{water}(i-1) + c*Q(i)$$

with:

$T_{water}(i)$: water temperature (°C) per hour (i)

T_{air} (i): air temperature (°C) per hour (i)

$Q(i)$: flow rate (m^3/s) per hour (i)

a, b and c: adjustment coefficients. The table below illustrates the values for these coefficients for the main tributary, the various branches, and the tributaries. The performance of the model is evaluated using the root mean squared error (RMSE).

	Branch 1	**Branch 2**	**Branch 3**	**Trib. 1**	**Trib. 2**	**Trib. 3**	**Trib. 7**	**Trib. 8**	**Trib. 9**
a	0.08	0.19	0.23	0.16	0.54	0.21	0.54	0.10	0.35
b	0.94	0.83	0.80	0.86	0.42	0.67	0.42	0.87	0.67
c	-0.01	3.38	1.05	4.44	14.10	-	14.10	-	-
RMSE	0.36	0.82	1.02	0.62	1.80	2.84	1.80	0.81	2.05

Step 2: Using the preceding estimated model, the water temperature was extrapolated from August 18 to September 22, 2011.

Premises for the variables for which there is available field data

Water quality monitoring was performed in the summer 2010, at which time measurements were taken on July 9 and September 4 (see table below). The values from the AQR1, AQR9, AQR10, AQR11, AQR12 stations were used to create the time series for 2011 and for each variable.

Campaign	**Block 1**	**Block 1 Tributaries**	**Blocks 2 and 3**	**Blocks 2 and 3 Tributaries**
July	AQR1, AQR10, AQR11	AQR1	AQR10, AQR11	AQR9, AQR12
September	Average of Block 2 and Block 1 tributary data	AQR1, AQR19, AQH1, AQH2	AQR10, AQR12, AQR21	AQR9, AQR12, AQR20

- For all the variables except dissolved oxygen, the water temperature, pH, total Kjeldahl nitrogen, and aluminum, the data from July and September were not visibly different. An average value was thus calculated and applied to the entire modeling period (June 5 to September 22).
- For dissolved oxygen, pH, total Kjeldahl nitrogen, and aluminum, the data from July and September were visibly different. Therefore, an average value for the entire summer could not be reasonably predicted. A time series from June 5 to September 22 was necessary for the modeling. It was, thus, necessary to define the most plausible tendencies for these variables.

In general, only the values from July 9 and September 4 were available. A linear regression was applied between these two values. More precisely, the following calculations were made:

- Dissolved Oxygen: For June, it was assumed that the dissolved oxygen concentration would increase as a function of the melting ice. In winter, the lakes covered with ice are heterotrophic, which means that the oxygen in the lake is consumed by bacteria (that produce CO_2) faster than it is produced by photosynthetic organisms. In the spring, the photosynthetic organisms grow and produce oxygen (Wetzel, 2002). Therefore, it was decided to consider a continuous increase in oxygen during the summer.
- pH: For June, it was assumed that the pH would increase as a function of the melting ice. CO_2 is a key element to pH variation. In spring, the CO_2 that had accumulated under the ice during winter escapes increasing the pH of the water (Demarty et al, 2011).
- Total Kjeldhl Nitrogen (TKN): From June 5 to July 9, 2011, the value measured on July 9 was applied because there was no indication (reputable) of a tendency to follow. From July 9 to September 22, 2011, a linear regression was applied, justified by the fact that the nitrogen must have been consumed during the summer.
- Aluminum (and bioavailable aluminum fraction): The value from July is clearly lower than the value in September; nonetheless, a constant increase in aluminum concentration between the two campaigns is not justified. Strong rain occurred on August 21, 2011, which could have resulted in the observed increase in concentration. Therefore, it was decided that the value measured on July 9 would be applied to June 5 through August 21, 2011. Between August 21 and September 4, 2011, a linear regression was applied to reflect the increasing inflow following the ambient flow rate increase in this period. The September 4 concentration was applied until September 22.

Premises for the variables for which there is no available field data

- For orthophosphates, a value equal to 50% of the total phosphorus value is assumed (conservative value based on other research conducted in the 'Nord-du-Quebec').
- For barium, no data was found in the study region; the detection limit was therefore applied over the entire modelled period.
- In the 'Nord-du-Quebec' (Opinaca Region), total organic carbon (TOC) values of 6 to 11.1 mg/L^{-1} were reported (Schetagne et al, 2005). In the same region, dissolved organic carbon (DOC) values of 4.2 to 17.5 mg/L^{-1} were measured (average of 8.8 mg/L^{-1}; Marchand et al, 2009), representing thus, on average, 80 to 100% of the TOC. For our calculations, a TOC value of 6 mg/L^{-1} was used, including a DOC value of 4.8 mg/L^{-1} and a particulate organic carbon (POC) value of 1.2 mg/L^{-1}. According to Guillemots et al (2011), the 28-day lability of the DOC coming from the lakes in eastern Quebec is 6% on average. This ratio was used to determine the labile and refractory fractions of the DOC and the POC in our model.
- For total inorganic carbon (TIC), the value of 1.2 mg/L^{-1} (Schetagne et al, 2005) was applied over the entire modelled period.

- For dissolved silica and particulate silica, the value of 1.25 mg/L^{-1} was attributed to each, which refers to the value of 2.5 mg/L^{-1} for total silica described in Schetagne et al, 2005, and taking into consideration that the particulate and dissolved fractions are equally divided.

DEMARTY, M, J. BASTIEN & A. TREMBLAY. 2011. Annual follow-up of gross diffusive carbon dioxide and methane emissions from a boreal reservoir and two nearby lakes in Quebec, Canada. Biogeosciences. 8 : 41–53.

GUILLEMOTS F. & P.A. DELGIORGIO. 2011. Reconstructing the various facets of dissolved organic carbon bioavailability in freshwater ecosystems. Limnology and Oceanography. 56(2): 734– 748.

SCHETAGNE, R., LALUMIERE, R. & J. THERRIEN. 2006. *Suivi environnemental du complexe La Grande. Évolution de la qualité de l'eau*. Rapport synthèse 1978-2000. GÉNIVAR Groupe conseil inc. et direction Barrages et Environnement, Hydro-Québec. 168 p. et annexes.

MARCHAND D., Y. T. PRAIRIE & P. A. DEL GIORGIO. 2009. Linking forest fires to lake metabolism and carbon dioxide emissions in the boreal region of Northern Quebec. Global Change Biology. 15 : 2861–2873, doi: 10.1111/j.1365-2486.2009.01979.

APPENDIX 2

Water Quality Criteria Notes for Table 2

a Dissolved oxygen for warm water biota: early life stages=6 mg/L and
for the other life stages=5.5 mg/L.
For cold water biota: early life stages=9.5 mg/L and for the other life stages=6.5 mg/L.

b For clear waters, a maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period). For high flow or turbid waters, maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is >80 NTUs.

c For clear waters, a maximum increase of 25 mg/L from background levels for any short-term exposure e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d). For high flow waters, a maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is >250 mg/L.

d The values represent the range of desired concentrations for phosphorus in an oligotrophic environment; exceeding the high limit could signal an eventual environmental problem. See the CCME Guidance Framework for Phosphorus factsheet.

e The established recommendation for aluminum is 0.005 mg/L if pH <6.5 and 0.1 mg/L if pH ≥6.5.

f This criterion varies as a function of water hardness. The formula is $10^{\{0.86[\log(\text{hardness})]-3.2\}}1000$ for a value of mg/L.

g The established recommendation for copper at water hardness from 0 to 120 mg/L (soft-medium).

h Could not protect species that consume aquatic organisms.

i This criterion varies as a function of water hardness. The formula is $e^{0.76[\ln(\text{hardness})]+1.06}$ µg/L.

j This criterion varies as a function of water hardness. The formula is $e^{1.273[\ln(\text{hardness})]-4.705}$ µg/L.

k The dissolved oxygen concentrations must not be inferior to the following values:
For a temperature of 0°C: 54% saturation and 8 mg/L

For a temperature of 5°C: 54% saturation and 7 mg/L

For a temperature of 10°C: 54% saturation and 6 mg/L

For a temperature of 15°C: 54% saturation and 6 mg/L

For a temperature of 20°C: 57% saturation and 5 mg/L

For a temperature of 25°C: 63% saturation and 5 mg/L

l All artificial decreases or increases in temperature must not change the water temperature along the length of a section of a river or a portion of a lake resulting in predictable movement or change of present or potential aquatic populations; alter certain sensitive, local zones, such as a spawning ground; kill living organisms around a discharge point. In addition, the environment must not undergo sudden changes in temperature caused by, for example, a sudden stop of a thermal discharge in the cold season.

m A pH of 6.0 to 9.5 is required at the effluent point in the mining directive and the majority of the industrial discharge regulations from the ministry. This requirement meets the aquatic environment protection objective.

n The sensitivity of an environment to acidification varies with alkalinity concentrations. If the CaCO3 concentration is lower than 10, the sensitivity is high. If the concentration varies between 10 and 20, the sensitivity is medium. If the concentration is higher than 20, the sensitivity is low.

o During dry periods, the water quality criteria are defined by an average maximum increase of 2 UTN from the natural concentration. During high water flows (rain, snow) or in turbid waters, the water quality is defined by either of the following: a maximum increase at any one time of 8 UTN of background levels when background levels are between 8 and 80 UTN or by a 10% increase of background levels when background is >80 NTUs measured at a given time.

p During dry periods, the water quality criteria are defined by an average maximum increase of 5 mg/L from the natural concentration. During high water flows (rain, snow), the water quality is defined by either of the following: a maximum increase at any one time of 25 mg/L of background levels when background levels are between 25 and 250 mg/L or by a 10% increase of background levels when background is >250 mg/L measured at a given time.

q This value is based on toxic effects and does not include indirect eutrophication effects.

r The allowed concentrations of nitrites increases with chloride concentrations in an aquatic environment. The indicated value is for chloride concentrations <2 mg/L.

s The criterion for ammonia nitrogen varies with pH and temperature. The indicated values for ammonia nitrogen are the most restrictive based on pH values of 4.88 to 7.1 and temperatures of 9.6 to 26.7 measured during the campaign.

t This quality criterion applies to streams and rivers flowing into lakes that do not present environmental problems. It is designed to prevent a change in habitat in the lakes, notably by limiting the growth of algae and aquatic plants.

u This quality criterion is designed to limit excessive algae and aquatic plant growth in the streams and rivers. Certain factors influence the potential effect of phosphorus. The main physical factors mentioned include: type of substrate, depth, transparency and temperature of the water, velocity of the current, and shade. These characteristics are not considered in the quality criteria. Therefore, the phosphorus quality criteria should be used judiciously according to the environment being evaluated.

v For the oligotrophic lakes whose natural concentration is or was less than 0.01 mg/L, the quality criterion is defined by a maximum increase of 50% from the natural concentration without exceeding 0.01 mg/L.

w The sensitivity of an environment to acidification varies with calcium concentrations. If the Ca concentration is less than 4, the sensitivity is high. If the concentration varies between 4 and 8, the sensitivity is medium. If the concentration is greater than 8, the sensitivity is low. There is also an indicator for alkaline sensitivity.

x This quality criterion applies to waters with a hardness of < 100 mg/L and a chloride concentration of < 5 mg/L.

y This criterion is under revision.

z This quality criterion is defined for waters with low hardness (< 10 mg/L) and a pH around 6.5. When the aquatic environment does not exhibit these conditions, this criterion is generally not used. When this criterion is used, the surface water data must be corrected to reduce the non-bioavailable metal fraction of the particles. A correction factor of 0.66 is used on the surface water data with total suspended solids concentrations < 5 mg/L. A correction factor of 0.33 is used on the surface water data with total suspended solids concentrations ≥ 5mg/L. Certain good quality surface waters may contain higher natural levels than the water quality criteria. In this case, the natural levels must be considered as the reference value rather than the quality criteria. A quality criterion for the site itself may also be determined on a case by case basis.

aa This criterion varies as a function of water hardness. The formula is $e^{[0.7409\ (\ln \text{hardness}) - 4.719]}/1000$.

bb This criterion varies as a function of water hardness. The formula is $e^{[0.819\ (\ln \text{hardness}) + 0.6848]}/1000$.

cc This criterion varies as a function of water hardness. The formula is $e^{[0.8545\ (\ln \text{hardness}) - 1.702]}/1000$.

dd This quality criterion is provisional. This quality criterion may not protect the mayfly (Ephemerella subvaria) if this species is as sensitive as some data indicate. Before using this quality criteria, the surface water quality data must be corrected to reduce the non-bioavailable metal fraction of the particles. A 0.5 correction factor is used for the surface water data with a total suspended solids concentration < 10 mg/L. A 0.33 correction factor is used for the surface water data with a total suspended solids concentration ≥ 10 mg/L. Certain good quality surface waters may contain natural levels higher than the quality criteria. In this case, the natural levels will be considered as the reference value rather than the quality criteria. A quality criterion for the site itself may also be determined on a case by case basis.

ee This criterion varies as a function of water hardness. The formula is $e^{[0.8784\ (\ln \text{hardness}) + 3.5199]}/1{,}000$.

ff This quality criterion was defined from the data on inorganic mercury (Hgll) but is it applied to the total mercury. If a significant portion of mercury in the water column is methylmercury, this criterion will not be a sufficient protector. In addition, this does not account for the transformation of the inorganic mercury into methylmercury and the bioaccumulation of methylmercury in the food chain.

gg This criterion varies as a function of water hardness. The formula is $e^{[0.846\ (\ln \text{hardness}) +0.0584]}/1000$.

hh This criterion varies as a function of water hardness. The formula is $e^{[1.273\ (\ln \text{hardness}) -4.705]}/1000$.

ii This criterion varies as a function of water hardness. The formula is $e^{[0.8473\ (\ln \text{hardness}) +0.884]}/1000$.

jj The ministry opts for an operational quality criterion of 0.1 mg/L for petroleum hydrocarbons. Oil and petrochemicals must not be present in concentrations that can be detected by a visible film or a discoloured surface, be detected by odour, can cause colouring of the flesh of edible fish or form deposits on the shore and bottom sediments, be detected visually or by odour, or be harmful to the resident aquatic organisms.

kk **pH range and lethal pH effects on fish**

3.0-3.5: It is unlikely a fish would survive more than a few hours in this range although certain plants and invertebrates may exist at lower pH values.

3.5-4.0: This range is lethal to salmonid. There are indications showing that golden shiner, tench, fluvial perch, and pike can survive in this range, presumably after being acclimatized to non-lethal concentrations slightly higher, but the lower limit of this range could still be lethal to the golden shiner.

4.0-4.5: Presumably harmful to salmonid, tench, bream, golden shiner, porgy, and the common carp that are not acclimatized to low pH values although their resistance in this range increases with their size and age. Fish can acclimatize to these values, however, of the perch, bream, golden shiner, and pike, only the pike can reproduce.

4.5-5.0: Presumably harmful to salmonid eggs and fry as well as adults particularly in fresh water containing low concentrations of calcium, sodium, and chloride. Can be harmful to the common carp.

5.0-6.0: Unlikely harmful to all species, unless the concentration of free carbon dioxide is higher than 20 mg/L or the water contains newly precipitated iron salts in the form of ferric hydroxide whose precise toxicity is unknown. The lower limit of this range can be harmful to salmonid not acclimated if calcium, sodium, and chloride concentrations are low or if the water temperature is low. Can also be harmful to the reproduction of the golden shiner.

6.0-6.5: Presumably not harmful to fish unless the concentration of free carbon dioxide exceeds 100 mg/L.

6.5-9.0: Not harmful to fish, although the toxicity of other fish could be modified by the changes within this range.

9.0-9.5: Presumably harmful to salmonid and fluvial perch if the range persists.

9.5-10: Lethal to salmonid over a long period, but tolerable over a short period. Can be harmful to certain species in the development phase.

10.0-10.5: Tolerable to the golden shiner and salmonid over a short period but lethal over a long period.

10.5-11.0: Lethal quickly to salmonid. Prolonged exposure to the upper limit of this range is lethal to carp, tench, porgy, and pike.

11.0-11.5: Lethal quickly to all species.

ll During clear flow periods, the quality criterion is defined by a maximum increase of 8 UTN from the background level.

mm During dry periods, the quality criterion is defined by a maximum increase of 25 mg/L from the natural concentration.

nn This quality criterion will probably not be a sufficient protector when chlorides are associated to potassium, calcium, or magnesium rather than to sodium. In addition, since freshwater organisms only tolerate chloride within a limited range without suffering acute toxicity, exceeding the quality criterion could be harmful to a good number of species. This quality criterion is under revision.

oo There should be no toxic effects at this concentration if the pH remains between 6.5 and 9.0.

pp This criterion varies as a function of water hardness. The formula is $e^{[1.0166\ (\ln \text{hardness}) - 3.924]}/1{,}000$.

qq This criterion varies as a function of water hardness. The formula is $e^{[0.819\ (\ln \text{hardness}) + 3.7256]}/1{,}000$.

rr This criterion varies as a function of water hardness. The formula is $e^{[0.9422\ (\ln \text{hardness}) - 1.700]}/1{,}000$.

ss This quality criterion is provisional. This quality criterion may not protect the mayfly (*Ephemerella subvaria*) if this species is as sensitive as some data indicate.

tt This criterion varies as a function of water hardness. The formula is $e^{[0.8784\ (\ln \text{hardness}) + 4.2889]}/1{,}000$.

uu This criterion varies as a function of water hardness. The formula is $2e^{[0.846\ (\ln \text{hardness}) + 2.255]}/1{,}000$.

vv This criterion varies as a function of water hardness. The formula is $e^{[1.273\ (\ln \text{hardness}) - 1.46]}/1{,}000$.

ww This quality criterion applies to selenium and inorganic salts thereof.

xx This quality criterion is defined for Bunker C oil. Higher criteria are available for other types of hydrocarbons.

yy This concentration is a maximum acceptable concentration (MAC) defined for drinking water.

zz The total concentration of nitrates and nitrites must not exceed 10 mg/L.

A The presence of ammonia nitrogen at higher concentrations could compromise disinfection.

B Above this concentration, the organoleptic and aesthetic properties of drinking water could be altered.

C Above this concentration, the organoleptic and aesthetic properties of drinking water could be altered. A sulphate concentration higher than 500 mg/L could have a laxative effect on certain people.

D Because of the limitations using data obtained from animal experiments as a model for humans, and the uncertainty surrounding human data, it is impossible to determine a guideline based on health arguments. However, coagulation optimization procedures using aluminum-based coagulant agents in drinking water treatment systems led to the definition of practical value limits: 0.1 mg/L or less in major water treatment systems and 0.2 mg/L or less in small water treatment systems.

E This quality criterion is provisional. This concentration is a maximum acceptable concentration (MAC) defined for drinking water.

F This concentration is a maximum acceptable concentration (MAC) defined for drinking water. It deals with the concentration of arsenic, which represents an "essentially negligible" health risk. Health Canada defines the term "essentially negligible" as a range from one new cancer above background per 100,000 people to one new cancer above background per 1 million people (i.e., 10^{-5} to 10^{-6}) over a lifetime. This criterion is used in the context of surface water contamination prevention, which is why it differs from the drinking water standard. Certain good quality surface water may contain natural concentrations higher than the quality criterion.

G Above this concentration, organoleptic and aesthetic drinking water properties may be altered. Certain good quality surface water may contain higher natural concentrations.

H This quality criterion is based on a consumption of 15 grams of fish or shellfish per day. This quality criterion includes methylmercury.

I This value is defined for drinking water.

J This quality criterion is equivalent to a level of risk of one additional cancer for an exposed population of 1 million people. This quality criterion applies only to the inorganic form. Temporary quality criterion.

K This quality criterion includes methylmercury. Quality criteria were also established to prevent aquatic organism tissue contamination.

L This quality criterion is provisional. This quality criterion was calculated from toxicity data for low hardness water ($\leq$120 mg/L ($CaCO_3$))

M This criterion varies as a function of water hardness. The formula is $e^{[1.0629(\ln \text{hardness}) + 1.1869]}/1000$.

APPENDIX 3

CORMIX Simulation Reports – Mine Effluent

A) Spring Conditions

B) Summer Conditions

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 7.0GT
                       HYDRO2:  Version-7.0.1.0  August, 2011
SITE NAME/LABEL:                Renard Project - Mine Outfall
  DESIGN CASE:                  Mine Outfall - Spring - Alternative 1
  FILE NAME:                    P:\2060 Renard Modelisation Effluent\2060
Analyse des donnees\Emissaire minier\2060 Renard minier Printemps Diffuseur
Parallele.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/16/2011--14:24:20
*********************************************************************************
SUMMARY OF INPUT DATA:
---------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                          = bounded
  Width                          BS      = 375 m
  Channel regularity             ICHREG  = 1
  Ambient flowrate               QA      = 90 m^3/s
  Average depth                  HA      = 12 m
  Depth at discharge             HD      = 12 m
  Ambient velocity               UA      = 0.02 m/s
  Darcy-Weisbach friction factor F       = 0.0137
    Calculated from Manning's            = 0.02
  Wind velocity                  UW      = 2 m/s
  Stratification Type            STRCND  = U
  Surface temperature                    = 6 degC
  Bottom temperature                     = 6 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density                RHOAS   = 999.9430 kg/m^3
  Bottom density                 RHOAB   = 999.9430 kg/m^3
---------------------------------------------------------------------------------
DISCHARGE PARAMETERS:            Submerged Multiport Diffuser Discharge
  Diffuser type                  DITYPE  = alternating parallel
  Diffuser length                LD      = 250 m
  Nearest bank                           = left
  Diffuser endpoints             YB1     = 125 m;    YB2 = 125 m
  Number of openings             NOPEN   = 50
  Number of Risers               NRISER  = 50
  Ports/Nozzles per Riser        NPPERR   = 1
  Spacing between risers/openings SPAC   = 5.10 m
  Port/Nozzle diameter           D0      = 0.04 m
    with contraction ratio               = 1
  Equivalent slot width          B0      = 0.0003 m
  Total area of openings         TA0     = 0.0628 m^2
  Discharge velocity             U0      = 2.40 m/s
  Total discharge flowrate       Q0      = 0.151 m^3/s
  Discharge port height          H0      = 0.25 m
  Nozzle arrangement             BETYPE  = alternating without fanning
  Diffuser alignment angle       GAMMA   = 0 deg
```

```
  Vertical discharge angle        THETA  = 90 deg
  Actual Vertical discharge angle THEAC  = 90 deg
  Horizontal discharge angle      SIGMA  = 0 deg
  Relative orientation angle      BETA   = 90 deg
  Discharge temperature (freshwater)     = 6 degC
  Corresponding density           RHO0   = 999.9430 kg/m^3
  Density difference              DRHO   = 0 kg/m^3
  Buoyant acceleration            GP0    = 0 m/s^2
  Discharge concentration         C0     = 100 %
  Surface heat exchange coeff.    KS     = 0 m/s
  Coefficient of decay            KD     = 0 /s
------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)         q0     = 0.000604 m^2/s
  Momentum flux                   m0     = 0.001452 m^3/s^2
  Buoyancy flux                   j0     = 0 m^3/s^3
------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.00 m         Lm  = 3.63 m         LM  = 99999 m
  lm' = 99999 m         Lb' = 99999 m         La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 99999
  Port/nozzle Froude number       FRD0   = 99999
  Velocity ratio                  R      = 120.16
------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                         = no
  Water quality standard specified        = yes
  Water quality standard          CSTD    = 10 %
  Regulatory mixing zone                  = yes
  Regulatory mixing zone specification    = distance
  Regulatory mixing zone value            = 300 m (m^2 if area)
  Region of interest                      = 4500 m
******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = MU9 |
  *------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 12 m
******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the bottom below the port centre:
    125 m from the left bank/shore.
  Number of display steps NSTEP = 1500 per module.
```

```
--------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS:
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
implication.  However, this information may be useful for the discharge
designer because the mixing in the NFR is usually sensitive to the discharge
design conditions.
  Pollutant concentration at NFR edge  c = 10.416700 %
  Dilution at edge of NFR              s = 9.6
  NFR Location:                        x = 90 m
    (centerline coordinates)           y = 0 m
                                       z = 12 m
  NFR plume dimensions:  half-width (bh) = 30 m
                          thickness (bv) = 12 m
Cumulative travel time:       0 sec.
--------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is equal or about equal to the surrounding ambient
water density at the discharge level.
  Therefore, the effluent behaves essentially as NEUTRALLY BUOYANT.
--------------------------------------------------------------------------------
Near-field instability behaviour:
  The diffuser flow will experience instabilities with full vertical mixing
in the near-field.
  There may be benthic impact of high pollutant concentrations.
--------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 90 m
downstream and continues as vertically mixed into the far-field.
--------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section does not contact bank.
************************ TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
The plume conditions at the boundary of the specified RMZ are as follows:
  Pollutant concentration              c = 9.333297 %
  Corresponding dilution               s = 10.7
  Plume location:                      x = 300 m
    (centerline coordinates)           y = 0 m
                                       z = 12 m
  Plume dimensions:      half-width (bh) = 33.48 m
                          thickness (bv) = 12 m
Cumulative travel time:       10482.4131 sec.

Note:
Plume concentration c and dilution s values are reported based on prediction
file values - assuming linear interpolation between predicted points just
before and just after the RMZ boundary has been detected.
```

Please ensure a small step size is used in the prediction file to account for this linear interpolation. Step size can be controlled by increasing (reduces the prediction step size) or decreasing (increases the prediction step size) the - Output Steps per Module - in CORMIX input.

At this position, the plume is NOT IN CONTACT with any bank.
Furthermore, the specified water quality standard has indeed been met within the RMZ. In particular:
The ambient water quality standard was encountered at the following plume position:

Water quality standard		= 10 %
Corresponding dilution	s	= 10
Plume location:	x	= 162.73 m
(centerline coordinates)	y	= 0 m
	z	= 12 m
Plume dimensions: half-width	(bh)	= 31.25 m
thickness	(bv)	= 12 m

********** FINAL DESIGN ADVICE AND COMMENTS **********
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent the actual three-dimensional diffuser geometry. Thus, it approximates the details of the merging process of the individual jets from each port/nozzle.
In the present design, the spacing between adjacent ports/nozzles (or riser assemblies) is of the order of, or less than, the local water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a final CORMIX1 (single port discharge) analysis, with discharge data for an individual diffuser jet/plume, in order to compare to the present near-field prediction.

DIFFUSER DESIGN DETAILS: Because of the alternating arrangement of the opposing nozzles/ports, the AVERAGE VERTICAL ANGLE (THETA) has been set to 90 deg. This represents a ZERO NET HORIZONTAL MOMENTUM FLUX for the entire diffuser.

REMINDER: The user must take note that HYDRODYNAMIC MODELLING by any known technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 7.0GT
                       HYDRO2:Version-7.0.1.0  August, 2011
SITE NAME/LABEL:                Renard Project - Mine Outfall
  DESIGN CASE:                  Mine Outfall - Summer - Alternative 1
  FILE NAME:                    P:\2060 Renard Modelisation Effluent\2060
Analyse des donnees\Emissaire minier\2060 Renard minier Etiage Diffuseur
Parallele.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/16/2011--15:19:44
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                          = bounded
  Width                          BS      = 375 m
  Channel regularity             ICHREG  = 1
  Ambient flowrate               QA      = 90 m^3/s
  Average depth                  HA      = 12 m
  Depth at discharge             HD      = 12 m
  Ambient velocity               UA      = 0.02 m/s
  Darcy-Weisbach friction factor F       = 0.0137
    Calculated from Manning's            = 0.02
  Wind velocity                  UW      = 2 m/s
  Stratification Type            STRCND  = C
  Surface temperature                    = 17 degC
  Bottom temperature                     = 5 degC
  Temperature below thermocline          = 9 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density                RHOAS   = 998.7761 kg/m^3
  Bottom density                 RHOAB   = 999.9667 kg/m^3
  Stratification height          HINT    = 6 m (pycnocline level)
  Density below pycnocline       RHOAP   = 999.7833 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:            Submerged Multiport Diffuser Discharge
  Diffuser type                  DITYPE  = alternating parallel
  Diffuser length                LD      = 250 m
  Nearest bank                           = left
  Diffuser endpoints             YB1     = 125 m;    YB2 = 125 m
  Number of openings             NOPEN   = 50
  Number of Risers               NRISER  = 50
  Ports/Nozzles per Riser        NPPERR   = 1
  Spacing between risers/openings SPAC   = 5.10 m
  Port/Nozzle diameter           D0      = 0.04 m
    with contraction ratio               = 1
  Equivalent slot width          B0      = 0.0003 m
  Total area of openings         TA0     = 0.0628 m^2
  Discharge velocity             U0      = 1.45 m/s
  Total discharge flowrate       Q0      = 0.091 m^3/s
```

```
  Discharge port height           H0     = 0.25 m
  Nozzle arrangement              BETYPE = alternating without fanning
  Diffuser alignment angle        GAMMA  = 0 deg
  Vertical discharge angle        THETA  = 90 deg
  Actual Vertical discharge angle THEAC  = 90 deg
  Horizontal discharge angle      SIGMA  = 0 deg
  Relative orientation angle      BETA   = 90 deg
  Discharge temperature (freshwater)     = 18 degC
  Corresponding density           RHO0   = 998.5967 kg/m^3
  Density difference              DRHO   = 1.3624 kg/m^3
  Buoyant acceleration            GP0    = 0.0134 m/s^2
  Discharge concentration         C0     = 100 %
  Surface heat exchange coeff.    KS     = 0 m/s
  Coefficient of decay            KD     = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)         q0     = 0.000364 m^2/s
  Momentum flux                   m0     = 0.000527 m^3/s^2
  Buoyancy flux                   j0     = 0.000005 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.00 m         Lm  = 1.32 m         LM  = 1.84 m
  lm' = 1.21 m         Lb' = 0.98 m         La  = 1.15 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 790.35
  Port/nozzle Froude number       FRD0   = 62.65
  Velocity ratio                  R      = 72.42
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                        = no
  Water quality standard specified       = yes
  Water quality standard          CSTD   = 10 %
  Regulatory mixing zone                 = yes
  Regulatory mixing zone specification   = distance
  Regulatory mixing zone value           = 300 m (m^2 if area)
  Region of interest                     = 5000 m
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MS3 |
  *-------------------------*
  The specified ambient density stratification is important, the discharge
  near field flow is confined to the lower layer by the ambient density
  stratification.
  Applicable layer depth = lower layer depth = 6 m
*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
```

```
X-Y-Z Coordinate system:
  Origin is located at the bottom below the port center:
    125 m from the left bank/shore.
  Number of display steps NSTEP = 1000 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS:
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
implication.  However, this information may be useful for the discharge
designer because the mixing in the NFR is usually sensitive to the discharge
design conditions.
  Pollutant concentration at NFR edge  c = 2.1325 %
  Dilution at edge of NFR              s = 46.9
  NFR Location:                        x = 46.71 m
    (centerline coordinates)           y = 0 m
                                       z = 5.16 m
  NFR plume dimensions:  half-width (bh) = 90.27 m
                           thickness (bv) = 1.18 m
Cumulative travel time:       2303.2070 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water density at
the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
the surface.
-------------------------------------------------------------------------------
Stratification assessment:
  The specified ambient density stratification is dynamically important.
  The discharge near field flow is trapped within the linearly stratified
ambient density layer.
-------------------------------------------------------------------------------
UPSTREAM INTRUSION SUMMARY:
Plume exhibits upstream intrusion due to low ambient velocity or strong
discharge buoyancy.
  Intrusion length                        =  40.56 m
  Intrusion stagnation point              =  -38.99 m
  Intrusion thickness                     =  2.77 m
  Intrusion half width at impingement     =  90.27 m
  Intrusion half thickness at impingement =  1.18 m
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes laterally fully mixed at 382.45 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 102.50 m downstream.
  Plume contacts second bank at 382.45 m downstream.
************************ TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
The plume conditions at the boundary of the specified RMZ are as follows:
  Pollutant concentration              c = 1.568352  %
  Corresponding dilution               s = 63.8
```

```
  Plume location:                        x = 300 m
    (centerline coordinates)             y = 125 m
                                         z = 5.16 m
  Plume dimensions:      half-width (bh) = 340.61 m
                          thickness (bv) = 0.85 m
Cumulative travel time:       14955.0107 sec.

Note:
Plume concentration c and dilution s values are reported based on prediction
file values - assuming linear interpolation between predicted points just
before and just after the RMZ boundary has been detected.

Please ensure a small step size is used in the prediction file to account for
this linear interpolation. Step size can be controlled by increasing (reduces
the prediction step size) or decreasing (increases the prediction step size)
the - Output Steps per Module - in CORMIX input.

At this position, the plume is CONTACTING the LEFT bank.
Furthermore, the specified water quality standard has indeed been met within
the RMZ. In particular:
The ambient water quality standard was encountered at the following plume
position:
  Water quality standard                   = 10  %
  Corresponding dilution                 s = 10
  Plume location:                        x = 0.18 m
    (centerline coordinates)             y = 0 m
                                         z = 2.21 m
  Plume dimensions:      half-width (bh) = 0.22 m
                          thickness (bv) = 0.22 m
********************* FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent the
actual three-dimensional diffuser geometry.  Thus, it approximates the
details of the merging process of the individual jets from each port/nozzle.
In the present design, the spacing between adjacent ports/nozzles (or riser
assemblies) is of the order of, or less than, the local water depth so that
the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a final
CORMIX1 (single port discharge) analysis, with discharge data for an
individual diffuser jet/plume, in order to compare to the present near-field
prediction.
------------------------------------------------------------------------------
DIFFUSER DESIGN DETAILS:  Because of the alternating arrangement of the
opposing nozzles/ports, the AVERAGE VERTICAL ANGLE (THETA) has been set to 90
deg.  This represents a ZERO NET HORIZONTAL MOMENTUM FLUX for the entire
diffuser.
------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELLING by any known
technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
```

CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

APPENDIX 4

CORMIX Simulation Reports – Domestic Effluent

A) Construction Phase

B) Operation Phase

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 7.0GT
                       HYDRO1:Version-7.0.0.0  April, 2011
SITE NAME/LABEL:              Renard Project - Domestic Outfall
  DESIGN CASE:                   Domestic Outfall
  FILE NAME:                     P:\2060 Renard Modelisation Effluent\2060
Analyse des donnees\Emissaire domestique\2060 Renard Domestic Operation Peak
Hour Flow.prd
  Using subsystem CORMIX1:     Single Port Discharges
  Start of session:             11/08/2011--13:16:59
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                          = unbounded
  Average depth                  HA      = 7.5 m
  Depth at discharge             HD      = 6.75 m
  Ambient velocity               UA      = 0.01 m/s
  Darcy-Weisbach friction factor F       = 0.0160
    Calculated from Manning's            = 0.02
  Wind velocity                  UW      = 2 m/s
  Stratification Type            STRCND  = C
  Surface temperature                    = 17 degC
  Bottom temperature                     = 12 degC
  Temperature below thermocline          = 13 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density                RHOAS   = 998.7761 kg/m^3
  Bottom density                 RHOAB   = 999.4994 kg/m^3
  Stratification height          HINT    = 6 m (pycnocline level)
  Density below pycnocline       RHOAP   = 999.3789 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:            Single Port Discharge
  Nearest bank                           = left
  Distance to bank               DISTB   = 45 m
  Port diameter                  D0      = 0.2 m
  Port cross-sectional area      A0      = 0.0314 m^2
  Discharge velocity             U0      = 0.15 m/s
  Discharge flowrate             Q0      = 0.00468 m^3/s
  Discharge port height          H0      = 0.2 m
  Vertical discharge angle       THETA   = 0 deg
  Horizontal discharge angle     SIGMA   = 240 deg
  Discharge temperature (freshwater)     = 18 degC
  Corresponding density          RHO0    = 998.5967 kg/m^3
  Density difference             DRHO    = 0.8424 kg/m^3
  Buoyant acceleration           GP0     = 0.0083 m/s^2
  Discharge concentration        C0      = 100 %
  Surface heat exchange coeff.   KS      = 0 m/s
  Coefficient of decay           KD      = 0 /s
-------------------------------------------------------------------------------
```

```
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.18 m         Lm  = 2.64 m         Lb  = 38.69 m
  LM  = 0.69 m         Lm' = 99999 m         Lb' = 99999 m
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
  Port densimetric Froude number  FR0    = 3.66
  Velocity ratio                  R      = 14.90
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                        = no
  Water quality standard specified       = yes
  Water quality standard          CSTD   = 1 %
  Regulatory mixing zone                 = yes
  Regulatory mixing zone specification   = distance
  Regulatory mixing zone value           = 300 m (m^2 if area)
  Region of interest                     = 1000 m
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = H3 |
  *------------------------*
  The specified ambient density stratification is important, the near field
flow is confined to lower layer by ambient density jump at the pycnocline.
The linearly stratified lower layer was represented by a uniform lower layer
with density equal to mean lower layer density layer.
  Applicable layer depth = lower layer depth = 6 m
********************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

--------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the bottom below the port center:
    45 m from the left bank/shore.
  Number of display steps NSTEP = 1000 per module.
--------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS:
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
implication.  However, this information may be useful for the discharge
designer because the mixing in the NFR is usually sensitive to the discharge
design conditions.
  Pollutant concentration at NFR edge  c = 3.7769 %
  Dilution at edge of NFR              s = 26.5
  NFR Location:                        x = 9.40 m
    (centerline coordinates)           y = -2.78 m
                                       z = 6 m
  NFR plume dimensions:  half-width (bh) = 18.92 m
                          thickness (bv) = 0.33 m
Cumulative travel time:       1014.1844 sec.
--------------------------------------------------------------------------------
Buoyancy assessment:
```

The effluent density is less than the surrounding ambient water density at the discharge level.
Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Stratification assessment:
The specified two layer ambient density stratification is dynamically important. The discharge near field flow will be confined to the lower layer by the ambient density stratification.
The linearly stratified lower layer will be represented by a uniform lower layer with density equal to mean lower layer density.

UPSTREAM INTRUSION SUMMARY:
Plume exhibits upstream intrusion due to low ambient velocity or strong discharge buoyancy.

Intrusion length	=	13.20 m
Intrusion stagnation point	=	-13.26 m
Intrusion thickness	=	0.32 m
Intrusion half width at impingement	=	18.92 m
Intrusion half thickness at impingement	=	0.33 m

PLUME BANK CONTACT SUMMARY:
Plume in unbounded section contacts nearest bank at 64.54 m downstream.

********** TOXIC DILUTION ZONE SUMMARY **********
No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********
The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration	c =	0.130091 %
Corresponding dilution	s =	768.7
Plume location:	x =	300 m
(centerline coordinates)	y =	45 m
	z =	6 m
Plume dimensions: half-width (bh)	=	180.16 m
thickness (bv)	=	2.00 m
Cumulative travel time:		30074.5371 sec.

Note:
Plume concentration c and dilution s values are reported based on prediction file values - assuming linear interpolation between predicted points just before and just after the RMZ boundary has been detected.

Please ensure a small step size is used in the prediction file to account for this linear interpolation. Step size can be controlled by increasing (reduces the prediction step size) or decreasing (increases the prediction step size) the - Output Steps per Module - in CORMIX input.

At this position, the plume is CONTACTING the LEFT bank.
Furthermore, the specified water quality standard has indeed been met within the RMZ. In particular:
The ambient water quality standard was encountered at the following plume position:

```
  Water quality standard                = 1  %
  Corresponding dilution              s = 100.0
  Plume location:                     x = 82.74 m
    (centerline coordinates)          y = 45 m
                                      z = 6 m
  Plume dimensions:      half-width (bh) = 103.04 m
                          thickness (bv) = 0.45 m
********** FINAL DESIGN ADVICE AND COMMENTS **********
REMINDER:  The user must take note that HYDRODYNAMIC MODELLING by any known
technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated plume
geometries) are reliable for the majority of cases and are accurate to within
about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
the design configuration as highly complex and uncertain for prediction.
```

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 7.0GT
                       HYDRO1:  Version-7.0.0.0  April, 2011
SITE NAME/LABEL:                 Renard Projet - Domestic Outfall
  DESIGN CASE:                   Domestic Outfall
  FILE NAME:                     P:\2060 Renard Modelisation Effluent\2060
Analyse des donnees\Emissaire domestique\2060 Renard Domestic Operation Daily
flow.prd
  Using subsystem CORMIX1:     Single Port Discharges
  Start of session:             11/08/2011--11:45:29
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                          = unbounded
  Average depth                  HA      = 7.5 m
  Depth at discharge             HD      = 6.75 m
  Ambient velocity               UA      = 0.01 m/s
  Darcy-Weisbach friction factor F       = 0.0160
    Calculated from Manning's            = 0.02
  Wind velocity                  UW      = 2 m/s
  Stratification Type            STRCND  = C
  Surface temperature                    = 17 degC
  Bottom temperature                     = 12 degC
  Temperature below thermocline          = 13 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density                RHOAS   = 998.7761 kg/m^3
  Bottom density                 RHOAB   = 999.4994 kg/m^3
  Stratification height          HINT    = 6 m (pycnocline level)
  Density below pycnocline       RHOAP   = 999.3789 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:            Single Port Discharge
  Nearest bank                           = left
  Distance to bank               DISTB   = 45 m
  Port diameter                  D0      = 0.2 m
  Port cross-sectional area      A0      = 0.0314 m^2
  Discharge velocity             U0      = 0.04 m/s
  Discharge flowrate             Q0      = 0.001169 m^3/s
  Discharge port height          H0      = 0.2 m
  Vertical discharge angle       THETA   = 0 deg
  Horizontal discharge angle     SIGMA   = 240 deg
  Discharge temperature (freshwater)     = 18 degC
  Corresponding density          RHO0    = 998.5967 kg/m^3
  Density difference             DRHO    = 0.8987 kg/m^3
  Buoyant acceleration           GP0     = 0.0088 m/s^2
  Discharge concentration        C0      = 100 %
  Surface heat exchange coeff.   KS      = 0 m/s
  Coefficient of decay           KD      = 0 /s
-------------------------------------------------------------------------------
```

```
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.18 m         Lm  = 0.66 m         Lb  = 10.31 m
  LM  = 0.17 m         Lm' = 0.69 m         Lb' = 1.39 m
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
  Port densimetric Froude number  FR0    = 0.89
  Velocity ratio                  R      = 3.72
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                        = no
  Water quality standard specified       = yes
  Water quality standard          CSTD   = 1 %
  Regulatory mixing zone                 = yes
  Regulatory mixing zone specification   = distance
  Regulatory mixing zone value           = 300 m (m^2 if area)
  Region of interest                     = 1000 m
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = S5 |
  *------------------------*
  The specified ambient density stratification is important, the discharge
near field flow is confined to the lower layer by the ambient density
stratification.
  Applicable layer depth = lower layer depth = 6 m
********************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

--------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the bottom below the port center:
    45 m from the left bank/shore.
  Number of display steps NSTEP = 1000 per module.
--------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
implication.  However, this information may be useful for the discharge
designer because the mixing in the NFR is usually sensitive to the discharge
design conditions.
  Pollutant concentration at NFR edge  c = 4.2596 %
  Dilution at edge of NFR              s = 23.5
  NFR Location:                        x = 1.92 m
    (centerline coordinates)           y = -0.56 m
                                       z = 3.50 m
  NFR plume dimensions:  half-width (bh) = 2.04 m
                           thickness (bv) = 0.67 m
Cumulative travel time:       156.8302 sec.
--------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water density at
the discharge level.
```

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Stratification assessment:
The specified ambient density stratification is dynamically important.
The discharge near field flow is trapped within the linearly stratified ambient density layer.

UPSTREAM INTRUSION SUMMARY:
Plume exhibits upstream intrusion due to low ambient velocity or strong discharge buoyancy.

Intrusion length	=	0.88 m
Intrusion stagnation point	=	0.02 m
Intrusion thickness	=	1.71 m
Intrusion half width at impingement	=	2.04 m
Intrusion half thickness at impingement	=	0.67 m

PLUME BANK CONTACT SUMMARY:
Plume in unbounded section contacts nearest bank at 106.58 m downstream.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration	c =	0.079542 %
Corresponding dilution	s =	1257.2
Plume location:	x =	300 m
(centerline coordinates)	y =	45 m
	z =	3.50 m
Plume dimensions: half-width (bh)	=	201.73 m
thickness (bv)	=	0.73 m

Cumulative travel time: 29964.8809 sec.

Note:
Plume concentration c and dilution s values are reported based on prediction file values - assuming linear interpolation between predicted points just before and just after the RMZ boundary has been detected.

Please ensure a small step size is used in the prediction file to account for this linear interpolation. Step size can be controlled by increasing (reduces the prediction step size) or decreasing (increases the prediction step size) the - Output Steps per Module - in CORMIX input.

At this position, the plume is CONTACTING the LEFT bank.
Furthermore, the specified water quality standard has indeed been met within the RMZ. In particular:
The ambient water quality standard was encountered at the following plume position:

Water quality standard	=	1 %
Corresponding dilution	s =	100
Plume location:	x =	37.51 m
(centerline coordinates)	y =	-0.56 m

```
                                        z = 3.50 m
  Plume dimensions:      half-width (bh) = 15.60 m
                          thickness (bv) = 0.37 m
********** FINAL DESIGN ADVICE AND COMMENTS **********
REMINDER:  The user must take note that HYDRODYNAMIC MODELLING by any known
technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated plume
geometries) are reliable for the majority of cases and are accurate to within
about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
the design configuration as highly complex and uncertain for prediction.
```

Appendix 3.10.2

Notes for the water quality criteria presented in Table 3.10.5

Notes for Water Quality Criteria

a Dissolved oxygen for warm water biota: early life stages=6 mg/l and for the other life stages=5.5 mg/l. For cold water biota: early life stages=9.5 mg/l and for the other life stages=6.5 mg/l.

b For clear waters, a maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period). For high flow or turbid waters, maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is >80 NTUs.

c For clear waters, a maximum increase of 25 mg/l from background levels for any short-term exposure e.g., 24-h period). Maximum average increase of 5 mg/l from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d). For high flow waters, a maximum increase of 25 mg/l from background levels at any time when background levels are between 25 and 250 mg/l. Increase should not reach more than 10% of background levels when background is >250 mg/l.

d The values represent the range of desired concentrations for phosphorus in an oligotrophic environment; exceeding the high limit could signal an eventual environmental problem. See the CCME Guidance Framework for Phosphorus factsheet.

e The established recommendation for aluminum is 0.005 mg/l if pH <6.5 and 0.1 mg/l if pH ≥6.5.

f This criterion varies as a function of water hardness. The formula is $10^{\{0.86[\log(\text{hardness})]-3.2\}}$/1,000 for a value of mg/l.

g The established recommendation for copper at water hardness from 0 to 120 mg/l (soft-medium).

h Could not protect species that consume aquatic organisms.

i This criterion varies as a function of water hardness. The formula is $e^{0.76[\ln(\text{hardness})]+1.06\ \mu g/L}$.

j This criterion varies as a function of water hardness. The formula is $e^{1.273[\ln(\text{hardness})]-4.705\ \mu g/L}$.

k The dissolved oxygen concentrations must not be inferior to the following values:

- For a temperature of 0°C: 54% saturation and 8 mg/l
- For a temperature of 5°C: 54% saturation and 7 mg/l
- For a temperature of 10°C: 54% saturation and 6 mg/l
- For a temperature of 15°C: 54% saturation and 6 mg/l
- For a temperature of 20°C: 57% saturation and 5 mg/l
- For a temperature of 25°C: 63% saturation and 5 mg/

l All artificial decrease or increase in temperature must not change the water temperature along the length of a section of a river or a portion of a lake resulting in predictable movement or change of present or potential aquatic populations; alter certain sensitive, local zones, such as a spawning ground; kill living organisms around a discharge point. In addition, the environment must not undergo sudden changes in temperature caused by, for example, a sudden stop of a thermal discharge in the cold season.

m A pH of 6.0 to 9.5 is required at the effluent point in the mining directive and the majority of the industrial discharge regulations from the ministry. This requirement meets the aquatic environment protection objective.

n The sensitivity of an environment to acidification varies with alkalinity concentrations. If the $CaCO_3$ concentration is lower than 10, the sensitivity is high. If the concentration varies between 10 and 20, the sensitivity is moderate. If the concentration is higher than 20, the sensitivity is low.

o During dry periods, the water quality criteria is defined by an average maximum increase of 2 UTN from the natural concentration. During high water flows (rain, snow) or in turbid waters, the water quality is defined by either of the following: a maximum increase at any one time of 8 UTN of background levels when background levels are between 8 and 80 UTN or by a 10% increase relatively to background levels when background is >80 NTUs measured at a given time.

p During dry periods, the water quality criteria is defined by an average maximum increase of 5 mg/l from the natural concentration. During high water flows (rain, snow) or in turbid waters, the water quality is defined by either a maximum increase at any one time of 25 mg/l of background levels when background levels are between 25 and 250 mg/l or by a 10% increase of background levels when background is >250 mg/l measured at a given time.

q This value is based on toxic effects and does not consider indirect eutrophication effects.

r The allowed concentrations of nitrites increases with chlorine concentrations in aquatic environment. The indicated value is for chlorine concentrations <2 mg/l.

s The criteria for ammonia nitrogen varies with pH and temperature. The indicated values for ammonia nitrogen are the most restrictive based on pH values of 4.88 to 7.1 and measured temperatures of 9.6 to 26.7 during sampling campaign.

t This quality criterion applies to streams and rivers flowing into lakes that do not present environmental problems. It is designed to prevent a change in habitat in those lakes, notably by limiting the growth of algae and aquatic plants.

u This quality criterion is designed to limit excessive algae and aquatic plant growth in streams and rivers. Certain factors influence the potential effect of phosphorus. The main physical factors mentioned include: type of substrate, depth, transparency and temperature of the water, speed of the current, and shade. These characteristics are not considered in the quality criteria. Therefore, the phosphorus quality criteria should be used judiciously according to the on-site environment.

v For the oligotrophic lakes whose natural concentration is or was less than 0.01 mg/l, the quality criterion is defined by a maximum increase of 50% from the natural concentration without exceeding 0.01 mg/l.

w The sensitivity of an environment to acidification varies with calcium concentrations. If the Ca concentration is less than 4, the sensitivity is high. If the concentration varies between 4 and 8, the sensitivity is medium. If the concentration is greater than 8, the sensitivity is low. There is also an indicator for alkaline sensitivity.

x This quality criterion applies to waters with a hardness of < 100 mg/l and a chlorine concentration of < 5 mg/l.

y This criterion is under revision.

z This quality criterion is defined for waters with low hardness (< 10 mg/l) and a pH around 6.5. When the aquatic environment does not exhibit these conditions, this criterion is generally not used. When this criterion is used, the surface water data must be corrected to reduce the non-bioavailable metal fraction associated to particles. A correction factor of 0.66 is used for the surface water data with suspended matter concentrations < 5 mg/l. A correction factor of 0.33 is used for the surface water data with suspended matter concentrations ≥ 5mg/l. Certain good quality surface waters may contain higher natural levels than the water quality criteria. In this case, the natural levels must be considered as the reference value rather than the quality criteria. A quality criterion for the site itself may also be determined on a case by case basis.

aa This criterion varies with water hardness. The formula is $e^{[0.7409\ \ln(\text{hardness}) - 4.719]}/1{,}000$.

bb This criterion varies with water hardness. The formula is $e^{[0.819\ \ln(\text{hardness}) + 0.6848]}/1{,}000$.

cc This criterion varies with water hardness. The formula is $e^{[0.8545\ \ln(\text{hardness}) - 1.702]}/1{,}000$.

dd This quality criterion is provisional. This quality criterion may not protect the mayfly (*Ephemerella subvaria*) if this species is as sensitive as some data indicate. Before using this quality criterion, the surface water quality data must be corrected to reduce the non-bioavailable metal fraction of the particles. A 0.5 correction factor is used for the surface water data with a suspended matter concentration < 10 mg/l. A 0.33 correction factor is used for the surface water data with a suspended matter concentration ≥ 10 mg/l. Certain good quality surface waters may contain natural levels higher than the quality criteria. In this case, the natural levels will be considered as the reference value rather than the quality criteria. A quality criterion for the site itself may also be determined on a case by case basis.

ee This criterion varies with water hardness. The formula is $e^{[0.8784\ \ln(\text{hardness}) + 3.5199]}/1{,}000$.

ff This quality criterion was defined from the data on inorganic mercury (HgII) but it is applied to the total mercury. If a significant portion of mercury in the water column is under the methylmercury form, this criterion will not be sufficiently protective. In addition, this does not account for the transformation of the inorganic mercury into methylmercury and the bioaccumulation of methylmercury in the food chain.

gg This criterion varies with water hardness. The formula is $e^{[0.846\ \ln(\text{hardness}) + 0.0584]}/1{,}000$.

hh This criterion varies with water hardness. The formula is $e^{[1.273\ \ln(\text{hardness}) - 4.705]}/1{,}000$.

Ii This criterion varies with water hardness. The formula is $e^{[0.8473\ \ln(\text{hardness}) + 0.884]}/1{,}000$.

jj The ministry opts for an operational quality criterion of 0.1 mg/l for petroleum hydrocarbons. Oil and petrochemicals must not be present in concentrations that can be detected by a visible film constituting a screen or a discolored surface, be detected by odour, by colouring of the flesh of edible fish or form deposits on the shore and bottom sediments, be detected visually or by odour, or be harmful to the resident aquatic organisms.

kk **pH range and pH lethal effects on fish**

3.0-3.5: It is unlikely a fish would survive more than a few hours in this range although certain plants and invertebrates can live at lower pH values.

3.5-4.0: This range is lethal to salmonids. There are indications showing that golden shiner, tench, perch, and pike can survive in this range, presumably after being acclimatized to slightly higher non-lethal concentrations, but the lower limit of this range could still be lethal to the golden shiner.

4.0-4.5: Presumably harmful to salmonids, tench, bream, golden shiner, porgy, and the common carp that are not acclimatized to these values although their resistance in this range may increase with length and age. Fishes may acclimate to these values, however of the perch, bream, golden shiner, and pike, only the pike can reproduce.

4.5-5.0: Presumably harmful to salmonids eggs and fry as well as adults particularly in fresh water containing low concentrations of calcium, sodium, and chloride. Can be harmful to the common carp.

5.0-6.0: Unlikely harmful to all species, unless the concentration of free carbon dioxide is higher than 20 mg/l or the water contains newly precipitated iron salts in the form of ferric hydroxide whose precise toxicity is unknown. The lower limit of this range can be harmful to not acclimated salmonids if calcium, sodium, and chloride concentrations are low or if the water temperature is low. Can also be harmful to the reproduction of the golden shiner.

6.0-6.5: Presumably not harmful to fish unless the concentration of free carbon dioxide exceeds 100 mg/l.

6.5-9.0: Not harmful to fish, although the toxicity to other fish could be modified by the changes within this range.

9.0-9.5: Presumably harmful to salmonids and perch if the range persists.

9.5-10: Lethal to salmonids over a long period, but tolerable over a short period. Can be harmful to certain species in the development phase.

10.0-10.5: Tolerable to the golden shiner and salmonids over a short period but lethal over a long period.

10.5-11.0: Rapidly lethal to salmonids. Prolonged exposure to the upper limit of this range is lethal to carp, tench, porgy, and pike.

11.0-11.5: Rapidly lethal to all species.

ll During clear flow periods, the quality criterion is defined by a maximum increase of 8 UTN from the background level.

mm During dry periods, the quality criterion is defined by a maximum increase of 25 mg/l from the natural concentration level.

nn This quality criterion will probably not be sufficiently protective when chlorides are associated to potassium, calcium, or magnesium rather than to sodium. In addition, since freshwater organisms only tolerate chloride within a limited range without suffering acute toxicity, exceeding the quality criterion could be harmful to a good number of species. This quality criterion is under revision.

oo There should be no toxic effects at this concentration if the pH remains between 6.5 and 9.0.

pp This criterion varies with water hardness. The formula is $e^{[1.0166\ \ln(\text{hardness}) - 3.924}$/1,000.

qq This criterion varies with water hardness. The formula is $e^{[0.819\ \ln(\text{hardness}) + 3.7256]/}$/1,000.

rr This criterion varies with water hardness. The formula is $e^{[0.9422 \ln(\text{hardness}) - 1.700]}/1{,}000$.

ss This quality criterion is provisional. This quality criterion may not protect the mayfly (*Ephemerella subvaria*) if this species is as sensitive as some data indicate.

tt This criterion varies with water hardness. The formula is $e^{[0.8784 \ln(\text{hardness}) + 4.2889]}/1{,}000$.

uu This criterion varies with water hardness. The formula is $2e^{[0.846 \ln(\text{hardness}) + 2.255]}/1{,}000$.

vv This criterion varies with water hardness. The formula is $e^{[1.273 \ln(\text{hardness}) - 1.46]}/1{,}000$.

ww This quality criterion applies to selenium and inorganic salts thereof.

xx This quality criterion is defined for Bunker C oil. Higher criteria are available for other types of hydrocarbons.

yy This concentration is a maximum acceptable concentration (MAC) defined for drinking water.

zz The total concentration of nitrates and nitrites must not exceed 10 mg/l.

A The presence of ammonia nitrogen at higher concentrations could compromise disinfection.

B Above this concentration, the organoleptic and aesthetic properties of drinking water could be altered.

C Above this concentration, the organoleptic and aesthetic properties of drinking water could be altered. A sulphate concentration higher than 500 mg/l could have a laxative effect on certain people.

D Because of the limitations using data obtained from animal experiments as a model for humans, and the uncertainty surrounding human data, it is impossible to determine a guideline based on health arguments. However, coagulation optimization procedures using aluminum-based coagulant agents in drinking water treatment systems led to the definition of practical value limits: 0.1 mg/l or less in major water treatment systems and 0.2 mg/l or less in small water treatment systems.

E This quality criterion is provisional. This concentration is a maximum acceptable concentration (MAC) defined for drinking water.

F This concentration is a maximum acceptable concentration (MAC) defined for drinking water. It deals with the concentration of arsenic, which represents an “essentially negligible” health risk. Health Canada defines the term “essentially negligible” as a range from one new case of cancer above background per 100,000 people to one new case of cancer above background per 1 million people (i.e., 10^{-5} to 10^{-6}) over a lifetime. This criterion is used in the context of surface water contamination prevention, which is why it differs from the drinking water standard. Certain good quality surface water may contain natural concentrations higher than the quality criterion.

G Above this concentration, organoleptic and aesthetic drinking water properties may be altered. Certain good quality surface water may contain higher natural concentrations.

H This quality criterion is based on a consumption of 15 grams of fish or shellfish per day. This quality criterion includes methylmercury.

I This value is defined for drinking water.

J This quality criterion is equivalent to a level of risk of one additional cancer for an exposed population of 1 million people. This quality criterion applies only to the inorganic form. Temporary quality criterion.

K This quality criterion includes methylmercury. Quality criteria were also established to prevent aquatic organism tissue contamination.

L This quality criterion is provisional. This quality criterion was calculated from toxicity data for low hardness water (≤120 mg/l ($CaCO_3$)).

M This criterion varies with water hardness. The formula is $e^{[1.0629\ \ln(\text{hardness}) + 1.1869]}/1{,}000$.

Appendix 3.10.3

Renard Project – Business Case Study Water Management Plan (Golder Associates Ltd., 2011e)

Appendix 3.10.3

Available in digital format on the CD at the end of Volume 2

Appendix 3.10.4

Renard Project – Water Treatment Evaluation (Golder Associates Ltd., 2011i)

Appendix 3.10.4

Available in digital format on the CD at the end of Volume 2

Appendix 3.18.1

Progressive Rehabilitation and Closure Plan (Roche and EnviroCri, 2011)

Appendix 3.18.1

Available in digital format on the CD at the end of Volume 2

Appendix 4.2.1

Report on the Comments and Concerns Expressed during Pre-consultation and Environment Exchange Group Meetings

Annexe 4.2.1 Relevé des commentaires et préoccupations formulés lors des rencontres de préconsultation et au sein des groupes d'échange sur l'environnement

La présente annexe donne le relevé brut des commentaires et préoccupations qui ont été formulés lors des rencontres de pré-consultation et pendant les rencontres des Groupes d'échanges sur l'environnement. Ceux-ci sont classifiés selon qu'ils réfèrent aux thèmes suivants :

- les précisions d'ordre technique (P);
- les considérations économiques (Ec);
- les considérations sociales et culturelles (S);
- les relations entre le promoteur et les parties prenantes (R);
- l'évaluation environnementale (Ev);
- les impacts et l'environnement (I).

Le relevé comprend également la liste des participants, sauf ceux de la compagnie Les Diamants Stornoway (Canada) inc. et du consultant en environnement, Roche ltée. Dans ces deux cas, les participants habituels étaient :

Pour Stornoway :

- Martin Boucher, Directeur, Développement durable
- Hélène Robitaille, Directrice, Relations avec la communauté
- Sylvie Chicoine, Coordonnatrice à l'environnement

Pour Roche ltée :

- Vital Boulé, Directeur de projet
- Catherine Lussier, anthropologue

Les deux premières rencontres de pré-consultation ont eu lieu à Chibougamau alors que la troisième a eu lieu à Mistissini. Les rencontres des Groupes d'échanges sur l'environnement ont toutes eu lieu à Mistissini.

RENCONTRES DE PRÉ-CONSULTATION DU 12 OCTOBRE 2010

Participants

- Johanne Morasse, Commission régionale sur les ressources naturelles et le territoire de la Baie-James (CRRNTBJ)
- Sonia Marcoux, CRRNTBJ
- Jacynthe Marois, Centre régional de santé et de services sociaux de la Baie-James (CRSSSBJ)
- Jean-Benoît Gauthier, CRSSSBJ
- Renée-Claude Baillargeon, Emploi Québec (EQ)
- Serge Boulanger, EQ
- Cyrille Djoman, EQ

- Jacques Morin, Centre local d'emploi (CLE)
- Michèle Perron, Conseil régional des partenaires du marché du travail (CRPMT)
- Pierre Pelletier, ComaxNord

Commentaires et préoccupations

- Sur votre documentation, on voit la route qui conduit à LG-4; est-ce un scénario d'accès que vous envisagez? (P)
- Avec le prolongement de la 167, quel sera le temps de parcours entre Chibougamau et la mine? (P)
- Pour favoriser les retombées économiques en régions, il faudra s'assurer que les contrats sont d'envergure réaliste ou à la hauteur des capacités du marché. (Ec)
- Favoriser l'embauche locale et l'achat de services régionaux constituent une approche intéressante pour la région. (Ec)

RENCONTRES DE PRÉ-CONSULTATION DU 13 OCTOBRE 2010

Participants

- Steve Gamache, maire, Ville de Chapais
- Laurent Levasseur, Ville de Chapais
- Esther Levasseur, Commission scolaire de la Baie-James (CSBJ)
- Jean-Claude Simard, CSBJ
- Manon Cyr, mairesse, Ville de Chibougamau
- Réjean Girard, conseiller, Ville de Chibougamau
- Gerry Poirier, conseiller, Ville de Chibougamau
- Mario Asselin, Service d'urbanisme, Ville de Chibougamau
- Pierre D'Amours, Corporation de développement économique, Ville de Chibougamau
- Gérald Lemoyne, maire, Municipalité de Baie-James (MBJ)
- Stéphane Simard, MBJ
- Louis Gagnon, MBJ
- Daniel Bergeron, Conférence régionale des élus de la Baie-James (CRÉBJ)
- Réal Dubé, CRÉBJ
- Stéphane McKenzie, CRÉBJ
- Dominique Simard, Comité de développement social de la Baie-James (CDSBJ)
- Matthew Iserhoff, Commission scolaire crie (CSC)
- Luc Collette, CSC
- Sébastien Vandal, Chambre de commerce de Chibougamau
- François Béchamp, Chambre de commerce de Chibougamau
- Pierre Folco, géologue, Société de développement de la Baie-James (SDBJ)

Commentaires et préoccupations

- Concernant le recrutement, est-ce que Stornoway a une politique où on définit un objectif d'embauche pour les Cris (pourcentage sur le nombre total de travailleurs)? (Ec)
- Quel est le calendrier de mise en œuvre du projet? (P)
- À la mine, il faut avoir un programme de sensibilisation des travailleurs à des cultures différentes. (S)
- Dans le cas du recrutement pour les emplois relatifs aux explosifs, il faut tenir compte du fait que les employés ne doivent pas avoir d'antécédents judiciaires. (Ec)
- Pour que la région puisse offrir des bons services à la minière, il faut que celle-ci rendent compte régulièrement de ses besoins. (R)
- Les responsables municipaux sont disposés à faire la promotion requise pour attirer des travailleurs en région pour répondre aux besoins de la mine. (Ec)
- Il faut un maximum de retombées pour les gens qui résident sur le territoire de la région. (Ec)
- Lorsque l'on parle ici de région, on réfère au territoire de la Baie-James. (S)
- La meilleure façon d'atteindre ces objectifs régionaux, c'est de disposer d'une entente avec la compagnie minière. (R)
- En région, nous devons optimiser nos efforts; ainsi, pour ce qui concerne la formation, nous devons connaître les besoins de la mine. (R)
- On aimerait bien que 100% des travailleurs proviennent de la région mais on sait que cela est impossible. (Ec)
- Comme l'accès des travailleurs à la mine se fera en avion, on souhaite qu'il y ait une escale à Chibougamau. (Ec)
- Pour ce qui concerne certains permis, autorisations, règles et taxes, le MDDEP va demander à la minière de faire affaire avec la MBJ. (R)
- On a besoin de connaître les besoins de Stornoway pour susciter les groupes de la région à offrir des services et être proactifs. (R)
- On souhaiterait que la minière soit liée par un pourcentage prédéterminé d'emplois en Jamésie. (Ec)
- Pour avoir accès à un maximum d'emplois, il est nécessaire que la région connaisse à l'avance les besoins en termes de formation. (R)
- Quelle est la durée de vie du projet? (P)
- Est-ce que vous devrez construire une route d'accès avant de débuter le projet? (P)
- Est-ce que les Cris devront parler français, même pour conduire un camion? (Ec)
- Est-ce que Chibougamau va constituer un point de transit pour le personnel et la marchandise? (Ec)
- Si la région veut vraiment être partie au dossier, il est important que l'on dispose de toute l'information nécessaire. (R)
- Malgré les désirs de la région, on peut se demander si les entreprises de Chibougamau sont capables d'assumer un mandat de 2 000 000 $. (Ec)

RENCONTRES DE PRÉ-CONSULTATION DU 14 OCTOBRE 2010

Participants

- Hubert Petawabano, officier de l'environnement local, Nation de Mistissini
- Matthew Wapachee, Directeur, développement communautaire, Nation de Mistissini
- Laura Atikessé, Conseil cri de la santé et des services sociaux de la Baie-James (CCSSSBJ)

- Thomas Coon, Association des trappeurs cris (ATC)
- Roderick Quinn, Service de l'environnement, Nation de Mistissini
- Willie Gunner, ATC
- Johnny Swallow, utilisateur du terrain de trappage M11
- Paulemean Swallow, frère d'un maître de trappage du M11
- Gordon Swallow, utilisateur, terrain M11
- Joseph Swallow, utilisateur, terrain M11
- Marlene MacKinnon, Conseil cri sur l'exploration minérale (CCEM)
- Peter Coonishish, Strateco
- Diane Marois, représentante de l'industrie minière, CRPMT

Commentaires et préoccupations

- Combien de temps va durer l'étude d'impact sur l'environnement? (Ev)
- Allez-vous poursuivre vos travaux d'exploration pendant la réalisation de l'étude d'impact? (P)
- Est-ce que le projet dépend de l'état d'avancement du prolongement de la route 167? (P)
- Est-ce que vous connaissez la date de début de construction du prolongement? (P)
- Est-ce que vous allez tenir compte des effets cumulatifs? (Ev)
- À quelle étape de développement se trouve actuellement le projet Renard? (P)
- Est-il exact que pour les fins de l'exploration vous avez construit une rampe d'accès souterraine? (P)
- Quel type d'avion utilisera votre piste d'atterrissage? (P)
- À quel moment prévoyez-vous envoyez votre étude d'impact au COMEX/COFEX? (Ev)
- Est-ce que votre étude d'impact sur l'environnement va considérer les utilisateurs actuels du territoire? (Ev)
- Est-ce que c'est Stornoway ou un consultant externe qui réalise l'étude d'impact? (Ev)
- Est-ce que les familles qui utilisent le territoire sont impliquées dans la réalisation de l'étude d'impact? (R)
- Combien y aura-t-il de travailleurs à la mine? (P)
- Il sera important de bien mailler les savoir scientifiques et traditionnels. (Ev)
- Est-ce que le projet aura des impacts sur les rivières? Y aura-t-il des dérivations? (I)
- Quelle est la vie utile du projet? (P)
- Quel pourcentage d'emplois cris visez-vous? (Ec)
- Dans les démarches que vous effectuez relativement à la formation, est-ce que celles-ci visent tous les niveaux de l'exploitation minière? (Ec)
- Pour l'alimentation électrique, avez-vous une alternative à l'utilisation d'une centrale thermique sur place? (P)
- Envisagez-vous des sources d'énergie alternatives comme le solaire? (I)
- Qui est impliqué dans la préparation d'une entente de pré-développement? (R)
- On espère que l'exploitation de la mine n'aura pas d'effet sur les ressources alimentaires du milieu et qu'il sera toujours sécuritaire d'en consommer. (I)

- Nous souhaitons que l'étude d'impact nous souligne tout grand changement de l'environnement appréhendé. (I)
- Les horaires de travail des Cris devront favoriser à la fois les besoins de la mine et les besoins des familles (problématique de l'éloignement). (S)
- Est-ce que, pour la construction des installations de la mine vous allez faire affaire avec des entrepreneurs cris? (Ec)
- Lors de la construction, on peut présumer qu'il y aura un fort trafic sur la route 167; est-ce qu'il y aura une guérite de contrôle? (i)
- À l'instar de ce qu'il y avait à la mine Troilus, est-ce qu'il y aura à la mine Renard des installations récréatives et activités pour les employés (ex. bowling)? (S)

GROUPE D'ÉCHANGE N^{O} 1 DU 16 FÉVRIER 2011

Participants

- Nellie Petawabano, conseillère, Nation de Mistissini
- Simeon Petawabano, Conseil des aînés, Nation de Mistissini
- Michael Mianscum, Service de développement des ressources humaines cries (SDRH)
- Abel J. Trapper, SDRH, industrie minière, emploi et formation
- Andy Baribeau, négociateur, Nation de Mistissini
- Margaret Wapachee, Développement économique, Nation de Mistissini
- Hubert Petawabano, officier de l'environnement local, Nation de Mistissini
- Marlene MacKinnon, CCEM
- Jim MacLeod, EnviroCrie ltée
- Paul Linton, CCSSSBJ

Commentaires et préoccupations

- Est-ce que l'on va assurer la consultation de la famille Swallow tout au long de l'étude? (R)
- Est-ce que l'évaluation environnementale comprend l'étude des ours? (I)
- Quels types de salamandre ont été trouvés dans la zone d'étude et où? (I)
- Qu'entend-on par « micromammifères »? (I)
- Qu'est qui se passe lorsque qu'un animal à statut particulier ou se trouvant sur la liste des espèces en péril est tué lord de la réalisation des études? (I)
- Quelle sera la procédure pour le groupe d'échange sur l'environnement? (R)
- Il est important d'avoir autour de la table du groupe d'échange les personnes concernées par les sujets qui sont abordés. (R)
- On aimerait avoir des cartes qui permettent de voir les bassins hydrographiques qui sont en lien avec le projet. (Ev)

GROUPE D'ÉCHANGE N^{O} 2 DU 16 MARS 2011

Participants

- Simeon Petawabano, Conseil des aînés, Nation de Mistissini
- Michael Petawabano, SDRH

- Abel J. Trapper, SDRH, industrie minière, emploi et formation
- Sydney Swallow, maître de trappage, terrain M11
- Roderick Swallow, maître de trappage, terrain M11
- Johnny Swallow, utilisateur, terrain M11
- Paulemean Swallow, frère d'un maître de trappage du M11
- Gordon Swallow, utilisateur, terrain M11
- Margaret Wapachee, Développement économique, Nation de Mistissini
- Henry Mianscum, représentant de la famille Swallow
- Marlene MacKinnon, CCEM
- Derrick Blackned, Blackned Enterprises
- James Blackned, Blackned Enterprises
- Claude-Étienne Fournier, Blackned Enterprises
- Evadney Swallow, utilisateur, terrain M11
- Jim MacLeod, EnviroCrie ltée
- Blazo Voyageur, Eskan Company
- Don MacLeod, DS MacLeod Consultants
- Paul Bedell, Golder
- Louis de Carufel, Fournier et fils (Val d'Or)
- Heidi Klein, observateur

Commentaires et préoccupations

- Est-ce que l'EIES comprendra des recommandations sur les façons d'intégrer les Cris dans l'exploitation de la mine? (Ec)
- Est-ce qu'il y aura des recommandations concernant l'amélioration des compétences des Cris? (Ec)
- L'EIES devrait comprendre un plan pour aider à rencontrer les besoins en main-d'œuvre. (Ec)
- Dans l'EIES, il est important de décrire, en plus des activités réalisées sur le territoire par les cris, ce que le territoire représente pour les Cris. (S)
- Une personne ayant vécu l'expérience de la mine Troilus confirme que l'on retrouve encore des animaux carnivores autour de cette mine. Celle-ci a toutefois eu un impact sur la grande chasse et la végétation dans un rayon de 25 km. (I)
- Combien de temps va durer l'exploitation de la mine à ciel ouvert? (P)
- Est-ce que tous les sites de la mine vont être exploités en même temps? (P)
- Si vous continuez d'évaluer la quantité de la ressource dans la kimberlite, est-ce que l'on peut penser que le projet pourra être plus grand que prévu actuellement? (P)
- Concernant la digue envisagée dans le lac Lagopède, est-ce que cela peut occasionner des inondations? (I)
- Est-ce que la faune sauvage peut revenir éventuellement sur le site de confinement de la kimberlite traitée? (I)
- Quel sera la sécurité des amas de résidus (« rock pile ») pour les générations futures? (I)
- Est-ce qu'il y a des risques que l'aire de confinement de la kimberlite usinée ait des impacts sur la qualité de l'eau? (I)

- Qu'en est-il des du blocage ou de la dérivation des ruisseaux qui se trouvent sur le site de la mine? (I)
- Il est important de reconnaître que l'utilisation du lot M11 est très active. (S)

GROUPE D'ÉCHANGE N^{O} 3 DU 6 AVRIL 2011

Participants

- Robert Jimiken, négociateur, Nation de Mistissini
- James Lazore, Eskan Company
- Hubert Petawabano, officier de l'environnement local, Nation de Mistissini
- Roderick Quinn, Service de l'environnement, Nation de Mistissini
- Margaret Wapachee, Développement économique, Nation de Mistissini
- Marlene MacKinnon, CCEM
- Sam Petawabano, aîné, Nation de Mistissini
- Derek Blackned, Blackned Enterprises
- James Blackned, Blackned Enterprises
- Donald MacLeod, consultant en développement des affaires
- Jim MacLeod, EnviroCrie ltée
- Thomas Coon, ATC et Conseil des aînées de la Nation de Mistissini
- Willie Gunner, ATC
- Laura Atikessé, CCSSSBJ

Commentaires et préoccupations

- Est-il vrai qu'un diamant a été trouvé dans un échantillon? (P)
- Est-ce que le traitement de la kimberlite implique l'utilisation de produits chimiques? (I)
- Pourquoi ne pas utiliser la kimberlite usinée pour la construction? (P)
- Quel sera le pourcentage de la kimberlite usinée par rapport à celle qui sera extraite? (P)
- Quel est le principal problème environnemental appréhendé s'il n'y a pas utilisation de produits chimiques? (I)
- Quels sont les impacts à long terme par rapport aux impacts à court terme? (I)
- Quelles sont les spécifications que vous suivez dans la réalisation de l'EIES? (Ev)
- À quel moment prévoyez-vous l'ouverture de la mine et quelle est sa durée de vie? (P)
- Combien de Cris ont travaillé à ce jour sur le projet? (Ec)
- Qu'arrivera-t-il au projet si le MTQ rencontre des problèmes avec le prolongement de la route 167? (P)
- Est-ce que vous avez documenté la faune benthique? (I)
- Est-ce que les études vont se poursuivre à toutes les années? Y aura-t-il un programme de suivi environnemental? (Ev)
- Est-ce qu'il y a d'autres zones que vous avez identifiées pour exploration potentielle? (P)

- Est-ce que vous avez effectué des tests concernant le phosphore et d'autres composants dans l'eau? (I)
- Lorsque l'eau touche les matériaux extraits, est-ce qu'il y a acidification de cette eau? (I)
- Dans la kimberlite, avez-vous trouvé des éléments anormaux? (I)
- Concernant une éventuelle ligne d'alimentation électrique, avez-vous eu des échanges avec d'autres minières désirant développer des projets dans le secteur? (P)
- Est-ce que l'exploitation de la mine va débuter quand le prolongement de la route sera complété? (P)
- Est-ce que les aires d'extraction seront remplies après les opérations minières? (I)
- Quelle sera la procédure d'inspection des équipements pour ne pas perdre de diamants? (P)
- Est-ce que les employés de la mine pourront bénéficier de rabais pour l'achat de diamants? (P)
- Avez-vous un plan en cas de situation d'urgence? (Ev)
- Qu'allez-vous faire des huiles usées? (I)
- Maintenant que la mine Troilus est fermée, on devrait pouvoir retrouver en région du personnel qualifié. (Ec)
- Les cris qui suivent actuellement une formation en forage pourraient éventuellement travailler à la mine Renard. (Ec)
- La nourriture qui ne sera pas consommé au campement ne devrait pas être jeté mais donnée aux ainés. (S)
- Faites bien la distinction entre la consultation publique et des audiences publiques; la ligne est mince entre les deux. (R)
- Le présent échange de groupe est très pro-actif. Comme le suggère la CBJNQ, vous devriez étendre ce processus à l'ensemble de la communauté. (R)
- Vous devriez être présent au symposium sur les mines qui aura lieu le 25 mai. (R)

GROUPE D'ÉCHANGE N^{O} 4 DU 9 JUIN 2011

Participants

- Robert Jimiken, négociateur, Nation de Mistissini
- Roderick Quinn, Service de l'environnement, Nation de Mistissini
- Margaret Wapachee, Développement économique, Nation de Mistissini
- Marlene MacKinnon, CCEM
- Donald MacLeod, consultant en développement des affaires
- Sydney Swallow, maître de trappage, terrain M11
- Nanny Swallow, épouse de Sydney Swallow, terrain M11
- Elsa Swallow, fille de Sydney Swallow, terrain M11
- Emerson Swallow, fils de Roderick Swallow, maître de trappage, terrain M11

Commentaires et préoccupations

- Qu'allez-vous faire des huiles usées? (I)
- Existe-t-il d'autres cibles potentielles à explorer? (P)

- Quel était le coût estimé de la digue projetée sur le lac Lagopède? Quel est le coût évité en éliminant celle-ci? (P)
- À quel endroit les travaux vont-ils s'amorcer? (P)
- Est-ce que la roche contient des traces de métaux? (I)
- Est-ce que le PH de l'eau va changer après le projet? Comment cela peut-il affecter le benthos ainsi que les habitats? Anticipez-vous des changements de cette nature? (I)
- Est-ce qu'il y aura un système de suivi de la qualité de l'eau? (Ev)
- Comment intégrez-vous les savoirs locaux à l'évaluation environnementale? (S)
- Est-ce que le bruit à proximité du camp a eu pour effet de perturber le caribou des bois? (I)
- À quel moment pensez-vous avoir terminé l'évaluation environnementale? (Ev)
- Est-ce que les broyeurs vont entraîner l'émission de poussière? (I)
- Est-ce que l'aire de confinement de la kimberlite usinée va entraîner l'émission de poussière une fois que celle-ci aura séché? (I)
- À quel endroit allez-vous puiser votre eau potable? (P)
- Puisque la communauté planifie actuellement l'établissement d'un nouveau lieu d'enfouissement, pourquoi est-ce que Stornoway ne considère pas la possibilité de disposer de ses matières résiduelles à cet endroit? (I)

GROUPE D'ÉCHANGE N^{O} 5 DU 18 AOÛT 2011

Participants

- Andy Baribeau, négociateur, Nation de Mistissini
- Roderick Quinn, Service de l'environnement, Nation de Mistissini
- Marlene MacKinnon, CCEM
- Jim MacLeod, EnviroCrie ltée
- Sydney Swallow, maître de trappe, terrain M11
- Roderick Swallow, maître de trappe, terrain M11
- Ella Swallow, épouse de Roderick Swallow, terrain M11
- Gordon Swallow, frère de Roderick Swallow, terrain M11
- Jonathan Swallow, fils de Sydney Swallow, terrain M11
- Peter Coonishish, résidant, Nation de Mistissini
- Hubert Petawabano, officier de l'environnement local, Nation de Mistissini
- Alan Penn, conseiller scientifique, Administration régionale crie (ARC)

Préoccupations et commentaires

- Qu'arrive-t-Il du minerai qui n'est pas exploité? Celui-ci présente-t-il un potentiel supplémentaire? Dans une telle éventualité, est-ce qu'il y aura une nouvelle étude d'impact sur l'environnement? (Ev)
- Précisions techniques concernant le concassage et l'extraction du minerai? (P)
- Quelle est la différence entre le mort-terrain et la kimberlite usinée? (P)
- Qu'entend-on par « stériles »? (P)
- Quelle est l'importance de la végétation étudiée en termes de diversité biologique? (I)

- Si le sol n'est pas riche, est-ce que cela veut dire que l'impact est plus important? (I)
- Pour la végétalisation au moment de la restauration, est-ce que vous allez utiliser plusieurs variétés de plantes? (I)
- Lors ce cette restauration, quelle sera la croissance des plantes en altitude? (I)
- Pour les travaux de restauration, envisagez-vous favoriser des partenariats avec Chibougamau et Mistissini? (Ec)
- Est-ce que vous avez documenté la présence du caribou forestier? (I)
- Quelles sont les études que vous avez réalisées sur les poissons du lac Lagopède et quelle est la biomasse de ce lac? (I)
- Les eaux du lac lagopède reviendront à l'état naturel en combien d'années? (I)
- Où en êtes vous quand à la compensation des habitats du poisson? (Ev)
- Pouvez-vous nous préciser comment la fosse R65 agira comme bassin de sédimentation? (P)
- Est-ce qu'il y aura suivi du nitrate? (Ev)
- À quelle distance de la rive du lac lagopède se trouve l'usine de traitement des eaux usées domestiques? (P)
- Est-ce que la conception de vos installations a pris en considération les conditions climatiques nordiques? (I)
- Précisions sur le nombre de tunnels, leur diamètre, la rampe d'accès, le puits d'accès, le processus de séparation en milieu dense et le transport du minerai? (I)
- À quoi vont servir les approvisionnements en hydrocarbures? (I)
- Est-ce que les vols aériens vont être arrêtés durant la saison de la chasse? (S)
- Soyez prudents lorsque vous faites des comparaisons quant à l'empreinte de différents projets d'exploitation diamantifère. (Ev)
- Pouvoir disposer de vos présentations Power point serait très utile pour diffuser de l'information pertinente sur le site de la nation de Mistissini. (R)
- Il serait pertinent de pouvoir disposer de l'étude d'impact sur l'environnement et le milieu social (EIES) avant Noël 2011. (Ev)
- Il faut prendre garde à ne pas interrompre les communications ave la population lors de la réalisation de l'EIES. (R)
- Dans l'EIES, on doit utiliser un vocabulaire qui soit compréhensible par le plus grand nombre. (R)
- Lors des prochaines rencontres des Groupes d'échanges sur l'environnement, il serait utile de rencontrer des intervenants régionaux sensibles aux retombées économiques du projet. (Ec)
- Lors de la végétalisation des sites perturbés, on devrait utiliser des espèces locales ou régionales pour éviter l'importation de végétation invasive. (I)
- Stornoway devra porter attention à la publicisation des démarches qui seront faites pour l'obtention des divers permis. (R)

GROUPE D'ÉCHANGE N^{O} 6 DU 13 OCTOBRE 2011

Participants

- John Matoush, chef négociateur, Nation de Mistissini
- Andy Baribeau, négociateur, Nation de Mistissini
- Roderick Quinn, Service de l'environnement, Nation de Mistissini
- Jim MacLeod, EnviroCrie ltée
- Paulemean Swallow, frère d'un maître de trappage du M11
- Ella Swallow, épouse de Roderick Swallow, terrain M11
- Jonathan Swallow, fils de Sydney Swallow, terrain M11
- Laura Atikessé, CCSSSBJ

Autres participants

À la demande des autorités de la Nation crie de Mistissini, Hydro-Québec a profité de l'organisation du 6^{e} Groupe d'échange par Stornoway pour présenter les démarches relatives à l'étude de la ligne potentielle d'alimentation électrique du projet Renard à 161 kV Nikamo-Renard. Outres les représentants de Stornoway, les personnes suivantes ont participé à cette réunion spéciale :

- Mary MacLeod, EnviroCri ltée
- Roderick Quinn, Service de l'environnement, Nation de Mistissini
- Jim MacLeod, EnviroCri ltée
- Harry Mianscum, utilisateur, terrain M3
- Laura Atikessé, CCSSSBJ
- Andy Baribeau, négociateur, Nation de Mistissini
- Charlie Jimiken, utilisateur, terrain M4
- Mary Jane Jimiken, utilisatrice, terrain M4
- Annie Neeposh, utilisatrice, terrain M2A
- Johnny Rabbitskin, maître de trappage, terrain M1
- Jean-Baptiste Loon, maître de trappage, terrain M10
- Walter Swallow, maître de trappage, terrain M10
- Philip Swallow, utilisateur, terrain M10
- Emerson Swallow, utilisateur, terrain, M11
- Roderick Swallow, maître de trappage, terrain M11
- Johnny Swallow, utilisateur, terrain M11
- Gordon Swallow, utilisateur, terrain M11
- Sydney Swallow, maître de trappage, terrain M11
- Nannie Swallow, utilisatrice, terrain M11
- Allan Neeposh, utilisateur, terrain M2A
- Clifford Neeposh, utilisateur, terrain M2A
- Alfred Swallow, maître de trappage, terrain M1A
- Lazzie Swallow, utilisatrice, terrain M1A

- Paulemean Swallow, utilisateur, terrain M11

Commentaires et préoccupations

- Est-ce que l'on pourra mettre votre information sur le site Web de la nation de Mistissini? (R)
- Est-ce que vous êtes disposés à partager les renseignements que vous allez recueillir lors de la surveillance environnementale? (R)
- Quelle sera la durée de la construction? (I)
- Est-ce que la piste d'atterrissage sera en gravier? (I)
- Est-ce qu'il y aura des stations d'échantillonnage de l'eau dans le lac? (Ev)
- Avec le temps, est-ce qu'il y aura agrandissement du panache de diffusion des eaux usées dans le lac? (I)
- Quelle est l'influence de placer le point de rejet des eaux usées en profondeur dans le lac? Est-ce que cela a une influence sur le couvert de glace? (I)
- Est-ce que votre système de traitement des eaux usées est typique des autres installations minières ou est-ce un système particulier? (I)
- Lors de votre analyse des eaux du lac Lagopède, avez-vous effectué des échantillons à différentes périodes de l'année? (Ev)
- Qui réalisera le suivi environnemental? (Ev)
- Lors du démantèlement, allez-vous offrir votre matériel en priorité aux utilisateurs du terrain M11? (S)
- Est-ce que Stornoway va disposer d'un fonds avant que débute la période de fermeture? (Ev)
- Est-ce que la restauration du site va s'amorcer en parallèle avec l'empilement de la kimberlite usinée? Est-ce que vous allez utiliser les fonds de restauration pour ce faire? (Ev)
- Cela prendra combien de temps avant que les fosses ne deviennent des lacs? (I)
- Est-ce que la population de Mistissini sera impliquée dans le Plan de gestion environnementale? (R)
- Allez-vous avoir un conseiller scientifique externe? (Ev)
- De quelle façon allez-vous engager le personnel chargé du suivi environnemental? Qui va assurer ce suivi environnemental? (Ev)
- On peut souhaiter que vos données de surveillance environnementale soient intégrées dans une base de données. (Ev)

Appendix 4.2.2

Summary of the Renard Project Communication Activities

Annexe 4.2.2 Summary of the relationship Renard Project – Cree Nation

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
June 2, 2000	Letter	G.Poirier (SOQUEM)	Notice to Chief Kenny Loon regarding SOQUEM's mining exploration activities in Mistissini Territory
May 10, 2001	Letter	G.Thériault (SOQUEM)	Notice to Chief John Longchap regarding JV's mining exploration activities in Mistissini Territory
December 17, 2001	Fax	G.Thériault (SOQUEM)	Copies of the December 17, 2001 Ashton press release sent to Chief John Longchap.
January 21, 2002	Fax	G.Thériault (SOQUEM)	Proposed agenda of the January 28 meeting sent to Chief John Longchap
January 28, 2002	Meeting	Mistissini	First meeting in Mistissini with some band council representatives and family representatives. Traditional diner. JV representatives were B.Clements, P.Bertrand, G.Thériault and G.Poirier. Powerpoint presentation presented by B.Clements
February 11, 2002	Letter	G.Poirier (SOQUEM)	Letter to William McLeod. Object: Ashton/SOQUEM presentation
February 11, 2002	Fax	G.Poirier (SOQUEM)	Notice to Chief John Longchap regarding JV's mining exploration activities in Mistissini Territory
February 13, 2002	Chief Letter	Chief John Longchap	Letter to G.Thériault summarizing the services available in Mistissini.
June 17, 2002	Fax	G.Poirier (SOQUEM)	Notice to Chief John Longchap regarding JV's mining exploration activities in Mistissini Territory
February 24, 2003	Meeting	Mistissini	Band Council meeting. Some Band council representatives, family representatives and public. JV's representatives were B.Clements, P.Bertrand and G.Poirier. Powerpoint presentation presented by B.Clements
February 27, 2003	Internal note	B.Clements (Ashton)	Summary of the meeting held on February 24, 2003
March 3, 2003	Email	Jim MacLeod	Details on some services available in Mistissini.
March 7, 2003	Letter	B.Clements (Ashton)	Letter to Thomas Neeposh asking for a list of potential candidates from the Swallow family
March 7, 2003	Letter	B.Clements (Ashton)	Letter to Kathleen Wootton including a CD-Rom of the February 24 presentation.
May 22, 2003	Letter	Thomas Neeposh	Letter to B.Clements including a detailed list of potential candidates from the Swallow family.
June 3, 2003	Letter	B.Clements (Ashton)	Letter to Chief Longchap. Object: Update on Ashton/SOQUEM diamond Exploration activities in North-Central Quebec.
June 4, 2003	Fax	Thomas Neeposh	Fax to B.Clements. Object: Employment/Training priority list-Swallow family.
September 26, 2003	Letter	B.Clements (Ashton)	Letter (by Fax) to Kathleen Wootton. Object: Update on Ashton/SOQUEM diamond Exploration activities in North-Central Quebec.
January 22-29, 2004	Emails	G.Poirier (SOQUEM) Jim MacLeod	Exchange of emails regarding Mistissini personal needs

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
February 23, 2004	Meeting	Mistissini	Band Council Meeting. Powerpoint presentation presented by B.Clements.
February 24, 2004	Field Visit	Foxtrot	Field visit during the bulk sample program. Mistissini representatives: Thomas Neeposh, Sydney Swallow, Paulemine Swallow. JV representatives: B.Clements, G.Poirier, Gerald Thériault, Mike Hardin ?
March 2, 2004	Letter	P.Bertrand (SOQUEM)	Letter to Thomas Neeposh. Object: Otish Mountains Exploration Area map.
March 16, 2004	Email	G.Poirier (SOQUEM)	Discussion regarding personnel needs and support letter for a training project
March 29, 2004	Fax	G.Poirier (SOQUEM)	Letter to Abel Trapper (CHRD) and Jack Blacksmith (CMEB). Object: Diamond Exploration Field Assistant Training Course.
April 7, 2004	Fax	B.Lucas (Ashton)	Fax to B.Clement summarizing the content of the Diamond Exploration Field Assistant Course.
May 17, 2004	Internal note	G.Poirier (SOQUEM)	Summary table of the aboriginal employees hired by SOQUEM and the JV and aboriginal services used.
May 21, 2004	Letter	MRNF Minister Pierre Corbeil	Letter to Robert Boyd (Ashton) remembering the importance to make business with Cree people.
June 8, 2004	Presentation	G.Poirier (SOQUEM) A.Gaumond (Virginia)	Mining exploration information tour. Several communities were visited including Mistissini. Powerpoint presentation.
June 18, 2004	Fax	G.Poirier (SOQUEM)	Fax to Thomas Neeposh regarding personnel needs for the summer program.
June 24, 2004	Letter	B.Clements (Ashton)	Letter to Chief Longchap. Object: Update on Ashton/SOQUEM diamond Exploration activities in North-Central Quebec.
June 29, 2004	Fax	G.Poirier (SOQUEM)	Fax to Thomas Neeposh regarding personnel needs for the summer program.
July 19, 2004	Letter	B.Clements (Ashton)	Letter to Anthony MacLeod. Object: 1st Annual Golf Classic.
August 11, 2004	Letter	Chief Longchap	Letter to B.Clements. Note of thanks for the Ashton contribution to the Annual Golf Classic.
September 2004	Field Visit	Foxtrot	Field visit during the bulk sample program. Mistissini representatives: Chief Longchap, Jim MacLeod, Thomas Neeposh, Roderick and Sydney Swallow, Johnny Swallow. JV representatives: B.Clements, M.Hardin?
December 22, 2004	Email	G.Poirier (SOQUEM)	Email to Jim MacLeod regarding the future personnel needs for the winter 2005 program.
December 22, 2004	Contract	G.Poirier (SOQUEM)	Contract between SOQUEM and MacLeod Exploration for Native workforce needs during 2005 program.
December 22, 2004	Fax	B.Lucas (Ashton)	Letter to Abel Trapper (CHRD), Jack Blacksmith (CMEB) and Jim MacLeod (MacLeod Expl.). Object: Diamond Exploration Field Assistant Training Course.
February 11, 2005	Email	G.Poirier (SOQUEM)	Email to Jim MacLeod MacLeod regarding additional personnel needs for the winter 2005 program.

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
March 16, 2005	Fax	B.Clements (Ashton)	Letter to Chief Longchap. Object: Drilling on Monts Otish Property.
April 20, 2005	Letter	Chief John Longchap	Letter to B.Clements. Object: Foundation for the Mistissini Academic & Achievement Awards Program
May 26 to September 11, 2006	Emails	G.Poirier (SOQUEM) Jim MacLeod	Exchange of emails regarding Mistissini personnel needs
September 20, 2005	Chief Letter	Chief John Longchap	Letter to B.Clements addressing Mistissini concerns : Contracting of Mistissini Business, Employment, Training, Greater Participation in the Project.
October 3, 2005	Meeting	Mistissini	Band Council Meeting. Band council representatives, family representatives and public. JV's representatives were ???. Powerpoint presentation presented by B.Clements
October 28, 2005	Legal Advice	Gilles Marchand (Lavery De Billy)	Legal advice regarding the September 25, 2005 Chief Longchap Letter.
November 9, 2005	Letter	B.Clements (Ashton)	Letter to Chief Longchap. Object: Cree Nation of Mistissini and Ashton/SOQUEM Joint Venture.
November 25, 2005	Meeting	Québec City	Information Meeting held at the SOQUEM office during Quebec Exploration 2005 conference. Mistissini representatives: John Longchap, Thomas Neeposh, Jim MacLeod, Sydney Swallow, Roderick Swallow, Matthew Matoush and Coom Matoush.
December 5, 2005	Fax	B.Clements (Ashton)	Fax to Chief Longchap. Object: Meeting in Mistissini – Thursday, December 8, 2005.
December 6, 2005	Meeting	Lavery de Billy Montreal office	Rencontre avec Gilles Marchand spécialiste du droit autochtone chez Lavery de Billy. Participants : G.Poirier, P.Bertrand, Ann Bigue, M.Hardin.
December 7, 2005	Meeting	Bureau du MRNF	Rencontre avec les représentants du MRNF et MDDEP concernant le développement des projets miniers en territoire conventionné. Participants : G.Poirier, P.Bertrand, B.Clements, M.Hardin, Alain Simard, P.Marcoux, André Isabel, Daniel Berrouard.
December 8, 2005	Meeting	Mistissini	Meeting with Mistissini Legal council (Elisabeth Paterson), Chief Longchap and Thomas Neeposh. JV representatives: G.Poirier, P.Bertrand, B.Clements and M.Hardin.
January 4, 2006	Contract	G.Poirier (SOQUEM)	Contract between SOQUEM and MacLeod Exploration for Native workforce needs during 2006 program.
January 10, 2006	Chief Letter	Chief John Longchap	Letter to B.Clements addressing Mistissini same concerns than in the September 25, 2005 Chief letter.
January 13 to February 1, 2006	Fax	G.Poirier (SOQUEM)	Several faxes to Jim MacLeod and Thomas Neeposh regarding Mistissini personnel needs for Winter program
January 22, 2006	Email	B. Clements	Email to Kathleen Wootton regarding the February 6 and 7 visit

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
February 6, 2006	Meeting	Mistissini	Band council Meeting. Some Band council representatives including Chief Longchap and Elisabeth Paterson, family representatives and public. JV's representatives were B.Clements, M.Hardin, P.Bertrand and G.Poirier. Powerpoint presentation presented by B.Clements
February 6, 2006	Meeting	Mistissini	Public Meeting. Brooke Clements gave a talk using a Powerpoint presentation. Around 35-40 people from Mistissini attended to that meeting held at the Youth Center.
February 7, 2006	Meeting	Mistissini	Business Meeting. Meeting with Mistissini business representatives: Don MacLeod, Thomas Neeposh, Jim MacLeod, Marlene McKinnon, Richard Shecapio.
February 16, 2006	Document	B.Clements (Ashton)	Extract from a document submitted to the COMEV. "Summary of recent community consultation by Ashton Diamonds Canada and SOQUEM".
March 3, 2006	Letter	B.Clements (Ashton)	Letter to Chief Longchap. Object: copy of the report submitted to COMEV and CD-Rom of the Mistissini February Presentation
March 2006	Field Visit	Foxtrot	Field Visit with Roderick Swallow around the future portal site. B.Clements, G.Poirier, S.Nantel and D.Skelton.
April 3, 2006	Letter	Chief John Longchap	Letter to P.Bertrand. Object: Solicitation for support in the realisation of the access road to the Otish Mountains.
May 8, 2006	Letter	Robert Boyd (Ashton)	Letter to Chief Longchap giving the support of Ashton-SOQUEM to the realisation of the access road to the Otish Mountains
May 26, 2006	Email	William MacLeod	B.Clements email. Object Waashaashkun Airways
July 5, 2006	Internal note	D.Skelton (Ashton)	Memo to B.Clements. Subject: Grocery and flights comparaison.
July 20, 2006	Internal note	B.Clements (Ashton) D.Skelton (Ashton)	Memo to P.Bertrand. Subject: Mistissini Cree First Nation contracts for services.
August 24-25, 2006	Meeting	G.Poirier (Ashton)	Minutes of the meeting held in Mistissini with Thomas Neeposh (Family representative) Sydney and Roderick Swallow (Tallyman) and other members of the Swallow family (Johnny and Paulemean).
September 5, 2006	Phone Call	G.Poirier (Ashton)	Summary of a phone call between G.Poirier and Sydney Swallow regarding the nomination of Henry Mianscum as the Family spokesperson.
September 6, 2006	Phone call	G.Poirier (Ashton)	Summary of a phone call between G.Poirier and Thomas Neeposh regarding the recent change of the Swallow family spokesperson.
September 12, 2006	Field Visit	Foxtrot	Field Visit with Sydney Swallow and Henry Mianscum (the new Family spokesperson) site tour of the ramp and the DMS plant. G.Poirier, S.Nantel and D.Skelton were representatives of the JV for that visit.

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
September 26, 2006	Meeting	CHRD office Mistissini	Minutes of an information meeting held at the CHRD office in Mistissini with the CHRD management team.
October 2, 2006	Email	Philippe Petawabano	Email to Jacques Harvey regarding airplane services
October 12, 2006	Field Visit Meeting	Foxtrot	Field Visit with Chief Longchap and Thomas Neeposh. Meeting and site tour of the ramp and the DMS plant. B.Clements, M.Hardin, G.Poirier and D.Skelton were representatives of the JV for that visit.
October 14, 2006	Email	G.Poirier (Ashton)	First Ashton application to the CHRD employment integration Program (for the period covering December 2006 to March 31, 2007)
October 31, 2006	Internal note	G.Poirier (Ashton)	Summary of the interviews with aboriginal candidates for the DMS training positions.
December 4, 2006	Agreement	CRA/Ashton	Funding agreement between CRA and Ashton regarding DMS plant operation training program for the period of December 2006 to March 31, 2007 (TPI-21312).
January 12, 2007	Email	Chief Longchap	Email to B.Clements raising some concerns of the Mistissini community regarding level of employment and Contract
January 18, 2007	Fax	B.Clements (SWY)	Fax to Chief Longchap. Object: Update on Foxtrot Property Activities
January 30, 2007	Email	G.Poirier (SWY)	Email to Thomas Neeposh and Jim MacLeod. Object Fuel Supply.
February 6, 2007	Chief Letter	Chief Longchap	Letter to B.Clements. Object: Request to fulfill undertakings with respect to Cree involvement in diamond exploration on Mistissini Lands.
February 16, 2007	Email	Élisabeth Paterson (Hutchins Caron & Ass)	Email sent to Mike Hardin. Object: Excerpt from proposed MOU – Cree Nation of Mistissini.
February 16, 2007	Email	B.Clements (SWY)	Email sent to Chief Longchap. Object: Mistissini Winter 2007 personnel table.
February 19, 2007	Meeting	Mistissini	Band Council Meeting. Some Band council representatives including Chief Longchap and Thomas Neeposh, family representatives and public. JV's representatives were B.Clements, M.Hardin, G.Poirier, Eira Thomas and Matt Manson. Powerpoint presentation presented by Eira Thomas and B.Clements. Lunch with Thomas Neeposh.
March 23, 2007	Meeting	CHRD office Mistissini	Discussion about the establishment of the Foxtrot-Mistissini Joint Committee. G.Poirier, Henry Mianscum, Abel Trapper, Sydney Swallow and Roderick Swallow.
April 3, 2007	Internal note	M.Hardin (SWY)	Email to G.Poirier. Object: Status of MOU discussions with Cree Nation of Mistissini
April 16, 2007	Email	G.Poirier (SWY)	Second Ashton application to the CHRD employment integration Program (for the period covering April 1 to June 30, 2007)

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
May 29, 2007	Letter	M.Manson (SWY)	Letter to Chief Longchap. Object: Invitation to July 4, 2007 diner at the Mistissini Lodge with Stornoway board of directors.
June 18, 2007	Meeting	CHRD office Mistissini	First Meeting of the Foxtrot-Mistissini Working Group. Approval of the final comments concerning the working group mandates.
June 29, 2007	Agreement	Ashton/Waashashkun	Draft of the Aircraft Charter Services Agreement proposed to Waashashkun Airways Ltd (this agreement was never signed).
July 4, 2007	Meeting	Mistissini	Informal Stornoway Board diner at the Mistissini Lodge with Chief Longchap, Thomas Neeposh and Kathleen Wootton
July 13, 2007	Fax	D.Skelton (Ashton)	Letter to Philip Petawabano (Waashashkun Airways) following the flight schedule problems happened during the board and journalist visits to Foxtrot.
September 5, 2007	Meeting	Mistissini CHRD office	Second meeting of the Foxtrot-Mistissini Working Group. Discussion about mid-term and long-term job opportunities using examples from existing mines.
September 11, 2007	Letter	M.Manson	Invitation letter to Chief Longchap for a meeting regarding access infrastructure and MOU/IBA first discussions.
September 2007	Agreement	CRA/Ashton	Funding agreement between CRA and Ashton regarding DMS plant operation training program for the period of April 1 to June 30, 2007 (TPI-21362)
October 16, 2007	Meeting	Montréal Hotel Delta Centre-ville	Attendees: Chief Longchap, Thomas Neeposh, Matt Manson and Ghislain Poirier. SWY update of the project. Discussions around road access (Northern winter road and Southern all-weather road) and the MOU negotiation.
November 5, 2007	Meeting	Mistissini CHRD office	Third meeting of the Foxtrot-Mistissini Working Group. Discussion about the development schedule of the project, winter road access, diamond valuation, prefeasability study.
Nov 8 & 9, 2007	Meeting	Mistissini	Consultation meeting regarding the Northern winter road access project. The meeting was conducted by Catherine Lussier (Roche subcontractor), Roderick Swallow and Sydney Swallow attended to that meeting as Tallymen of the family trapline.
November 21, 2007	Letter	Ghislain Poirier	Letter to Chief Roderick Pachano advising Chisasibi community that we would like to consult some Chisasibi Tallyman according to the SWY winter road project demand to the COMEV.
November 27, 2007	Reception	Quebec City Chateau Frontenac	SWY-SOQ private reception held in the Chateau Frontenac in margin of the Quebec Exploration 2007 conference. The goal of that reception was to present to stakeholders a collection of diamonds recovered from the 2007 bulk sample. Chief Longchap, Thomas Neeposh, Roderick Swallow and Sydney Swallow attended to that reception.

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
November 27, 2007	Diner	Restaurant	Informal diner held after the SWY-SOQ private reception. Chief Longchap, Thomas Neeposh, Roderick Swallow and Sydney Swallow, Eira Thomas, Matt Manson, Dave Skelton and Ghislain Poirier attended to that diner.
December 14, 2007	Meeting	Montreal Hutchins, Caron et Ass.	MOU exploratory meeting. Participants: Peter Hutchins, Elizabeth Paterson, Mike Hardin and Ghislain Poirier.
February 15, 2008	Letter	Matt Manson	M.Manson sent to Chief Longchap a proposed MOU. This document reflects SWY vision of that type of agreement. SWY didn't work on the October 16, 2007 MOU provided by CNM but proposed rather a new document and approach
February 19, 2008	Meeting	Québec City Secrétariat aux Affaires Autochtones	The principal objective of the meeting was to understand more fully the policies and practices of the Quebec government. M.Hardin and G.Poirier for SWY and Patrick Brunelle and Michel Mongeau from the Secrétariat and Daniel Berrouard from the MDDEP and Hugues Melançon from Ministère de la justice.
February 20, 2008	Meeting	Montreal Hutchins, Caron et Ass. office	MOU negotiation meeting. Participants: Peter Hutchins, Elizabeth Paterson, Thomas Neeposh and Kathleen Wooton, Matt Manson, Mike Hardin and Ghislain Poirier.
March 20, 2008	Meeting	Montreal McCarthy-Tetreault office	Joint Venture meeting. Review of the MOU meeting held at Hutchins office on February 20, 2008 and strategic preparation for the next meeting. G.Poirier, M.Manson and M. Hardin (phone) for SWY and P.Bertrand and A. Bigue for SOQUEM.
March 31,2008	Letter	Chief Longchap	Letter to Philip Awashish (COMEV president): *Comments on the Directive concerning impact assessment for the Stornoway-SOQUEM Renard mining project winter road*. CONFIDENTIAL
April 3, 2008	Conference	Alan Penn	Talk given by Alan Penn (CRA/GCCEI scientific advisor) to a Canadian Institute conference held in Montreal.
April 4, 2008	Letter	Matt Manson	Letter to Chief Matthew Mukash proposing a Renard Project presentation to the CRA/GCCEI.
April 11, 2008	Email	G.Poirier (SWY)	Email to Elizabeth Patterson advising proposed meeting and presentation 20th, 21st, 22nd April.
April 16, 2008	Fax, Email	Matt Manson	Letter to Chief John Longchap. Proposed agenda for meeting April 22nd , 2008.
April 18, 2008	Meeting	Mistissini CHRD office	Renard-Mistissini Working Group meeting.
April 21, 2008	Meeting	Mistissini Mistissini Band Council	Band Council Meeting. Some Band council representatives including Chief Longchap, Kathleen Wootton, Thomas Neeposh and Swallow family representatives including the Tallyman Sydney Swallow. JV's representatives were M.Hardin, G.Poirier, Eira Thomas and Matt Manson. Powerpoint presentation presented by Matt Manson.

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April 22, 2008	Meeting	Mistissini Mistissini Lodge	MOU negotiation meeting. Participants: Chief Longchap, Elizabeth Patterson, Thomas Neeposh and Kathleen Wooton, Eira Thomas, Matt Manson, Mike Hardin and Ghislain Poirier. A package of information related to the winter road project has been provided to Chief Longchap.
April 30, 2008	Letter	Peter Hutchins	Letter to Matt Manson: Compliance with Section 22 Environmental and Social Protection Regime under the James Bay and Northern Quebec Agreement (Treaty).
May 13, 2008	Meeting	McCarthy Quebec City office	Strategy meeting regarding the answer to provide to Chief Longchap following the April 30 Hutchins' letter.
May 13, 2008	Letter	Matt Manson	Letter to Chief Longchap Re : Quarterly Meeting Letter suggesting the establishment of quarterly meetings.
May 26, 2008	Letter	Ghislain Poirier	Letter to Sydney Swallow. Re: Winter Road Preliminary map Letter accompanying the map showing the proposed Winter Road route.
May 30, 2008	Letter	Bill Namagoose	Letter to Matt Manson. Re: Renard Diamond Project – James Bay Territory On behalf Matthew Mukash, Mr. Namagoose suggested an exploratory meeting regarding the Renard project
May 30, 2008	Memo	Matt Manson	Summary of the Renard Project site tour for Alan Penn
June 10, 2008	Letter	Matt Manson	Letter to Chief Longchap Re: MOU and Peter Hutchins' Letter of April 30, 2008.
June 10, 2008	Letter	Matt Manson	Letter to Bill Namagoose Re : Information Meeting – Renard Diamond Project. This letter was an answer to Bill Namagoose's May 30 letter.
June 12, 2008	Letter	Matt Manson	Letter to Bill Namagoose Re : Renard Diamond Project. The Peter Hutchins' April 30 letter to Mike Hardin/Matt Manson and Matt Manson's June 10 letter to Chief Longchap were attached to this letter.
June 17, 2008	Memo	Mike Hardin	Memo : Re: Access to Government Files - Renard Diamond project. Proposed strategy giving access to government file information.
July 7, 2008	Letter	Chief Longchap	Letter to Madeleine Paulin MDDEP deputy Minister Re: Propriété Foxtrot (secteur Renard) – Stornoway Corporation (Ashton) / SOQUEM INC N/Réf 3214-14-41 – Building of the Winter Road.
July 8, 9, 10, 2008	Event	Mistissini Sport Complex	Cree Regional Career fair. Annual event organized by the CHRD. SWY has a booth for 2 days.
July 10, 2008	Meeting	Mistissini CHRD office	Renard-Mistissini Working Group meeting.

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July 15, 2008	Meeting	Quebec City MDDEP's Quebec City office	July 15, 2008 Memorandum regarding the meeting held the day before (July 14) at the MDDEP's office. Re: Meeting with Michael O'Neill, COMEV-COMEX secretary.
July 25, 2008	Email	Matt Manson	Email to Bill Namagoose Re : Agenda for July 31st 2008
July 31, 2008	Meeting	Ottawa Embassy of the Cree Nation	Meeting with representatives of the Grand Council of the Crees Eeyou Itschee (Bill Namagoose, Abel Bosum and A.Penn) and SWY-SOQUEM representatives (M.Manson, E.Thomas, G.Poirier, P.Bertrand)
August 13, 2008	Memo	Ghislain Poirier	Memorandum Re : Summary of the August 6, 2008 phone call to Claude François Lemasson, Goldcorp Inc. regarding Environmental Assessment and agreement negotiation with Wemindji.
August 18, 2008	Email	Ghislain Poirier	Email to Kathleen Wootton Re: Environment Consultant
August 19, 2008	Memo	Ghislain Poirier	Memorandum Re : Summary of the August 14, 2008 telephone calls to Pierre Marcoux, MRNF; Robert Joly, MDDEP; and Claude François Lemasson, Goldcorp Inc. regarding document flow obligation.
August 27, 2008	Letter	Matt Manson	Letter to Madeleine Paulin, MDDEP Deputy Minister Re: Proposition d'aménager un chemin d'hiver pour desservir le sîte d'exploration du Projet diamantifère Renard – Votre dossier 3214-14-41
August 27, 2008	Letter	Matt Manson	Letter to Chief Longchap Re: Proposed Winter Road to the exploration site of the Renard Diamond Project English translation of the letter sent to Madame Paulin
August 27, 2008	Email	Ghislain Poirier	Email to Simon Latraverse Re: Emploi et Formation pour les cris dans le secteur minier. G.Poirier provided Renard employment data to S.Latraverse for the benefit of a CHRD study.
September 8, 2008	Letter	Madeleine Paulin	Letter to Matt Manson Letter answering to the Matt Manson's August 27, 2008 letter.
September 8 and 9	Field Visit	Lagopède	Two-days official field visit. Ghislain Poirier, Roch Chartré, Sydney Swallow and Roderick Swallow. Overview of all Renard Project operations with focus on environmental impacts and remediation program.
September 12, 2008	Request	Sydney Swallow	Ghislain Poirier agreed to provide a free return flight (Otter) to Sydney Swallow on Monday September 29 allowing Sydney and his family to come back in Mistissini after a hunting trip on their trapline. All arrangements were done with Roch Chartré. Finally Sydney never went to his hunting trip and the SWY offer has been declined.

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September 13, 2008	Job opportunity	Sydney Swallow and Jonathan Swallow	Ghislain Poirier offered a two weeks contract to Sydney Swallow (DMS loader operator) and Jonathan Swallow (DMS technician) but Sydney declined this offer and Jonathan didn't provide an answer.
September 26, 2008	Letter	Matt Manson	Letter to Chief Longchap Re: Proposal for a Renard Pre-Development Agreement.
October 10, 2008	Memo	Matt Manson	Memo from Matt Manson summarizing the phone call with Chief Longchap regarding the Pre-development Agreement
October 29, 2008	Email	Matt Manson	Emails to Chief Longchap and Bill Namagoose regarding the SWY press release announcing the results of the Renard Economic Assessment.
October 31, 2008	Email	Ghislain Poirier	Email to Chief Longchap confirming the SWY presentation during the Band Council held in Montreal on November 17
November 3, 2008	Letter	Ghislain Poirier	Letter to Bill Namagoose (GCC) suggesting a "Renard Diamond Project Information Meeting"
November 17, 2008	Meeting	Montreal Sheraton Center	Special Mistissini Band Council meeting held in Montreal. Attending to this meeting: Matt Manson, Ghislain Poirier and Pierre Bertrand, Alan Penn, Chief Longchap and regular members of the Mistissini Band Council (including Kathleen Wootton). Matt Manson's Powerpoint presentation updating on the Preliminary Assessment.
December 17, 2008	Meeting	Mistissini CHRD office	Renard-Mistissini Working Group meeting. Ghislain Poirier and D'Arcy Raymond (A1Geoservices), Abel Trapper, Norman Blacksmith, Sydney Swallow, Roderick Swallow and Jonathan Swallow. Powerpoint presentation updating on the Preliminary Assessment
December 17, 2008	Letter	Ghislain Poirier	Letter to Chief Longchap accompanying a hard copy of the "Technical Report on the Preliminary Assessment of the Renard Project, Quebec".
December 17, 2008	Diner	Mistissini Lodge restaurant	Christmas dinner with Ghislain Poirier, Sydney Swallow and his spouse Nanny Swallow, Roderick Swallow and his spouse Evadney Swallow.
January 8, 2009	Email	Christopher Quinn	Meechum fuel quote for 1000 barrels sent by email to Roch Chartré
January 12, 2009	Meeting	GCCEI/CRA Montreal's office	Meeting with Alan Penn (representing the GCCEI), Ghislain Poirier (representing SWY) and Lorraine Brooke a consultant recommended by Kathleen Wootton to assist Mistissini people during the future consultation process related to the Environemental and Social Impact Assessment (ESIA).
January 22, 2009	Email	Christopher Quinn	Meechum fuel quote for 1000 barrels sent by email to Roch Chartré
January 30, 2009	Memo	Matt Manson	Note to Ann Bigue, Ghislain Poirier and Pierre Bertrand on conversations with Chief Longchap, January 29 and 30, 2009
February 7, 2009	Fax	Christopher Quinn	Meechum bid for fuel supply (1500 barrels) sent by fax to Dave Skelton

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February 11, 2009	Agreement	Eskan Company	Contract between Eskan company (Sodexo Quebec Ltd) and Stornoway for temporary staff support (cooks).
February 11, 2009	Email	Ghislain Poirier	Exchange of emails between Ghislain Poirier and Thomas Neeposh regarding the Meechum fuel bid and information regarding the camp manager.
February 24, 2009	Application	Ghislain Poirier	Application form sent to Abel Trapper regarding the CHRD's Territorial Program for the training of two candidates during the drill winter program
March 23, 2009	Email	Ghislain Poirier	Email to Chief Longchap regarding the provincial government announcement related to the Monts Otish Road
March 27, 2009	Agreement	CRA/Stornoway	Funding agreement between CRA and Stornoway regarding core shack labourer on-site training for the period of January 1 to Match 30, 2009 (TPI-21593)
March 27, 2009	Email	Ghislain Poirier	Invitation sent to Chief Longchap for an information meeting on the Renard project
April 22, 2009	Meeting	Mistissini CHRD office	Renard-Mistissini Working Group meeting. Ghislain Poirier, Abel Trapper, Norman Blacksmith, Sydney Swallow. Update on the winter program and on the Preliminary Assessment
May 20-26, 2009	Emails	Ghislain Poirier and Henry Mianscum	Exchange of emails regarding the possibility to collaborate for a strategic planning for potential training related to the future mine operation
June 2, 2009	Meeting	Mistissini CHRD office	SWY-SOQUEM (GP, MM, PB) presentation of the Renard project to some CHRD representatives: Henry Mianscum, Abel Trapper and Michael Mianscum. Discussion about mine training strategy.
June 15, 2009	Report	Ghislain Poirier	Final report submitted to the CHRD in relation to the Funding Agreement TPI-21593 (Core Shack Labourer – Winter 2009 drill program)
June 30, 2009	Letter	Matt Manson	Letter to Chief Longchap, re: Commencement of negotiation leading to an IBA
July 23, 2009	Event	Stanley Longchap Golf Classic	GP, MM and PB participated to the golf tournament and invited Chief Longchap to a two-days IBA negotiation meeting in Val d'Or including two afternoon of golf. Chief was enthusiastic face to this proposal.
July 31, 2009	Email	Ghislain Poirier	Email to Chief Longchap formally inviting him to a two-days negotiation session in Val d'Or at the end of August
August 3, 2009	Letter	Ghislain Poirier	Congratulation letter to Grand Chief Matthew Coon-Come for his election victory.
August 10, 2009	Visit	Mistissini (GP)	Lunch with Sydney Swallow: discussion about Emmanuel camp restoration plan. Meeting with Chief Longchap: discussion about IBA nego meeting to come. Meeting with Thomas Neeposh: discussion about Otish Road.
August 14, 2009	Email	Ghislain Poirier and Chief Longchap	Exchange of emails. The IBA meeting scheduled during the week of August 24 has to be postponed later.

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August 24, 2009	Visit	Lagopède	Ghislain Poirier and Sydney Swallow's family (his wife and 5 daughters) carried out a one-day visit at Lagopede.
August 2009	Article	Native Journal	Article in the Native Journal about Roxanne MacLeod; a native worker at Lagopede camp
September 3, 2009	Email	Ghislain Poirier	Invitation sent to Chief Longchap for a two-days IBA negotiation session in Montreal in October
October 7-8, 2009	Meeting	Montreal Queen Elizabeth Hotel	"Exploratory" IBA meeting. G.Poirier, M.Manson, P.Bertrand, Chief Longchap and Sam Etapp. Golf game on October 8. Negotiation schedule, Involvement of the GCC, Taxation, Training, Communication, Implementation Committee, Troilus case study, Trapline family.
October 13,2009	Email	Ghislain Poirier	Email to Chief Longchap suggesting some dates for the next IBA meeting
October 30, 2009	Report	Ghislain Poirier	Final report submitted to the CHRD in relation to the Funding Agreement TPI-21638 (Core Shack Labourer – Summer 2009 drill program)
November 3, 2009	Meeting	Mistissini CHRD office	Renard-Mistissini Working Group meeting. Ghislain Poirier, Abel Trapper, Norman Blacksmith, Roderick, Emerson, Johnny and Gordon Swallow (Sydney joined us for the lunch). Update on the summer program. Discussion about the Cree Capacity Study. Discussion about the Emmanuel camp restoration plan.
November 3, 2009	Meeting	Mistissini Mistissini Lodge	Ghislain Poirier and Samuel Etapp. Renard Project Presentation. Update about Cree level of employment. Renard-Mistissini Working Group.
November 11, 2009	Email	Ghislain Poirier	Formal Invitation to the IBA meeting in Montreal
November 17, 2009	Email	Ghislain Poirier	Email to Chief Longchap and Abel Bosum presenting the proposed Agenda of the meeting.
November 19, 2009	Meeting	Montreal Hyatt Regency Hotel	"Orientation" IBA meeting. G.Poirier, M.Manson, P.Bertrand, Chief Longchap (partially), Sam Etapp, Abel Bosum, F.Dandonneault. History of the relationship, Troilus Agreement and Troilus experience, Role of the Parties, Involvement of the Family, Objectives of the IBA, IBA principles, Willingness of the Parties, Next Meeting: Big Items !!!
November 20, 2009	Agreement	CHRD Training program	Signed copy of the Agreement signed by CRA and SWY representatives. Core Shack Labourer – Summer 2009 program
December 15, 2009	Visit	Ghislain Poirier	Visit in Mistissini. Short meeting with Chief Longchap. Lunch with Sydney and Roderick Swallow. Meeting with Sam Etapp.
January 19, 2010	Meeting	Gowling's office, Montreal	IBA meeting
January 25, 2010	Meeting	Mistissini Band Council	Ghislain Poirier and Pierre Bertrand – annual update presentation of the Renard project
January 25, 2010	Lunch	Mistissini Lodge	Lunch Ghislain Poirier, Pierre Bertrand, Sam Etapp, Sydney Swallow, Nannie Swallow, Roderick Swallow and Gordon Swallow.

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February 8, 2010	email	Ghislain Poirier	Email to Abel Bosum and Chief Longchap proposing the next IBA meeting
February 12, 2010	email	Ghislain Poirier	Email to Abel Bosum and Chief Longchap informing them about the submission to the COMEV of the Notice of Intent
February 22, 2010	Meeting	Lavery DeBilly Montreal office	PDA Negotiation Meeting. Matt Manson, Pierre Bertrand, Ghislain Poirier and Ann Bigue representing SWY; Abel Bosum, Alan Penn, Francois Dandonneault representing the GCC (EI) ; Sam Etapp and Robert Jimiken representing Mistissini
February 23, 2010	email	Ghislain Poirier	Email to Alan Penn. North Winter Road withdrawal letter
February 23, 2010	email	Ghislain Poirier	Email to Alan Penn. Notice of Intent report
February 23, 2010	email	Ghislain Poirier	Email to Sam Etapp and Robert Jimiken. Renard Diamond Mine anticipated workforce table
March 11, 2010	email	Ghislain Poirier	Email to Sam Etapp. Proposed Renard development Schedule powerpoint presentation.
March 22, 2010	email	Ghislain Poirier	SWY press release presenting the results of the PA revision
March 24, 2010	Meeting	Mistissini Sport Center	PDA Negotiation Meeting. Eira Thomas, Pierre Bertrand, Ghislain Poirier and Ann Bigue (phone) representing SWY; Abel Bosum, Alan Penn, Francois Dandonneault representing the GCC (EI) ; Sam Etapp and Robert Jimiken representing Mistissini
March 24, 2010	Open House	Mistissini Youth Center	Renard Diamond Project Community Open House. Around 100 people circulated at this event from 2:00pm to 7:00pm. Update presentation by Eira Thomas. IBA presentation by Abel Bosum. Environmental process by Alan Penn. A selection of Renard diamond and a 3D-Model of the mine site have been presented.
March 24, 2010	Letter	Sydney and Roderick Swallow	Letter to Ghislain Poirier addressing the views of Sydney and Roderick Swallow in regards to the current negotiation process. They disagreed with the Mistissini Band Council approach regarding the right of the family into the negotiation. They appointed Mr. Henry Mianscum as the only representative of the Family. They requested a direct negotiation with SWY.
April 22, 2010	Meeting	Hotel Quebec, Quebec City	PDA Negotiation Meeting. Pierre Bertrand, Ghislain Poirier and Ann Bigue representing SWY; Abel Bosum, Alan Penn, Francois Dandonneault representing the GCC (EI) ; Robert Jimiken and Chief Longchap representing Mistissini
May 2, 2010	Meeting	Mistissini (Sydney Swallow's home)	GP met Sydney, Nannie, Gordon, Emerson and Johnny Swallow. Discussion about the March 24, 2010 letter. Presentation of the 3D-Model and poster about the project.

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June 1, 2010	Visit	Mistissini (Mistissini Lodge)	GP visit at Mistissini. GP met Sydney, Nannie, Roderick, Gordon, Jonathan and Johnny Swallow. Discussion about the relationship between the family and the Band Council following a recent meeting between them.
June 2, 2010	Meeting	Gowlings' office Montreal	PDA Negotiation Meeting. Pierre Bertrand, Ghislain Poirier, Matt Manson and Ann Bigue representing SWY; Abel Bosum, Francois Dandonneault representing the GCC (EI) ; Robert Jimiken representing Mistissini
June 3, 2010	Meeting	Queen Elisabeth, Montreal	Meeting G Poirier and M. Boucher with Alan Penn. Update on the tender process regarding the ESIA
June 8, 2010	Visit	Mistissini (Mistissini Lodge)	Introduction of the SWY team (GP, PG, MB, RB) in Mistissini. We met Roderick and Gordon Swallow for a breakfast at the Lodge and Sydney Swallow at his home (he was sick). The team met also Chief Longchap at the Band Council and Abel Trapper at the CHRD.
June 14, 2010	Memo	Alan Penn	Note from Alan Penn regarding the Directive received from the MDDEP in regards of the Renard Notice of Project.
June 16, 2010	Memo	Robert Jimiken	Proposal from Robert Jimikin (Director of Municipal Services) regarding a possible emplacement for the Stornoway office.
June 16, 2010	Meeting	Gowlings' office Montreal	PDA/IBA Negotiation Meeting. Pierre Bertrand, Ghislain Poirier, Matt Manson and Ann Bigue representing SWY; Abel Bosum, Alan Penn, Francois Dandonneault representing the GCC (EI) ; Robert Jimiken and Chief Longchap representing Mistissini.
June 22, 2010	Letter	G. Poirier	Letter to Christopher Matoush in regards to SWY's exploration programs to come. Christopher is trying to start a surveyor business.
July 6, 2010	Meeting	SWY's office Brossard	GP and MB met Alan Penn and discussed about the Directive received from the COMEV
July 12, 2010	Email	G. Poirier	GP sent an email to Abel Bosum, Robert Jimikin, Alan Penn and F. Dandonneault containing the Directive received from the COMEV
July 15, 2010	Letter	Swallow Family	Letter addressed to Matt Manson from Sydney, Roderick, Gordon and Johnny Swallow. The Letter addressed their concerns and positions in regards to the PDA.
July 16, 2010	Meeting	Montreal Gowlings office	Execution of the PDA. GP, MM, Pierre Bertrand, Jean-Jacques Carrier, Abel Bosum, Robert Jimikin, Chief Longchap, Alan Penn, F Dandonneau, A Bigue.
July 22, 2010	Letter	Matt Manson	Letter from Matt Manson in response of the Letter sent by the Swallow Family on July 15, 2010.
July 22, 2010	Letter	Chief Longchap	Letter from Chief Longchap in response of the Letter sent by the Swallow Family on July 15, 2010.
July 23, 2010	Meeting	Band Office, Mistissini	GP and Robert Jimikin met three representatives of the Swallow Family (Sydney, Johnny and Emerson). The goal of that meeting was to explained the PDA and its commitments towards the Swallow Family.

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July 26, 2010	Press release	Stornoway	SWY's press release announcing the signature of the PDA with Mistissini Band Council and the GCC(EI)/CRA
July 27, 2010	Email	John Longchap	Email from Chief Longchap to GP. It was his last day as Chief of Mistissini and he provided good words for the IBA negotiations to come.
August 4, 2010	Email	Matt Manson	Email from Matt Manson authorizing the release of the PDA to Goldcorp at the request of Abel Bosum.
August 9, 2010	Letter	G. Poirier	Letter to Richard Shecapio congratulated him for his recent election as Chief of Mistissini
August 20, 2010	Letter	Grand Chief Coon-Come	Letter from Grand Chief Coon-Come in response of the Letter sent by the Swallow Family on July 15, 2010.
August 31, 2010	Meeting	Mistissini Lodge	GP, PG, HR breakfast with Sydney, Roderick, Johnny and Gordon Swallow. Discussion about the Emmanuel Camp contract followed later by a meeting at the Robert Jimikin office at the Band Council.
August 31, 2010	Meeting	Mistissini Lodge	GP, PG, HR: SWY annual presentation to Mistissini Band Council during one of their regular meeting.
September 9, 2010	Contract	Mistissini Office Lease	Execution of the SWY Mistissini office lease. This contract is between SWY and the Council of the Cree Nation of Mistissini.
September 10, 2010	Announce	The Nation	Annoucement in the magazine The Nation of the appointement of Helene Robitaille as Manager Community Relations, Training and Development.
October 5, 2010	Meeting	Mistissini Mistissini Lodge	IBA Negotiation Meeting (GP, PG, HR, Pierre Bertrand, Chief Shecapio, Robert Jimikin, Andy Baribeau, Abel Bosum, Francois Dandonneau, Alan Penn)
October 8, 2010	Memo	Alan Penn	Memo from Alan Penn providing comments in preparation of the ESIS
October 26, 2010	Meeting	Longueuil SWY office	PDA Implementation Meeting (GP, HR, Pierre Bertrand, Robert Jimikin, Andy Baribeau, Thomas Neeposh, Francois Dandonneau, Abel Bosum, Alan Penn)
October 26, 2010	Meeting	Longueuil SWY office	IBA Negotiation Meeting (GP, HR, PG, Ann Bigue, Pierre Bertrand, Robert Jimikin, Andy Baribeau, Thomas Neeposh, Francois Dandonneau, Abel Bosum, Alan Penn)
October 28, 2010	Letter	G. Poirier	Letter to Abel Bosum and Chief Shecapio proposing establish an ESIS Exchange Group with objective to act as an information forum on a regularly basis in Mistissini.
November 10-11, 2010	Meeting	Mistissini Mistissini Lodge	IBA Drafting Session (GP, HR, Ann Bigue, Francois Dandonneau, Andy Baribeau)
November 11	Meeting	G Poirier	GP discussion about he Cree Mineral Strategy with Francois Dandonneau on the return flight to Montreal

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November 18-19, 2010	Meeting	Longueuil SWY office	IBA negotiation meeting (GP, HR, PG, Ann Bigue, Pierre Bertrand, Robert Jimikin, Andy Baribeau, Thomas Neeposh, Francois Dandonneau, Abel Bosum, Alan Penn)
November 24, 2010	Meeting	Quebec Chateau Frontenac	MM and GP met some members of the Swallow Family (Sydney, Roderick, Johnny, Gordon and Emerson) at Quebec Exploration 2010. They explained that they want to be involved in some business activities at the mine site.
December 9, 2010	Meeting	Chibougamau Chibougamau Inn	IBA drafting session (GP, HR and Andy Baribeau)
December 9, 2010	Memo	Alan Penn	Memo from Alan Penn : Initial Thoughts about an approach to environment-related provisions in a Cree-SWY agreement on Renard Project.
December 14, 2010	Press release	Stornoway	SWY announces acquisition of remaining 50% of the Renard Project
December 14, 2010	Email	Andy Baribeau	Email from Andy Baribeau regarding the Training Chapter of the IBA
December 17, 2010	Meeting	Quebec Chateau Frontenac	GP met Abel Bosum at the Table des Partenaires du Plan Nord. Discussion about Goldcorp Agreement and Financial Matters to put on the agenda.
December 21, 2010	Meeting	Mistissini Mistissini Lodge	Meeting between GP, Andy Baribeau, Robert Jimikin and some representatives of the Swallow Family (Sydney, Roderick, Gordon and Johnny). Discussion about business opportunities.
January 4, 2011	Letter	Rachel Neeposh (Sydney's niece)	Letter to GP re: Letter of Intent to Provide Lodging for Stornoway
January 20, 2011	Press release	Stornoway	SWY announces opening of a representative office in Mistissini.
January 20, 2011	Event	Mistissini SWY's Mistissini office	Official Opening of the SWY's Mistissini office. Official speeches from Abel Bosum, Chief Shecapio and Matt Manson. SWY representatives (GP, PG, MB, HR, MM, ET) welcome official representatives of Mistissini and Chibougamau. The population of Mistissini has been invited for dinner but very few people attended.
January 20-21, 2011	Meeting	Mistissini Mistissini Lodge	IBA Negotiation Meeting (GP, PG, MB, HR, Pierre Bertrand, Ann Bigue, Abel Bosum, Chief Shecapio, Andy Baribeau, Francois Dandonneau, Alan Penn). Swallow Family has been invited to share their concerns and expectations at the Negotiation table but according that Roderick Swallow was very sick we postponed this meeting.
January 26-27, 2011	Meeting	Montreal Gowlings office	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
February 2, 2011	Letter	Roderick and Sydney Swallow	Letter to Matt Manson presenting Swallow Family concerned and expectations in regards of the PDA and the IBA negotiations.
February 7-8, 2011	Meeting	Mistissini Mistissini Lodge	IBA Negotiation Meeting (GP, PG, MB, HR, Pierre Bertrand, Ann Bigue, Abel Bosum, Chief Shecapio, Andy Baribeau, Francois Dandonneau, Alan Penn)

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February 8, 2011	Meeting	Mistissini Mistissini Lodge	PDA Implementation meeting (GP, HR, MB, PB, Robert Jimikin, Francois Dandonneau, Alan Penn)
February 8, 2011	Email	Martin Boucher	Email to Andy Baribeau presenting the proposing the content of the first Exchange Group meeting to take place.
February 8, 2011	Meeting	Mistissini	Gp met Roderick and Gordon Swallow. They invite GP at Roderick home and introduce him to Roderick's father and also to Gordon's father (at the elders center).
February 10, 2011	Email	Helene Robitaille	Email to GP following a meeting of the Swallow Familly representatives with chief Shecapio
February 10, 2011	Meeting	Montreal SWY office	Exchange meeting on the ESIA with the Cree Regional Authority Mr. Alan Penn, SWY and Roche
February 15, 2011	Meeting	Montreal FMC office	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
February 16, 2011	Meeting	Mistissini Mistissini Lodge	Environmental Exchange Group # 1
February 22, 2011	Meeting	Montreal FMC office	IBA Negotiation Meeting (GP, PG, MB, HR, Pierre Bertrand, Ann Bigue, Abel Bosum, Andy Baribeau, Francois Dandonneau, Alan Penn)
February 23, 2011	Letter	Ghislain Poirier	Letter to Sydney and Roderick Swallow. Answer to their letter dated on January 19 2011.
February 24, 2011	Meeting	Montreal	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
March 1, 2011	Letter	Helene Robitaille	Letter to Henry Mianscum : Invitation to a business information session with Stornoway Diamonds.
March 8, 2011	Meeting	Ghislain Poirier	At the PDAC in Toronto, GP met William McLeod (CCDC) and had a discussion on catering services for the Renard Mine. CCDC (ADC) has a MOU with the Swallow family to this effect.
March 10, 2011	Meeting	Montreal	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
March 15, 2011	Meeting	Mistissini Sport Center	GP, MB, HR and representatives of Roche met the Swallow Family (Sydney, Roderick, Johnny, Gordon, Paulemean) and keep inform them about the surveys conducted at Renard and give them a chance to provide their input. This private meeting with them had the objective to replace the first Exchange Group that they didn't attend.
March 16, 2011	Meeting	Mistissini Sport Center	GP met shortly Henry Mianscum before the Environmental Exchange Group and discuss about the SWY efforts to focus on Cree training and Employment and also about efforts of all Parties to avoid the creation of "Front companies" in the context of Renard Diamond Mine.
March 16, 2011	Meeting	Mistissini Sport Center	Environmental Exchange Group # 2
March 22, 2011	Meeting	Montreal Gowlings office	IBA Negotiation Meeting (GP, PG, MB, HR, Pierre Bertrand, Ann Bigue, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Thomas Neeposh)
March 29, 2011	Meeting	Montreal (FMC office)	IBA Negotiation Meeting (GP, PG, MB, HR, Pierre Bertrand, Ann Bigue, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Alan Penn)
April 6, 2011	Meeting	Mistissini Mistissini Lodge	Environmental Exchange Group # 3

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
April 8, 2011	Letter	Abel Bosum	Invitation to SWY from the GCC(EI)/CRA to participate to a presentation by the "Cree Jobs Partnership" on April 26, 2011 in Montreal.
April 11, 2011	Letter	Chief Shecapio	Invitations sent to Sydney and Roderick to meet the members of the IBA negotiation table scheduled on April 12, 2011 and provide their concerns and expectations.
April 11, 2011	Letter	Swallow Family	Letter sent to Matt Manson (received on April 12) where the Swallow raised the SWY duty to consult the Family and their rights to be involved in the negotiation.
April 12-13, 2011	Meeting	Mistissini Mistissini Lodge	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Abel Bosum, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Alan Penn)
April 12, 2011	Meeting	Mistissini Mistissini Lodge	Meeting between the negotiation teams and representatives of the Swallow Family (Sydney, Roderick, Johnny, Gordon, Paulemean, Emerson, Joseph, Christopher). The Swallow submitted a document presenting their requests in regards of the development of the Renard Mine and provided explanations on it.
April 25, 2011	Email	Ghislain Poirier	GP circulated the minutes of the PDA Implementation meetings held on October 26, 2010 and February 8, 2011.
April 26, 2011	Letter	Matt Manson	Letter to Sydney and Roderick Swallow as answer of their letter sent on April 11, 2011.
April 26, 2011	Meeting	Montreal Delta Centre-ville Hotel	SWY presentation at the "Cree Jobs Partnership". GP, PG and HR presented the Renard project and the SWY visions in term of training, employment and contracts
May 3, 2011	Meeting	Montreal	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
May 12, 2011	Posting	Mistissini	Job Posting for an Environmental Monitor
May 17, 2011	Meeting	Chibougamau	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
May 24, 2011	Meeting	Montreal (FMC office)	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Abel Bosum, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Thomas Neeposh, Alan Penn). Presentation of the Financial Matters of the Cree Mining Policy.
May 25, 2011	Meeting	Montreal	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
June 1, 2011	Event	Mistissini Sport Center	Symposium Mines Baie James. SWY update on the Renard Project (PG) and Cree Mining Policy publicly presented and explained by Abel Bosum.
June 2, 2011	Meeting	Chibougamau	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
June 7, 2011	Phone call	GP and Robert Jimikin	Discussion about the meeting held on June 2 in Mistissini between the Swallow Family and Chief Shecapio, Robert Jimikin and Thomas Neeposh.
June 9, 2011	Meeting	Mistissini Mistissini Lodge	Environmental Exchange Group # 4

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
June 17, 2011	Meeting	Chibougamau Chibougamau Inn	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Abel Bosum, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Thomas Neeposh, Alan Penn).
June 23, 2011	Meeting	Quebec Hotel Quebec	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
June 27, 2011	Email	Helene Robitaille	Email to Henry Mianscum about the SWY camp supervisor job posting.
July 4, 2011	Meeting	Montreal SWY office	Exchange meeting on the ESBS and ESIA with the Cree Regional Authority Mr. Alan Penn, SWY and Roche
July 5, 2011	Meeting	Montreal Gowlings office	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
July 5-6, 2011	Meeting	Montreal FMC office	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Abel Bosum, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Thomas Neeposh, Alan Penn, Chief Shecapio).
July 6, 2011	Meeting	Montreal Gowlings office	IBA Negotiation Meeting - Financial Matters (GP, PG, MM, ZB, Ann Bigue, Amar Leclair-Ghosh, Abel Bosum, Francois Dandonneau, Robert Jimikin, Chief Shecapio, Harvey Sands, David Hermitage).
July 11, 2011	Meeting	?	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
July 20, 2011	Phone Call	HR and Johnny Swallow	Discussion about the relationship between SWY and the Swallow Family on one hand and between the Family and CNM on the other hand. Injunction?
July 29, 2011	Article	The Nation	Summary of the artic expedition of Kayleigh Spencer from Mistissini. The participation of Kayleigh to “Student on Ice” was sponsored by SWY.
August 8, 2011	Email	Andy Baribeau	Email form Andy Baribeau summarizing the meeting that Andy and Robert Jimikin have had with some members of the Swallow Family. The goal of this meeting was to explain the IBA and obtain the concerns and expectations of the Family.
August 15, 2011	Meeting	Montreal FMC office	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Chief Shecapio).
August 16, 2011	Meeting	Montreal FMC office	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
August 18, 2011	Meeting	Mistissini Mistissini Lodge	Environmental Exchange Group # 5
August 18, 2011	Letter	Ghislain Poirier	Invitation sent to Sydney and Roderick Swallow regarding an information meeting on August 26, 2011 about the IBA on-going negotiation.
August 22, 2011	Meeting (Cancelled)	Montreal Gowlings office	IBA Negotiation Meeting - Financial Matters. The meeting scheduled for August 22 has been cancelled and the Parties decided to wait for the release of the BFS before to initiate the negotiation of this Chapter of the IBA.
August 24, 2011	Memo	GCC(EI)/CRA	Memorandum submitted to Quebec government in regard of the Bill 14 (new Mining Act)
August 26, 2011	Meeting	Mistissini Mistissini Lodge	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Chief Shecapio).

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
August 26, 2011	Meeting	Mistissini Mistissini Lodge	IBA Information meeting. The IBA was presented to the Swallow Family by Stornoway representatives (PG, GP, HR) on behalf of the Parties. Andy Baribeau from CNM attended to that meeting.
August 26, 2011	Letter	Rachel Neeposh	Three documents provided to GP during the information meeting with the Swallow Family: Swallow Family Unity Agreement, Resolution of the CNM for the support of a Business venture – Cree North Lodging, a support letter signed by both tallymen for Cree North Lodging.
September 2, 2011	Letter	Ghislain Poirier	Letter sent to Abel Bosum and Chief Shecapio : Follow-up on the information session about the IBA held on August 26, 2011 with the Swallow Family.
September 11, 2011	Email	Ghislain Poirier	Email sent to members of the Drafting table regarding some proposal for Chapter 2 (Objectives of the Agreement)
September 14, 2011	Email	Ghislain Poirier	Email sent to members of the Drafting table regarding some proposal for Chapter 8 (Social and Cultural Matters)
September 20-21, 2011	Meeting	Chibougamau Chibougamau Inn	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
September 26, 2011	Meeting	Montreal FMC office	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau).
September 30, 2011	Meeting	Montreal SWY office	Exchange meeting on the ESBS with the Cree Regional Authority Mr. Alan Penn, SWY and Roche
October 5, 2011	Meeting	Montreal FMC office	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
October 6, 2011	Meeting	Montreal Gowlings office	IBA Drafting Session (GP, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau)
October 12, 2011	Meeting	Mistissini	Mitigation measures. MB and HR met some members of the Swallow Family (5) and discussed about the nature of mitigation measures to carry out for the relocation of the Sydney's camp (located close to the proposed airstrip).
October 13, 2001	Meeting	Mistissini Mistissini Lodge	Environmental Exchange Group # 6
October 19, 2011	Meeting	Quebec City Chateau Laurier	IBA Negotiation Meeting (GP, PG, MB, Ann Bigue, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Abel Bosum).
October 19, 2011	Meeting	Quebec City Chateau Laurier	PDA implementation meeting (GP, MB and Robert Jimikin).
November 1, 2011	Event	Funeral of Clarence Swallow	HR represented SWY at the funeral of Clarence Swallow (the father of Sydney Swallow)
November 2, 2011	Meeting	Montreal FMC office	IBA Negotiation Meeting (GP, PG, MB, HR, Ann Bigue, Andy Baribeau, Francois Dandonneau, Robert Jimikin, Chief Shecapio, Abel Bosum).
November 16, 2011	Press release	Stornoway	SWY announced the results of the Feasibility Study.
November 17, 2011	Email	Ann Bigue	Email exchange between AB and FD regarding the presentation about security/background checks issues at the mine site presented at the November 2 negotiation meeting.

DATE	DOCU-MENT OR EVENT	AUTHOR / LOCATION	DETAILS
November 17, 2011	Meeting	Montreal Restaurant Julien	Dinner with GP, PG, ZB and Abel Bosum. SWY presented the results of the BFS to Abel Bosum according that he cannot attend to the November 18 meeting.
November 18, 2011	Meeting	Montreal Gowlings office	IBA Negotiation Meeting - Financial Matters (GP, PG, MM, ZB, Ann Bigue, Amar Leclair-Ghosh, Brent Cochrane Francois Dandonneau, Robert Jimikin, Andy Baribeau, Chief Shecapio, Harvey Sands, David Hermitage and Mike ???).
November 18, 2011	Meeting	Quebec City Roche office	Exchange meeting on the ESIA with the Cree Regional Authority Mr. Alan Penn

Appendix 6.3.1

Modeling of Atmospheric Emissions of the Renard Project (Roche, 2011)

Stornoway Diamond (Canada) inc.

Atmospheric Emissions Modeling - Renard Diamond Project

Refer Number. : 061470.001-400

Report

December 2011

Stornoway Diamond (Canada) inc.

Atmospheric Emissions Modeling - Renard Diamond Project

Refer Number. : 061470.001-400

Report

Report Date : December 2011

Prepared by : _____

André Boilard, ing.,MBA

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1. INTRODUCTION

A study modeling the atmospheric emissions from the mining complex's different sources was conducted for the Renard Diamond Project Environmental and Social Impact Assessment that Roche Ltd. prepared for Stornoway Diamond Corporation (Canada) Inc.

Its goal was to calculate the ground-level concentrations of the main contaminants likely to affect air quality in the sector surrounding the Renard Project site and the deposition rates of particles from the storage areas, especially the processed kimberlite confinement area. The nitrogen dioxide (NO_2), carbon monoxide (CO), fine particles, dustfall and sulfur dioxide (SO_2) ground-level concentrations were calculated to ensure compliance with the standards governing maximum ambient air levels defined by the Ministere du Developpement Durable, de l'Environnement et des Parcs du Quebec (Quebec Ministry of Sustainable Development, the Environment and Parks - MDDEP). The results were compared with the standards that took effect with the *Clean Air Regulation* (CAR) (R.R.Q., c. Q-2, r. 4.1) on June 13, 2011 for gaseous contaminants and the dustfall standard contained in the *Regulation respecting the quality of the atmosphere* (R.R.Q., c. Q-2, r. 38).

To conduct the modeling, the contaminant emission rates from stationary sources were obtained from the team that carried out the Renard Project Technical Feasibility Study.

This atmospheric emission modeling report includes a description of the methodology used to perform the modeling and presents its results.

2. MODELING PROCEDURE

Certain baseline data, grouped into the following five categories, are needed for modeling calculations:

- meteorological data;
- topographic survey of the sector;
- data on proposed land use around the mining complex;
- data on configuration of the buildings surrounding the emission sources;
- the source's emission parameters.

2.1 Meteorological Data

AERMOD, the model used for this study, requires data measured on an hourly basis. In Quebec, only data from the Canadian Atmospheric Environment Service (AES) network meets this criterion. The network has few stations measuring meteorological data in northern Quebec and there is no station with a 30 km radius of the project site, a requirement stipulated in the *Guide de modélisation de la dispersion atmosphérique* (air dispersion modeling guide).[1] The station closest to the Renard Project site is the Nitchequon station, which operated from 1942 to 1985. Located approximately 95 km from the Renard Project study area, this station's data were deemed sufficiently representative of the area's climate to be used for modeling purposes.

Nitchequon station data for 1980-1984 were used for modeling calculations. These years were selected because the station ceased operating in November 1985 and the data available for 1980-1984 were complete enough to be used in the dispersion model chosen. Wind speed and direction were measured at a height of 10 m from the ground.

Mixing heights for this same period come from the Maniwaki Upper Air Station, which is most representative of the mine site. Data were processed using the latest version of AERMET software, i.e. version 06341.

Table 1 compares the Nitchequon modeling data with mean data obtained between 1959 and 1985. Figure 1 contains the wind rose illustrating 1980-1984 data used for modeling purposes. Wind frequency for the five years in question is comparable to that of 1959-1985. The percentage of winds from the north, east, south and west is slightly lower for 1980-1984 than for 1959-1985; calm winds are more frequent in the modeling data.

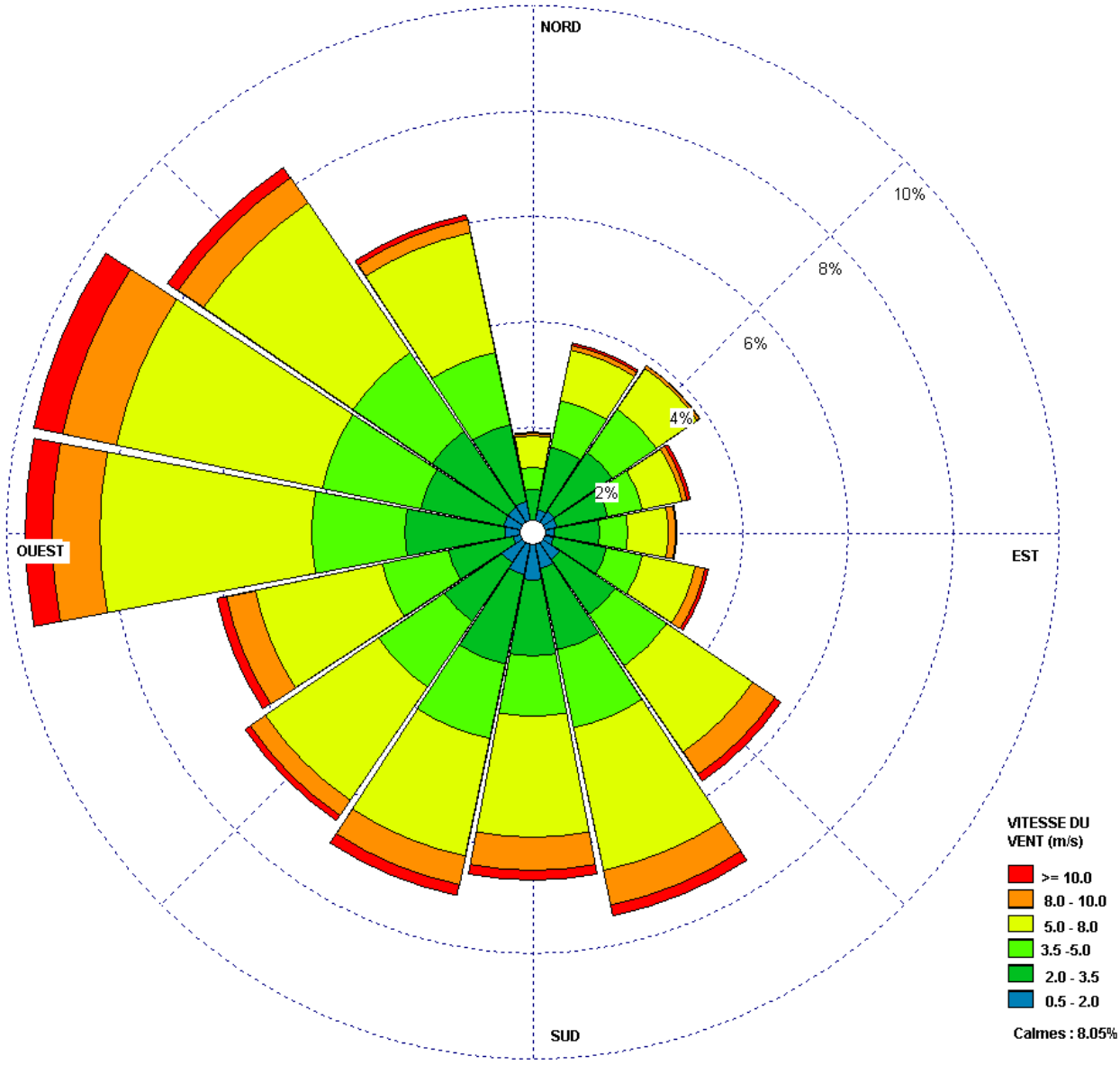
[1] Guide de modelisation de la dispersion atmosphérique. - Direction du suivi de l'état de l'environnement, Ministère du Developpement Durable, de l'Environnement et des Parcs du Québec, April 2005, 38 pp.

The mean temperatures observed at the Nitchequon station for 1959-1985 and for the modeling years (1980-1984) are shown in Table 2. Discrepancies between 1980-1984 and 1959-1985 data are minimal, with the greatest differences being observed in February and March.

Table 1: Nitchequon station wind rose and modeling data

Origin of wind	Frequency (%)						
	Nitchequon 1980	Nitchequon 1981	Nitchequon 1982	Nitchequon 1983	Nitchequon 1984	Nitchequon mean 1980-1984	Nitchequon mean 1959-1995
N	2.40%	1.92%	1.47%	2.37%	1.35%	1.90%	5.43%
NNE	3.36%	4.19%	2.87%	4.60%	3.30%	3.66%	3.57%
NE	2.62%	4.26%	3.07%	5.13%	4.17%	3.85%	3.86%
ENE	1.91%	4.79%	2.55%	3.23%	2.80%	3.06%	2.60%
E	2.50%	3.81%	2.88%	2.36%	2.17%	2.75%	4.01%
ESE	3.76%	3.06%	3.57%	3.41%	3.22%	3.40%	2.94%
SE	5.34%	5.16%	6.04%	6.44%	5.53%	5.70%	4.94%
SSE	7.13%	6.13%	8.15%	7.52%	8.21%	7.43%	5.97%
S	6.35%	5.33%	7.00%	6.36%	7.93%	6.60%	8.76%
SSW	7.14%	6.29%	6.48%	6.75%	8.47%	7.03%	6.29%
SW	7.00%	6.04%	6.12%	6.85%	7.01%	6.60%	6.59%
WSW	5.74%	5.21%	7.47%	5.70%	6.47%	6.11%	5.90%
W	9.79%	9.25%	9.99%	8.61%	10.49%	9.62%	11.70%
WNW	10.05%	9.52%	11.53%	7.77%	9.55%	9.69%	8.77%
NW	9.31%	8.73%	8.48%	7.66%	7.76%	8.39%	7.61%
NNW	7.45%	6.08%	6.15%	6.38%	4.75%	6.16%	5.44%
Calm	8.15%	10.23%	6.19%	8.86%	6.81%	8.05%	5.61%

Figure 1: Wind rose – Modeling data



North
East
South
West
Windspeed
Calms

Table 2: Mean values of temperature-related modeling data and mean Nitchequon station values

Month	Nitchequon 1980	Nitchequon 1981	Nitchequon 1982	Nitchequon 1983	Nitchequon 1984	Nitchequon mean 1980-1984	Nitchequon mean 1959-1985
January	-19.2	-21.5	-25.3	-21.4	-27.6	-23.0	-22.9
February	-22.1	-11.5	-23.8	-21.0	-15.6	-18.8	-21.0
March	-13.2	-8.4	-15.8	-13.8	-14.2	-13.1	-14.5
April	-4.2	-6.4	-9.0	-1.6	-2.3	-4.7	-5.5
May	3.5	1.1	3.5	2.3	2.7	2.6	2.1
June	8.5	7.9	9.9	11.3	9.8	9.5	9.8
July	12.7	14.6	13.3	12.3	14.2	13.4	13.6
August	15.0	13.8	10.3	12.3	13.7	13.0	12.0
September	4.8	8.5	6.9	8.2	5.7	6.8	6.6
October	-1.6	0.5	1.1	0.9	0.7	0.3	0.0
November	-9.8	-5.8	-7.5	-7.2	-7.0	-7.4	-7.8
December	-24.9	-13.3	-17.9	-20.4	-19.5	-19.2	-18.9
Year	-4.2	-1.6	-4.4	-3.1	-3.3	-3.3	-3.8

Source: Environment Canada

2.2 Topography

Topographic data for the sector surrounding the Renard Diamond Project Site came from the Geobase database. The study area's terrain is rough. In fact, the altitude of the receivers chosen in the study area varies from 464 to 676 meters, i.e. a difference of 208 m between the highest and lowest receiver. The mining facilities will be built in the portion located on the eastern side of a valley stretching along a north-northeast/south-southwest axis, on a plateau whose altitude varies from 495 to 515 m. Approximately 800 m southwest of the mine is a 676-m hill, the sector's highest point. Mount Lagopede, whose altitude is 659 m, is about 2.5 km west-southwest of the site.

For modeling, a number of receivers must be defined to determine whether contaminant concentrations from mine sources comply with existing standards. For the modeling study zone, an 11 km x 10.5 km grid with receivers every 100 m was set up.

2.3 Building-Related Data

A building's presence can affect the air flow around it and influence a source's plume configuration. For calculation purposes, the configuration of all buildings located near sources must be taken into account.

For this modeling, we took most of the existing buildings into consideration, ignoring those that were clearly too low or too far away to affect the chimneys. Building coordinates and heights were supplied by the team in charge of the project's Technical Feasibility Study. Data on the buildings' physical dimensions and sources' position and elevation in comparison were entered into the BPIP-PRIME software developed by the US Environmental Protection Agency (US EPA). Figure 2 shows the mining complex building configurations and point source positions in relation to them.

2.4 Surface Characteristic Data

The surface characteristics of the zone surrounding the mining facilities were taken into consideration when processing meteorological data using AERMET software. The parameters surface roughness, Albedo and Bowen ratio, used to process the meteorological data, were chosen according to land use characteristics around the mine and are presented in Table 3. These parameters were selected based on the criteria contained in the AERMET model documentation.[2]

[2] US EPA. User's guide for the AERMOD meteorological preprocessor (AERMET). - EPA-454/B-03-002, November 2004, pp. 4-49 to 4-51.

Table 3: Roughness, Albedo and Bowen values used

Sector (angles)	Season	0-360°
Albedo	Spring	0.12
	Summer	0.12
	Fall	0.12
	Winter	0.12
Bowen	Spring	0.7
	Summer	0.3
	Fall	0.8
	Winter	1.5
Roughness	Spring	1.3
	Summer	1.3
	Fall	1.3
	Winter	1.3

2.5 Source Emission Data

The fifth and most important category is source emission data. There are 4 types of atmospheric emission sources on the Renard Mining Project site.

Stationary sources: This refers to sources whose location remains unchanged for the project's entire duration and whose rate of emission is fixed. They include the power generating sets used to produce electricity, the material transfer points, the dust extractors used at the ore processing plant, etc. The contaminants emitted by these sources consist of airborne particles and exhaust (nitrogen oxides (NO_x), sulfur dioxide (SO_2) and carbon monoxide (CO)) for the power generating sets and airborne particles for the others.

Mobile sources: This refers to the machinery used to transport ore, overburden, waste rock and processed kimberlite for construction site preparation and for dismantling the facilities. The contaminants emitted by the sources involved are exhaust and airborne particles raised by vehicle traffic.

Area sources: Emissions from these sources are likely to be produced by materials deposited and wind erosion. For this project, these sources are the processed kimberlite confinement area, the overburden and waste rock stockpiles, the mine's secondary roads and surface blasting.

Quarries: For the Renard Project, two areas resemble quarries and have been treated as such in this study. They are: open pit mine R65, which will be operated like a quarry for this project, and open pit R2/R3, which will also be operated like an open pit mine.

The main problem linked to modeling the atmospheric emissions from most of these sources is their variability. Only the stationary sources (ore processing plant, power generating sets) have emission rates that are stable over time. The emission rates of area sources, mobile sources and quarries are likely to vary considerably as mine operations progress. For example, the size and volume of the processed kimberlite confinement area will grow over the 20 years the mine is operational so that the surface exposed to wind erosion ─ the primary emission source in this situation ─ will change constantly over time. Similarly, open pit R2/R3 will be a significant emission source in the first 3 years of mining operations, but the emissions from R2/R3 will decline once the underground mining begins.

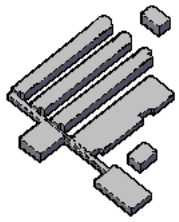
Another difficulty is that dust emissions will be virtually inexistent when precipitation occurs. This means that precipitation must be taken into account to get a realistic picture of the situation. The fact that the ground freezes from October to May also limits particles deposited on the ground or stored in the different storage areas from becoming airborne.

The characteristics of the main stationary sources are shown in Table 4. The characteristics of the mobile and area sources, which fluctuate substantially over time and in the zone they are emitted, cannot be presented in a table.

Table 4: Characteristics of the mine's main stationary sources

Description	Primary crusher (3210-BH-001)	Transfer tower (3160-BH-001)	Crushing area scrubber (3230-DS-001)	Hopper bag breaker (3410-BH-001)	Dryer (3500-BH-001)	Generators (12)
UTM X position (m)	688,930	689,050	688,940	688,890	688,880	688,916 to 688,932
UTM Y position (m)	5,855,000	5,855,030	5,854,970	5,854,950	5,854,910	5,855,082 to 5,855,130
Height from chimney base (m)	501	501	511	510	511	510
Chimney height from ground (m)	24	26	30	33	33	20
Gas temperature (K)	293	293	293	293	293	700
Gas flow rate (m^3/h)	7,500	12,240	27,600	1,700	26,520	27,358
Efflux velocity (m/s)	18.37	18.79	19.36	9.25	16.239	46.33
Source diameter (m)	0.38	0.48	0.71	0.255	0.76	0.457
Contaminant	Emission rates (g/s)					
	Primary crusher (3210-BH-001)	Transfer tower (3160-BH-001)	Crushing area scrubber (3230-DS-001)	Hopper bag breaker (3410-BH-001)	Dryer (3500-BH-001)	Generators (12)
Nitrogen dioxide (NO_2)	N/A	N/A	N/A	N/A	N/A	3.92
Carbon monoxide (CO)	N/A	N/A	N/A	N/A	N/A	0.44
Fine particles ($PM_{2.5}$)	0.063	0.102	0.230	0.014	0.221	0.045
Sulfur dioxide (SO_2)	N/A	N/A	N/A	N/A	N/A	0.062

Figure 2: Configuration of mining complex buildings and position of main stationary emission sources



2.6 Modeling Procedure

The modeling calculations used an 11 km x 10.5 km grid with receivers every 100 m.

The calculation software used was AERMOD, version 11103, the latest version of this general-purpose dispersion software developed by the US Environmental Protection Agency. Calculations considered the study area to be located in a rural environment. Urban parameters are used only when the zone surrounding the emission source is located amid heavy industries or in a densely populated area.

Concentrations were calculated on an hourly basis, over 8 hours, 24 hours and annually depending on the standards governing each contaminant. The modeling parameters are shown in Table 5.

Since the emission rates from area sources, more specifically, the processed kimberlite confinement area, are likely to vary with precipitation, weather conditions and the extent of the source in question, modeling was conducted on an hourly basis. An Excel worksheet was set up for each source area to specify the surface area occupied as a function of time, wind-exposed surface depending on the prevailing wind direction, and the appropriate emission factor, calculated in keeping with wind speed. The combustion gas emissions from mobile sources were calculated and attributed using the surface areas likely to be used by these sources. In the same worksheet, a spreadsheet was set up for each of the 5 years of meteorological data used in order to indicate the weather conditions and presence of precipitation. Finally, stationary source data were included in the worksheet. This information was then used to generate the input files required for the AERMOD model. The concentrations obtained for each receiver were compiled in a database showing the results for each mine operating year and then processed to extract the maximum values for each receiver, the maximum values for the appropriate time base (8 hours or 24 hours) and the annual averages.

For airborne particle calculations, the heaviest particles deposited were also taken into account given that this factor is especially important for surfaces exposed to wind erosion.

The emission factors used in cases involving wind erosion were calculated using the method described in the publication AP-42, Section 13.2.5, "Industrial Wind Erosion."[3] The emission factors used for mining complex traffic (access roads, roads for light-weight vehicles, roads for heavy trucks) were calculated using the method described in publication AP-42, Section 13.2.2, "Unpaved Roads."[4] The emission factors linked to handling the materials stored in the different storage areas (processed kimberlite, overburden and waste rock stockpiles, pre-production ore stockpile) were taken from publication AP-42, Section 13.2.4, "Aggregate Handling and Storage

[3] Industrial Wind Erosion. **AP-42, *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary point and area sources***, Chap. 13, Sect. 13.2.5, 15 pages, November 2006. Office of Air Quality Planning and Standards, Office of Air and Radiation, US Environmental Protection Agency, Research Triangle Park. (http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0205.pdf)

[4] Unpaved Roads. **AP-42, *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary point and area sources***, Chap. 13, Sect. 13.2.2, 20 pages, November 2006. Office of Air Quality Planning and Standards, Office of Air and Radiation, US Environmental Protection Agency, Research Triangle Park. (http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf)

Piles."[5] Finally, the emission factors for the explosives used for surface blasting were taken from publication AP-42, Section 13.3, "Explosives Detonation."[6]

2.7 Ambient Air Standards

The modeling calculation results were compared to MDDEP ambient air standards. Table 6 presents the standards currently in effect in Quebec under the *Clean Air Regulation* (CAR) (R.R.Q., c. Q-2, r. 4.1).

2.8 Workplace Standards

Since a large part of the study area is located in an industrial environment, where ambient air standards are not applicable, the results of the modeling calculations were also compared with the workplace standards set by the Ministere du Travail du Québec (Quebec Ministry of Labour). Since these standards normally apply to an 8-hour work shift, the maximum applicable concentrations were adjusted to reflect the mine's 12-hour work shifts, using the method described in the *Guide d'ajustement des valeurs d'exposition admissibles pour les horaires de travail non-conventionnels* published by the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (Robert-Sauvé Occupational Health and Safety Research Institute).[7] Table 7 shows the standards currently in effect in Quebec under the *Regulation respecting occupational health and safety* (R.R.Q., c. S-2.1, r. 13) and the standards applicable to 12-hour work shifts.

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[5] Aggregate Handling and Storage Piles. **AP-42, *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary point and area sources***, Chap. 13, Sect. 13.2.4, 6 pages, November 2006. Office of Air Quality Planning and Standards, Office of Air and Radiation, US Environmental Protection Agency, Research Triangle Park. (http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0205.pdf)

[6] Explosives Detonation. **AP-42, *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary point and area sources***, Chap. 13, Sect. 13.3, 5 pages, January 1995. Office of Air Quality Planning and Standards, Office of Air and Radiation, US Environmental Protection Agency, Research Triangle Park. (http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s03.pdf)

[7] Drolet, Daniel. - GUIDE TECHNIQUE T-21 - Guide d'ajustement des valeurs d'exposition admissibles (VEA) pour les horaires de travail non conventionnels, 3e édition revue et mise à jour, Services et expertises de laboratoire, IRSST - (http://www.irsst.qc.ca/media/documents/PubIRSST/t-21.pdf)

Table 5: Chosen modeling parameters

Calculations in intermediate terrain	
Calculation of mean concentrations	
Deposit of airborne particles was considered in calculations	
Dispersion was done in rural mode	
The following options were selected:	– Stack tip downwash – Calms Processing Routine – Missing Data Processing Routine – No Exponential Decay
Height of introduced terrain	
Calculations were performed at ground level	
Means were calculated for 1 hour, 8 hours, 24 hours and on an annual basis	
Modeling is performed immediately following file verification	
Result output options:	– Modeling produces a file containing the highest short-term maximum values for display purposes (PLOTFILE Keyword)
Emission data are expressed in g/sec	
Conversion factor: 1,000,000	
Concentrations calculated are expressed in µg/m³	
Anemometer height: 10 m	

Table 6: Ambient air standards used for this report

Contaminant	Standard (µg/m³) [8]					
	4 minutes	1 hour	8 hours	24 hours	30 days	1 year
Nitrogen dioxide (NO_2)		414		207		103
Cabon monoxide (CO)		34,000	12,700			
Sulfur dioxide (SO_2)	1,050			288		52
Particulate matter less than 2.5 microns in size ($PM_{2.5}$)				30		
Dustfall[9]					7.5 t/km²	

Table 7: Workplace standards used for this report

[8] *Clean Air Regulation* (R.R.Q., c. Q-2, r. 4.1), except for dustfall.
[9] *Regulation respecting the quality of the atmosphere* (R.R.Q., c. Q-2, r.38).

Contaminant	Standard (µg/m³) [10]	
	8-hour work shift	12-hour work shift
Nitrogen dioxide (NO_2)	5,600	3,733
Carbon monoxide(CO)	40,000	26,667
Sulfur dioxide (SO_2)	5,200	3,467

[10] *Regulation respecting occupational health and safety* (R.R.Q., c. S-2.1, r. 13 – December 1, 2011 version).

3. CALCULATION RESULTS

The results of the calculations obtained using AERMOD software are presented below. Since these calculations involved five years of meteorological data, to make this report more readable, only the maximum values obtained during mine operation are presented in the body of the text. The 5 years of meteorological data (1980-1984) were applied to each source present for each mine operating year and the highest concentration for each receiver was used to present the concentration of isocontours around the mining complex.

The results have been presented graphically in the form of isocontours. To rapidly identify the areas where ambient air standards and workplace standards are met, those whose results fall short of these standards are shown in blue or white, those whose results exceed ambient air standards but fall short of occupational standards are shown in yellow or orange, and those whose results exceed occupational standards are shown in red. This colour-coded system applies to all of the figures portraying isocontours in this report.

3.1. Nitrogen Dioxide (NO_2)

The first contaminant presented is nitrogen dioxide (NO_2), whose main emission sources are the power generating set generators, mining trucks, other mobile equipment used on the mine site (bulldozers, levellers, light-weight trucks), trucks supplying the mine in fuel and foodstuff and blasting.

NO_2 concentration modeling was performed using the conversion option limited by the presence of tropospheric ozone (Ozone limiting method), which allows the presence of ozone in the atmosphere to be taken into account in the mechanisms transforming NO emissions into NO_2. For the latter, hourly ozone concentration data were required. These ozone data had to be those most representative of the Renard Project mine site. The closest station for which complete data (annual for 2002-2006) were available was Lac-St-Jean's La Dore station (National Air Pollution Surveillance Program station 053201). Table 8 shows the maximum results and Map 6.3.1 illustrates the maximum hourly rates. Map 6.3.2 shows the maximum daily concentrations and Map 6.3.3 illustrates the highest annual mean concentrations.

Table 8: Summary of maximum results for nitrogen dioxide (NO_2) for all mine sources

Year	Hourly basis		24-hour basis		Annual basis	
	Value (µg/m³)	% of workplace standard	Value (µg/m³)	% of workplace standard	Value (µg/m³)	% of ambient air standard
1980	1,301.2	34.85%	595.7	15.96%	79.66	77.34%
1981	1,302.1	34.88%	553.5	14.83%	79.85	77.52%
1982	1,396.6	37.41%	596.0	15.96%	76.74	74.50%
1983	1,311.4	35.13%	635.6	17.03%	72.28	70.17%
1984	1,217.9	32.63%	599.7	16.06%	68.49	66.50%

The highest results came from the mine operation zones where only workers will be found. The governing standard in this case is the workplace standard (see Table 7). Since the mine's work shifts will be 12 hours long, the standard was weighted to reflect this increased exposure time.

Outside the operation zone, the highest hourly concentrations were observed in the worker's camp. The maximum concentration obtained here was 610 µg/m³, which exceeds the ambient air standard set at 414 µg/m³ under the *Clean Air Regulation* (R.R.Q., c. Q-2, r. 4.1). This standard will be exceeded no more than 18 h/yr on the camp site, i.e. less than 0.21% of the time. On a daily basis, the maximum concentration on the worker's camp site would be 158.4 µg/m³, which is lower than the 207 µg/m³ ambient air standard. The highest annual average at the workers' camp would be 10.8 µg/m³, which represents 10.5% of the annual standard of 103 µg/m³. Table 9 presents the values obtained in the workers' camp and the number of hours per year that values will exceed the standard.

Table 9: Maximum nitrogen dioxide (NO_2) values obtained in the workers' camp and maximum number of hours/year exceeding standards

Year	Hourly basis		
	Value (µg/m³)	Percentage of standard	Number of hours/year exceeding standards
1980	583.3	140.9%	7
1981	599.4	144.8%	18
1982	610.2	147.4%	11
1983	558.7	135.0%	11
1984	571.6	138.1%	11

Other concentrations also exceed the hourly standard in uninhabited zones (nearby hillsides). To eliminate the risk of exceeding the hourly NO_2 standard in the workers' camp, the height of the generator chimneys would have to be modified. Preliminary calculations show that they would have to be approximately 30 m high compared to ground level. This situation could be reassessed in the project's detailed engineering phase.

688 000 mE

690 000 mE

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

Halde de stériles /
Waste rock stockpile

Halde de mort-terrain /
Overburden stockpile

Complexe d'habitation et de services /
Accommodation complex

R-65

1210

2060

5210

3210

3110

5310

Lac Lagopède

Concentrations en µg/m³ / Concentrations in µg/m³

- 0 - 100
- 100 - 200
- 200 - 300
- 300 - 414
- 414 - 500
- 500 - 750
- 750 - 1000
- 1000 - 1250
- 1250 - 3733
- 3733 et plus / over 3733

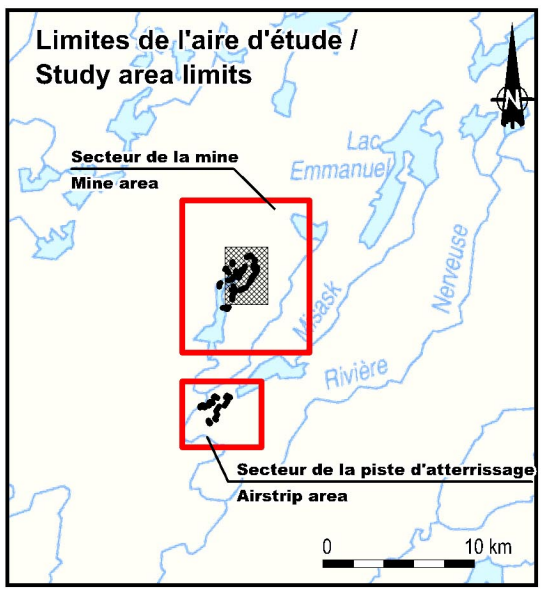
Critère de qualité de l'air ambiant applicable en milieu de travail (Règlement c.5-2.1, r. 13) : 5 600 µg/m³ par quart de 8 heures
3 733 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas (Regulation c.5-2.1, r.13) : 5 600 µg/m³ per 8 hours shift
3 733 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

Limites de l'aire d'étude / Study area limits



Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale / Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) / Applicable air quality standard (Regulation Q-2, r. 4.1) : 414 µg/m³*

les diamants stornoway (canada) inc.

Projet diamantifère Renard / Renard diamond mine project

Étude d'impact environnemental et social / Environmental and Social Impact Assessment

Concentrations horaires de NO_2 les plus élevées obtenues par calcul de modélisation / Highest NO_2 concentrations computed by dispersion modeling on an hourly basis

ROCHE

Carte de base / Base Map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_NO² horaire_111223.WOR

Décembre 2011 / December 2011

Carte / Map 6.3.1

688 000 mE

690 000 mE

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

Halde de stériles /
Waste rock stockpile

Halde de mort-terrain /
Overburden stockpile

Complexe d'habitation et de services /
Accommodation complex

R-65

1210

2060

5210

3210

3110

5310

Lac Lagopède

50
100
150
207
250

Concentrations en µg/m³ /
Concentrations in µg/m³

0 - 50	
50 - 100	
100 - 150	
150 - 207	
207 - 250	
250 - 300	
300 - 500	
500 - 3733	
3733 et plus / over 3733	

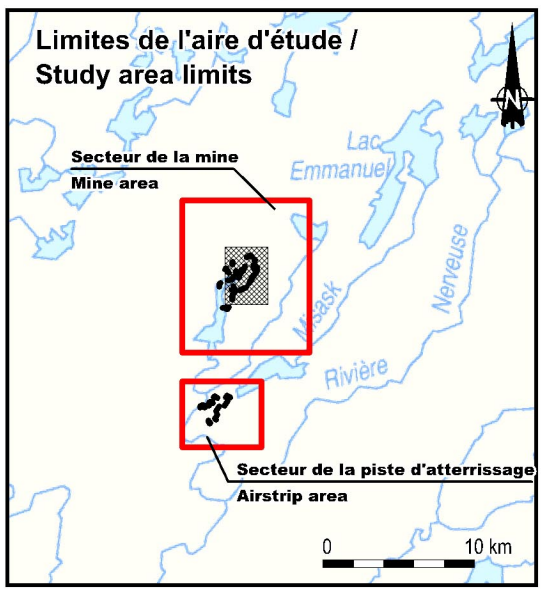
Critère de qualité de l'air ambiant applicable en milieu de travail
(Règlement c.5-2.1, r. 13) : 5 600 µg/m³ par quart de 8 heures
3 733 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas
(Regulation c.5-2.1, r.13) : 5 600 µg/m³ per 8 hours shift
3 733 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

**Limites de l'aire d'étude /
Study area limits**



Courbe de niveau (intervalle de 50 pieds) /
Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale /
Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) /
Applicable air quality standard (Regulation Q-2, r. 4.1) : 207 µg/m³*

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**Projet diamantifère Renard /
Renard diamond mine project**

Étude d'impact environnemental et social /
Environmental and Social Impact Assessment

Concentrations quotidiennes de NO_2 les plus élevées obtenues par calcul de modélisation / Highest NO_2 concentrations computed by dispersion modeling on an daily basis

ROCHE

*Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_NO² quotidien_111223.WOR*

Décembre 2011 / December 2011

Carte / Map 6.3.2

688 000 mE

690 000 mE

5 856 000 mN

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

Halde de stériles /
Waste rock stockpile

Halde de mort-terrain /
Overburden stockpile

R-65

1210

2060

5210

3210

3110

5310

Complexe d'habitation et de services /
Accommodation complex

Lac Lagopède

20
25
30
40
75
79,5
15
10
5
3

Concentrations en µg/m³ /
Concentrations in µg/m³

- 0 - 0,5
- 0,5 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 40
- 40 - 50
- 50 - 75
- 75 - 103
- 103 - 3733
- 3733 et plus / over 3733

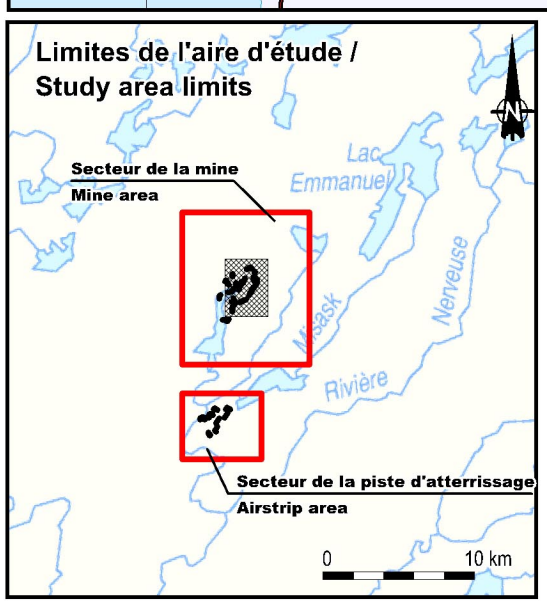
Critère de qualité de l'air ambiant applicable en milieu de travail
(Règlement c.5-2.1, r. 13) : 5 600 µg/m³ par quart de 8 heures
3 733 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas
(Regulation c.5-2.1, r.13) : 5 600 µg/m³ per 8 hours shift
3 733 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

Limites de l'aire d'étude /
Study area limits



Courbe de niveau (intervalle de 50 pieds) /
Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale /
Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) / Applicable air quality standard (Regulation Q-2, r. 4.1) : 103 µg/m³*

les diamants stornoway (canada) inc.

Projet diamantifère Renard /
Renard diamond mine project

Étude d'impact environnemental et social /
Environmental and Social Impact Assessment

Concentrations annuelles de NO_2 les plus élevées obtenues par calcul de modélisation / Highest NO_2 concentrations computed by dispersion modeling on an annual basis

ROCHE

Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_NO² annuel_111223.WOR

Décembre 2011 / December 2011

Carte / Map 6.3.3

3.2. Carbon Monoxide (CO)

The carbon monoxide (CO) sources involved in Renard Project operations are the same as for nitrogen oxide (NO_2).

Both hourly and 8-hour carbon monoxide (CO) concentrations are much lower than current standards. The maximum hourly concentration would be 527.4 µg/m³ (the workplace standard is 26,667 µg/m³ for 12-hour work shifts and the ambient air standard is 34,000 µg/m³), while the maximum 8-hour concentration would be 145.5 µg/m³ (the ambient air standard is 12,700 µg/m³). The maximum values obtained for each year are presented in Table 10.

Map 6.3.4 shows the maximum hourly concentrations while Map 6.3.5 presents the maximum 8-hour concentrations.

Table 10: Summary of maximum results for carbon monoxide (CO) for all mine sources

Year	Hourly basis			8-hour basis		
	Value (µg/m³)	% of workplace standard	% of ambient air standard	Valuer (µg/m³)	% of workplace standard	% of ambient air standard
1980	523.8	1.96%	1.54%	142.4	0.53%	1.12%
1981	517.7	1.94%	1.52%	143.2	0.54%	1.13%
1982	513.6	1.93%	1.51%	134.8	0.51%	1.06%
1983	512.5	1.92%	1.51%	132.2	0.50%	1.04%
1984	527.4	1.98%	1.55%	145.5	0.55%	1.15%

3.3. Fine Particles ($PM_{2.5}$)

The maximum concentration of fine particles from the various mine sources (processing plant, circulation on unpaved roads, wind erosion from stockpile areas) calculated by modeling appears to be lower than the current standard, i.e. 30 µg/m³ over 24 hours. In a 24-hour period, the maximum concentration from mine sources totals 10.83 µg/m³.

Table 11 presents the maximum results for each year for which modeling was run. Map 6.3.6 shows the maximum results obtained for 24 hours.

Table 11: Summary of maximum results for fine particles ($PM_{2.5}$) for all mine sources

Year	24-hour basis	
	Value (µg/m³)	% of ambient air standard
1980	10.15	33.8%
1981	9.43	31.4%
1982	10.16	33.9%
1983	10.83	36.1%
1984	10.22	34.1%

688 000 mE

690 000 mE

5 856 000 mN

5 856 000 mN

Aire de confinement de la kimberlite usinée / Processed kimberlite confinement area

R-65

Halde de stériles / Waste rock stockpile

Halde de mort-terrain / Overburden stockpile

1210

2060

5210

3210

3110

5310

Complexe d'habitation et de services / Accommodation complex

Lac Lagopède

Concentrations en µg/m³ / Concentrations in µg/m³

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- 200 - 300
- 300 - 400
- 400 - 600
- 600 - 26 667
- 26 667 - 34 000
- 34 000 et plus / over 34 000

Critère de qualité de l'air ambiant applicable en milieu de travail (Règlement c.5-2.1, r. 13) : 40 000 µg/m³ par quart de 8 heures
26 667 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas (Regulation c.5-2.1, r.13) : 40 000 µg/m³ per 8 hours shift
26 667 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

Limites de l'aire d'étude / Study area limits

Secteur de la mine / Mine area

Secteur de la piste d'atterrissage / Airstrip area

Lac Emmanuel

Rivière Nerveuse

0 10 km

Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale / Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) / Applicable air quality standard (Regulation Q-2, r. 4.1) : 34 000 µg/m³*

les diamants stornoway (canada) inc.

Projet diamantifère Renard / Renard diamond mine project

Étude d'impact environnemental et social / Environmental and Social Impact Assessment

Concentrations horaires de CO les plus élevées obtenues par calculs de modélisation / Highest CO concentrations computed by dispersion modeling on an hourly basis

ROCHE

Carte de base / Base Map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_CO horaire_111223.WOR

Décembre 2011 / December 2011

Carte / Map 6.3.4

688 000 mE

690 000 mE

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

R-65

Halde de stériles /
Waste rock stockpile

Halde de mort-terrain /
Overburden stockpile

1210

2060

5210

3210

3110

5310

Complexe d'habitation et de services /
Accommodation complex

Lac Lagopède

Concentrations en µg/m³ /
Concentrations in µg/m³

- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 145
- 150 - 12 700
- 12 700 - 26 667
- 26 667 et plus / over 26 667

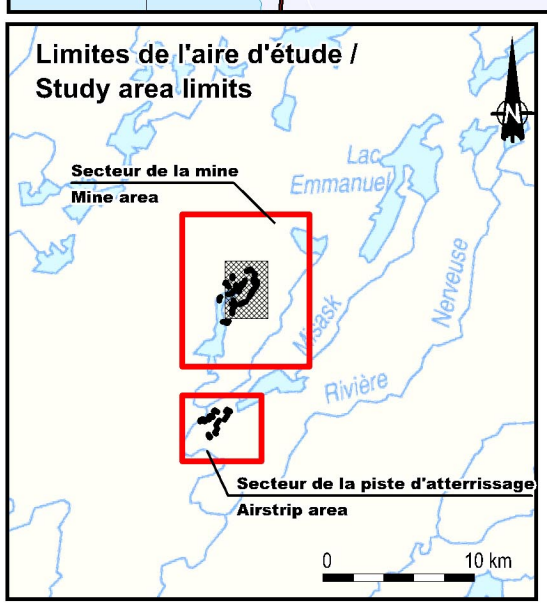
Critère de qualité de l'air ambiant applicable en milieu de travail
(Règlement c.5-2.1, r. 13) : 40 000 µg/m³ par quart de 8 heures
26 667 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas
(Regulation c.5-2.1, r.13) : 40 000 µg/m³ per 8 hours shift
26 667 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

**Limites de l'aire d'étude /
Study area limits**



Courbe de niveau (intervalle de 50 pieds) /
Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale /
Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) /
Applicable air quality standard (Regulation Q-2, r. 4.1) : 12 700 µg/m³*

les diamants stornoway (canada) inc.

**Projet diamantifère Renard /
Renard diamond mine project**

Étude d'impact environnemental et social /
Environmental and Social Impact Assessment

Concentrations sur 8 heures de CO les plus élevées obtenues par calculs de modélisation / Highest CO concentrations computed by dispersion modeling on a 8-hours basis

ROCHE

*Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_CO 8 heures_111223.WOR*

Décembre 2011 / December 2011

Carte / Map 6.3.5

688 000 mE

690 000 mE

5 856 000 mN

Aire de confinement de la kimberlite usinée / Processed kimberlite confinement area

Halde de stériles / Waste rock stockpile

Halde de mort-terrain / Overburden stockpile

R-65

1210

2060

5210

3210

3110

5310

Complexe d'habitation et de services / Accommodation complex

Lac Lagopède

Concentrations en µg/m³ / Concentrations in µg/m³

- 0 - 0,5
- 0,5 - 1,0
- 1,0 - 1,5
- 1,5 - 2,0
- 2,0 - 2,5
- 2,5 - 3
- 3 - 5
- 5 - 10
- 10 - 30
- 30 et plus / over 30

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

Limites de l'aire d'étude / Study area limits

Secteur de la mine / Mine area

Secteur de la piste d'atterrissage / Airstrip area

Lac Emmanuel

Rivière Nerveuse

0 10 km

Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale / Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) / Applicable air quality standard (Regulation Q-2, r. 4.1) : 30 µg/m³*

les diamants stornoway (canada) inc.

Projet diamantifère Renard / Renard diamond mine project

Étude d'impact environnemental et social / Environmental and Social Impact Assessment

Concentrations quotidiennes de $PM_{2.5}$ les plus élevées obtenues par calculs de modélisation / Highest $PM_{2.5}$ concentrations computed by dispersion modeling on a daily basis

ROCHE

Carte de base / Base Map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_PM25 quotidien_111223.WOR

Décembre 2011 / December 2011

Carte / Map 6.3.6

3.4. Dustfall

Dustfall levels from the various mine sources were also calculated. The results are compared to the standard contained in the *Regulation respecting the quality of the atmosphere* (R.R.Q., c. Q-2, r.38), which is 7.5 tonnes/km²/30 days, although this standard was not included in the *Clean Air Regulation* (R.R.Q., c. Q-2, r. 4.1). The maximum results obtained are shown in Table 12 and Map 6.3.7 contains the maximum monthly results obtained.

Table 12: Summary of maximum results for dustfall for all mine sources

Year	30-day basis	
	Value (tonnes/km²/30 days)	% of ambient air standard
1980	2.54	33.8%
1981	2.29	30.5%
1982	2.47	32.9%
1983	2.47	32.9%
1984	2.54	33.8%

3.5. Sulfur Dioxide (SO_2)

Sulfur dioxide emission sources are those using diesel fuel: generators used for the power generating set, mine trucks and other rolling stock, trucks supplying the mine site and light-weight trucks used in mine operations. For calculation purposes, diesel sulfur content was assumed to be 15 mg/kg.

The results were compared with the applicable ambient air standards, i.e. 1,050 µg/m³ for 4 minutes, 288 µg/m³ for 24 hours and 52 µg/m³ annually, and the applicable workplace standard, i.e. 3,467 µg/m³ for a 12-hour work shift. The 4-minute values were derived from the 1-hour values obtained using the method indicated in the *Guide de modelisation de la dispersion atmospherique,*[11] i.e. by multiplying the hourly values obtained by a correction factor of 1.909.

The highest 4-minute value was 50.1 µg/m³, which represents 4.77% of the ambient air standard of 1,050 µg/m³. Over 1 hour, the highest result is 26.3 µg/m³, i.e. 0.76% of the

[11] Op. cit.

applicable workplace standard. For 24 hours, the highest concentration would be 10.2 µg/m³, i.e. 3.54% of the ambient air standard, while the highest annual mean would be 1.30 µg/m³, i.e. 2.5% of the ambient air standard applicable. Table 13 presents the maximum results obtained for each modeling year. Maps 6.3.8, 6.3.9 and 6.3.10 show the hourly, daily and annual results obtained respectively.

Table 13: Summary of maximum results for sulfur dioxide (SO_2) for all mine sources

Year	4-minute basis		1-hour basis		24-hour basis		Annual basis	
	Value (µg/m³)	% of ambient air standard	Value (µg/m³)	% of workplace standard	Value (µg/m³)	% of ambient air standard	Value (µg/m³)	% of ambient air standard
1980	49.1	4.67%	25.7	0.74%	9.56	3.32%	1.28	2.46%
1981	49.3	4.70%	25.8	0.75%	8.88	3.08%	1.28	2.46%
1982	46.8	4.45%	24.5	0.71%	9.56	3.32%	1.30	2.50%
1983	46.7	4.44%	24.4	0.71%	10.20	3.54%	1.14	2.20%
1984	50.1	4.77%	26.3	0.76%	9.62	3.34%	1.16	2.23%

688 000 mE

690 000 mE

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

Halde de stériles /
Waste rock stockpile

Halde de mort-terrain /
Overburden stockpile

Complexe d'habitation et de services /
Accommodation complex

R-65

1210

2060

5210

3210

3110

5310

Lac Lagopède

1
2,5
2
0,5
0,4
0,2
0,3
0,2
0,1
0,2
0,5
0,1
0,5
0,2

**Concentrations en g/m²/mois /
Concentrations in g/m²/month**

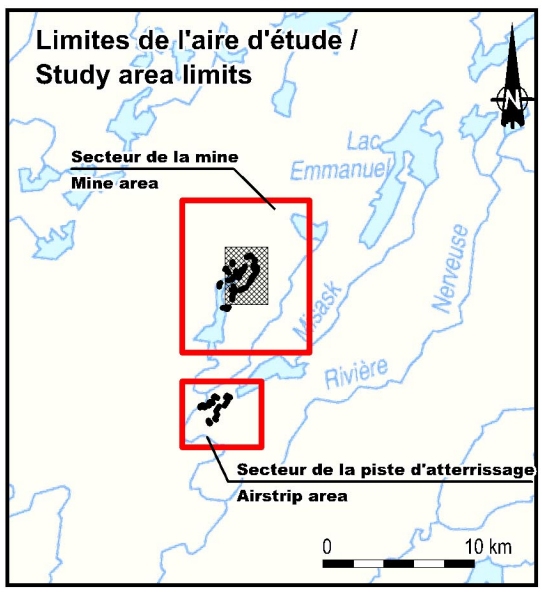
- 0 - 0,1
- 0,1 - 0,2
- 0,2 - 0,3
- 0,3 - 0,4
- 0,4 - 0,5
- 0,5 - 1,0
- 1,0 - 1,5
- 1,5 - 2,0
- 2,0 - 7,5
- 7,5 et plus / over 7,5

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

**Limites de l'aire d'étude /
Study area limits**



Courbe de niveau (intervalle de 50 pieds) /
Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale /
Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r.38)*
Applicable air quality standard (Regulation Q-2, r.38) : 7,5 g/m² / mois
7,5 g/m² / month

les diamants stornoway (canada) inc.

**Projet diamantifère Renard /
Renard diamond mine project**

Étude d'impact environnemental et social /
Environmental and Social Impact Assessment

Taux de déposition de particules les plus élevés obtenues par calculs de modélisation / Highest deposition rates of particules computed by dispersion modeling on a monthly basis

ROCHE

Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_particules mensuelles_111223.WOR

Décembre 2011 / December 2011

Carte / Map 6.3.7

688 000 mE

690 000 mE

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

R-65

Halde de stériles /
Waste rock stockpile

Halde de mort-terrain /
Overburden stockpile

1210

2060

5210

3210

3110

5310

Complexe d'habitation et de services /
Accommodation complex

Lac Lagopède

**Concentrations en µg/m³ /
Concentrations in µg/m³**

- 0 - 0,5
- 0,5 - 1
- 1 - 2
- 2 - 3
- 3 - 5
- 5 - 10
- 10 - 25
- 25 - 1050
- 1050 - 3467
- 3467 et plus / over 3467

Critère de qualité de l'air ambiant applicable en milieu de travail
(Règlement c.5-2.1, r. 13) : 5 200 µg/m³ par quart de 8 heures
3 467 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas
(Regulation c.5-2.1, r.13) : 5 200 µg/m³ per 8 hours shift
3 467 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

**Limites de l'aire d'étude /
Study area limits**

Secteur de la mine
Mine area

Secteur de la piste d'atterrissage
Airstrip area

Lac Emmanuel

Rivière Nerveuse

0 10 km

Courbe de niveau (intervalle de 50 pieds) /
Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale /
Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) / Applicable air quality standard (Regulation Q-2, r. 4.1) : 1050 µg/m³*

les diamants stornoway (canada) inc.

**Projet diamantifère Renard /
Renard diamond mine project**

Étude d'impact environnemental et social /
Environmental and Social Impact Assessment

Concentrations horaires de SO_2 les plus élevées obtenues par calcul de modélisation / Highest SO_2 concentrations computed by dispersion modeling on an hourly basis

ROCHE

*Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_SO² horaire_111223.WOR*

Décembre 2011 / December 2011

Carte / Map 6.3.8

688 000 mE

690 000 mE

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

R-65

Halde de stériles /
Waste rock stockpile

1210

Halde de mort-terrain /
Overburden stockpile

2060

5210

3210

3110

5310

Complexe d'habitation et de services /
Accommodation complex

Lac Lagopède

Concentrations en µg/m³ /
Concentrations in µg/m³

- 0,1 - 0,3
- 0,3 - 0,5
- 0,5 - 1,0
- 1,0 - 2,0
- 2,0 - 3,0
- 3,0 - 5,0
- 5,0 - 10,0
- 10,0 - 288
- 288 - 3467
- 3467 et plus / over 3467

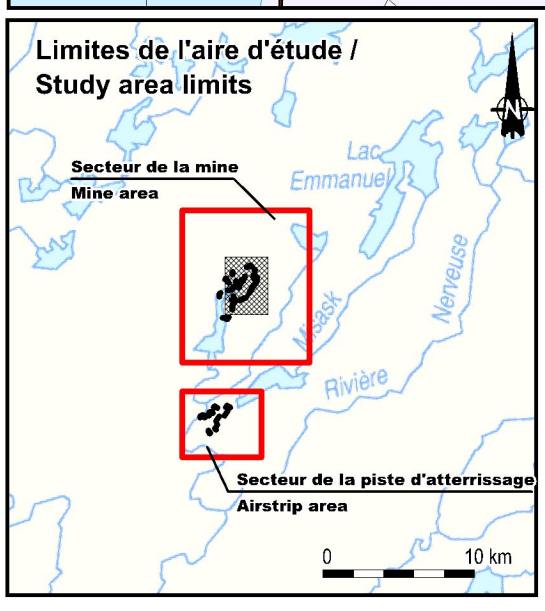
Critère de qualité de l'air ambiant applicable en milieu de travail
(Règlement c.5-2.1, r. 13) : 5 200 µg/m³ par quart de 8 heures
3 467 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas
(Regulation c.5-2.1, r.13) : 5 200 µg/m³ per 8 hours shift
3 467 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

**Limites de l'aire d'étude /
Study area limits**



Courbe de niveau (intervalle de 50 pieds) /
Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale /
Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) / Applicable air quality standard (Regulation Q-2, r. 4.1) : 288 µg/m³*

les diamants stornoway (canada) inc.

**Projet diamantifère Renard /
Renard diamond mine project**

Étude d'impact environnemental et social /
Environmental and Social Impact Assessment

Concentrations quotidiennes de SO_2 les plus élevées obtenues par calculs de modélisation / Highest SO_2 concentrations computed by dispersion modeling on a daily basis

ROCHE

*Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_SO² quotidien_111223.WOR*

Décembre 2011 / December 2011

Carte / Map 6.3.9

688 000 mE

690 000 mE

5 856 000 mN

5 856 000 mN

Aire de confinement de la kimberlite usinée /
Processed kimberlite confinement area

R-65

Halde de stériles /
Waste rock stockpile

Halde de mort-terrain /
Overburden stockpile

1210

2060

5210

3210

3110

5310

Complexe d'habitation et de services /
Accommodation complex

Lac Lagopède

0,3

0,2

0,4

0,5

0,1

0,04

0,03

Concentrations en µg/m³ /
Concentrations in µg/m³

0 - 0,01
0,01 - 0,02
0,02 - 0,03
0,03 - 0,05
0,05 - 0,10
0,10 - 0,20
0,20 - 0,30
0,30 - 0,40
0,40 - 0,50
0,50 - 1,0
1,0 - 52
52 - 3467
3467 et plus / over 3467

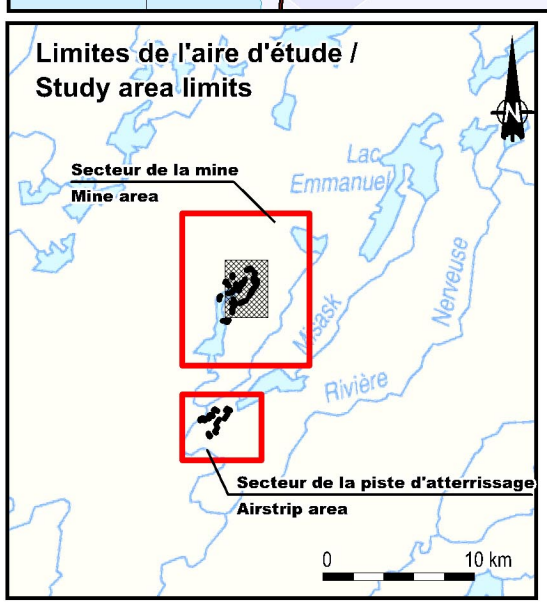
Critère de qualité de l'air ambiant applicable en milieu de travail (Règlement c.5-2.1, r. 13) : 5 200 µg/m³ par quart de 8 heures
3 467 µg/m³ par quart de 12 heures /
Applicable air quality standard for work areas (Regulation c.5-2.1, r.13) : 5 200 µg/m³ per 8 hours shift
3 467 µg/m³ per 12 hours shift *

0 250 500 m

Échelle / Scale 1 : 12 500

UTM, zone 18 (NAD83)

**Limites de l'aire d'étude /
Study area limits**



Courbe de niveau (intervalle de 50 pieds) /
Contour line (50 feet interval)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Source d'émission atmosphérique fixe principale /
Main atmospheric emission source

* *Critère de qualité de l'air ambiant applicable (Règlement Q-2, r. 4.1) / Applicable air quality standard (Regulation Q-2, r. 4.1) : 52 µg/m³*

les diamants stornoway (canada) inc.

**Projet diamantifère Renard /
Renard diamond mine project**

Étude d'impact environnemental et social /
Environmental and Social Impact Assessment

Concentrations annuelles de SO_2 les plus élevées obtenues par calcul de modélisation / Highest SO_2 concentrations computed by dispersion modeling on an annual basis

ROCHE

Carte de base / Base Map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470_EIES_SO² annuel_111223.WOR

Décembre 2011 / December 2011

Carte / Map 6.3.10

4. CONCLUSION

The results obtained by modeling the dispersion of airborne contaminants from the Renard Mining Project's different sources show that ground-level concentrations and dust deposition levels comply with workplace air quality standards for the mine operation zone and with ambient air quality standards outside this zone, with one exception. The only locations where one of the standards is exceeded are outside the camp site, where the hourly nitrogen dioxide (NO_2) air quality standard could be exceeded for a maximum of 18 hours/year, and in the hills located approximately 800 m southeast and 2.5 km west-southwest of the mine operation site, also for hourly nitrogen dioxide (NO_2). Power generating set emissions are primarily responsible for this phenomenon. A quick overview of possible solutions that would reduce ground-level concentrations shows that with 30 m-high chimneys, maximum hourly nitrogen dioxide concentrations could be kept under the 414 µg/m³ standard at the worker's accommodation and service complex. This situation can be reassessed in the project's detailed engineering phase.

The power generating set, with 10 of a possible 12 generators in constant operation, is the Renard Project's main source of ambient air contamination. The modeling study also took particle emissions from wind erosion and airborne particulates generated by rolling stock traffic into account. The results show that particle deposition rates tend to diminish rapidly outside the 300 m zone surrounding the stockpile areas, more specifically around the processed kimberlite confinement area, where a relatively large percentage of particles under 1 mm in size are found.

Appendix 6.4.1

Acoustic Simulation Report (Yockell Associés Inc., December 2011)

ROCHE LTÉE
GROUPE-CONSEIL

RENARD DIAMOND PROJECT
NOISE IMPACT ASSESSMENT

Yockell Associés inc.

December 2011

(Ref. no.: 21011197)

ROCHE LTÉE
GROUPE-CONSEIL

RENARD DIAMOND PROJECT
NOISE IMPACT ASSESSMENT

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1.0 INTRODUCTION

Roche ltée, Groupe-conseil awarded *Yockell associés inc.* to mandate an impact assessment on the noise generated by Renard Project's mining operations.

The assessment's goal was to determine the sound levels that would be reached in the sensitive areas located closest to the site and, eventually, to determine the mitigation measures required to meet the noise level thresholds defined by the Ministere du Developpement Durable, de l'Environnement et des Parcs (MDDEP).

2.0 NOISE LEVELS

Existing noise levels (background noise) were not measured in the Renard Project study area, given its relative isolation and the absence of significant noise sources likely to influence ambient noise levels. The project is located in an area with no residential or sensitive zones as described in MDDEP Directive 98-01. It does encompass the M11 trapline tallymen's camp, which is located 1.5 km from the northeastern end of the airstrip. Once the mine will be in operation, only the sector containing the mine's accommodation and services complexmight be disturbed by the noise. For the time being, the background noise for these areas is 25-35 dBA based on measurements taken on comparable sites over the past 40 years. This is the level generally found in natural environments which primarily results from the sound of branches and high grasses blowing in the wind.

The only notable noise sources are the wind, airplanes, wildlife using the study area and exploration and trapping activities carried out there. Occasionally, when the site is used by the tallymen, the sound of snowmobiles (winter) or small crafts can be heard. However, these limited random noise sources cannot be considered steady-state sources affecting the sector's equivalent sound level (L_{Aeq}).

3.0 IMPACT ASSESSMENT METHODOLOGY

3.1 FORECAST CALCULATION METHODOLOGY

The calculation method for point source simulations complies with the procedure described in ISO-9613. To get a representative picture of the sound levels resulting from construction, the method includes calculation of attenuation due to ground effects and screens.

Distance attenuation is calculated for hemispheric propagation as follows:

$$A_{dist} = 20 \times \log\left(\frac{d_1}{d_2}\right)$$

Where d_2 is the distance between the source and the assessment point and d_1 is the distance between the source and the metering point in a coherent unit.

To calculate the screen effect, Meakawa's theory, generalized by Kurze, is applied as follows:

$$A_{écran} = -10 \times \log\left(\frac{40\Delta}{\lambda}\right) \quad \text{(screen)}$$

Where Δ is the difference in the acoustic path between the wave's direct path and its passage over the screen, and λ is the wavelength considered in a coherent unit.

For calculation purposes, the buildings situated between the sources and receivers and all natural or man-made differences in elevation are considered screens. In addition to the screen effect, modeling also took soil type (porous, hard, mixed), the effects of atmospheric conditions and distance into account. The levels are calculated for each source at various locations and added to get the resulting overall level. The tables in Appendix 1 show the different attenuations considered and the resulting noise levels in the sensitive zone.

3.2 IDENTIFICATION OF MAIN IMPACT SOURCES

In the construction phase, the main noise sources will be linked to site clearing and preparation, including blasting, excavation and bulk materials transport (Table 3.1). Surface blasting will occur mainly in the construction phase and in the first two years of the operation phase (in the open pit mines). The noise sources are intermittent and the noise levels for blasting are typically 110-130 dB. Thereafter, blasting will be much less frequent and the noise level will be in large part attenuated by the pit walls. Blasting, while involving high point levels, will have little effect on the equivalent sound level (LAeq,1h), given its very short duration. The leading sources of steady-state noise in the construction phase will be associated to mobile equipment (drillers, graders, front-end loaders, etc.) on-site. All of this equipment will generate noise levels of approximately 95 dBA at a distance of 15 m.

TABLE 3.1: MAIN SOURCES' NOISE LEVELS

Equipment	Noise levels in dBA	Measurement distance in m	Location
Power generating sets	< 70	7	Outside building
Blasting	110 - 130	15	Open pit
Rock breaker	85	15	Main crusher
Compressors	80	10	Outside building
Off-road	89	15	Property, stockpiles and open pits
Driller	89	7.6	Property and open pits
Front-end loader	85	9	Open pits, stockpiles
Main crusher	82	9	Main crusher
Ore processing plant	<70	1	Processing plant

The highest noise levels will be encountered when activities will start in the open pit mine (first 2 years) and while the equipment will be located on the surface of the extraction area. As operations will progress, the noise level will decrease due to the screen effect of the open pit mine's walls. While the underground mine will be in operation, the noise will be generated by surface facilities, mine ventilation systems, aggregate transport, etc. Noise levels will be lower than during the construction phase.

In the operation phase, the main noise sources will be linked to the preparation and operation of the open pit mines and borrow pits (blasting, excavation, rock crushing, etc.), heavy machinery traffic (ore and processed kimberlite transport) between the extraction areas and storage areas, generators, ore processing plant ventilation systems, compressed air system and wastewater treatment plant superchargers.

When the mine begins operating, the equipment will be positioned on the bedrock's highest level. The noise levels in the accommodation and services areas will be at their maximum. Noise will be generated mainly by drilling and aggregate handling/transportation. The key noise sources will be concentrated around the open pit mines, where the main crusher is unloaded and in the different storage areas.

While the underground mine is operational, the noise will come largely from transporting aggregates on-site, the small tonnage of ore extracted from open pit R65 (the only one operating) and the surface crushing activities linked to R65 extraction activities. In the operation phase, the piles will be higher, abating noise propagation.

The rock breaker will be used only to fracture boulders larger than 1,000 mm, which are relatively scarce. The rock breaker will be located in a building and the noise level outside the building should be around 85 dB, associated primarily with the main crusher. The conveyers should not constitute significant noise sources except at transfer points, where the noise level will depend on particle size and the height from which they fall.

To attenuate this noise, the power generating sets will be installed inside buildings equipped with acoustic insulation allowing noise levels to be reduced to 70 dB at a distance of 7 m from the building. On the whole, the generators and compressors will be very secondary noise sources, given that they will be indoors. This way, they will have no influence whatsoever on perceived noise levels in the accommodation and services complex.

The wastewater treatment plant superchargers will be fitted with a soundproofing cover. The 60-tonne off-road trucks used to transport the ore will be equipped with

acoustic resonators. To attenuate the noise, the conveyers will be installed inside the ore processing plant and tunnels. The mine's ventilation system will not operate at high speed or under high pressure so the noise level should be negligible. The ore processing plant's ventilation system will be soundproofed and designed to operate at low speeds and at a noise level generally around 70 dB. The air compressor will include a muffler and generate noise levels inside the building of 90-100 dB. Outside the building, noise levels should not exceed 80 dB.

Finally, during the closure phase, the vehicle fleet needed to dismantle facilities and rehabilitate the site will be reduced. During the closure phase, the main noise sources will be:

- trucks (40 t) carrying the overburden and waste rock to the processed kimberlite confinement (PKC) area to prepare for hydroseeding;
- dismantling activities (power shovels, jack hammers for concrete surfaces, trucks, etc.) ;
- road and airstrip scarifying activities (levellers);
- open pit digging to restore the hydrographical network (shovel excavator, trucks).

The noise levels of these machines will be lower than in the operation phase and should be about 90 dBA at a distance of 15 m from the equipment.

3.3 IMPACT DESCRIPTION AND ASSESSMENT

3.3.1 Construction and Site Preparation Phase Impact

3.3.1.1 Impact Description and Assessment

The temporary buildings located near the projected accommodation and services complex area are the inhabited areas closest to the construction worksite. Simulations targeted the period in which all equipment was at the existing bedrock's highest level. For the overburden stockpile, the operating levels are lower.

In these simulations, noise levels during the construction phase would be L*Aeq,1h* 50-60 dBA in the temporary dormitories located south of the mine site. These levels correspond to values measured in residential streets.[1]

In areas located outside the project limits, noise levels are expected to be about 60 dBA while the work is ongoing, depending on the location considered. At a distance of ± 6 km, the noise level drops to residual background levels. However, depending on the location, the site's topography can reduce the scope of this potential impact zone. For example, noise levels of 60 dBA are the equivalent of two people 1 meter apart having a conversation.

3.3.1.2 Mitigation Measures

Based on the preceding results, it can be considered that noise levels near the accommodation and services complex area will exceed the target value of 40 dBA at night-time by 5-10 dBA. Various mitigation measures will be used to attenuate noise levels at source and measurements will be performed on the accommodation and services complex site to ensure that these levels are not problematic. Should residual noise levels disturb workers in the complex, installation of a 5 m soundproofing berm will be considered.

3.3.1.3 Residual Impact

During the construction phase, noise levels will be under 40 dBA at all times. Therefore, the magnitude of this impact is considered low, and its spatial scope, limited. Given the construction phase's short duration, the impact's significance can be described as low.

3.3.2 Operation Phase Impact

3.3.2.1 Impact Description and Assessment

When the mine begins operating, the equipment will be positioned on the bedrock's highest level. Noise levels in the accommodation and services complex area will be at

[1] *Le bruit et ses effets sur la santé,* Ministère de la Santé, Édition ADHEB, Rennes, 1990

their maximum, generated primarily by drilling and aggregate handling/transport. The main noise sources will be concentrated in the open pit mines, where the main crusher is unloaded, in the different storage areas (waste rock, overburden, ore), and in the processed kimberlite confinement (PKC) area. The noise in the different service areas will reach 49 dBA, due mainly to aggregate transport.

Despite the ore processing plant's acoustic insulation, some noise could flee through the building's walls. However, since the difference in noise levels would be 10 dBA, that is much lower than the levels caused by the other outside sources, its significance for the overall noise level would be zero. This noise source will represent the background noise perceived in the accommodation and services complex areas approximately 25 dBA.

While the underground mine is operational, noise will be generated mainly by aggregate transport on site. In this phase, the stockpiles (waste rock, overburden and ore) and processed kimberlite confinement (PKC) area will be the biggest noise sources. Noise levels in the accommodation and services complex areas will attain values bordering on 45 dBA.

3.3.2.2 Mitigation Measures

Based on the preceding results, it can be considered that the noise levels near the accommodation and services complex areas will exceed the target value at night-time (40 dBA) by 5-10 dBA. To reduce the noise levels anticipated, a 5 m soundproofing berm could be built at the northern end of accommodation and services complex.

3.3.2.3 Residual Impact

During the operation phase, the magnitude of this impact is considered low, its spatial extent, limited, and its duration, moderate. The residual impact's significance can be considered as low.

3.3.3 Closure Phase Impact

3.3.3.1 Impact Description and Assessment

The equipment used for site preparation and development will be positioned at the operation's sites, that is on the processed kimberlite confinement (PKC) area and on the overburden stockpile.

Based on the simulations performed, noise levels during the site's closure phase will be L*eq,1h* 54.5 dBA in and around the accommodation and services complex located in the southernmost part of the mine site. However, given the required mitigation measures implemented in the operation phase, noise levels will be limited to 45 dBA.

3.3.3.2 Mitigation Measures

No additional mitigation measures will be required during the closure phase. The measures implemented during the operation phase will make it possible to meet noise level target for the accommodation and services complex until it is dismantled.

3.3.3.3 Residual Impact

Noise levels at the accommodation and services complex will be 45 dBA until it is dismantled. Therefore, the residual impact is considered low (low magnitude, site specific extent and short duration).

4.0 REGULATORY FRAMEWORK

The Ministere du Developpement Durable de l'Environnement et des Parcs (MDDEP) uses Guideline 98-01, created in February 1998 and revised in June 2006, to process complaints and requirements involving companies whose operations generate noise and which carry out activities that have not been regulated for this contaminant. The Guideline, promotes two normative approaches. The first is based on maximum allowable levels by zoning category (Table 6.4.1).

TABLE 6.4.1 ALLOWABLE NOISE LEVELS BY ZONING CATEGORY

Zoning category	Night-time (7:00 p.m. to 7:00 a.m.)	Daytime (7:00 a.m. to 7:00 p.m.)
I	40	45
II	45	50
III	50	55
IV	70	70

Note: All levels are $L_{Aeq,1h}$ in dBA

The zoning categories are defined as follows:

Zone I: Area intended for single family dwellings (detached or duplex) schools, hospitals or other establishments (teaching, health or convalescence). Property of an existing dwelling in an agricultural zone.

Zone II: Area intended for multiple-dwelling housing units, mobile home parks, institutions or campgrounds.

Zone III: Area intended for commercial use or recreation parks. However, night-time noise levels apply only on the properties of constructions used for residential purposes. In all other cases, maximum daytime noise levels also apply at night-time.

Zone IV: Area zoned for industrial or agricultural purposes. However, on the property of an existing dwelling in an industrial zone, that complied with the municipal by-laws in effect when it was

built, noise level criteria are 50 dBA at night and 55 dBA in the day.

It is important to specify that zoning categories are established according to uses permitted by municipal zoning by-laws. When an area or part of an area is not zoned for a certain activity, within a municipality, real uses determine the zoning category.

The second normative approach is based on ambient noise $L_{Aeq,1h}$ at the assessment point affected. This approach applies if the sector's ambient noise $L_{Aeq,1h}$ is higher than the zone-based approach. If so, the noise source in question can produce a level lower than or equal to the ambient noise $L_{Aeq,1h}$ existing in the environment.

For the above-mentioned sound limits, no identified zone covers the type of area where the project is located. Although these areas as not identified as such, allowable noise levels could resemble those for dwellings in agricultural environments, i.e. $L_{Aeq,1h}$ 45 dBA in the day and 40 dBA at night. However, since, in this case, the noise is project related and since the impacts could be felt in an area associated with the project (accommodation and services complex), the allowable noise levels could also be applicable to homes in industrial environments, i.e. daytime $L_{Aeq,1h}$ of 55 dBA and night-time $L_{Aeq,1h}$ of 50 dBA.

Herein, the environment's residual noise is generally very low. Consequently, the target standard in rest areas should be at a level equivalent to zone I, i.e. 45 dBA in the day and 40 dBA at night.

5.0 ACOUSTIC MONITORING DURING THE OPERATION PHASE

Acoustic monitoring will be performed during the project's operation phase at the limits of the accommodation and services complex.

Before the construction phase, a baseline ambient noise level will be defined to serve as a basis for the operation phase monitoring program. Given the absence of permanent residences, the construction phase's short duration and the limited nature of the noise sources, acoustic monitoring is not necessary in the construction phase.

Monitoring will be carried out on a quarterly basis in the first year of operation. After that, it will be performed annually.

These measures will allow the mitigation measures implemented to be validated and any associated changes that might be required. Acoustic monitoring will also allow identification of the noise sources responsible for sound levels likely to aggravate disturbances, thereby allowing the stationary and mobile equipment identified to be properly managed and to make corrections at the source, if need. It will also be used to determine whether aging equipment could be responsible for source noise increase.

Noise level measurements will entail 24-hour continuous readings showing the noise's hour-by-hour progression, noise rating numbers over a 24-hour period and a noise change chart over time (day).

Measurement standards and methodology could correspond to the procedure described in the MDDEP's Guideline 98-01.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The environment surrounding the Renard Project location consists essentially of pristine forests. Noise levels are very low and occupancy *per se* is non-existent. The sector has no inhabited zones. However, the mine's implementation would entail developing an accommodation and services complex area where dormitories and rest areas would be located.

Simulations showed that critical periods correspond to site preparation and development and that equipment generated noise levels will be 50-60 dBA in the temporary rest areas.

The mine operation phase can be divided into two periods. The first involves open pit mining where all equipment will be at ground level. Anticipated noise levels are approximately 50 dBA. Mitigation measures will allow these levels to be reduced to 40 dBA in the accommodation and services complex areas.

When the underground mine will be operating, impacts will be caused by mobile surface equipment. Noise levels will be slightly lower. The existing mitigation measures will result in levels of about 35 dBA in the accommodation and services complex area.

Finally, during the site closure phase, noise levels will be somewhat higher, i.e. 45 dBA, in the accommodation and services complex area.

The project's impacts can be qualified as low.

APPENDIX 1
DETAILED SIMULATION RESULTS

APPENDIX 1
DETAILED SIMULATION RESULTS

Project :	Renard Diamond Project
Table: A1.1	**Noise level associated to the construction**

Soil	Temp. (°C)	Atm. P. (kPa)	Humidity (%)
porous	20	101.3	60

Equipment considered	Distance				Elevation				Operation duration	Level at the source (dBA)
	So-Re	Réf.	So-Scr1	Scr1-Scr2	So	Re.	Screen 1	Screen 2		
Grouped equipment	1130.0	15.0	0.0	0.0	10.0	1.5	0.0	0.0	50.0	95.0
Grouped equipment	420.0	15.0	0.0	0.0	10.0	1.5	0.0	0.0	50.0	95.0

(cont.)

Equipment considered	Pathway difference	Number of effective screens	Attenuation				Duration correction	Resulting level (dBA)	
			screen(s)	distance	ground	atmos.		With ground	Without ground
Grouped equipment	-	None	0.0	37.5	5.08	0.56	-0.8	**51.1**	56.2
Grouped equipment	-	None	0.0	28.9	3.54	0.21	-0.8	**61.6**	65.1

Resulting level	**56.3**

Project :	Renard Diamond Project
Table: A1.2	**Noise level associated to the operation**

Soil	Temp. (°C)	Atm. P (kPa)	Humidity (%)
porous	20	101.3	60

Equipment considered	Distance				Elevation				Operation duration	Level at the source (dBA)
	So-Re	Réf.	So-Scr1	Scr1-Scr2	So	Re.	Screen 1	Screen 2		
Crusher (3210)	554.0	9.0	6.0	0.0	12.5	1.5	15.0	0.0	60.0	82.0
Off-road (3210)	554.0	15.0	6.0	0.0	13.0	1.5	15.0	0.0	30.0	89.0
Rock-breaker (3210)	554.0	15.0	6.0	0.0	12.5	1.5	13.0	0.0	5.0	85.0
Off-road (3205)	590.0	15.0	66.0	0.0	13.0	1.5	15.0	0.0	15.0	89.0
Off-road (3710)	580.0	15.0	0.0	0.0	13.0	1.5	0.0	0.0	15.0	89.0
Drillers (1210)	740.0	7.6	185.0	0.0	1.5	1.5	13.0	0.0	50.0	89.0
Off-road (4600)	595.0	15.0	0.0	0.0	3.0	1.5	0.0	0.0	20.0	89.0

(cont.)

Equipment considered	Pathway difference	Number of effective screens	Attenuation				Duration correction	Resulting level (dBA)	
			screen(s)	distance	ground	atmos.		With ground	Without ground
Crusher (3210)	0.5571	Screen 1	15.2	35.8	5.25	0.27	0.0	**25.5**	30.8
Off-road (3210)	0.3715	Screen 1	13.4	31.4	5.25	0.27	-3.0	**35.7**	40.9
Rock-breaker (3210)	0.0323	Screen 1	2.8	31.4	5.25	0.27	-10.8	**34.5**	39.8
Off-road (3205)	0.0921	Screen 1	7.3	31.9	5.79	0.29	-6.0	**37.7**	43.5
Off-road (3710)	-	None	0.0	31.7	5.75	0.28	-6.0	**45.2**	51.0
Drillers (1210)	0.4762	Screen 1	14.5	39.8	7.64	0.36	-0.8	**25.9**	33.6
Off-road (4600)	-	Aucun	0.0	32.0	5.80	0.29	-4.8	**46.1**	51.9

Resulting level	**49.4**

Project :	Renard Diamond Project
Table: A1.3	**Noise level associated to the operation, with screen**

Soil	Temp. (°C)	Atm. P (kPa)	Humidity (%)
porous	20	101.3	60

Equipment considered	Distance				Elevation				Operation duration	Level at the source (dBA)
	So-Re	Réf.	So-Scr1	Scr1-Scr2	So	Re.	Screen 1	Screen 2		
Crusher (3210)	554.0	9.0	6.0	518.0	12.5	1.5	15.0	5.0	60.0	82.0
Off-road (3210)	554.0	15.0	6.0	518.0	13.0	1.5	15.0	5.0	30.0	89.0
Rock-breaker (3210)	554.0	15.0	6.0	513.0	12.5	1.5	13.0	5.0	5.0	85.0
Off-Road (3205)	590.0	15.0	66.0	489.0	13.0	1.5	15.0	5.0	15.0	89.0
Off-road (3710)	580.0	15.0	550.0	0.0	13.0	1.5	5.0	0.0	15.0	89.0
Drillers (1210)	740.0	7.6	185.0	520.0	1.5	1.5	13.0	5.0	50.0	89.0
Off-road (4600)	595.0	15.0	560.0	0.0	3.0	1.5	5.0	0.0	20.0	89.0

(cont.)

Equipment considered	Pathway difference	Number of effective screens	Attenuation				Duration correction	Resulting level (dBA)	
			screen(s)	distance	ground	atmos.		With ground	Without ground
Crusher (3210)	0.6908	Screens 1 & 2	18.1	35.8	5.25	0.27	0.0	**22.6**	27.8
Off-road (3210)	0.5052	Screens 1 & 2	16.7	31.4	5.25	0.27	-3.0	**32.4**	37.6
Rock-breaker (3210)	0.1485	Screens 1 & 2	11.4	31.4	5.25	0.27	-10.8	**25.9**	31.1
Off-Road (3205)	0.1950	Screens 1 & 2	12.6	31.9	5.79	0.29	-6.0	**32.4**	38.2
Off-road (3710)	0.1477	Screen 1	11.4	31.7	5.75	0.28	-6.0	**33.8**	39.6
Drillers (1210)	0.5932	Screens 1 & 2	17.4	39.8	7.64	0.36	-0.8	**23.0**	30.6
Off-road (4600)	0.1762	Screen 1	12.2	32.0	5.80	0.29	-4.8	**33.9**	39.7

Resulting level	**39.6**

Project :	Renard Diamond Project
Table: A1.4	**Noise level associated to the closure phase**

Soil	Temp. (°C)	Atm. P (kPa)	Humidity (%)
porous	20	101.3	60

Equipment considered	Distance				Elevation				Operation duration	Level at the source (dBA)
	So-Re	Réf.	So-Scr1	Scr1-Scr2	So	Re.	Screen 1	Screen 2		
Grouped Equipments	1130.0	15.0	1095.0	0.0	10.0	1.5	5.0	0.0	50.0	90.0
Grouped Equipment	420.0	15.0	385.0	0.0	10.0	1.5	5.0	0.0	50.0	90.0

(cont.)

Equipment considered	Patthway difference	Number of effective screens	Attenuation				Duration correction	Resulting level (dBA)	
			screen(s)	distance	ground	atmos.		With ground	Without ground
Grouped Equipments	0.1540	Screen 1	9.6	37.5	5.08	0.56	-0.8	**36.5**	41.6
Grouped Equipment	0.1210	Screen 1	8.5	28.9	3.54	0.21	-0.8	**48.0**	51.6

Resulting level	**42.3**

Appendix 6.6.1

Prediction of Inflow Rates, Drawdown, and Particle Migration for the Business Case Mine Plan at Renard Diamond Mine

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TECHNICAL MEMORANDUM

TO:	**Robert Beaulieu – Stornoway Diamond Corporation** **Martin Boucher – Stornoway Diamond Corporation** **Guy Bourque – Stornoway Diamond Corporation**	**1927**
FROM:	**Houmao Liu** **Jianwei Xiang** **Dan Stone**	
DATE:	**15 November 2011**	
SUBJECT:	**Prediction of Inflow Rates, Drawdown, and Particle Migration for the Business Case Mine Plan at Renard Diamond Mine**	

INTRODUCTION

Itasca Denver, Inc., in coordination with Itasca Consulting Canada, Inc., (Itasca) has been retained to support Stornoway Diamond Corporation's (Stornoway) Renard diamond mine project by providing hydrogeologic input to the feasibility study of the business case mine plan at Renard diamond mine. To date, Itasca has preformed the following:

- compiled the existing hydrogeologic data,
- constructed a numerical, three-dimensional (3D) groundwater flow model of the site,
- estimated the potential groundwater inflows to the mine workings for the business case mine plan,
- estimated drawdown at the end of mining and under steady-state conditions after mine closure,
- estimated time to fill up the open pits, and
- simulated the particle migration paths from various storage facilities.

HYDROGEOLOGIC STUDY AREA

The hydrogeologic study area (HSA) for the Renard mine is shown in Figure 1. Also shown in the figure are:

- ultimate footprints of the R2, R3, and R65 pits,
- underground mine workings,
- extent of the groundwater flow model domain,
- surface-water features,
- bedrock outcrops,
- footprints of the faults, and
- topographic contours.

Both footprints for the open pits and underground mine workings were provided by Stornoway. The boundary of the groundwater flow model domain was selected to be far away from the mining area, where the hydraulic stress induced by mining is insignificant. The water levels of the major lakes were obtained from Stornoway (personal communication, Martin Boucher, 7 September 2011). The footprints of the faults in Figure 1 also include the top and bottom elevations of each fault and their dip directions. The topographic contours were used to define the top of the groundwater flow model.

PREVIOUS HYDROGEOLOGIC INVESTIGATIONS AND RELEVANT DATA

Five hydrogeologic field investigations have been conducted at the site: one in 2006 (GENIVAR, 2006), two in 2010 (WESA, 2010, Roche 2010), and two in 2011 (Golder 2011a; 2011b). During their field investigation, GENIVAR installed seven monitoring wells in the overburden, conducted slug testing and short-term pump testing, and measured water levels in both the overburden monitoring wells and open holes in the country rock. As shown in Figure 2, the hydrogeologic investigation by GENIVAR was limited to the R2 and R3 areas. Based on their investigation results, GENIVAR observed that: 1) the water levels in the overburden are higher than those in the country rock, and 2) the hydraulic conductivity (*K*) values of the overburden are about one order-of-magnitude greater than the *K* values of the country rock (Figure 3).

WESA conducted packer testing in two existing coreholes that were selected by Stornoway and Itasca (Itasca, 2010). The holes were drilled by Chibougamau Diamond Drilling using HQ diamond-drilling methods and the packer testing was conducted using a wireline packer-testing system (WESA, 2010). One of the holes (R2-73) is 717 m in length and is inclined at an angle of 56.86° from horizontal at an azimuth of 303.2°, while the other hole (R4-45) is 471 m in length and is inclined at 50° from horizontal at an azimuth of 180°. The locations of these two coreholes are shown in Figure 2. The hydraulic conductivity values of the country rock obtained during the packer testing are shown in Figure 3.

Roche (2010) measured water levels and *K* values in six open boreholes in the country rock (Figure 2). These *K* values, as shown in Figure 3, range from 8.0 x 10^{-9} to 5.0 x 10^{-7} m/s. The low *K* values of the country rock measured by Roche (2010) are within the range of *K* values from the previous investigations. The two highest *K* values of the country rock recorded by Roche (2010) are greater than the previously measured *K* values of the country rock (with the exception of one measured *K* value in kimberlite) and are within the previously measured *K* value range for the overburden. These high *K* values are used as a basis to assign the *K* value to the upper permeable country rock, as discussed below.

Golder Associates (Golder, 2011a) reported the water levels at five shallow piezometers (BH-10-1 to BH-10-04 and BH10-01A). The locations of these piezometers and corresponding measured water levels are shown in Figure 2. The depths of the piezometers range from 4.20 to 14.9 metres below ground surface (mbgs). Golder reported that the *K* value is 2.5 x 10^{-6} m/s for the till and is 1.7 x 10^{-9} m/s for the country rock. As shown in Figure 3, the *K* for the till is within the previously observed range for the till (overburden) and the country rock value is in the lower end of the previously observed range for the country rock.

Golder conducted single-well pressure response tests with packers at BH-11-05 to BH-11-08, and BH-11-17 (Golder, 2011b). The locations of these holes are shown in Figure 2. The hydraulic testing was conducted at depth intervals of 15 to 60 m. The *K* values from these holes range from 9.0 x 10^{-8} to 6.0 x 10^{-6} m/s. As shown in Figure 3, the *K* values from these tests are in the higher end of the previously observed range for the country rock.

Figure 3 shows that the *K* value of the country rock generally decreases with depth. Based on the available data, Itasca assumed that the country rock within 50 mbgs is more permeable than the country rock in the interval between 50 mbgs and 250 mbgs. The country rock that is lower than 250 mbgs is considered to be least permeable, as summarized in Table 1.

A comparison of the *K* values derived from all investigations relative to compiled global values (Freeze and Cherry, 1979) is shown in Figure 4. The figure shows the large variation in the measured *K* values for the country rock within 50 mbgs at the site. Below 50 mbgs, the *K* values for the country rock are in the lower range for fractured metamorphic rock. The figure also shows that the site-specific *K* values of the glacial overburden are at the high end of the range for glacial till.

DESCRIPTION OF NUMERICAL MODEL

The groundwater flow model constructed for this investigation utilises the numerical code *MINEDW* (Azrag et al., 1998) developed by Itasca, which solves 3D groundwater flow problems with an unconfined (or phreatic) surface using the finite-element method. *MINEDW* has several attributes that were specially developed to address conditions often encountered in mine

dewatering. The modeling code has been used and verified on numerous mine dewatering projects throughout the world.

Model Domain and Grid

Focusing on the pit areas and considering the regional topography, an essentially circular model domain was selected with a radius of approximately 4 km from the proposed pits (Figure 1). The model domain encompasses an area of about 56 km^2. The finite-element discretisation is finest in the pit area, where the elements have horizontal dimensions of 15 to 20 m (Figure 5). The size of the elements gradually increases toward the boundaries of the model, where the distance between adjacent nodes ranges from 200 to 300 m.

The model comprises 101,600 nodes, 191,083 elements, and has 19 layers (Figure 6). The thickness of the overburden ranges from 0 to 25 m in the mine vicinity and was simulated with two model layers. The country rock (bedrock) was simulated with 17 model layers. The simulated thickness of the country rock is approximately 900 m.

Simulations of Geologic Units

Overburden

The ground surface elevations of the HSA were derived from Digital Elevation Model (DEM) data. Itasca (Canada) previously developed a 3D surface of the top-of-country rock, which covers an area of approximately 4.3 km^2. The thickness of the overburden specified in the model was calculated by subtracting the top-of-country rock surface from the DEM-derived land surface. Figure 7 shows a contour map of the overburden thickness based on those data sets. The area with the greatest overburden thickness is in the hills southwest of the pits. The figure shows the extent of the available top-of-country rock surface, which is smaller than the DEM surface. Consequently, for parts of the model domain where top-of-country rock elevations are presently unknown, the overburden was assumed to have a constant thickness of 20 m. The country rock was assumed to be exposed at the land surface (i.e., crop out) if the calculated thickness of the overburden was less than 2 m. The outcrop of the country rock was further updated based on the information provided by Stornoway (personal communication, Martin Boucher, 30 August 2011). Figure 5 shows the simulated outcrop of the country rock.

Country Rock

The presently available pit-area geologic model indicates that there are three types of country rock in the pit areas: cracked country rock, brecciated country rock, and native country rock (or country rock). Based on the hydraulic conductivity values from the packer tests (Figure 3) and the steady-state model calibration (discussed below), both brecciated country rock and cracked country rock were considered to be about two to five times more permeable than the native country rock. The data shown in Figure 3 indicate that the hydraulic conductivity values of all

types of country rock decrease with depth. Based on the available data, the areal extents of both the brecciated country rock and cracked country rock are limited to the immediate vicinity of the pit areas in the groundwater flow model, as shown in Figure 8.

Kimberlite

The kimberlites and kimberlite pipes were simulated as two distinct geologic units with slightly different hydraulic conductivity values, as summarized in Table 1. The areal and vertical extents of both the kimberlites and kimberlite pipes simulated in the model (Figure 8) are consistent with the geologic model being used by Itasca (Canada) in geomechanical studies of the Renard site.

Regional Geologic Features

Figure 1 shows both dykes and interpreted faults in the HSA. Plan views of the model's representation of the dykes are shown in Figures 5 and 8. Both the Lynx and Hibou dykes were simulated to a depth of 75 m, with the Lynx dyke dipping to the east and the Hibou dyke dipping to the north (personal communication, Michael Macmorran, 13 July 2010). Both dykes were simulated with hydraulic conductivity slightly higher than the upper native country rock (Table 1).

Four major faults (Portal fault, Fault 40, Fault 24, and Fault 28), shown in Figure 1, were considered in designing the model grid. Among these faults, Fault 28 potentially interconnects the lake, the R4 underground mine and the R2 mine. Currently, there are insufficient data to confirm the presence of these faults or to identify the hydrogeologic nature of each one (Stornoway, 2010). Itasca finely discretised the model grid in the locations of these interpreted faults (Figures 5 and 8) so that the model has the flexibility to simulate these faults if additional data become available in the future and it is deemed necessary to do so. For the purpose of the current model simulations, these faults were assumed to have the same hydraulic properties as the in-situ rock. This assumption should be validated as more field data become available.

Simulations of Surface-Water Features and Boundary Conditions

A plan view of the boundary conditions of the groundwater flow model is shown in Figure 9. Three types of boundary conditions were assigned to the model domain to simulate the groundwater recharge, the influence of lakes, and the subsurface flow into/out of the model domain as part of the regional groundwater system.

Lakes

All major lakes within the HSA (Figures 1 and 9) were incorporated into the model and were simulated as specified-head nodes (equal to the estimated surface elevations of the lakes). In all, there are 1740 nodes representing lakes within the model domain.

Regional Subsurface Flow

To simulate the regional subsurface flow, variable-flux boundary conditions were assigned to all lateral boundary nodes except for those nodes on the top slice associated with lakes, which were set as specified-head boundary conditions (Figure 9). The variable-flux boundary condition is a special feature of *MINEDW* that enables an essentially infinite groundwater flow system to be simulated at the model boundary. Because there is no active dewatering, the hydraulic stresses induced by mining will not be large and are not anticipated to reach the model boundary; therefore, the impact of mining on the regional subsurface flow is expected to be insignificant.

Groundwater Recharge

The long-term average precipitation for the Renard mine area is estimated to be 800 mm/year (Golder, 2010). For the purpose of predicting the inflow rate to the pits, the groundwater recharge was assumed to be uniform in time (i.e., no seasonal variation). The recharge rate to the groundwater system was estimated by pre-mining calibrations. During the steady-state calibration, the recharge rates were varied until a reasonable water-level distribution was obtained. The recharge rate was assigned using the relationship:

$$R = f_R \cdot P \tag{1}$$

where

R = recharge to the groundwater system (Length (L)/Time (T)),
f_R = recharge factor (dimensionless and less than 1.0), and
P = precipitation (L/T).

The recharge to the groundwater system is applied to the first saturated node of the model. Based on the steady-state model calibration, Itasca derived a recharge factor of 10% (80 mm/yr) in the model area with elevation below 550 metres above mean sea level (mamsl) and 24% (194 mm/yr) in the model area with elevation greater than 550 mamsl. As shown in Figure 10, the higher recharge was applied to only a small area in order to ensure that the groundwater table follows the topography observed at the site. As observed in Golder (2011a) and shown in Figure 2, for the topographically high piezometers such as BH-10-02 (ground surface of 556.7 mamsl) and BH-10-04 (ground surface of 558.7 mamsl), the groundwater depth ranges from 0.88 to 1.44 mugs.

Base of the Model

The bottom of the model is approximately 150 m below the bottom of the ultimate pits, and it is reasonable to assume that there will be no mining-induced groundwater flow at or below

that depth. Consequently, the nodes on the bottom slice of the model were assigned no-flow boundary conditions.

CALIBRATION OF MODEL

The calibration to pre-mining, steady-state groundwater conditions was done by adjusting the recharge factors and *K* values in various hydrogeologic zones of the model until a reasonable match of measured and modelled groundwater levels in the monitoring wells was obtained.

The model was calibrated to 51 observed heads obtained from previous hydrogeologic investigations. Figure 11 shows the steady-state calibration results. The model is reasonably well calibrated to the measured water levels. The hydraulic parameter values derived from the model calibration are summarized in Table 1. A comparison between the model-calibrated *K* values and field-measured *K* values is shown in Figure 3.

Contours of the simulated pre-mining water levels are shown in Figure 12. In general, the groundwater level and flow direction are controlled by the surface elevations of the lakes and the topography of the HSA.

SIMULATION OF INFLOW TO OPEN PITS AND UNDERGROUND MINE WORKINGS

The walls of the three open pits and the underground mine workings at Renard mine were simulated with drain nodes according to the relationship:

$$Q = \begin{cases} 0, & H \le H_s \\ C_L\left(H_s - H\right), & H > H_s \end{cases} \tag{2}$$

where

- Q = groundwater discharge to a drain node [m^3/day],
- H_s = specified elevation of drain node representing wall of the pit or mine workings [m],
- H = calculated hydraulic head [m], and
- C_L = so-called leakance factor, assigned either an assumed value or one estimated from

$$C_L = \frac{f \cdot K \cdot D_2 \cdot D_3}{D_1} \tag{3}$$

where

K = hydraulic conductivity of materials surrounding the drain node [m/day],
D_1, D_2, D_3 = generic dimensions related to size of the individual element to which any particular drain node is associated [m], and
f = factor that accounts for the effect of non-Darcian flow, the actual size of the excavation relative to the grid size, and the shape of the excavation.

In simulating the inflow rates to the pits and underground mine workings for this analysis, the leakance factor was assigned to be very large, so that the inflow was primarily controlled by the K value of the formation. The drain nodes that represent the pit bench excavation or underground workings are activated according to the planned mining schedules.

Simulation of Mine Development and Production

The open pits, ramp, shaft, and the draw drifts of the underground mine were simulated with a series of drain nodes assigned to have zero pressure upon excavation. The simulations of underground mining also involved changing the hydraulic properties of the geologic materials that are planned to be mined out (such as kimberlite) or impacted by the mining (such as the crack zone).

Simulation of Open Pits

The open pits were simulated with a series of drain nodes that were activated according to the excavation schedule of each pit. The outlines of the ultimate pits are shown in Figures 1 and 13. Contours of the ultimate pit surfaces for the BCS are shown in Figure 13. The mining schedules of these pits are summarised in Table 2. The small lakes in the R2 and R65 pit areas will be pumped dry prior to mining.

Simulation of Underground Mining

Schedules of underground mining are summarised in Table 3. The footprint of the underground mine workings are shown in Figures 1 and 14. The top elevation of R4/R9 underground mining is 395 mamsl. The kimberlite will be mined using the blasthole shrinkage option. The mined-out zone will subsequently be filled with waste rock. To simulate the effects of mining, the hydraulic conductivity values of the kimberlite within the dashed line in Figure 15 were increased gradually to a more permeable value based on the breakthrough schedule, and the draw drift at each drawpoint level was simulated with drain nodes that were activated according to the mining schedule.

Simulation of Subsidence and Crack Zones

Both the subsidence and crack zones associated with underground mining were included in the groundwater flow model simulations. The extents of the subsidence and crack zones were previously developed by Itasca (Canada). The ultimate footprints of the subsidence and crack zones are shown in Figure 14. Given the small footprint of the R3 underground mine, neither a subsidence zone nor a crack zone was simulated in that area. Both the subsidence and crack zone were simulated as areas of enhanced hydraulic conductivity values that develop over time. The time for development of the crack zone was simulated as being the same as the breakthrough time, whereas the development time of the subsidence zone was simulated as being twice as long as the breakthrough time.

Simulation of Ramp

Ramp development is scheduled to start in July 2013 and to be completed in January 2019. The footprint of the ramp is shown in Figures 1 and 14. Based on the ramp configuration and the scheduled dates for different targeted ramp elevations provided by Stornoway, a series of drain nodes set to zero pressure were activated in the model (starting in July 2013) to simulate the ramp development.

Simulation of Shaft

The location of the shaft is shown in Figures 1 and 14. Similar to the simulation of the ramp, the shaft was simulated as a deepening progression of activated drain nodes beginning in July 2013. The total length of the shaft is 750 m. Although the shaft will be concrete lined, the lining was not considered to be watertight, because preliminary designs include cold joints approximately every 5 m. Therefore, the model did not simulate the effects of concrete lining on the inflow to the shaft.

PREDICTION OF INFLOW

Three predictive simulations were conducted, including a base case scenario and two additional scenarios designed to assess the effects of uncertainties in the key model parameters on the predicted drawdown configurations. The two additional sensitivity scenarios modified the base case scenario as follows:

- Scenario 1: decreasing specific yield values of the overburden from 0.2 to 0.1 and of the upper permeable country rock from 0.05 to 0.01.
- Scenario 2: assuming the country rock is isotropic (K_z increased to equal K_x).

The key modeling assumptions related to the predictive model simulations are summarised as follows:

1) The predicted inflow does not include enhanced infiltration and recharge resulting from precipitation/runoff captured by the open pits and their connections to the underground workings.
2) All of the faults included in the model were simulated with the same hydrogeologic parameter values as the country rock.
3) Underground mining only occurs in the kimberlite zones and the hydraulic conductivity of those zones increases after they are broken through.
4) The hydrogeologic properties of the crown pillar of the R4 underground mine would remain unchanged during and after mining.

Table 4 summarises the predicted inflow rates for the base case scenario on a monthly basis according to the different mining components—ramp development, shaft development, open pits, underground workings, and combined total inflow. The predicted maximum inflow rate is approximately 4,200 m^3/day, which briefly occurs at several points during the life-of-mine. As shown in Figure 16, the total inflow rates during most of the mining years are in the range of 3,000 and 4,000 m^3/day.

Figure 16 shows that the predicted inflow is not very sensitive to either specific yield or the isotropic condition of the country rock. Decreasing the specific yields by factors of two (overburden) and five (upper permeable country rock) decreases the total inflow by less than 20 percent, relative to the base case, whereas assuming an isotropic condition of the country rock increases the predicted inflow by about 20 percent.

PREDICTIONS OF PIT REFLOODING

Reflooding of the R2/R3 and R65 pits was simulated after the cessation of mining operations based on the following assumptions:

1) Annual precipitation of 800 mm/yr within the pit perimeter accumulates in the pit.
2) The evaporation rate from the pit lake surface is 319 mm/yr.
3) Surface-water runoff of 1,068,480 m^3/yr will be directed toward the R2/R3 pit.
4) A channel will connect the R65 pit to Lac Lagopede during the reflooding period. Water flow in the channel will be controlled to ensure that the reflooding time for R65 pit will be the same as for R2/R3 pit.
5) The final R65 pit lake elevation will be the same as Lac Lapopede (483 mamsl) and the final R2/R3 pit lake elevation will be 507 mamsl.
6) The underground stopes will be backfilled, with a remaining void volume of 756,429 m^3.

7) The mine shaft, drifts, and raises, with a combined void volume of 881,221 m^3, will not be backfilled.
8) The volumes of the R65 and R2/R3 pits are 8,550,000 m^3 and 4,938,000 m^3, respectively.

In simulating the pit reflooding, the groundwater model calculates the accumulation of inflow from drain nodes at pit benches to the pit. The accumulation of water in the pit leads to a rise in water level in the pit. The model calculates the rise of the water level in the pit based on the relationship of the pit bench elevations and the corresponding void volumes of the pit. As the water level rises in the pit, the inundated pit benches are simulated as time-varying specified heads equal to the water level of the pit, whereas the pit benches above the pit's water level continue to be simulated with drain nodes. When the water level in the pit reaches the lowest elevation of the pit perimeters (507 mamsl for R2/R3 and 483 mamsl for R65), pit reflooding was considered to be completed. After reflooding of the pits, all model nodes that represent the pit benches were simulated as constant-head boundary nodes. The mine and flow components related to the pit reflooding under the base case scenario are summarised in Tables 5 and 6, respectively.

Figure 17 shows the simulated pit water levels over time under the base case scenario for R2/R3 and R65 pits. As shown in the figure, the model predicted that by 2040 both R2/R3 and R65 pits will be reflooded. Also shown in Figure 17 are the simulated pit water levels for the two additional modelling scenarios, which indicate that neither the specific yield or isotropic condition of the country rock (for the simulated values) has a noticeable influence on the predicted pit reflooding rate.

The simulation of pit reflooding does not explicitly simulate the actual configuration of the underground workings such as the shaft, raises, void of the backfilled stopes, and drifts; however, the equivalent volume of these underground workings was accounted for in the model, and that volume was assumed to be filled before the R2/R3 pit lake is formed.

PREDICTIONS OF GROUNDWATER FLOW PATHS

Itasca predicted groundwater flow paths by simulating the migration of particles released from the PKC, waste pile, and overburden pile for all three mine inflow predictive simulations. These simulations did not include the effect of enhanced infiltration on groundwater flow because Golder determined that the infiltration rate to the country rock was very small due to the low-permeability nature of the country rock (personal communication, Michel Mailloux, 7 July 2011).

The request for particle tracking simulations was only made recently in June 2011. It should be noted that the groundwater flow model was originally constructed to predict inflow to the

mine; therefore, the model did not simulate the detailed localized topography and hydrogeology in the vicinity of the three facilities where the particles were released. Any use of the simulated particle tracking results should be carefully considered in light of this limitation.

Following are the general procedures that were used in the particle tracking simulations:

1) Generate data sets of the simulated water level over time.
2) Release the particles to the first saturated model layer at the beginning of the model simulations. The particles could be either released in the overburden or in the country rock depending on the water levels at different locations at the start of mining.
3) For each time step, calculate the velocity field.
4) Calculate the travel distance and new position of each particle based on the current velocity and travel time.
5) Repeat Steps 3 and 4 until the targeted simulated date is reached.

Particle tracking simulations were conducted for all three modelling scenarios. The particle tracking simulations were run to determine the migration paths of particles terminating at the following three stages:

1) end of mining,
2) end of pit reflooding, and
3) steady-state post pit reflooding.

Figure 18 shows the simulated particle migration paths for the above-listed three stages under the base case modelling scenario. As shown in the figure, about half of the particles from the overburden pile reach the R2/R3 pit at the end of mining (Figure 18a).

Between the end of mining and the end of pit reflooding, particles (Figure 18b) do not migrate noticeably further from their position at the end of the mine due to the short reflooding time. Figure 18c shows the location of the final receptors under steady-state post pit reflooding.

Figure 19 shows the simulated particle migration paths for the above-listed three stages assuming lower specific yield values for both the overburden and the upper permeable country rock. A comparison of Figures 18 and 19 shows that the specific yield has very little effect on particle migration paths.

Figure 20 shows the simulated particle migration paths for the above-listed three stages assuming isotropic country rock. A comparison between Figures 18 and 20 shows that, under

isotropic conditions, particles migrate faster and more particles migrate to R65 than under anisotropic conditions.

PREDICTION OF POTENTIOMETRIC AND DRAWDOWN DISTRIBUTIONS

As requested by Golder, the simulated potentiometric and drawdown contours are being provided with this memorandum for both the end of mining and the end of pit reflooding (Figures 21 to 29). Drawdown was calculated from the difference between the water table under pre-mining conditions and the water table of the specified time step. In general, the water table under pre-mining conditions is within the overburden. The water table at the end of mining resides in both the overburden and the country rock. The contours are presented in this memorandum as follows:

1) Figures 21, 22, and 23 – potentiometric contours at the end of mining for the three modelled scenarios;
2) Figures 24, 25, and 26 – drawdown contours at the end of the mining for the three modelled scenarios; and
3) Figures 27, 28, and 29 – drawdown contours under steady-state post pit reflooding for the three modelled scenarios.

The contours were also provided to Golder in DWG format for use in further analyses.

Drawdown contours in Figures 24 through 26 show that the 1-m drawdown propagation is limited to the mining area. Decreasing the specific yield slightly increases the areal extent of the 1-m drawdown by about 250 m from the base case scenario. Figure 26 shows that isotropic conditions of the country rock will increase the areal extent of the 1-m drawdown by about 250 m from the base case scenario, relative to anisotropic conditions.

As shown in Figures 27 through 29, even at the steady-state post pit reflooding, the groundwater is not predicted to return to pre-mining conditions because of the presence of the pit lakes. After the pit reflooding, the groundwater system incorporates the pit lakes and establishes new equilibrium water levels. The drawdown contours in these figures are simply derived by differencing the simulated water level after pit reflooding and the simulated water level under pre-mining conditions.

PREDICTION OF IMPACTS ON BASEFLOW

As shown in Figure 24, six lakes (F3301, F3295, F3296, F3298, F2607, and 32302) are within the 1-m drawdown limit. F3296 is too small to be incorporated into the model, thus, the change of its baseflow was not evaluated by the model. Itasca evaluated the potential impact to the other five lakes through the predicted reduction in baseflow (baseflow is the amount of inflow to the

lake from groundwater). It should be noted that the predicted baseflow is not calibrated with any measured data; however, by comparing the relative reduction of predicted baseflow before and after mining, the potential impact of mining on the lakes can be quantified. As shown in Figure 30, by the end of mining, the predicted reductions in baseflow to F3295 and 32302 are insignificant and the predicted maximum reduction in baseflow to F3301 and F2607 is approximately 40 and 60 m^3/day, respectively. A comparison of flow rates into these lakes with the baseflow reduction is shown in the following table. In general, the reduction in baseflow accounts for less than one percent of the daily average inflow.

Lake	Initial Drainage Area (ha)	Drainage Area After Mining (ha)	Percent of Decrease in Drainage Area (%)	Daily Average Flow into Lake Before Mining (m^3/day)	Daily Average Flow into Lake After Mining (m^3/day)	Reduction of Baseflow at End of Mining (m^3/day)
F3301	166.0	166.0	0.0	4246	4246	40
F2607	358.4	263.4	26.5	9167	6737	60
F3295	218.5	200.6	8.2	5589	5131	0
F3296	224.8	207.3	7.8	5750	5302	not simulated
F3298	22.6	6.8	69.9	578	174	3
F32302	15681.2	15435.8	1.6	401086	394809	0

Note: Table provided by Martin Boucher (Stornoway) via email on 15 November 2011.

IMPACT OF ENHANCED RECHARGE THROUGH STORAGE FACILITIES ON GROUNDWATER CONDITIONS

The model simulations summarised in the previous sections did not include the impact of enhanced recharge through the PKC, waste pile, and overburden pile (storage facilities). Figure 31 shows the predicted drawdown under steady-state post pit reflooding for the base case scenario assuming the enhanced recharge rates through these facilities. The recharge rates for these three facilities are shown in Figure 31 (email communication with Michel Mailloux, 28 October 2011). As shown in Figure 31, by considering the enhanced recharge rates through the storage facilities, the drawdown under steady-state post pit reflooding, is limited to very small areas in the pit vicinity.

LIMITATIONS

The confidence level of the groundwater flow model predictions largely depend on the available hydrogeologic data obtained from the site. Currently, there are only limited data on the hydrogeologic conditions of (1) the site overburden material, (2) the interaction between the surface-water bodies and the groundwater system, and (3) the hydrogeologic conditions of the faults. The model incorporates all of the currently available data, but the predictions are subject to change pending new data collected in future investigations. In addition, the model

was designed to predict the inflow rates to the open pits and underground mine workings; thus it only has simplified representations of the detailed topographic and overburden conditions in the vicinity of the PKC, waste piles, and overburden piles. These limitations should be addressed in a future model update.

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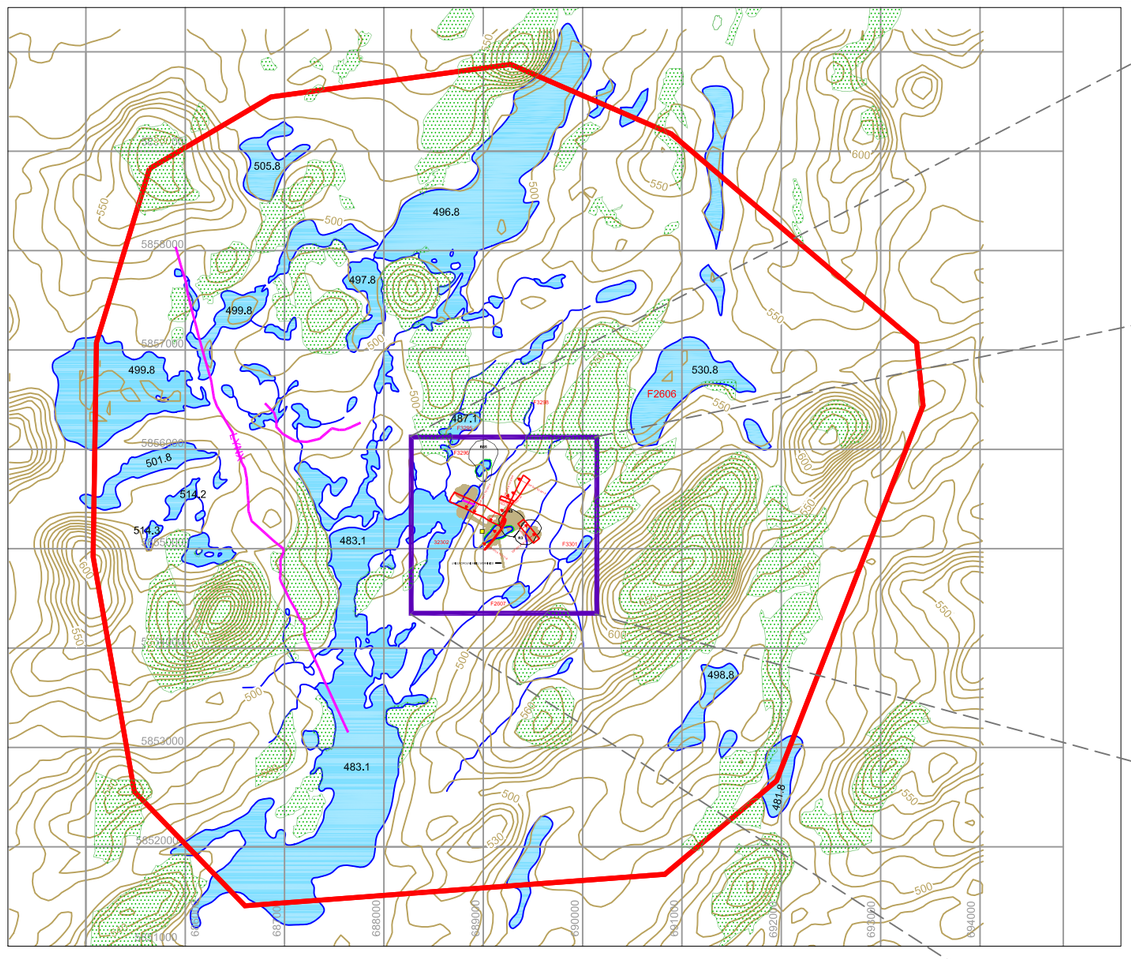
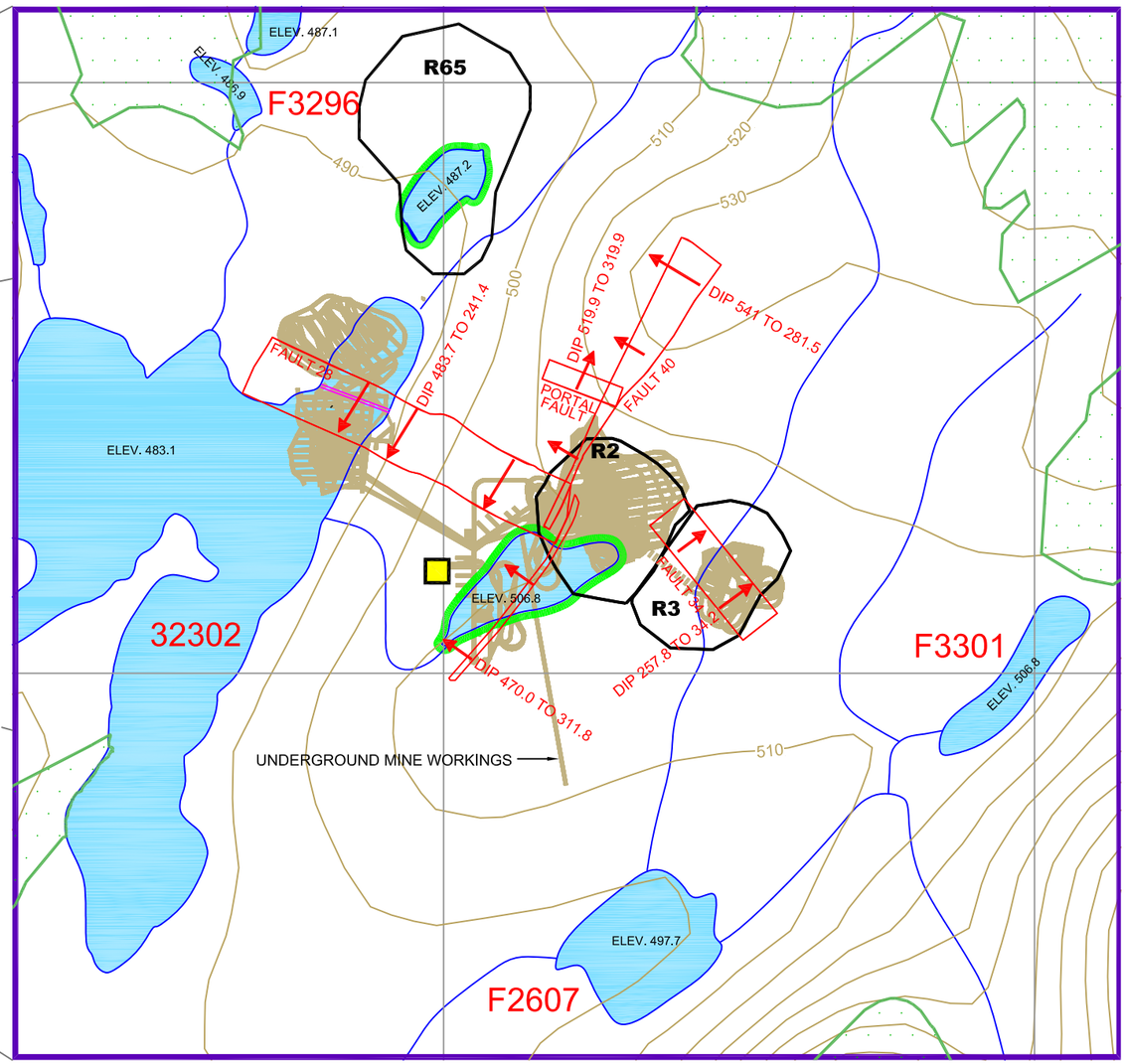
Attachments: Figure 1 - Hydrogeologic Study Area
Figure 2 - Locations of Measured Water Levels and Hydraulic Testing
Figure 3 - Distribution of Measured and Modelled Hydraulic Conductivity with Depth
Figure 4 - Ranges of Hydraulic Conductivities from Previous Investigations

Figure 5 - Geologic Units in Layer 1 of Groundwater Flow Model
Figure 6 - Cross-Section A-A′ of Groundwater Flow Model
Figure 7 - Estimated Overburden Thickness
Figure 8 - Geologic Units in Layer 3 of Groundwater Flow Model
Figure 9 - Boundary Conditions of Groundwater Flow Model
Figure 10 - Simulated Zone of Recharge
Figure 11 - Results of Steady-State Calibration
Figure 12 - Simulated Pre-Mining Water Table Elevation
Figure 13 - Configuration of Ultimate Pits
Figure 14 - Plan View of Underground Mine Workings
Figure 15 - Schematic of Underground Mining at R2/R3
Figure 16 - Predicted Mine Inflows
Figure 17 - Simulated Pit Water Levels Over Time for Three Model Scenarios
Figure 18 - Simulated Particle Tracks for the Base Case
Figure 19 - Simulated Particle Tracks Assuming Lower Specific Yield
Figure 20 - Simulated Particle Tracks Assuming Isotropic Country Rock
Figure 21 - Potentiometric Contours at End of Mining for Base Case
Figure 22 - Potentiometric Contours at End of Mining Assuming Lower Specific Yield
Figure 23 - Potentiometric Contours at End of Mining Assuming Isotropic Country Rock
Figure 24 - Drawdown Contours at End of Mining for Base Case
Figure 25 - Drawdown Contours at End of Mining Assuming Lower Specific Yield
Figure 26 - Drawdown Contours at End of Mining Assuming Isotropic Country Rock
Figure 27 - Drawdown Contours under Steady-State Conditions Post Pit ReFlooding for Base Case
Figure 28 - Drawdown Contours under Steady-State Conditions Post Pit ReFlooding Assuming Lower Specific Yield
Figure 29 - Drawdown Contours under Steady-State Conditions Post Pit ReFlooding Assuming Isotropic Country Rock
Figure 30 - Predicted Change of Base Flows for Selected Lakes during Mine Operation for Base Case
Figure 31 - Drawdown Contours under Steady-State Conditions Post Pit Reflooding for Base Case with Enhanced Recharge in Storage Facilities

Table 1 - Hydraulic Parameters of Geologic Units in Groundwater Flow Model
Table 2 - Mining Schedule for Open Pits
Table 3 - Mining Schedule for Underground Mining
Table 4 - Predicted Inflow Rate for the Base Case Scenario
Table 5 - The Void Volume of Major Mining Components of Pit Reflooding
Table 6 - The Averaged Flow Components of Pit Reflooding Over Reflooding Period





EXPLANATION

- MODEL BOUNDARY
- BEDROCK OUTCROP
- OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- TOPOGRAPHIC CONTOUR (mamsl)
- FOOTPRINT OF INTERPRETED FAULT IN MINE AREA (FAULT 34, DIP 257.8 TO 34.2)
- DIPPING DIRECTION FROM TOP TO BOTTOM ELEVATIONS (mamsl)
- LAKE (GREEN OUTLINE INDICATES PORTION OF LAKE TO BE DRAINED) - ELEVATION IN mamsl (ELEV. 506.8)
- DYKE
- F3301 LAKE ID

PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	HSA
DRAWING DATE	6 OCT 2011
REVISION DATE	25 OCT 2011

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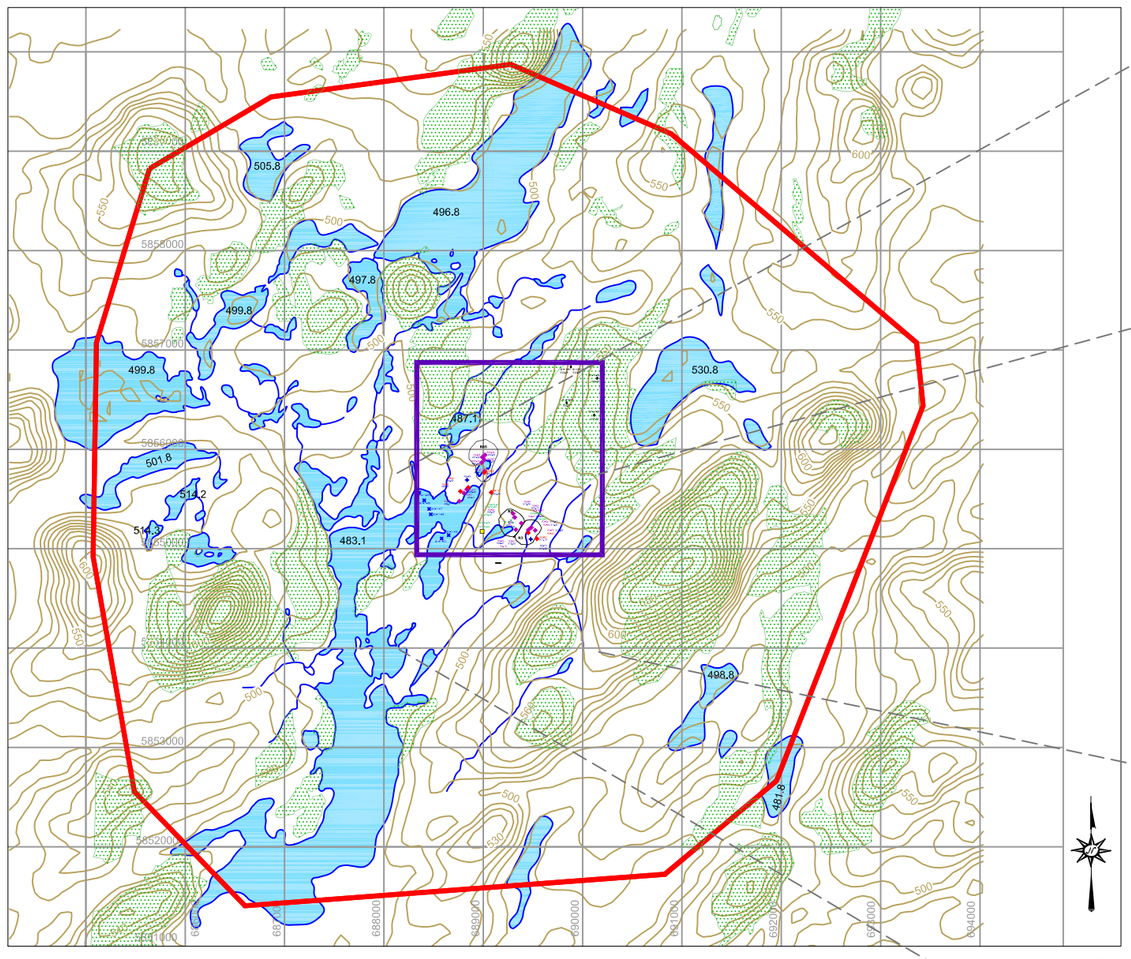
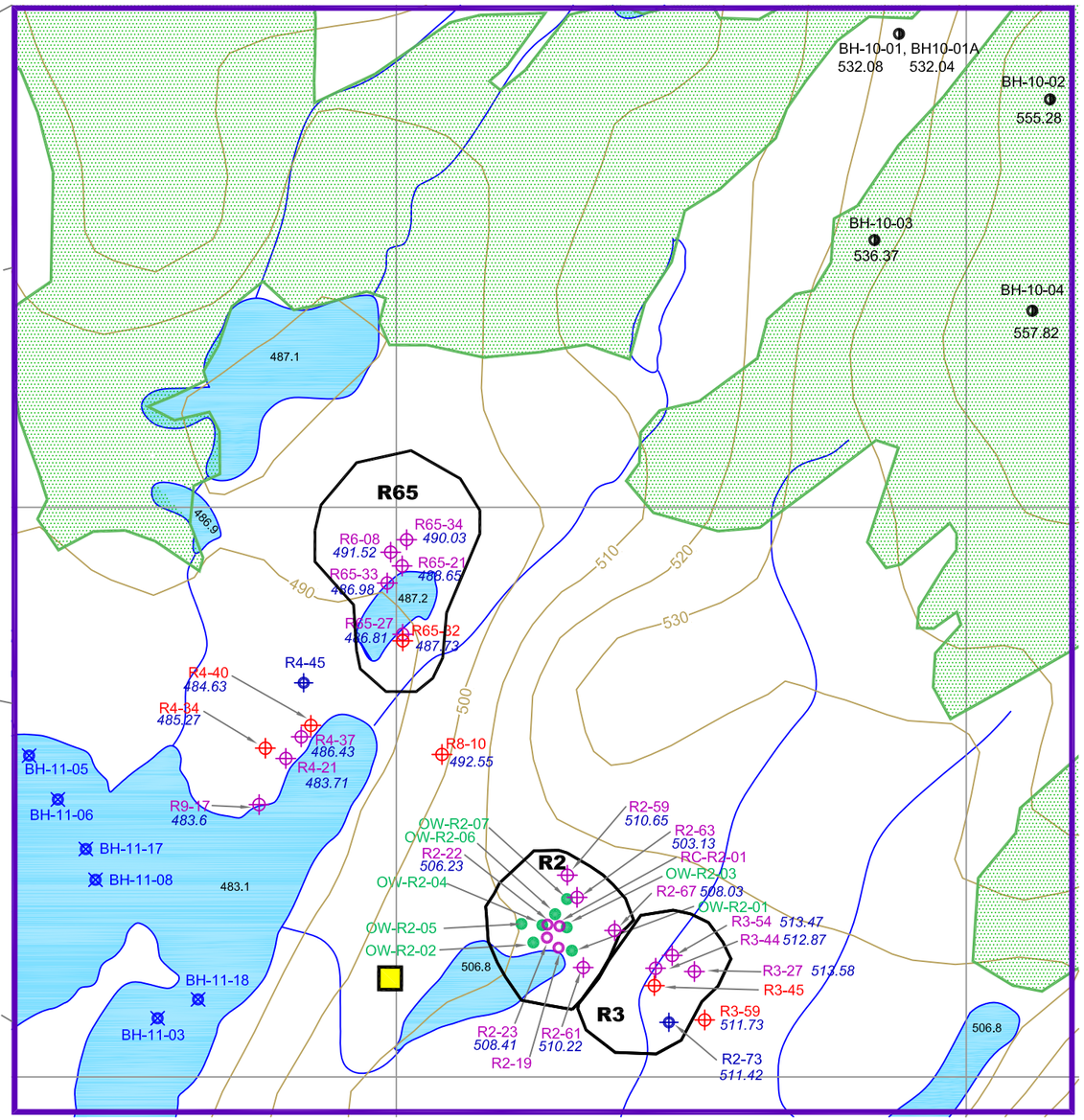
Hydrogeologic Study Area

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 1





EXPLANATION

- R8-10 / 492.55 — BOREHOLE WATER LEVEL (mamsl), MEASURED BY ROCHE (2010)
- R3-59 — BOREHOLE WHERE HYDRAULIC TESTING WAS CONDUCTED (ROCHE, 2010)
- R2-73 — BOREHOLE WHERE PACKER TESTING WAS CONDUCTED (WESA, 2010)
- OW-R2-01 — OVERBURDEN BOREHOLE WHERE HYDRAULIC TESTING WAS CONDUCTED (GENIVAR, 2006)
- RC-R3-06 — BEDROCK BOREHOLE WHERE HYDRAULIC TESTING WAS CONDUCTED (GENIVAR, 2006)
- BH-10-01 / 532.08 — PIEZOMETER WITH WATER LEVEL (mamsl) (GOLDER 2011)
- BH-11-03 — BOREHOLE WHERE HYDRAULIC TESTING WAS CONDUCTED (GOLDER 2011)
- BEDROCK OUTCROP
- MODEL BOUNDARY
- PROPOSED SHAFT
- OUTLINE OF ULTIMATE PIT
- 506.8 — LAKE (ELEVATION IN mamsl)
- TOPOGRAPHIC CONTOUR (mamsl)

PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	LOC–MEAS–WL
DRAWING DATE	6 OCT 2011
REVISION DATE	--

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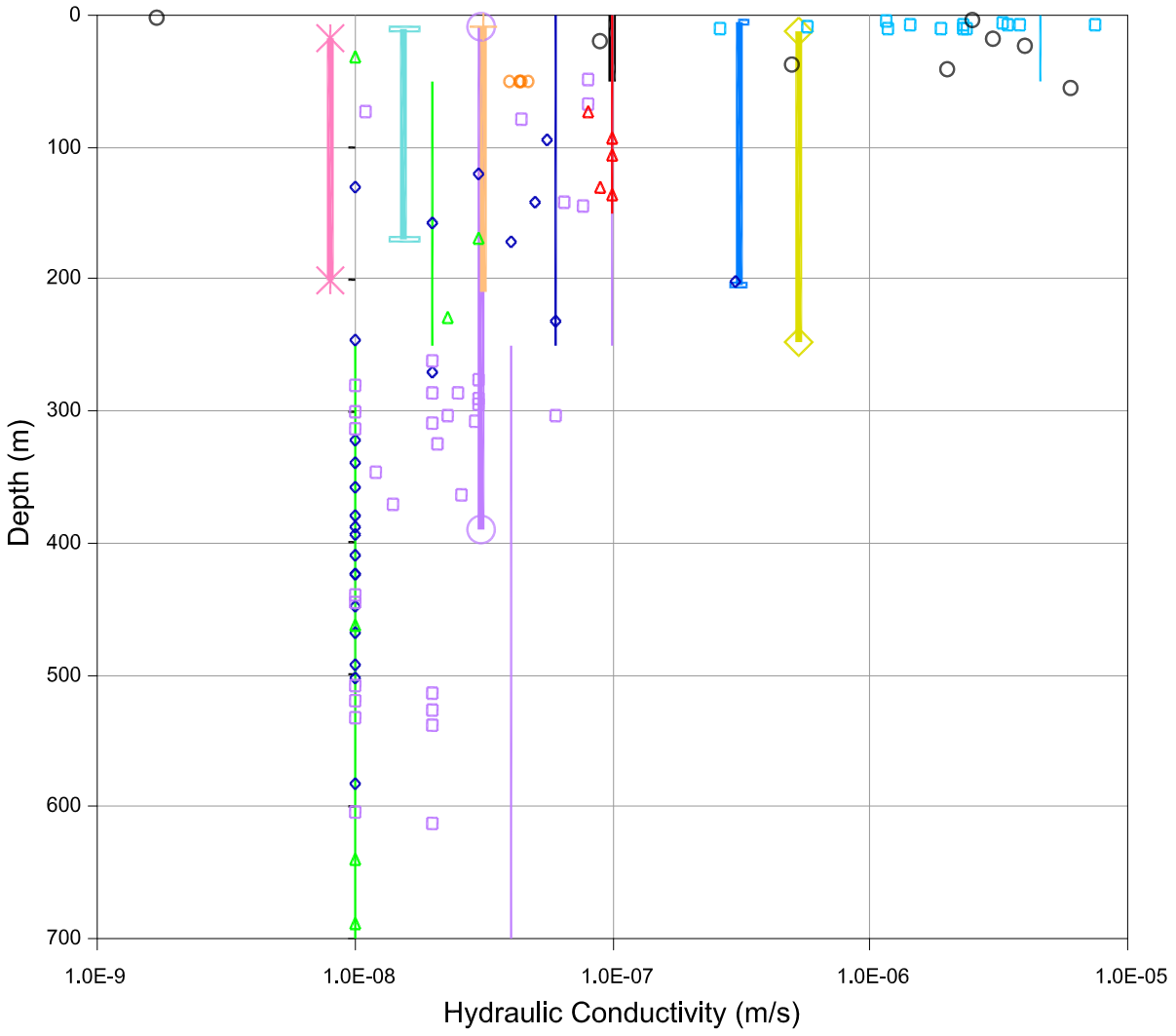
Locations of Measured Water Levels and Hydraulic Testing

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 2



Modelled range

- Overburden
- Country rock
- Cracked country rock
- Brecciated country rock
- Kimberlite
- Permeable country rock

Measured

- Overburden (GENIVAR)
- Country rock (WESA)
- Cracked country rock (WESA)
- Brecciated country rock (WESA)
- Kimberlite (WESA)
- Permeable country rock (Golder, 2011)
- Country rock (GENIVAR)

Open hole testing by Roche (2010)

- R3-45
- R4-34
- R65-32
- R3-59
- R4-40
- R8-10

PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	MEAS–MOD–WITHDEPTH
DRAWING DATE	7 OCT 2011
REVISION DATE	--

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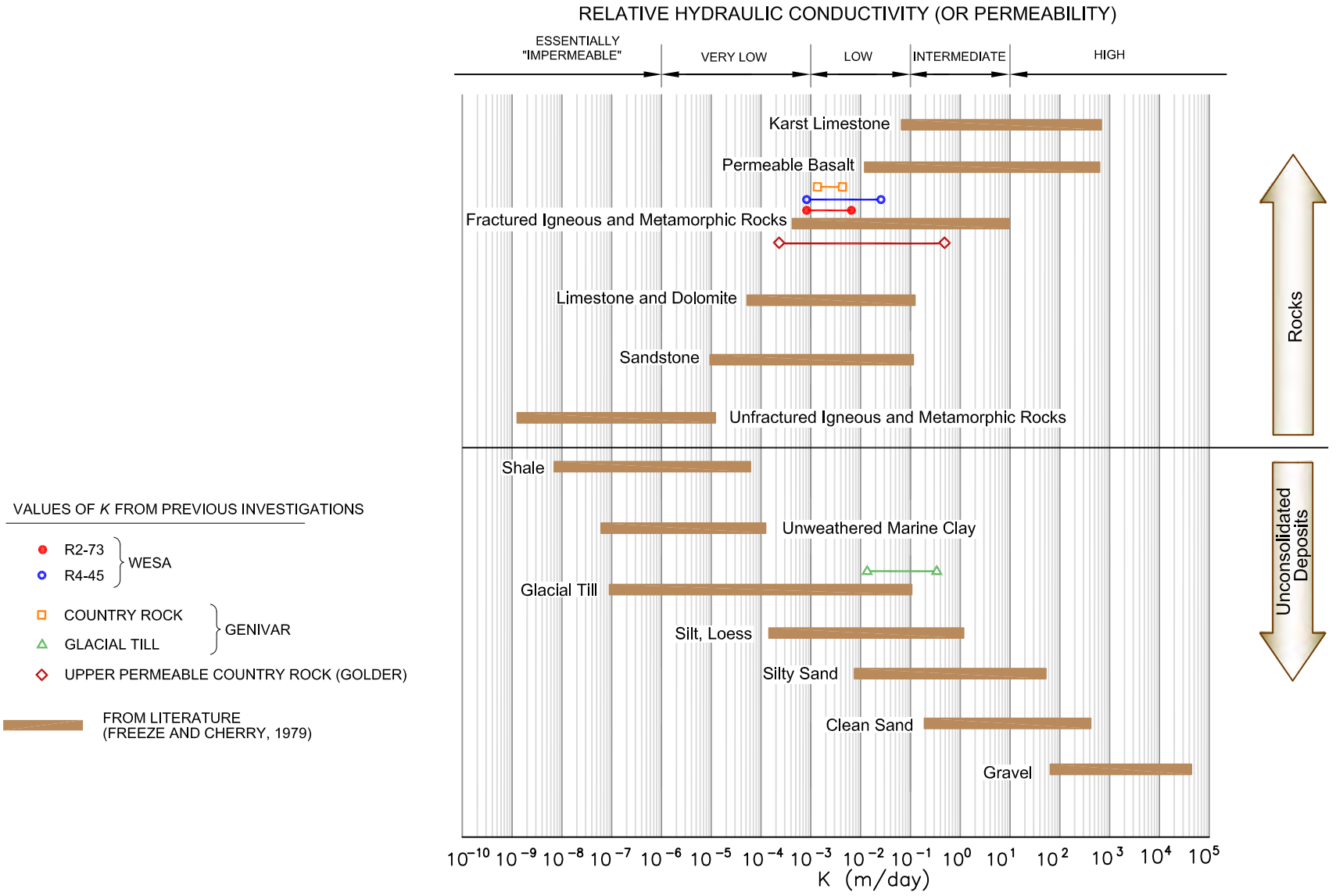
Distribution of Measured and Modelled Hydraulic Conductivity with Depth

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 3



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BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	HYD-COND-VALUES
DRAWING DATE	7 OCT 2011
REVISION DATE	--

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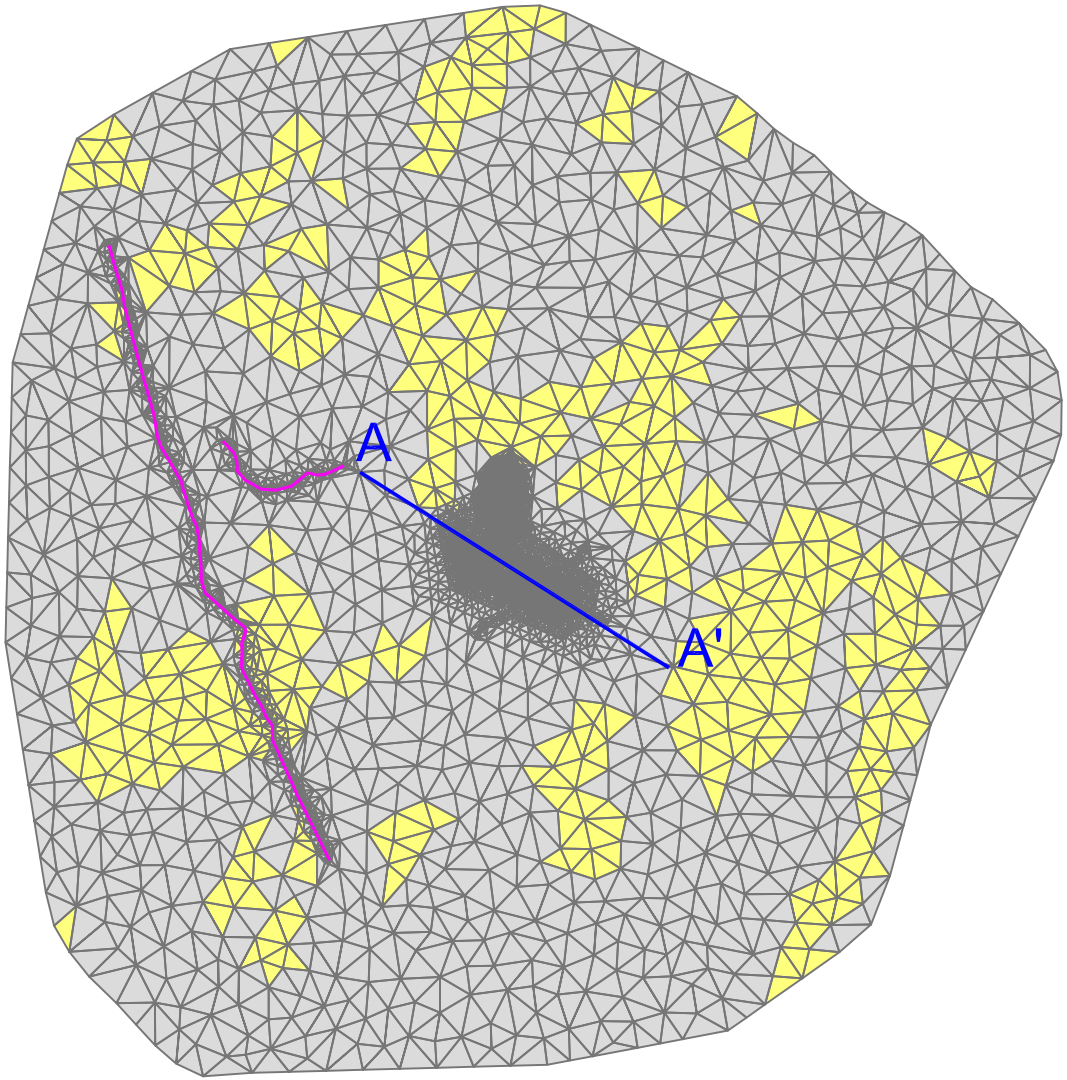
Ranges of Hydraulic Conductivities from Previous Investigations

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 4



EXPLANATION

OVERBURDEN

PERMEABLE COUNTRY ROCK

DYKE

A — A' CROSS SECTION LOCATION (SEE FIGURE 6)

0 1200

SCALE (m)

PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	LAYER1
DRAWING DATE	7 OCT 2011
REVISION DATE	--

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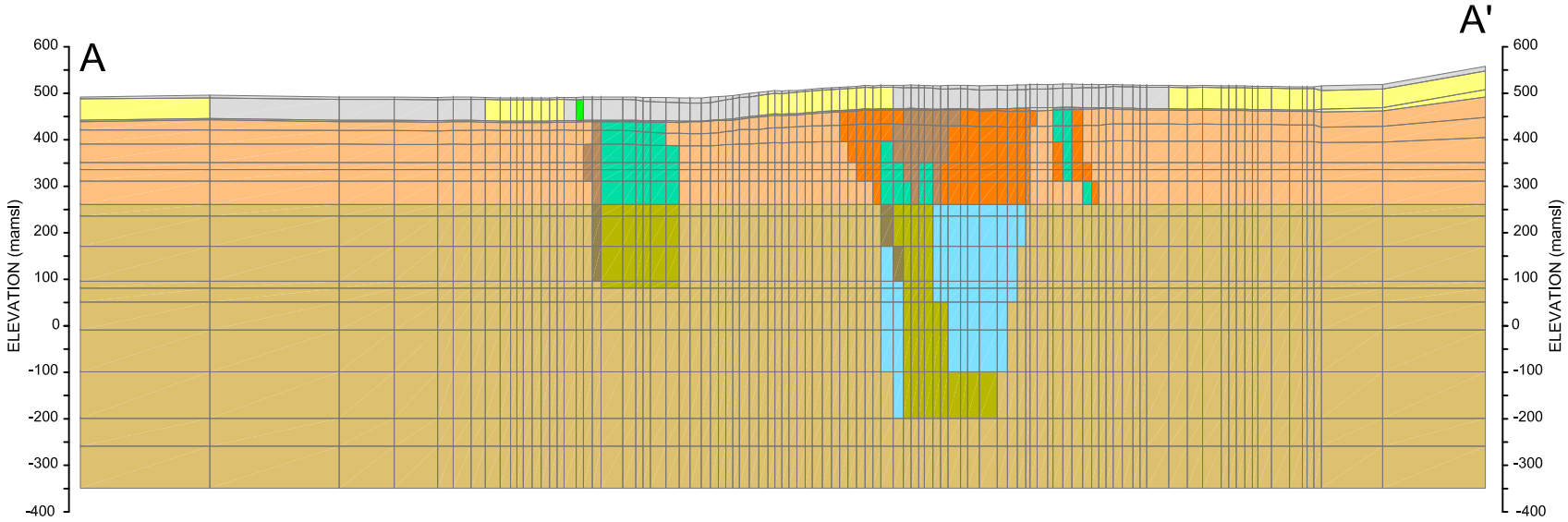
Geologic Units in Layer 1 of Groundwater Flow Model

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 5



EXPLANATION

- OVERBURDEN
- PERMEABLE COUNTRY ROCK
- LOWER COUNTRY ROCK
- UPPER KIMBERLITE
- LOWER KIMBERLITE
- UPPER BRECCIA COUNTRY ROCK
- LOWER BRECCIA COUNTRY ROCK
- UPPER CRACKED COUNTRY ROCK
- LOWER CRACKED COUNTRY ROCK

0 300
SCALE (m)

NOTE: SEE FIGURE 5 FOR LOCATION OF CROSS SECTION

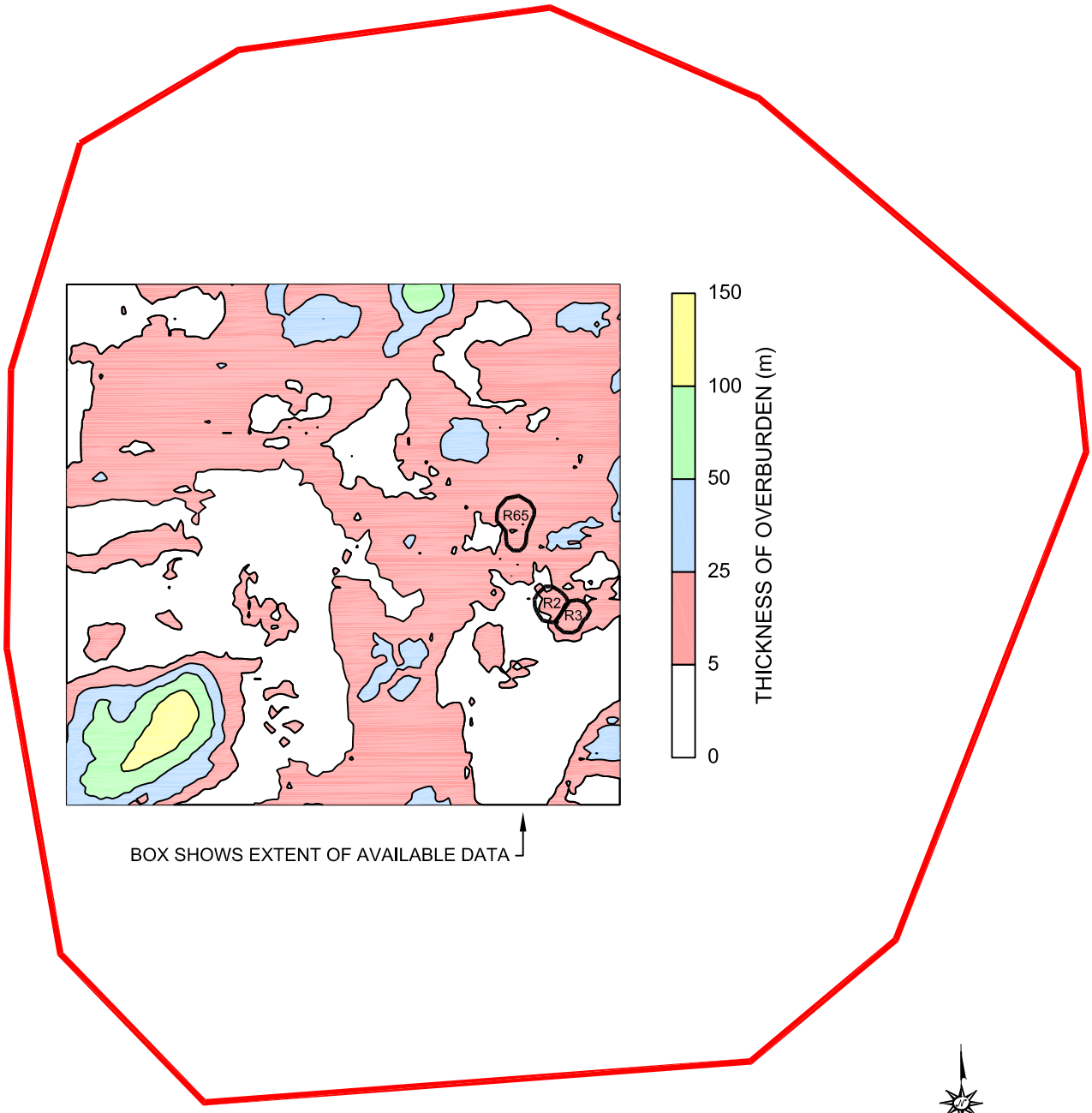
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	XSEC–AA
DRAWING DATE	7 OCT 2011
REVISION DATE	--

ITASCA™ Denver, Inc.

Cross Section A-A' of Groundwater Flow Model

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 6



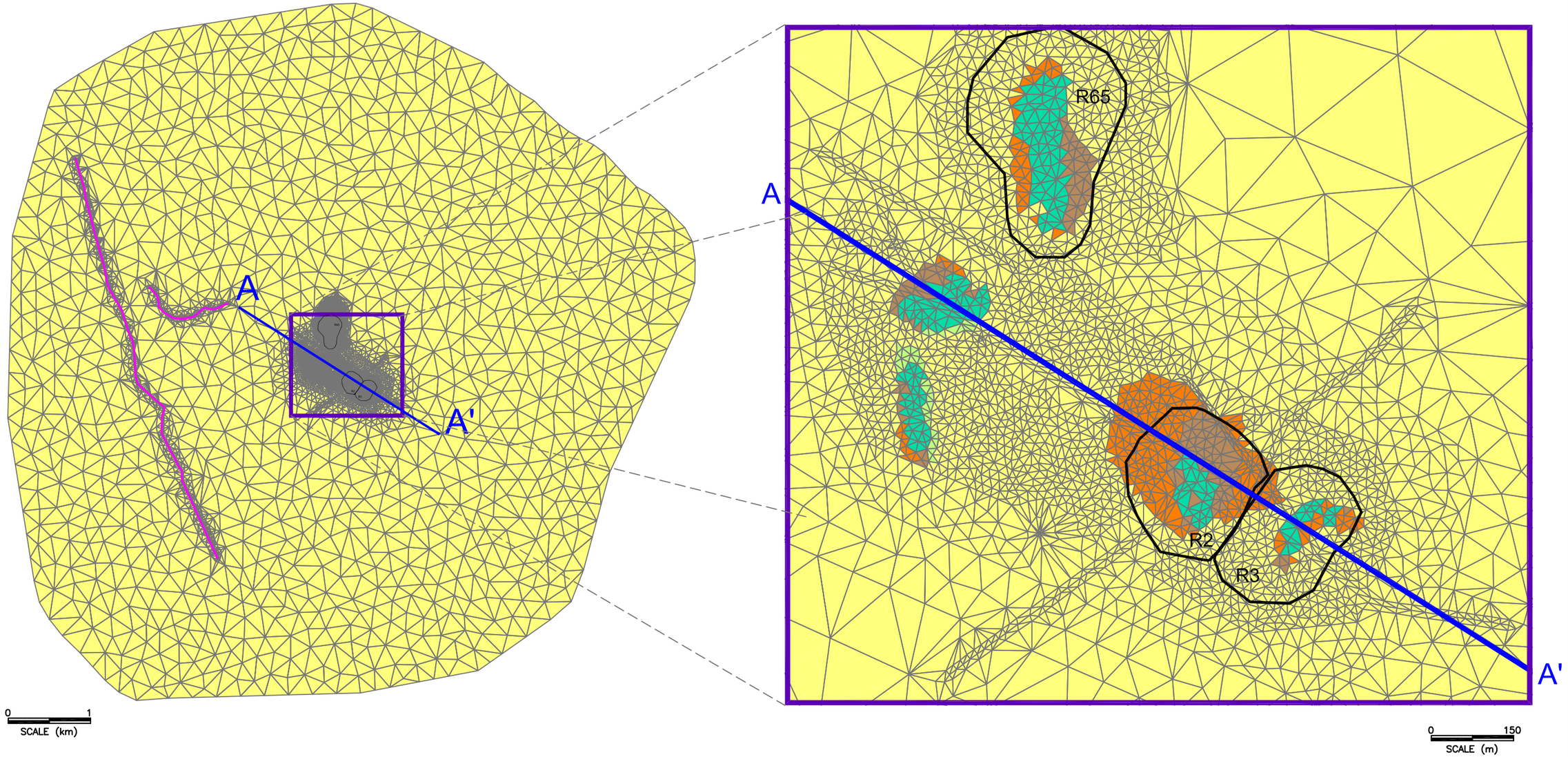
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	OVB–THICKNESS
DRAWING DATE	7 OCT 2011
REVISION DATE	--

ITASCA™ Denver, Inc.

Estimated Overburden Thickness

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 7



EXPLANATION

- PERMEABLE COUNTRY ROCK
- UPPER KIMBERLITE
- UPPER PIPE
- UPPER CRACKED COUNTRY ROCK
- UPPER BRECCIA COUNTRY ROCK
- DYKE
- FOOTPRINT OF ULTIMATE PIT
- A — A' CROSS SECTION LOCATION (SEE FIGURE 6)

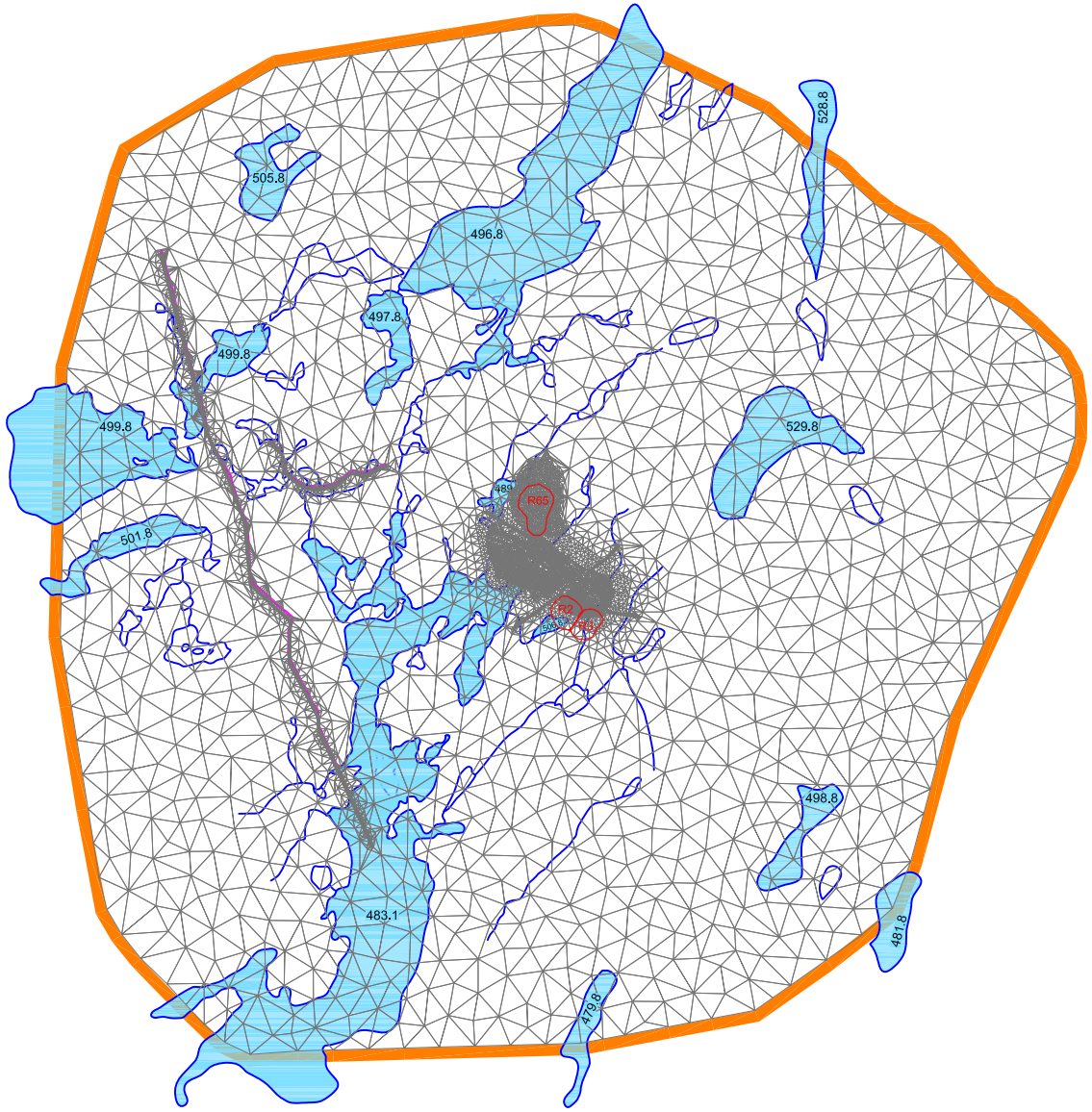
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	LAYER3
DRAWING DATE	7 OCT 2011
REVISION DATE	--

ITASCA™ Denver, Inc.

Geologic Units in Layer 3 of Groundwater Flow Model

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 8



EXPLANATION

FOOTPRINT OF ULTIMATE PIT

LAKE

DYKE

BOUNDARY CONDITIONS

VARIABLE FLUX

489.8

CONSTANT HEAD
(LAKE WITH WATER LEVEL ELEVATION - mamsl)

0 1200
SCALE (m)

PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	BOUND–COND
DRAWING DATE	7 OCT 2011
REVISION DATE	--

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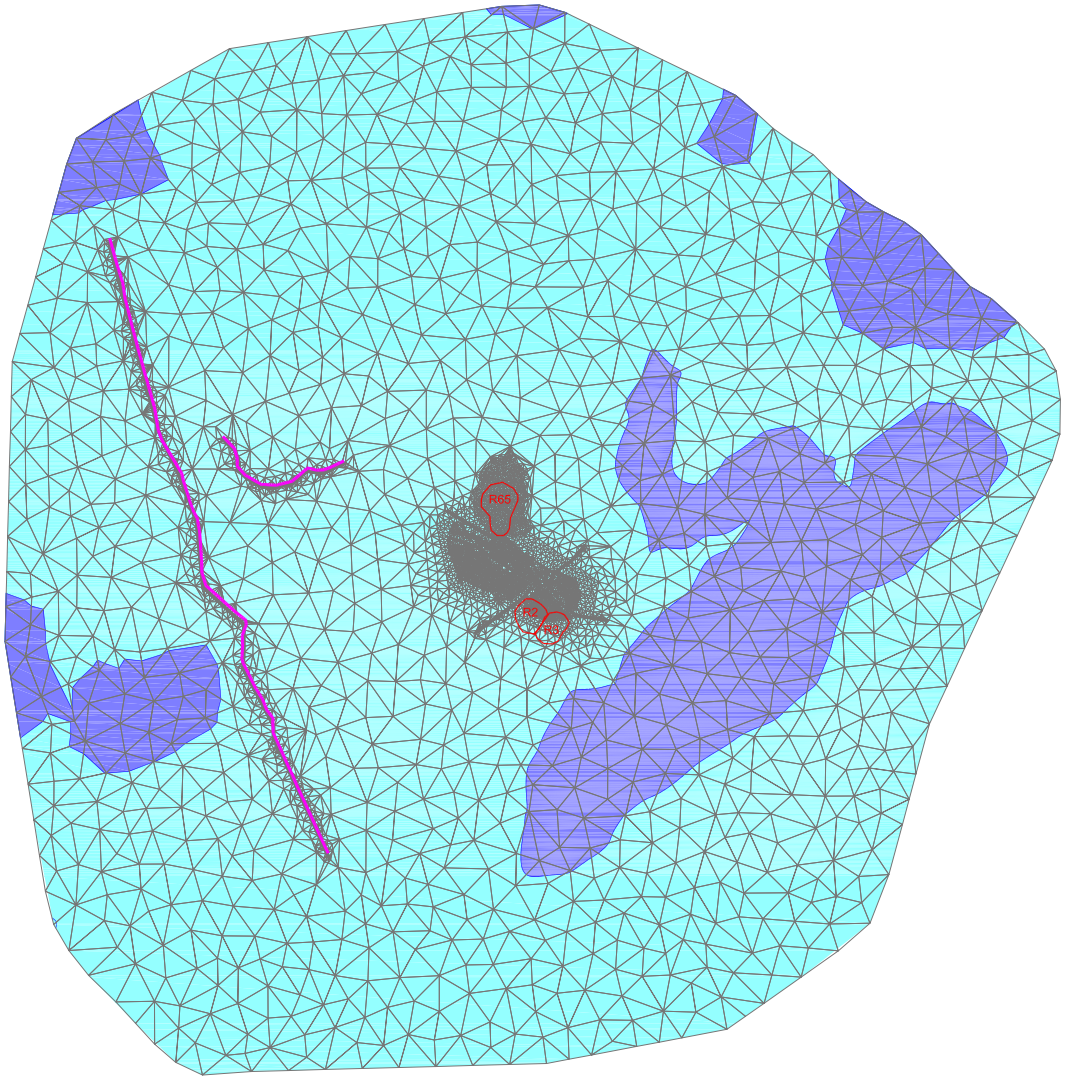
Denver, Inc.

Boundary Conditions of Groundwater Flow Model

CLIENT:
Stornoway Diamond Corporation

FIGURE NO.
9



EXPLANATION

ZONE OF RECHARGE (194 mm/yr)

ZONE OF RECHARGE (80 mm/yr)

DYKE

FOOTPRINT OF ULTIMATE PIT

N

0 1200

SCALE (m)

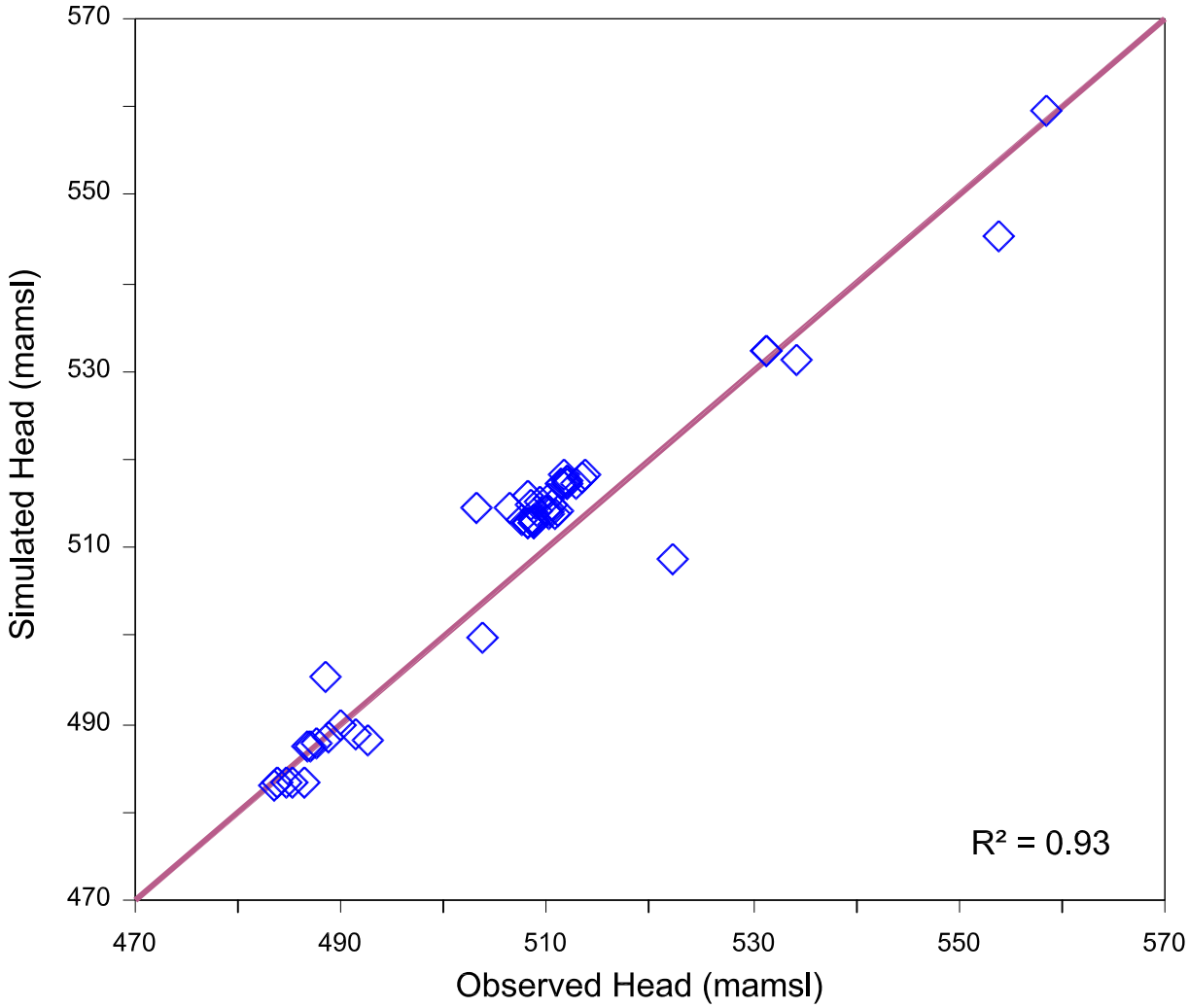
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	RECH-ZONE
DRAWING DATE	7 OCT 2011
REVISION DATE	--

ITASCA™ Denver, Inc.

Simulated Zone of Recharge

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 10



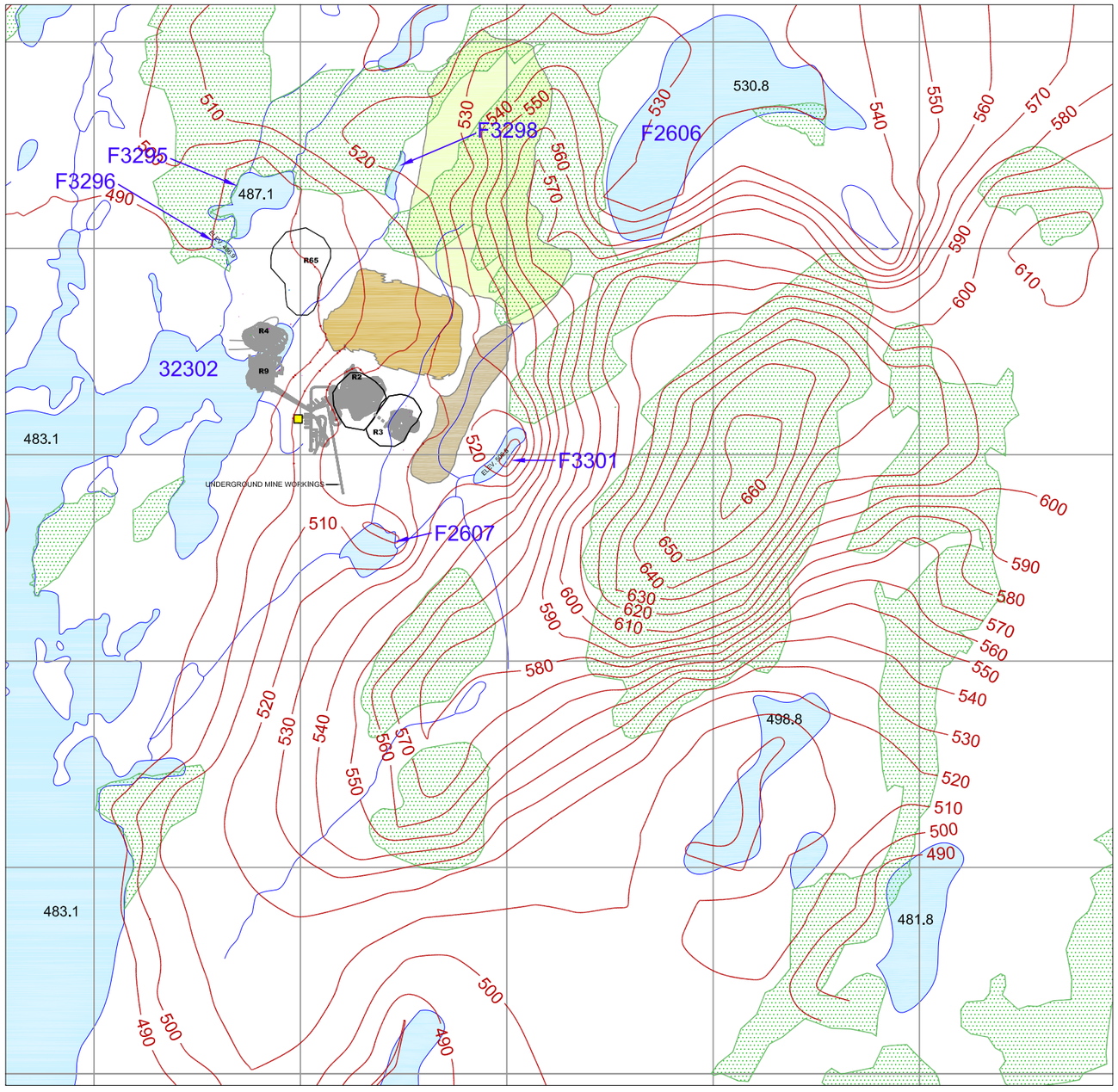
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	SS-CAL
DRAWING DATE	7 OCT 2011
REVISION DATE	--

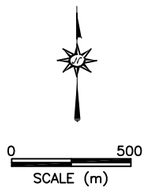
ITASCA™ Denver, Inc.

Results of
Steady-State Calibration

CLIENT:
Stornoway Diamond Corporation

FIGURE NO.
11





EXPLANATION

- PRE-MINING WATER TABLE CONTOUR (mamsl)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

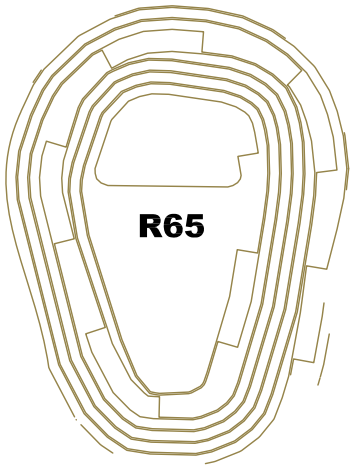
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	SIM–PREMINING–WT
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

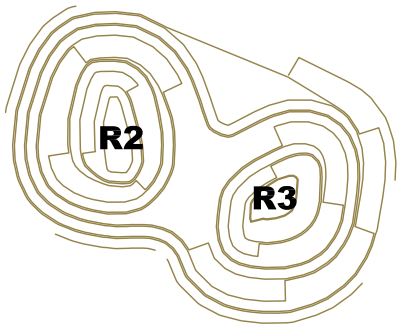
ITASCA™ Denver, Inc.

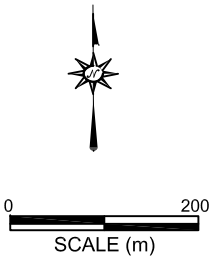
Simulated Pre-Mining Water Table Elevation

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 12







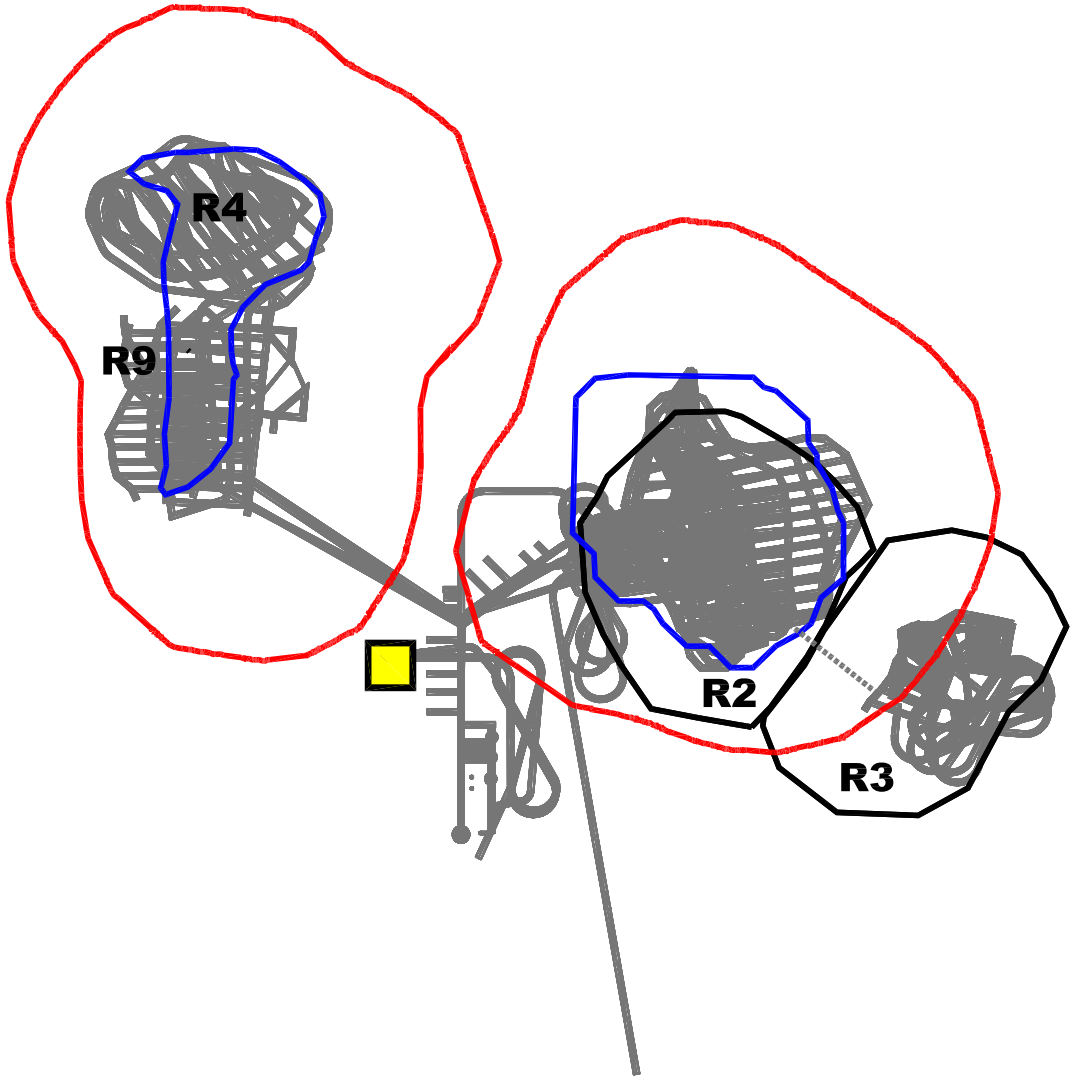
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	CONF–ULTPITS
DRAWING DATE	7 OCT 2011
REVISION DATE	--

ITASCA™
Denver, Inc.

Configuration of Ultimate Pits

CLIENT:
Stornoway Diamond Corporation

FIGURE NO.
13



EXPLANATION

APPROXIMATE OUTLINE OF ULTIMATE PIT

UNDERGROUND MINE WORKING

PREDICTED ULTIMATE FOOTPRINT OF CRACK ZONE (ITASCA, 2010)

PREDICTED ULTIMATE FOOTPRINT OF SUBSIDENCE (ITASCA, 2010)

PROPOSED SHAFT

0 150

SCALE (m)

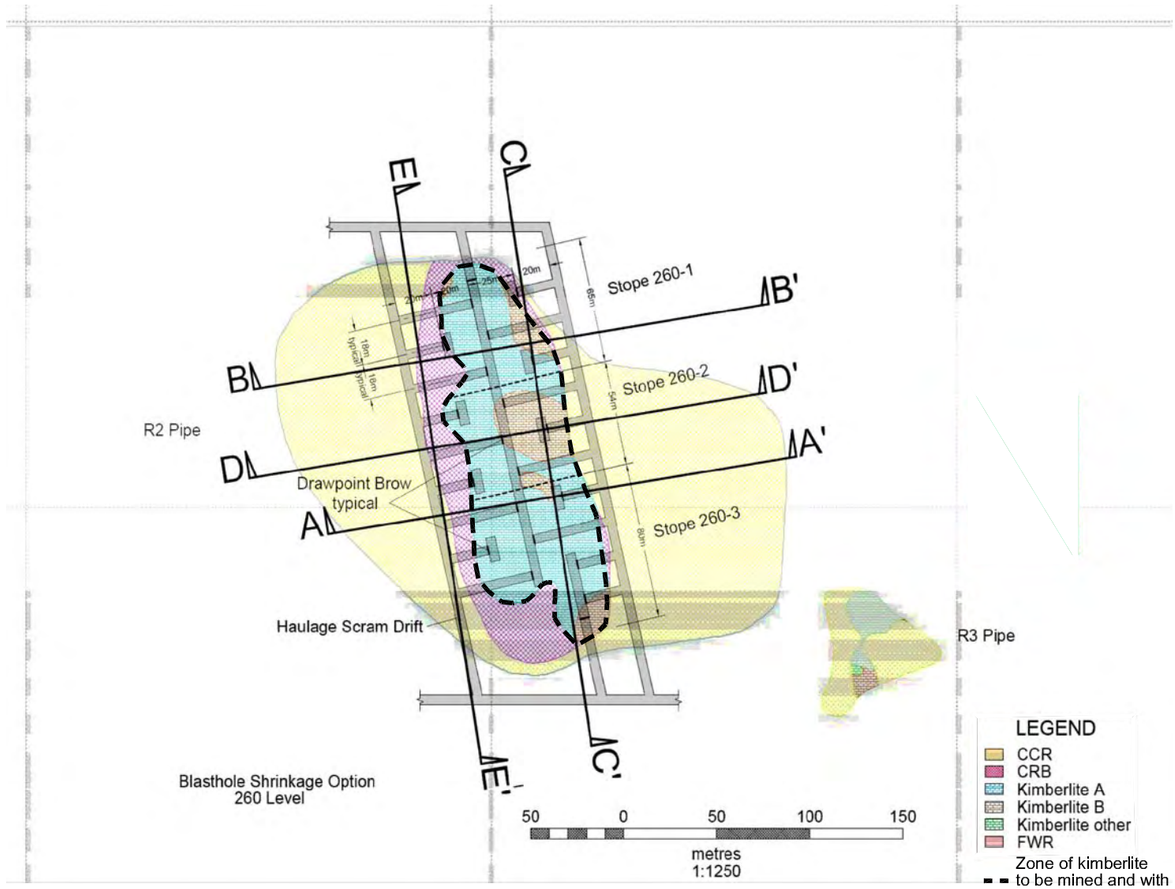
PROJECT NO.	1927
BY	HL
CHECKED	DBS
DRAWN	SAC
DRAWING NAME	PV-UG-MINEWORKINGS
DRAWING DATE	7 OCT 2011
REVISION DATE	--

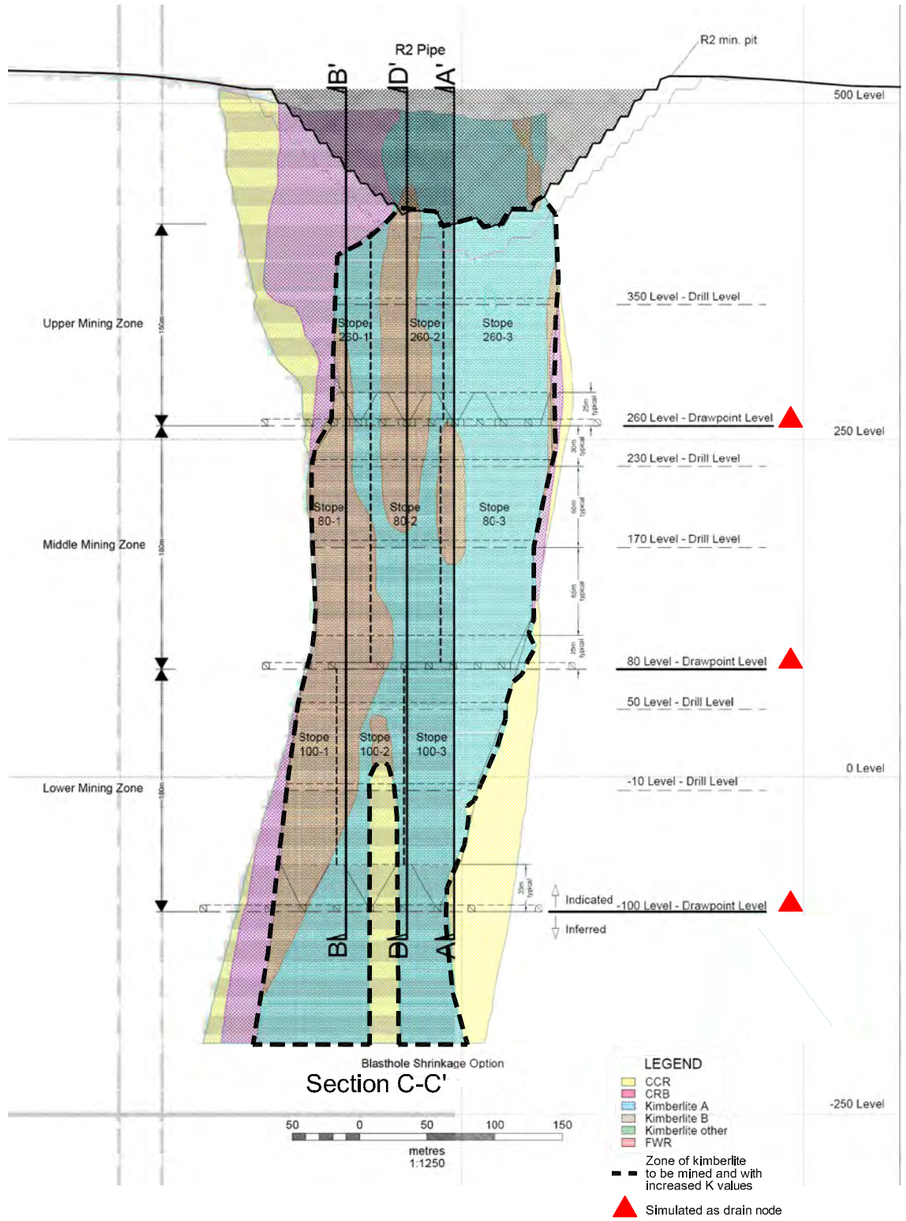
ITASCA™ Denver, Inc.

Plan View of Underground Mine Workings

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 14





SOURCE: STORNOWAY DIAMOND CORPORATION, 2011

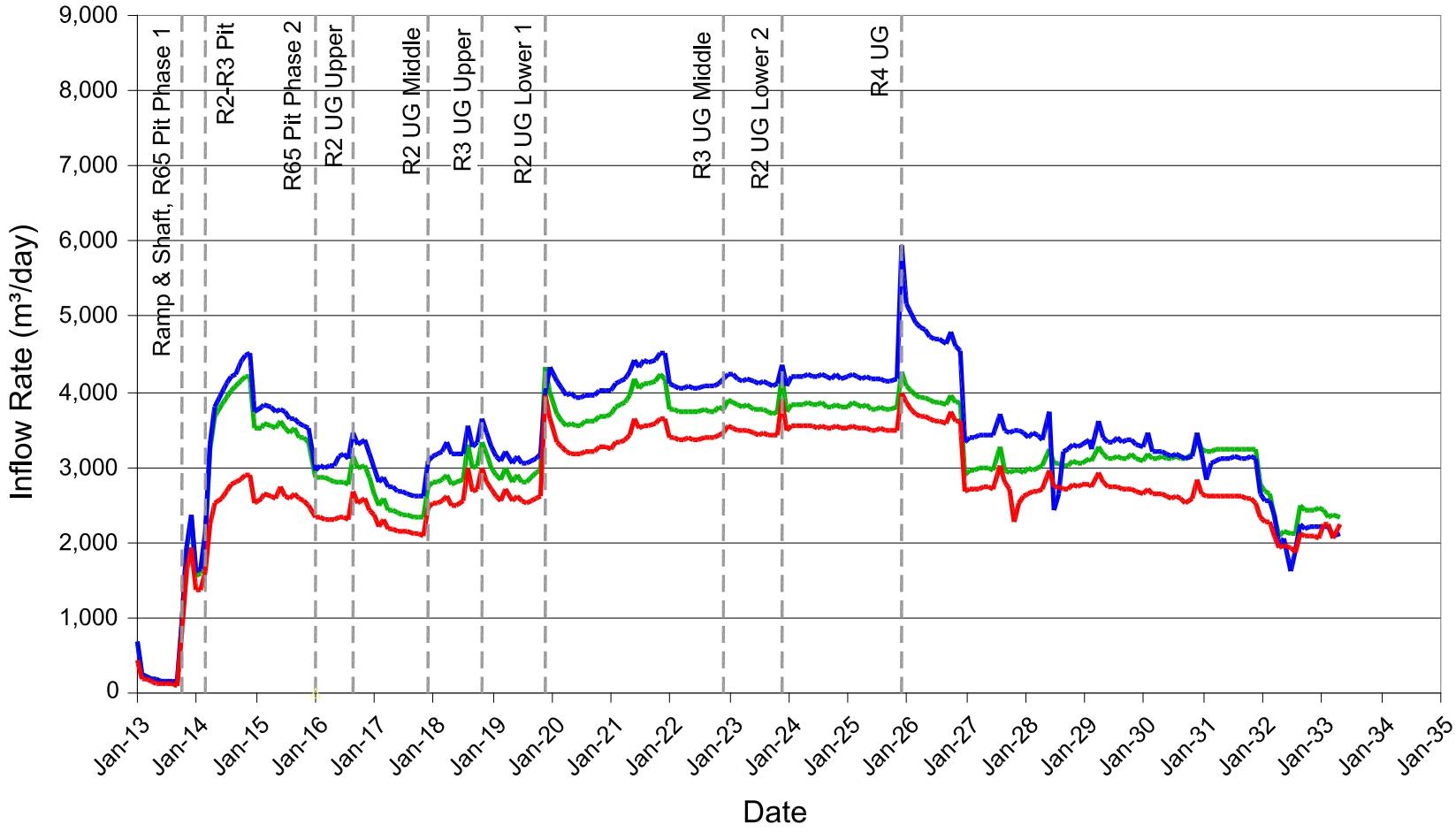
PROJECT NO.	1927
BY	OTHERS
CHECKED	DBS
DRAWN	OTHERS/SAC
DRAWING NAME	SCHEMATIC–UGMINING
DRAWING DATE	7 OCT 2011
REVISION DATE	–

ITASCA™ Denver, Inc.

Schematic of Underground Mining at R2/R3

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 15



Base Case

Isotropic country rock

Lower specific yield

Development / mining begins

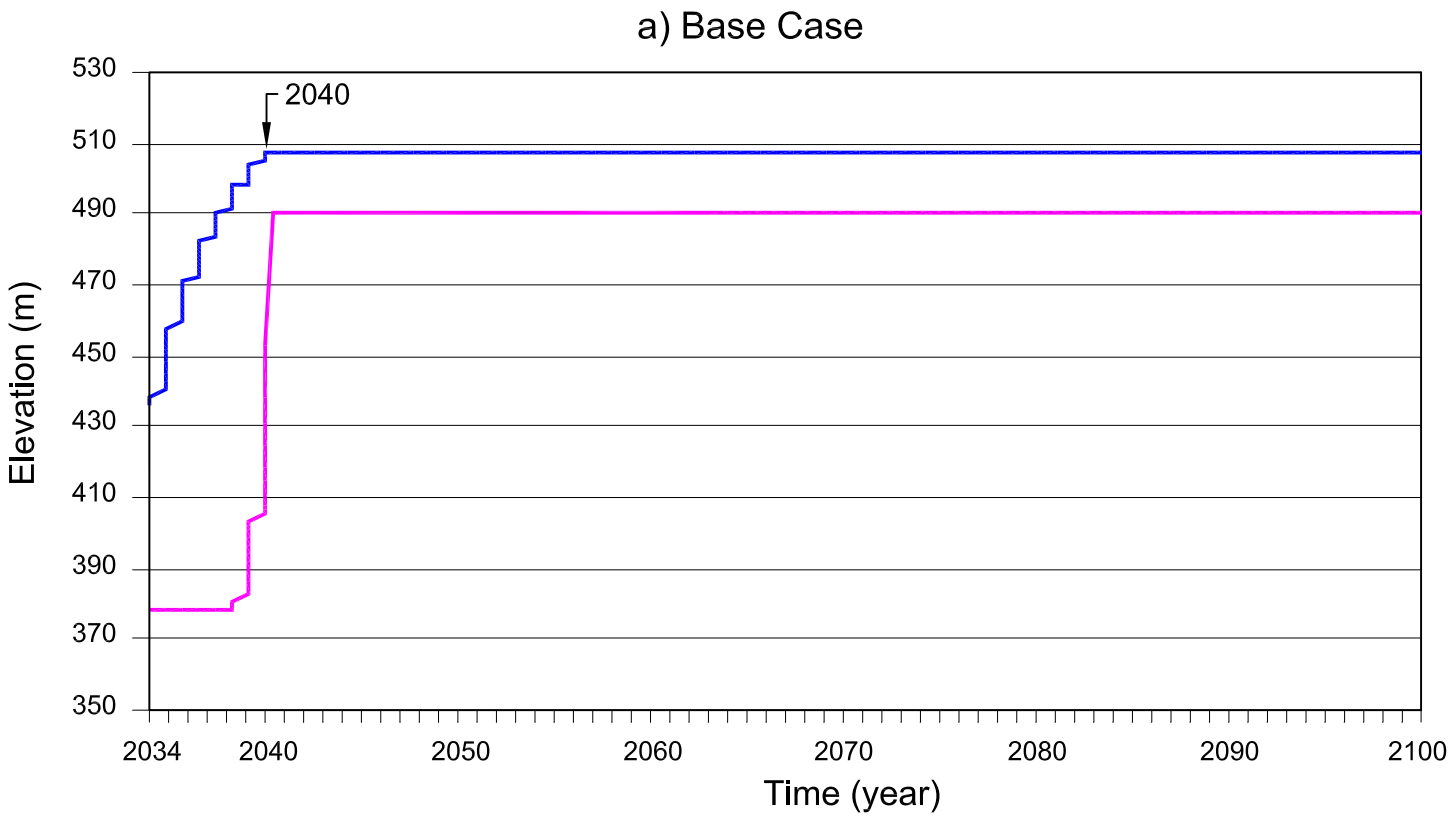
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	PRED–MINE–INFLOWS
DRAWING DATE	7 OCT 2011
REVISION DATE	--

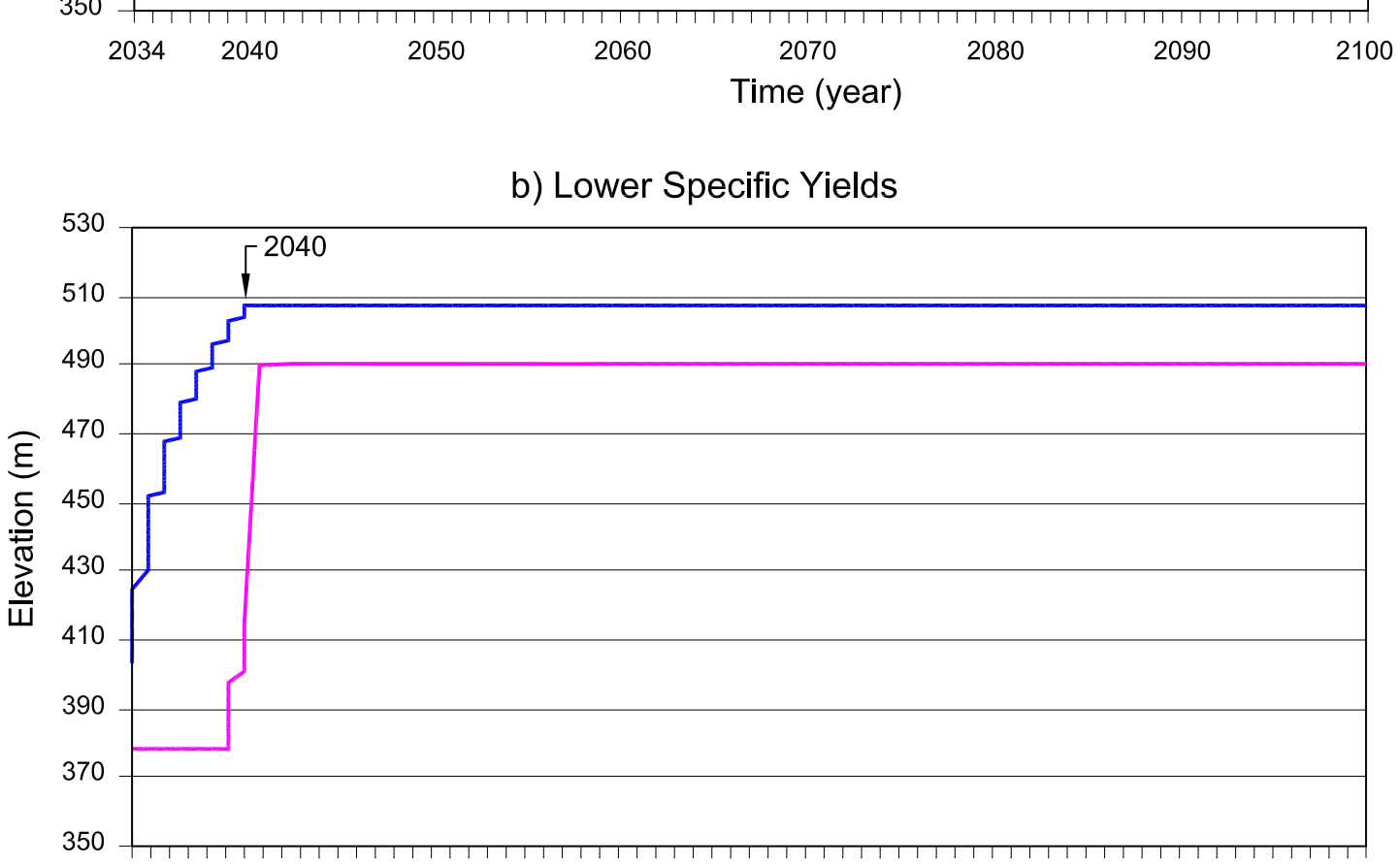
ITASCA™ Denver, Inc.

Predicted Mine Inflows

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 16





R2/R3

R65

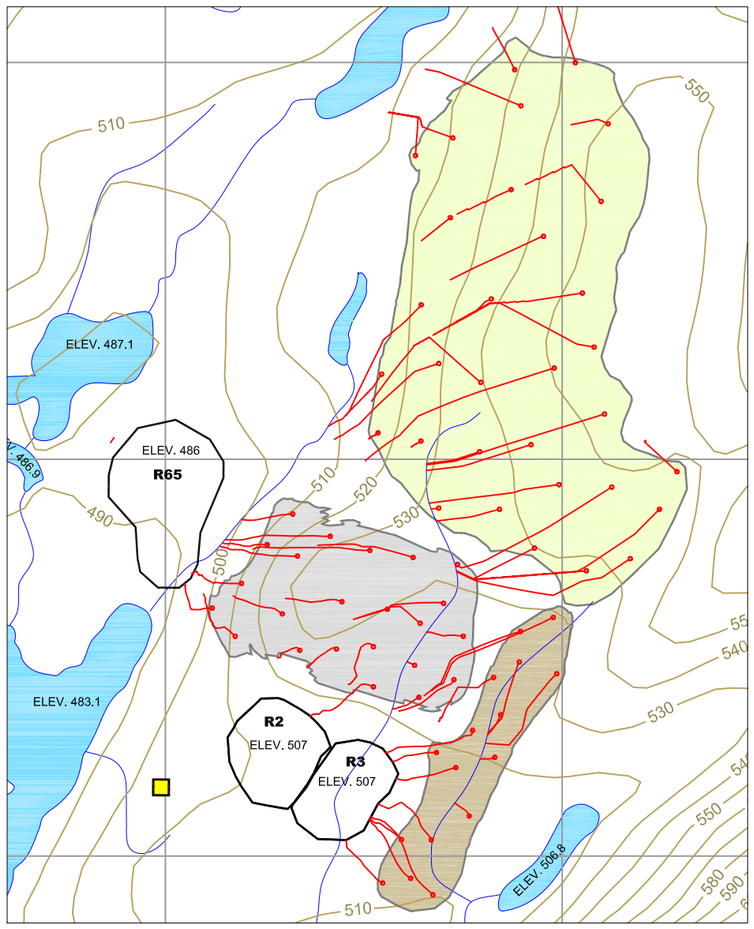
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	SIM–PIT–WLS
DRAWING DATE	7 OCT 2011
REVISION DATE	15 NOV 2011

ITASCA™ Denver, Inc.

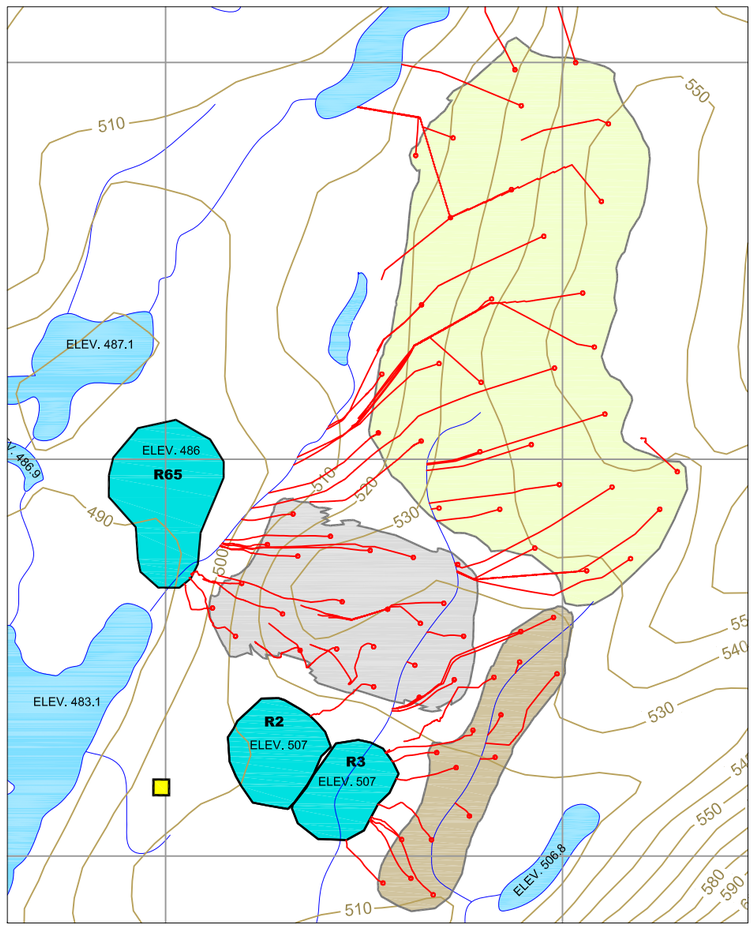
Simulated Pit Water Levels
Over Time for Three Model Scenarios

CLIENT: Stornoway Diamond Corporation

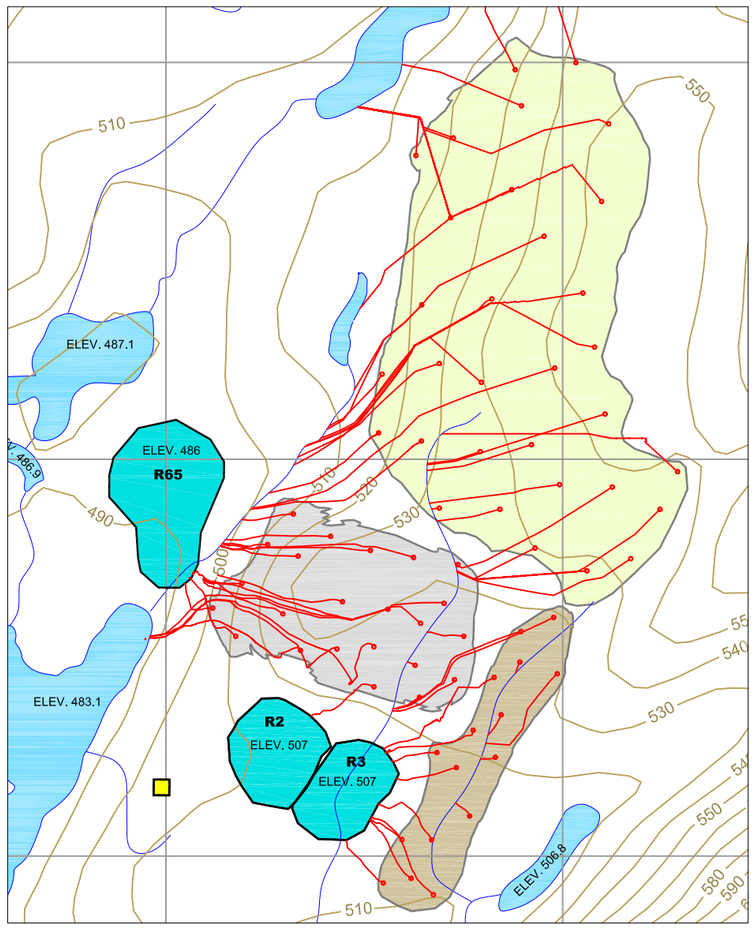
FIGURE NO. 17



a) End of Mining



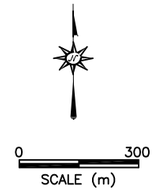
b) End of Pit Reflooding



c) Under Steady-State Conditions

EXPLANATION

- APPROXIMATE OUTLINE OF ULTIMATE PIT
- PARTICLE TRACK (DOT INDICATES POINT OF ORIGIN)
- PROPOSED SHAFT
- TOPOGRAPHIC CONTOUR (mamsl)
- PKC
- WASTE PILE
- OVERBURDEN PILE
- ELEV. 506.8 — LAKE - ELEVATION (mamsl)
- ELEV. 486 — INFILLED PIT LAKE SHOWING FINAL ELEVATION (mamsl)



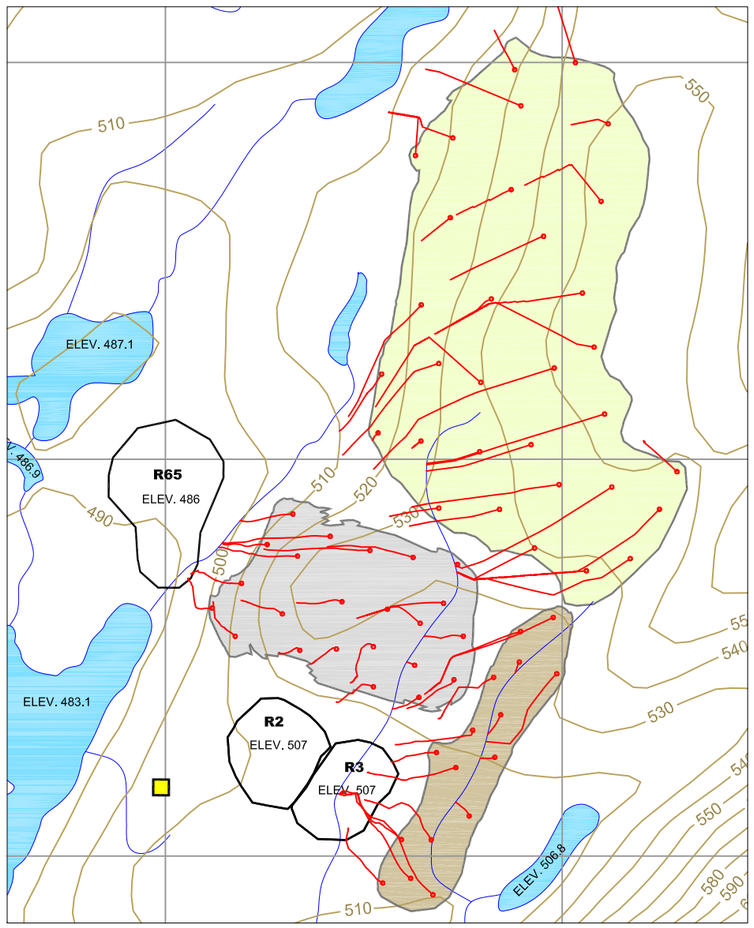
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	PART-TRACK-BASECASE
DRAWING DATE	7 OCT 2011
REVISION DATE	--

ITASCA™ Denver, Inc.

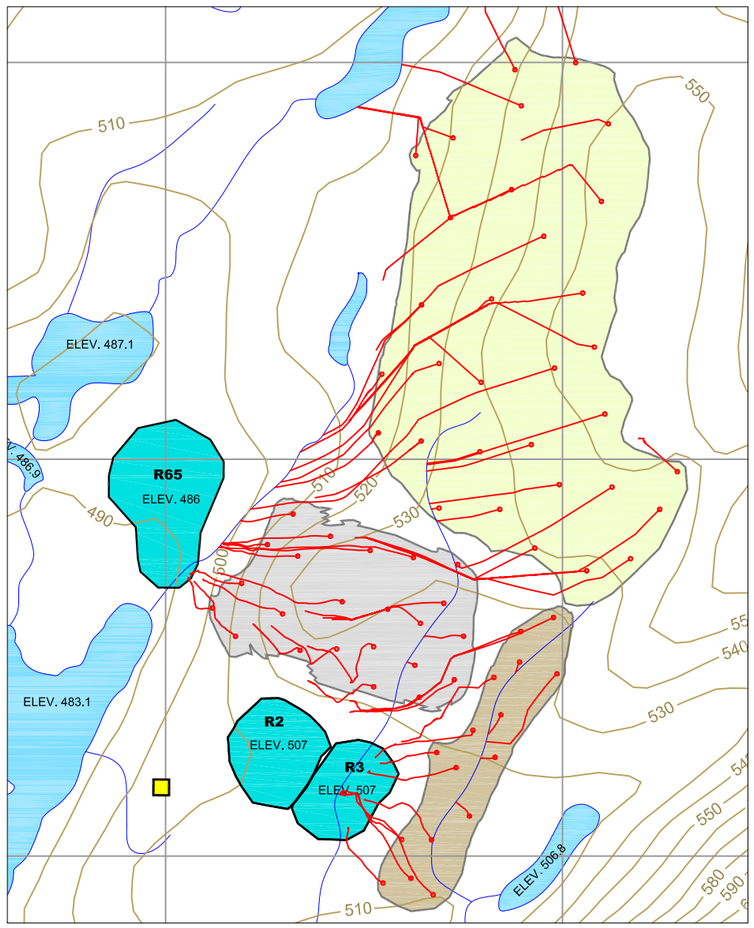
Simulated Particle Tracks for the Base Case

CLIENT: Stornoway Diamond Corporation

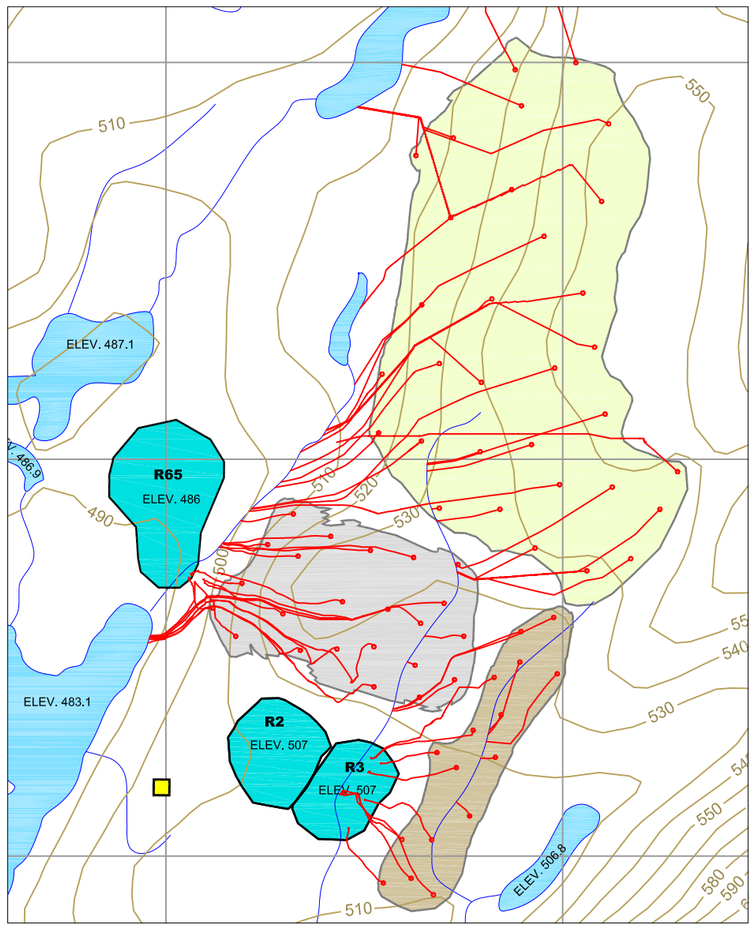
FIGURE NO. 18



a) End of Mining



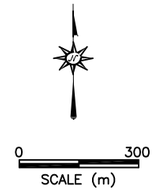
b) End of Pit Reflooding



c) Under Steady-State Conditions

EXPLANATION

- APPROXIMATE OUTLINE OF ULTIMATE PIT
- PARTICLE TRACK (DOT INDICATES POINT OF ORIGIN)
- PROPOSED SHAFT
- TOPOGRAPHIC CONTOUR (mamsl)
- PKC
- WASTE PILE
- OVERBURDEN PILE
- ELEV. 506.8 — LAKE - ELEVATION (mamsl)
- ELEV. 486 — INFILLED PIT LAKE SHOWING FINAL ELEVATION (mamsl)



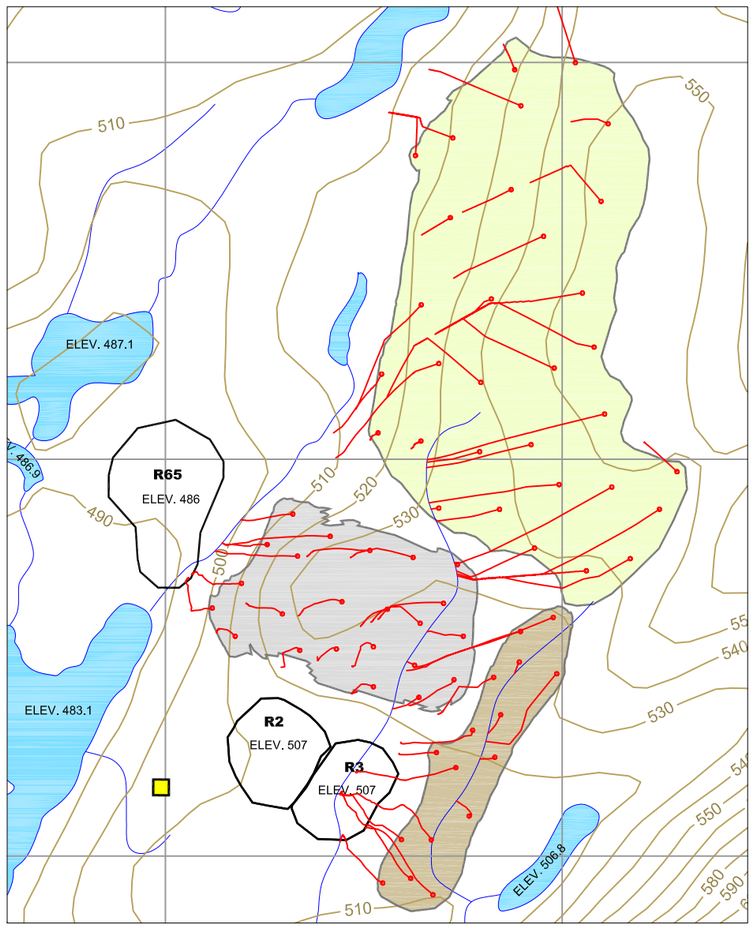
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	PART–TRACK–LOWER–SY
DRAWING DATE	7 OCT 2011
REVISION DATE	--

ITASCA™ Denver, Inc.

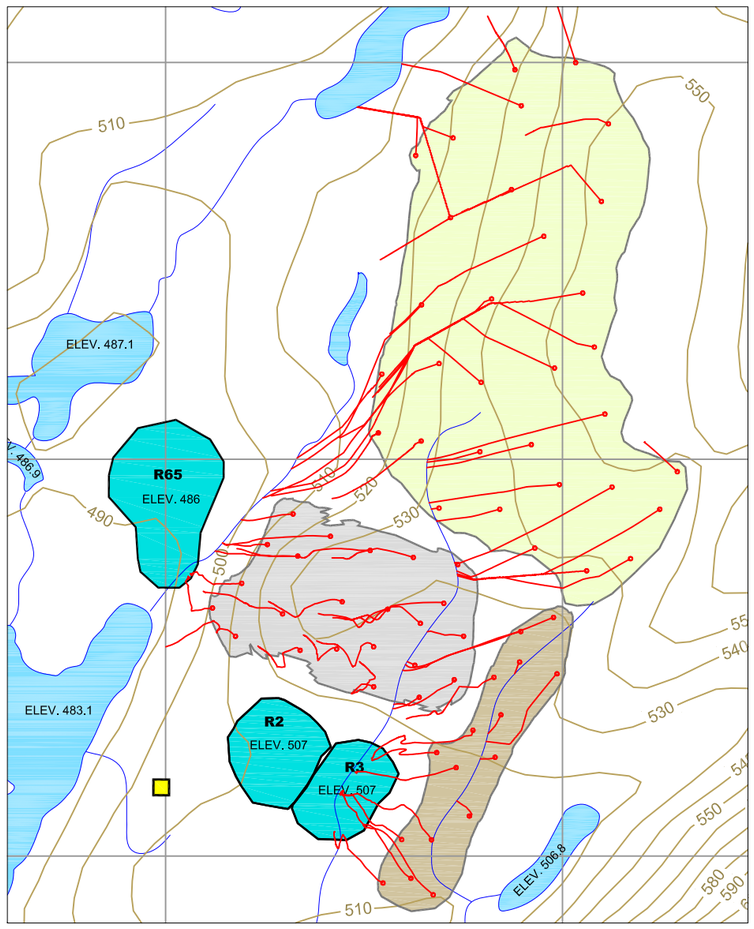
Simulated Particle Tracks
Assuming Lower Specific Yield

CLIENT: Stornoway Diamond Corporation

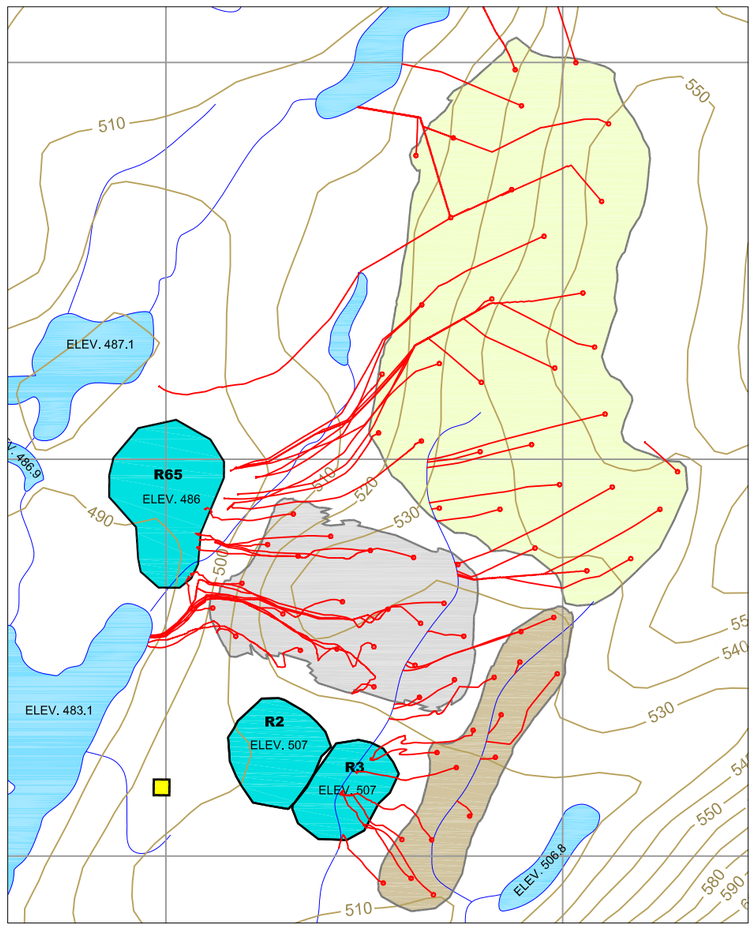
FIGURE NO. 19



a) End of Mining



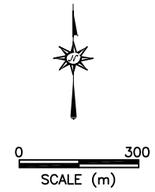
b) End of Pit Reflooding



c) Under Steady-State Conditions

EXPLANATION

- APPROXIMATE OUTLINE OF ULTIMATE PIT
- PARTICLE TRACK (DOT INDICATES POINT OF ORIGIN)
- PROPOSED SHAFT
- TOPOGRAPHIC CONTOUR (mamsl)
- PKC
- WASTE PILE
- OVERBURDEN PILE
- ELEV. 506.8 — LAKE - ELEVATION (mamsl)
- ELEV. 486 — INFILLED PIT LAKE SHOWING FINAL ELEVATION (mamsl)



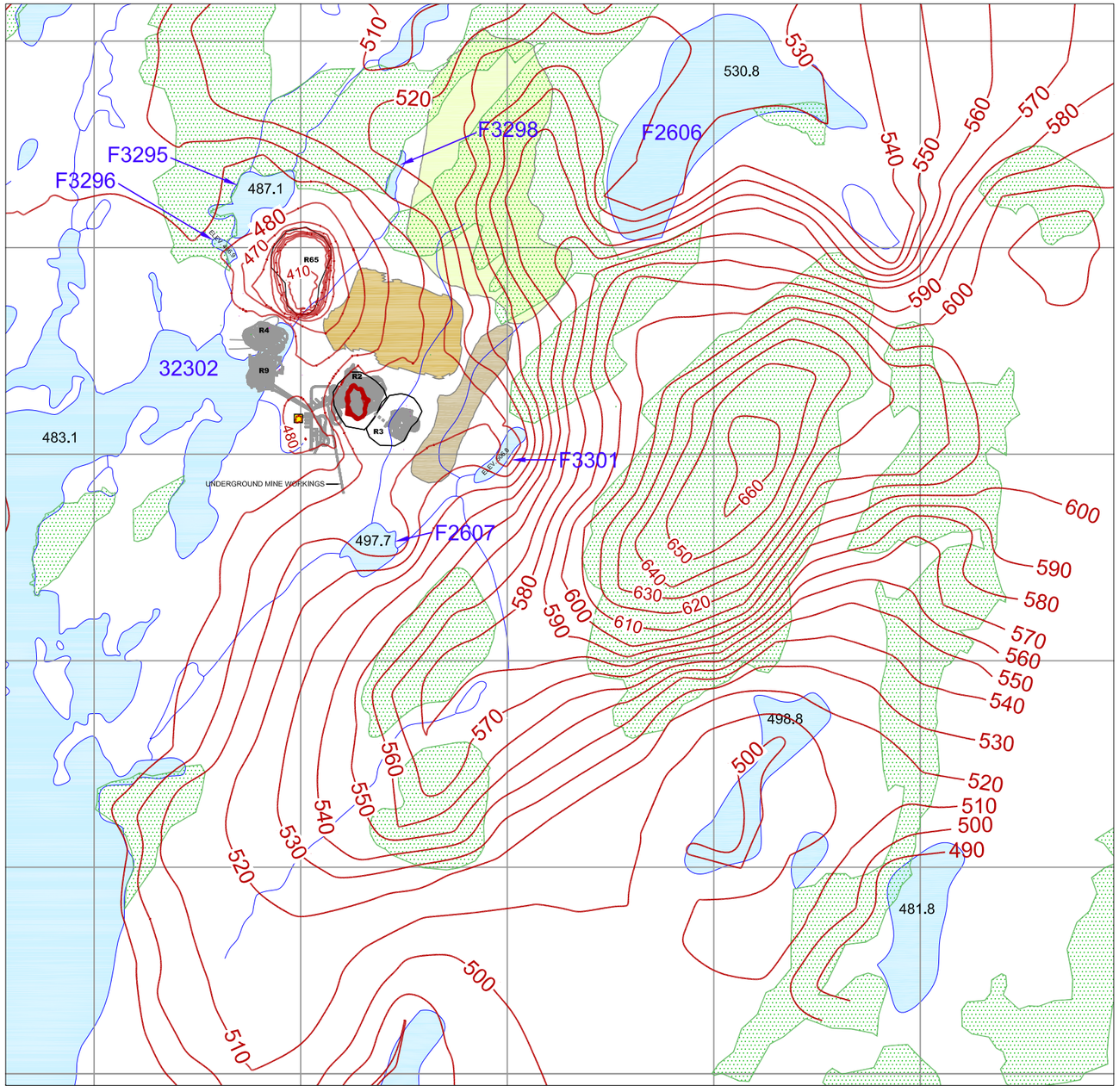
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	PART-TRACK-ISOTROPIC
DRAWING DATE	7 OCT 2011
REVISION DATE	--

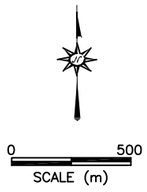
ITASCA™ Denver, Inc.

Simulated Particle Tracks
Assuming Isotropic Country Rock

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 20





EXPLANATION

- POTENTIOMETRIC CONTOUR (mamsl)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

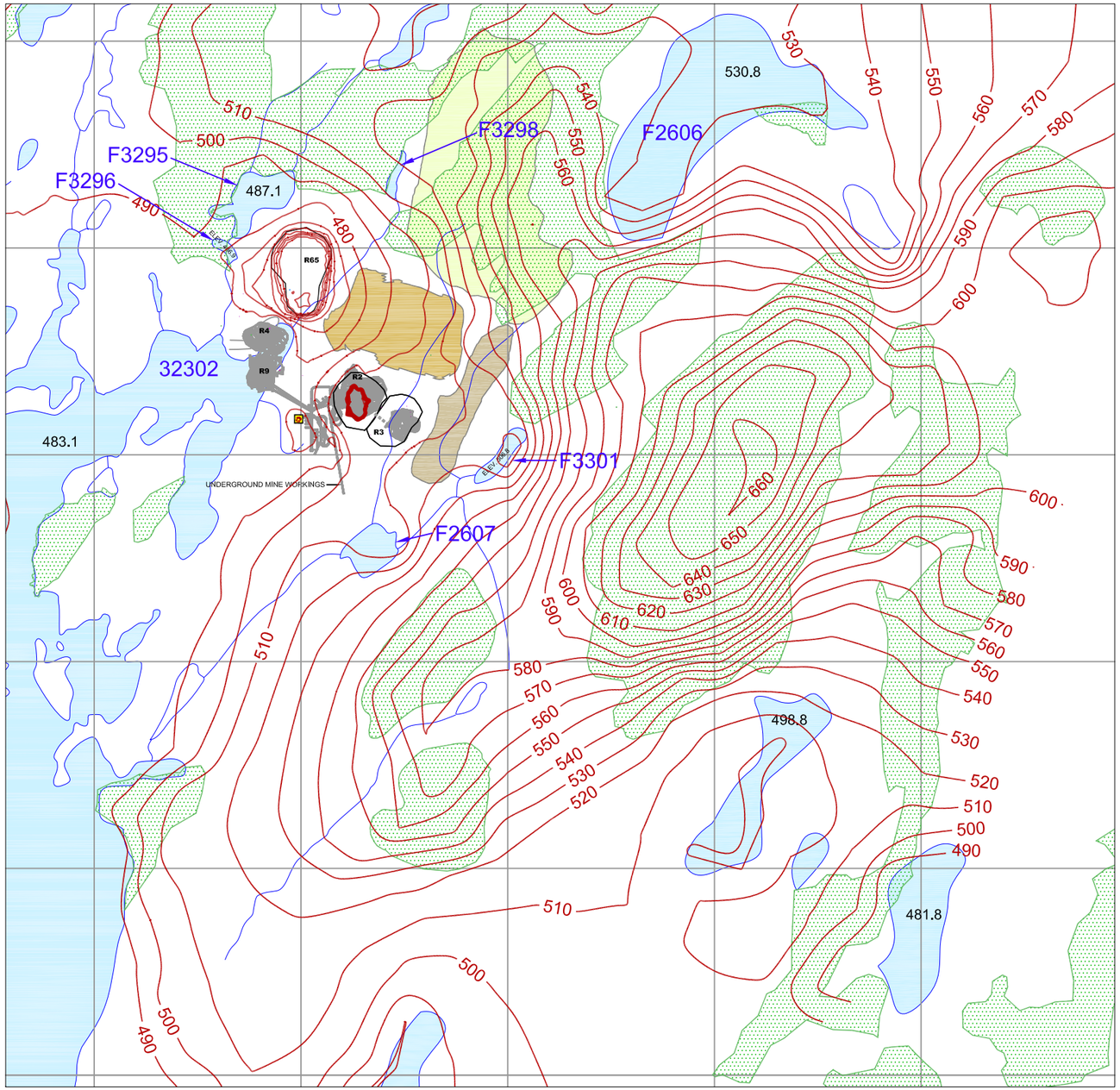
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	POT-CONTOURS-EOM-BC
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

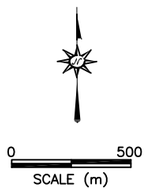
ITASCA™ Denver, Inc.

Potentiometric Contours at End of Mining for Base Case

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 21





EXPLANATION

- POTENTIOMETRIC CONTOUR (mamsl)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

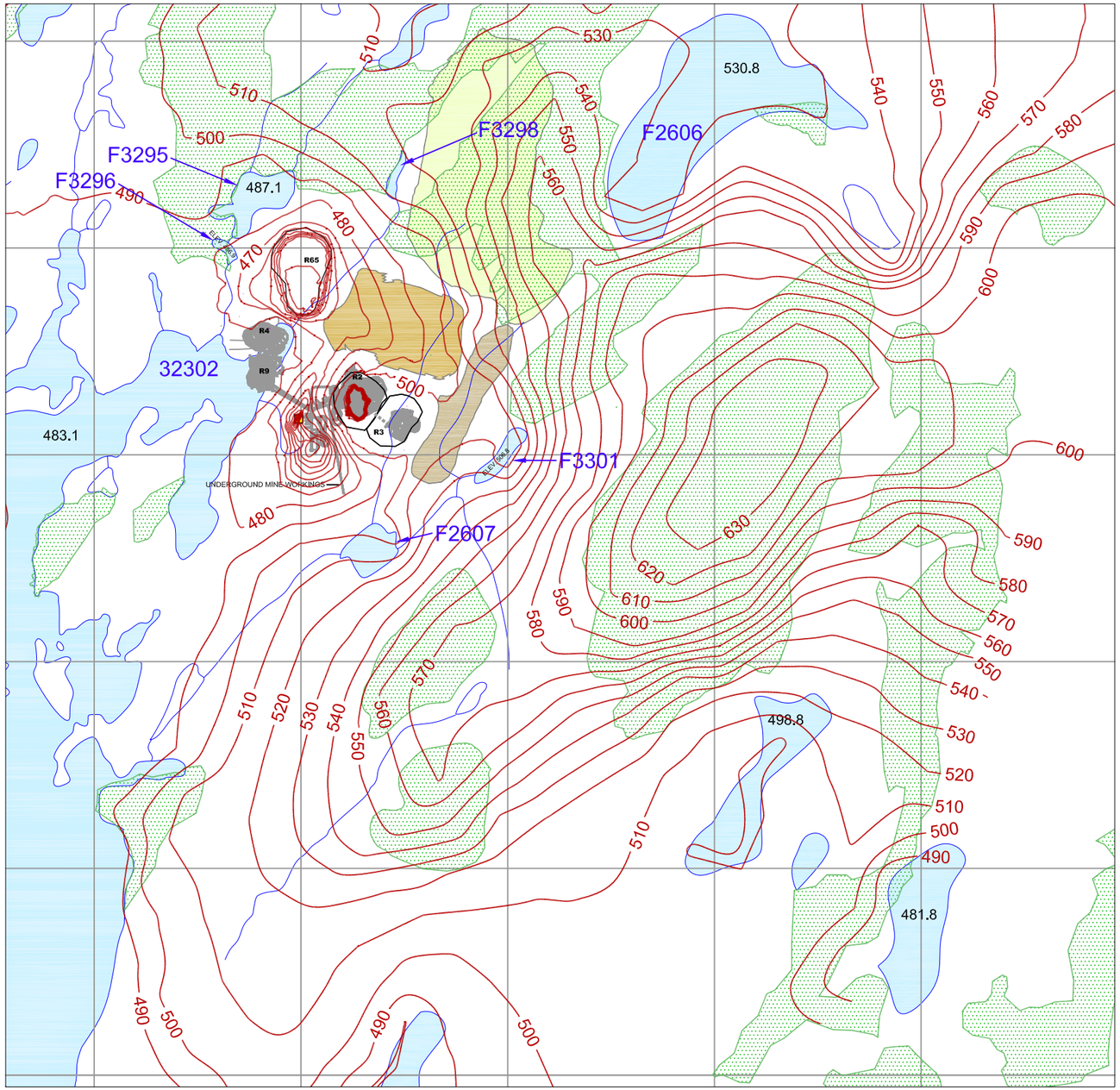
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	POT-CONTOURS-LOWER-SY
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

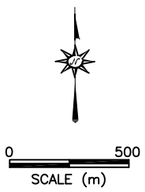
ITASCA™ Denver, Inc.

Potentiometric Contours at End of Mining Assuming Lower Specific Yield

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 22





EXPLANATION

- POTENTIOMETRIC CONTOUR (mamsl)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

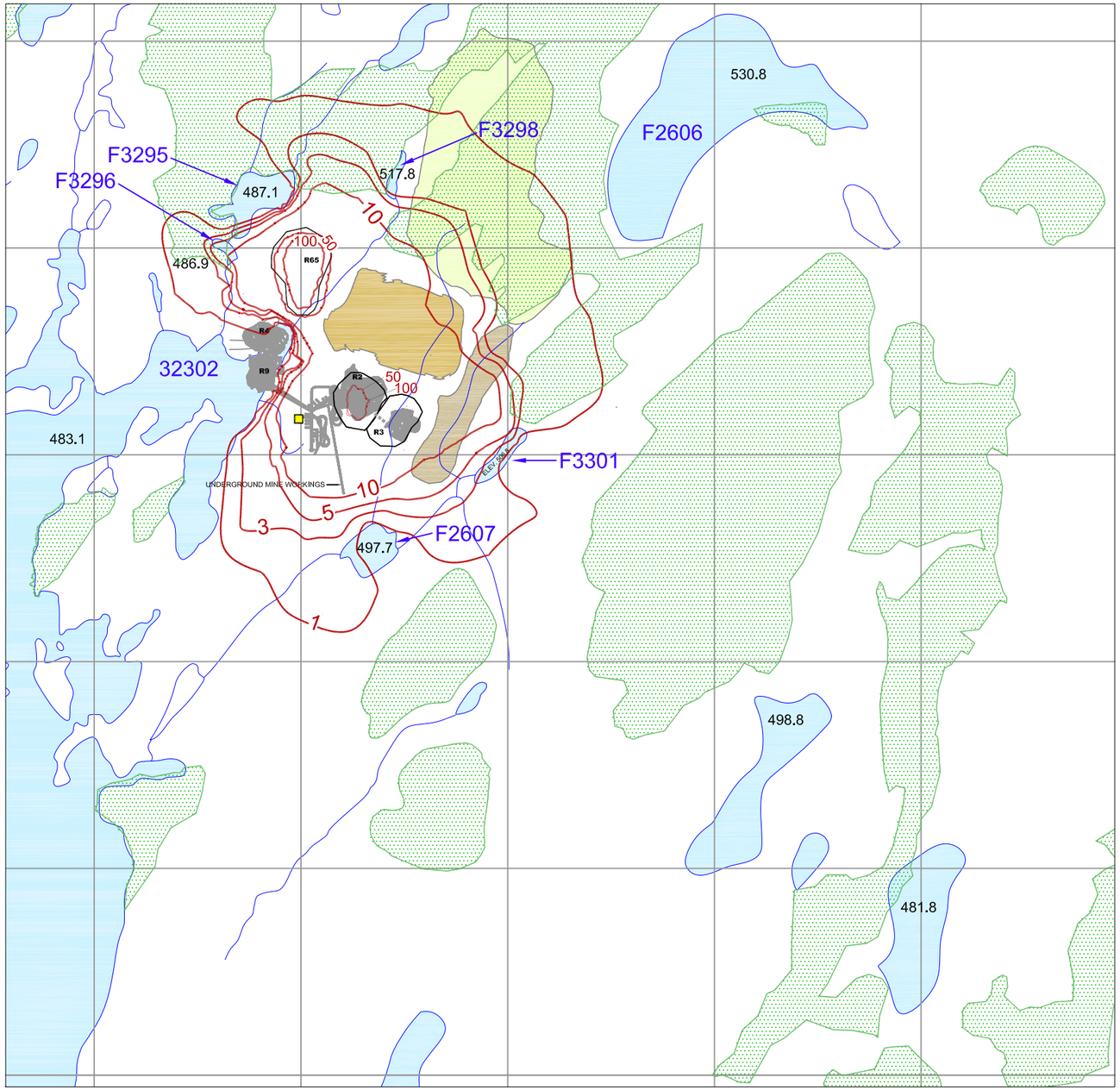
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	POT-CONTOURS-ISOTROPIC
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

ITASCA™ Denver, Inc.

Potentiometric Contours at End of Mining Assuming Isotropic Country Rock

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 23



EXPLANATION

- DRAWDOWN CONTOUR (m)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

0 500
SCALE (m)

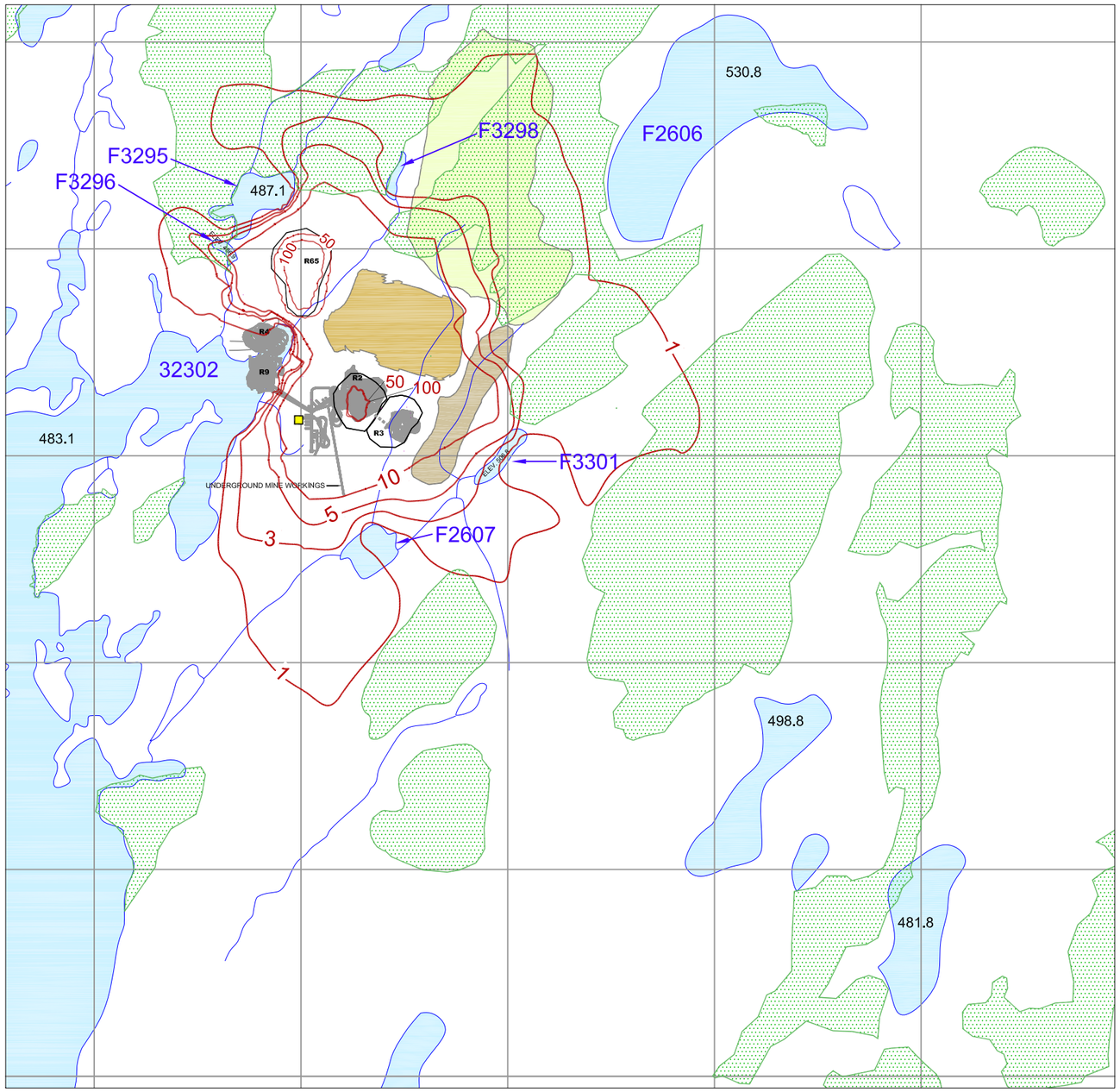
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	BASECASE–MINING
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

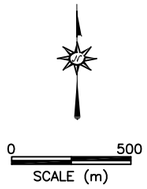
ITASCA™ Denver, Inc.

Drawdown Contours at End of Mining for Base Case

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 24





EXPLANATION

- DRAWDOWN CONTOUR (m)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

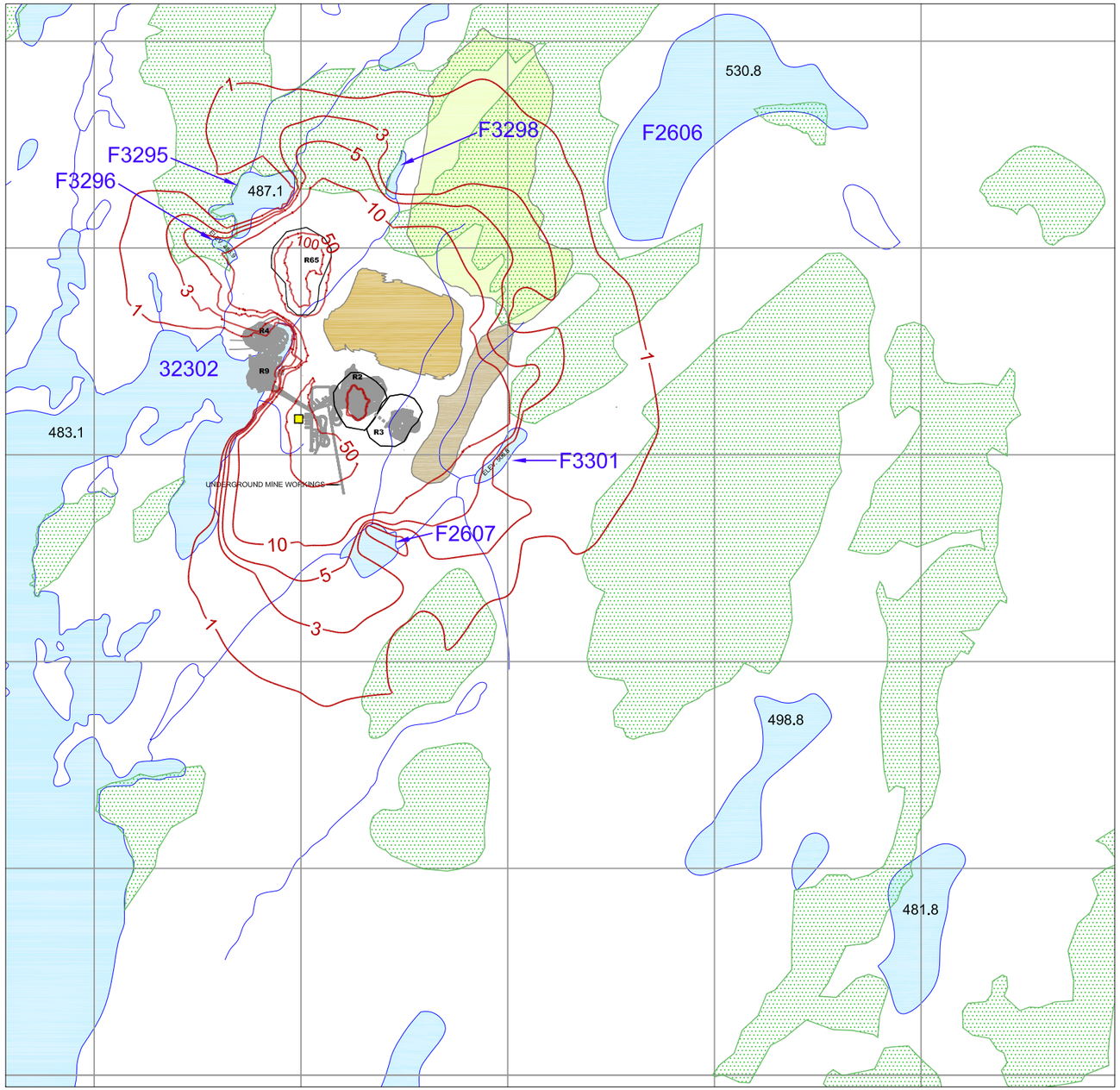
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	SY–MINING
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

ITASCA™ Denver, Inc.

Drawdown Contours at End of Mining Assuming Lower Specific Yield

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 25



EXPLANATION

- DRAWDOWN CONTOUR (m)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

0 500
SCALE (m)

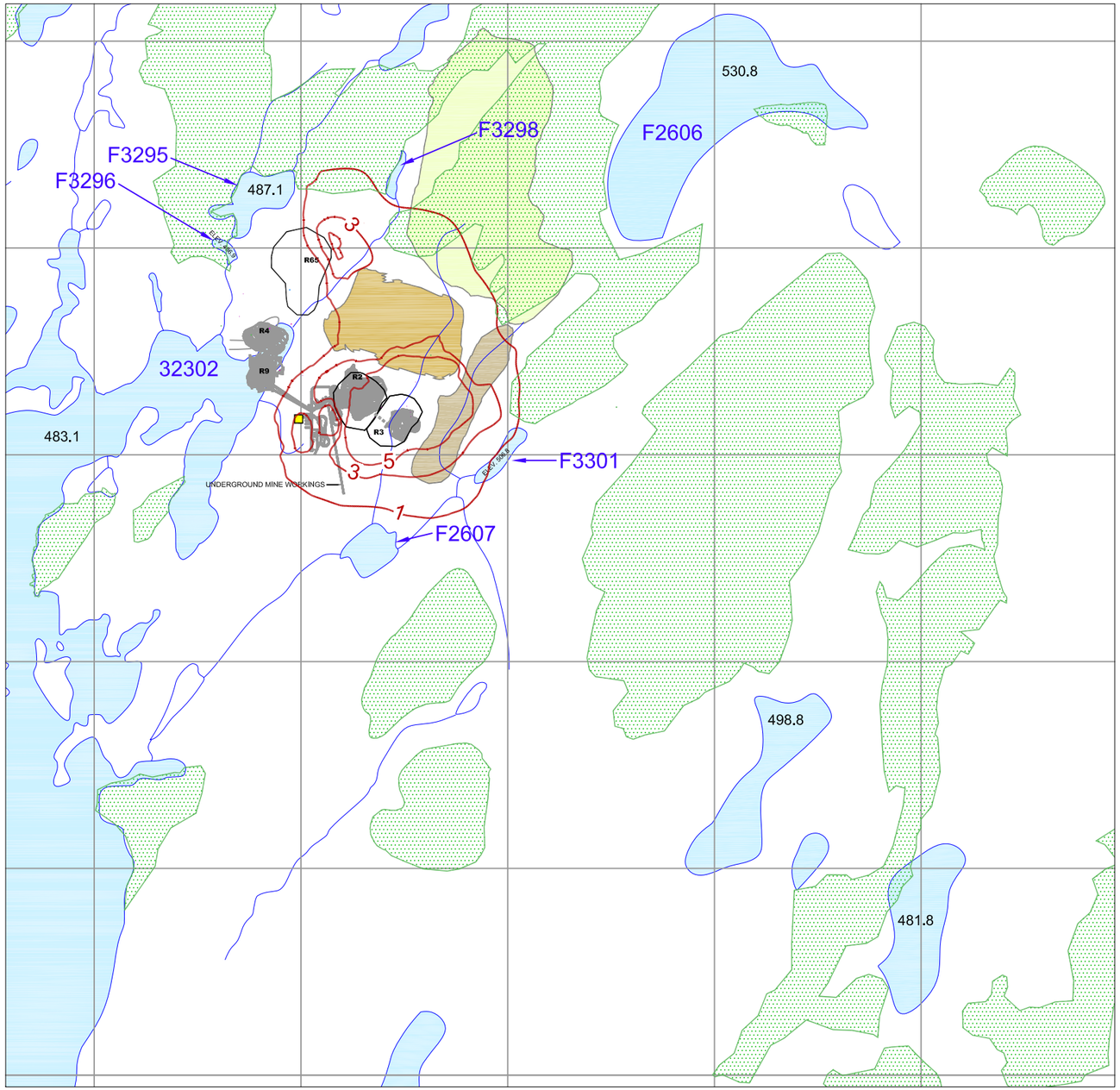
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	DD-EOM-ISOTROPIC
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

ITASCA™ Denver, Inc.

Drawdown Contours at End of Mining Assuming Isotropic Country Rock

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 26



EXPLANATION

- DRAWDOWN CONTOUR (m)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

0 500
SCALE (m)

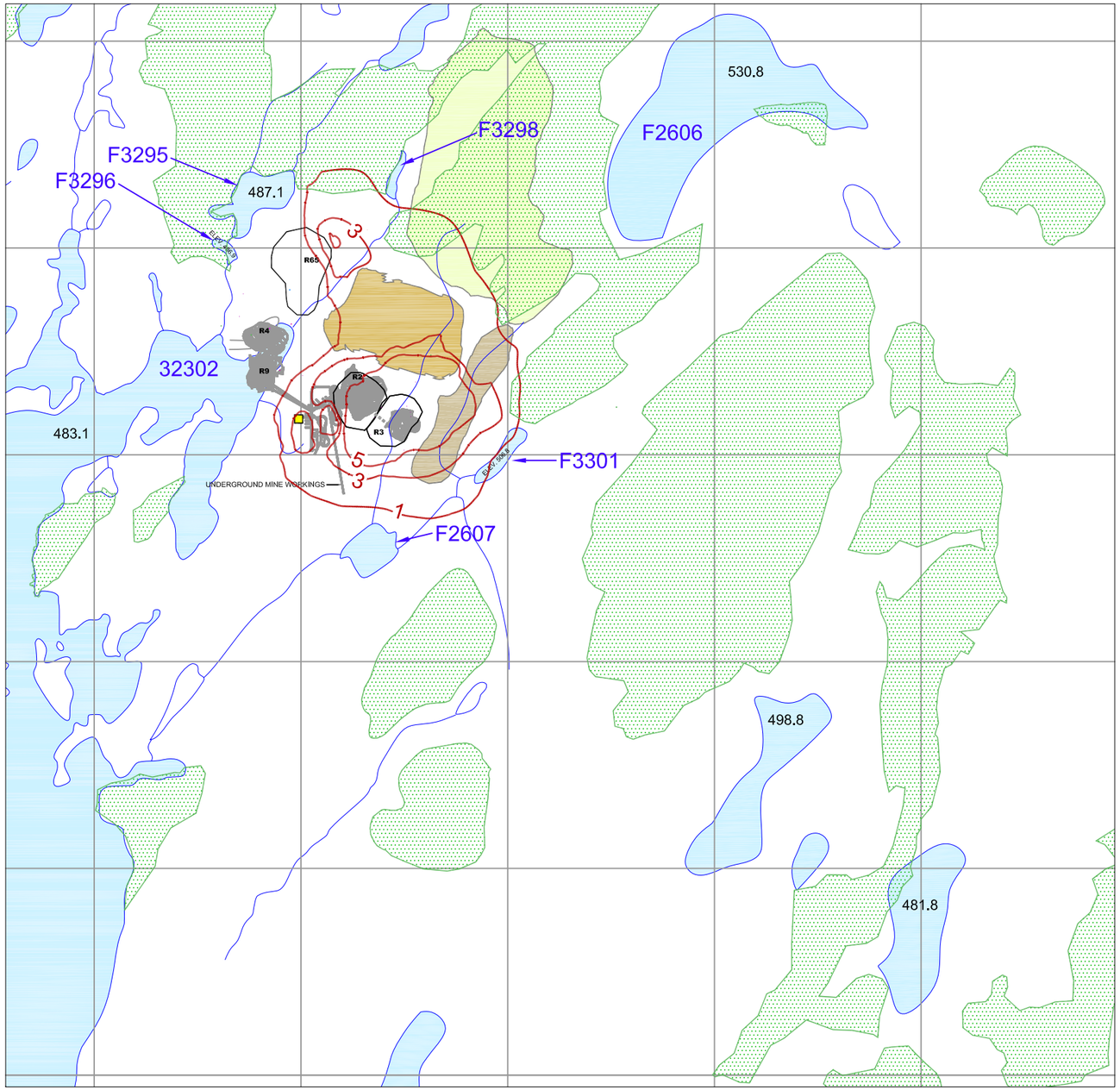
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	BASECASE–FINAL
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

ITASCA™ Denver, Inc.

Drawdown Contours under Steady-State Conditions Post Pit Reflooding for Base Case

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 27



EXPLANATION

- DRAWDOWN CONTOUR (m)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

0 500
SCALE (m)

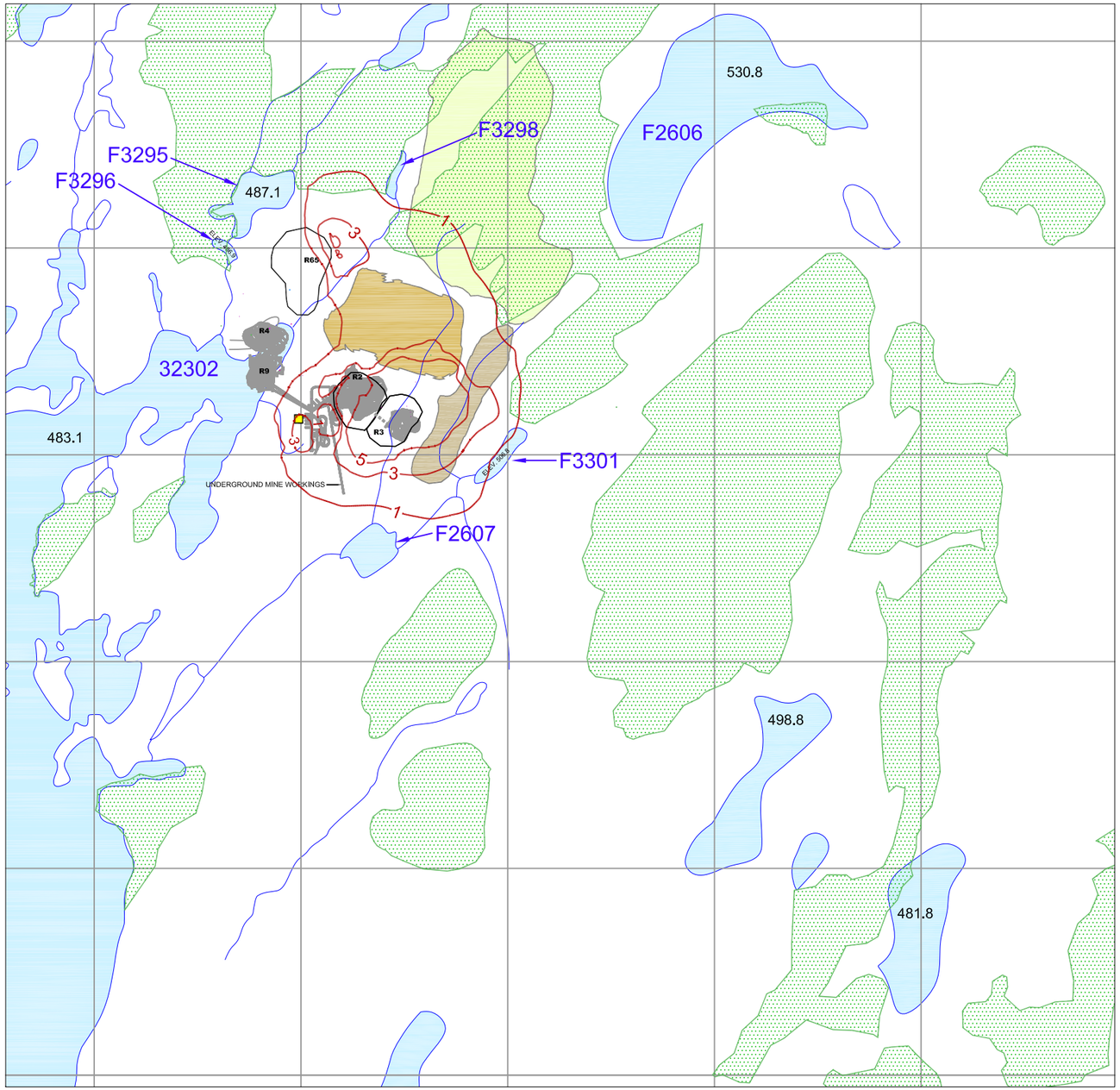
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	SY–FINAL
DRAWING DATE	6 OCT 2011
REVISION DATE	25 OCT 2011

ITASCA™ Denver, Inc.

Drawdown Contours under Steady-State Conditions Post Pit Reflooding Assuming Lower Specific Yield

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 28



EXPLANATION

- DRAWDOWN CONTOUR (m)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- PKC
- WASTE PILE
- OVERBURDEN PILE
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

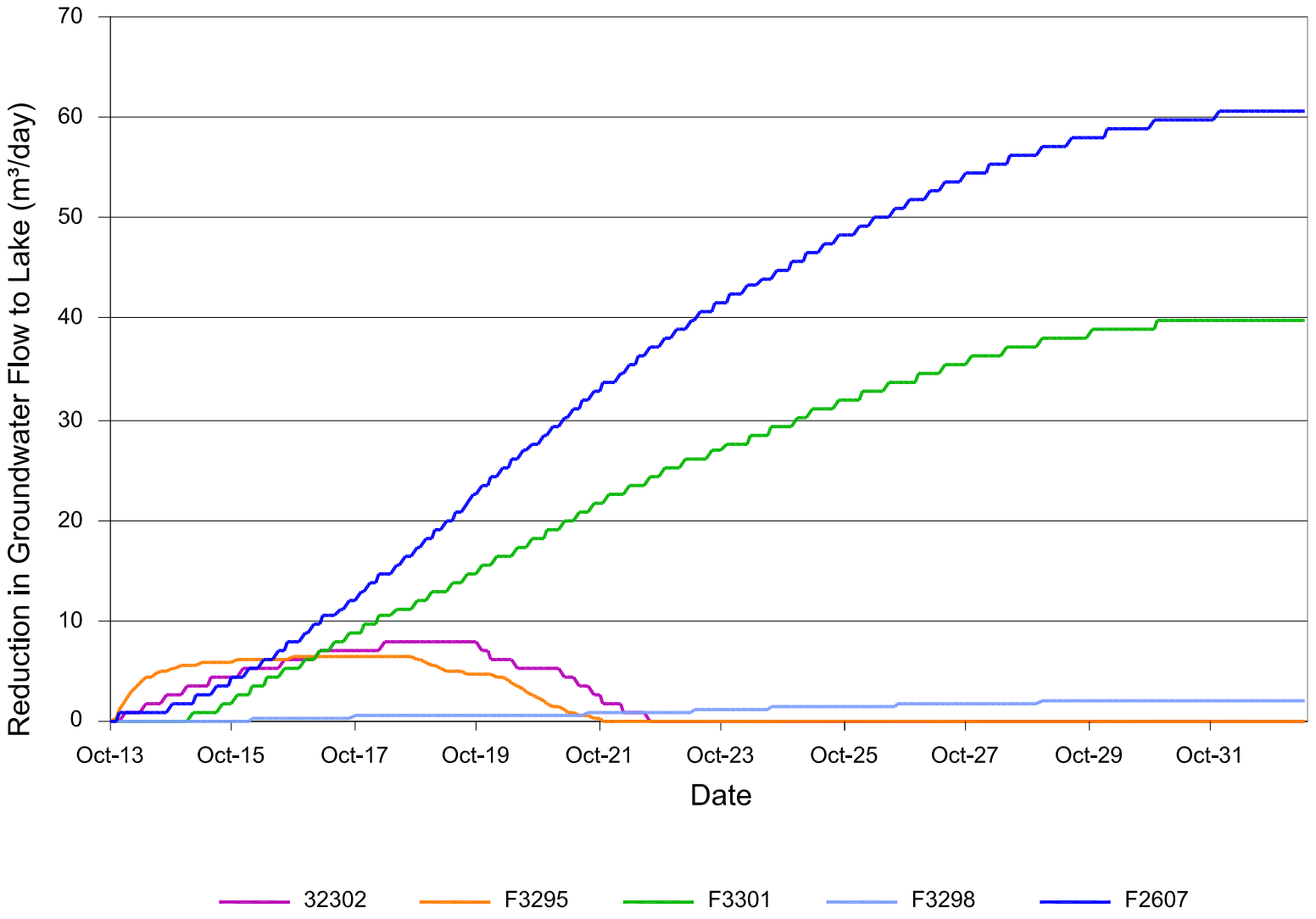
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	DD-SS-ISOTROPIC
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

ITASCA™ Denver, Inc.

Drawdown Contours under Steady-State Conditions Post Pit Reflooding Assuming Isotropic Country Rock

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 29



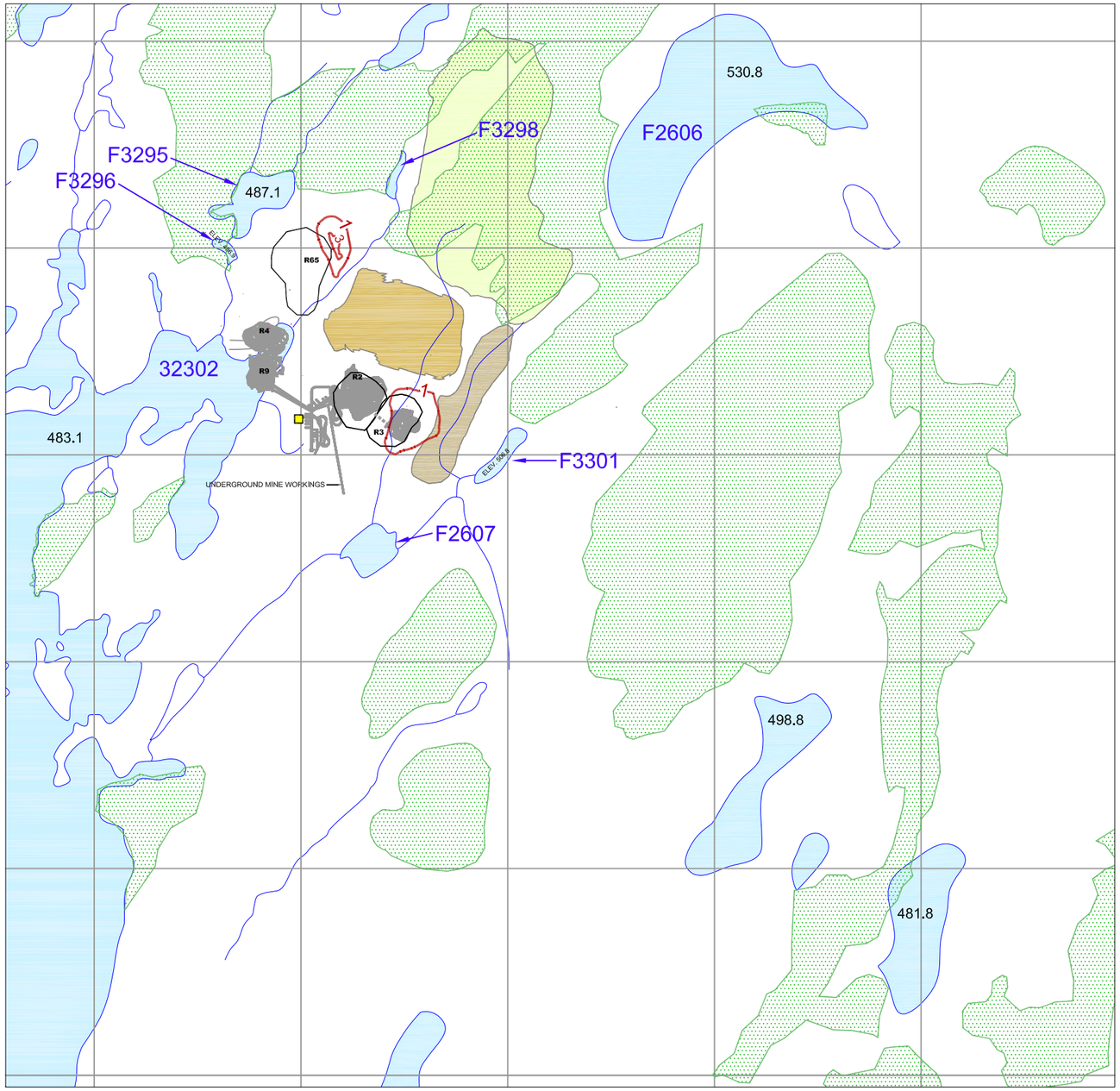
PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	SELECTED–LAKES
DRAWING DATE	7 OCT 2011
REVISION DATE	25 OCT 2011

ITASCA™
Denver, Inc.

Predicted Reduction in Base Flows for Selected Lakes during Mine Operation for Base Case

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 30



EXPLANATION

- DRAWDOWN CONTOUR (m)
- APPROXIMATE OUTLINE OF ULTIMATE PIT
- UNDERGROUND MINE WORKINGS
- PROPOSED SHAFT
- BEDROCK OUTCROP
- 506.8 — LAKE - ELEVATION IN mamsl
- F3301 — LAKE ID

SIMULATED ENHANCED RECHARGE (mm/yr)

PKC	280
WASTE PILE	320
OVERBURDEN PILE	200

0 500
SCALE (m)

PROJECT NO.	1927
BY	JX
CHECKED	HL
DRAWN	SAC
DRAWING NAME	RECHARGE–FINAL
DRAWING DATE	1 NOV 2011
REVISION DATE	--

ITASCA™ Denver, Inc.

Drawdown Contours under Steady-State Conditions Post Pit Reflooding for Base Case with Enhanced Recharge in Storage Facilities

CLIENT: Stornoway Diamond Corporation

FIGURE NO. 31

TABLE 1

Hydrologic Parameters of Geologic Units in Groundwater Model

Formation/Unit		Hydraulic Conductivities (m/s)		Specific Storage (m^{-1})	Specific Yield ( )
		K_x , K_y	K_z		
Overburden		4.6×10^{-6}	2.3×10^{-6}	5.0×10^{-6}	0.2
Permeable Country Rock		1.0×10^{-7}	1.0×10^{-7}	5.0×10^{-6}	0.05
Country Rock	Upper	2.0×10^{-8}	1.0×10^{-9}	5.0×10^{-6}	NA
	Lower	1.0×10^{-8}	2.0×10^{-9}		
Brecciated Country Rock	Upper	1.0×10^{-7}	2.0×10^{-8}		
	Lower	2.0×10^{-8}	4.0×10^{-9}		
Cracked Country Rock	Upper	1.0×10^{-7}	2.0×10^{-8}		
	Lower	4.0×10^{-8}	8.0×10^{-9}		
Kimberlite	Upper	6.0×10^{-8}	1.2×10^{-8}		
	Lower	1.0×10^{-8}	2.0×10^{-9}		
Kimberlite Pipe	Upper	4.0×10^{-8}	8.0×10^{-9}		
	Lower	1.0×10^{-8}	2.0×10^{-9}		
Dyke		5.0×10^{-8}	1.0×10^{-8}		
Breakthrough Kimberlite/Waste Rock		5.8×10^{-5}	1.2×10^{-5}		
Zone of Relaxation		9.8×10^{-8}	4.9×10^{-9}		
Cracked Zone		4.1×10^{-8}	2.0×10^{-9}		

TABLE 2

Mining Schedule for Open Pits

Pit	Start Time	End Time	Elevation of Pit Bottom at End Time (mamsl)
R2-R3	Mar 2014	Dec 2014	498
	Jan 2015	Dec 2015	458
	Jan 2016	Dec 2016	403
R65	Oct 2013	Dec 2013	458
	Jan 2016	Dec 2016	458
	Jan 2017	Dec 2017	458
	Jan 2018	Dec 2018	458
	Jan 2019	Dec 2019	458
	Jan 2020	Dec 2020	458
	Jan 2021	Dec 2021	458
	Jan 2022	Dec 2022	458
	Jan 2023	Dec 2023	448
	Jan 2024	Dec 2024	448
	Jan 2025	Dec 2025	438
	Jan 2026	Dec 2026	428
	Jan 2027	Dec 2027	418
	Jan 2028	Dec 2028	418
	Jan 2029	Dec 2029	408
	Jan 2030	Dec 2030	398
	Jan 2031	Dec 2031	378

TABLE 3

Mining Schedule for Underground Mining

Underground Mine	Start Time	Breakthrough Time	Elevation of Drawpoint Level (mamsl)
R2 Upper	Sept 2016	Sept 2017	260
R2 Middle	Dec 2017	Dec 2019	80
R2 Lower 1	Dec 2019	Dec 2022	-100
R2 Lower2	Dec 2023	May 2025	-200
R3 Upper	Nov 2018	Jan 2020	260
R3 Middle	Dec 2022	Dec 2022	80
R4 Middle	Dec 2025	May 2033 (End Time)	95

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TABLE 4

Predicted Inflow Rate for the Base Case Scenario
(Page 1 of 6)

Month Since October 2013	Predicted Inflow Rate (m^3/day)							
	Ramp	Shaft	R2/R3 Pit	R2 U/G	R3 U/G	R65 Pit	R4 U/G	Total
1	52.1	21.8	129.6	0.0	0.0	717.1	0.0	920.6
2	93.3	47.0	121.0	0.0	0.0	1658.9	0.0	1920.2
3	133.1	46.6	112.3	0.0	0.0	2047.7	0.0	2339.6
4	163.3	60.3	112.3	0.0	0.0	1218.2	0.0	1554.2
5	196.1	67.4	103.7	0.0	0.0	1209.6	0.0	1576.8
6	201.3	62.0	613.4	0.0	0.0	1157.8	0.0	2034.5
7	203.9	99.4	1805.8	0.0	0.0	1114.6	0.0	3223.6
8	219.5	108.9	2272.3	0.0	0.0	1088.6	0.0	3689.3
9	220.3	102.0	2445.1	0.0	0.0	1062.7	0.0	3830.1
10	222.0	127.9	2531.5	0.0	0.0	1036.8	0.0	3918.2
11	235.0	164.2	2609.3	0.0	0.0	1019.5	0.0	4028.0
12	236.7	145.2	2687.0	0.0	0.0	1002.2	0.0	4071.2
13	270.4	137.4	2747.5	0.0	0.0	993.6	0.0	4148.9
14	286.8	162.4	2773.4	0.0	0.0	976.3	0.0	4199.0
15	289.4	149.5	2782.1	0.0	0.0	967.7	0.0	4188.7
16	292.9	169.3	2108.2	0.0	0.0	959.0	0.0	3529.4
17	288.6	214.3	2065.0	0.0	0.0	950.4	0.0	3518.2
18	281.7	295.5	2073.6	0.0	0.0	941.8	0.0	3592.5
19	303.3	264.4	2047.7	0.0	0.0	933.1	0.0	3548.4
20	311.0	254.9	2039.0	0.0	0.0	924.5	0.0	3529.4
21	311.9	375.8	2013.1	0.0	0.0	924.5	0.0	3625.3
22	308.4	338.7	1969.9	0.0	0.0	915.8	0.0	3532.9
23	318.0	321.4	1909.4	0.0	0.0	907.2	0.0	3456.0
24	318.0	432.0	1849.0	0.0	0.0	907.2	0.0	3506.1
25	311.9	402.6	1788.5	0.0	0.0	898.6	0.0	3401.6
26	321.4	393.1	1771.2	0.0	0.0	898.6	0.0	3384.3
27	323.1	387.9	1745.3	0.0	0.0	889.9	0.0	3346.3
28	322.3	510.6	1157.8	0.0	0.0	889.9	0.0	2880.6
29	421.6	447.6	1131.8	0.0	0.0	864.0	0.0	2865.0
30	421.6	424.2	1123.2	0.0	0.0	889.9	0.0	2859.0
31	454.5	409.5	1080.0	0.0	0.0	889.9	0.0	2833.9
32	468.3	400.0	1028.2	0.0	0.0	907.2	0.0	2803.7
33	509.8	391.4	993.6	0.0	0.0	915.8	0.0	2810.6
34	517.5	381.0	967.7	0.0	0.0	933.1	0.0	2799.4
35	508.0	373.2	941.8	0.0	0.0	950.4	0.0	2773.4
36	482.1	365.5	889.9	451.5	0.0	967.7	0.0	3156.7
37	459.6	359.4	872.6	303.3	0.0	985.0	0.0	2979.9
38	438.9	354.2	812.2	419.9	0.0	993.6	0.0	3018.8
39	429.4	351.6	829.4	254.0	0.0	1010.9	0.0	2875.4
40	417.3	348.2	518.4	407.8	0.0	967.7	0.0	2659.4
41	412.1	344.7	527.0	253.2	0.0	959.0	0.0	2496.1
42	402.6	342.1	457.9	430.3	0.0	941.8	0.0	2574.7
43	398.3	339.6	457.9	304.1	0.0	933.1	0.0	2433.0
44	393.1	337.0	432.0	343.0	0.0	924.5	0.0	2429.6

ITASCA Denver, Inc.

TABLE 4

Predicted Inflow Rate for the Base Case Scenario
(Page 2 of 6)

Month Since October 2013	Predicted Inflow Rate (m^3/day)							
	Ramp	Shaft	R2/R3 Pit	R2 U/G	R3 U/G	R65 Pit	R4 U/G	Total
45	389.7	335.2	423.4	310.2	0.0	924.5	0.0	2382.9
46	385.3	333.5	397.4	347.3	0.0	915.8	0.0	2379.5
47	381.9	331.8	388.8	347.3	0.0	907.2	0.0	2357.0
48	379.3	330.0	380.2	344.7	0.0	907.2	0.0	2341.4
49	376.7	328.3	371.5	348.2	0.0	907.2	0.0	2331.9
50	374.1	326.6	362.9	346.5	0.0	933.1	0.0	2343.2
51	359.4	324.0	362.9	707.0	0.0	1002.2	0.0	2755.6
52	505.4	297.2	354.2	671.3	0.0	976.3	0.0	2804.5
53	556.4	276.5	354.2	613.4	0.0	1002.2	0.0	2802.8
54	624.7	260.1	345.6	576.3	0.0	1028.2	0.0	2834.8
55	691.2	240.2	345.6	559.0	0.0	1054.1	0.0	2890.1
56	641.1	226.4	319.7	488.2	0.0	1097.3	0.0	2772.6
57	650.6	209.1	337.0	473.5	0.0	1131.8	0.0	2802.0
58	681.7	195.3	337.0	458.8	0.0	1175.0	0.0	2847.7
59	673.1	190.9	345.6	857.1	0.0	1226.9	0.0	3293.6
60	642.8	189.2	345.6	545.2	0.0	1261.4	0.0	2984.3
61	628.1	188.4	354.2	534.0	0.0	1330.6	0.0	3035.2
62	616.9	186.6	345.6	502.8	0.0	1425.6	260.1	3337.6
63	607.4	185.8	345.6	484.7	0.0	1494.7	60.3	3178.5
64	599.6	184.9	337.0	456.2	0.0	1304.6	121.8	3004.1
65	593.6	184.0	345.6	446.7	0.0	1244.2	71.3	2885.3
66	586.7	183.2	345.6	431.1	0.0	1218.2	71.1	2835.9
67	580.6	182.3	328.3	560.7	0.0	1201.0	130.5	2983.4
68	574.6	181.4	337.0	454.5	0.0	1192.3	77.7	2817.4
69	569.4	180.6	302.4	446.7	0.0	1192.3	190.9	2882.3
70	564.2	179.7	319.7	435.5	0.0	1192.3	114.9	2806.3
71	559.0	179.7	319.7	427.7	0.0	1218.2	105.4	2809.7
72	554.7	178.8	267.8	416.4	0.0	1270.1	171.9	2859.8
73	551.2	178.0	285.1	410.4	0.0	1347.8	142.6	2915.1
74	546.9	177.1	190.1	401.8	0.0	1425.6	213.4	2954.9
75	505.4	177.1	216.0	1737.0	0.0	1512.0	195.3	4342.8
76	476.9	176.3	224.6	1451.5	0.0	1477.4	187.5	3994.3
77	461.4	175.4	172.8	1088.6	0.0	1555.2	241.9	3695.3
78	450.1	174.5	164.2	985.0	0.0	1598.4	245.4	3617.6
79	441.5	173.7	155.5	889.9	0.0	1641.6	241.9	3544.1
80	435.5	172.8	155.5	851.9	0.0	1728.0	240.2	3583.9
81	429.4	172.8	155.5	808.7	0.0	1753.9	239.3	3559.7
82	424.2	171.9	146.9	780.2	0.0	1788.5	238.5	3550.2
83	419.9	171.1	146.9	761.2	0.0	1866.2	237.6	3602.9
84	415.6	170.2	146.9	743.0	0.0	1892.2	236.7	3604.6
85	412.1	169.3	146.9	730.9	0.0	1926.7	236.7	3622.8
86	408.7	168.5	138.2	719.7	0.0	2004.5	235.9	3675.5
87	406.1	168.5	138.2	706.8	0.0	2013.1	235.0	3667.7
88	402.6	167.6	138.2	694.7	0.0	2065.0	234.1	3702.2

ITASCA Denver, Inc.

TABLE 4

Predicted Inflow Rate for the Base Case Scenario
(Page 3 of 6)

Month Since October 2013	Predicted Inflow Rate (m^3/day)							
	Ramp	Shaft	R2/R3 Pit	R2 U/G	R3 U/G	R65 Pit	R4 U/G	Total
89	400.0	166.8	138.2	690.3	0.0	2177.3	234.1	3806.8
90	397.4	166.8	138.2	682.6	0.0	2211.8	233.3	3830.1
91	394.8	165.9	138.2	674.8	0.0	2263.7	233.3	3870.7
92	392.3	165.0	129.6	669.6	0.0	2367.4	232.4	3956.3
93	387.9	165.0	129.6	889.9	0.0	2367.4	231.6	4171.4
94	385.3	164.2	129.6	711.9	0.0	2410.6	231.6	4033.2
95	382.8	164.2	129.6	693.8	0.0	2522.9	230.7	4123.9
96	380.2	163.3	129.6	687.7	0.0	2514.2	230.7	4105.7
97	378.4	162.4	129.6	679.1	0.0	2557.4	229.8	4136.8
98	375.8	162.4	129.6	673.1	0.0	2652.5	229.8	4223.2
99	374.1	161.6	121.0	665.3	0.0	2635.2	229.0	4186.1
100	372.4	161.6	121.0	660.1	0.0	2237.8	229.0	3781.7
101	370.7	161.6	121.0	654.9	0.0	2237.8	229.0	3774.8
102	369.8	160.7	121.0	650.6	0.0	2203.2	228.1	3733.3
103	368.1	160.7	121.0	647.1	0.0	2203.2	228.1	3728.2
104	366.3	159.8	121.0	644.5	0.0	2229.1	228.1	3748.9
105	364.6	159.8	121.0	638.5	0.0	2220.5	227.2	3731.6
106	363.7	159.0	112.3	636.8	0.0	2229.1	227.2	3728.2
107	362.0	159.0	112.3	635.0	0.0	2263.7	227.2	3759.3
108	361.2	159.0	112.3	632.4	0.0	2246.4	227.2	3738.5
109	359.4	158.1	112.3	630.7	0.0	2255.0	226.4	3742.0
110	358.6	158.1	112.3	628.1	0.0	2306.9	226.4	3790.4
111	356.8	158.1	112.3	623.8	0.0	2281.0	243.6	3775.7
112	354.2	157.2	112.3	757.7	0.0	2289.6	207.4	3878.5
113	351.6	157.2	103.7	717.1	0.0	2324.2	211.7	3865.5
114	349.1	156.4	103.7	705.9	0.0	2289.6	211.7	3816.3
115	347.3	156.4	103.7	698.1	0.0	2281.0	210.8	3797.3
116	345.6	155.5	103.7	689.5	0.0	2315.5	209.1	3818.9
117	344.7	155.5	103.7	686.0	0.0	2272.3	208.2	3770.5
118	343.0	155.5	103.7	680.0	0.0	2272.3	207.4	3761.9
119	342.1	154.7	95.0	678.2	0.0	2306.9	206.5	3783.5
120	340.4	154.7	95.0	673.1	0.0	2263.7	205.6	3732.5
121	339.6	154.7	95.0	672.2	0.0	2255.0	204.8	3721.2
122	337.8	153.8	95.0	668.7	0.0	2289.6	204.8	3749.8
123	324.9	152.1	95.0	1170.9	0.0	2246.4	202.2	4191.4
124	318.0	150.3	95.0	814.8	0.0	2142.7	201.3	3722.1
125	313.6	149.5	95.0	855.4	0.0	2220.5	200.4	3834.4
126	309.3	148.6	95.0	841.5	0.0	2229.1	199.6	3823.2
127	306.7	147.7	95.0	833.8	0.0	2246.4	198.7	3828.4
128	304.1	146.9	86.4	826.8	0.0	2289.6	197.9	3851.7
129	302.4	146.0	86.4	821.7	0.0	2263.7	197.0	3817.2
130	299.8	145.2	86.4	817.3	0.0	2272.3	196.1	3817.2
131	298.9	145.2	86.4	813.9	0.0	2306.9	196.1	3847.4
132	297.2	144.3	86.4	808.7	0.0	2272.3	195.3	3804.2

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TABLE 4

Predicted Inflow Rate for the Base Case Scenario
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Month Since October 2013	Predicted Inflow Rate (m^3/day)							
	Ramp	Shaft	R2/R3 Pit	R2 U/G	R3 U/G	R65 Pit	R4 U/G	Total
133	295.5	144.3	86.4	807.0	0.0	2281.0	195.3	3809.4
134	294.6	143.4	86.4	801.8	0.0	2315.5	194.4	3836.2
135	293.8	143.4	86.4	799.2	0.0	2289.6	193.5	3805.9
136	292.0	143.4	86.4	795.7	0.0	2298.2	193.5	3809.4
137	291.2	142.6	86.4	793.2	0.0	2350.1	192.7	3856.0
138	290.3	142.6	86.4	790.6	0.0	2315.5	192.7	3818.0
139	289.4	142.6	77.8	789.7	0.0	2315.5	192.7	3807.6
140	288.6	141.7	77.8	788.0	0.0	2332.8	191.8	3820.6
141	286.8	141.7	77.8	787.1	0.0	2298.2	191.8	3783.5
142	286.0	141.7	77.8	787.1	0.0	2298.2	190.9	3781.7
143	285.1	140.8	77.8	785.4	0.0	2332.8	190.9	3812.8
144	284.3	140.8	77.8	783.6	0.0	2298.2	190.9	3775.7
145	283.4	140.8	77.8	781.9	0.0	2281.0	190.9	3755.8
146	282.5	140.0	77.8	781.1	0.0	2332.8	190.1	3804.2
147	279.9	139.1	77.8	777.6	542.4	2272.3	190.1	4279.2
148	277.3	138.2	77.8	775.9	479.5	2151.4	190.1	4090.2
149	274.8	135.6	77.8	774.1	357.7	2211.8	190.1	4021.9
150	272.2	134.8	77.8	770.7	304.1	2203.2	189.2	3951.9
151	269.6	133.1	77.8	767.2	268.7	2211.8	189.2	3917.4
152	267.8	132.2	77.8	764.6	246.2	2255.0	189.2	3932.9
153	266.1	131.3	77.8	761.2	229.8	2229.1	188.4	3883.7
154	264.4	130.5	69.1	757.7	218.6	2220.5	188.4	3849.1
155	262.7	130.5	69.1	755.1	210.8	2255.0	188.4	3871.6
156	261.8	129.6	69.1	752.5	202.2	2229.1	187.5	3831.8
157	259.2	128.7	69.1	750.0	352.5	2220.5	187.5	3967.5
158	257.5	127.9	69.1	747.4	238.5	2246.4	186.6	3873.3
159	256.6	127.9	69.1	744.8	263.5	2203.2	186.6	3851.7
160	257.5	127.9	77.8	0.0	259.2	2177.3	0.0	2899.6
161	262.7	127.9	86.4	0.0	253.2	2237.8	0.0	2967.8
162	269.6	128.7	86.4	0.0	246.2	2229.1	0.0	2960.1
163	275.6	128.7	95.0	0.0	241.1	2237.8	0.0	2978.2
164	283.4	129.6	95.0	0.0	236.7	2255.0	0.0	2999.8
165	290.3	130.5	95.0	0.0	234.1	2237.8	0.0	2987.7
166	297.2	130.5	60.5	0.0	229.0	2229.1	0.0	2946.2
167	301.5	130.5	86.4	0.0	510.6	2246.4	0.0	3275.4
168	308.4	130.5	8.6	0.0	300.7	2220.5	0.0	2968.7
169	315.4	130.5	0.0	0.0	265.2	2220.5	0.0	2931.6
170	322.3	131.3	0.0	0.0	258.3	2246.4	0.0	2958.3
171	329.2	131.3	0.0	0.0	262.7	2229.1	0.0	2952.3
172	336.1	132.2	0.0	0.0	282.5	2185.9	0.0	2936.7
173	342.1	132.2	0.0	0.0	286.8	2237.8	0.0	2998.9
174	348.2	133.1	0.0	0.0	284.3	2194.6	0.0	2960.1
175	354.2	133.9	0.0	0.0	286.8	2203.2	0.0	2978.2
176	359.4	133.9	0.0	0.0	282.5	2237.8	0.0	3013.6
177	362.0	133.1	0.0	0.0	563.3	2194.6	0.0	3253.0

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TABLE 4

Predicted Inflow Rate for the Base Case Scenario
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Month Since October 2013	Predicted Inflow Rate (m^3/day)							
	Ramp	Shaft	R2/R3 Pit	R2 U/G	R3 U/G	R65 Pit	R4 U/G	Total
178	366.3	133.1	0.0	0.0	343.9	2194.6	0.0	3037.8
179	371.5	133.9	0.0	0.0	314.5	2229.1	0.0	3049.1
180	376.7	134.8	0.0	0.0	309.3	2194.6	0.0	3015.4
181	381.9	134.8	0.0	0.0	311.0	2194.6	0.0	3022.3
182	387.1	135.6	0.0	0.0	313.6	2237.8	0.0	3074.1
183	392.3	135.6	0.0	0.0	318.0	2203.2	0.0	3049.1
184	396.6	136.5	0.0	0.0	318.0	2211.8	0.0	3062.9
185	400.9	136.5	0.0	0.0	319.7	2255.0	0.0	3112.1
186	405.2	137.4	0.0	0.0	323.1	2211.8	0.0	3077.6
187	407.8	136.5	0.0	0.0	522.7	2211.8	0.0	3278.9
188	411.3	136.5	0.0	0.0	367.2	2255.0	0.0	3170.0
189	415.6	137.4	0.0	0.0	343.0	2211.8	0.0	3107.8
190	419.0	137.4	0.0	0.0	337.0	2211.8	0.0	3105.2
191	423.4	138.2	0.0	0.0	335.2	2255.0	0.0	3151.9
192	426.8	139.1	0.0	0.0	335.2	2211.8	0.0	3113.0
193	430.3	139.1	0.0	0.0	337.0	2211.8	0.0	3118.2
194	433.7	139.1	0.0	0.0	337.0	2255.0	0.0	3164.8
195	437.2	140.0	0.0	0.0	338.7	2211.8	0.0	3127.7
196	440.6	140.0	0.0	0.0	338.7	2151.4	0.0	3070.7
197	444.1	140.0	0.0	0.0	382.8	2194.6	0.0	3161.4
198	447.6	140.0	0.0	0.0	365.5	2151.4	0.0	3104.4
199	450.1	140.8	0.0	0.0	363.7	2151.4	0.0	3106.1
200	453.6	140.8	0.0	0.0	359.4	2177.3	0.0	3131.1
201	456.2	141.7	0.0	0.0	361.2	2151.4	0.0	3110.4
202	458.8	141.7	0.0	0.0	362.0	2151.4	0.0	3113.9
203	462.2	141.7	0.0	0.0	362.0	2185.9	0.0	3151.9
204	464.8	141.7	0.0	0.0	362.0	2151.4	0.0	3119.9
205	467.4	141.7	0.0	0.0	362.9	2142.7	0.0	3114.7
206	470.0	142.6	0.0	0.0	362.9	2194.6	0.0	3170.0
207	470.9	141.7	0.0	0.0	638.5	2142.7	0.0	3393.8
208	473.5	142.6	0.0	0.0	416.4	2203.2	0.0	3235.7
209	476.1	142.6	0.0	0.0	389.7	2211.8	0.0	3220.1
210	477.8	142.6	0.0	0.0	385.3	2203.2	0.0	3208.9
211	480.4	142.6	0.0	0.0	390.5	2211.8	0.0	3225.3
212	483.0	143.4	0.0	0.0	390.5	2220.5	0.0	3237.4
213	485.6	143.4	0.0	0.0	391.4	2203.2	0.0	3223.6
214	487.3	143.4	0.0	0.0	392.3	2211.8	0.0	3234.8
215	489.9	143.4	0.0	0.0	392.3	2211.8	0.0	3237.4
216	492.5	144.3	0.0	0.0	393.1	2203.2	0.0	3233.1
217	494.2	144.3	0.0	0.0	394.0	2203.2	0.0	3235.7
218	496.8	144.3	0.0	0.0	394.8	2211.8	0.0	3247.8
219	499.4	145.2	0.0	0.0	396.6	2203.2	0.0	3244.3
220	501.1	145.2	0.0	0.0	397.4	1728.0	0.0	2771.7
221	503.7	145.2	0.0	0.0	398.3	1615.7	0.0	2662.8
222	505.4	145.2	0.0	0.0	399.2	1607.0	0.0	2656.8

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TABLE 4

Predicted Inflow Rate for the Base Case Scenario
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Month Since October 2013	Predicted Inflow Rate (m^3/day)							
	Ramp	Shaft	R2/R3 Pit	R2 U/G	R3 U/G	R65 Pit	R4 U/G	Total
223	507.2	146.0	0.0	0.0	399.2	1287.4	0.0	2339.7
224	509.8	146.0	0.0	0.0	406.1	1028.2	0.0	2090.0
225	511.5	146.0	0.0	0.0	408.7	1088.6	0.0	2154.8
226	513.2	146.0	0.0	0.0	408.7	1045.4	0.0	2113.3
227	514.9	146.0	0.0	0.0	408.7	1045.4	0.0	2115.1
228	516.7	146.9	0.0	0.0	410.4	1408.3	0.0	2482.3
229	518.4	146.9	0.0	0.0	410.4	1347.8	0.0	2423.5
230	521.0	146.9	0.0	0.0	411.3	1347.8	0.0	2427.0
231	522.7	146.9	0.0	0.0	412.1	1347.8	0.0	2429.6
232	524.4	147.7	0.0	0.0	413.0	1365.1	0.0	2450.3
233	526.2	147.7	0.0	0.0	413.9	1356.5	0.0	2444.3
234	527.9	147.7	0.0	0.0	414.7	1235.5	0.0	2325.9
235	530.5	147.7	0.0	0.0	415.6	1261.4	0.0	2355.3
236	532.2	147.7	0.0	0.0	415.6	1244.2	0.0	2339.7

TABLE 5
The Void Volume of Major Mining Components of Pit Reflooding

Mining Components	Void Volume (m^3)
Shaft	29,298
Drifts	825,684
Vent Raise	2,978
Backfill Raises	4,763
Other Raises	18,498
U/G Stope	756,429
R3/R4 Pit	4,938,000
R65 Pit	8,550,000

TABLE 6
The Averaged Flow Components of Pit Reflooding Over Reflooding Period

Flow Components	Flow Rate (m^3/yr)	
	R2/R3	R65
Groundwater Inflow	5.11×10^4	3.75×10^4
Precipitation	7.73×10^4	1.07×10^5
Runoff	1.07×10^6	0
Evaporation Loss	6.92×10^5	7.84×10^5

Appendix 6.8.1

Quality Control Results from Surface Water Samples Taken July 9-10 2010

Annexe 6.8.1 Résultats du contrôle de qualité des échantillons d'eau de surface prélevés le 9 et 10 juillet 2010

Station d'échantillonnage	Unité	Limite de détection	AQR8			AQR11			Blanc de terrain
Type d'échantillon			Régulier	Duplicata		Régulier	Duplicata		
Date d'échantillonnage			2010-07-09	2010-07-09	% de différence[1]	2010-07-10	2010-07-10	% de différence[1]	2010-07-09
UTM (NAD 83, Zone 18) Est			689 183			689 496			
UTM (NAD 83, Zone 18) Nord			5 855 181			5 854 578			
Paramètres physico-chimiques de base									
Alcalinité totale	mg/l	1	4	4	0%	2	2	0%	<1
Matières en suspension	mg/l	2	<2	<2	0%	<2	<2	0%	<2
Solide dissous totaux	mg/l	10	30	36	18%	13	14	7%	<10
Dureté totale	mg/l	1	7	7	0%	<1	<1	0%	<1
Ions et nutriments majeurs									
Azote total Kjeldahl	mg/l	0,15	0,64	0,68	6%	0,54	0,56	4%	0,40
Nitrates et nitrites	mg/l	0,02	<0,02	<0,02	0%	<0,02	<0,02	0%	<0,02
Azote ammoniacal	mg/l	0,02	<0,02	<0,02	0%	<0,02	0,04	75%	0,02
Phosphore total	mg/l	0,005	0,007	0,008	13%	<0,005	<0,005	0%	<0,005
Calcium	mg/l	0,1	2,9	2,8	4%	0,7	0,7	0%	<0,1
Magnésium	mg/l	0,02	0,82	0,82	0%	0,20	0,19	5%	<0,02
Sodium	mg/l	0,03	1,2	1,3	8%	0,36	0,36	0%	<0,03
Sulfates	mg/l	0,1	6,8	6,7	1%	1,1	1,1	0%	<0,1
Chlorures	mg/l	0,05	0,39	0,40	3%	0,27	0,29	7%	<0,05
Métaux et métalloïdes									
Aluminium	mg/l	0,01	<0,01	<0,01	0%	<0,01	<0,01	0%	<0,01
Antimoine	mg/l	0,006	<0,006	<0,006	0%	<0,006	<0,006	0%	<0,006
Arsenic	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%	<0,001
Cadmium	mg/l	0,0005	<0,0005	<0,0005	0%	<0,0005	<0,0005	0%	<0,0005
Chrome	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%	<0,001
Cobalt	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%	<0,001
Cuivre	mg/l	0,001	0,003	0,001	100%	0,005	0,002	86%	<0,001
Fer	mg/l	0,02	0,20	0,21	5%	0,06	0,07	15%	<0,02
Manganèse	mg/l	0,001	0,004	0,004	0%	0,003	0,003	0%	<0,001
Mercure	mg/l	0,0001	<0,0001	<0,0001	0%	<0,0001	<0,0001	0%	<0,0001
Molybdène	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%	<0,001
Nickel	mg/l	0,001	0,004	0,004	0%	<0,001	<0,001	0%	<0,001
Plomb	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%	<0,001
Potassium	mg/l	0,1	1,0	1,0	0%	0,2	0,2	0%	<0,1
Sélénium	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%	<0,001
Zinc	mg/l	0,002	<0,002	<0,002	0%	<0,002	<0,002	0%	<0,002
Autres paramètres									
Hydrocarbures Pétroliers (C_{10}-C_{50})	mg/l	0,100	<0,100	<0,100	0%	<0,100	<0,100	0%	<0,100

[1] Lors du calcul des % de différence, les résultats correspondant à une valeur inférieure à la limite de détection de la méthode analytique sont remplacés par la moitié de cette limite de détection. Le % de différence entre les échantillons a été établi en divisant la différence absolue par la moyenne des deux échantillons correspondants.

Résultat dépassant le critère de performance pour les contôles de qualité

Appendix 6.8.2

Quality Control Results from Surface Water Samples Taken September 4 and 6 2010

Annexe 6.8.2 Résultats du contrôle de qualité des échantillons d'eau de surface prélevés en septembre 2010

Station d'échantillonnage	**Unité**	**Limite de détection**	**AQR8**			**AQR9**		
Type d'échantillon			**Régulier**	**Duplicata**		**Régulier**	**Duplicata**	
Date d'échantillonnage			2010-09-06	2010-09-06	**% de différence[1]**	2010-09-06	2010-09-06	**% de différence[1]**
UTM (NAD 83, Zone 18) Est			689 190	689 190		688 884	688 884	
UTM (NAD 83, Zone 18) Nord			5 855 220	5 855 220		5 855 038	5 855 038	
Paramètres physico-chimiques de base								
Alcalinité totale	mg/l	1	6	5	18%	4	4	0%
Matières en suspension	mg/l	2	<2	<2	0%	<2	<2	0%
Solide dissous totaux	mg/l	10	26	25	4%	29	31	7%
Dureté totale	mg/l	1	7	7	0%	6	7	15%
Ions et nutriments majeurs								
Azote total Kjeldahl	mg/l	0,15	0,34	0,36	6%	0,36	0,31	15%
Nitrates et nitrites	mg/l	0,02	0,02	0,03	40%	<0,02	<0,02	0%
Nitrites	mg/l	0,01	<0,01	<0,01	0%	<0,01	<0,01	0%
Azote ammoniacal	mg/l	0,02	0,02	0,02	0%	<0,02	0,02	100%
Phosphore total	mg/l	0,005	0,007	0,008	13%	0,008	<0,005	100%
Calcium	mg/l	0,1	2,5	2,5	0%	2,5	2,5	0%
Magnésium	mg/l	0,1	0,8	0,8	0%	0,9	0,8	12%
Sodium	mg/l	0,03	1	1	0%	1,1	1,1	0%
Potassium	mg/l	0,1	0,9	0,9	0%	0,9	0,9	0%
Sulfates	mg/l	0,1	5,3	5,3	0%	5	5	0%
Chlorures	mg/l	0,05	0,3	0,3	0%	0,27	0,29	7%
Métaux et métalloïdes								
Aluminium	mg/l	0,03	0,11	0,11	0%	0,12	0,12	0%
Antimoine	mg/l	0,006	<0,006	<0,006	0%	<0,006	<0,006	0%
Arsenic	mg/l	0,002	<0,002	<0,002	0%	<0,002	<0,002	0%
Cadmium	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%
Chrome	mg/l	0,03	<0,03	<0,03	0%	<0,03	<0,03	0%
Cobalt	mg/l	0,03	<0,03	<0,03	0%	<0,03	<0,03	0%
Cuivre	mg/l	0,003	<0,003	<0,003	0%	<0,003	<0,003	0%
Fer	mg/l	0,1	0,3	0,2	40%	0,2	0,2	0%
Manganèse	mg/l	0,003	0,006	0,006	0%	<0,003	<0,003	0%
Mercure	mg/l	0,0001	<0,0001	<0,0001	0%	<0,0001	<0,0001	0%
Molybdène	mg/l	0,03	<0,03	<0,03	0%	<0,03	<0,03	0%
Nickel	mg/l	0,01	<0,01	<0,01	0%	<0,01	<0,01	0%
Plomb	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%
Sélénium	mg/l	0,001	<0,001	<0,001	0%	<0,001	<0,001	0%
Zinc	mg/l	0,005	<0,005	<0,005	0%	<0,005	<0,005	0%
Autres paramètres								
Hydrocarbures Pétroliers (C_{10}-C_{50})	mg/l	0,100	<0,100	<0,100	0%	<0,100	<0,100	0%

[1] Lors du calcul des % de différence, les résultats correspondant à une valeur inférieure à la limite de détection de la méthode analytique sont remplacés par la moitié d
de détection. Le % de différence entre les échantillons a été établie en divisant la différence absolue par la moyenne des deux échantillons correspondants.

Résultat dépassant le critère de performance pour les contôles de qualité

Appendix 6.8.3

Quality Control Results for Surface Water and Sediments from Campaigns Taking Place in 2002, 2003, and 2004 in and around the Study Area

Annexe 6.8.3a Données de qualité de l'eau mesurées en 2002, 2003 et 2004 sur la propriété Foxtrot

Paramètres	Mesure *in situ* (x)	Profondeur	Unité	Limite de détection	Cours d'eau														
Caractéristiques des stations																			
Station (Correspondance 2010)					AQH3			–			AQR14			AQR12			AQR4		
Station (nom original)					SSW1			SSW2			SSW3			SSW4			SSW5		
UTM (NAD 83, Zone 18) Est					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
UTM (NAD 83, Zone 18) Nord					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Date d'échantillonnage					2002-09-04	2002-09-26	2003-07-30	2002-09-04	2002-09-26	2003-07-30	2002-09-04	2002-09-26	2003-07-30	2002-09-04	2002-09-26	2003-07-30	2002-09-04	2002-09-26	2003-07-30
Heure d'échantillonnage					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Profondeur					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Caractéristiques physicochimiques de base																			
Température	x	Surface	°C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	x	Fond	°C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxygène dissous	x	Surface	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxygène dissous	x	Fond	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
pH		Surface	pH unit	–	5,6	4,9	5,4	5,6	5,2	5,5	5,5	5,2	5,6	5,2	4,5	4,7	4,7	4,7	4,7
	x	Surface	pH unit	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	pH unit	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Alcalinité totale ($CaCO_3$)			mg/l	2	3	2	–	3	<2	–	<2	2	–	2	<2	–	<2	<2	–
Conductivité		Surface	µS/cm	–			10			7			9			14			12
	x	Surface	µS/cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	µS/cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dureté totale ($CaCO_3$)			mg/l	2	10	8	7	10	3	6	10	6	<2	12	6	4	7	8	5
Solides dissous totaux		Surface	mg/l	10	–	–	22	–	–	<10	–	–	<10	–	–	50	–	–	20
	x	Surface	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Matière en suspension			mg/l	2	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Transparence (disque de Secchi)	x		m	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Turbidité			UNT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Potentiel d'oxydo-réduction	x	Surface	mV	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	mV	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Carbone inorganique dissous			mg/l	1	–	–	1,6	–	–	1,2	–	–	0,8	–	–	3,3			1
Ions et nutriments majeurs																			
Nitrates			mg/l	0,020	–	–	<0,02	–	–	<0,02	–	–	<0,02	–	–	<0,02	–	–	<0,02
Nitrites			mg/l	0,001	–	–	0,002	–	–	0,002	–	–	0,002	–	–	<0,001	–	–	0,001
Nitrites-Nitrates			mg/l	?	–	0,11		–	0,12	–	–	0,13		–	0,12	–	–	0,12	–
Phosphore total			mg/l	0,030	–	–	0,13	–	–	0,16	–	–	0,44	–	–	0,06	–	–	0,13
Calcium (Ca)			mg/l	0,1	–	–	0,7	–	–	0,5	–	–	0,6	–	–	1	–	–	0,7
Magnésium (Mg) [total]			mg/l	0,05	–	–	0,32	–	–	0,21	–	–	0,24	–	–	0,35	–	–	0,26
Sodium			mg/l	0,400	–	–	0,5	–	–	<0,4	–	–	0,5	–	–	0,6	–	–	0,6
Potassium			mg/l	0,100	–	–	0,2	–	–	<0,1	–	–	<0,1	–	–	<0,1	–	–	<0,1
Sulfates			mg/l	2,000	3	–	<2	<2	–	<2	<2	–	<2	<2	–	<2	<2	–	<2
Sulfures totaux			mg/l	0,020	–	<0,02	–	–	<0,02	–	–	<0,02	–	–	<0,02	–	–	<0,02	–
Chlorures			mg/l	2	–	–	<2	–	–	<2	–	–	<2	–	–	<2	–	–	<2
Métaux et métalloïdes																			
Arsenic (As) [total]			mg/l	0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Cadmium (Cd) [total]			mg/l	0,005-0,0005	<0,005	<0,005	<0,0005	<0,005	<0,005	<0,0005	<0,005	<0,005	<0,0005	<0,005	<0,005	<0,0005	<0,005	<0,005	<0,0005
Chromium (Cr) [total]			mg/l	0,001	0,02	<0,01	<0,001	0,03	<0,01	<0,001	0,02	<0,01	<0,001	0,02	<0,01	<0,001	0,02	<0,01	<0,001
Cuivre (Cu) [total]			mg/l	0,01-0,001	0,01	<0,01	<0,001	0,01	<0,01	<0,001	<0,01	<0,01	<0,001	<0,01	<0,01	0,003	<0,01	<0,01	<0,001
Fer (Fe) [total]			mg/l	0,02	0,24	0,14	–	0,13	0,1	–	0,13	0,14	–	0,16	0,24	–	0,35	0,27	–
Manganèse (Mn) [total]			mg/l	0,01	–	<0,01	–	–	<0,01	–	–	<0,01	–	–	<0,01	–	–	<0,01	–
Mercure (Hg) [total]			mg/l	0,0001-0,0002	<0,0001	<0,0002	–	<0,0001	<0,0002	–	<0,0001	<0,0002	–	<0,0001	<0,0002	–	<0,0001	<0,0002	–
Plomb (Pb) [total]			mg/l	0,003-0,05	<0,05	<0,05	<0,003	<0,05	<0,05	<0,003	<0,05	<0,05	<0,003	<0,05	<0,05	<0,003	<0,05	<0,05	<0,003
Nickel (Ni) [total]			mg/l	0,001-0,02	<0,02	<0,02	<0,001	<0,02	0,04	<0,001	<0,02	0,04	<0,001	<0,02	0,04	<0,001	<0,02	0,05	<0,001
Zinc (Zn) [total]			mg/l	0,002	0,02	0,01	0,006	0,02	0,01	0,007	0,01	<0,01	0,007	0,01	0,01	0,006	0,01	0,01	0,006
Paramètres organiques																			
Acide humique			mg/l	–	–	–	0	–	–	0	–	–	0	–	–	0	–	–	0
Acide fulvique			mg/l	5	–	–	25	–	–	5 et moins	–	–	35	–	–	45	–	–	35
Carbone organique dissous			mg/l	–	–	–	6,5	–	–	4,5	–	–	5,2	–	–	16	–	–	13

Sources:

Roche. 2005. Environmental Baseline Study (2004) – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 44 pages + 12 annexes.

Roche. 2003. Environmental Baseline Study – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 46 pages + 10 annexes.

Amyot, G. 2002. Programme de caractérisation environnementale préliminaire – Projet

Annexe 6.8.3a Données de qualité de l'eau mesurées en 2002, 2003 et 2004 sur la propriété Foxtrot

Paramètres	Mesure *in situ* (x)	Profondeur	Unité	Limite de détection	Lac																
Caractéristiques des stations																					
Station (Correspondance 2010)					AQH2			–			–	AQR18	–	–	–	–	–	–	–	–	–
Station (nom original)					SSW6			SSW7			SSW8	SSW9	SSW10	SSW11	SSW12	SSW13	SSW14	SSW15	SSW16	SSW17	SSW18	SSW19
UTM (NAD 83, Zone 18) Est					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
UTM (NAD 83, Zone 18) Nord					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Date d'échantillonnage					2002-09-04	2002-09-26	2003-07-30	2002-09-04	2002-09-26	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30
Heure d'échantillonnage					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Profondeur					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Caractéristiques physicochimiques de base																					
Température	x	Surface	°C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	x	Fond	°C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxygène dissous	x	Surface	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxygène dissous	x	Fond	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
pH		Surface	pH unit	–	5,6	5,3	5,7	5,6	5,5	5,6	5,6	5,4	5,5	5,5	5,8	5,8	5,7	5,6	5,8	5,3	5,6	5,6
	x	Surface	pH unit	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	pH unit	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Alcalinité totale ($CaCO_3$)			mg/l	2	<2	<2	–	<2	2	–	–	–	–	–	–	–	–	–	–	–	–	–
Conductivité		Surface	µS/cm	–			8			8	8	7	7	8	8	8	9	8	8	11	9	8
	x	Surface	µS/cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	µS/cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dureté totale ($CaCO_3$)			mg/l	2	7	6	3	10	3	<2	4	<2	6	4	2	2	2	<2	3	4	3	2
Solides dissous totaux		Surface	mg/l	10	–	–	16	–	–	<10	12	<10	22	<10	12	11	12	16	12	21	10	15
	x	Surface	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	mg/l	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Matière en suspension			mg/l	2	6	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Transparence (disque de Secchi)	x		m	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Turbidité			UNT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Potentiel d'oxydo-réduction	x	Surface	mV	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Fond	mV	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Carbone inorganique dissous			mg/l	1			1,8			<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	1,1	<1,0	<1,0	<1,0	<1,0	<1,0
Ions et nutriments majeurs																						
Nitrates			mg/l	0,020	–	–	<0,02	–	–	<0,02	0,03	0,05	<0,02	0,03	<0,02	<0,02	0,05	<0,02	<0,02	0,03	0,02	<0,02
Nitrites			mg/l	0,001	–	–	0,001	–	–	0,001	0,001	<0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001
Nitrites-Nitrates			mg/l	?	–	0,11	–	-	0,12													
Phosphore total			mg/l	0,030	–	–	<0,03	–	–	0,05	0,04	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Calcium (Ca)			mg/l	0,1	–	–	0,6	–	–	0,6	0,7	0,5	0,5	0,5	0,6	0,5	0,7	0,5	0,6	1	0,6	0,6
Magnésium (Mg) [total]			mg/l	0,05	–	–	0,21	–	–	0,27	0,21	0,18	0,2	0,21	0,23	0,26	0,22	0,22	0,21	0,29	0,22	0,21
Sodium			mg/l	0,400	–	–	0,4	–	–	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,4	<0,4	0,4	0,7	0,4	0,5
Potassium			mg/l	0,100	–	–	<0,1	–	–	0,2	<0,1	<0,1	0,1	<0,1	0,2	0,2	<0,1	<0,1	0,2	0,1	<0,1	<0,1
Sulfates			mg/l	2,000	<2	–	2	<2	–	<2	2	<2	3	<2	2	<2	<2	<2	<2	<2	3	<2
Sulfures totaux			mg/l	0,020	-	<0,02	–	–	<0,02	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlorures			mg/l	2	–	–	<2	–	–	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Métaux et métalloïdes																						
Arsenic (As) [total]			mg/l	0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Cadmium (Cd) [total]			mg/l	0,005-0,0005	<0,005	<0,005	<0,0005	<0,005	<0,005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,005	<0,005	<0,005
Chromium (Cr) [total]			mg/l	0,001	0,03	<0,01	<0,001	0,03	<0,01	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Cuivre (Cu) [total]			mg/l	0,01-0,001	<0,01	<0,01	<0,001	<0,01	<0,01	0,001	<0,001	<0,001	<0,001	<0,001	0,002	0,001	0,002	0,001	<0,001	<0,001	0,001	<0,001
Fer (Fe) [total]			mg/l	0,02	0,14	0,11	–	0,08	0,11	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganèse (Mn) [total]			mg/l	0,01	–	<0,01	–	–	<0,01	–	–	–	–	–	–	–	–	–	–	–	–	–
Mercure (Hg) [total]			mg/l	0,0001-0,0002	<0,0001	<0,0002	–	<0,0001	<0,0002	–	–	–	–	–	–	–	–	–	–	–	–	–
Plomb (Pb) [total]			mg/l	0,003-0,05	<0,05	<0,05	<0,003	<0,05	<0,05	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003
Nickel (Ni) [total]			mg/l	0,001-0,02	<0,02	<0,02	<0,001	<0,02	<0,02	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Zinc (Zn) [total]			mg/l	0,002	0,01	0,01	0,006	0,01	0,01	0,005	0,015	0,007	0,005	0,006	0,006	0,005	0,007	0,006	0,005	0,006	0,007	0,004
Paramètres organiques																						
Acide humique			mg/l	–	–	–	0	–	–	0	0	0	0	0	0	0	0	0	0	0	0	0
Acide fulvique			mg/l	5	–	–	5 et moins	–	–	15	moins de 5	15	20	moins de 5	5 et moins	5 et moins	10	5 et moins	moins de 5	10	moins de 5	moins de 5
Carbone organique dissous			mg/l	–	–	–	3,6	–	–	4	3,8	4,8	4,2	4,5	3,4	4,8	4,6	4,6	3,7	11	4,6	4,8

Sources:

Roche. 2005. Environmental Baseline Study (2004) – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 44 pages + 12 annexes.

Roche. 2003. Environmental Baseline Study – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 46 pages + 10 annexes.

Amyot, G. 2002. Programme de caractérisation environnementale préliminaire – Projet

Annexe 6.8.3a Données de qualité de l'eau mesurées en 2002, 2003 et 2004 sur la propriété Foxtrot

Paramètres	Mesure *in situ* (x)	Profondeur	Unité	Limite de détection	Lac									
Caractéristiques des stations														
Station (Correspondance 2010)					–	–	–	–	–	AQR33	–	AQR18	AQR3	–
Station (nom original)					Lake C	Lake D	Lake E	Lake F	Lake G	Lake H	Lake I	Lake J	Lake K	Lake L
UTM (NAD 83, Zone 18) Est					682 116	682 698	683 950	686 053	686 961	690 348	691 227	690 979	689 334	691 361
UTM (NAD 83, Zone 18) Nord					5 859 567	5 858 803	5 858 985	5 857 159	5 857 195	5 857 584	5 857 528	5 856 552	5 854 526	5 853 478
Date d'échantillonnage					2004-08-26	2004-09-02	2004-09-03	2004-08-26	2004-08-26	2004-08-26	2004-08-26	2004-08-26	2004-08-26	2004-08-26
Heure d'échantillonnage					15:17	16:55	14:10	10:15	10:59	17:00	15:52	12:20	17:40	13:00
Profondeur					3,0	22,3	0,9	8,8	10,1	4,3	11,9	18,3	0,9	4,4
Caractéristiques physicochimiques de base														
Température	x	Surface	°C	–	12,6	11,5	12,0	13,4	14,2	14,3	13,2	12,8	11,3	13,6
	x	Fond	°C	–	12,6	4,5	–	11,4	6,6	12,9	4,6	6,1	–	11,9
Oxygène dissous	x	Surface	mg/l	–	10,4	9,8	9,7	10,9	10,2	10,1	9,9	10,2	10,2	9,4
			%	–	98	90	90	104	99	99	95	96	93	90
Oxygène dissous	x	Fond	mg/l	–	10,3	7,9	–	10,8	3,4	10,0	6,5	8,6	–	9,4
			%	–	97	61	–	99	28	96	50	69	–	87
pH		Surface	pH unit	–	–	–	–	–	–	–	–	–	–	–
	x	Surface	pH unit	–	5,2	6,5	5,8	5,3	5,7	4,8	5,1	4,8	4,9	5,1
		Fond	pH unit	–	5,2	5,0	–	5,3	5,4	4,6	4,7	4,5	–	4,6
Alcalinité totale ($CaCO_3$)			mg/l	2	–	–	–	–	–	–	–	–	–	–
Conductivité		Surface	µS/cm	–	–	–	–	–	–	–	–	–	–	–
	x	Surface	µS/cm	–	19	14	12	22	14	10	9	11	11	8
		Fond	µS/cm	–	18	12	–	19	14	10	8	10	–	8
Dureté totale ($CaCO_3$)			mg/l	2	–	–	–	–	–	–	–	–	–	–
Solides dissous totaux		Surface	mg/l	10	13	10	12	10	10	15	12	13	21	13
	x	Surface	mg/l	–	16	12	10	18	11	8	7	9	10	7
		Fond	mg/l	–	16	13	–	17	14	8	9	10	–	7
Matière en suspension			mg/l	2	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Transparence (disque de Secchi)	x		m	–	2,1	3,3	–	4,1	3,5	2,4	3,2	3,4	–	–
Turbidité			UNT	–	0,8	0,8	0,3	0,3	0,5	0,4	0,4	0,3	0,4	0,6
Potentiel d'oxydo-réduction	x	Surface	mV	–	249	219	250	289	271	284	278	305	277	280
		Fond	mV	–	257	290	–	279	273	299	311	327	–	312
Carbone inorganique dissous			mg/l	1	–	–	–	–	–	–	–	–	–	–
Ions et nutriments majeurs														
Nitrates			mg/l	0,020	–	–	–	–	–	–	–	–	–	–
Nitrites			mg/l	0,001	–	–	–	–	–	–	–	–	–	–
Nitrites-Nitrates			mg/l	?	–	–	–	–	–	–	–	–	–	–
Phosphore total			mg/l	0,030	–	–	–	–	–	–	–	–	–	–
Calcium (Ca)			mg/l	0,1	0,6	0,6	0,5	0,5	0,5	0,5	0,4	0,4	0,5	0,5
Magnésium (Mg) [total]			mg/l	0,05	0,15	0,12	0,10	0,16	0,11	0,08	0,09	0,10	0,17	0,15
Sodium			mg/l	0,400	–	–	–	–	–	–	–	–	–	–
Potassium			mg/l	0,100	–	–	–	–	–	–	–	–	–	–
Sulfates			mg/l	2,000	–	–	–	–	–	–	–	–	–	–
Sulfures totaux			mg/l	0,020	–	–	–	–	–	–	–	–	–	–
Chlorures			mg/l	2	–	–	–	–	–	–	–	–	–	–
Métaux et métalloïdes														
Arsenic (As) [total]			mg/l	0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Cadmium (Cd) [total]			mg/l	0,005-0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005
Chromium (Cr) [total]			mg/l	0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Cuivre (Cu) [total]			mg/l	0,01-0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Fer (Fe) [total]			mg/l	0,02	0,10	0,10	0,06	0,06	0,08	0,18	0,15	0,10	0,29	0,13
Manganèse (Mn) [total]			mg/l	0,01	0,03	0,02	<0,01	0,02	<0,01	<0,01	0,02	0,02	0,01	<0,01
Mercure (Hg) [total]			mg/l	0,0001-0,0002	–	–	–	–	–	–	–	–	–	–
Plomb (Pb) [total]			mg/l	0,003-0,05	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003
Nickel (Ni) [total]			mg/l	0,001-0,02	0,002	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Zinc (Zn) [total]			mg/l	0,002	0,006	0,003	0,004	0,004	0,004	0,004	0,003	0,004	0,003	0,003
Paramètres organiques														
Acide humique			mg/l	–	–	–	–	–	–	–	–	–	–	–
Acide fulvique			mg/l	5	–	–	–	–	–	–	–	–	–	–
Carbone organique dissous			mg/l	–	–	–	–	–	–	–	–	–	–	–

Sources:

Roche. 2005. Environmental Baseline Study (2004) – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 44 pages + 12 annexes.
Roche. 2003. Environmental Baseline Study – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 46 pages + 10 annexes.
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Annexe 6.8.3b Données de qualité des sédiments mesurées en 2003 et 2004 sur la propriété Foxtrot

Paramètre	Unité	Limite de détection de la méthode	Cours d'eau					Lac													
Caractéristiques des stations																					
Station (Correspondance 2010)			AQH3	–	AQR14	AQR12	AQR4	AQH2	–	–	AQR18	–	–	–	–	–	–	–	–	–	–
Station (nom original)			SSW1	SSW2	SSW3	SSW4	SSW5	SSW6	SSW7	SSW8	SSW9	SSW10	SSW11	SSW12	SSW13	SSW14	SSW15	SSW16	SSW17	SSW18	SSW19
UTM (NAD 83, Zone 18) Est			–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
UTM (NAD 83, Zone 18) Nord			–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Date d'échantillonage			2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30	2003-07-30
Nutriments																					
Phosphore total	mg/kg	20	330	620	340	51	330	52	110	120	29	72	<20	220	33	100	350	77	380	340	90
Soufre total	%	0,009	0,16	0,22	0,2	0,02	0,09	<0,009	<0,009	0,27	<0,009	<0,009	<0,009	0,45	0,01	<0,009	0,01	<0,009	0,14	0,01	<0,009
Granulométrie																					
Argile et colloides (Φ < 4 µm)	%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Limon (4 µm < Φ < 60 µm)	%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sable fins (60 µm < Φ < 200 µm)	%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sable grossier (200 µm < Φ < 2 mm)	%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gravier (Φ > 2 mm)	%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Métaux																					
Arsenic [total]	mg/kg	0,5	2	3,2	0,5	<0,5	0,6	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	1,3	<0,5	<0,5	<0,5	<0,5	0,7	<0,5	<0,5
Cadmium [total]	mg/kg	0,03	0,4	0,34	0,26	0,04	0,14	0,05	0,05	0,37	0,07	0,02	0,02	0,68	0,05	0,03	0,22	0,02	0,3	0,08	0,03
Chrome[total]	mg/kg	2	39	32	20	5	16	9	13	26	22	15	7	14	5	7	18	12	16	19	8
Cuivre [total]	mg/kg	1	8	19	5	<1	2	3	<1	7	1	4	<1	6	<1	<1	<1	<1	2	<1	<1
Fer [total]	mg/kg	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Plomb [total]	mg/kg	5	28	14	<5	<5	9	<5	<5	<5	<5	<5	<5	17	<5	<5	<5	<5	<5	<5	<5
Magnésium [total]	mg/kg	5	2000	1100	1000	510	980	1000	1400	1500	1700	1800	690	910	500	680	1300	1500	710	1400	970
Mercure [total]	mg/kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nickel [total]	mg/kg	2	17	14	8	3	8	4	6	18	8	8	5	18	4	4	6	6	8	6	4
Zinc [total]	mg/kg	5	29	37	13	<5	11	14	8	48	27	10	<5	37	<5	6	10	9	16	12	6
Composés organiques																					
Carbone organique total	%	0,01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Sources:
Roche. 2005. Environmental Baseline Study (2004) – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 44 pages + 12 annexes.
Roche. 2003. Environmental Baseline Study – Foxtrot Property. Préparée pour Ashton Mining of Canada Inc. 46 pages + 10 annexes.

Annexe 6.8.3b Données de qualité des sédiments mesurées en 2003 et 2004 sur la propriété Foxtrot

Paramètre	Unité	Limite de détection de la méthode	Lac									
Caractéristiques des stations												
Station (Correspondance 2010)			–	–	–	–	–	–	–	AQR18	AQR3	–
Station (nom original)			Lake C	Lake D	Lake E	Lake F	Lake G	Lake H	Lake I	Lake J	Lake K	Lake L
UTM (NAD 83, Zone 18) Est			681 600	682 751	684 008	686 053	686 961	690 348	691 325	691 106	689 241	691 256
UTM (NAD 83, Zone 18) Nord			5 859 755	5 859 057	5 859 052	5 857 159	5 857 195	5 857 584	5 857 595	5 856 678	5 854 209	5 853 542
Date d'échantillonage			2004-09-01	2004-09-02	2004-09-03	2004-08-27	2004-08-28	2004-08-28	2004-08-29	2004-08-30	2004-08-30	2004-08-31
Nutriments												
Phosphore total	mg/kg	20	–	–	–	–	–	–	–	–	–	–
Soufre total	%	0,009	–	–	–	–	–	–	–	–	–	–
Granulométrie												
Argile et colloides (Φ < 4 µm)	%	–	0	0	0	0	0	0	0	0	0	0
Limon (4 µm < Φ < 60 µm)	%	–	0	0	0	0	0	0	0	0	0	0
Sable fins (60 µm < Φ < 200 µm)	%	–	4,9	35,2	89,7	71,1	21,8	26,0	8,2	80,0	66,8	53,2
Sable grossier (200 µm < Φ < 2 mm)	%	–	66,1	63,5	9,8	26,9	51,4	39,3	44,6	19,1	31,5	43,4
Gravier (Φ > 2 mm)	%	–	29,0	1,3	0,6	2,0	26,9	34,7	47,2	0,9	1,7	3,4
Métaux												
Arsenic [total]	mg/kg	0,5	<0,5	<0,5	1,7	<0,5	0,8	<0,5	3,9	1,6	0,7	<0,5
Cadmium [total]	mg/kg	0,03	0,04	0,05	0,36	0,40	0,60	0,16	0,03	0,17	0,12	0,28
Chrome[total]	mg/kg	2	9	7	25	18	11	20	60	31	15	13
Cuivre [total]	mg/kg	1	1	1	7	7	7	8	23	7	5	7
Fer [total]	mg/kg	10	2 500	2 900	11 000	4 000	3 000	3 900	15 000	11 000	6 400	2 300
Plomb [total]	mg/kg	5	<5	<5	32	<5	11	<5	<5	7	<6	<5
Magnésium [total]	mg/kg	5	1 100	580	1 100	680	540	1 300	5 200	1 600	680	540
Mercure [total]	mg/kg	–	–	–	–	–	–	–	–	–	–	–
Nickel [total]	mg/kg	2	2	<2	7	13	7	3	44	8	6	5
Zinc [total]	mg/kg	5	7	9	40	32	41	13	40	20	12	31
Composés organiques												
Carbone organique total	%	0,01	0,19	0,24	9,4	27,0	34,0	0,28	0,21	11,0	7,8	16,0

Sources:
Roche. 2005. Environmental Baseline Study (2004) – Foxtrot Property. Pr
Roche. 2003. Environmental Baseline Study – Foxtrot Property. Préparée

Appendix 6.8.4

Notes for Water Quality Criteria Relative to Tables 6.8.1 and 6.8.2

Appendix 6.8.4 Notes for Water Quality Criteria Relative to Tables 6.8.1 and 6.8.2

Notes for water quality criteria - Tables 6.8.1 and 6.8.2

[a] Dissolved oxygen for warm water biota: first stages of life cycle = 6 mg/l and other stages of life cycle = 5.5 mg/l
For cold water biota: first stages of life cycle = 9.5 mg/l and other stages of life cycle = 6.5 mg/l.

[b] For clear water, maximum increase of 8 NTU over background levels for short-term exposure (e.g. 24-hour period) and maximum mean increase of 2 NTU over background levels for long-term exposure (e.g. 30-day period). For flood flows or turbid waters, maximum increase, at all times, of 8 NTU over background levels, when the latter are between 8 and 80 NTU. This increase must not exceed 10% when background levels are >80 NTU.

[c] For clear water, maximum increase of 25 mg/l over background levels for short-term exposure (e.g. 24-hour period) and maximum mean increase of 5 mg/l over background levels for long-term exposure (e.g. 24 hours-30 days). For flood flows, maximum increase, at all times, of 25 mg/l over background levels, when the latter are 25-250 mg/l. This increase must not exceed 10% when background levels are >250 mg/l.

[d] The values shown represent the desirable range of phosphorus concentrations in an oligotrophic environment. Exceeding the upper limit may indicate a potential environmental problem. See CCME phosphorus fact sheet for more information.

[e] The recommendation established for aluminum is 0.005 mg/l at pH <6.5 and 0.1 mg/l at pH ≥6.5.

[f] The recommendation for cadmium varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$/1000). The recommended minimum is 0.000005 mg/l, regardless of the water hardness level.

[g] The recommendation for copper varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{0.8545[(\text{hardness no.})]-1.465}$ *0.2/1000 mg/l). The recommended minimum is 0.002 mg/l, regardless of the water hardness level.

[h] This criterion applies to inorganic mercury. It could not protect the wild species that consume aquatic organisms.

[i] The recommendation for nickel varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of CaCO3/l (formula = $e^{0.76[(\text{hardness no.})]+1.06)}$/1000). The recommended minimum is 0.025 mg/l, regardless of the water hardness level.

[j] The recommendation for lead varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of CaCO3/l (formula = $e^{1.273[(\text{hardness no.})]-4.705)}$/1000). The recommended minimum is 0.001 mg/l, regardless of the water hardness level.

[k] Dissolved oxygen concentrations should not be lower than the following:
0°C temperature: 54% saturation and 8 mg/l
5°C temperature: 54% saturation and 7 mg/l
10°C temperature: 54% saturation and 6 mg/l
15°C temperature: 54% saturation and 6 mg/l
20°C temperature: 57% saturation and 5 mg/l
25°C temperature: 63% saturation and 5 mg/l

[l] Any artificial temperature increase or decrease must not modify the water temperature of an entire river section or portion of a lake causing the foreseeable move or modification of existing or potential aquatic populations, alter localized sensitive zones (i.e. spawning grounds), or kill living organisms near an outfall. Further, the environment must not undergo sudden temperature changes due, for example, to suddenly stopping thermal discharge in the cold season.

Appendix 6.8.4 Notes for Water Quality Criteria Relative to Tables 6.8.1 and 6.8.2

[m] Effluent pH levels must be 6.0-9.5 under the mine directive and most MDDEP regulations governing industrial discharge. This requirement meets the aquatic life criterion.

[n] An environment's sensitivity to acidification varies with its alkalinity. If the $CaCO_3$ concentration is under 10 mg/l, it is highly sensitive. If this concentration varies between 10 and 20 mg/l, it is moderately sensitive. If it is higher than 20 mg/l, it is not very sensitive.

[o] In dry periods, the quality criterion is defined by a maximum mean increase of 2 NTU over the natural concentration. During flooding (rain, thaw) or in turbid waters, the quality criterion is defined either by a maximum increase, at all times, of 8 NTU over the background concentration if the latter is 8-80 NTU or by a 10% increase over the background concentration when the latter is higher than 80 NTU measured at a given time.

[p] In dry periods, the quality criterion is defined by a maximum mean increase of 5 mg/l over the natural concentration. During flooding (rain, thaw) or in turbid waters, the quality criterion is defined either by a maximum increase, at all times, of 25 mg/l over the background concentration if the latter is 25-250 mg/l or by a 10% increase over the background concentration when the latter is higher than 250 mg/l measured at a given time.

[q] This value is established based on toxic effects and does not reflect the indirect effects of eutrophication.

[r] Allowable nitrite concentrations increase with the aquatic environment's chloride concentrations. The value shown is for chloride concentrations <2 mg/l.

[s] The ammonia nitrogen criterion varies with pH and temperature. The values shown for ammonia nitrogen are the most restrictive, given the pH values (4.88-7.1) and temperature (9.6-26.7) measured in this campaign.

[t] This quality criterion applies to streams flowing into lakes whose environmental context is not problematic. It seeks to avoid modifying the habitats in these lakes, notably by limiting the growth of algae and aquatic plants.

[u] This quality criterion seeks to limit the excessive growth of algae and aquatic plants in streams and rivers. Certain factors influence phosphorus' potential effect. The main physical factors generally mentioned are substrate type, water depth, transparency and temperature, current speed and shade. Because these characteristics are not reflected in the quality criteria, it is important to use phosphorus quality criteria in keeping with the environment assessed.

[v] For oligotrophic lakes whose natural concentration is or was under 0.01 mg/L, the quality criterion is defined by a maximum 50% increase over the natural concentration without exceeding 0.01 mg/L.

[w] An environment's sensitivity to acidification varies with its calcium concentration. If the Ca concentration is under 4, it is highly sensitive. If this concentration varies between 4 and 8, it is moderately sensitive. If it is higher than 8, it is not very sensitive. There is also a sensitivity indicator for alkalinity.

[x] This quality criterion applies to waters whose hardness is < 100 mg/L and whose chloride concentration is < 5 mg/L.

[y] This criterion is being revised.

Appendix 6.8.4 Notes for Water Quality Criteria Relative to Tables 6.8.1 and 6.8.2

[z] This quality criterion was defined for water that is not very hard (< 10 mg/L) and whose pH is about 6.5. This criterion is not generally used for aquatic environments that do not approach these conditions. When it is used, surface water data must be corrected to reduce the non-bioavailable fraction of the metal that is associated with the particles. A correction factor of 0.66 is used on data for surface water with a MES concentration < 5 mg/L. A correction factor of 0.33 is used on data for surface water with a MES concentration >= 5 mg/L. Some good quality surface waters can contain natural levels that are higher than the water quality criterion. In these situations, the natural levels, not the quality criterion, must be considered as the reference value. A site-specific quality criterion can also be determined on a case-by-case basis.

[aa] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[0.7409\ (\text{hardness no.}) - 4.719]}$/1000).

[bb] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[0.819\ (\text{hardness no.}) + 0.6848]}$/1000).

[cc] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[0.8545\ (\text{hardness no.}) - 1.702]}$/1000).

[dd] This quality criterion is described as provisional. It does not protect mayflies (*Ephemerella subvaria*) if this species is as sensitive as some data indicate. Before being compared to this quality criterion, surface water quality data must be corrected to reduce the fraction of the metal associated with the particles that is not bioavailable. A correction factor of 0.5 is used on data for surface water with a MES concentration lower than 10 mg/L. A correction factor of 0.33 is used on data for surface water with a MES concentration equal to or greater than 10 mg/L. Some good quality surface waters can contain natural levels that are higher than the water quality criterion. In these situations, the natural levels, not the quality criterion, must be considered as the reference value. A site-specific quality criterion can also be determined on a case-by-case basis.

[ee] This criterion varies with water hardness. The value shown is the lowest, given the hardness levels obtained (formula = $e^{[0.8784\ (\text{hardness no.}) + 3.5199]}$/1000).

[ff] This quality criterion was defined using data for inorganic mercury (HgII) but has been applied to total mercury. If a significant portion of the mercury in the water column is in the form of methylmercury, this quality criterion is insufficiently protective. Further, it does not consider the transformation of inorganic mercury into methylmercury and the latter's bioaccumulation in the food chain.

[gg] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[0.846\ (\text{hardness no.}) + 0.0584]}$/1000.

[hh] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[1.273\ (\text{hardness no.}) - 4.705]}$/1000.

[ii] This criterion varies with water hardness. The value shown is the lowest, given the hardness levels obtained (formula = $e^{[0.8473\ (\text{hardness no.}) + 0.884]}$/1000).

[jj] The MDDEP has opted for an operational quality criterion of 0.1 mg/l for petroleum hydrocarbons. Petrochemical oils and products must not be present in concentrations that can be detected by a visible film constituting a screen or causing surface discoloration, by smell, by flesh colouring of edible aquatic organisms or by deposits on banks and bottom sediments. It must not be detected visually or olfactorily or be toxic for resident aquatic organisms.

Appendix 6.8.4 Notes for Water Quality Criteria Relative to Tables 6.8.1 and 6.8.2

[kk] **pH range and lethal effects of pH on fish**

3.0 – 3.5: It is unlikely that fish could survive more than a few hours at this range although certain plants and some invertebrates can be found at lower pH levels.

3.5 – 4.0: This range is lethal for salmonids. Literature show that golden shiner, tench, european perch and pike can survive in this range, ostensibly after a period of acclimatization to slightly higher non-lethal concentrations. The lower limit of this range can, however, be lethal for golden shiner.

4.0 – 4.5: Likely harmful to salmonids—tench, bream, golden shiner, porgies and carp—which are not acclimatized to low pH levels. However, their resistance in this range increases with size and age. While fish can adapt to these values, only pike can reproduce (not perch, bream or golden shiner).

4.5 – 5.0: Likely harmful to salmonid eggs, fry and adults, especially in freshwater environments with low calcium, sodium and chloride concentrations. Can be harmful to carp.

5.0 – 6.0: Unlikely to be harmful for all species, unless the concentration of free carbon dioxide is higher than 20 mg/l or the water contains freshly precipitated iron salts in the form of ferric hydroxide, whose exact toxicity is unknown. This range's lower limit can be harmful to unacclimatized salmonids if calcium, sodium and chloride concentrations or water temperature are low. It can also be harmful for golden shiner reproduction.

6.0 – 6.5: Likely not to be harmful to fish unless the free carbon dioxide concentration exceeds 100 mg/l.

6.5 – 9.0: Not harmful to fish, although the toxicity of other fish can be modified by changes in this range.

9.0 – 9.5: Likely harmful to salmonids and perch, if this range persists.

9.5 – 10.0: Lethal for salmonids over a long period but tolerable for a short period. May be harmful for the developmental stages of certain species.

10.0 – 10.5: Tolerable for golden shiner and salmonids for a short period but lethal over a long period.

10.5 – 11.0: Rapidly lethal for salmonids. Prolonged exposure at the higher limits of this range is lethal for carp, tench, porgies and pike.

11.0 – 11.5: Rapidly lethal for all species.

[ll] During clear flow periods, the quality criterion is defined by a maximum increase of 8 NTU from background concentrations.

[mm] In dry periods, the quality criterion is defined by a maximum increase of 25 mg/l over the natural concentration.

Appendix 6.8.4 Notes for Water Quality Criteria Relative to Tables 6.8.1 and 6.8.2

[nn] This quality criterion will probably not be sufficiently protective when chlorides are associated with potassium, calcium or magnesium rather than sodium. Further, because freshwater organisms tolerate chlorides only within a limited range without suffering from acute toxicity, exceeding the quality criterion could harm a good many species. This quality criterion is being revised.

[oo] There should be no toxic effects at this concentration if the pH is maintained between 6.5 and 9.0.

[pp] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[1.0166\ (\text{hardness no.}) - 3.924}/1000$).

[qq] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[0.819\ (\text{hardness no.}) + 3.7256]}/1000$).

[rr] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[0.9422\ (\text{hardness no.}) - 1.700]}/1000$).

[ss] This quality criterion is described as provisional. It does not protect mayflies (*Ephemerella subvaria*) if this species is as sensitive as certain data indicate.

[tt] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[0.8784\ (\text{hardness no.}) + 4.2889]}/1000$).

[uu] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $2e^{[0.846\ (\text{hardness no.}) + 2.255]}/1000$).

[vv] This criterion varies with water hardness. The value shown is the value obtained for a hardness level of 10 mg of $CaCO_3$/l (formula = $e^{[1.273\ (\text{hardness no.}) - 1.46]}/1000$).

[ww] This quality criterion applies to selenium and its mineral salts.

[xx] This quality criterion is defined for “Bunker C fuel oil”. Higher criteria are available for other types of hydrocarbons.

[yy] This is a maximum allowable concentration (MAC) defined for drinking water.

[zz] The total nitrates and nitrites concentration must not exceed 10 mg/l.

[A] The presence of ammonia nitrogen at higher concentrations can compromise disinfection effectiveness.

[B] Above this concentration, drinking water’s organoleptic or esthetic properties could be altered.

[C] Above this concentration, drinking water’s organoleptic or esthetic properties could be altered. A sulfate concentration higher than 500 mg/l can have a laxative effect on some people.

[D] Given the limited opportunities for using animal test data as a model for humans and the uncertainty surrounding human data, it is impossible to determine a reference value based on health-related arguments. Nevertheless, optimization of coagulation processes using aluminum-based coagulants in drinking water treatment facilities has led to the definition of practical threshold values: 0.1 mg/l or less in large water treatment facilities and 0.2 mg/l or less in small water treatment facilities.

[E] This quality criterion is described as provisional. This is a maximum allowable concentration (MAC) defined for drinking water.

Appendix 6.8.4 Notes for Water Quality Criteria Relative to Tables 6.8.1 and 6.8.2

[F] This is a maximum allowable concentration (MAC) defined for drinking water. It is the concentration of arsenic that represents an “essentially negligible” health risk. Health Canada defines the term “essentially negligible” as a range from one new cancer above background per 100 000 people to one new cancer above background per 1 million people (i.e. 10^{-5} to 10^{-6}) over a lifetime. This criterion is used in the context of preventing surface water contamination, which is why it differs from the drinking water standard. Certain good quality surface waters may contain natural concentrations that are higher than the quality criterion.

[G] Above this concentration, drinking water’s organoleptic or esthetic properties could be altered. Some good quality surface waters may have higher natural concentrations.

[H] This quality criterion is based on a daily consumption of 15 g of fish, mollusk or crustacean. This quality criterion includes methylmercury.

[I] This value is defined for drinking water.

[J] This quality criterion is equivalent to the risk level of one new cancer for a population of 1 million exposed individuals. This quality criterion applies to the inorganic form only. Provisional quality criterion.

[K] This quality criterion includes methylmercury. Quality criteria have also been established to prevent contamination of aquatic organisms’ tissues.

Appendix 6.9.1

Quality Control Results for Sediments Taken September 4-6, 2010

Annexe 6.9.1 Résultats de contrôle de qualité des sédiments prélevés en septembre 2010

Station d'échantillonnage	Unité	Limite de détection de la méthode	AQR9			AQR8		
Type d'échantillon			Régulier	Duplicat	% de différence[1]	Régulier	Duplicat	% de différence[1]
Date d'échantillonnage			2010-09-06	2010-09-06		2010-09-06	2010-09-06	
UTM (NAD 83, Zone 18) Est			688 884	688 884		689 190	689 190	
UTM (NAD 83, Zone 18) Nord			5 855 038	5 855 038		5 855 220	5 855 220	
Paramètres physico-chimiques de base								
Soufre (S)	%	0,01	0,13	0,09	36%	0,11	0,12	9%
pH (en laboratoire)	pH	–	4,85	5,46	12%	5,64	5,40	4%
Phosphore total	mg/kg	20	240	170	34%	540	590	9%
Granulométrie								
Gravier (>2 mm)	%	0,1	23	19	19%	26	24	8%
Sable (0,062-2 mm)	%	0,1	73	79	8%	68	67	1%
Limon (0,031-0,062 mm)	%	0,1	1,3	0,7	60%	2,9	4,3	39%
Argile (<0,0020)	%	0,1	2,1	1,5	33%	3,8	4,9	25%
Métaux								
Arsenic (As)	mg/kg	0,5	0,7	0,9	25%	4,0	3,1	25%
Cadmium (Cd)	mg/kg	0,2	<0,2	<0,2	0%	<0,2	<0,2	0%
Chrome (Cr)	mg/kg	1	21	200	162%	70	83	17%
Cobalt (Co)	mg/kg	1	4	4	0%	23	23	0%
Cuivre (Cu)	mg/kg	1	4	4	0%	24	27	12%
Fer (Fe)	mg/kg	10	6 100	7 000	14%	30 000	30 000	0%
Magnésium (Mg)	mg/kg	10	1 500	1 300	14%	6 700	11 000	49%
Manganèse (Mn)	mg/kg	1	38	58	42%	510	470	8%
Mercure (Hg)	mg/kg	0,01	0,02	<0,01	100%	0,01	0,02	67%
Molybdène (Mo)	mg/kg	1	1	4	120%	6	6	0%
Nickel (Ni)	mg/kg	0,5	15	76	134%	44	61	32%
Plomb (Pb)	mg/kg	1	12	7	53%	5	8	46%
Sélénium (Se)	mg/kg	0,5	<0,5	<0,5	0%	<0,5	<0,5	0%
Zinc (Zn)	mg/kg	5	10	8	22%	51	59	15%
Composés organiques								
Hydrocarbures (C_{10}–C_{50})	mg/kg	–	<100	210	123%	<100	<100	0%
Carbone organique total	mg/kg	500	21 000	19 000	10%	9 100	13 000	35%
Matières volatiles (550°C)	% g/g	–	2	1,9	5%	0,99	5,4	138%

[1] Lors du calcul des % de différence, les résultats correspondant à une valeur inférieure à la limite de détection de la méthode analytique sont remplacés par la moitié de cette limite de détection. Le % de différence entre les échantillons a été établie en divisant la différence absolue par la moyenne des deux échantillons correspondants.

Résultat dépassant le critère de performance pour les contôles de qualité

Appendix 6.9.2

Nonparametric Correlations between Quality Parameters of Sediments Collected in September 2010 in the Renard Project Study Area

Annexe 6.9.2 Corrélations non paramétriques entre les paramètres de qualité des sédiments récoltés en septembre 2010 dans l'aire d'étude du projet Renar

	S	S2-	PT	Gravier	Sable	Limon	Argile	As	Cd	Cr	Co	Cu	Fe	Mg	Mn	Hg	Mo	Ni	Pb	Se	Zn	Hydrocar	COT	Mat_volatiles
pH	0,065	-0,205	0,125	-0,0114	-0,0368	0,126	0,121	-0,0787	0,0245	0,312	0,339	0,152	0,284	0,273	0,232	-0,0602	0,194	0,355	-0,0211	-0,132	0,251	0,0576	0,0222	-0,0687
	0,764	0,683	0,567	0,955	0,866	0,564	0,579	0,716	0,908	0,145	0,112	0,486	0,187	0,205	0,282	0,781	0,369	0,0953	0,923	0,542	0,242	0,792	0,916	0,75
	23	5	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
S		-0,3	0,523	-0,321	-0,697	0,627	0,896	0,447	0,562	-0,0702	-0,0174	0,403	-0,0779	-0,274	-0,334	0,778	0,369	0,286	0,558	0,572	0,469	0,334	0,94	0,802
		0,683	**0,0075**	0,116	**0,0000662**	**0,000813**	**0,0000002**	0,0252	**0,00363**	0,736	0,931	0,0455	0,709	0,181	0,102	**0,0000002**	0,0692	0,163	**0,00392**	**0,00296**	0,0183	0,102	**0,0000002**	**0,0000002**
		5	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
S2-			0,564	0,3	-0,2	-0,7	0,154	-0,564	0,205	-0,103	0,105	0,5	0,7	-0,3	0,7	-0,158	-0,821	0	-0,103	-0,564	-0,41	-0,707	0,3	0,6
			0,35	0,683	0,783	0,233	0,783	0,35	0,683	0,783	0,783	0,45	0,233	0,683	0,233	0,783	0,0833	1	0,783	0,35	0,45	0,133	0,683	0,35
			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
PT				-0,163	-0,73	0,496	0,641	0,415	0,377	-0,164	0,289	0,602	0,219	0,0112	0,0235	0,601	0,244	0,169	0,655	0,403	0,472	0,0624	0,508	0,416
				0,432	**0,0000002**	0,0119	**0,000556**	0,0388	0,0627	0,43	0,16	**0,00153**	0,289	0,955	0,908	**0,00153**	0,237	0,417	**0,000367**	0,0455	0,0173	0,764	**0,00979**	0,0388
				25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Gravier					0,109	-0,665	-0,455	0,189	0,03	0,401	0,315	0,39	0,164	0,339	0,33	-0,343	0,0131	0,379	-0,101	-0,222	0,0561	-0,044	-0,308	-0,499
					0,599	**0,000258**	0,0225	0,361	0,884	0,0464	0,124	0,053	0,43	0,0959	0,106	0,092	0,949	0,0615	0,628	0,284	0,787	0,832	0,133	0,0113
					25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Sable						-0,688	-0,825	-0,32	-0,425	0,121	-0,0992	-0,623	-0,12	0,0693	0,174	-0,695	-0,0952	-0,0993	-0,551	-0,486	-0,483	-0,217	-0,762	-0,569
						0,000108	**0,0000002**	0,117	0,0343	0,559	0,633	**0,000899**	0,564	0,739	0,402	**0,0000749**	0,646	0,633	**0,00449**	0,0141	0,0145	0,294	**0,0000002**	**0,0031**
						25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Limon							0,811	-0,0291	0,311	-0,382	-0,214	0,044	-0,177	-0,241	-0,345	0,543	-0,0353	-0,229	0,291	0,47	0,31	0,16	0,644	0,707
							0,0000002	0,887	0,129	0,0588	0,299	0,832	0,391	0,243	0,0905	**0,00527**	0,864	0,269	0,156	0,0179	0,131	0,441	**0,000509**	**0,0000373**
							25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Argile								0,255	0,415	-0,189	-0,0501	0,412	-0,01	-0,243	-0,343	0,828	0,17	0,0959	0,558	0,511	0,44	0,205	0,898	0,828
								0,215	0,0392	0,361	0,809	0,0408	0,96	0,238	0,092	**0,0000002**	0,41	0,644	**0,00386**	**0,00917**	0,0278	0,321	**0,0000002**	**0,0000002**
								25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
As									0,374	0,245	0,363	0,535	0,284	0,125	0,173	0,453	0,572	0,495	0,667	0,553	0,384	0,0233	0,409	0,243
									0,0644	0,235	0,0736	**0,006**	0,167	0,546	0,404	0,0233	**0,00291**	0,012	**0,000238**	**0,00429**	0,0577	0,911	0,042	0,24
									25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Cd										-0,299	-0,0789	0,288	-0,287	-0,395	-0,281	0,459	0,141	0,111	0,422	0,538	0,371	0,159	0,565	0,549
										0,145	0,703	0,161	0,162	0,0501	0,17	0,0211	0,498	0,594	0,0357	**0,00575**	0,0674	0,443	**0,00341**	**0,00462**
										25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Cr											0,679	0,33	0,713	0,761	0,719	-0,201	0,49	0,793	0,0429	-0,209	0,416	0,133	-0,0674	-0,426
											0,00016	0,107	**0,0000224**	**0,0000002**	**0,0000118**	0,332	0,0133	**0,0000002**	0,835	0,312	0,0388	0,522	0,745	0,034
											25	25	25	25	25	25	25	25	25	25	25	25	25	25
Co												0,486	0,834	0,794	0,883	-0,0713	0,486	0,804	0,251	-0,175	0,641	0,187	-0,0692	-0,325
												0,0139	**0,0000002**	**0,0000002**	**0,0000002**	0,731	0,0139	**0,0000002**	0,224	0,4	**0,000556**	0,367	0,739	0,112
												25	25	25	25	25	25	25	25	25	25	25	25	25
Cu													0,457	0,286	0,243	0,43	0,277	0,534	0,426	0,231	0,526	0,00545	0,364	0,124
													0,0215	0,164	0,238	0,0319	0,178	**0,00617**	0,0336	0,264	**0,0071**	0,978	0,073	0,551
													25	25	25	25	25	25	25	25	25	25	25	25
Fe														0,79	0,812	-0,00827	0,339	0,605	0,253	-0,21	0,488	-0,0838	-0,0539	-0,286
														0,0000002	**0,0000002**	0,966	0,0967	**0,00139**	0,219	0,31	0,0136	0,687	0,795	0,163
														25	25	25	25	25	25	25	25	25	25	25
Mg															0,85	-0,336	0,42	0,645	0,0164	-0,288	0,512	0,118	-0,264	-0,486
															0,0000002	0,0991	0,0365	**0,000486**	0,937	0,16	**0,00904**	0,569	0,2	0,0141
															25	25	25	25	25	25	25	25	25	25
Mn																-0,344	0,325	0,626	-0,00311	-0,392	0,458	0,0157	-0,346	-0,533
																0,0912	0,111	**0,00083**	0,987	0,0525	0,0213	0,94	0,089	**0,00626**
																25	25	25	25	25	25	25	25	25
Hg																	0,291	0,0607	0,723	0,621	0,379	0,217	0,839	0,733
																	0,155	0,77	**0,00000546**	**0,000935**	0,061	0,294	**0,0000002**	**0,0000002**
																	25	25	25	25	25	25	25	25
Mo																		0,734	0,505	0,32	0,669	0,461	0,336	0,0546
																		0,0000002	0,0103	0,117	**0,000232**	0,0206	0,0991	0,792
																		25	25	25	25	25	25	25
Ni																			0,337	0,0217	0,685	0,304	0,213	-0,124
																			0,0983	0,916	**0,000124**	0,137	0,303	0,551
																			25	25	25	25	25	25
Pb																				0,601	0,433	0,0509	0,662	0,515
																				0,00155	0,0309	0,807	**0,000286**	**0,00858**
																				25	25	25	25	25
Se																					0,272	0,106	0,565	0,551
																					0,187	0,612	**0,00336**	**0,00449**
																					25	25	25	25
Zn																						0,483	0,459	0,222
																						0,0146	0,0213	0,282
																						25	25	25
Hydrocar																							0,341	0,0735
																							0,0935	0,722
																							25	25
COT																								0,828
																								0,0000002
																								25

Contenu des cellules
r_s : coefficient de corrélation de Spearman
P : valeur P
N : nombre de valeurs

Légende

P < 0,01	fortement significatif
P < 0,05	faiblement significatif
$r_s > 0,8$	corrélation forte positive
$0,5 < r_s < 0,8$	corrélation moyenne positive
$0,1 < r_s < 0,5$	corrélation faible positive
$-0,8 < r_s$	corrélation forte négative
$-0,5 < r_s < -0,$	corrélation moyenne négative
$-0,5 < r_s$	corrélation faible négative

Appendix 7.6.1

Codes, levels of certainty and definition of breeding indices (Quebec Breeding Bird Atlas, 2011)

QUÉBEC BREEDING BIRD ATLAS

BREEDING EVIDENCE CODES, LEVELS OF CERTAINTY AND DEFINITIONS

Code	Level of certainty	Definition
X	Species observed	Species observed during its breeding season, but not in suitable nesting habitat (no breeding evidence found).
H	Possible breeding	Species observed in suitable nesting habitat during its breeding season.
S	Possible breeding	Individual singing or producing other sounds associated with breeding (e.g., calls or drumming) in suitable nesting habitat during the species' breeding season.
M	Probable breeding	At least 7 individuals singing or producing other sounds associated with breeding (e.g., calls or drumming), heard during the same visit to a single square and in suitable nesting habitat during the species' breeding season.
P	Probable breeding	Pair observed in suitable nesting habitat during the species' breeding season.
T	Probable breeding	Presumed territory based on the presence of an adult bird, whether producing sounds associated with breeding (e.g., song, other calls or drumming) or not, at the same place, in suitable nesting habitat, on at least two visits, one week or more apart, during the species' breeding season.
C	Probable breeding	Breeding behaviour involving a male and female (e.g., display, courtship feeding and copulation) or antagonistic behaviour between two or more individuals (e.g., territorial disputes or chases), in suitable nesting habitat during the species' breeding season.
V	Probable breeding	Bird visiting a probable nest site in suitable nesting habitat during the species' breeding season.
A	Probable breeding	Agitated behaviour or alarm call of an adult in suitable nesting habitat during the species' breeding season.
B	Probable breeding	Brood patch or cloacal protuberance on an adult individual caught in suitable nesting habitat during the species' breeding season.
N	Probable breeding	Nest-building by wrens or nest hole excavation by woodpeckers.
CN	Confirmed breeding	Nest building, including the carrying of nesting material, by all species except wrens and woodpeckers.
DD	Confirmed breeding	Individual attempting to draw attention away from a nest or young by feigning injury or by using any other distraction display.
NU	Confirmed breeding	Empty nest used during the atlas survey period, or the shells of eggs laid during the same period.
JE	Confirmed breeding	Recently fledged (nidicolous species) or downy (nidifugous species) young incapable of sustained flight.
NO	Confirmed breeding	Adult occupying, leaving or entering a probable nest site (visible or not) and whose behaviour suggests the presence of an occupied nest.
FE	Confirmed breeding	Adult carrying a fecal sac.
AT	Confirmed breeding	Adult carrying food for young.
NF	Confirmed breeding	Nest containing one or more eggs.
NJ	Confirmed breeding	Nest with one or more young (seen or heard).

Appendix 7.6.2

Anatidae observations indicative of breeding pair status according to Bordage *et al.* (2003)

Appendix 7.6.2 Anatidae observations indicative of breeding pair status according to Bordage *et al.* (2003)

Observation[a]				Number of indicated breeding pairs					
				Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
M	F	U	T	Dabbling ducks (except American Black Duck)	American Black Duck	Diving ducks (except Ring-necked Duck)	Ring-necked Duck	Canada Goose	Common Loon
1	0	0	1	1	1	1	1	1	1
0	1	0	1	0	1	0	0	1	1
0	0	1	1	0	1	0	0	1	1
2	0	0	2	2	1.5	2	2	1	1
1	1	0	2	1	1.5	1	1	1	1
1	0	1	2	1	1.5	1	1	1	1
0	2	0	2	0	1.5	0	0	1	1
0	1	1	2	0	1.5	0	0	1	1
0	0	2	2	0	1.5	0	0	1	1
3	0	0	3	3	3	3	3	1	0
2	1	0	3	2	3	2	2	1	0
2	0	1	3	2	3	2	2	1	0
1	2	0	3	1	3	1	1	1	0
1	1	1	3	1	3	1	1	1	0
1	0	2	3	1	3	1	1	1	0
0	3	0	3	0	3	0	0	1	0
0	2	1	3	0	3	0	0	1	0
0	1	2	3	0	3	0	0	1	0
0	0	3	3	0	3	0	0	1	0
4	0	0	4	4	4	4	4	0	0
3	1	0	4	0	4	3	3	0	0
3	0	1	4	3	4	3	3	0	0
2	2	0	4	2	4	2	2	0	0
2	1	1	4	2	4	2	2	0	0
2	0	2	4	2	4	2	2	0	0
1	3	0	4	1	4	1	1	0	0
1	2	1	4	1	4	1	1	0	0
1	1	2	4	1	4	1	1	0	0
1	0	3	4	1	4	1	1	0	0
0	4	0	4	0	4	0	0	0	0
0	3	1	4	0	4	0	0	0	0
0	2	2	4	0	4	0	0	0	0
0	1	3	4	0	4	0	0	0	0
0	0	4	4	0	4	0	0	0	0
1	x	x	>4	0	0	0	1	0	0
2	x	x	>4	0	0	0	2	0	0
3	x	x	>4	0	0	0	3	0	0
4	x	x	>4	0	0	0	4	0	0
>4	x	x	>4	0	0	0	0	0	0

[a] M: male; F: female; U: sex unknown; T: total.

Appendix 8.7.1

Technical terms used in landscape analysis[1]

[1] The information in this section comes from the following work : *Gaudreau, Richard, Méthode d'analyse visuelle pour l'intégration des infrastructures de transport Ministère des Transports du Québec, Service de l'environnement, 1986.*

Appendix 8.7.1 Technical terms used in landscape analysis [1]

Ambiance : L'ambiance du paysage traduit l'atmosphère matérielle de l'endroit, l'impression qu'il produit sur l'observateur. L'ambiance est le résultat global de notre perception.

Concordance : Harmonie qui résulte lorsque les relations qui existent entre les éléments du paysage tendent vers un même effet.

Complexité visuelle : La complexité influence la capacité d'absorption et tient du volume et du nombre des éléments d'utilisation du sol (végétation et bâtiment) selon la fonction résidentielle, récréative, institutionnelle ou commercial à laquelle ils sont destinés. Plus l'utilisation du sol est complexe, plus le paysage est absorbant et plus l'accessibilité visuelle est faible.

Continuité : La continuité d'un paysage est cette qualité qui fait qu'on le perçoit comme un tout, composé de parties non séparées.

Découverte progressive : Cheminement dont l'évolution est graduelle et constante, facilitant ainsi la découverte régulière et continue d'un paysage.

Dynamisme : Qualité d'une séquence visuelle donnant une impression de force et de mouvement. On parle aussi de l'animation d'une séquence.

Élément d'orientation : Objets ou endroits susceptibles d'être reconnus et choisis par l'usager pour se retrouver.

Harmonie : Effet d'ensemble résultant des relations qui existent entre les éléments du paysage. Il s'établit un rapport de concordance lorsque ces éléments tendent à un même effet. L'harmonie de l'infrastructure est en relation avec l'harmonie du paysage environnant qui dépend du nombre et de l'importance des points de vue, de l'intensité et de la concordance de l'ambiance. Un paysage harmonieux est nécessairement concordant et la discordance traduit un manque d'harmonie.

Histoire : Valeur architecturale ou qualité des événements dont ont été témoin des sites ou des bâtiments spécifiques.

Image : Évocation de la réalité d'un paysage dont la représentation, en raison d'un rapport de similitude ou d'analogie, est collective. L'image de ce paysage est reconnus et typique.

Marge de recul : Distance entre l'infrastructure projetée et la limite d'une propriété riveraine.

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[1] The information in this section comes from the following work **:** *Gaudreau, Richard, Méthode d'analyse visuelle pour l'intégration des infrastructures de transport, Ministère des Transports du Québec, Service de l'environnement, 1986.*

Mise en scène : Organisation des éléments d'une unité de paysage. Elle concerne la disposition et l'agencement des parties extérieures et visibles du reliefs, de la végétation et de l'utilisation du sol.

Observateur : Personne qui, à titre d'usager (observateur mobile) ou de riverain (observateur fixe) observe un paysage susceptible d'être modifié par l'implantation d'une infrastructure. On peut diviser les riverains en trois catégories : les riverains occupant un lieu de travail, les résidents et ceux qui se livres à des activités de loisir. Il y a d'autres part, trois catégories d'usagers : ceux qui font la navette, les touristes et ceux qui y voyagent pour le travail.

Occupation du sol : Terme générique de l'inventaire des caractéristiques du paysage regroupant l'hydrographie, la végétation et les éléments de l'utilisation du sol.

Points de vue : Principaux endroits d'où l'on jouit d'une vue particulièrement pittoresque ou spectaculaire. Un des paramètres de l'harmonie.

Transition : Passage brusque ou progressif entre deux paysages. On qualifie la transition entre deux paysages de brusque ou de progressive selon que le passage s'effectue entre deux zones de relief et d'occupation du sol homogène ou mixtes.

Appendix 8.7.2

Evaluation of visual accessibility for the study area

Appendix 8.7.2 Evaluation of visual accessibility for the study area

						Unités de paysage				
				Accès au paysage	Indice simple	DS-1	LC-1	LC-2	MT-1	MT-2
Capacité d'absorption	Végétation	Densité	Faible Moyenne Forte	Fort Moyen Faible	2 1 0	1	2	2	1	1
		Hauteur	Friche Jeune forêt Forêt mature	Fort Moyen Faible	2 1 0	1	2	2	1	1
	Utilisation du sol	Densité	Faible Moyenne Forte	Fort Moyen Faible	2 1 0	2	2	2	2	2
		Hauteur	Basse Moyenne Élevée	Fort Moyen Faible	2 1 0	2	2	2	2	2
		Complexité	Faible Moyenne Forte	Fort Moyen Faible	2 1 0	2	2	2	2	2
	Relief		Plat Ondulé Montagneux	Fort Moyen Faible	2 1 0	1	2	2	0	0
	Type de vue		Ouverte Filtrée Fermée	Fort Moyen Faible	2 1 0	1	2	2	1	1
	INDICE DE LA CAPACITÉ D'ABSORPTION MAX 14					10	14	14	9	9
Observateurs	Riverains	Type	Résidence Loisir Travail	Fort Moyen Faible	2 1 0	0	0	2	0	0
		Nombre	Fort Moyen Faible	Fort Moyen Faible	2 1 0	0	0	0	0	0
		Marge de recul	Faible Moyenne Forte	Fort Moyen Faible	2 1 0	0	0	0	0	0
	INDICE DE LA VISIBILITÉ DES RIVERAINS MAX 6					0	0	2	0	0
	Usagers	Type	Touristes Navette Affaire	Fort Moyen Faible	2 1 0	1	1	1	1	1
		Nombre	Fort Moyen Faible	Fort Moyen Faible	2 1 0	0	0	0	0	0
		Vitesse de déplacement	<60 km/h 60-90 km/h > 90 km/h	Fort Moyen Faible	2 1 0	2	2	2	2	2
	INDICE DE LA VISIBILITÉ DES USAGERS MAX 6					3	3	3	3	3
INDICE D'ACCESSIBILITÉ VISUELLE MAX 26						13	16	19	12	12

Indice fort > 17, indice moyen 9 à 17, indice faible < 9.

Appendix 8.7.3

Visual interest of landscape

Appendix 8.7.3 Visual interest of landscape

						Unités de paysage				
				Intérêt visuel	Indice simple	DS-1	LC-1	LC-2	MT-1	MT-2
Harmonie	Point de vue	Importance	Forte Moyenne Faible	Fort Moyen Faible	2 1 0	0	1	1	2	0
		Concordance	Forte Moyenne Faible	Fort Moyen Faible	2 1 0	2	2	2	2	2
	Ambiance existante	Intensité	Forte Moyenne Faible	Fort Moyen Faible	2 1 0	1	2	2	2	1
		Concordance	Forte Moyenne Faible	Fort Moyen Faible	2 1 0	1	2	2	2	1
	INDICE D'HARMONIE			MAX 8		4	7	7	8	4
Continuité	transition	Nombre	Faible Moyen Fort	Forte Moyenne Faible	2 1 0	2	1	1	2	2
		Intensité	Progressive Moyenne Brusque	Forte Moyenne Faible	2 1 0	2	1	1	2	2
	INDICE DE DYNAMISME			MAX 4		4	2	2	4	4
Orientation	Image		Forte Moyenne Faible	Fort Moyen Faible	2 1 0	0	1	1	0	0
	Éléments ponctuels	Nombre	Élevé Moyen Faible	Fort Moyen Faible	2 1 0	0	1	1	0	0
		Importance	Forte Moyenne Faible	Fort Moyen Faible	2 1 0	0	1	2	0	0
	Découverte progressive		Forte Moyenne Faible	Fort Moyen Faible	2 1 0	0	0	0	0	0
	INDICE D'ORIENTATION			MAX 8		0	3	4	0	0
INDICE DÉ L'INTÉRÊT VISUEL				MAX 20		8	12	13	12	8

Indice fort > 12, indice moyen 6 à 12, indice faible < 6.

Appendix 8.7.4

Evaluation of value assigned to landscape

Appendix 8.7.4 Evaluation of value assigned to landscape

						Unités de paysage				
				Valeur attribuée	Indice simple	DS-1	LC-1	LC-2	MT-1	MT-2
Du paysage	Mise en scène	Nombre de sites	Forte Moyenne Faible	Forte Moyenne Faible	2 1 0	0	1	1	0	0
		Structure	Forte Moyenne Faible	Forte Moyenne Faible	2 1 0	0	0	0	0	0
	Histoire	Nombre de sites	Forte Moyenne Faible	Forte Moyenne Faible	2 1 0	1	2	1	1	0
		Importance	Forte Moyenne Faible	Forte Moyenne Faible	2 1 0	0	1	2	1	0
	Symbolisme	Nombre de sites	Forte Moyenne Faible	Forte Moyenne Faible	2 1 0	1	2	1	1	0
		Importance	Forte Moyenne Faible	Forte Moyenne Faible	2 1 0	1	1	2	1	0
	Vocation		Douce Moyenne Dure	Forte Moyenne Faible	2 1 0	2	2	2	2	2
INDICE DÉ LA VALEUR ATTRIBUÉE MAX 14						5	9	9	6	0

Indice fort > 8, indice moyen 5 à 8, indice faible < 5.

Appendix 8.7.5

Visual simulations of the site in its current conditions and of the facilities in the operation phase

Visual 3D simulation of Camp Lagopede – Current conditions

Visual 3D simulations of the Renard Project – Operation phase

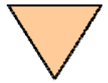
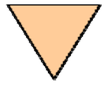
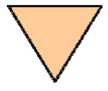
stornoway

Visual 3D simulations of the Renard Project – Post-closure phase

Appendix 9.1.1

Summary of impacts and mitigation and improvement measures by valued component - Construction Phase

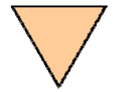
Appendix 9.1.1 Summary of Impacts, and Mitigation and Improvement Measures for Valued Component - Construction Phase

	Valued component	Impact Source	Potential Impact	Mitigation and Enhancement Measures	Residual Impact
Physical Environment	**Air Quality**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities	• Increase in airborne particulates.	• Use of dust control on secondary roads in order to limit dust emission caused by vehicle circulation; • Use of mats to confine to the worksites dust propagation generated by blasting of surfaces ; • Positioning of power generating sets as far as possible from the temporary worker's camp to minimize exhaust gas concentrations within the accommodation and services complex area.	
		Quarry and borrow pit operation.	• Increase in airborne particulates.		
		Use and maintenance of machinery and power generating sets, and road traffic.	• Combustion gas emissions from machinery and power generating sets, mainly nitrogen oxides (NOx), sulphur dioxide (SO2), carbon monoxide (CO) and fine particles; • Increase in airborne particulates.		
		Construction of mine facilities (ore processing plant, accommodation and services complex, airstrip, power generating sets, and ancillary facilities).	• Increase in airborne particulates.		
	Ambient Noise Level	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Increase of ambient noise levels caused by mobile equipment such as trucks, loaders, etc., as well as occasional, short-term but high intensity noise from activities related to blasting, soil compaction, and flooding.	• Various mitigation measures will be used to abate sources of noise. Noise monitoring in the accommodation and services complex area will ensure acceptable noise level. If the residual noise level is likely to disturb workers at the accommodation and services complex, building of a 5-m soundproofing structure will be considered.	
		Quarry and borrow pit operation.	• Increase of ambient noise level from mobile equipment such as trucks, loaders, crushers, etc.		
		Use and maintenance of machinery and power generating sets, and road traffic.	• Increase of ambient noise level from mobile equipment such as trucks, and loaders, etc.		
		Dewatering of lakes and streams, and water and sediment management.	• Increase of ambient noise levels generated by the continuous low-intensity noise from the pumping units.		
		Water management on worksite.	• Increase of ambient noise level from the suppressor at the wastewater treatment station.		
		Construction of mine facilities (ore processing plant, accommodation and services complex, airstrip, power generating sets, and ancillary facilities).	• Increase in ambient noise level from mobile equipment such as trucks and loaders, as well as occasional, short-term but high intensity noise from activities related to blasting, soil compaction, and sinking.		
	Soil	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Change in the quantity and quality of the soil within the footprint of the project; • The passage of machinery could also cause soil compaction as well as increase airborne particulates and erosion.	• Stabilize excavated soil and backfilling with stabilization techniques blending with the natural surroundings, as far as possible. These techniques include revegetation, restoration of vegetation cover, and gabions and riprap, using a geotextile fabric when necessary; • The slopes of the excavated soil and backfilling must be stabilized using techniques blending with the natural surroundings, as far as possible, wherever erosion is likely to cause sediment transport toward streams. Wherever possible, terrain slopes should be reduced to 1.5 (H): 1 (V) or by using other available techniques; • If an area have to remain uncovered for a long period, use riprap or any other strategy considered effective to cover the site; • Protect storage areas for bulk materials (cement, sand, etc.) with plastic tarp for small areas and sediment control fences for larger areas; • Wherever indurated soil is present, ensure to leave the indurate layer intact and preserve the humus, except for areas including a road developed in compliance with guidelines.	
		Quarry and borrow pit operation.	• Borrow pit and managing operation may generate impacts on soil by removing of natural topsoil which enhance erosion susceptibility; •Soil compaction increase airborne particulates as well as erosion.	• Clear completely the area first; • Remove topsoil (organic fraction) and set aside for restoration work; • Restoration of borrow pits will be undertaken following the end of operations; • Areas impacted by borrow pits will be covered with a layer of topsoil and revegetated; • Cleared areas will then be revegetated.	

Physical Environment	**Soil**	Use and maintenance of machinery and power generating sets, and road traffic.	• Soil compaction promotes erosion and decreases soil permeability; • Increased risk of soil contamination by accidental spillage or leakage of hydrocarbon or other contaminants.	• Circulation of machinery and other vehicle will be limited to access roads rights-of-way and work areas that have been previously identified; • Speed limit of vehicles on the site will be reduced to minimize dust emission; • Abrasives will be used instead of salts for winter road maintenance; • Specific sites for vehicles and machinery maintenance will be identified. Maintenance areas and fuelling stations will be planned to prevent soil contamination in case of accidental spills or leak; • If possible, heavy machinery passageways will be limited to firm ground to avoid rutting. • Use of machinery equipped with tires or caterpillar will be promoted.	
		Storage and management of hazardous materials and fuels.	• Increased risk of soil contamination in case of a poorly managed hydrocarbons or hazardous materials accidental spill.	• Requirements of the Petroleum Products Act (RSQ, chapter P-29.1) and the Petroleum Products Regulation (RQ c. P-29.1, r.3) will be applied to the management of materials and oil products; • The number of petroleum products tanks and machinery refuelling stations sites will be kept to a minimum to reduce the sites at risk. They will be built in compliance to current regulations; • Storage areas for petroleum products will be equipped with holding tanks with a capacity of at least 110% of the volume of the largest tank in order to contain leaks and spills; • Barrel storage areas will be equipped with watertight dikes or other containment facilities, in order to contain the highest of the following volumes: 25% of the total capacity of all storage containers or 125% of the largest capacity; • Underground areas designated as permanent sites for routine maintenance activities, lubrication, and refuelling will be covered with a concrete slab designed to prevent oil leaks or be equipped with a non-leaking automatic fuelling system; • Hazardous materials will be managed in accordance with the Regulation respecting hazardous materials (RSQ, c. Q-2, r. 15.2). Transportation of hazardous materials will be made in accordance with the Transportation of Dangerous Goods Act (RSQ, c. C-24.2, s. 622, para. 1-8); •Procedures for preventing risks of accidental spills and leaks will be established as well as an emergency response plan (e.g. containment structures, runoff treatment within storage and fuel handling areas, etc.); • A permanent and easily accessible emergency kit for containment of petroleum products and hazardous materials will be available at each refuelling station. Absorbents will be used to contain oil spill. Safe disposal sites for contaminated absorbent will be provided; • Any spillage or leakage will be reported immediately to responsable of the emergency response plan of the project. The response plan for spills will be implemented quickly and rigorously; • An area affected by a spill will be immediately confined and cleaned. Contaminated soil will be excavated and transported to a storage area complying with guidelines regarding contaminated soil storage and transfer sites, soil assessment will be conducted in accordance with current guidelines and standards; • Disposal of contaminated soil, petroleum residues, and other hazardous waste will be carried out in compliance with current laws and regulations; • Clearly identified sealed containers will be available on site to receive waste contaminated petroleum products.	
	Groundwater	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles of materials, borrow pits, roads - All facilities.	• Waterproofing of the soil surface at different locations; • Change in runoff coefficient on the site; • Change in the pattern of groundwater recharge.	• The overall design of the mine site has been progressively optimized to minimize interference with the waterways and the hydrogeological regime of surface deposits; • Mitigation measures will be implemented during the construction phase to reduce the quantity of runoff exiting the construction site to minimize contaminant transport.	
		Quarry and borrow pit operation.	• The presence of borrow pits could alter surface and groundwater flow in surface deposits.	Wherever possible, the exploitation of borrow pits will be limited to the portion located above the water table. Therefore, no pumping will be required to drain borrow pits. Thus, no significant impact on groundwater due to the exploitation of borrow pits is foreseen.	
		Use and maintenance of machinery and power generating sets, and road traffic.	• Increased risk of groundwater contamination due to leakage or accidental spills of hydrocarbon or other contaminants.	Circulation of machinery and other vehicle will be limited to access roads rights-of-way and to work areas that have been previously identified.	
		Dewatering of lakes and streams, and water and sediment management.	• Change in the pattern of recharge and discharge of groundwater.		

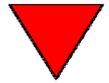
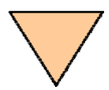
Physical Environment	**Groundwater**	Storage and management of hazardous materials and fuels.	• Increased risk of groundwater contamination due leakage or accidental spills of hydrocarbon or other contaminants.	• Hazardous materials will be managed in accordance with Regulation respecting hazardous materials (RSQ, c. Q-2, r. 15.2). Transportation of hazardous materials will be made in accordance with the Transportation of Dangerous Goods Act (RSQ, c. C-24.2, s. 622, para. 1-8), and the Regulation respecting biomedical waste (c. Q-2, r. 12), para. 1 to 8). Petroleum products will be managed in accordance with the Petroleum Products Act (RSQ, chapter P-29.1) (RSQ, chapter P-29.1) and the Petroleum Products Regulation (RQ c. P-29.1, r.3) for material management and petroleum products; • Minimize use of and use alternatives to hazardous materials; • Storage areas for petroleum products will be equipped with a holding tank with a capacity at least 110% of the volume of the largest tank in order to contain leaks and spills; • Barrel storage areas will be equipped with watertight dikes or other containment facilities, in order to contain the highest of the following volumes: 25% of the total capacity of all storage containers or 125% of the largest capacity; • Establishment of procedures for spill prevention and response (e.g., containment structures, stormwater treatment in areas of storage and handling of fuel) and a emergency response plan for spills (procedures and methods of intervention); • Any spillage will be immediately reported to the person responsible for the mine emergency response plan; • The underground areas designated as permanent sites for routine maintenance activities, lubrication and refuelling will be covered with a concrete slab designed to prevent the outflow of petroleum products or equipped with an automatic non-leak filling system; • A permanent and easily accessible emergency kit for recovering petroleum products and hazardous materials will be present on site. Absorbents will be used to hold waste oil; • Properly sealed and identified containers for receiving the waste contaminated petroleum products will be available; • Oil contaminated absorbent materials will be disposed appropriately.	
	Hydrological regime	Construction of mine facilities (ore processing plant, accommodation and services complex, airstrip, generating power sets, and ancillary facilities).	• Alteration of the sub-watersheds limits and runoff coefficients. • Waterproofing of additional surfaces will increase peak flow in the sub-watersheds outlets concerned.		
		Quarry and borrow pit operation.	• Change in runoff coefficient on the site.		
		Dewatering of lakes and streams, and water and sediment management.	• Change in water level in other nearby lakes and stream derivation; • Water from the dewatering will be pumped to a sedimentation pond, a treatment plant, and to Lake Lagopede, which will result in an estimated 2.3 m increase of the lake water level.	• Water from the bottom of the lake that are rich in suspended solids will be treated using Envirobags before being released into Lake Lagopede; • Bottom sediment of dewatered lakes will be excavated in early winter to minimize sediment transport.	
		Water supply.	• Due to the large volume of water available and the low withdrawal rate during the construction phase, water intake from of water from Lake Lagopede is unlikely to alter the hydrological sub-basins connected to the site.		
		Water management on worksite (runoff, drinking water, process water, wastewater, etc.).	• Diversion of a stream section of the SBVR-2 outlet to prevent flooding of pit R-65.	• The water management plan submitted by Golder (2011e) provides a network of ditches and culverts to collect runoff, as well as a water treatment plant to monitor water quality prior to release into Lake Lagopede.	

Physical Environment	**Surface Water**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles of materials, borrow pits, roads - All facilities.	• Temporary degradation of water quality, especially caused by erosion and sediment transport toward the hydrological network; • Possible increase of total suspended solids (TSS), nutrients, organic matter, and metals. • The reduction of vegetation cover and the possible increase in TSS concentrations could contribute to increase of the water temperature of small streams or lakes.	• The footprint of the project was reduced to a minimum in order to reduce clearing; • Do not establish a sandpit within 75 m of a lake or perennial stream or fish habitat, unless conditions comply with the Regulation respecting pits and quarries (Q -2, r. 7); • Work area limits will be clearly identified on site in order to strictly limit work to required areas; • Control erosion and sediment transport toward streams and waterbodies by selecting strategies considering characteristics of the site and environmental conditions (e.g. silt fences, rockfill, geotextiles, straw bales, sedimentation ponds); • No debris will be disposed of into the aquatic environment and any debris accidentally dumped will be removed promptly; • Services areas and excavation and fill materials stockpiles will be cleared, and the topsoil layer will be set aside for the rehabilitation phase; • Clearing, grading, and levelling will be executed, as far as possible, immediately before the beginning of infrastructure installation; • Slopes will be stabilized as quickly as possible to prevent erosion; • No levelling or excavation will be carried out near streams during flood periods or during heavy rain; • Preventive stabilization work will be carried out if work must be suspended during the winter; • Maintain and retain vegetation cover within a buffer strip of 30 metres from the natural high water mark; •If necessary, manually cut trees located close to aquatic environments (less than 30 m), and dispose of woody debris beyond the natural high water mark; •All drainage ditches that receive runoff from the construction site will be stabilized before construction activities begin and will be maintained until completion of the work; •Install silt fences wherever soil will be disturbed and add additional barriers where there is a risk of fine sediment transport; •Protect material storage areas (cement, sand, etc.) with plastic tarp for small areas and silt fences for larger areas; •Dispose of backfilling soil in order to prevent runoff transport of fine particles toward streams or lakes; • Within 60 m of a lake or a perennial stream, and within 30 meters of an intermittent stream, preserve the vegetation cover and stumps, except where a road will be developed (including roadway, shoulders and road embankment) and where backfilling is required for the road.	
		Quarry and borrow pit operation.	• The exploitation of borrow pits (extraction, crushing, screening, etc.) may cause water quality degradation, especially through sediment transport into the hydrological network, if erosion is not controlled at the source.	• Control erosion at source and reduce sediment transport to lakes or streams; • Runoff will be deviated to a vegetated area located at a distance of at least 20 m from a lake or a stream measured from the natural high water mark; • Slopes of an exploited surface of a sand pit will be of 30 degrees at most (from horizontal), to prevent erosion and land slumping; • The water released into the environment by quarry or sand pit operation, or by crushing or screening processes will not include a contaminant concentration greater than 15 mg/l of oil, grease, or mineral originating tar , and greater than 25 mg / litre of total suspended solids. • The pH of water released into the environment by quarry or sand pit operation, or by crushing or screening processes should be between 5.5 and 9.5, unless demonstrated that the pH value of the natural environment is outside of this range, as it is the case for the Renard Project area.	
		Dewatering of lakes and streams, and water and sediment management.	• Temporary degradation of water quality, especially through erosion and sediment transport into the hydrological network.	• Water from lake and stream dewatering will be treated by mobile treatment units in order to remove total suspended solids prior to release into Lake Lagopede.	
		Water supply.	• Due to the large volume of water available and the low withdrawal rate during the construction phase, water intake from Lake Lagopede is not likely to change water quality.		

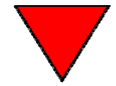
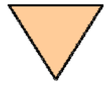
Physical Environment	**Surface Water**	Water management on site (runoff, drinking water, process water, wastewater, etc.).	• Risk of increased sediment transport and increased concentration of phosphorus to the hydrological network. • The treatment plant for domestic wastewater is likely to emit contaminants (phosphorus, nitrogen, fecal coliform, organic matter) that can modify the characteristics of Lake Lagopede within the effluent plume; • Risk of increase in the amount of propylene glycol at the airstrip water discharge point.	• During work, respect as much as possible the terrain natural drainage and carry out appropriate measures to allow normal water flow; • Divert drainage ditches to stable vegetated areas located more than 20 m away from the natural high water mark; • Construct a sedimentation basin for drainage ditches at least 20 m from the receiving stream and drain the basin when the height of water above the sediment is less than 30 cm on at least 50% of the area of the basin; • Culverts will be installed in compliance with guidelines of Fisheries and Oceans Canada; • Machinery streambed fording will be prohibited unless the necessary infrastructure has been installed and required authorizations obtained from the departments concerned. To cross a stream or a fish habitat, a bypass will be installed and removed at the end of the work; • Installation of culverts in a stream will preferably be carried out during low flow period and within best delay; • If necessary, water accumulation in the work area will be pumped to vegetated area located at a distance of at least 20 m from a stream; • After installation of a culvert, other structures required for the work will be removed out of the water; the contractor will ensure streambed inflow and outflow stabilization. The stream bed must then be restored to its natural profile and with similar substrate, and the banks stabilized and, revegetated when necessary; • Place shallow channels or waterbars across secondary roads to limit erosion; • When necessary, use the lower-third method for ditch maintenance.	
		Stockpiling and waste management system and trench landfill site.	• Leaching from the trench landfill site is likely to transport contaminants into the hydrological network, if unmanaged.	• Waste material will be managed in accordance with current regulations (Regulation respecting the application of the Environment Quality Act(Q-2, r.3), Regulation respecting the landfilling and incineration of residual materials (Q -2, r.19), Regulation respecting the environmental and social impact assessment and review procedure applicable to the territory of James Bay and Northern Québec (Q-2, r.25), Regulation respecting the quality of the atmosphere (c. Q-2, r. 38), and Regulation respecting used tire storage (Q-2, r.20)).	
		Storage and management of hazardous materials and fuels.	• Risk of water contamination by hydrocarbon or other contaminants.	• Hazardous material will be managed in accordance with Regulation respecting hazardous materials (RSQ, c. Q-2, r. 15.2), Regulation respecting Transportation of Dangerous Goods Act (RSQ, c. C-24.2, s. 622, para. 1-8), and Regulation respecting biomedical waste (c. Q-2, r. 12), para. 1 to 8). Petroleum products will be managed in accordance with the Petroleum Products Act (RSQ, chapter P-29.1) (RSQ, chapter P-29.1) and the Petroleum Products Regulation (RQ c. P-29.1, r.3) for material management and petroleum products; • Minimize use of and promote use of alternatives to hazardous materials; • Containment and runoff treatment facilities will be installed within storage and fuel handling areas; • Storage areas for new and used petroleum products will be provided with a containment platform of sufficient capacity to contain leaks and accidental spills; • Establishment of an emergency response plan in case of a spill (procedures and intervention methods) as well as procedures for spill prevention and response (e.g. containment structures, storm water treatment in areas of storage and handling of fuel); • Any spillage incident will be immediately reported to responsible of the mine emergency response plan; • The underground areas designated as permanent sites for routine maintenance activities, lubrication, and refuelling will be covered with a concrete slab designed to prevent outflow of petroleum products; • All mobile production equipment will be equipped with a system for express filling with overflow protection; • A permanent and easily accessible emergency kit for recovering petroleum products and hazardous materials will be present on site. Absorbers will be used to hold waste oil; • Properly sealed containers identified for receiving waste contaminated petroleum products will be introduced; • Oil contaminated absorbent materials will be safely disposed appropriately.	

Physical Environment	**Sediment**	Site preparation and development: drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities:	• Temporary modification of the grain size distribution of sediment, mainly caused by erosion and sediment transport to the hydrological network.	• Mitigation measures implemented to protect groundwater will also apply here.	
		Quarry and borrow pit operation.	• Exploitation of borrow pits and crushing of borrow materials may potentially promote sediment transport to the hydrological network, if unmanaged.	• Mitigation measures implemented to protect groundwater will also apply here.	
		Use and maintenance of machinery and power generating sets, and road traffic.	• Risk of sediment contamination by leakage or accidental spills of hydrocarbon or other contaminants.	• Mitigation measures implemented to protect groundwater will also apply here.	
		Dewatering of lakes and streams, and water and sediment management.	• Modification of sediment grain size distribution and transport of organic matter, nutrients, or metals at the releasing point of release of pumped waters.	• Mitigation measures implemented to protect groundwater will also apply here.	
		Water management on site (runoff, drinking water, process water, wastewater, etc.).	• Risk of increased sediment transport and increase of nutrient, organic matter, and metals concentrations to the hydrological network. •Within the plume area, site specific increase of sediments' organic matter content and increased concentrations of nutrients and fine particles may be be observed; • At the limits of the plume, contaminant concentrations will be in the same range of concentrations as those currently measured in the receiving environment, so there should be no impact on sediment quality.	• Mitigation measures implemented to protect groundwater will also apply here.	
		Storage and management of hazardous materials and fuels.	• Risk of sediment contamination by leakage or accidental spills of hydrocarbon or other contaminants.	• Mitigation measures implemented to protect groundwater will also apply here.	
Biological Environment	**Benthos**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities	• Increased sediment transport to the hydrological network; • Site specific and temporary increase of water turbidity and concentration of total suspended solids; • Alteration of bottom substrate grain size distribution and siltation of gravel or rocky substrates due to sedimentation of particulate matter; • Decrease of dissolved oxygen concentration near bottom of lakes and streams.	• Preservation of a 30-meter riparian vegetated buffer strip along streams and lakes; • Management of the worksite areas runoff, which will be redirected to a vegetated area located at least 20 m away from a stream; • Building a network of drainage ditches from the ontset of the construction phase in order to divert runoff around the mine site and redirect it to a sedimentation pond.	
		Use and maintenance of machinery and power generation sets, and road traffic.	• Potential risk of water contamination by leakage or accidental spills of hydrocarbon or other contaminants.	• Minimize the encroachment of machinery in streams by limiting vehicles circulation to access roads and work areas; • Reduce traffic speed limits to minimize soil erosion and dust emission toward hydrological network; • Maintenance and machinery cleaning and refuelling will be carried out further than 60 m away from any stream and a recovery kit will be available in case of accidental leakage or spillage.	
		Dewatering of lakes and streams, and water and sediment management.	• Modification and loss of wildlife habitat.	• Water from lake dewatering process will be treated by mobile treatment units in order to remove total suspended solids prior to release into Lake Lagopede.	
		Storage and management of hazardous materials and fuels.	• Potential risk of surface water contamination by hydrocarbon or other contaminants following accidental spills or leaks.	• Mitigation measures implemented to protect surface water will also apply here.	

Biological Environment	**Fish**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Increased concentrations of total suspended solids in water, due to transport and deposition of sediment in fish habitat; • Potential increase of water temperature in small receiving streams due to clearing of banks and to warmer and more turbid runoff; • The possible development of periphyton and algae in small streams in response to potentially greater amounts of organic matter and phosphorus; • The use of explosives nearby streams can potentially cause vibrations and sound waves that may temporarily disturb fish.	•Perform work during low flow periods and in respect to the timing windows for fish. A timing window will be applied for work to be performed in water. Thus, stream diversion and small lake dewatering as well as culvert installation will be done outside the spawning period of brook trout, i.e. between September 1 and November 1. Regarding the installation of the outfalls in Lake Lagopede, work will be done between May 30 and August 31 to protect spawning of northern pike and white sucker during springtime, as well as lake trout and whitefish during fall. However, it is possible, when justified, to obtain an exemption from authorities in exceptional circumstances; • Permanently dispose of clearing materials or debris (trees, stumps, shrubs, branches, brush, dead wood and other plant debris) at a distance of at least 60 m away from the bank of a lake or a stream or any flood plain, marsh, swamp, or bog; • Do not dispose of any debris into the aquatic environment, and remove any debris introduced as quickly as possible; • Vegetation will be preserved within the 30 m buffer strip bordering a stream; • If absolutely necessary to clear within 20 meters of a stream, cut trees manually and dispose of woody debris outside of the natural high water mark. This will keep the tree to fall in streams and water bodies and maintain soil integrity by protecting it from the passage of machinery; • Runoff will be directed to temporary sedimentation basins until the construction of the sedimentation pond that will be located at pit R-65; • Always control erosion at the source and slow runoff velocity in order to reduce erosive force; • Promote soil infiltration of runoff from work areas; • Avoid transporting fine particles to the aquatic environment beyond the immediate area of work; • Limit clearing to a strict minimum in the field, i.e. only to the exact location of the river crossing; • Do not perform any work or excavation near the river during flood periods or during heavy rain; • Fording machinery in streams will be prohibited; • Encourage riparian slope stabilization as quickly as possible using recognized bioengineering techniques; • Install culverts as recommended by the Best Practice Guide for the design and installation of culverts under 25 m (DFO, 2010). • Ensure the free flow of water at all times to maintain the functions of fish habitat downstream from the construction zone. Take the necessary measures to prevent and limit impacts (e.g. flooding, dewatering, erosion, sediment transport, etc.) upstream and downstream from the work area; • Design the temporary diversion of streams (if required) to withstand floods that may occur during the construction period; stabilize adequately to prevent erosion and sediment transport downstream and to maintain the free passage of fish.	
		Use and maintenance of machinery and power generating sets, and road traffic. Storage and management of hazardous materials and fuels.	• Potential risks of accidental spills or leaks of petroleum products if they are not contained.	• The movement of machinery and other mobile equipment will be limited primarily to the right-of-way for access roads and work areas that have been identified previously; •Maintenance and cleaning of machinery, its refuelling, and mechanical checkups will be conducted in stable and safe locations that are more than 60 m away from streams, lakes or other water bodies ; • An inspection of machinery, trucks, and power generating sets will be made before entering the site, and then on a regular basis to ensure they are in good repair and free of any oil spill; •Hazardous materials will be managed in accordance with the Regulation respecting hazardous materials (RSQ, c. Q-2, r. 15.2), Regulation respecting Transportation of Dangerous Goods Act (RSQ, c. C-24.2, s. 622, para. 1-8), and the Regulation respecting biomedical waste (c. Q-2, r. 12), para. 1 to 8). Petroleum products will be managed in accordance with the Petroleum Products Act (RSQ, chapter P-29.1) (RSQ, chapter P-29.1) and the Petroleum Products Regulation (RQ c. P-29.1, r.3) for material management and petroleum products; • Storage areas for hazardous materials and petroleum products will be equipped with a containment platform of sufficient capacity to contain leaks and spills; • An emergency kit for recovering petroleum products and hazardous materials will be present on site and accessible at all times; • All spills will be reported immediately to the person responsible for implementing the project emergency response plan. This emergency response plan will have been developed and approved prior to the work. The affected area will be confined immediately, and cleaned without delay; • The proponent and contractors will ensure that all equipment is in good working order to prevent any leakage of fuel, oil, or grease. No cleaning of equipment will be allowed near or in the aquatic environment.	

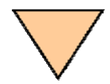
Biological Environment	**Fish**	Dewatering of lakes and streams, and water and sediment management.	• Permanent loss of fish habitat. • Temporary loss of fish habitat.	• Lower the lake level slowly, so that the fish are concentrated in the deepest poolsof the lake; • Capture all the fish with the help of seine or a trap net; • Relocate the fish in a lake nearby with similar fish populations; • If a bypass is necessary, minimize the length of the diverted section; • Avoid work during critical periods for aquatic life; • Redevelop the streams by reproducing the original features (natural shorelines with native plant species, size, slope, and identical width); • Plan the reprofiling of the bank slope (if required) to ensure stability; • Provide a section of preferential flow ("thalweg") in the substrate of the bed of the stream and ensure the free passage of fish; • The diversion structures will not obstruct fish passage and will not shrink the width, measured from the high water mark, of the habitat by more than a third; • Choose the proper stream bed substrate consisting of a natural granular coating to ensure optimal flow; • Limit rockfill on stream banks to the height of the natural high water line, and create a vegetation buffer from the edge of the rockfill using recognized bioengineering techniques, promoting undercut strata of herbaceous plants, shrubs, and trees.	
		Water supply.	• Due to the large volume of water available and the low withdrawal rate during the construction phase, water intake from Lake Lagopede is unlikely to alter the quality of fish habitat;	• Grating openings can be round, square, rectangular, or any combination thereof, but should not have any protrusions that could injure fish; • The materials used will be resistant to corrosion and UV rays, including brass, bronze, aluminum, monel, galvanized or stainless steel, and plastics; • Guide openings and joints will be smaller than the criteria for structures needed to prevent fish passage; • Gratings will be positioned at least 300 mm from the lake bottom to prevent entrainment of sediment and benthic organisms; • A support structure will be fitted onto grating panels to prevent them from sagging or collapsing.	
		Water management on site (runoff, surface water, drinking water, process water, wastewater, etc.).	• Occasional and temporary increase in turbidity and TSS concentrations in the receiving environment; • Given the low concentrations of phosphorus and organic matter in the receiving environment, the development of periphyton and algae in small streams can be accelerated by a proportionately more important input of these compounds; • Avoidance effect by fish within the limits of influence of the effluent plume.	• Mitigation measures implemented to protect surface water will also be applied here.	
		Manpower and procurement.	• Possible increase in fishing pressure.	• Clauses in the contracts of workers and contractors will prohibit fishing on the site.	
	Vegetation and Wetlands	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.		• Reduce the footprint of facilities and infrastructure as part of the design phase to minimize the loss of terrestrial habitat and wetlands; • Prevent fragmentation of forest stands and wetlands; • Maintain a riparian buffer strip of 30 m; • Limit the number of affected sub-watersheds to prevent impacts on the hydrological regime of wetlands; • Limit to a strict minimum the stripping, clearing, excavation, backfilling and grading of work areas in order to respect the natural topography and prevent erosion; • Prohibition to dispose of any debris or any wood waste in floodplains and wetlands such as swamps and bogs, even outside the areas directly affected by the work; • The limit of work areas will be clearly delimited in order to prevent clearing outside the project footprint. No traffic will be permitted outside of accesses, passageways, and work areas; • Limit and control the risks of forest fires during construction; • Segregate topsoil (organic fraction) to keep it for progressive revegetation work; • The overburden removed during the preparation of the mine site will be kept and stored for future restoration work.	

Biological Environment	**Reptiles and Amphibians**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Loss of aquatic habitat; • Changes in habitat quality due to changes in topography and hydrological regime, noise and dust; • Creation of physical barriers limiting the movement of reptiles and amphibians.	• Limit stripping, clearing, excavation, backfilling and grading work areas to a minimum in order to respect the natural topography and prevent erosion; •Limited backfilling of wetlands to only what is necessary, and minimize the footprint of facilities; • In all areas of the work site where there is risk of erosion, quickly stabilize and restore the vegetation covers that is temporarily disturbed by construction; • Carefully follow government's guidelines for the installation of culverts; favour the use of large diameter culverts in order to limit the reduction of the stream width and ensure the penetration of light (a long narrow culvert could be a barrier to amphibians); maintain the presence of substrate at the bottom of the culvert to provide shelter for amphibians (especially two-lined salamanders) that cross through it. • Maintain a buffer strip of at least 30 m along streams and water bodies (screen, filtering of contaminants from the road and stockpile areas, ecological corridor and habitat for species) and of up to 60 m for storage areas of debris or organic matter and areas for storage and refuelling of hydrocarbon or hazardous materials; • Limit fragmentation of habitat by maintainint ecological corridors to ensure movements of anurans between wetlands where they congregate for breeding. These environments are also sites of larval development (source habitats), from which juveniles are dispersed. The point is to maintain an interconnected mosaic of wetlands to allow populations to respond to natural fluctuations in water levels (Ouellet et al., 2005; Leheurteux and Ouellet, 2007); • Install sediment retention barriers when needed (steep slopes with scarce vegetation) on the edge of wetlands. These can limit transport of sediment (limit turbidity in streams and wetlands), and contaminants (in water, can affect the development of eggs and larvae more or less severely depending on concentrations) due to vehicles (oil, grease, particles in the exhaust gases); • Limit movement of equipment and personnel to work areas.	
		Use and maintenance of machinery and power generating sets, and road traffic.	• Creation of physical barriers limiting the movement of reptiles and amphibians; • Fragmentation of habitat; • Road traffic is also a source of noise, atmospheric emissions (dust, contaminants associated with the exhaust emissions) and contamination (e.g. loss of hydraulic motor oil and petroleum products).	• Limit movement of equipment and personnel to work areas; • At stream crossings install bridges on streams that constitute preferential pathways for amphibians; preferably use culverts in a half-pipe shape with a broad and flat base with substrate similar to the stream bed; • Preserve a buffer strip of at least 30 m along streams and water bodies (screen, filtering of contaminants from the road and stockpile areas, ecological corridor and wildlife habitat) and of up to 60 m for storage areas of debris or organic matter and areas for storage and refuelling of hydrocarbon or hazardous materials; • Limit the use of abrasives in the vicinity of stream crossings (to limit transport into streams); • Ensure a systematic maintenance program for vehicles and machinery to minimize oil losses (hydraulic, motor) that could be washed down from roads and work areas into wetlands; • Control atmospheric emissions at the source (e.g. dust); • Adopt noise abatement measures: installation of appropriate sound insulation on the exhaust pipes of engines and compressor components.	
		Dewatering of lakes and streams, and water and sediment management.	• Loss of aquatic habitat.	• During dewatering of lakes F3303 and F3302, the fish from these lakes will be captured and relocated into Lake Lagopede. The use of seines and other fishing gear will also capture amphibians that may be found in lakes at this time. They can also be relocated at the same time as the fish. • The water pumped out of the F3303 and F3302 lakes will be treated by mobile treatment units and their water quality will be monitored prior to being released into Lake Lagopede; • The excavated sediment will be dried on a drying bed and subsequently stored with the overburden for future use in the progressive revegetation program.	
		Water management on site (runoff, drinking water, process water, wastewater, etc.).	• Modification of amphibian habitat due to stream diversions.	• Limit movement of machinery during the stream diversion work to reduce the impact on terrestrial environment; • Adopt erosion control measures and promote quick stabilization of stream banks once derivation is completed.	

	Reptiles and Amphibians	Construction of mine facilities (ore processing plant, accommodation and services complex, airstrip, power generating sets, ancillary facilities).	• The construction site can be a powerful source of sound that can affect anuran reproduction by interfering with their calls.	• Mitigate atmospheric emissions at the source (e.g. dust); • Adopt noise abatement measures: install noise attenuating devices for fans, install appropriate sound insulation on the exhaust pipes of engines and compressor components; • Limit movement of equipment and personnel to work areas; • Ensure a systematic maintenance program for vehicles and machinery to minimize oil losses (hydraulic, motor) that could be washed down from roads and work areas into wetlands.	
Biological Environment	**Waterfowl and waterbirds**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Disturbance of breeding pairs of different species near the work area.		
		Dewatering of lakes and streams, and water and sediment management.	•Loss of habitat that can cause a decrease in waterfowl population in the study area.	• Preferably, start pumping water after the breeding season (mid August) to allow reproduction for another year; • Install nesting boxes for the common goldeneye around Lake Lagopede and other nearby lakes to maintain the number of waterfowl breeding pairs in the mine area.	
		Water management on site (runoff, drinking water, process water, wastewater, etc.).	• Disturbance of loon breeding pairs caused by small craft that can harm the reproduction process; • The construction of aerated lagoons may benefit some species as a resting or even nesting area.	• Make users aware of the need to avoid circulation of small crafts in sheltered bays, which are potential areas for common loon nesting and brood rearing in the spring and summer.	
		Manpower and procurement.	• Increased access of the territory by Cree small craft users will cause additional inconvenience for the loon couples and contribute to reproductive failure in certain years.	• Make users aware of the need to avoid circulation of small crafts in sheltered bays, which are potential areas for common loon nesting and brood rearing in the spring and summer.	
	Raptors	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Loss of habitat leading to a reduction in hunting areas for the red-tailed hawk; • Cleared but not stripped areas could provide an optimal habitat for hunting.	•Avoid disturbance and stripping of the ground in areas where only trees must be cut in order to maintain attractiveness of these zones as hunting areas for red-tailed hawks and other species of this group.	
		Construction of mine facilities (ore processing plant, accommodation and services complex area, airstrip, power generating sets, ancillary facilities).	• Development of lookout stations (powerline poles) for the red-tailed hawk; • Development of potential nesting sites and increase of human sources of food for the raven.		

	Forest birds	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Loss of biotopes inhabited by forest birds including nesting habitat; • Development of breeding habitat for some species nesting on developed land; • Several forest bird nests may be destroyed by clearing and stripping of sites. Their number will depend on the percentage of overlap between the period when the trees and brush will be cleared and the reproduction period.	• Clearing of sites will be done mostly in autumn and winter, or outside of the peak of the forest bird breeding season, which extends from May 1 to August 15 for the sector, as recommended by the Canadian Wildlife Service (CWS); • Dead, fallen trees and low shrubs will be preserved wherever possible in areas where soil will not be disrupted, particularly in the airstrip area.	
		Construction of mine facilities (ore processing plant, accommodation and services complex area, airstrip, power generating sets, ancillary facilities).	• Development of nesting habitat for tree swallows that could use some of the mine site infrastructures.		
Biological Environment	**Micro-mammals**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Habitat loss due to clearing; • Disruption caused by drilling, blasting, filling / excavating; • Disruption of daily or seasonal activities of the animals present.	• Keep a 30 m wide riparian buffer strip intact (from the natural high water mark), between infrastructures and a stream or lake. Clearly delineate work areas clearing limits (orange tape or fence); • When possible, keep a protective cover by making a partial cut to reduce the impact of land clearing and habitat fragmentation.	
		Quarry and borrow pit operation.	• Disturbance caused by extraction of borrow material; • Disruption of daily or seasonal activities of animals present.		
		Use and maintenance of machinery and power generating sets, and road traffic.	• Mortality caused by risk of collision with machinery and vehicles used for clearing and other construction or supply activities.	• Circulate with machinery only in areas to be cleared. Circulation of machinery is prohibited along banks and riparian areas where clearing, if required, should be done manually.	
		Construction of mine facilities (ore processing plant, accommodation and services complex area, airstrip, power generating sets, ancillary facilities).	• Disruption caused by construction of mine facilities, such as the ore processing plant, the accommodation and services complex area, power generating sets and the airstrip; • Disruption of daily or seasonal activities of the animals; • Movement of individuals affected by the disturbance to surrounding habitats, which is likely to temporarily increase the competition for territory and resources.		
	Fur-bearing Animals	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Habitat loss due to land clearing; • Disruption caused by drilling, blasting, filling, excavating, etc; • Movement of individuals to surrounding areas, which can lead to additional energy expenditure, an increase in vulnerability to predators, or increase competition for territory and resources in the surrounding areas of the project.	• Starting from the natural high water mark, a 30 m wide buffer strip will be kept intact, between infrastructures and a stream or lake. The areas to be cleared will be clearly delineated prior to conduct work (orange tape or fence); • Road design and management to limit the risk and frequency of traffic accidents (e.g. cutting vegetation at large curves in order to allow drivers of vehicles to see the animals); • Ensure that beavers affected by construction activities are trapped by Crees or captured alive during the summer, and then relocated in suitable habitats.	
		Quarry and borrow pit operation.	•Disturbance caused by extraction of borrow material; • Disruption of daily or seasonal activities of animals present.		
		Use and maintenance of machinery and power generating sets, and road traffic.	• Machinery and vehicles used for clearing, construction activities and supplies will cause mortality; • The effect of avoidance in work areas can disrupt behaviours related to feeding, breeding, and rearing of young.	• Circulate with machinery only in areas to be cleared. Circulation of machinery is prohibited along banks and riparian areas where clearing, if required, should be done manually. •The abrasives used for winter road maintenance will be limited to sand and gravel unless there are exceptional circumstances. Consequently, there will be no negative effects on wildlife associated with the use of calcium.	

		Construction of mine facilities (ore processing plant, accommodation and services complex area, airstrip, power generating sets, ancillary facilities).	• Disruption caused by construction of mining facilities, such as the ore processing plant, the accommodation and services complex, power generating sets and the airstrip; • Possible increase in the number of wolves and foxes near the camp facilities.	• Make workers aware that it is important not to feed the animals and leave food out in order to prevent attraction of fur-bearing animals near the work areas. Awareness programs can be done through posters and information sessions; • Develop a plan to protect wildlife to reduce poaching opportunities.	
	Big game	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities	• Habitat loss due to land clearing and the preparation of sites; • Disruption caused by drilling, blasting, filling, excavating; • In winter, the disturbance caused by construction activities could affect caribou by changing the period and their migration patterns.		
		Quarry and borrow pit operation.	• Disruption of animals that are close to the site, due to borrow pit extraction activities.		
		Construction of mine facilities (ore processing plant, accommodation and services complex area, airstrip, power generating sets, ancillary facilities).	• In winter, the disturbance caused by construction activities could affect woodland caribou by changing the period and their migration patterns; • Possible increase in the number of black bears near project facilities.	• Install appropriate fences to exclude large mammals from the camp, the hazardous materials storage areas and the trench landfill; • Make land users aware that it is important not to feed wild animals or leave food out to avoid attracting black bears near camp facilities. In the case where animals must be slaughtered, allow tallymen to hunt the unwelcome bears themselves; • Develop a wildlife protection plan to reduce poaching opportunities; • Make land users aware of the effects of illegal harvesting, poaching, accidental slaughtering, and overall disturbance of woodland caribou; • If applicable, document the movements of woodland caribou on the property using opportunistic observations, aerial surveys or GPS collars placed on the woodland caribou.	
		Use and maintenance of machinery and power generating sets, and road traffic.	• Very low probability of collisions.		
Human Environment	**Use of the Territory and Natural Resources**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Disturbance or loss of hunting, trapping, and/ or fishing territory; • Decreased quality of hunting and fishing in and around the project area because of noise from construction activities (e.g. blasting activities); • Inconvenience to land users and the workforce due to noise and dust emissions.	• Recognize and respect the role of M11 trapline users in the traditional and contemporary management of natural resources in the environment; • Keep land users informed of the anticipated progress of construction and its location to ensure user safety during more dangerous operations (e.g. blasting) and agree with users about any accommodation deemed necessary; • The mitigation measures related to ambient noise, air quality, and water quality also apply here; • The Swallow family camp that is located near the airstrip will be relocated. An agreement is being negotiated with the tallymen to relocate the camp to an area that will be equally suitable.	
		Use and maintenance of machinery and power generating sets, and road traffic.	• Decreased quality of hunting and fishing in and around the project area because of noise from machinery and traffic.	• Reduction of noisy activities (e.g. travel by helicopter or ATV) on certain portions of the territory during waterfowl and moose hunting periods; • Ensure that the development of the mine does not interfere with any navigation or snowmobile trails; • Establish appropriate signboards at locations where snowmobile trails and all terrain vehicles paths intersect with the mine roads and access roads; • The mitigation measures related to the biological and physical environment also apply here.	
		Water management on site (runoff, drinking water, process water, wastewater, etc.).	• Disturbance or loss of hunting, trapping, and/ or fishing territory.		

		Construction of mine facilities (ore processing plant, accommodation and services complex area, airstrip, power generating sets, ancillary facilities).	• Decreased quality of hunting and fishing in and around the project area because of noise from construction activities (e.g. blasting activities).		
		Manpower and procurement.	• Disturbance of land users during takeoff and landing of aircrafts transporting manpower and supplies.	• For workers, develop an awareness program in relation to Cree culture and land use on M11 trapline; • Fishing, hunting, and trapping will be prohibited on the site by clauses in the contracts for workers and contractors; • A safety zone will be established around the project site where the practice of hunting, fishing, and trapping will be suspended; • Compensate disturbance caused to the tallymen, whose base camp is located east of the airstrip. Discussions between the two parties are underway to relocate the camp in an equally suitable area of the trapline.	
	Employment and Economy	Manpower and procurement.	• Creation of jobs. •Local, regional, provincial, and national economic spinoffs. •Wherever possible, the involvement of local and regional manpower and businesses will be prioritized in relation to the construction of the mine.	• Implement the Impact and Benefit Agreement (IBA) signed with the Cree Nation; • Develop a recruitment policy favouring regional employment; • Encourage awarding of contracts to companies in the region, provided that they submit a competitive bid; • Work closely with the communities of Chibougamau and Chapais to maximize regional benefits in terms of jobs and economy; • Consider establishing a work group with representatives of Chibougamau and Chapais, in consultation with local and regional organizations working in the field of economy, employment, and training in order to establish mechanisms to monitor economic spinoffs; • The Impact and Benefit Agreement (IBA) also incorporates a series of measures to be implemented to promote employment, integration, advancement, and retention of Cree workers in all spheres of activities at the mine; • Establish a communication plan to disclose to local participants, with a full description of human resources necessary for the project.	
	Health and Well-being	Use and maintenance of machinery and power generating sets, and road traffic.	• Activities can cause an increased level of dust and atmospheric emissions; • Accidental spills or leaks of petroleum products or other chemicals on the work site may contaminate water, vegetation, fish, and wildlife in the area.	• The main mitigation measures in terms of impacts on the health of the study area's users are those that have already been provided to reduce impacts on air quality, groundwater quality, and surface water quality; • To increase safety on the road, scheduled carriers will be equipped with satellite phones.	
		Storage and management of hazardous materials and fuels.	• Leaks or accidental spills of petroleum products or other chemicals on the work site can contaminate water, vegetation, fish, and wildlife in the area.		
		Manpower and procurement.	•There are direct risks to the health and safety of personnel and visitors on the road and the work site.	• The project will have the on-site emergency medical and evacuation services required in case of illness or accidents; • To address any health or safety issues that could result from a failure or an accident, the emergency response plan will include construction activities; • To maximize effectiveness, the plan will be shared with the staff and training will be offered; • Inform residents of the communities of the emergency measures put in place.	

Human Environment	**Archaeological and Cultural Heritage**	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• It is possible that archaeological remains are accidentally uncovered during the various excavations that will be done on site.	• In the case of an incidental discovery of an archaeological resource during mining operations, managers will be informed of their obligation to report promptly to the contractor. They must, if necessary, stop work at the place of discovery to complete evaluation by archaeologists and inform the Cree representatives; • The applicable provisions of Quebec's Cultural Property Act will be implemented (temporary protective measures, assessment of discoveries, archaeological digs); • In the case of the discovery of a burial site, the police will be called immediately and verifications will be made with trapline M11 officials to confirm identity. Relocation of such a site or any other arrangement agreed upon with the family involved will be borne by Stornoway; • Measures are planned in the IBA in the case of discovery of archaeological or culturally significant sites for the Cree.	•
	Landscape	Site preparation and development: clearing, drilling, blasting, backfilling, filling, excavation, drainage, confinement areas and stockpiles, borrow pits, roads - All facilities.	• Decreased quality of the landscape by changing the natural character of the landscape.	• No infrastructure will be installed within less than 30 meters from Lake Lagopede; • The accommodation and services complex area will be built on two floors in order to create a smaller footprint on the environment.	▼
		Water management on site (runoff, drinking water, process water, wastewater, etc.).	• Decreased quality of the landscape by changing the natural character of the landscape.		
		Construction of mine facilities (ore processing plant, accommodation and services complex area, airstrip, power generating sets, ancillary facilities).	• The establishment of these facilities in the landscape has a direct negative impact due to the visual contrast between the existing natural and man-made constructions.		

▼ Negative – low
▼ Negative – moderate
▼ Negative - high
▲ Positive – low
▲ Positive – moderate
▲ Positive - high
• Negligible or null

Appendix 9.2.1

Summary of impacts and mitigation and improvement measures by valued component – Operation Phase

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Physical environment	Air quality	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Increase in airborne particles.		
		Use and maintenance of machinery and power generating sets; road circulation	• Combustion gas emissions by machinery and power generating sets, primarily nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO) and fine particles. • Increase in airborne particles.	• Use of dust control agents on mine roads will reduce dust raised by vehicles transporting ore/processed kimberlite and mine supply vehicles.	
		Ore mining, handling and storage	• Increase in airborne particles. • Nitrogen oxide emission by blasting (NO_x).		
		Ore processing	• Increase in airborne particles.		
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Increase in airborne particles.	• For the processed kimberlite confinement area, sprinkling during dry weather in the locations where the kimberlite is stockpiled will reduce the probability of emission by wind erosion.	
		Power generating sets	• Combustion gas emissions by machinery and power generating sets, primarily nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO) and fine particles.		
		Airstrip operation	• Combustion gas emissions by machinery and power generating sets, primarily nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO) and fine particles. • Increase in airborne particles.		
		Progressive site rehabilitation	• Decrease of wind erosion, and, as a result, increase in airborne particles, on rehabilitated sites.		
	Ambient noise level	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Increase in ambient noise levels caused by equipment, machinery and occasional, short-term but high-magnitude noise generated by blasting, soil compacting and pile-driving.	• Various noise mitigation measures will be used to abate noise levels at-source and measurements will be performed on the accommodation and services complex site to ensure that noise levels are not problematic. Should residual noise levels disturb workers in the accommodation and services complex, installation of a 5-m soundproofing structure will be considered.	
		Use and maintenance of machinery and power generating sets; road circulation	• Increase in ambient noise levels caused by mobile equipment, such as trucks, loaders, etc.		
		Ore mining, handling and storage	• Increase in ambient noise levels caused by mobile equipment, such as trucks, loaders, etc. and by blasting. • Increase in ambient noise levels caused by stationary equipment, such as mine ventilation systems.		
		Ore processing	• Increase in ambient noise levels caused by stationary equipment, such as the plant, conveyors, etc.		
		Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• Increase in ambient noise levels caused by wastewater treatment plant suppressors.		
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Increase in ambient noise levels caused by mobile equipment, such as trucks, loaders, etc.		
		Power generating sets	• Increase in ambient noise levels caused by the constant noise of the power generating sets.		
		Airstrip operation	• Increase in ambient noise levels caused by air transport.		

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Physical environment	Soil	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Change in soil quantity and quality within project footprint; • Machinery traffic could also cause soil compaction and raise fine particles promoting erosion.	• Completely clear the required portion before use; • Separate and remove topsoil (organic fraction) and reserve for rehabilitation work.	
		Use and maintenance of machinery and power generating sets; road circulation	• Machinery circulation could also cause soil compaction and raise fine particles promoting erosion.	• Vehicle speed on-site will be limited to reduce fine airborne particles; • In winter, abrasives will be used rather than de-icing salts; • Vehicle and other mobile machinery maintenance will be performed on designated sites. Maintenance and fuelling areas will be designed to avoid soil contamination due to accidental leaks or spills; • Where possible, work using heavy machinery will be limited to firm soil to avoid rut formation. When possible, machinery equipped with tires or tracks will be used.	
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Surface soil contamination in waste rock and overburden stockpile areas and the processed kimberlite confinement areas.	• Stockpiling and confinement areas will be marked out to clearly define their limits. Ore losses at transhipping sites will be recovered during operations. Ore losses at transfer sites and conveyors will be minimized during operations by using wind-erosion protection (covering conveyors and transfer towers). • The ore, waste rock and overburden stockpile areas and the processed kimberlite confinement areas will be marked off and a drainage system will collect runoff; • The processed kimberlite confinement area will be rehabilitated on an ongoing basis to stabilize total suspended solids and reduce their transport. This approach should limit metal leaching and infiltration into the soil through runoff, where applicable. • As far as possible, the overburden will be reused in berm design.	
		Fuel and hazardous materials storage and management	• Increased risk of soil contamination by potential accidental petroleum product or hazardous material spills or leaks that are not quickly contained and recovered.	• The requirements of the Act respecting petroleum products and equipment (R.S.Q., c. P-29.1) and the Petroleum Products Regulations (R.R.Q. c. P-29.1, r.3) will be applied to materials and petroleum products management. • The number of hydrocarbon storage tanks and machinery fuelling sites will be minimized to reduce the number of sites at risk. They will be developed in keeping with current regulations. • Petroleum products storage areas will be equipped with holding tanks with a minimum capacity of 110% of the largest tank's volume so as to contain accidental leaks and spills; • Barrel storage areas will be equipped with airtight dikes, or other confinement measures, so as to contain the higher of the following volumes: 25% of the total capacity of all of the containers stored there OR 125% of the largest container's capacity; • The underground areas designated permanent sites for routine maintenance, lubrication and fuelling will be covered by a concrete slab designed to prevent petroleum products from flowing out of this perimeter OR equipped with an automated leak-free filling system; • Hazardous materials will be managed in keeping with the Regulation respecting hazardous materials (R.S.Q., c. Q-2, r. 15.2) and transported in keeping with the Transportation of Dangerous Substances (R.R.Q., c. C-24.2, s. 622, par. 1 to 8). • Procedures to prevent the risk of accidental spills and leaks will be implemented, as well as an emergency response plan (e.g. containment structures, runoff water treatment in storage and fuel handling areas, etc.). • Every worksite fuelling area will have a complete, permanent emergency kit that is accessible at all times for recovering petroleum products and hazardous materials. Absorbents will be used to contain used oils. Soiled absorbents will be disposed of safely. • Accidental spills or leaks will be reported to the person in charge of the project's emergency response plan immediately. In case of spill, the emergency response plan will be implemented quickly and strictly; • The area affected by a spill will be contained and cleaned immediately. Contaminated soil will be removed and taken to a contaminated soil storage area in keeping with the Regulation respecting contaminated soil storage and contaminated soil transfer stations and a characterization will be carried out according to current standards and best practices; • Contaminated soil, residual oil and other residual hazardous materials will be disposed of in compliance with current legislation and regulations. • Clearly identified airtight containers will be on-site for disposal of waste soiled by petroleum products.	
		Progressive site rehabilitation	• Progressive rehabilitation work is designed to gradually re-establish a forest cover, thereby eliminating soil erosion and constituting a positive impact.		

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Physical environment	Groundwater	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Modification of the groundwater filling and flow pattern in surficial deposits.	• Work will be carried out progressively over the project's entire duration.	
		Use and maintenance of machinery and power generating sets; road circulation	• Increased risk of groundwater contamination by accidental leaks or spills of hydrocarbons or other contaminants.	. Machinery and other mobile equipment traffic will be limited mainly to access road rights-of-way and pre-identified work areas.	
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Generation of leachate waters that might contain contaminants due to the chemical composition of the different ores composing the material to be excavated.	• Only processed kimberlite will be stored in the processed kimberlite confinement areas; • If anthropic contamination of the overburden occurs or is suspected, this material will be characterized and its management method established in keeping with the most recent version of the MDDEP's Soil Protection and Contaminated Sites Rehabilitation Policy (Guideline 019).	
		Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• Water table drawdown that might affect daily flows in lakes on the mine's outskirts.	• Environmental design measures have been adopted to minimize runoff from areas with contamination potential (e.g. by limiting impermeable surfaces) and reduce peak outflow (e.g. channel waters to retention basins during peak flows); • All measures will be implemented to collect and control waters that come into contact with mine tailings (including ore processing waters and open pit dewatering waters) and waste rock and overburden stockpiles areas and processed kimberlite confinements areas; • A percolating water catchment system, including drainage ditches around the waste rock stockpiles, will be built to channel the waters collected to the appropriate treatment facilities; • A groundwater quality monitoring program will be implemented as required by Guideline 019; • Additional observation wells will be developed in areas where the effect of water table drawdown may be greater; • Water levels will be monitored in the observation wells during construction to validate modelling results; • Certain stream flows will be monitored to check for potential flow variations following dewatering activities; • A contingency plan will be developed once new data are acquired.	
		Solid waste storage and management (trench landfill site)		• Dispose of solid waste in keeping with current regulations (*Regulations respecting the application of the Environment Quality Act* (R.R.Q., c. Q-2, r.3), *Regulation respecting biomedical waste* (R.R.Q., c. Q-2, r. 12), Regulation respecting the landfilling and *incineration of residual materials* (R.R.Q., c. Q-2, r.19), *Regulation respecting the environmental and social impact assessment and review procedure applicable to the territory of James Bay and Northern Québec* (R.R.Q., Q-2, r. 25), *Regulation respecting hazardous materials* (R.R.Q., c. Q-2, r. 32), *Regulation respecting used tire storage* (R.R.Q., c. Q-2, r. 20) and Regulation respecting the quality of the *atmosphere* (R.R.Q., c. Q-2, r. 38); • Implement a groundwater monitoring program as stipulated in the Regulation respecting the landfilling and incineration of residual materials (R.R.Q.F29, c. Q-2, r.19).	
		Fuel and hazardous materials storage and management	• Increased risk of groundwater contamination by accidental leaks or spills of hydrocarbons or other contaminants.	• Hazardous materials will be managed in keeping with the Regulation respecting hazardous materials (R.R.Q., c. Q-2, r. 15.2), the Transportation of Dangerous Substances Regulation (R.R.Q., c. C-24.2, s. 622) and the Regulation respecting biomedical waste (R.R.Q., c. Q-2, r. 12), par. 1 to 8). Petroleum products will be managed in keeping with the Act respecting petroleum products and equipment (R.S.Q., c. P-29.1) and the Petroleum Products Regulations (R.R.Q. c. P-29.1, r.3); • Minimize and use alternatives to hazardous materials; • Petroleum products storage areas will be equipped with holding tanks with a minimum capacity of 110% of the largest tank's volume so as to contain accidental leaks and spills; • Barrel storage areas will be equipped with airtight dikes, or other confinement measures, so as to contain the higher of the following volumes: 25% of the total capacity of all of the containers stored there OR 125% of the largest container's capacity; • Spill prevention and response procedures will be implemented (e.g. containment structures, runoff water treatment in storage and fuel handling areas, etc.) as well as emergency response plan; • Accidental spills will be reported to the person in charge of the mine's emergency response plan immediately; • The underground areas designated permanent sites for routine maintenance, lubrication and fuelling will be covered by a concrete slab designed to prevent petroleum products from flowing out of this perimeter OR equipped with an automated leak-free filling system; • The worksite will have a complete, permanent emergency kit that is accessible at all times for recovering petroleum products and hazardous materials. Absorbents will be used to contain used oils; • Clearly identified airtight containers will be installed for disposal of waste soiled by petroleum products; • Absorbent materials soiled by hydrocarbons and other hazardous solid waste will be disposed of safely in an authorized site; • A groundwater monitoring system will be set up around structures at risk of contamination to monitor changes in groundwater quality.	

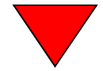
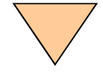
Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Physical environment	Hydrological regime	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Negligible modification of the hydrological network of the site's sub-watersheds.		
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Decrease of natural surface flows fololllowing development of overburden and waste rock stockpiles and processed kimberlite confinement area.	• Implementation of a network of ditches and culverts to collect and, if necessary, treat runoff waters around overburden and waste rock stockpiles and processed kimberlite confinement areas, and monitoring of their quality prior to release water into Lake Lagopede. • The waste rock stockpiles impact on the configuration of the site's natural sub-watersheds will be limited by the fact that, throughout the mine's service life, waste rock stockpiles will be returned into the ditches.	▼
		Water supply	• Given the significant volume of water available and the low withdrawal rates in the operation phase, water intake from Lake Lagopede is not likely to change the hydrological regime of sub-watersheds adjacent to the site.	• To minimize the mine's impact on the site's hydrological regime during the operation phase, the water management plan provides for the water collected in open pit R-65's sedimentation basin to be pumped to the ore processing plant for reuse. By promoting recirculation of the site's water in a closed loop, water intake and effluent discharge in Lake Lagopede are minimized.	
		Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• Modification of the site's natural drainage network; • Increase in peak flows during rain and spring thaw.	Implementation of a network of ditches and culverts to collect and, if necessary, treat runoff around overburden, waste rock and processed kimberlite confinement areas, and monitoring of their quality prior to their release into Lake Lagopede.	
	Surface water	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Temporary water quality degradation due to erosion, sediment transport into the hydrological network; • Possible increase in total suspended solids (TSS), nutrients, organic matter and metals; • Water quality degradation through sediment transport into the hydrological network if erosion is not controlled at-source; • Decrease in forest cover and potential increase in TSS concentrations could contribute to increasing the smallest streams' or water bodies' water temperatures.	Measures applicable to the construction phase and operation phase: • The project's footprint has been reduced to restrict clearing to a minimum; • The work areas will be clearly identified on-site to limit interventions to the required areas; • Implementation of devices to control soil erosion at-source and sediment transport to streams and water bodies by using strategies adapted to the site and environmental conditions (e.g. sediment barriers, riprap, geotextile, bales of hay, sedimentation basins); • No debris will be dumped into the aquatic environment; any debris that accidentally enters will be removed immediately; • Service areas and backfilling and excavation materials storage areas will be stripped and a layer of organic soil will be saved to be replaced during site rehabilitation; • As far as possible, clearing, earthwork and levelling will be carried out just before infrastructure installation work; • Slopes will be stabilized as soon as possible to prevent soil erosion; • No earthwork or excavation will be performed near streams during flood season or heavy rains; • Preventive stabilization will be carried out if work must be interrupted during the winter; • Maintain plant cover within a 30-m riparian strip measured from the HWM; • If need be, trees will be cut down manually near aquatic environments (less than 30 m) and woody debris will be disposed of outside the high water mark; • All drainage ditches receiving construction worksite runoff will be stabilized before construction activities begin again and will be maintained until the work is finished; • Sediment barriers will be placed wherever the soil must be disturbed. Additional barriers will be added where there is a risk of fine sediment transport; • Materials (cement, sand, etc.) storage sites will be protected using plastic sheets for small surfaces and sediment barriers for larger surfaces; • Dispose of excess soil removed during profiling so as to avoid runoff carrying fine particles into streams or water bodies; • Less than 60 m from a permanent lake or stream and less than 30 m from an intermittent stream, plant cover and roots will be preserved, except where the road is to be built (including the road's pavement, shoulders and embankment slopes) and where backfill is needed for the road; Measures specific to the operation phase: • Maintain a riparian strip at least 30 m wide along streams and water bodies; • Preserve a strip of land on the site perimeter to accumulate stripped organic matter; • Separate the topsoil (organic fraction) and reserve it for rehabilitation work; • Remove and stockpile organic matter more than 20 m from a lake, stream or fish habitat in order to reuse it.	▼

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Physical environment	Surface water	Use and maintenance of machinery and power generating sets; road circulation	• Summer road maintenance and winter spreading of abrasives are likely to promote sand and gravel transport to surface waters; • Risk of water contamination by hydrocarbons or other contaminants through accidental leaks or spills.	• Attenuate atmospheric emissions from non-point sources at-source (e.g. dust); • Conduct prior (and then regular) inspection of machinery and trucks to ensure they are in good working order, are clean and have no fuel leaks; • Do not clean or wash machinery in a lake, stream or fish habitat or less than 60 m from them, or park machinery or travel in it on the plant cover less than 30 m from streams, measured from the high water mark; • If possible, limit heavy machinery traffic to firm soil in order to avoid rut formation. Give precedence to machinery with tires or wide tracks; • At worksite exits, make sure to install gravel zones to reduce sediment input on roads.	
		Ore mining, handling and storage	• Generation of ammonium nitrate, through use of explosives, which is likely to affect water quality if not properly managed; • Runoff and exfiltration waters in contact with these materials may affect surface water quality.	• Regularly optimize the blasting pattern and explosives volume to minimize explosives residues; • Use best practices to handle explosives and fill blasting holes (Forsyth, 1995; Wright and Hopky, 1998); • Thoroughly clean accidental explosives spills.	
		Ore processing		• Maximize use of mine wastewaters generated on-site and minimize liquid waste (e.g. use runoff and recirculate treated waters for facilities' requirements) and reduce effluent discharge.	
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Increase in sediment transport resulting from runoff in contact with the waste rock and overburden stockpiles and the processed kimberlite confinement area; • Increase in sediment transport resulting from anticipated hydrologic changes linked to modifications of topography and increase in site surface sealing.	• Runoff and exfiltration waters from ore, waste rock and overburden stockpiles and the processed kimberlite confinement area will be managed in keeping with the provisions of Guideline 019; • Materials storage areas will be designed to reduce the risk of erosion as far as possible; • A percolating water catchment system, including drainage ditches around the waste rock stockpiles, will be built to channel the waters collected to the appropriate treatment facilities; • The mine tailings accumulation area will be located at least 60 m from the high water mark of any stream or body of water; • Only the materials intended for the waste rock and overburden stockpiles and the processed kimberlite confinement area will be disposed of in these sites; • When required, wind and water erosion protection measures will be implemented (see construction phase mitigation measures); • Mine effluent will meet effluent discharge objectived for waste to be defined by the MDDEP, Guideline 019 and the Metal Mining Effluent Regulations designed to protect fish habitat. Monitoring will be carried out and, if need be, the water will be treated before being released into the environment; • At least once a season, visits will be conducted to monitor confinement structures' and related structures' physical stability. A log reporting on these visits will be kept updated and will be accessible at all times; • In addition to monitoring water quality downstream of the work, a visual lake water quality monitoring program will be carried out during the work so as to be able to react quickly in case of unexpected sediment inputs; • The overburden removed during mine site preparation will be kept and stored in order to preserve the soil's physical and biological characteristics, control wind and water erosion and eventually be used for progressive site rehabilitation.	▼
		Water supply	• Given the significant volume of water available and the low withdrawal in the operation phase, water intake in Lake Lagopede is not likely to modify water quality.	• Minimize water withdrawal in the hydrological network, minimize liquid waste (e.g. use runoff waters, recirculate treated waters for facilities' requirements and collect rainwater) and maximize use of mine wastewaters generated on-site.	
		Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• Treated mine effluent discharge may modify water quality near the outfall discharge point into Lake Lagopede; • The domestic wastewater treatment station is likely to discharge contaminants (phosphorus, nitrogen, fecal coliforms, organic matter) that might modify the characteristics of Lake Lagopede's water inside the effluent dispersion plume; • Higher runoff water flow velocity, due to sealing of many site surfaces, could facilitate transport of particulate matter present in the excavated areas, if erosion and sediment transport are not controlled at-source.	• Collect and control waters in contact with mine tailings, including ore processing plant waters, mine drainage waters, waste rock and overburden waters and processed kimberlite confinement area waters; • Minimize runoff areas representing potential sources of contaminants (e.g. by limiting impermeable surfaces); • Reduce peak flows (e.g. channel waters to retention basins during peak flows) to avoid treatment station overflows; • Wastewater treatment facilities and septic facilities will be operated in keeping with current regulations.	

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Physical environment	**Surface water**	Solid waste storage and management (trench landfill site)	• Leaching waters from waste or hazardous materials management sites can carry a variety of contaminants into the hydrological network if not controlled.	• Waste will be managed in compliance with current regulations (*Regulation respecting the application of the Environment* Quality Act (c. Q-2, r.3), *Regulation respecting the landfilling and incineration of residual materials* (c. Q-2, r.19), *Regulation respecting the environmental and social impact assessment and review procedure applicable to the territory of James Bay and Northern Québec* (c. Q-2, r.25), *Regulation respecting the quality of the atmosphere* (c. Q-2, r. 38) and the Regulation respecting used tire storage (c. Q-2, r.20).	
		Fuel and hazardous waste materials storage and management	• Potential risk of surface water contamination through accidental leaks or spills of petroleum products or other contaminants by hydrocarbons or other contaminants through accidental leaks or spills.	Measures applicable to the construction phase and operation phase: • Hazardous materials will be managed in compliance with the Regulation respecting hazardous materials (R.R.Q., c. Q-2, r. 15.2), the Transportation of Dangerous Substances Regulation (R.R.Q., c. C-24.2, s. 622) and the Regulation respecting biomedical waste (R.R.Q., c. Q-2, r. 12), par. 1 to 8). Petroleum products will be managed in keeping with the Act respecting petroleum products and equipment (R.S.Q., c. P-29.1) and the Petroleum Products Regulations (R.R.Q. c. P-29.1, r.3); • Minimize and use alternatives to hazardous materials; • Containment structures and runoff water treatment will be installed on fuel storage and handling areas; • New petroleum products storage areas will be equipped with a containment platform of sufficient capacity to contain accidental leaks and spills; • A "spill" emergency response plan (response procedures and methods) and prevention and response procedures will be implemented (e.g. containment structures, runoff water treatment in storage and fuel handling areas, etc.); • Accidental spills will be reported to the person in charge of the mine's emergency response plan immediately; • The underground areas designated permanent sites for routine maintenance, lubrication and fuelling will be covered by a concrete slab designed to prevent petroleum products from flowing out of this perimeter; • All mobile production equipment will be equipped with an express, OPD system; • The worksite will have a complete, permanent emergency kit that is accessible at all times for recovering petroleum products and hazardous materials. Absorbents will be used to contain used oils; • Clearly identified airtight containers will be installed for disposal of waste soiled by petroleum products; • Absorbent materials soiled by hydrocarbons and other hazardous solid waste will be disposed of safely in an authorized site. Measures specific to the operation phase: • Gasoline and oil separators in the mechanical workshops and grease separators in the kitchen will be maintained systematically and regularly.	
		Airstrip operation	• Use of aviation de-icers can increase the quantity of propylene glycol present at the discharge point of waters from the airstrip site.	• To limit propylene glycol dispersion, all de-icing activities will be grouped together in a single location and small quantities estimate at about 1,000 per year will be used; • To ensure that neighbouring lakes and streams are not contaminated or that there is an impact on the dissolved oxygen concentration associated with the use of propylene glycol, analysis of this compound and of the dissolved oxygen and DBOs levels in surface waters downstream of the airstrip will be included in the surface water quality monitoring program.	
Physical environment	**Sediment**	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Modification of sediment quantity, particle size and chemical composition by introduction of organic matter, nutrients or metals if the sites are not properly developed and erosion is not controlled at-source.	• The mitigation measures implemented to protect surface waters will also apply here.	
		Use and maintenance of machinery and power generating sets; road circulation	• Summer road maintenance and winter spreading of abrasives are likely to promote sand and gravel transport which will be deposited downstream of stream crossings and probably modify existing sediment particle size; • Winter spreading of abrasives is likely to promote sand and gravel transport into the hydrological network and modify the substrate quality of streams downstream of mine site drainage ditch crossing points.	• The mitigation measures implemented to protect surface waters will also apply here.	
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Runoff and exfiltration waters in contact with these materials could modify sediment quality; • Tests performed on the materials resulting from mining show that the waters in contact with them are not likely to modify sediment quality, given that these materials do not generate acid and that the leaching potential of these metals is lower than Guideline 019 criteria.	• The mitigation measures implemented to protect surface waters will also apply here.	

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Physical environment	Sediment	Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• Risk of deposition of more or less fine particles from water in contact with the operating mine at the treated mine effluent discharge point; • Increase in sediment transport into Lake Lagopede at the mine effluent discharge point due to anticipated hydrological changes linked to the reduction in soil infiltration; • Increase in nutrient concentrations and organic load of sediments within the right of the domestic effluent dispersion plume.	• The mitigation measures implemented to protect surface waters will also apply here.	
		Fuel and hazardous waste materials storage and management	• Road transport, maintenance and operation of machinery and power generating sets and storage of fuel and hazardous materials (i.e. waste oil) are activities likely to increase the probability of sediment contamination by hydrocarbons.	• The mitigation measures implemented to protect surface waters will also apply here.	
Biological environment	Benthos	Maintenance and operation of machinery and power generating sets; road circulation	• Potential risk of surface water contamination through accidental leaks or spills of petroleum products or other contaminants.	• Prevent machinery encroachment on streams by limiting vehicle traffic to access roads; • Machinery maintenance and fuelling will be performed in areas specially designed for this purpose more than 60 m from streams; • Diesel fuelling and storage for power generating set operation will be performed in areas specially designed for this purpose and a recovery kit will be available in case of accidental leaks or spills.	
		Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• Increase the sediment, organic matter and nutrient load in Lake Lagopede and receiving streams located downstream; • Modification of water and sediment quality inside the initial effluent mixing zone plume.	• The mitigation measures implemented to protect surface waters will also apply here.	
		Fuel and hazardous waste materials storage and management	• Potential risk of surface water contamination through accidental leaks or spills of petroleum products or other contaminants.	• The mitigation measures implemented to protect surface waters will also apply here.	
	Fish	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Increase in concentrations of TSS in water, due to sediment transport and deposition in fish habitat; • Use of explosives near streams may cause vibrations and waves likely to temporarily disrupt fish.	• The contractor must comply with guidelines governing the use of explosives in or near Canadian fisheries waters; • It is prohibited to use ammonium nitrate or fuel oil in or near fisheries waters due to the production of toxic by-products (ammonium hydroxide).	
		Maintenance and operation of machinery and power generating sets; road circulation	• Potential risk of surface water contamination through accidental leaks or spills of petroleum products or other contaminants; • Increase in sediment transport into the hydrological network near the worksite.	• Vehicles will have to travel more slowly (30 km/h speed limit on-site and 70 km/h on secondary roads); • Unauthorized machinery traffic will be prohibited outside work areas; • Vehicles shall not circulate within 30 m from a stream unless there is a specific reason; • If dust control agents are used, they must be MDDEP-compliant or MDDEP-approved; • Construction phase mitigation measures also apply in the operation phase.	

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Biological environment	**Fish**	Water supply	• Lake level fluctuations may generate minimal habitat losses; • Risk of mortality linked to small fish entering the water intake; • Avoidance effect near water intake.	• Grating openings can be round, square, rectangular or combinations thereof, but will have no projections that could injure fish; • Materials used will be corrosion- and UV ray-resistant: brass, bronze, aluminum, Monel, galvanized or stainless steel and plastics; • Guide openings and joints will be smaller than the criteria for structures needed to prevent fish passage; • Gratings will be positioned at least 300 mm from the lake bottom to prevent drawing in sediments or benthic organisms; • A support structure will be fitted onto grating panels to prevent them from sagging or collapsing.	
		Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• Increase in sediment, organic matter and nutrient load in Lake Lagopede and receiving streams located downstream; • Modification of water and sediment quality inside the initial effluent mixing zone plume; • Modification of the hydrological regime of certain streams, potentially modifying habitat use by fish.	• The mitigation measures implemented to protect surface waters will also apply here.	
		Work force and procurement	• Possible increase in fishing pressure.	• Fishing will be prohibited on-site by contractual clauses governing workers and contractors.	
	Vegetation and wetlands	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Reduction of surfaces covered by vegetation and wetlands during clearing.	• Limit work area stripping, clearing, excavation, backfilling and levelling to a strict minimum in order to respect the natural topography and prevent erosion; • Prohibit disposing of wood debris or natural waste materials in flooded areas or wetlands, i.e. swamps and peatlands, even outside areas directly affected by work.	
		Use and maintenance of machinery and power generating sets; road circulation	• Introduction of seeds of certain invasive species.	• Work area boundaries will be clearly defined and identified. No encroachment will be permitted outside these areas. No traffic will be tolerated outside accesses, crossings or work areas; • Foresee contractual measures with contractors to ensure that worksite machinery and equipment are cleaned to limit propagation of exotic and invasive plant species.	
		Progressive site rehabilitation	• Gain in vegetation cover surface area through progressive site revegetation.	• Rapidly stabilize and reforest areas temporarily disturbed by construction with indigenous species and revegetate areas abandoned after operations.	
	Reptiles and amphibians	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Loss of aquatic habitats; • Modification of habitat quality due to a change in topography and water inflow (modified hydrology), noise and dust; • Creation of physical barriers restricting reptile and amphibian travel.	• Limit dust emission; • Limit machinery and worker travel to work areas; • Model topographic profile limiting erosion; • Maintain a riparian buffer strip at least 30 m wide along streams and water bodies (screen, filter for contaminants originating in road and storage areas, land corridor and species habitat) and up to 60 m wide for debris and organic matter accumulation areas, hazardous products storage sites and fuelling areas.	
		Use and maintenance of machinery and power generating sets; road circulation	• Creation of physical barriers restricting reptile and amphibian travel; • Habitat fragmentation; • Increase in noise (interference with anuran breeding), potential contaminant transport (hydrocarbons, oils) by runoff flowing into peripheral wetlands and dust emission.	• Use noise reduction measures: install appropriate sound-proofing devices on motor exhaust pipes; • Attenuate air emissions at source (dust); • Limit the use of abrasives along culverts (leaching into streams); • Ensure a systematic vehicle and machinery maintenance program to limit oil losses (hydraulic, motor) that could leach from roads and storage areas into wetlands.	
		Progressive site rehabilitation	• Mitigation of habitat loss impacts by promoting recolonization of restored areas by amphibians.	• Carry out progressive revegetation of the processed kimberlite confinement area, borrow pits and inactive areas so that these new environments are suitable for amphibians (cover density, prey presence) to promote their recolonization.	
		Ore mining, handling and storage	• Increase in noise (interference with anuran breeding), potential contaminant transport (hydrocarbons, oils) by runoff flowing into peripheral wetlands and dust emission.	• Limit backfilling of wetlands and storage area rights-of-way to the strict minimum; • Maintain a riparian buffer strip 30 to 60 m wide (screen, filter for contaminants originating from storage areas) from wetlands bordering on storage areas.	

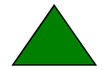
Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Biological environment	**Reptiles and amphibians**	Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Machinery can be a powerful noise source that may affect anuran breeding by interfering with their calls; • Risk of wetland contamination by runoff; • Modification of natural habitats bordering on stockpiles or confinement areas due to progressive modification of topography and hydrology.	• Limit dust emission; • Limit machinery and worker travel to work areas; • Ensure a systematic vehicle and machinery maintenance program to limit oil losses (hydraulic, motor) that could leach from roads and storage areas into wetlands; • Model topographic profile limiting erosion.	▼
		Airstrip operation	• Increase in noise (interference with anuran breeding), potential contaminant transport (hydrocarbons, oils) by runoff flowing into peripheral wetlands and dust emission.	• Use noise reduction measures: install appropriate sound-proofing devices on motor exhaust pipes; • Attenuate air emissions at source (dust); • Limit the use of abrasives along culverts (leaching into streams); • Ensure a systematic vehicle and machinery maintenance program to limit oil losses (hydraulic, motor) that could leach from roads and storage areas into wetlands; • Maintain a riparian buffer strip at least 30 m wide along streams and water bodies (screen, filter for contaminants originating in road and storage areas, land corridor and species habitat) and up to 60 m wide for debris and organic matter accumulation areas, hazardous products storage sites and fuelling areas.	
	Waterfowl and other waterbirds	Water management of worksite (runoff, drinking water, process water, wastewater, etc.)	• The aerated lagoons may be used by some species as rest or breeding areas; • Occasional small craft travel to maintain outfalls and monitor water quality in Lake Lagopede in spring and summer may disturb Common Loon breeding in Lake Lagopede.	• Advise staff to avoid the sheltered bays that constitute the Common Loon's potential breeding and brood rearing sites in spring and summer.	▽
		Man power and procurement	• Increase in small craft travel by Cree users will further disturb the Common Loon pair and abort breeding some years.	• Advise land users to avoid the sheltered bays that constitute the Common Loon's potential breeding and brood rearing sites in spring and summer.	
	Raptors	–	–		•
	Forest-dwelling birds	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Loss of biotopes inhabited by forest-dwelling birds, notably breeding habitats; • Forest-dwelling birds' nests may be destroyed in the operation phase. The number will depend on the percentage of overlap between the time trees and underbrush are cut and the breeding season; • Nests may be deserted during blasting operations.	• Site clearing and stripping will be done mainly in fall and winter, i.e. outside the forest birds' breeding season (May 1 - August 15 in the area), as recommended by the Canadian Wildlife Service (CWS).	▽
		Ore mining, handling and storage	• Nests may be deserted during blasting operations.		
		Airstrip operation	• Low probability of fatal collisions; • Disturbance of breeding pairs by aircraft takeoff and landing.		
	Micromammals	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Additional habitat losses associated with pit development.		▽
		Use and maintenance of machinery and power generating sets; road circulation	• Risk of mortality caused by machinery used in clearing, other construction activities and vehicle traffic on access roads.		
		Ore mining, handling and storage	• Disturbance of daily or seasonal activities of the animals present; • The individuals disturbed will move to peripheral habitats, thereby temporarily increasing competition for territories and resources.		
		Airstrip operation	• Little documentation exists on the impact of noise generated by aerial activity.		
		Progressive site rehabilitation	• A small proportion of the habitats lost during site clearing and preparation will be restored.		

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Biological environment	Fur-bearing animals	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Additional habitat losses associated with pit development.	• Develop a wildlife protection plan to reduce opportunities for poaching; • Continue to make workers aware that they should not feed the animals or leave food lying around that might attract fur-bearing animals to work areas or nearby. The awareness campaign could take the form of posters and information sessions.	
		Use and maintenance of machinery and power generating sets; road circulation	• Risk of mortality caused by machinery used in clearing, other construction activities and vehicle traffic on access roads; • The avoidance effect in work areas could disturb feeding, breeding and rearing behaviour; • Movement to peripheral habitats may demand higher energy expenditure, increase vulnerability to predation and generate competition in the area around the project; • The presence of the mine and road accesses are likely to increase frequentation of the area and increase hunting and trapping pressure.	• Cut vegetation height in curves so that drivers can clearly see animals crossing or preparing to cross; • The abrasives used for winter road maintenance will be limited to sand and gravel unless exceptional circumstances require otherwise. There will be no adverse effects on wildlife linked to the use of calcium.	
		Ore mining, handling and storage	• Risk of mortality caused by machinery used for mine operation activities and vehicle traffic on access roads; • The avoidance effect in work areas could disturb feeding, breeding and rearing behaviour; • Movement to peripheral habitats may demand higher energy expenditure, increase vulnerability to predation and generate competition in the areas surrounding the project.		
		Airstrip operation	• Disturbance caused by aircraft takeoff and landing could temporarily affect certain individuals frequenting the area.	• As far as possible, avoid tourism-related low-altitude flights in order to limit the impact of this disturbance on wildlife.	
		Progressive site rehabilitation	• A small proportion of the habitats lost during pit development will be rehabilitated.	• Shut down and rehabilitate sites used temporarily during the construction phase.	
	Big game animals	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Additional habitat losses associated with pit development.		
		Use and maintenance of machinery and power generating sets; road circulation	• Low risk of mortality caused by collisions with vehicle traffic on access roads and the mine site.	• Simple measures (e.g. signs near current moose yards) will be implemented to minimize the risk of collision.	
		Ore mining, handling and storage	• The avoidance effect in work areas could disturb feeding and migration behaviour.		
		Solid waste storage and management (trench landfill site)	• Increase in the number of bears in the area near the trench landfill site.	• Install an electric fence to keep bears away from the trench landfill site; • Regularly backfill buried waste; • Place waste in sites or containers so as not to attract wildlife.	
		Airstrip operation	• Disturbance caused by aircraft takeoff and landing could temporarily affect certain individuals frequenting the area.		
		Presence of facilities	• Increased risk of poaching; • The presence of roads and the camp are likely to increase the number of predators in the area.	• Make workers aware that they must not feed the animals or leave food lying around so as not to attract Black Bears to the camp, • Install an electric fence around the camp; • Should animals have to be killed, allow tallymen to hunt the unwanted bears; • Monitor the wildlife protection plan to reduce opportunities for poaching; • If applicable, document Woodland Caribou movement on the property; • Continue to make workers aware of the effects of harvesting, poaching, accidental kills and disturbance of Woodland Caribou.	
		Progressive site rehabilitation	• A small proportion of the habitats lost during site clearing and preparation will be rehabilitated.	• Shut down and rehabilitate access roads and temporary facilities used during the construction phase; • During progressive rehabilitation of construction sites, apply appropriate sylvicultural practices (maintain habitat's coniferous characteristics) to promote the return of Woodland Caribou habitat.	

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Human environment	**Land and natural resource use**	Maintenance and operation of machinery and power generating sets; road circulation	• Decreased hunting and fishing quality in and around the project footprint due to the noise caused by machinery and road circulation.	• Recognize and respect the role played by trapline M11 holders in traditional and contemporary management of the area's natural resources; • Keep the area's users informed of the planned construction procedure and work location to ensure user safety during more dangerous operations (e.g. blasting), and make sure to agree with them on any arrangements deemed necessary; • Reduce noisy activities (e.g. helicopter or ATV travel) on certain portions of the territory during the waterfowl and moose hunting seasons; • Ensure that mine developments do not interfere with navigation routes or snowmobile trails; • Implement adequate signing where snowmobile and ATV trails cross mine roads and access roads; • Biological and physical environment mitigation measures will also apply here; • Develop a worker awareness program about the Cree culture and the presence and land use of trapline M11 users; • Fishing, hunting and trapping will be prohibited on-site through clauses in workers' and contractors' contracts; • A safety zone will be set up around the project site where hunting, fishing and trapping will be suspended; • Compensate disturbances foreseen for the tallyman whose base camp is located east of the airstrip. Discussions between the two parties are under way to relocate this camp elsewhere on the trapline; • Throughout the project, unforeseen impacts will be assessed and the appropriate mitigation measures applied.	
		Ore mining, handling and storage	• Disturbance or loss of hunting, trapping and/or fishing territories; • Decreased hunting and trapping quality in and around the project footprint due to the noise caused by activities.		
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• Decreased hunting and trapping quality in and around the project area due to the noise caused by activities.		
		Airstrip operation	• Decreased hunting and trapping quality in and around the project area due to the noise caused by activities and the airstrip.		
		Presence of facilities	• Direct prohibition of hunting and trapping affecting the mine site and its buffer zone, in whole or in part.		
		Man power and procurement			
		Progressive site rehabilitation			
	Economy and employment	Man power and procurement	• Job creation; • Local, regional, provincial and Canadian economic spinoffs; • As far as possible, local and regional workers and companies will be involved in mine construction work.	• Implement the Impact and Benefit Agreement (IBA) signed with the Cree Nation; • Promote contract-awarding to regional companies provided they submit a competitive bid; • Develop a training strategy to promote the development of employee skills at all organizational levels; • Develop in-house training programs; • Get involved in certain external training programs by working with educational institutions to encourage the region's youngsters and students to take training programs linked to the mining industry and trades specific to the Renard project; • Assign up to 8 employees to supervising training programs; • Reserve up to 1.5% of the payroll to ensure the success of training program development and implementation; • In keeping with the IBA, create a Training and Employment Committee composed 50-50 of Stornoway representatives and the Cree party; • Set up a rotating work system involving air access, commonly called "fly-in fly-out"; • Lodge Renard mine employees in an accommodation and services complex where they have their own room, complete with television, telephone and Internet access, and where they have access to numerous services or related infrastructures, e.g. cafeteria, kitchen, library, common room with a television and home theatre, spaces set up to promote social interaction, etc. • In addition to an advantageous basic salary, performance bonuses will be paid to employees whose work is outstanding; • Set up a pension fund and offer group insurance to employers; • Implement an employee assistance program; • Facilitate integration of Cree workers by implementing various measures, including worker awareness of cultural differences; • Inform sub-contractors carrying out the work and make them aware of the importance of promoting Cree work force participation; • Draw up human resources policies based on recognized equal employment access principles.	

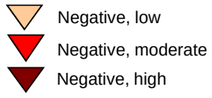
Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

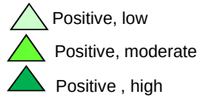
	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Human environment	Health and welfare	Uase and maintenance of machinery and power generating sets; road circulation	• Activities can increase dust and atmospheric emission levels; • Accidental petroleum or other chemical product leaks or spills on the work site can contaminate the neighbouring waters, vegetation, fish and wildlife; • Circulation of various hazardous materials, such as hydrocarbons and explosives, could theoretically present certain risks (albeit minimal) for residents' health.	• With regard to public and worker health, air quality monitoring will cover all forms of contaminants likely to be found in the air, including, where applicable, metals discharged in particulate form. All current health protection standards will be obeyed. The same approach will be used for liquid effluents, surface water quality and groundwater quality; • Worker health and safety will be ensured through an industrial health and safety management plan.	▼
		Fuel and hazardous materials storage and management	• Accidental petroleum or other chemical product leaks or spills on the work site can contaminate the neighbouring waters, vegetation, fish and wildlife; • Circulation of various hazardous materials, such as hydrocarbons and explosives, could theoretically present certain risks (albeit minimal) for residents' health.		
		Presence of facilities			
		Man power and procurement	• There are direct health and safety risks to staff and visitors on the work site; • Dust emission from the different materials storage areas can affect worker and visitor health; • Overall, the project's work force and procurement will have a positive affect on the Crees' and Jamesians' general social conditions, given the project's economic spinoffs; • The increase in personal income and better job opportunities will improve living conditions (e.g. housing) and help improve individual and collective health (physical, mental and social); • Negative effects include the effect of Native workers' extended absences on their family lives.	• Hire Cree personnel to carry out various support functions or services (human resources, health, recreation, security, etc.), thereby making it possible to react quickly to any problem situation; • Among Cree personnel, identify Cree resource persons able to act as Cree/French/English interpreters, if need be; • Cooperate with the Mistissini community to develop programs promoting healthy lifestyles and preventing consumption of drugs and alcohol; • Implement means to keep the Mistissini community informed of mine activities; • Promote recreational, social, cultural and sports activities allowing workers to spend time together outside the work context; • Set up (at the mine) spaces reserved for Cree cultural activities; • Implement measures to facilitate the integration, promotion and retention of Cree personnel; • Work with Cree organizations to implement measures promoting workers' maintaining ties to their communities and families (e.g. easy telephone and Internet communications) and assist workers having personal or family problems; • In the long term, the best way to properly identify and manage impacts on health and welfare is ultimately up to regional health organizations such as the CCSSSBJ and CRSSSBJ. Such monitoring might eventually put pressure on these organizations through the increased workload. Aware of its responsibilities in this regard, Stornoway is open to supporting any long-term monitoring and action program that might encompass all development projects belonging to Plan Nord.	
	Cultural and archaeological heritage	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	It is possible that archaeological vestiges might be discovered by chance during excavation on-site.	• Should archaeological resources unexpectedly be found during mine operation, the persons in charge must be informed and must immediately report the find to the principal contractor. If need be, they must stop work on this site until it has undergone a complete evaluation by archaeologists and inform Cree representatives; • The applicable provisions of the Cultural Property Act will be implemented (temporary protection measures, assessment of findings, archaeological digs); • Should a grave be found, the police will be called immediately and checks will be performed with those responsible for trapline M11 to confirm the identity. Such sites will be relocated or other arrangements made with the family concerned and carried out by Stornoway; • Measures are stipulated in the IBA for discovery of archaeological sites or sites of cultural significance to the Cree.	●

Appendix 9.2.1 Summary of Impacts, Mitigation Measures and Enhancement Measures by Valued Component - Operation Phase

	CESV	Impact agent	Potential impact	Mitigation and enhancement measures	Residual impact
Human environment	Landscape	Pit development: clearing, drilling, blasting, backfilling, excavation, drainage - All facilities	• Open pit R-65's and, more particularly, open pit R-2/R-3's more formal, circular contours will stand out in the landscape.	• Minimize the footprint of all facilities so that their impact on the landscape is lessened.	
		Ore mining, handling and storage	• Ore accumulation, which will be piled high, will decrease landscape quality.		
		Mining material management (overburden and waste rock stockpiles and kimberlite confinement areas)	• The final layouts and heights respectively of the overburden stockpile area (20 m high), waste rock stockpile area (52 m high) and processed kimberlite confinement area (maximum height = 90 m) will have an ongoing, high-magnitude negative impact.	• Use overburden and waste rock excavated from the open pits as materials for civil engineering work; • Minimize the footprint and maximum height of the overburden stockpile area, waste rock storage area and processed kimberlite confinement area so that they do not exceed the peak of the hill located to the east, on the other side of the access road to Lake F2606, thereby reducing the environmental impact.	
		Airstrip operation	• Decrease of landscape quality through modification of its natural character.	• Operate a sandpit near the airstrip jointly with the MTQ to minimize the footprint on the surrounding landscape.	
		Presence of facilities	• Decrease of landscape quality through modification of its natural character.		
		Progressive site rehabilitation	• Revegetation of the processed kimberlite confinement area's and overburden stockpile area's horizontal surfaces will have a beneficial impact on the landscape.	• Revegetate the processed kimberlite confinement area's levels and plateau progressively during the operation phase.	

Legend of symbols - Impact Significance



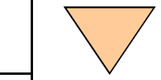
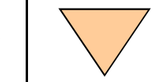
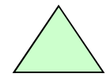


Negligible or null

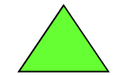
Appendix 9.3.1

Summary of impacts and mitigation and improvement measures by valued component – Closure Phase

Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Physical environment	**Air quality**	Use and maintenance of machinery and power generating sets and road traffic	• Emissions of combustion gas by machinery and generators mainly nitrogen oxides (NOx), sulfur dioxide (SO2), carbon monoxide (CO) and fine particulates; • Increase of airborne particulates.	• Use of dust control on secondary on the mine's roads will minimize dust emission caused by road traffic.	
		Dismantling and repurposing of facilities	• Increase of airborne particulates.		
		Final site rehabilitation and revegetation	• Increase of airborne particulates.		
	Ambient noise level	Use and maintenance of machinery and power generating sets and road traffic	• Increased ambient noise level (less important than during the operation phase), resulting from noise caused by mobile equipment such as trucks, loaders, etc.	• Various noise-mitigation measures will be implemented to mitigate sound levels at their source, and noise will be measured at the accomodation and services complex site to ensure that the levels measured are not problematic. In cases where residual noise levels may disturb workers at the accomodation and services complex, the construction of a 5 m high soundproofing structure will be considered.	
		Dismantling and valorization of facilities	• Increased ambient noise level (less important than during the operation phase), resulting from noise caused by mobile equipment,such as trucks, loaders, etc.		
	Soil	Use and maintenance of machinery and power generating sets and road traffic	• Soil compaction promotes erosion and decreasing soil permeability; • Increased risk of soil contamination by accidental leaks or spills of hydrocarbons or other contaminants.	• Machinery and other mobile equipment traffic will mainly be limited to pre-identified access road rights-of-way and work areas. • On-site vehicle speed will be limited so as to rlimit dust emission; • Abrasives will be used in winter instead of de-icing salt; • Maintenance of vehicles and other mobile machinery will be carried out at sites set aside for this purpose. Maintenance and supply areas will be designed to avoid soil contamination in cases of accidental leaks or spills; • Heavy machinery work will be limited, whenever possible, to firm ground so as to avoid rutting. The use of machinery equipped with large tires or tracks will be prioritized.	
		Final site rehabilitation and revegetation	• Final rehabilitation activities intended to restore the vegetation cover, minimize soil erosion, and eliminate soil contamination, if any, which will be a positive impact.	• Surfaces of the processed kimberlite confinement areas and overburden stockpiles areas will be restored through the establishment of non-invasive, low-maintenance plant species adapted to nordic conditions, following the specifications of the site rehabilitation plan; • The flat surfaces of the processed kimberlite confinement areas will be replanted, i.e. 32.7% of its total area. These surfaces will be covered by a layer of overburden, followed by a layer of topsoil, then replanted; • The flat surfaces of the overburden pile, representing 40.5% of its total area, will be replanted, and the slopes will be covered by waste rock to ensure stability; • The temporary ore-storage site will be covered by a 0.5 m thick layer of overburden and a 0.3 to 0.5 m thick layer of organic matter before planting; • Earthwork and levelling will be carried out, whenever possible, immediately before revegetation work is undertaken; • Whenever possible, slopes must be smoothed to 1.5(H):1(V), or by using other available techniques; • Cut-and-fill slopes must be stabilized using techniques that blend, as much as possible with the natural setting wherever erosion could cause sediment transport to a stream. If an area has to remain barren for a long period, it will be protected with riprap or any other strategy deemed effective for the site; •All site surfaces to be replanted will have to be free of debris, waste, unusable material, machinery parts, or any other elements not found on the site before work began; • Slopes will be smoothed and stabilized; • Stockpiled topsoil will be spread on the site; • An environmental soil-characterization study will be undertaken within six months following the definitive cessation of mining activities, in accordance with section 31.51 of the Environment Quality Act; • If applicable, soil contaminated above the applicable criteria will be removed or taken off site for final treatment and disposal in an authorized site.	

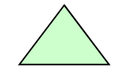
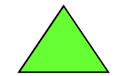
Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Physical environment	Groundwater	Water management (runoff, flooding of pits)	• The end of dewatering activities will result in lake formation in pits and groundwater levels to rise to their level; • Return to a steady-state in about 6 years (Itasca, 2011).	• Water levels in observation wells will be monitored after site closure so as to validate the predictions until steady state conditions are reached; • Flow rate of some streams will be monitored so as to verify a potential flow-rate increase following the end of dewatering activities.	
		Use and maintenance of machinery and of power generating sets and road traffic	• Increased risk of soil contamination by accidental leaks or spills of hydrocarbons or other contaminants.	• Machinery and other mobile equipment circulation will mainly be limited to access road rights-of-way and work areas pre-identified in the site rehabilitation plan.	
		Dismantling and upgrading of facilities	• Increased risk of soil contamination by accidental leaks or spills of hydrocarbons or other contaminants resulting from the use of machinery during the Dismantling and repurposing of facilities.	• Machinery and other mobile equipment circulation will mainly be limited to access road rights-of-way and work areas pre-identified in the site restoration plan.	
		Presence of site remains	• The presence of stockpiles should not significantly change the groundwater flow regime in these areas, which should stabilize at initial piezometric condition levels; • Following the operation phase, changes in the geochemistry of groundwater may occur near processed kimberlite confinement area and overburden stockpiles; • Low contaminant concentrations in waters running through confinement area and stockpiles for materials from mining activities will be found at resurgence points, i.e. similar to natural background level.	• If contaminants are observed in groundwater after mining operations closure, post-rehabilitation monitoring of groundwater quality downstream from the processed kimberlite confinement areas and/or overburden stockpiles will have to be undertaken over a five-year period, as recommanded in Guideline 019. Such monitoring will make it possible to validate numerical model predictions and prevent a loss of groundwater use following the mine closure.	
	Hydrological regime	Water management (runoff, flooding of pits)	• Modification of the hydrological network of some sub-watersheds of the site.		
		Final site rehabilitation and revegetation	• Modification of the topography and surface water flow pattern of the site's sub-watersheds; • Revegetation of the stockpiles will modify the runoff coefficient by slowing down runoff; • Revegetation will also protect slopes of stockpile and confinement area from erosion.		

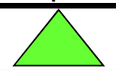
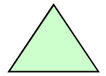
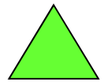
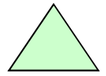
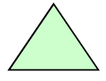
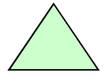
Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Physical environment	Surface water	Water management (runoff, flooding of pits)	• Temporary degradation of water quality due to the input of soil or sediment particles during stabilization and restoration works of the site topography and restoration of the drainage pattern; • At the end of revegetation work, and cessation of the discharge of treated domestic wastewater and treated mining effluents, a gradual improvement of surface water quality should be observed.	• Collect and monitor water having been in contact with tailings, including water from the ore processing plant, from dewatering and from the waste rock and overburden stockpiles, and the processed kimberlite confinement area; • Minimize runoff from zones representing potential sources of contaminants (for instance, by limiting impervious surfaces); • Reduce peak flow rates (for instance, by channelling water toward retention ponds during peak flow periods) so as to avoid overflows at the treatment plant; • Wastewater treatment facilities and septic facilities will be operated in accordance with the regulations in force; • Surface drainage will be restored as much as possible to enable a return to conditions similar to those found before mining operations began.	
		Use and maintenance of machinery and power generating sets and road traffic	• Risk of water contamination by accidental leakage or spillage of hydrocarbons or other contaminants (lower risk in the closure phase since the vehicle fleet will be limited).	• Machinery will not be allowed to ford streambeds unless the required infrastructures have been installed and prior authorizations obtained from the ministeries concerned. Bridging will be installed for purposes of crossing a stream or fish habitat and removed at the end of the work period; • Mitigate atmospheric emissions from diffuse sources (for instance, dusts) at source; • Carry out a prior inspection, followed by regular inspections, of the machinery and trucks used so as to ensure that they are in good condition, clean, and free of any hydrocarbon leaks; • Avoid cleaning or washing machinery in a lake, stream, or fish habitat, or less than 60 m from any of the latter, and avoid parking or circulating with machinery on the vegetation cover less than 30 m from streams, as measured from the natural high water mark; • Heavy machinery work will be limited, whenever possible, to firm ground so as to avoid rutting. The use of machinery equipped with large tires or tracks will be prioritized; • At the worksite exit, ensure that gravel zones are in place so as to reduce sediment transport on roads.	
		Final site rehabilitation and revegetation	• Temporary degradation of water quality due to the input of soil or sediment particles during stabilization and restoration works of the site topography and restoration of the drainage pattern; • The closure of the landfill trench site, the transport of hazardous materials off site and site revegetation will contribute to the overall improvement of surface water quality.	• Development of devices to control soil erosion and sediment transport to streams and waterbodies at source by choosing strategies adapted to the site and to environmental conditions (for instance, sediment barriers, riprap, geotextile, sedimentation pond, etc.); • Earthwork and levelling will be carried out, whenever possible, immediately before revegetation work is undertaken; • Barren areas within the riparian area will be rapidly stabilized to avoid any risk of sediment input to the aquatic environment; • No debris will be discharged into the aquatic environment and all debris accidentally introduced into the aquatic environment will be removed as soon as possible; • No earthworks or excavation will be undertaken near streams during high-flow periods or heavy rains; • Preventive stabilization work will be carried out if certain work must be suspended during winter; • All site surfaces to be replanted will have to be free of debris, waste, unusable material, machinery parts, or any other elements not found on the site before work began; • Rehabilitation and replanting should be carried out as quickly as possible; • Slopes will be smoothed and stabilized; • Stockpiled topsoil will be spread on the site.	

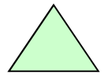
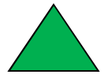
Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Physical environment	Sediment	Water management (runoff, flooding of pits)	• Reduction of flow rates, as well as of sediment loads,soil particles and/or organic matter loads in the dispersion plume area of domestic and mining effluents; • Restoring the site's drainage pattern may temporarily cause sediment transport to the hydrological network; • Site revegetation will reduce the number of impervious areas and will therefore have a positive effect on the dynamic of sediment transportation and on water quality by a return to the same properties as before construction.	• Mitigation measures established for surface water protection will also apply here.	
		Use and maintenance of machinery and of power generating sets and road traffic	• Risk of water contamination by accidental leaks or spills of hydrocarbons or other contaminants (lower risk in the closure phase since the vehicle fleet will be smaller.	• Mitigation measures established for surface water protection will also apply here.	
		Final site rehabilitation and revegetation	• The rehabilitation and revegetation of the site may lead to a temporary increase in the quantities of suspended particles and organic matter in runoff; • Rehabilitation activities will help to restore the sediment transport dynamic conditions observed prior to the Renard Project by eliminating several sources of contaminants; • Site revegetation will reduce the number of impervious areas and will therefore have a positive effect on sediment transport dynamic and on water quality by a return to the same properties as before construction work began.	• Mitigation measures established for surface water protection will also apply here.	
Biological environment	Benthos	Water management (runoff, flooding of pits)	• Creation of new benthos habitats during pit flooding; • Cessation of the release of treated domestic wastewater and treated mining effluents upon closure phase will have a positive impact on substrate recovery and on benthic communities at discharge points for domestic mining effluents, with a return to near pre-project conditions.	• Mitigation measures established for surface water protection will also apply here.	
		Use and maintenance of machinery and power generating sets and road traffic	• Potential risk of surface water contamination following accidental spills or leaks of petroleum products or other contaminants.	• Vehicle and machinery circulation will be limited to access roads; • Machinery maintenance and its fuel supply procedures will be carried out over 60 m from a stream or other waterbody and a recovery kit will be available in case of accidental spills; • Mitigation measures established for surface water protection will also apply here.	
		Dismantling and repurposing of facilities	• Temporary increase in erosion and sediment and organic matter transport to Lake Lagopede.		
		Final site rehabilitation and revegetation	• Return to natural environment conditions.		

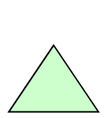
Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Biological environment	**Fish**	Water management (runoff, flooding of pits)	• Creation of new fish habitats during pit flooding; • Return to initial pre-projet conditions following the cessation of effluent release into Lake Lagopede.	• Gradual flooding of pits to avoid resuspension of pariculate matter; • Create hydraulic connection with the natural environment to ensure free passage of fish.	
	Vegetation and wetlands	Water management (runoff, flooding of pits)	• Pit flooding resulting in an increase of wetland area.		
		Final site rehabilitation and revegetation	• Final site revegetation resulting in an increase of vegetation area.	• Quickly stabilize and revegetate areas temporarily disturbed by mining activities with species indigenous to the region, and replant areas abandoned after having been mined.	
	Reptiles and amphibians	Final site rehabilitation and revegetation	• Partial topography restoration since all waste rock will be returned to the pits or will have been used for underground backfilling; • Revegetation will make the site environment more conducive for amphibians with respect to food supply and provide shelter and better potential for hibernation.	• Initiate rehabilitation as quickly as possible in order to make these new environments conducive to amphibian life (density of cover, presence of prey) in order to promoting their recolonization.	
		Water management (runoff, flooding of pits)	• Surface drainage will be restored to near pre-operation conditions; • Creation of new habitats suited to the reproduction or hibernation of some amphibians (lakes created following pit flooding, stream restoration, etc.).	• During restoration of the hydrological network, study opportunities for developing permanent wetlands, in particular for the reproduction, development and hibernation of the northern frog: an aquatic environment for reproduction, feeding, rest and refuge for amphibians; • Make every effort to establish a diverse on site wetland mosaic (mine and confinement area and stockpiles) in order to offset the barrier effect of this areas and re-establish the aquatic habitat diversity prioir to the opening of the mine.	
	Waterfowl and waterbirds	Water management	• Pit flooding will create new resting habitats for migratory birds.		
		Final site rehabilitation and revegetation	• Pond backfilling will destroy a habitat created during the construction phase.	• Plant species preferred by the Canada goose will be prioritized for sowing.	
	Raptors	Dismantling and repurposing of facilities	• Loss of anthropogenic food sources and nesting sites through the disappearance of infrastructures.		
		Final site rehabilitation and revegetation	• Increase in habitat conducive to red-tailed hawk hunting.		
	Forest-dwelling birds	Dismantling and repurposing of facilities	• Loss of nesting habitats for the tree swallow nesting on man-made structures.		
		Final site rehabilitation and revegetation	• Natural recolonization and revegetation of approximately 75% of the impacted area, which will be once again a suitable habitat for forest birds.	• At least one conducive wetland site should be developed to replace at least one of those lost in the construction phase. Wetland development should be included in the drainage restoration plan for the site. Wetlands could be integrated to stream banks restored (for instance, F3298V) in areas where slopes are low.	

Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Biological environment	**Micromammals**	Use and maintenance of machinery and power generating sets and road traffic	• Risk of mortality caused by machinery used during clearing and other construction activities, as well as by vehicles traffic on access roads .		
		Final site rehabilitation and revegetation	• Disturbance of the daily or seasonal activities of on-site animals; • Risk of mortality associated with the excavation and earthworks; • Significant disturbance of anthropogenic habitats of the mine site; • Restoration of most habitats lost during site preparation and development.		
	Fur-bearing animals	Use and maintenance of machinery and power generating sets and road traffic	• Risk of mortality caused by machinery used during other rehabilitation activities as well as by vehicle on access routes; • Avoidance effect in work zones, which may disturb feeding and reproduction behaviours and rearing of the young;	• Save for exceptional circumtances, abrasives used for winter road maintenance will be restricted to sand and gravel. There will be no negative effects on wildlife linked to the use of calcium.	
		Final site rehabilitation and revegetation	• Avoidance effect in work zones,which may disrupt feeding and reproduction behaviours and rearing of the young; • Restoration of most habitats lost during site preparation and development.		
	Big game animals	Use and maintenance of machinery and power generating sets and road traffic	• Avoidance effect in work zones, which may disrupt feeding and migration behaviours; • Risk of mortality caused by machinery used during other rehabilitation activities as well as by traffic on access roads;		
		Final site rehabilitation and revegetation	• Avoidance effect in work zones, which may disrupt feeding and migration behaviours; • Restoration of most habitats lost during site preparation and development;	• Apply the appropriate sylvicultural practices (maintain the habitat's resinous characteristics) to favour the return of a woodland caribou habitat.	
		Presence of site remains	• For a certain period, the trench landfill site may attract animals due to food odour emissions.This will, however, be a short-term impact, lasting only until the organic matter decomposes.		

Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Human environment	**Land and natural resources use**	Water management (runoff, flooding of pits)	• Creation of large lakes with flooding of the pits during the closure operation phase.	• Recognize and respect the role of trapline M11 title holders in the traditional and contemporary management of the natural resources of the environment; • Keep users of the environment informed about the construction schedule and location so as to ensure user safety during more dangerous operations (for instance blasting), and ensure agreements for accommodation considered necessary; • Reduce noisy activities (for instance, helicopter or all-terrain vehicle travel) on certain parts of the territory during periods of waterfowl and moose hunting; • Ensure that mine developments do not interfere with any navigation circuit or snowmobile trail; • Set up appropriate traffic control wherever snowmobile and ATV trails intersect with mine roads and access roads; • Mitigation measures pertaining to biological and physical environments will apply here as well; • Develop an awareness program for workers concerning Cree culture and the presence and occupation patterns of M11 trapline users; • Fishing, hunting and trapping will be prohibited on the site in accordance with provisions in the workers' and contractors' contracts; • Establish a buffer zone around the project site where fishing, hunting and trapping activities will be prohibited; • Provide compensation for expected impacts for the tallyman whose homebase camp is located to the east of the airstrip. The two parties have entered into discussions concerning the relocation of this camp elsewhere on the trapline; • During the project life, any unexpected impact will be assessed and the appropriate mitigation measures applied; • Consider improvement measure linked to the rehabilitation of the environment and involving the repurposing of certain associated facilities for the benefit of M11 trapline users; • The airstrip will be offered to local authorities since it constitutes a regional sustainable development infrastructure for the community as a whole.	
		Dismantling and repurposing of facilities	• Reduction of the quality of hunting and trapping, related to noise, within and on the periphery of the footprint of the project.		
		Final site rehabilitation and revegetation	• Progressive rehabilitation of vegetation cover and wildlife.		
		Presence of site remains	• Some traces will however remain, such as the processed kimberlite confinement areas and the overburden stockpiles area. On the other hand, the flat surfaces of these areas will be revegetated and will gradually blend in with the hills of the site, although their shapes will differ.		
	Economy and employment	Manpower and procurement	• Reduction of mining activities; • Hiring of a few workers during the closure phase; • Mine closure will involve a massive loss of jobs and contracts at Renard Project facilities; • Loss of local, regional, provincial and Canada-wide economic spinoffs.	• Prioritize the hiring of a regional manpower; • Prioritize the granting of contracts to businesses from the region having filed a competitive bid; • Offer severance pay with amounts varying according to the different employment groups; • Participate in the measures outlined by the Act respecting Manpower Standards for the establishment of a committee assisting the manpower reclassification; • Set aside budgets to carry out post closure monitoring of worker reclassification.	
Human environment	**Health and well-being**	Use and maintenance of machinery and of power generating sets and road traffic	• Activities may increase dust emissions; • Accidental leaks or spills of petroleum products or of any other contaminant on the work site may contaminate water, vegetation, fish, and wildlife in the surroundings.	• Concerning health of workers and of general public, air quality monitoring will consider all forms of contaminants that may be found in the air, including, if applicable, metals emitted in particulate form. Efforts will be made to ensure that all health protection standards in force will be respected. The same approach will be adopted for liquid effluents and surface water and groundwater quality; • Health and safety of employees will be provided by the sanitation and safety management plan on worksite; • Hiring of Cree personnel to carry out various supervisory and services responsabilities (human resources, health, recreation, safety, etc.) and to provide rapid response to any problematic situation; • Identify among Cree personnel resources who could act as Cree/French-English interpreters should the need arise; • Cooperation with the Mistissini community to deliver awareness programs promoting healthy lifestyle and prevention of drug and alcohol abuse; • Establish measures to ensure information of Mistissini community about mine activities; • Promote recreational, social, cultural and sporting activities enabling workers to socialize outside the workplace framework; • Establish spaces reserved for Cree cultural activities in the mine site; • Establish measures to facilitate the integration, advancement and retention of Cree personnel; • In conjunction with Cree organizations, establish measures to promote connection between workers and the communities and their families (for instance, by facilitating telephone and online communications) and assisting workers experiencing personal or family problems; • In the long term, organizations such as the CCSSSBJ and CRSSSBJ will identify and appropriately manage impacts on health and well-being. Such monitoring actions may eventually result in these organizations being overworked. Aware of this fact and of its responsibilities in this regard, Stornoway is willing to support any long term monitoring and intervention project that would, for instance, encompass all development projects included in the Plan Nord.	
		Final site rehabilitation and revegetation	• The final rehabilitation and revegetation of the site will, from a psychosocial point of view, have a positive effect by mitigating, as much as possible, the negative effect associated with a feeling of loss caused by implementation of mining activities in a previously undisturbed environment.		
		Manpower and procurement	• Health and safety of staff and visitors are directly at risk on the worksite itself; • Dust emissions from various material deposits could affect the health of workers and visitors; • Manpower and procurement will have an overall positive impact on the general social conditions of the Cree and Jamesian populations given the project's economic spinoffs; • Increased individual income and better employment opportunities will improve life conditions, especially with regard to accommodation, and will also help to improve individual and community health, including physical, mental and social health; • Negative effects on family life caused by prolonged absences of Native workers .		

Appendix 9.3.1 Summary of Impacts and Mitigation and Enhancement Measures by Valued Component – Closure Phase

	Valued component	Impact agent	Potential impact	Mitigation and Enhancement Measures	Residual impact
Human environment	Archeological and cultural heritage	–	• The closure of the Renard Project is not expected to have any impact on archeological resources.	–	●
	Landscape	Dismantling and repurposing of facilities	• Dismantling and repurposing of facilities will have a positive effect on landscape.	• Return all waste rock and granular base to the pits or reuse for underground backfilling or various constructions; • Scarify and revegetate the airstrip area after use; • Dismantle all buildings and other facilities adjacent to the airstrip or transfer airport facilities to regional authorities.	▲
		Final site rehabilitation and revegetation	• Final site rehabilitation and revegetation will have a positive effect on landscape; • Flooding of the mine pits will have a positive impact on landscape, largely offsetting the dewatering of the two small lakes during the construction phase.	• Cover the temporary confinement area with a 0.5 m thick layer of overburden and a 0.3 to 0.5 m thick layer of organic matter before planting; • Reuse stored overburden for purposes of rehabilitation; • Cover the waste rock stockpiling area with a 0.5 m thick layer of overburden and a 0.3 to 0.5 m thick layer of topsoil before planting; • Reserve the granular base of the confinement area forthe mine rehabilitation phase.	
		Presence of site remains	• The presence of site remains will have only a low negative impact on the landscape since its effect will gradually decrease as more vegetation will recolonize the site; • The slopes of the processed kimberlite confinement area as well as the overburden stockpile will remain visible in the landscape for some time since these areas will be covered by boulders.	• Progressively rehabilitate the management sites for material produced by mining operations in order to mitigate their visual impact.	

Legend of symbol- Impact significance

- ▽ Negative - low
- ▽ Negative - moderate
- ▽ Negative - high
- △ Positive - low
- △ Posittive - moderate
- △ Positive - high
- ● Negligible or null

Appendix 12.1

Risk Register

APPENDIX 12.1

RISK REGISTER

This appendix contains those excerpts from the risk register that are relevant to health, safety and the environment.

The risk assessment reported here was gathered at the end of Stornoway Diamond Corporation (Canada) Inc.'s Renard Project Feasibility Study.

Risk management is an ongoing process that is applied throughout the entire project, ending only once the project has been completed. The data presented in Appendix 12.1 represent the information available in November 2011. The risk register still evolves and issues that were not targeted by control measures will be progressively addressed.

The scope of the Renard Project's risk management process includes risks that can arise throughout the project, i.e. from the feasibility study to the closure of the mine.

The risk management approach used is based on ISO 31000 (Risk management – Principles and guidelines). Quantifying the project's risks will:

- Help understand the impact of collective risks over the project's duration;
- Help understand the level of uncertainty in order to apply appropriate risk management strategies;
- Ensure that project resources are allocated to the right task at the right time; and,
- Allow to develop and carry out risk contingency plans.

Site risk review meetings were held regularly with key project employees and Stornoway Diamond Corporation (Canada) Inc. managers. Procedures and tools used to identify, analyze, communicate, mitigate and monitor risks were used to support this process.

The following levels of consequence, probability of occurrence and manageability (uncertainty) were used to perform the assessment:

- Very high;
- High;
- Moderate;
- Low; and
- Very low.

The risk register is presented in the following table.

Risk Register

ID	Risk identification	Risk description	Capex/ Opex	Risk type	Category	WBS	Risk status	Consequence	Probability	Manageability	Risk level	Mitigation measures	Action	Comments
1	Water infiltration in underground mine.	Underestimation of water inflow through faulted country rock.	Capex	T	Cost and timetable	1220	Watch	Moderate	Moderate	Moderate	LOW	1.1. Hydrogeological study completed. Completed.	1.1.1. Numerical modeling. Completed.	
3	Water infiltration in open pits R2/R3.	Direct flow from lake via water passage.	Capex	T	Cost and timetable	1210	Active	High	Moderate	Moderate	MODERATE	3.1. Hydrogeological study to be completed after BFS. Completed.	3.1.1. Study faults' hydraulic conductivity after BFS. Completed.	Study Capex.
4	Ore dilution (underground).	Ore dilution could be higher than anticipated.	Opex	T	Cost	1220	Active	Very high	Moderate	Moderate	VERY HIGH	4.1. Select best mining method. Completed.	4.1.1. Complete trade-off study. Completed.	The mining method specifically addresses dilution control by keeping ore-bearing cuts and rock cuttings.
												4.2. Further define cracked country rock – CCR. Completed.	4.2.1. Additional plans and drilling. Completed.	
												4.3. Develop strategy for deciding on ore draw point spacing.	4.3.1. Draw point spacing study. Completed.	
													4.3.2. Outside calibration. Completed.	
													4.3.3. Geological modeling of draw point design (Itasca). Under way.	
												4.4. Consequence modeling / Mining sequence	4.4.1. 3D modeling of footing pillars. Under way.	
													4.4.2. Validation by peer. Completed.	
												4.5. Appropriate draw point management.	4.5.1. Assign people and software. Cost flowchart to be supplied by AMEC. Completed.	
													4.5.2. Ore flow model.	

ID	Risk identification	Risk description	Capex/ Opex	Risk type	Category	WBS	Risk status	Consequence	Probability	Manageability	Risk level	Mitigation measures	Action	Comments
5	Ore stripping ratio in underground mine lower than expected.	Resource sterilization.	Opex	T	Cost and timetable	1220	Active	High	Moderate	Moderate	MODERATE	5.1. Same as 4.1 and 4.3. Completed.	5.1.1. Same as 4.1.1, 4.3.1 and 4.3.2. Completed.	
												5.2. Appropriate footing pillar overlap strategy.	5.2.1. Develop specific drilling and blasting patterns.	
9	Lack of qualified mining operations personnel.	Difficulty of attracting and keeping qualified mining personnel could affect productivity.	Opex	T	Cost and timetable	1220	Active	Very high	High	Moderate	VERY HIGH	9.1. Organize hiring and training of employee early in the process. Completed.	9.1.1. Develop incentive programs that are part of the start-up process. Completed.	
												9.2. Integrate Native people and personnel from other countries. Completed.	9.2.1. Reach impact benefit agreement. Completed.	
												9.3. Prepare operational preparedness plan.	9.3.1. Prepare operational preparatory plan for the 4th quarter of 2011.	
12	Articles with extensive delivery deadlines.	Major equipment delivery could take more time than expected.	Capex	T	Timetable	1120	Watch	Very high	Low	Low	HIGH	12.1. Prepare a list of items with long delivery deadlines.	12.1.1. Complete FS. Completed.	Review items with extended delivery deadlines when launching project.
												12.2. Establish best timetable.	12.2.1. Define procurement strategy. Completed.	
16	Stability of open pit slopes.	Rockslide on open pit slopes caused by conditions not foreseen during operation.	Opex	T	Operation	1210	Active	High	Low	Moderate	LOW	16.1. Enact appropriate operation plan.	16.1.1. Implement operation-specific procedures.	
24	Quality and availability of borrow pit materials.	Quality and availability of material for airstrip is not confirmed.	Capex	T	Cost and timetable	0010	Active	High	Bas	Very high	LOW	24.1. Materials estimates and worksite checks to be completed.	24.1.1. To be completed by summer 2012.	
													24.1.2. Perform additional tests in ESKER in summer 2012.	
26	Site access – land.	The permanent access road, the extension of Route 167, may not be ready in time for construction, thereby causing delays in the construction timetable.	Capex	T	Cost and timetable	8100	Watch	Very high	Moderate	Low	VERY HIGH	26.1. Send a letter of intent to the Ministère des Transports for highway funding. Completed.	26.1.1. Representations. Completed.	Site access via an unachieved highway to be completed by August 2013.
												26.2. Letter of intent regarding road	26.2.1. Submit a letter of intent to the	

ID	Risk identification	Risk description	Capex/ Opex	Risk type	Category	WBS	Risk status	Consequence	Probability	Manageability	Risk level	Mitigation measures	Action	Comments
												maintenance.	Deputy Minister.	
												26.3. Build a winter road and temporary bridges. Cancelled.	26.3.1. Authorization for construction.	
												26.4. Use airlifts for heavy transportation (Hercules). Cancelled.	26.4.1. Compromised.	
27	Forest fire	A forest fire during construction or operations could cause delays / damage.	Capex	T	Cost and timetable	5000	Active	Low	High	Low	MODERATE	27.1. Appropriate design. Completed.	27.1.1. To be completed for the 1st quarter of 2011.	
												27.2. Implement emergency response plan.	27.2.1. Obtain and implement insurance companies' guidelines. Completed for design.	
													27.2.2. To be completed with the constructability review. Completed.	
													27.2.3. Reach agreement with SOPFEU.	
29	Conclusion of Impact and Benefit Agreement (with Cree Nation and Mistissini Band Council)	Conclusion of Impact and Benefit Agreement could be delayed after June 2011, thereby potentially affecting the project as a whole.	Capex	T	Cost and timetable	9250	Active	Very high	Moderate	Low	VERY LOW	29.1. Strategic plan for negotiations for the Impact and Benefit Agreement. Completed.	29.1.1. Clarify construction and operation requirements with Cree Nation. Completed.	
												29.2. Carry out strategic plan.	29.2.1. Impact and Benefit Agreement to be signed.	
34	Ore processing plant – Diamond breakage.	Inappropriate design could reduce the value of the diamonds recovered due to breakage.	Capex	T	Cost	3200	Watch	Very high	High	Moderate	VERY HIGH	34.1. Data review (internal study of damage to diamonds). Completed.	34.1.1. Apply best practices (shipping list). Completed.	Completed for BFS. To be reviewed in details at the design phase.
41	Power line.	Having a power line could be beneficial for the project.	Opex	O	Cost	8200	Active	Very high	Moderate	Moderate	OPPORTUNITY	41.1. Prepare a decision business case to support decision process.	41.1.1. Scoping study (SNC). Completed.	

ID	Risk identification	Risk description	Capex/ Opex	Risk type	Category	WBS	Risk status	Consequence	Probability	Manageability	Risk level	Mitigation measures	Action	Comments
												41.2. Hydro-Québec will perform a Feasibility Study during the 2nd quarter of 2012.	41.2.1. Follow-up with Hydro-Québec.	
43	Permit – GCA (Global certificate authorization)	Delays in receiving permits in time and lack of project definition.	Capex	T	Cost and timetable	9200	Watch	Very high	Moderate	Moderate	VERY HIGH	43.1. Quality of documentation needed for authorization (consultant to be determined). Completed.	43.1.1. Monitor process closely to ensure compliance with legislation. Completed.	Included in BFS.
												43.2. Timely identification of information and appropriate implementation strategy. Completed.	43.2.1. Ensure excellent coordination between all parties. Completed.	
48	Wastewater treatment.	Volume and quality of water discharged.	Capex	T	Technical	5830	Active	Very high	High	Very high	HIGH	48.1. Prepare site's water balance and quality model. Completed.	48.1.1. Prepare site's water balance and quality model. Completed.	
												48.2. Recycle and treat water. Completed.	48.2.1. Water model optimization.	
53	Economic analysis of project.	The return on investment could be lower than expected due to all of the changes that must be incorporated into the BFS' preliminary analysis (PA).	Capex	T	Cost	9300	Active	Very high	High	Moderate	HIGH	53.1. Financial analysis.	53.1.1. Optimize financial parameters (i.e. price of diamonds, fuel, etc.).	
												53.2. Identify an effective strategy for optimizing CAPEX/OPEX.	53.2.1. Trade off.	
												53.3. Find the best implementation approach to improve project feasibility.	53.3.1. Conduct external calibration and peer monitoring.	
56	Access ramp and mine shaft pile-driving: Soil conditions.	Interception of structures with significant hydraulic conductivity and poor soil conditions.	Capex	T	Cost and timetable	1120	Active	Very high	Moderate	Moderate	VERY HIGH	56.1. Mine shaft pilot hole tests and packer testing before detailed engineering.	56.1.1. Study of pilot holes and water sampling.	Provision made for cementing during shaft pile-driving.
													56.1.2. Develop a cementing strategy.	
58	Landslide and change of project scope.	Change in project scope between feasibility study (FS) and implementation.	Capex	T	Engineering	9300	Active	Very high	Moderate	High	HIGH	58.1. Try to get operating team's agreement.	58.1.1. External consultant or consultant hired by SWY.	

ID	Risk identification	Risk description	Capex/ Opex	Risk type	Category	WBS	Risk status	Consequence	Probability	Manageability	Risk level	Mitigation measures	Action	Comments
												58.2. Strong design base and documentation.	58.2.1. Communicate information.	
59	Water treatment during mine shaft pile-driving.	Water characteristics may not comply with environmental discharge criteria.	Capex	T	Technical	5800	Active	Very high	Moderate	Moderate	VERY HIGH	59.1. Proper design and authorizations.	59.1.1. Include mine shaft and access ramp pile-driving water. 59.1.2. Contractor will have to minimize contamination levels. 59.1.3. Characterize water quality for mine shaft and pilot hole of 56.1.1.	
60	Critical equipment breakdown during construction.	Delays during construction phase due to lack of critical spare parts.	Capex	T	Cost	9400	Watch	Very high	Moderate	High	HIGH	60.1. Identify critical spare parts.	60.1.1. Develop a plan for critical spare parts.	
61	Critical equipment breakdown.	Delays during operation due to lack of critical spare parts	Opex	T	Cost	9300	Watch	Very high	Moderate	High	HIGH	61.1. Identify spare parts to capitalize.	61.1.1. Include in cost estimate.	Included in BFS.
67	Staff transportation during first year of construction.	Accident due to unsuitable airstrip.	Capex	T	HSE	9400	Watch	Very high	Low	Moderate	HIGH	67.1. Transportation safety plan. 67.2. Ensure that airstrip is ready early in the project.	67.1.1. Design covered in preliminary engineering plan (PEP). 67.1.2. To be defined during detailed engineering. 67.2.1. Appropriate project timetable.	Included in BFS.
72	Aircraft accident.	Aircraft accident on airstrip with required intervention measures.	Capex	T	Operation	5900	Watch	Very high	Very low	Low	LOW	72.1. Ensure that airstrip is properly designed. Completed.	72.1.1. Implement the appropriate operation procedures. 72.1.2. Implement an emergency measures procedure	Included in BFS.

ID	Risk identification	Risk description	Capex/ Opex	Risk type	Category	WBS	Risk status	Consequence	Probability	Manageability	Risk level	Mitigation measures	Action	Comments
													for an aircraft accident.	
73	Lack of skilled workers for construction.	The lack of qualified workers for construction could cause delays.	Capex	T	Construction		Active	Very high	High	Moderate	VERY HIGH	73.1. Training anticipated.	73.1.1. Establish a training program.	
												73.2. Hiring anticipated.	73.2.1. Establish an employment plan.	
												73.3. Reduce total work force required on site.	73.3.1. Include in call for tender assembly strategy.	
												73.4. Prefabrication of project components.	73.4.1. Include in project engineering strategy.	
74	Processed kimberlite behaviour.	Flow characteristics when sludge thickens could cause mudding off (stop productivity).	Capex	T	Engineering		Watch	Moderate	Moderate	High	LOW	74.1. Ensure appropriate design of handling accessory equipment.	74.1.1. Perform handling tests during detailed design.	
75	Groundwater quality at depth	Groundwater at depth quality could differ from near-surface water quality, thereby potentially affecting water treatment design.	Capex	T	Engineering		Watch	Very high	Moderate	Moderate	VERY HIGH	75.1. Appropriate characterization of groundwater and appropriate water treatment design.	75.1.1. Same as 56.1.1	
76	Conflict arising from worker cross-contacts (ID-999).	During the implementation phase, the project will be separated into two areas: the “construction workers” zone and the “mine workers” zone. Conflicts could arise if construction workers (covered by a decree) have contacts with the owner’s mine workers (not covered by a decree).	Capex	T	Construction		Watch	High	Moderate	Moderate	MODERATE	76.1. Define work areas (construction and mine).	76.1.1. Include in implementation plan.	

Appendix 12.2

Hazard Identification Work Sheets (HAZID)

APPENDIX 12.2
HAZARD IDENTIFICATION (HAZID)
WORKSHEETS

Hazard Identification Worksheets

The following worksheets are included:

- Appendix Table 12.2-1 – Identification of hazards associated with the open pit mine;
- Appendix Table 12.2-2 – Identification of hazards associated with the underground mine;
- Appendix Table 12.2-3 – Identification of hazards associated with the diamond recovery plant;
- Appendix Table 12.2-4 – Identification of hazards associated with propane and fuel storage facilities;
- Appendix Table 12.2-5 – Identification of hazards associated with various chemical products;
- Appendix Table 12.2-6 – Identification of hazards associated with storage and handling of explosives;
- Appendix Table 12.2-7 – Identification of hazards associated with the processed kimberlite confinement area;
- Appendix Table 12.2-8 – Identification of hazards associated with the power generating sets;
- Appendix Table 12.2-9 – Identification of hazards associated with wastewater and solid waste treatment;
- Appendix Table 12.2-10 – Identification of hazards associated with the accommodation and services complex;
- Appendix Table 12.2-11 – Identification of hazards associated with the airstrip and terminal;
- Appendix Table 12.2-12 – Identification of hazards associated with road access; and
- Appendix Table 12.2-13 – Identification of hazards – Other hazards.

The individual Tables presented below describe the hazards identified. The column entitled "**Source**" identifies the underlying causes of incidents (e.g., a fire reaching a propane storage tank that could provoke explosion). The columns "**Specific Triggers**" and "**Consequences**" provide details both for mine facilities and for the environment. The column entitled "**Protection/Mitigation Measures"** describes the different protection or mitigation strategies employed. The final column, "**Remarks**", provides an assessment of the risk and formulates recommendations, as necessary.

Appendix 12.2 Table 1 - Identification of hazards associated with the open pit mine

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
OPEN PIT MINE					
1. Flooding of the pit	1. Surface water sources, including Lake Lagopede	• Damage caused by blasting and the installation of development of hydraulic pathway • Faults in the rock structure acting as path that allow water to flow down into the pit • Major flood conditions	• Water moving into the pit • Risk of injury and mortality for people in the pit • Risk of economic losses	1. Geological and hydro-geological studies to characterize the site. 2. Monitoring of the impact of blasting in the pit or in the underground mine on the development of water pathways that water can move through. 3. Pumps to remove water that builds up in the pit. 4. Emergency response plan for the mine, along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	Damage to the structure of the rock or faults in the rock could lead to water seeping into the pit. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty: Moderate*
2. Rock falls, landslide	2. Loose rock, unstable ground	• Pit slope too deep, unstable ground nearby	• Rock falling into the pit • Risk of injury and/or mortality for people in the pit • Risk of economic losses	1. Slopes of the pit designed in compliance with the Regulation respecting occupational health and safety in mines (L.R.Q. c. S-2.1 r.14) 2. Monitoring of the risk of landslides or rock falls into the pit. 3. Emergency response plan for the mine, along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	Landslides or rock falls into the pit could result in injury and/or mortality for people there. **Level of risk:** *Consequence severity level: Very high* *Probability of occurrence: Low* *Level of risk: Moderate - must be monitored* *Degree of uncertainty: Low*

Appendix 12.2 Table 1 - Identification of hazards associated with the open pit mine (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
OPEN PIT MINE					
3. Explosion	1. Rock blasting. 2. Explosion at explosives magazine	• Human error	• Risk of injury and mortality	1. Control of blasting activities (L.R.Q. c. S-2.1 r.14) 2. Emergency response plan for the mine, along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	Risk of injury or mortality if blasting operations are poorly managed. **Level of risk:** *Consequence severity level: Very high* *Probability of occurrence: Very low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty: Low*

Appendix 12.2 Table 2 - Identification of hazards associated with the underground mine

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
UNDERGROUND MINE					
1. Flooding of the mine	1. Seepage of water	• Rock fractures connecting with water tables located above the excavation site	• Flooding of the mine • Risk of injury and mortality • Risk of economic losses	1. Mine constructed in compliance with the requirements of the Regulation respecting occupational health and safety in mines (L.R.Q. c. S-2.1 r.14) 2. Exploratory drilling carried out to characterize the mine site 3. Hydrogeological modelling of infiltration and exfiltration (Itasca et Golder 2011) 4. Geological study and adoption of appropriate mining techniques 5. Monitoring of infiltration of water during pile driving operations and implementation of corrective measures 6. Retention of a sufficient depth of the surface pillar to prevent surface water infiltration 7. Fill the excavated area with mine waste rock 8. Use of pumps to move water to the surface, and use of monitoring mechanisms 9. Emergency response plan for the mine, along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	The hydrogeological modelling carried out served as a basis for characterizing the water infiltration and exfiltration in and from the mine. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Moderate*

Appendix 12.2 Table 2 - Identification of hazards associated with the underground mine (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
UNDERGROUND MINE					
2. Fire in the mine	1. Pipes, storage, or refuelling station for diesel and other fuels 2. Systems using hydraulic oils 3. Vehicles 4. Conveyor belts 5. Storage or use of explosives	• Fuel spill (diesel), spark and fire • Hydraulic oil leak, spark and fire • Vehicle tires catching fire • Poor conveyor belt alignment resulting in friction-induced sparks and fire • Fire caused by explosives	• Risk of injury and mortality • Risk of economic losses	1. Mine operated in compliance with the requirements of the Regulation respecting occupational health and safety in mines (L.R.Q. c. S-2.1 r.14) 2.Fuel spill containment measures 3. Quality maintenance of vehicles and conveyor belts 4. Smoke and fire detectors 5. Firefighting station with hoses 6. Portable fire extinguishers 7. Equipment/material for construction of smoke barriers 8. Ventilation of the underground mine 9. Mine shelters 10. Emergency response plan for the mine along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	Underground mine fire can break out as a result of fuel, vehicle tires, conveyors catching fire, etc. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 2 - Identification of hazards associated with the underground mine (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
UNDERGROUND MINE					
3. Rock collapse or rock slides	1. Loose rock, rock faults, high degree of rock stress	• Inappropriate blasting techniques • Inappropriate mining techniques	• Rock collapse or rock slides • Risk of injury and mortality • Risk of economic losses	1. Mine operated in compliance with the requirements of the Regulation respecting occupational health and safety in mines (L.R.Q. c. S-2.1 r.14) 2.Geological studies in preparation for the Mine Plan 3. Mine Plan 4. Use of appropriate mining techniques and training of the miners 5. Cleanup of loose rock 6. Inspection and monitoring of the underground mine 7. Mine shelters 8. Emergency Response Plan for the mine, along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	Rock falls occur as a result of loose rock or rock stress. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty: Low*

Appendix 12.2 Table 2 - Identification of hazards associated with the underground mine (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
UNDERGROUND MINE					
4. Detonation of explosives	1. Explosives	• Poor explosive charge calculations • Unexploded explosives • Transport of explosives	• Risk of injury and mortality • Risk of economic losses, including losses due to damages to mine structures	1. Mine operated in compliance with the requirements of the Regulation respecting occupational health and safety in mines (L.R.Q. c. S-2.1 r.14) 2. Subcontractor experienced in the use of explosives 3. Storage of explosives in the underground mine in compliance with the requirements of the Regulation respecting occupational health and safety in mines 4. Mine shelters 5. Emergency response plan for the mine, along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	An unplanned explosion could result in injury and/or mortality, and damage to the mine structure. **Level of risk:** *Consequence severity level: Extremely high* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 3 – Identification of hazards associated with the diamond recovery plant

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
DIAMOND RECOVERY PLANT					
1. Fire	1. Spill of hydraulic/lubricating oil 2. Faulty alignment of conveyor belt	• Oil catches fire • Friction between conveyor belt and metal parts leading to friction-induced sparks and fire	• Risk of injury and mortality • Economic losses, damage to equipment and loss of production	1. Use of low flash point hydraulic and lubricating oils 2. Containment measures for hydraulic and lubricating oil spills 3. Design based on NFPA standards 4. Monitoring using closed circuit television cameras 5. Fire protection water supply system with fire hydrants 6. Firefighting water tank and emergency vehicle 7. Emergency response team 8. Emergency response plan for the mine along with appropriate alarm systems and training of personnel (L.R.Q. c. S-2.1 r.14)	A fire in the diamond recovery plant could result in injuries and/or mortalities, in addition to economic losses. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 3 – Identification of hazards associated with the diamond recovery plant (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
DIAMOND RECOVERY PLANT					
2. Exposure to X-rays	1. X-ray diamond sorters	• X-ray leakage due to faulty equipment	• Exposure of those present to high levels of X-rays • Possibility that they develop certain illnesses as a result of overexposure to X-rays	1. Use of weak sources of X-rays 2. Equipment constructed to avoid leakage of X-rays 3. Regular monitoring of X-ray levels at appropriate intervals 4. Medical monitoring of personnel working in this area	Unwanted exposure to X-rays can result in serious illness. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Very low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Moderate* **Recommendations:** *It is recommended that a radiation level monitoring program be implemented, with medical monitoring of personnel exposed until confirmation of the risk level.*

Appendix 12.2 Table 3 – Identification of hazards associated with the diamond recovery plant (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
DIAMOND RECOVERY PLANT					
3. Pinch points (also called nip points in the CSA Standard)	1. Conveyors	• Unguarded pinch points	• Risk of injury and mortality	1. Pinch point guarding as required under CSA Standard Z-432 or an equivalent standard 2. Training and information on the hazards represented by pinch/nip points	Unguarded pinch points can result in injury or death. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty: Low*

Appendix 12.2 Table 4 – Identification of hazards associated with propane and fuel storage facilities

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
STORAGE AND USE OF PROPANE					
1. Fires that could involve propane tanks	1. Propane leak	• Ruptured flexible transfer hose • Pipe damage • Unexpected movement of the delivery vehicle during the transfer operation • Collision with a vehicle travelling in the area • Burning of combustible material, including brush • Forest fires	• Propane leak • Risk of a propane-related fire • Overheating of the propane tank caused by a jet of flame • Rupture of the propane tank, with a consequent explosion, fireball and projection of tank fragments (BLEVE) • Likely injuries and/or mortalities • Economic losses due to damage to facilities	1. Storage facilities constructed in compliance with CSA standards specified in the Propane Storage and Handling Code (CSA B-149.2-05) 2. Accredited propane supplier 3. Area around the propane storage tanks is kept clear of combustible materials, vegetation, debris, etc. 4. Ground under the storage tanks has a 1% downhill grade sloping toward the perimeter to avoid any build up of combustible liquid under tanks if an accidental leak occurs 5. Storage tanks are protected by bollards to protect against collisions by vehicles 6. Portable fire extinguishers are readily available 7. Fire protection water supply system 8. Emergency vehicle 9. Emergency response plan with specific measures procedures to follow in the event of a propane-related incident	Propane is a hazardous material. Three BLEVEs that have occurred in Ontario since 2003 were all as a result of poor handling practices. A similar accident occurred in Warwick, QC in1993, and resulted in the loss of 4 lives. It is extremely important to ensure that the appropriate protection and mitigation measures are in place, including the Emergency response plan, and that they are kept fully functional at all times. **Level of risk:** *Consequence severity level: Extremely high* *Probability of occurrence: Extremely low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low* **Recommendation:** *Use of flexible hose with automatic isolation of leaks from hose ruptures*

Appendix 12.2 Table 4 – Identification of hazards associated with propane and fuel storage facilities (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
STORAGE AND USE OF PROPANE					
2. Propane vapours	1. Propane leak	• Ruptured flexible transfer hose • Pipe damage • Unexpected movement of delivery vehicle during the transfer operation • Collision with a vehicle travelling in the area • Forest fires	• Possibility that propane vapours will be sucked into the mine ventilation system • Possibility of an explosion in the mine ventilation system • Likelihood of injury and mortality • Economic losses due to damaged facilities	1. Establishment of fuel reception and storage facilities located at a distance greater than 50% of the lower explosion limit of propane from the mine ventilation intake system. (175 m) 2. Accredited propane supplier 3. Storage tanks are protected by bollards to avoid collisions by vehicles 4. Use of flexible hose with automatic isolation of leaks from hose ruptures 5. Emergency response plan with special procedures required for responding to propane-related incidents.	See remarks on burning propane leaks. **Level of risk:** *Consequence severity level: Extremely high* *Probability of occurrence: Extremely low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low* **Recommendation:** *Ensure the supply line for the gas used for heating ventilated air in the mine is fully protected from shocks*

Appendix 12.2 Table 4 – Identification of hazards associated with propane and fuel storage facilities (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
PETROLEUM PRODUCTS, DIESEL AND GASOLINE					
1. Spill of petroleum products -- diesel or gasoline	1. Spill of diesel or gasoline during fuel delivery 2. Spill of petroleum products when daily feed storage tanks are being filled 3. Spill of petroleum products when vehicles are being fuelled	• Malfunction/corrosion of equipment • Human error • Forest fires	• Potential contamination of soil, and of surface or groundwater	1. Petroleum storage tanks located in a retention basin that can hold 110% of the volume of the largest tank 2. Tank level detection and spill prevention systems 3. Concrete slab floor at petroleum reception and distribution sites with spill confinement capacity 4. Water/petroleum separator at fuel storage area 5. Procedures for petroleum reception and distribution and corresponding training; 6. Double wall daily feed storage tanks 7. Spill cleanup kit, including absorbents 8. Emergency response plan	A spill of petroleum products could potentially result in contamination of soil and surface and groundwater **Level of risk:** *Consequence severity level: Moderate* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low* **Recommendation:** *Installation of systems to contain any spills that could occur when daily feed tanks are being filled with petroleum products*

Appendix 12.2 Table 4 – Identification of hazards associated with propane and fuel storage facilities (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
PETROLEUM PRODUCTS					
1. Petroleum-based fire	2. Petroleum products storage tanks, daily feed storage tanks, users of products	• Malfunction • Corrosion • Handling errors • Sparks • Forest fires	• Potential injuries and mortality • Risk of economic losses • Potential contamination of soil, and of surface or groundwater	1. Quality maintenance of equipment to prevent leaks or spills of petroleum products 2. Spill cleanup kit with absorbents 3. Fire and smoke detectors 4. Portable fire extinguishers that are readily available 5. Reserve supply of foam to fight petroleum-based fires 6. Fire protection water supply system with fire hydrants close to the petroleum products storage area 7. Fire truck 8. Emergency response plan and the specific measures procedures for this type of incident	A petroleum-based fire could potentially result in contamination of soil, as well as surface and groundwater **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Annexe 12.2 Table 4 – Identification of hazards associated with propane and fuel storage facilities (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
PETOLEUM PRODUCTS, OIL AND GREASE					
1. Spill of petroleum-based products – oil and grease	1. Containers of oil and grease, barrels, portable tanks	• Ruptured containers • Handling errors • Spills from equipment travelling on roads in the area	• Potential contamination of soil, and of surface and groundwater	1. Equipment and facilities to contain spills in areas where petroleum products are stored, distributed and used 2. Spill cleanup kit, with absorbents 3. Employee training and awareness activities on issues of environmental protection 4. Emergency response plan and the specific measures procedures for this type of incident	A spill of petroleum-based products could potentially cause injuries, mortalities, have significant economic consequences and result in the contamination of soil, and of surface and groundwater **Level of risk:** *Consequence severity level: Low* *Probability of occurrence: Low* *Level of risk: Low - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 5 – Identification of hazards associated with various chemical products

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
VARIOUS CHEMICAL PRODUCTS					
1. Spill of hazardous substances	1. Storage tanks 2. Barrels and portable containers 3. Other containers	• Equipment malfunction, corrosion. • Human error	• Contamination of process water, and surface and groundwater by acids (hydrochloric acid), bases (sodium hydroxide) or other chemicals • Contact of this contaminated water with people. • Potential for injuries from burns (hydrochloric acid, sodium hydroxide) or exposure to toxic gases (hydrochloric acid), and deaths	1. Maintenance program to prevent leaks due to corrosion or equipment malfunctions 2. Dedicated storage areas for chemical substances, and appropriate leak containment systems 3. Spill cleanup kits, with absorbents 4. Personal protective equipment to prevent direct contact with hazardous substances 5. Adoption of procedures for the safe handling and use of chemicals, and provision of corresponding training 6. Provision of emergency drench showers and eyewash stations in sectors where chemicals are used 7. First aid service 8. Emergency response plan with specific procedures in the case of chemical products	Accidental exposure to chemical substances can result in injuries (burns) and ultimately mortalities. **Level of risk:** *Consequence severity level: Moderate* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 6 - Identification of hazards associated with the storage and handling of explosives

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
EXPLOSIVES – ABOVE GROUND					
1. Fire / explosion	1. Explosives storage magazines 2. Transportation of explosives on the mine site	• Fire in an explosives magazine/storage area • Poor handling of explosives • Impact of debris on explosives storage magazines	• Explosion with projection of debris • Risk of injury and mortality • Potential material damage	1. Explosives magazines constructed in compliance with the Explosives Regulations (C.R.C., c. 599) of the Explosives Act (C.R.C, c. 599) and its related Directives 2. Permit from the Sûreté du Québec 3. Separating distances between explosives magazines to comply with the Regulations 4. Heating and lighting equipment serving the explosives magazines 5. Specialized subcontractors trained in handling of explosives 6. Explosives magazines are appropriately fenced 7. Emergency response plan for the mine with warning systems, and training of employees (L.R.Q. c. S-2.1 r.14)	An explosion in an explosives magazine or in equipment transporting explosives could cause injuries and mortalities. **Level of risk:** *Consequence severity level: Moderate* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table A-6 - Identification of hazards associated with the storage and handling of explosives (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
EXPLOSIVES – UNDERGROUND MINE					
2. Fire/ explosion	1. Underground mine explosives storage areas 2. Transportation of explosives on the mine site 3. Storage of explosives in the underground mine and in the pit mine	• Fire in an explosives magazine/storage area • Poor handling of explosives • Impact of debris on explosives storage magazines	• Explosion with bursts of debris • Risk of injury and mortality • Potential material damage	1. Permit from the Sûreté du Québec 2. Heating and lighting equipment serving the explosives magazines 3. Specialized subcontractors trained in handling of explosives 4. Explosives magazines in the underground mine respect the *Regulation respecting Occupational Health and Safety in Mines* (L.R.Q. c. S-2.1 r.14) 5. Emergency response plan for the mine with warning systems, and training of employees (L.R.Q. c. S-2.1 r.14)	An explosion in an explosives magazine or in explosives transportation equipment could result in injuries or mortality. **Level of risk:** *Consequence severity level: Moderate* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table A-6 - Identification of hazards associated with the storage and handling of explosives (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
EXPLOSIVES – ABOVE GROUND					
3. Theft of explosives	1. Explosives storage areas	• Theft	• The explosives could be used by people with criminal intentions	1. Explosives magazines constructed in compliance with the Explosives Regulations (C.R.C., c. 599) of the Explosives Act (C.R.C, c. 599) and its related Directives 2. Permit from the Sûreté du Québec 3. Controls for the circulation of people in the area 4. Surveillance cameras	Thefts of explosives could enable their use for criminal purposes **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Extremely low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 7 – Identification of hazards associated with the processed kimberlite confinement area

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
PROCESSED KIMBERLITE CONFINEMENT AREA					
1. Seepage of leachates into Lake Lagopede	1. Kimberlite confinement area	• Hydrostatic pressure • Permeability of soil	• Changes in the water quality of Lake Lagopede • Degradation of fish habitat • Impact on the water supply at the Renard Complex.	1. Geological and/or hydrogeological studies 2. Static and kinetic tests of the processed kimberlite showed that the leachates complied with MDDEP criteria for the protection of groundwater 3. Tests showing that the processed kimberlite does not generate acid mine drainage 4. Hydrogeological modelling of contaminants' transport 5. Water management plans requiring the collection of all runoff water from the mine site 6. Mine contact water management plan including control features such as ditches and settling ponds 7. Settling pond in R65 8. Mine wastewater treatment plant 9. Monitoring instrumentation system	Seepage of leachates into Lake Lagopede from the processed kimberlite confinement area could cause changes in the physico-chemical quality of water. **Level of risk:** *Consequence severity level: Low* *Probability of occurrence: Low* *Level of risk: Low – Must be monitored* *Degree of uncertainty : Low* **Recommendation:** The mitigation measures adopted will mitigate the level of risk

Appendix 12.2 Table 7 – Identification of hazards associated with the processed kimberlite confinement area (cont.)

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
PROCESSED KIMBERLITE CONFINEMENT AREA					
2. Surface water runoff	1. Kimberlite confinement area	• Hydrostatic pressure • Diversion of certain streams • Changes in the hydro-geological characteristics of certain waterways and lakes	• Changes in the quality of water in Lake Lagopede • Impact on fish habitat • Impact on the use of lake water for food and drinking at the Renard Complex • Changes to the current location of streams	1. Geological and hydro-geological studies 2. Monitoring of water quality in Lake Lagopede 3. Peripheral drainage ditches to capture and direct water toward a settling pond in R-65 4. Water Management Plan 5. Mine wastewater treatment plant 6. Limited number of sub-watersheds affected	The processed kimberlite confinement area could affect runoff of water on the site **Level of risk:** *Consequence severity level: Low* *Probability of occurrence: Low* *Level of risk: Low – Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 8 – Identification of hazards associated with the power generating sets

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
POWER GENERATING SETS					
1. Fire/explosion	1. Power generators 2. Transformers	• Diesel fuel leak, spark and fire • Overheating of power generators • Short circuit	• Potential injuries and/or deaths • Possibility of a power outage • Possibility that the accommodation and services complex could be affected, making it necessary to evacuate the site • Probable economic losses	1. Designed to conform to FM Global Data Sheets and NFPA Codes 2. There are normally reserve power generators available for use during power cuts 3. There is a reserve power generator for the mine shaft hoist 4. Power generators are housed in separate buildings 5. Fire (smoke, flame) detectors 6. Monitoring system with closed circuit video cameras 7. Portable fire extinguishers on hand for fighting early stage fires 8. Fire protection water supply system with fire hydrants and sprinklers to protect equipment 9. Trained Emergency Response Team 10. Emergency response plan	Fire in a power generator could result in injuries or deaths, as well as electric power outages **Level of risk:** *Consequence severity level: Low* *Probability of occurrence: Low* *Level of risk: Low – Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 9 – Identification of hazards associated with wastewater and solid waste treatment

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
WASTEWATER					
1. Domestic sewage	1. Accommodation and services complex	• Temperature of domestic wastewater • Concentrations of fecal coliforms, phosphorus and nitrogen	• Impact on the quality of lake ice • Risks for snowmobile users • Possible result: Lake ice can give way under the weight of snowmobiles, with potential mortality • Risk of localized proliferation of algae in the lake • Risk of localized bacterial contamination at discharge point	1. Discharge with diffuser located at a depth of 1,085 m 2. Discharge designed for a release volume of 458 L/day, low in comparison with the volume of water in Lake Lagopede, at a temperature of 0.5°C 3. Wastewater will be held initially in aerated lagoons and the temperature of the effluent will gradually adjust to air temperature 4. Flow of effluent discharged is relatively small in comparison with the volume of water at the discharge point 5. Discharge depth is relatively large 6. Dispersion plume will not reach the surface of the lake 7. Phosphorus control system included in the treatment process 8. Modelling of the treated effluent dispersion plume has been carried out	The addition of a residual load of contaminants into Lake Lagopede from the discharge point for treated domestic sewage could potentially reduce the strength of the ice and affect water quality **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low* **Recommendation:** *Monitoring of ice quality in the area of the sewage discharge point in Lake Lagopede*

Appendix 12.2 Table 10 – Identification of hazards associated with the accommodation and services complex

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
ACCOMMODATION AND SERVICES COMPLEX					
1. Fire	1. Kitchen/Cafeteria area 2. Sleeping quarters 3. Service areas	• Electrical short circuit • Fire in the kitchen area due to frying of food and accumulated grease under the floor and in grease traps	• Injuries/mortalities • Evacuation of the mine site • Economic losses	1. Smoking ban in the accommodation and services complex 2. Fire protection water supply system, with fire hydrants 3. Sprinkler system in the accommodation and services complex, including the kitchen area, designed to comply with applicable NFPA Codes and FM Global Data Sheets 4. Smoke detectors 5. Closed circuit cameras to identify signs of fires 6. Portable fire extinguishers 7. Emergency response Team 8. Emergency response plan	A fire in the accommodation and service complex could result in injuries or deaths, in addition to evacuation of the site **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Appendix 12.2 Table 11 – Identification of hazards associated with the airstrip and terminal

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
AIRSTRIP AND TERMINAL					
1. Aircraft accident	2. Aircraft	• Mechanical failure • Adverse weather conditions • Poor condition of the airstrip • Ice build up on aircraft lifting surfaces • Pilot error • Fire in the aircraft	• A number of people could potentially be injured or killed • Economic losses	1. Airstrip, runway, terminal and aircraft guidance equipment designed in compliance with Transport Canada standards 2. Aircraft de-icing equipment 3. Emergency vehicle 4. Firefighting equipment 5. Emergency Response Team 6. Mine Nurse, First Responders 7. Emergency response plan	An aircraft accident could result in a number of people being injured or killed **Level of risk:** *Consequence severity level: Extremely high* *Probability of occurrence: Extremely low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low* **Recommendation:** *An aircraft accident could create a significant number of victims (Consequence severity level: Extremely high). At the same time, the probability of occurrence should be Extremely low, because of the mitigation measures adopted.*

Appendix 12.2 Table 12 – Identification of hazards associated with road access

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
ROAD USE AND MAINTENANCE					
1. Accident involving hazardous substances on Route 167	1. Fuel tanker carrying diesel, gasoline or propane 2. Containers of acid 3. Containers of bases 4. Other chemicals	• Accident resulting in a spill of hazardous substances • Hydrocarbon fire	• Contamination of surface water, groundwater and soils with hydrocarbons, acids (hydrochloric acid), bases (sodium hydroxide) or other chemicals • Forest fires	1. Road designed in compliance with standards established by Quebec's *Ministère des transports* for heavy vehicle transport 2. Service station areas along Route 167 3. Trucks will travel in convoys, making assistance and intervention easier to provide	A road accident could result in a spill of hydrocarbons, acids, bases or other chemicals and contaminate surface and groundwater, as well as soil. **Level of risk:** *Consequence severity level: High* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Moderate* **Recommendation:** *Establishment of formal agreements with the Ministère des Transports, other mining companies in the area, the closest Cree communities and road users on how emergency equipment and other resources will be shared and deployed in the event of accidents.*

Appendix 12.2 Table 12 – Identification of hazards associated with road access

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
ROAD USE AND MAINTENANCE					
2. Disruption of traffic on Route 167	1. Blocked road access	• Extreme weather conditions (blizzards, for example) • Damage to roads caused by overflow and flooding of streams and rivers • Forest fires • Other causes	• Interruptions in deliveries of supplies to the Renard Complex • Safety risks	1. 10-day reserve of the fuels needed 2. Reserves of other supplies, including food for the cafeteria 3. Existence of an air link	Disruption of traffic caused by a road accident could also potentially cause interruptions to deliveries of supplies to the Renard Project **Level of risk:** *Consequence severity level: Low* *Probability of occurrence: High* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

3. Maintenance of roads, including Route 167 and roads inside the Renard Complex	2. Road maintenance equipment	• Spills of petroleum-based products • Injuries to crews working with this equipment	• Petroleum-based contamination of surface and groundwater, and of soil • Need for medical attention by a person injured in a remote location	1. Spill cleanup kits are included with road maintenance equipment 2. Emergency response plan with specific measures procedures 3. Means of radio communication with dispatch centres and users of the road	A petroleum-based spill from road maintenance equipment could potentially contaminate surface and groundwater, as well as soil. An injured person might not receive appropriate medical attention in a timely manner, due to the remoteness of the location. **Level of risk:** *Consequence severity level: Low* *Probability of occurrence: Low* *Level of risk: Moderate - Must be monitored* *Degree of uncertainty : Low*

Table A-13 - Identification of hazards – Other hazards

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
DRILL CASINGS					
1. Risks for snowmobile and boat traffic	1. Drill casings left above ground level 2. Drill casings in Lake Lagopede	• Hidden obstacles that snowmobiles can run into • Hidden obstacles motorized craft can run into	• Snowmobile or motorboat accident • Injury or drowning	1. Identify drill casings 2. Cut off drill casings at or below ground level so they no longer represent a risk	Casings left behind after land-based drilling and/or drilling in Lake Lagopede represent potential hazards for snowmobile and boat traffic. **Level of risk:** *Consequence severity level: Moderate* *Probability of occurrence: Moderate* *Level of risk: Moderate - Requires corrective action* *Degree of uncertainty : Low* **Recommendation:** *Identify drill casings and cut them off at or below ground or lake level.*

Table A-13 - Identification of hazards – Other hazards

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
FOREST FIRES					
1. Fire	2. Forest fires	• Human activity • Lightning	• Risk of injuries and/or mortalities • Risk of economic losses • Disruption of traffic on Route 167	1. Clearing of brush on the site 2. Restrictions on open fires 3. Steps taken to inform and create awareness in mine personnel on the issue of forest fires 4. Emergency Response Team 5. Firefighting equipment 6. Emergency response plan 7. Mutual assistance agreement with SOPFEU	A forest fire can potentially cause injuries and mortalities, as well as economic losses, in addition to cutting off access to the site for an undetermined period **Level of risk:** *Consequence severity level: Moderate* *Probability of occurrence: Moderate* *Level of risk: Moderate* *Degree of uncertainty : Moderate*

Table A-13 - Identification of hazards – Other hazards

Risk Category	Source	Specific Triggers	Consequences	Protection/Mitigation Measures	Remarks
CONTAMINATION OF FOOD					
1. Health	1. Contamination of food 2. Contamination of drinking water	• Contaminated food • Problems with the drinking water treatment process	• Several people require medical attention	1. Hygiene program for kitchen equipment and kitchen staff 2. Quality controls for drinking water 3. Air links with hospitals outside the area 4. On-site medical resources 5. Emergency response plan	Contamination of food or drinking water could create serious health problems for a significant number of people **Level of risk:** *Consequence severity level: Moderate* *Probability of occurrence: Low* *Level of risk: Moderate* *Degree of uncertainty : Moderate*

Appendix 12.3

Emergency Measures Plan

APPENDIX 12.3

EMERGENCY RESPONSES PLAN

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1. List of revisions

This manual should be kept currently updated. Any outdated manual pages should be replaced as indicated in the instructions accompanying the revised pages.

Date	Manual / Chapter / Pages	Instructions	Author
2011/12/19	Original version	None	Jean-Paul Lacoursière

N.B.: If conflicting interpretations arise, the electronic version published on the company intranet is the official version of the Emergency Response Plan.

2. Distribution List

2.1 Internal Distribution

N°	Identification	Hard copy	Electronic copy
1	Senior Management (Chief Executive Officer (CEO))	✓	✓
2	Director for Sustainable Development	✓	✓
3	Duty Manager	✓	✓
4	Camp Manager (Housing and Service Complex)	✓	✓
5	Head of Security	✓	✓
6	Underground Mine Manager	✓	✓
7	Pit Operations Manager	✓	✓
8	Ore Procesing Plant Manager	✓	✓
9	Coordinator for Emergency Response/ Health, Safety and Environmental Management	✓	✓
10	Mine Nurse	✓	✓
11	Emergency Response Team	✓	✓

2.2 External Distribution

N°	Identification	Hard copy	Electronic copy
1	Mistissini Band Council	✓	✓
2	Physician in charge	✓	✓
3	Agencies with mutual aids agreements	✓	✓

3. Legislative Framework

The legislative and regulatory framework applicable to the Emergency Response Plan is shown below.

Statutes and Regulations
• Act respecting Occupational health and safety (R.S.Q. S-2.1)
o Regulation respecting occupational health and safety (R.S.Q S-2-1, r.19.01)
o Regulation respecting occupational health and safety in mines (R.S.Q. c. S-2.2 r.19.1)
▪ Mine Rescue Training Manual (CSST), Fifth Edition
• Canadian Environmental Protection Act, 1999
o Environmental Emergency Regulations
• Environment Quality Act (R.S.Q. c. Q-2)
• Transportation of Dangerous Goods Act
o Transportation of Dangerous Goods Regulations

Other Statutes and Regulations may also apply.

4. Environmental Emergency Regulations

The Stornoway Diamonds (Canada) Inc. Renard Mine Complex is subjected to the Environmental Emergency Regulations of the Canadian Environmental Protection Act (CEPA 1999) because the projected quantities of propane to store on site exceed the regulatory limit of 4.55 tonnes.

Relevant declarations on projected propane storage will need to be provided to the regional office of Environment Canada before this amount of gas is stored at the complex.

Relevant Data:

Stornoway Diamonds (Canada) Inc. Renard Mine Complex

Longitude: 72°11' West;

Latitude: 52°49' North;

Regulated substance: Propane;

Total propane inventory: 132.5 tonnes; and

Storage capacity of largest storage container: 56.8 tonnes.

5. Introduction

The risk of accidents is always present, despite all preventive measures used to avoid them. Stornoway Diamonds (Canada) Inc. cannot claim to be immune from defects or errors that could potentially have negative impacts on mining operations, people using or working in the area and/or the environment.

Although the focus must first be placed on prevention rather than Emergency Response measures, there can be no doubt that the very nature of human activity, carries with it, a potential for the occurrence of emergency situations, and such situations not only can, but do, happen. However, with appropriate preparation or planning of adequate emergency measures, it is possible to minimize the risks, losses and damage caused by such situations. Any emergency situation caused confusion and shock at the outset. Well-trained First Responders do not usually react in this way in their daily activities; but, in an emergency situation, First Responders may simply be overwhelmed or, confused in part, and therefore cannot respond adequately to the situation. This is the kind of context in which early emergency preparedness planning really pays off. Since the impact of accidents tends to increase with time, appropriate emergency response planning can be a valuable tool for mitigating the overall effects of an emergency by minimizing the time necessary to bring the situation under control. Although it is impossible to entirely eliminate this initial period of confusion especially when First Responders are themselves affected, sound planning can shorten it and make it possible to carry out critical emergency measures immediately. In many cases, important decisions are taken at that time. The present Emergency Response Plan identifies a number of emergency situations that could potentially occur, with the ways and means needed to respond adequately in those circumstances.

A competent emergency response process requires a thorough understanding of the roles and practises of each responder. The Emergency plans identified here vary widely in their complexity depending on the nature and severity of the corresponding emergencies.

The plan aims to be both concise and well-structured, with enough detail to ensure that critical information is rapidly accessible in emergency situations. The amount of information provided depends on the degree of risk identified.

Given that every emergency has its own particular characteristics, this plan must necessarily be seen as a tool for action and not as an end in itself. The determination of how it should be applied calls for a safe and logical approach based on past experience.

This Emergency Response Plan is intended to meet the requirements of the Environmental Emergency Regulations of the Canadian Environmental Protection Act (CEPA 1999) and the CAN/CSA Standard for Emergency Preparedness and Response (Z731-2005); it is also designed to serve as support material for the CSST's Mine Rescue Training Manual (Fifth Edition).

This present document is an updated version of the Emergency Response Plan initially developed for the Exploration Phase of the Renard Mine Project, now adapted for the Mining Operation Phase of this same project.

6. Policy and Objectives

6.1 Policy regarding the Emergency Response Plan

Stornoway Diamonds (Canada) Inc. is committed to operating the Renard Project according to the best practice and respect of Company policy on health, hygiene, safety and environmental protection, and its policy on emergency response, so as to appropriately manage any emergency situation that could put employees, the general population, the environment or property at risk and/or lead to financial losses. The Stornoway Diamonds (Canada) Inc. Renard Project will maintain an Emergency Response Plan to ensure resources can be effectively and efficiently mobilized in the event of any emergency situation.

The Emergency Response Plan will be available at the company's head office and at each of the relevant service offices, as per the distribution list given above.

The plan will also be available on the company intranet.

The Emergency Response Plan Committee will carry out periodical revisions of the different elements of the plan, with any major changes requiring the approval of the senior management team. Only pages that have had one or more modifications will be changed in the manuals.

Vice President and Operations Manager

6.2 Health and Safety Policy

Stornoway Diamonds (Canada) Inc. is committed to providing a safe and healthy work environment by defining, maintaining and promoting safe and productive work practices in all its activities.

Stornoway will comply with any specific or prescribed health and safety regulations established by the different jurisdictions and applicable to its operations.

To this end, Stornoway will:

- Make health and safety issues an integral part to its activities, from their conception to their conclusion;
- Take all reasonable and practical measures to eliminate potential dangerous occupational situations;
- Provide information, training, procedures and protective equipment needed by employees to work productively in a safe environment;
- Ensure that all employees understand and respect the safe work practices and procedures established for the project;
- Ensure that all contractors working for the Company act in accordance with this policy;
- Always have people or stationed teams with the capacity to intervene in medical or emergency situations;
- Improve work environment health and safety through continuing evaluation and improvements procedures; and
- Ensure that all occupational incidents be fully investigated to eliminate or reduce the likelihood that such incidents might occur again.

6.3 Environmental Policy

Stornoway Diamond Corporation and its non-public subsidiaries (identified collectively as “Stornoway” or “the Company” is committed to promoting sound environmental practices in all its activities.

To this end, Stornoway, its employees and the contractors working for Stornoway will:

- Assess the environmental impact of all proposed activities and take any steps required to mitigate or eliminate that impact completely;
- Ensure that all activities comply with all environmental applicable legislation and regulations;
- Keep the issue of environmental impact at the forefront of its considerations at any time and strive constantly to foster company practices that lead to improved environmental performance;
- Maintain a deliberate level of environmental protection by using practices and technologies that minimize environmental impact and enhance environmental quality;
- Maintain a dialogue with the communities and other stakeholders in Stornoway mining project areas ;
- Progressively restore disturbed areas, develop site closure plans that can be continuously improved and, wherever possible, integrate new technologies into these activities

- Provide training to all employees and contractors to ensure they properly understand their environmental responsibilities with respect to mineral exploration properties.

6.4 Emergency Plan for Transportation of hazardous materials

As stipulated in the current regulations, emergency plans for the transportation of hazardous materials concern each trucker or other carrier of these materials. However, where appropriate, Stornoway Diamonds (Canada) Inc. will consider entering into mutual assistance agreements to give carriers access to any needed emergency equipment and personnel.

7. Description of Facilities

Stornoway Diamonds (Canada) Inc.'s Renard Mining Complex is located approximately 360 km north of the town of Chibougamau and 250 km to the north of the Cree community of Mistissini. It will be connected by the Route 167 North.

The Complex consists of an underground mine and open pit mine, in addition to the following operations and facilities:

- Mining, handling and storage of the ore (underground and pit mines);
- Ore processing plant;
- Tailings management;
- Fuel storage areas;
- Propane storage areas;
- Storage of chemicals;
- Explosives storage area;
- Power generating sets;
- Wastewater treatment plants;
- Equipment maintenance facilities;
- Airstrip with terminal;
- Accommodation and Services Complex; and
- Secondary mining roads and the use and maintenance of heavy machinery.

Supplies will be delivered to the Renard Mining Complex via Route 167.North

Rotation and transport of personnel will be accomplished using the mine airstrip and the connections that can be made from the mine site to Chibougamau, Val d'Or and Montreal.

Given the remote location of the site, personnel from the Renard Complex will need to provide initial emergency services in the event of an emergency incident.

8. Potential Emergencies at the Mine Site

As part of the present Emergency Response Plan, a risk analysis for potential emergencies at the mine site identified a list of possible incidents that may cause emergency situations. As a result, operational procedures were then established for 11 high risk situations. These situations are described in the following sections:

- Evacuation of all persons on site;
- Serious accident;
- Transport of an injured person;
- Missing person;
- Fire in sleeping quarters/kitchen area/cafeteria;
- Fire in a building;
- Severe weather warning;
- Contamination of food;
- Contamination of drinking water;
- Incidents in the mines;
    - Underground mine
    - Pit mine
- Incident involving hazardous substances;
    - Propane fire
    - Hydrocarbon spill
    - Hydrocarbon fire
    - Fire involving explosives.

The Emergency Response Procedures described in the following sections provide a breakdown of the steps to be followed when dealing with emergencies.

9. Roles and Responsibilities in Emergency Situations

This section covers the roles and responsibilities of personnel at the Stornoway Diamonds (Canada) Inc. Renard Project site, as well as external emergency responders.

9.1 Management of the Emergency Response Plan

The Emergency Response Plan is the responsibility of the Site Director. This responsibility is supported by the Assistant Site Director in the Director's absence.

An Emergency Response Coordinator (ERC), appointed specifically to that position, is responsible for preparing and updating the Emergency Response Plan. The Coordinator is also responsible for employee training and information on the Emergency Measures Plan and organization of appropriate simulation exercises.

This same Coordinator will act in an advisory capacity with the Directors. The Emergency Response Coordinator is vested with the authority for implementation of the plan and is an ex officio member of the Coordination Centre team in the event of any emergency.

An Emergency Response Plan Committee will support the ERC in the preparation and updating of the plan and its implementation during emergencies.

The Emergency Response Plan respects the management practices specified in the *Regulation respecting occupational health and safety in mines*.

9.2 Organization

The Emergency Measures Plan is the responsibility of the Site Director General.

The Emergency Response Plan will be applied by using the following guiding principles:

- Lines of authority remain the same during emergencies as in normal circumstances, so, in an emergency, the Duty Manager becomes the Emergency Response Coordinator, to the extent required by the magnitude of the emergency;
- In an emergency, the Project Supervisor or Camp Manager becomes Director of Operations;
- The Emergency Measures Plan Committee is responsible for developing, preparing and communicating the Emergency Response Plan, initiating and organizing extensive simulation exercises, reviewing results and ensuring their follow-up, developing relationships with civil authorities, other relevant companies working in the region and the Cree community, in addition to updating the Emergency Response Plan on an annual basis;
- Mine rescue operations are carried out by the Underground Rescue Team;
- The Mine Rescue Service of Quebec's CSST is responsible for the training of Mine Rescue Teams and maintenance of equipment at Mine Rescue Stations;
- The Emergency Response Team is responsible for responding to emergencies such as fires or spills at the process plant or any other emergency at ground level.

The main roles and responsibilities of the emergency response team are outlined below.

9.3 Definition of Roles and Responsibilities

9.3.1 Vice President Operations

- Makes or ratifies the major decisions.

9.3.2 Managers of Stornoway Diamonds (Canada) Inc. with mine rescue responsibilities

- Hold a mine rescue training certificate and attend periodic training;

- Notify the rescue training instructor or closest rescue trainer when an incident occurs in the underground mine;

- Notify the prevention and inspection service of the CSSTregional office.

9.3.3 Director of Mine Rescue Operations

- Is a senior employee of Stornoway Diamonds (Canada) Inc. assigned to this responsibility by the Mine Director;
- Is in charge of mine rescue operations in any emergency requiring the presence of Mine Rescue Teams;
- Is the only person authorized to give instructions to a Mine Rescue Team;
- Maintains ongoing contact with the Mine Rescue Team and is the person to whom the rescue team leader reports on rescue operations as they are progressing and upon his or her return to the above-ground command centre.

9.3.4 Technical Assistants to the Director of Mine Rescue Operations

- Provide assistance to the Director of Mine Rescue Operations;
- Perform the duties that the Director does not have time to or is unable to perform;
- Maintain contact with miners trapped underground to ensure they can be located, so relevant information can be gathered, and so they can receive appropriate instructions;
- Work in close collaboration with the other members of the Rescue Centre Team and the Director of Rescue Operations.

9.3.5 Mine Rescue Workers

- Are members of a Mine Rescue Team;
- Have been specially trained in mine rescue work;
- Have volunteered to assist rescue workers trapped underground;
- Hold mine rescue certificates.

9.3.6 Director General of Operations

- Appoints the members of the Emergency Response Plan Committee;
- Appoints an Emergency Response Coordinator and delegates all necessary authority to that person;
- Approves the Emergency Response Plan;
- Ensures that Emergency Response Teams have the resources they need to perform their tasks;
- Directs emergency response activities; and
- Ensures that appropriate communications are established and maintained with employees and their families, government agencies, and the Cree community.

9.3.7 Assistant Director

- Acts as Director General when this one is absent;
- Provides the personnel needed for calls to mine refuge chambers and monitors employee numbers in the event of an incident in the underground mine;
- Provides the personnel needed to check all mine exits in the event of an incident in the underground mine;
- Designates a person to act as Records Officer for the emergency.

9.3.8 Emergency Measures Coordinator

- Understand the particular fire and environmental risks of the project site;
- Organize the equipment and personnel needed for responding to emergencies;
- Chair the Emergency Measures Planning Committee;
- Develop emergency response procedures and train employees on their application;
- Maintain ongoing communications with employees and the Cree community to keep them informed about the Emergency Measures Plan. Invite feedback and ensure appropriate follow-up.

9.3.9 Emergency Measures Planning Committee

- Makes recommendations to the Director General of Operations on the roles and responsibilities of the members involved in the organization of emergency response measures;
- Makes recommendations to the Director General of Operations on the human and material resources needed for implementation of the Emergency Measures Plan;
- Is representative of the range of services provided at the Renard Mining Complex; and
- Committee members will establish specific emergency procedures to be followed in each of their particular areas of responsibility.

9.3.10 Emergency Response Team

- Is responsible for the application of all emergency measures at surface facilities;
- Carries out firefighting activities;
- Performs rescue operations for people in danger; and
- Takes appropriate action in the event of spills of hazardous products.

9.3.11 Security Guard

- Makes emergency calls as per procedures;
- Sounds the alarm;
- Controls authorized arrivals and departures; and
- Takes note of all relevant information, prepares any report required and submits it to appropriate authorities.

9.3.12 Mine Nurse

- Collaborates in planning for any emergency response;
- Makes needs assessments, assigns tasks, and organizes simulation exercises;
- Helps First Responders be ready to act appropriately in emergencies;
- Carries out triage of the injured;
- Participates in the evacuation and transport of the injured;
- Directs and coordinates first aid and emergency medical aid activities and the people involved in them;
- Makes assessments of the state of health of medical responders if an emergency response continues over a long period;
- Makes assessments of medical aid measures, and makes any changes needed in the circumstances;
- Is responsible for communications with medical services/physician concerned.

9.3.13 First Responders

- Provide first aid services to anyone injured or ill;
- Work under the instructions and authority of the Mine Nurse;
- Aid in the evacuation of any person who is injured or ill.

9.3.14 Superintendent/ Coordinator of Sector affected by the Emergency

- Ensures that the relevant emergency measures are applied in his or her sector;
- Ensures that equipment in the sector is safe and, if necessary, safely shutdown state;

- Ensures that sector personnel are all accounted for and that the area has been fully evacuated;
- Ensures that actions carried out in their sector are coordinated with the Emergency Response coordinator.

9.3.15 Witnesses to an incident

- Where possible, and without putting themselves in jeopardy, take action in response to an emergency;
- Initiate emergency procedures by communicating with supervisors or security services and providing:
    - their names;
    - the location and description of the emergency incident;
    - any other information requested;
- Remain available for future reference.

9.3.16 Employees/Subcontractors/Visitors

- Are familiar with fire and evacuation alarm signals;
- Know who they should report to in the event of an emergency;
- Know where assembly points are located;
- Apply different emergency procedures depending on the nature of the disaster; and
- Remain available on site and wait for instructions from Supervisors.

9.3.17 Mine Hoist Operator

- Has a clear understanding of his or her role and corresponding procedures;
- Can apply evacuation procedures;
- Keeps the hoist cage available for the Mine Rescue Team;
- Follows the instructions of the Director of Mine Rescue Operations.

9.3.18 Supervisors

- Notify the Coordinators for Health, Safety and the Environment and the Camp Coordinator when advised of an emergency situation;
- Ensure the application of the Emergency Response Plan according to the emergency;
- Ensure that sector equipment is left safely;
- Proceed to the appropriate Assembly Point and ensure they can be seen by employees from their department;
- Count up the number of their employees at the Assembly Point;
- Ensure that employees under their responsibility remain together;

- Participate in emergency measures, as needed; and
- Keep their employees informed about the progress of emergency operations and inform them when operations return to normal.

9.3.19 Logistics and Procurement Coordinator

- Develops and keeps update a directory of resources and services for reference in the event of an emergency situation;
- Organizes access to external resources to ensure that emergency responses will be adequate in the event of an emergency situation;
- Maintains relationship with external resource providers (suppliers) and negotiates service agreements with them;
- Ensures that external resources can be depended on to work properly if called upon in an emergency;
- Keeps Site Coordinator informed about the progress of emergency operations; and
- Reviews and breaks down emergency expenditures by category.

9.3.20 Human Resources Coordinator

- Ensures that all employees are made aware of the content of the Emergency Response Plan;
- Contacts families of employees, as needed;
- Ensures that the internal communications system works properly;
- Keeps abreast of developments relating to the emergency and be in a position to respond to requests for information from employees and the media;
- Acts in an advisory capacity on communications to Company management; and
- Informes employees and the media on the overall evaluation of how emergency operations were executed.

9.3.21 Camp Coordinator

- Ensures the safety of site facilities;
- Assesses the severity of an emergency and decides if a stay of operations is warranted;
- Ensures that employees are safe and that no person is missing;
- Collaborates in the planning for an emergency response;
- Determines whether and where the Emergency Response Plan will be implemented, depending on the situation;
- Assesses needs and assigns tasks to the appropriate employees;
- Is responsible for site safety and control of access to the site;
- Organizes the repair of transport and access roads, where needed; and
- Contributes to the assessment and planning for a return to normal operations.

9.3.22 Coordinator for Health, Safety and the Environment (HSE)

- Usually becomes the Emergency Response coordinator;
- Organizes people according to their areas of intervention;
- Assesses the situation and fully or partially implements the Emergency Response Plan;
- Makes every effort to ensure that resource people from different areas of activity work in collaboration;
- Keeps company management appropriately informed about the progress of emergency operations and the implementation of the Emergency Measures Plan;
- Issues operational directives, as needed;
- Approves the evacuation of particular sectors;
- Ensures that actions carried out contribute to the safety of individuals and the protection of property;
- Assesses the effectiveness of the Emergency Response Plan and proposes whatever improvements are needed to Company management; and
- Submits a report on the emergency situation to Company management.

9.3.23 Purchasing and Stores Coordinator

- Responds to requests for material and equipment necessary for rescue operations;
- Finds the needed material and equipment and, where necessary, ensures ASAP delivery; and,
- Keeps anyone calling for supplies updated on the progress of their request.

9.3.24 Records Officer

- Documents decisions taken;
- Identifies for the Emergency Response Coordinator any anomalies or duplication of actions;
- Compiles reports on measures taken and which people were involved;
- Notes and records who made each decision.

10. RESOURCES

This section covers the resources available to deal with the emergency response plan. Resources include personnel, training, equipment, facilities and the other means used to meet emergency response needs.

10.1 PERSONNEL

- Incident Commander: Director of mine rescue and Emergency Response Operations;
- Mine Rescue Team; and
- Emergency Response Team.

10.2 EQUIPMENT

The inventory below lists the equipment available.

- **Head protection**
  - Safety hard hats; and
  - Fire helmets.
- **Eye protection**
  - Safety goggles; and
  - Visors.
- **Breathing protection**
  - 3M Half mask respirators with cartridges for organic vapours and acid gases; and
  - Self-contained breathing apparatus.
- **Hand protection**
  - Oil resistant gloves;
  - Leather gloves; and
  - Welding gloves.
- **Foot protection**
  - Icelander rubber boots; and
  - Viking forestry boots.
- **Full body protection**
  - Firemen's suits;
  - Two pieces neoprene suit;
  - Two pieces P.V.C. suit; and
  - Mustang rescue suit.
- **Fire protection**
  - Fire protection water supply system with fire hydrants and hoses;
  - Firefighting foam;

- Sprinkler system;
- Fire truck with pump; and
- Different classes of portable fire extinguishers.

- **Useful materiel for an emergency**
  - D-6 Bulldozer;
  - Loader;
  - Power shovel;
  - Snowmobile;
  - Portable generator;
  - Small motor craft;
  - Chainsaw;
  - Ice auger;
  - Safety harness;
  - 15 m lifeline rope; and
  - Fall arrest device.
- **Communications material**
  - Handheld units;
  - Mobile units;
  - Base units;
  - Fire alarm system: fire alarm bell and outside light; and
  - General site-wide alarm system: alarm bell.
- **Miscellaneous equipment**
  - Chemical spill containment/cleanup kits;
  - Spill recovery equipment and absorbents; and
  - First aid kits.
- **Means of evacuation**
  - Ambulance;
  - Plane; and
  - Helicopter.

11. Alert and Emergency Response

This section covers the alert and emergency response process.

11.1 Alert

Figure 11.1 below illustrates the alert and emergency response process.

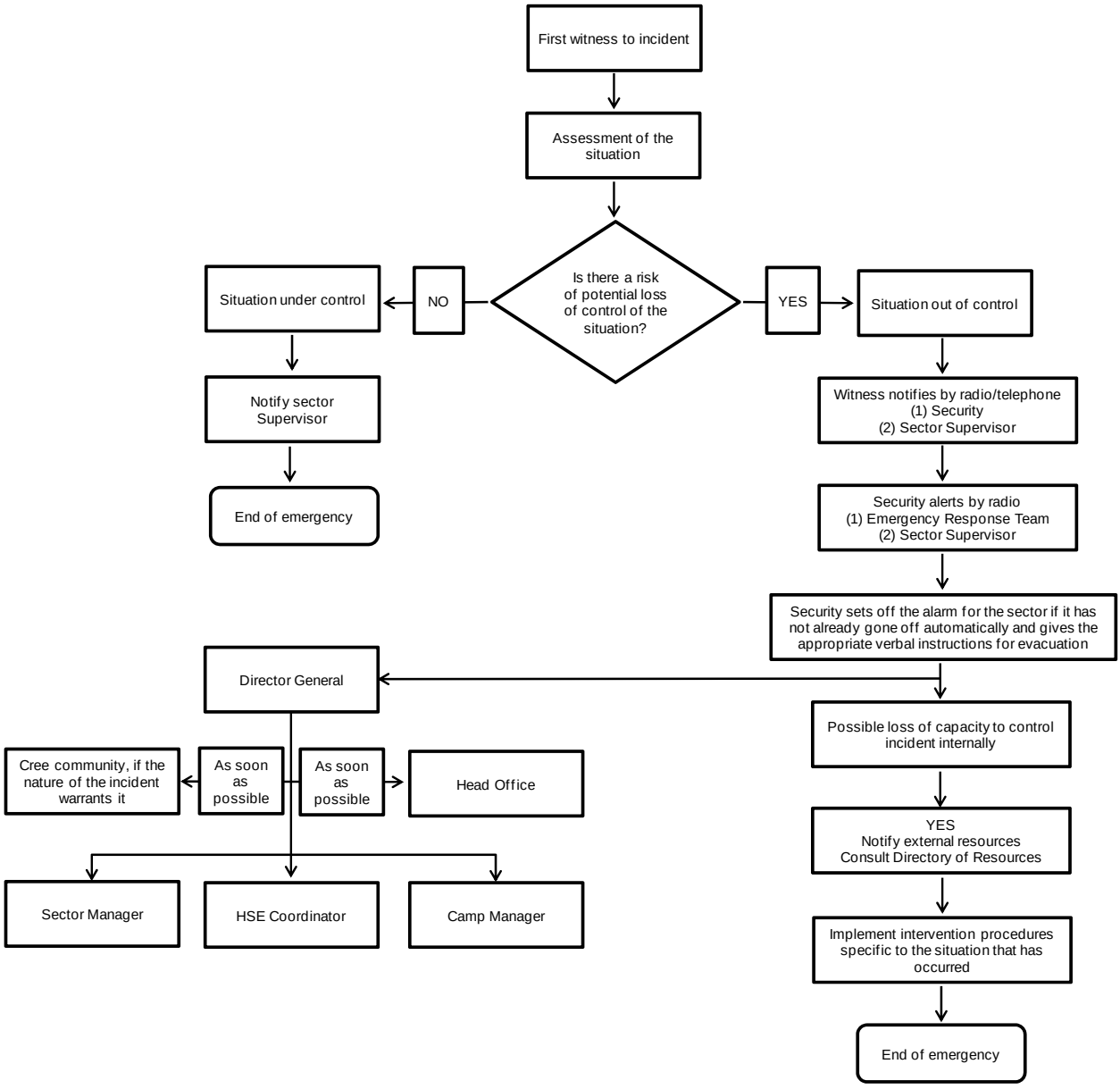


Figure 11.1 Alert and Emergency Response Process

Employees who observe an emergency situation should assess whether they are in a position to safely take action without putting themselves at risk and then take whatever steps are needed to correct or control the situation.

If so, they should begin by acting promptly, then notify their supervisor. The Accident/Incident/Environment Investigation Report will then be completed by the employee or employees concerned, and the Supervisor/Camp Manager.

If they are not in a position to take action themselves, they should immediately contact Security, by radio on Channel 1 or by phone**.**

Security personnel who receive a call of this nature should note down all relevant information and immediately communicate this information to the appropriate responders, as shown in Figure 11.1.

Any site alert should be given by the first individual to witness an emergency situation and it is this person who then informs any others present to evacuate the area.

When: Alerts should be given in the following situations:

- Fire/explosion ;
- Major uncontrolled spill of toxic or flammable substances;
- Any other situation that could endanger people, equipment, facilities or the environment.

What: The following equipment or methods can be used:

- Injection of mercaptan ("stink gas) into the underground mine ventilation system;
- Person to person verbal alert;
- Radio telephone;
- Phone.

Who:

- The alert **must be raised immediately** by any employee who becomes aware of an emergency situation.

Who should be alerted:

Immediately:

- People present in the area of the emergency; and
- Mine Security.

11.2 Emergency Response Measures

Specific Emergency Measures (EM) procedures are identified below:

- EM-01 Procedures in the event of a fire alarm or carbon monoxide or combustible gas alarm in sleeping quarters, kitchen area or miners' dry room;
- EM-02 Procedures in the event of fire in a building;
- EM-03 Procedures in the event of a serious accident;

- EM-04 Procedures for the transport of persons injured (on field)
- EM-05 Procedures for general evacuation of the site;
- EM-06 Procedures in the event of a forest fire;
- EM-07 Procedures in the event of a severe weather warning;
- EM-08 Procedures in the event of an incident and/or accident involving an aircraft;
- EM-09 Procedures in the event of a fire or other emergency situation in the underground mine;
- EM-10 Procedures in the event of a major spill of hazardous materials, fuel, etc.;
- EM-11 Procedures in the event of a propane-related accident.

Procedures will also be developed for contamination of food or of drinking water, epidemics and searches for missing persons.

12. Coordination and Command Centres

12.1 Coordination Centre

A coordination centre is the location from which emergency measures are coordinated and where all those involved in the coordination strategy can work together.

Three coordination centre locations have been planned:

- Office/meeting room at the Accommodation and Services Complex;
- Office/meeting room at the process plant; and
- Terminal at the airstrip.

The following resources will be available at each Coordination centre:

- Emergency Response Plan and Directory of Resources;
- Plans and documents describing the sector;
- Reliable means of communication;
- Work areas with tables; and
- Any other required equipment.

The same information and equipment must be found in at least two independent coordination centres, so that if one is inaccessible, the other can be used in its stead.

12.2 Command Centres

Command Centres will be located in proximity to the incident sites and maintain communications contact with the coordination centre.

13. Planning for the Return to Normal Operations

The purpose of an Emergency Response Plan is to define, develop and organize the methods and resources needed to protect lives and property and provide assistance during emergency situations.

However, a return to normal operations is essential, as is an investigation to determine causes of an incident and to drawn lessons to prevent reproduction of similar events in the future.

Clearly, after an emergency, operations need to resume as soon as possible, and it is the Director General on site at the time of the incident that has responsibility for deciding on a return to operations or the start of repair activities. Before making such authorization people involved must be consulted:

- Camp coordinator;
- HSE coordinator;
- Managers concerned;
- Head office;
- CSST, if applicable;
- Sûreté du Québec (provincial police), if applicable;
- Etc.

If an incident requiring action by the Mine Rescue Team occurs in the underground mine, only the Director of mine Rescue Operations can authorize a return to operations in the underground mine.

13.1 Investigation and Accident Report:

13.1.1 Technical Issues

Analysis of emergency situations after they have occurred is one way to ensure that mine personnel will have appropriate and effective protection for future operations. A post-incident process feedback meeting can significantly help improve operating procedures for first aid, rescue and environmental protection.

13.1.2 Human Issues

The psychological reactions of people involved in an emergency situation need also to be taken into consideration, so as to reduce the potential risk of post-traumatic stress syndrome. It is also important to ensure that feedback meetings are organized for the employees and responders involved.

14. Training

Personnel identified in the Emergency Response Plan will receive training on their roles and responsibilities, emergency response procedures, equipment, hazards, regulatory requirements and lessons learned from previous responses to emergencies (real or simulated situations).

- All persons admitted to the Renard Complex area, either as employees of Stornoway Diamonds (Canada) Inc., or as subcontractors, representatives of a government organization or as visitors will, before entering the site, be required to attend a briefing session covering alert or alarm systems used for fires, explosions, toxic clouds or any other emergency situation, and evacuation procedures, etc.
- Members of the Mine Rescue Team must be trained by a mine rescue expert, and as per the CSST's Mine Rescue Training Manual, Fifth Edition;
- Other employees identified in the plan must be thoroughly familiar with the Company's EMC. A training package will be developed for these employees at the beginning of each year.
- Training will include courses, practical exercises, simulations, integration of different emergency responses, and refresher courses. Courses must include:
  - The EMC itself and the roles played by those implementing it;
  - A tour of facilities with employees, with explanations on the purpose of various valves and electrical switches and actions that need to be taken in an emergency;
  - The location of the schematic diagram of mine facilities, including the position of shut-off valves, fire extinguishers, the main electrical shutoff switch and main sources of ignition in the mine environment;
  - Familiarization with the location of emergency exits;
  - Personal protection equipment, self-contained breathing apparatus and Class A protective suits;
  - Emergency response equipment (for fires, accidents);
  - Use of portable fire extinguishers;
  - First aid assistance.

The Emergency Measures plan must be tested annually to allow for the identification of any aspects that might be improved in terms of either organizational structures or response measures. The tests and the annual review are also a means of ensuring that the plan is kept fully up to date and consistently meets the requirements contained in the Environmental Emergency Regulations of the Canadian Environmental Protection Act, 1999.

Testing of the plan can be in the form of tabletop plan review exercises (during safety meetings, for example) or live exercises. At least one live exercise should be carried out every five years.

15. Procedures for Emergency Response Measures

No	Description
EM-01	Procedures in the event of a fire alarm or carbon monoxide or combustible gas alarm in sleeping quarters, kitchen area or miners' dry room;
EM-02	Procedures in the event of fire in a building
EM-03	Procedures in the event of a serious accident
EM-04	Procedures for the transport of persons injured above ground
EM-05	Procedures for general evacuation of the site
EM-06	Procedures in the event of a forest fire
EM-07	Procedures in the event of a severe weather warning
EM-08	Procedures in the event of an incident and/or accident involving an aircraft
EM-09	Procedures in the event of a fire or other emergency situation in the underground mine
EM-10	Procedures in the event of a major spill of hazardous substances, fuel, etc.
EM-11	Procedures in the event of a propane-related accident

EM-01 Procedures in the event of a fire alarm or carbon monoxide or combustible gas alarm in sleeping quarters, kitchen area or miners' dry room

Type of alarm used in the sleeping quarters

A. All sleeping quarters are equipped with a fire alarm system which sets off the alarm if smoke is detected by any one of the smoke detectors installed in dormitory bedrooms. **The alarm bell rings throughout the entire dormitory concerned.**

B. All sleeping quarters are also equipped with carbon monoxide detectors located in dormitory corridors. The alarm will sound if any carbon monoxide is sensed. **An ear-piercing alarm will sound in the corridors of the dormitory concerned**. The sound comes directly from the carbon monoxide detectors.

C. The kitchen and all laundry and bathroom areas with propane water heaters or propane burners are equipped with explosive gas detectors installed close to the source of the gas. **The sound produced is similar to the carbon monoxide alarm and can be picked up by all sensors and heard in all the corridors of the dormitory concerned.**

1. Role of Employees:

If you hear one of these 3 alarms in a dormitory area, you should:

Alarm set off automatically by the detection system:

a) Leave the dormitory by the exit closest to your room, calmly and in an orderly manner;

N.B. Do not waste time trying to collect any personal belongings.

b) If the alarm comes from the carbon monoxide or combustible gas detectors, leave the doors open behind you;

c) Proceed directly to Assembly Point A or B (see Figure EM-01.1);

d) Report to your immediate Supervisor or, in his or her absence, to the Camp Coordinator, and stay in a group;

e) Remain at the designated Assembly Point and wait for instructions from your Supervisor.

Fire alarm set off manually:

If you see smoke or the beginnings of a fire in the dormitory area, you should:

a) Go immediately to the exit nearest to where you are at the time or nearest to your bedroom;

b) Set off the manual fire alarm (small red panel);

c) If feasible, use available fire extinguishers to put out the fire, without putting your own safety at risk;

d) Leave the building and go directly to Assembly Point A or B (see Figure EM-01.1);

e) Report immediately to your immediate Supervisor or, in his or her absence, to the Camp Coordinator and stay in a group;

f) Remain at the designated Assembly Point and wait for instructions from your Supervisor.

2. Role of Security:

a) Register and identify the alarm;

b) Set off the alert as per alert procedures.

3. Role of Supervisors:

a) Proceed rapidly to the Assembly Point;

b) Count up the employees under their responsibility who are at the Assembly Point;

c) Inform the Camp Coordinator of the number of employees present;

d) Ensure that employees remain calm and in a group; and

e) Remain available to act in whatever way is needed.

4. Role of Camp Coordinator:

a) Notify the HSE Coordinator;

b) Notify the Electrician on duty;

c) Ensure that an Emergency Response Team is on hand;

d) Evacuate the occupants of nearby dormitories; and

e) Ensure needed emergency response material is available.

5. Role of Coordinator for Health, Safety and the Environment (HSE):

a) Coordinate the emergency response at the fire;

b) Provide support to the Emergency Response Team;

c) Notify Infirmary Personnel;

d) Notify the Managers concerned;

e) Ensure that firefighting runoff water does not get into streams around the camp;

f) If the fire could threaten the integrity of the site, begin general site evacuation procedures.

6. Role of Infirmary Personnel:

a) Remain available to respond in whatever way is needed;

b) Be ready to assist anyone suffering from the effects of smoke inhalation.

7. Role of the Emergency Response Team:

a) Deploy the material and equipment needed to contain the fire;

b) Get out fire hoses and attach them to the hydrants of the fire protection water supply system;

c) Fight the fire as directed by the HSE Coordinator or the Camp Coordinator;

d) Determine the kind of fire it is (A, B or C);

e) Must not take unnecessary risks, or put their own lives in danger;

f) Once the fire has been contained, stow the material away for future use.

8. Role of the Electrician:

A. In the event of a fire alarm:

a) Where possible, proceed to the alarm control panel for the dormitory concerned to locate the source of the fire;

b) Inform the Emergency Response Team of the location of the fire;

c) Shut off power to the dormitory concerned;

d) Remain available to the Emergency Response Team.

B. In the event of an alarm indicating the presence of carbon monoxide and/or an explosive gas:

a) Shut off the propane supply to the kitchen or laundry area concerned;

b) If dormitory doors are closed, open them and wait before entering the premises;

c) Proceed to the alarm control panel and determine where the alarm originated. Only the source of the carbon monoxide alarm can be checked on this panel.

C. In the case of an explosive gas alarm, the gas detectors need to be checked individually to identify the source of the alarm:

a) Shut off the propane supply to the kitchen or laundry area concerned;

b) Check what caused the alarm and where it went off;

c) Remain available; and

d) Once the emergency response is completed, rearm the alarm system in question.

9. Return to Premises:

Only the Camp Coordinator or the HSE Coordinator can decide if people can return to the premises they evacuated. This return can be authorized only after the Coordinator is satisfied that the premises are again safe and represent no risk for the physical well-being of employees.

10. Assembly Points

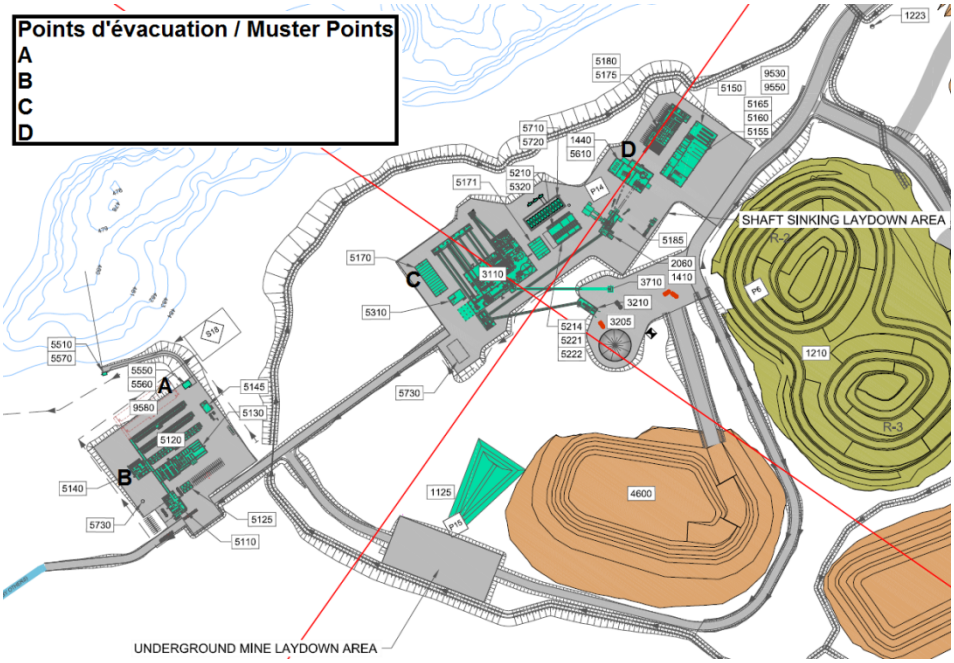


Figure EM-01.1 Assembly Points

The selection of the location of Assembly Points remains to be finalized in a subsequent version of the Emergency Measures Plan.

EM-02 Procedures in the event of fire in a building

If a fire breaks out in a building on the mine site, if you see or smell smoke or hear a smoke alarm go off in a building, follow the procedures given below:

1. Role of Employees:

a) If feasible, extinguish the fire, without putting your own safety at risk;

b) Alert Security by radio or phone;

c) If the fire cannot be controlled, withdraw to a safe place and wait for the Camp Coordinator and the Emergency Response Team (ERT) to arrive;

d) Remain available to help if needed.

2. Role of Security:

a) Register and identify the alarm;

b) Set off the alert as per alert procedures.

3. Role of Camp Coordinator:

a) Proceed immediately to the location of the fire;

b) Check whether there is in fact a fire and determine the risk of propagation;

c) Inform the Electrician on duty of the situation;

d) Notify the Supervisor of the department concerned;

e) Notify the Supervisors of the other departments about the situation so that they can check on the presence of their employees in the building concerned;

f) Notify the HSE Coordinator;

g) Ensure that propane or diesel and electricity feed lines have been shut off;

h) Work in liaison with the HSE Coordinator when giving instructions to the ERT about fighting the fire.

3. Role of Supervisors of the Department concerned and the other Departments:

a) Count up the number of their personnel present to ensure everyone is accounted for;

b) Inform the Camp Coordinator when the employee count is completed;

c) Have employees who are not needed for the emergency response remain in a safe area;

d) Remain available to help if needed.

4. Role of the Emergency Response Team:

a) Deploy the material and equipment needed to contain the fire;

b) Get out the fire hoses and attach them to the hydrants of the fire protection water supply system;

c) Fight the fire as directed by the HSE Coordinator or the Camp Coordinator;

d) Determine the kind of fire it is (A, B or C);

e) Must not take unnecessary risks or put their own live in danger;

f) Once the fire has been contained, stow the material away for future use.

5. Role of Coordinator for Health, Safety and the Environment (HSE):

a) Proceed immediately to the location of the fire;

b) Assess the situation and decide on the emergency response needed;

c) Work in liaison with the Camp Coordinator when giving instructions to the ERT about fighting the fire;

d) Monitor the progression of the fire;

e) If the situation deteriorates, consider beginning general site evacuation procedures;

f) Notify the Managers concerned.

6. Role of the Electrician:

a) Shut off electricity or diesel feed lines to the building;

b) Notify the ERT and the Camp Coordinator that these services have been shut off;

c) Remain available to help if necessary.

7. Role of Infirmary Personnel:

a) Remain available at the infirmary;

b) Be ready to assist anyone suffering from the effects of smoke inhalation.

EM-03 Procedures in the event of a serious accident

1. Definition of a serious accident

a) An accident where a worker suffers injuries such that he or she will probably be unable to carry out their duties for ten (10) or more working days.

b) An accident involving several workers who suffer injuries such that they will be unable to carry out their duties for at least one working day.

c) Material damage of $ 50,000 or more.

2) **Role of witnesses to a serious accident**

Any employee who witnesses a serious accident or discovers an injured person should:

a) Cease any work activity on the scene of the accident;

b) Call Security for help:

1) On the emergency radio channel or by phone.

2) Provide the following information:

i) The exact location of the accident;

ii) The phone number if you are calling from a phone;

iii) The number of people injured;

iv) Apparent injuries;

v) Whether the injured person(s) is/are in a position to go to the infirmary;

vi) Any other information asked for by the person you are speaking with;

vii) Check that the Security Guard has understood the information you gave before you hang up;

viii) Do not give the name of the injured person over the radio.

c) Before you act to provide assistance to anyone, **YOU MUST:**

1) Determine whether the situation poses any risks to you yourself, the injured person, the first aid responder or the environment.

2) Stay calm.

d) If the injury seems serious, **DO NOT MOVE** the injured person before a first responder arrives, unless the injured person's safety or yours are at risk;

e) Follow all instructions the Mine Nurse gives after contacting you;

f) Notify the Supervisor concerned;

g**)** Stay beside the injured person and reassure them.

2. Role of Security:

a) Register the emergency call;

b) Alert the Emergency Response Team, including First Aid Responders, or the Mine Rescue Team (if the injured person is underground) and direct them to the scene of the accident;

c) Alert the Mine Nurse and give him or her details of the situation;

d) Alert the Sector Supervisor;

e) Alert the HSE Coordinator; and

f) Alert the Director General.

3. Role of the Emergency Response Team and First Aid Responders

a) Take note of instructions from Security;

b) First Aid Responders close to the scene of the accident should proceed there immediately and prepare to administer assistance using the closest first aid kits, where appropriate, and contact the Mine Nurse for further instructions;

c) Describe the condition of the injured person to the Mine Nurse;

d) Provide medical aid to the injured person, as per established protocols and instructions from the Mine Nurse;

e) The Emergency Response Team should collect any equipment needed for this emergency from the emergency equipment storage area;

f) Transport the injured person to the infirmary;

g) Remain available to help Infirmary Personnel;

h) Remain available in case they are needed to accompany the injured person for a medical evacuation off site.

4. Role of Infirmary Personnel:

a) Take note of information called in by the Security Guard or reported directly;

b) Find out as much as possible about the condition of the injured person and the circumstances of the accident;

c) Communicate with whoever is with the injured person and give them instructions;

d) Communicate with the First Aid Responders and give them instructions on what should be done;

e) If necessary, go to the scene of the accident;

f) Provide needed medical assistance to the injured person;

g) Contact the reference physician and advise him or her of the situation;

h) Prepare the injured person for possible medical evacuation and make a request for transportation by air to the person in charge of transport;

i) Notify the receiving hospital;

j) Accompany the injured person during the transfer, if necessary.

5. Role of Sector Supervisor:

a) Ensure that Infirmary Personnel are advised of the situation;

b) Promptly advise le HSE Coordinator, the Director General and the Director of Human Resources as to the situation;

c) Apply whatever measures are needed to **keep the scene of the accident untouched**, unless this poses a risk for people's lives or health;

d) Collect all information available and prepare a preliminary report;

e) Remain available for an immediate investigation.

6. Roles of Coordinator for Health, Safety and the Environment and Director of Human Resources

A. Seriously injured person

a) Contact infirmary personnel and get details on the condition of the injured person(s);

b) Contact the service or sector concerned to get information about the accident;

c) Provide details of the accident to the Managers concerned;

d) Carry out an investigation, if necessary, at the scene of the accident;

e) Prepare and submit an accident report to the CSST within 24 hours;

g) Make a report to the Director General

B. Death of a worker

1) Responsibilities of HSE Coordinator:

a) Notify the Sûreté du Québec;

b) Notify the CSST;

c) Assist the CSST, the Sûreté and the Coroner during the investigation;

d) Keep the most detailed possible hourly log of actions taken;

e) Keep note of all actions taken by the CSST;

f) Make a report to Senior Management.

2) Responsibilities of H.R. Coordinator:

a) Have a copy of the victim's file available as it could be seized by the Sûreté du Québec;

b) Add notes to the file, as appropriate;

c) Inform beneficiaries about their rights and obligations and all fringe benefits accruing to them;

d) Prepare the legal file.

EM-04 Procedures for the transport of persons injured in an above-ground incident

Emergency response procedures in the event of an above-ground accident:

1. Role of witnesses on the scene of the accident:

a) Cease any work activity on the scene of the accident;

b) Call Security:

1) On the emergency channel or by phone.

2) Provide the following information:

i) The exact location of the accident;

ii) The phone number if you are calling from a phone;

iii) The number of people injured;

iv) Apparent injuries;

v) Whether the injured person(s) is/are in a position to go to the infirmary;

vi) Any other information asked for by the person you are speaking with;

vii) Check that the Security Guard has understood the information you gave before you hang up.

viii) Do not give the name of injured persons over the radio.

c) Before you act to provide assistance to anyone, **YOU MUST:**

1) Determine whether the situation poses any risks to you yourself, the injured person(s), the First Aid Responder or the environment,

2) Stay calm.

d) If the injury seems serious, **DO NOT MOVE** an injured person before a First Responder arrives, unless the injured person's safety or yours are at risk;

e) Follow all instructions the Mine Nurse gives after contacting you;

f) Notify the Supervisor concerned;

g) Stay beside the injured person(s) and reassure them.

2. Role of Security:

a) Register the emergency call;

b) Alert the Emergency Response Team, including First Aid Responders, or the Mine Rescue Team (if the injured person(s) is/are underground worker (s)) and direct them to the scene of the accident;

c) Alert the Mine Nurse and give him or her details of the situation;

d) Alert the Sector Supervisor;

e) Alert the HSE Coordinator; and

f) Alert the Director General.

3. Role of the Emergency Response Team and First Aid Responders

a) Receive instructions from Security;

b) First Aid Responders close to the scene of the accident should proceed there immediately and prepare to administer assistance using the closest first aid kits, where appropriate, and contact the Mine Nurse for further instructions;

c) Describe the condition of the injured person(s) to the Mine Nurse;

d) Provide medical aid to the injured person(s), as per established protocols and instructions from the Mine Nurse;

e) The Emergency Response Team should collect any equipment needed for this emergency from the emergency equipment storage area;

f) Transport the injured person(s) to the infirmary following instructions from Infirmary Personnel on how best to move them;

g) Remain available to help Infirmary Personnel;

h) Remain available in case they are needed to accompany the injured person(s) for a medical evacuation off site.

3. <u>Role of Infirmary Personnel:</u>

a) Take note of information called in by the Security Guard or reported directly;

b) Find out as much as possible about the condition of the injured person(s) and the circumstances of the accident;

c) Communicate with whoever is with the injured person(s) and give them instructions;

d) Communicate with the First Aid Responders and give them instructions on moving the injured person(s);

e) If necessary, go to the scene of the accident;

f) Provide needed medical assistance to the injured person;

g) Contact the reference physician and advise him or her of the situation;

h) Prepare the injured person(s) for possible medical evacuation and make a request for transportation by air to the person in charge of transport;

i) Notify the receiving hospital;

j) Accompany the injured person(s) during transfer, if necessary.

6. <u>Role of Sector Supervisor:</u>

a) Ensure that Infirmary Personnel are advised of the situation;

b) Promptly advise the HSE Coordinator, the Director General and the Director of Human resources of the situation;

c) Apply whatever measures are needed to **keep the scene of the accident untouched**, unless this poses a risk for people's lives or health;

d) Collect all information available and complete a preliminary investigation report;

e) Remain available for immediate investigation purposes.

6. Roles of Coordinator for Health, Safety and the Environment and Director of Human Resources

a) Contact Infirmary Personnel and get details on the condition of the injured person(s);

b) Contact the service or sector concerned to get information on the accident;

c) Provide details of the accident to the Managers concerned;

d) Carry out an investigation, if necessary, at the scene of the accident;

e) Prepare and submit an accident report to the CSST within 24 hours;

g) Make a report to the Director General

EM-05 Procedures for general evacuation of the site

Any *order* for a general evacuation of personnel of the Renard Complex site should be communicated by chain of command at the Complex. However, the *decision* to evacuate personnel from the site should be based on the recommendation of the Emergency Coordinator, working closely with on-site personnel involved in the emergency.

In all cases where a general emergency evacuation of personnel from the Renard Complex is necessary, the following procedures should be observed:

1. Role of Employees:

a) When the general alarm is sounded, employees must immediately proceed to Assembly Point A near the Housing Complex (See Figure EM-05.1);

N.B. Do not waste time trying to collect any personal belongings.

b) Report to your immediate Supervisor or, in his or her absence, to the Camp Coordinator, and stay with your group;

c) Stay calm and wait for instructions from your Supervisor;

d) If you are evacuated, stay at the designated evacuation site and wait for instructions;

e) Remain available for an eventual return to work call.

2. Role of Supervisors:

a) Send out a message on all radio frequencies that the evacuation alarm has been sounded;

b) Proceed to the Assembly Point and count the number of employees under your responsibility who are present;

c) Advise the Emergency Measures Coordinator of the number of employees under your responsibility who are present or missing. If any employees are missing, suggest where those employees might be;

d) Ensure that your group of employees remains calm and stays in one place;

e) Remain available to help plan the evacuation;

f) Keep a list of your group of employees, with phone numbers, to facilitate their return to the site.

3. Role of Camp Coordinator:

a) Sound the general alarm;

b) Apply any instructions received by the Emergency Measures Coordinator;

c) Contact the Logistics and Supplies Coordinator in Longueuil to request needed transportation;

d) Decide on what to use as a safe refuge site while personnel wait to be evacuated;

e) Plan and organize searches if anyone is missing;

f) Collaborate in decisions on the resources to leave behind during the evacuation;

g) Maintain regular communication with outside resources; and

h) Identify and assemble the essential services needed for the refuge site.

4. Role of Emergency Measures Coordinator (HSE Coordinator):

a) Assess the situation and put in place the measures needed for the evacuation;

b) In the absence of the Director General, inform Company Senior Management of the situation and the progress of the evacuation;

c) Ensure that on-site emergency personnel share needed information;

d) Issue any needed instructions relating to the evacuation;

e) Decide on all specific arrangements for the evacuation with the Camp Coordinator and the Director General;

f) Collaborate in decisions on the resources to leave behind during the evacuation;

g) Keep an up to date log of evacuation operations.

5. Role of Security:

a) Maintain order during the evacuation; and

b) Maintain whatever presence is necessary to ensure the security of the site.

6. Role of Infirmary Personnel:

a) Assess needs and dispense first aid services, as necessary;

b) Determine priorities for the evacuation of injured persons, as necessary;

c) Collect together all first aid material needed for the safe refuge site;

d) Be alert for signs of psychological distress among employees or emergency responders;

e) Collaborate with the Camp Coordinator and the Emergency Measures Coordinator;

f) Maintain an up to date list of evacuees, including their destination and phone numbers.

7. Director General:

a) Order the evacuation of the site, if necessary;

b) Support the decisions of the Emergency Measures Coordinator and the Camp Coordinator;

c) Inform Company Senior Management in Longueuil about the situation and the progress of the evacuation;

d) Keep employees regularly informed as to the situation and the progress of the evacuation;

e) Collaborate in decisions on the resources to leave behind during the emergency;

f) Keep a list of phone numbers of key individuals to contact for organizing the return to the mine site.

8. Role of Logistics and Supplies Coordinator:

a) Manage the transport and accommodation logistics for employees to be evacuated;

b) Decide on the receiving venue where evacuees will be sent;

c) Ensure that services are available at the selected venue;

d) Remain in constant contact with the Camp Coordinator;

e) Manage the logistics of the return to the mine site.

8. Return to the mine site:

This decision will be taken after a full assessment of the situation. Only the Director General at the site can order the return to the Renard Complex.

Procedures for the return to the site:

When advised by the Director General that a return to the site has been ordered, the Camp Coordinator must:

a) Communicate with Supervisors to inform them that operations will be resuming at the mine site;

b) Give Supervisors instructions as to which employees should now return;

c) Supervisors will then communicate with the employees under their responsibility and provide them with instructions on the return to the site;

d) Prepare a complete report on the evacuation and the return to the site.

EM-06 Procedures in the event of a forest fire

A. Any person observing signs of a forest fire near the mine site or on site access roads should:

1. Role of Employees:

a) Notify Security and provide all possible details on the location of the fire;

b) If the fire is still in its early stages, try to put it out rapidly and safely using any means at your disposal;

c) If unable to extinguish the fire, return to the camp and remain available to help, if necessary.

2. Role of Security:

a) Register the call about the discovery of a forest fire;

b) Alert the Director General, the HSE Coordinator and the Camp Coordinator;

3. Role of Camp Coordinator:

When advised about the discovery of a forest fire, the Coordinator should:

a) Notify the HSE Coordinator, coordinate the emergency response with him or her and keep the Director General informed as the situation develops;

b) Send a response team to the location of the fire (if accessible) with appropriate firefighting equipment;

c) Report the fire to SOPFEU;

d) Evacuate any employees currently in areas close to the location of the fire;

e) Notify Infirmary Personnel;

f) If progress of the fire threatens the mine site, ensure that mobile equipment is held in a safe location; and

g) Envisage an evacuation of the Renard Complex if the situation deteriorates.

4. Role of HSE Coordinator:

a) Coordinate the emergency response at the scene of the fire;

b) Provide support for actions carried out by the Emergency Response Team, as needed;

c) If the fire appears likely to threaten the integrity of the mine site, start to set up the Procedures for general evacuation of the site (→ See **EM-05);** and

d) Keep the Director General informed on how the situation is evolving.

5. Role of Infirmary Personnel:

a) Remain available; and

b) Be ready to assist anyone suffering from the effects of smoke inhalation.

EM-06 APPENDIX 1

FOREST FIREFIGHTING EQUIPMENT LOCKER	
	Inventory
MATERIAL:	Qty:
In-out splitter with Chicago coupling	1
100-foot forestry hose with Chicago coupling	10
Fire hose coupling wrench	2
Fire hose nozzle	2
Adjustable fire hose nozzle	2
Hose cutter	1
Water thief	1
6 Volt Lamp	1
Short-handled round point D-grip shovel	4
Axe	2
Backpack firefighting pump	1
Wajax fire pump	1
Suction pump system	1
Suction pump float	1
Chainsaw	1
20 litre jerry can of pre-mixed Wajax pump fuel	2
20 litre jerry can of pre-mixed chain-saw fuel	1

EM-07 Procedures in the event of a severe weather warning

In the event of a severe weather warning (violent storm and/or blizzard), the following procedures should be observed:

1. Role of Employee:

a) Do not move around outside buildings;

b) If you are out in the field, try to return to the mine site. If that is not possible, find some kind of shelter, such as a vehicle, a refuge cabin or any other place you believe would be safe;

c) Notify your Supervisor of your situation;

d) When conditions improve, advise your Supervisor and check with him or her about the possibility of returning to the mine site;

2. Role of Camp Coordinator:

The Camp Coordinator, when advised of a severe weather warning, should:

a) Advise all Supervisors of the weather conditions expected;

b) Avoid assigning employees to tasks or jobs outdoors or in the field (off site);

c) Ensure that all objects that could be displaced or damaged in those weather conditions are securely attached;

d) In collaboration with Supervisors, determine exactly where employees are in the field, and advise them of the situation;

e) Ensure continuity in communications with employees and Supervisors during the emergency; and

f) Plan for the return to the site of any employees stranded in the field.

3. Role of Supervisors:

a) Advise employees under their responsibility of the weather conditions expected;

b) Avoid assigning employees to tasks or jobs outdoors or in the field (off site);

c) Ensure that all objects that could be displaced or damaged in those weather conditions are securely attached;

d) Determine exactly where in the field employees from their sector are and ensure that they are safe;

e) Inform the Camp Coordinator as to where those employees are;

f) Ensure continuity in communications with those employees;

g) Plan for the return to the site of any employees stranded in the field.

4. Role of HSE Coordinator:

Work with the Camp Coordinator in applying control measures.

5. Role of Infirmary Personnel:

Remain available to provide any needed assistance.

EM-08 Procedures in the event of an incident and/or accident involving an aircraft

In the event of an emergency landing, a crash in the vicinity of the airstrip or a failed takeoff, the following procedures should be observed:

1. Role of Witnesses:

a) Alert Security;

b) Proceed toward the scene of the accident;

c) Assess the feasibility of an emergency response at the scene (smoke, fire, accessibility, etc.);

d) Communicate this information to Security; and

e) Remain available to respond to needs that may arise.

2. Employees at the Terminal:

Employees at the terminal are responsible for fueling aircraft, carrying out de-icing procedures, and managing cargo and passenger operations.

These employees are trained in the use of the wheeled powder fire extinguisher, portable extinguishers and emergency response procedures for incidents involving aircraft.

a) Proceed toward the scene of the accident with the appropriate equipment;

b) Prepare necessary firefighting material;

c) Prepare for firefighting manoeuvres;

d) Assess the situation;

e) Establish a security perimeter;

f) If fire has broken out, fight it with the appropriate equipment;

g) Employees must not take unnecessary risks or put their own lives in danger;

h) If fire has not broken out, employees should keep constantly in mind the possibility that spilt fuel can always catch fire and remain ready to respond immediately if that happens; and

i) Recover anyone injured from the aircraft and keep them at a safe distance from it.

3. Role of Security:

a) Register the emergency call;

b) Alert the Emergency Response Team, including First Aid Responders, and direct them to the site of the aircraft accident;

c) Alert the Mine Nurse and give him or her details of the situation;

d) Alert the Site Coordinator;

e) Alert the HSE Coordinator; and

f) Alert the Director General.

3. Role of the Emergency Response Team and First Aid Responders

a) Wait until Mine Security has given you your instructions;

b) The Emergency Response Team should then go promptly to the equipment storage room and collect together any equipment it will need for this particular emergency: fire extinguishers, stretchers, first aid kits and emergency vehicles;

c) Proceed to the scene of the accident;

d) Provide whatever assistance is called for;

e) Transport the injured to the infirmary at the Housing Complex for further attention.

4. Role of Infirmary Personnel:

a) Take the call from Mine Security or register any information communicated directly to the Infirmary;

b) Collect as much information as possible on the condition of those who have been injured;

c) Be prepared to provide medical assistance to however many people need it;

d) Draw on all available First Aid Responders;

e) Provide initial medical care needed by anyone injured;

e) Contact the outside physician of reference and advise that person of the situation;

e) Request air transportation assistance, recognizing that helicopters may be needed as an alternative, if as a result of the accident, the landing strip is unavailable for use;

f) Notify emergency services at the receiving hospital where the injured will be sent.

5. Role of Camp Coordinator:

The Camp Coordinator, when advised of the situation, should:

a) Plan how emergency services will be organized;

b) Assist nursing services in preparing to deal with a significant number of injured persons, ensure that stretchers and beds are available;

c) Prepare for an eventual emergency evacuation of the injured; and

d) Carry out the required tracking of events (operations logbook).

3. Role of HSE Coordinator:

a) Go to the scene of the accident;

b) Analyze the situation;

c) Coordinate rescue activities at the site;

d) Establish a security perimeter;

e) Ensure that, to the fullest extent possible, the scene of the accident remains undisturbed;

f) Collaborate with the relevant government authorities.

EM-09 Procedures in the event of a fire or other emergency situation in the underground mine

Emergency response measures for underground mines are described in the CSST's Mine Rescue Manual (Fifth Edition). Application of the requirements of this Manual is obligatory under Quebec's **Regulation on Health and Safety in Mines** which specifies methods and equipment, as well as the training and certification required. Training of rescue personnel is given by a specialized mine rescue instructor from the CSST. Additional emergency response equipment is always available from Mine Rescue Stations.

As specified in the Procedures and Use of Rescue Equipment for Underground Incidents contained in the Mine Rescue Manual, responsibility for dealing with such incidents falls to the Mine Rescue Team.

The procedures outlined here are intended to serve as a reference for details on certain aspects of underground mine rescue operations. In the event of conflicting interpretations, it is always the Mine Rescue Manual that prevails.

Warning System: Injection of Mercaptan gas, with its smell of rotten eggs or rotten cabbage, into the mine ventilation system.

1. General Information:

a. Events that can set off these Procedures:

- Fire underground;
- Fire at the surface;
- Flooding;
- Collapse of a section of the mine;
- Unplanned explosion;
- Presence of toxic gas (NH_3, H_2S, NO, NO_2 or CO);
- Flammable gas, methane; and
- Any other situation that cannot be controlled by on-site personnel and that threatens the lives of anyone working underground;

b. Any person who is in the underground mine for whatever reason must be familiar with the Procedures;

c. Procedures must be posted in all Mine Refuge Sites, as well as in the Mine Rescue Centre;

d. At least once a year – or as required -- all Coordinators and both underground and above-ground mine Heads of Department must read and explain the Procedures to their employees, to ensure that those employees are familiar with the sections of the Procedures that apply specifically to them and that, in addition, they understand all the required actions when a fire or other emergency situation occurs;

e. Coordinators and Heads of Departments are responsible for ensuring that all new employees are familiarized with these Procedures before they begin to work underground;

f. Up-to-date plans of air, water and ventilation lines must be kept in the Mine Rescue Centre and at the Engineering Workstation at all times;

g. The ventilation shaft will function as the emergency exit during both the mine construction and mine operations phases;

h. Mine refuge sites will be constructed at strategic places around the mine and will be able to provide shelter to every person working underground at the same time. They will be designed to respect the standards of Quebec's *Regulation respecting occupational health and safety in mines*; and

i. All subcontractors are required to comply with these Procedures.

2. List of Mine Rescue Equipment:

The list below identifies the equipment available for mine rescue operations. The location where it will be stored is yet to be determined.

- Self-rescue type respirators;
- Direct-reading instruments for carbon monoxide, nitrogen dioxide, oxygen and combustible gases;
- Positive pressure oxygen therapy breathing apparatus;
- Stretcher;
- Rope appropriate to needs.

3. Role of Mine Rescue Team:

a. To the fullest extent possible, try to control the situation (extinguish the fire, limit access to the area where mine walls have collapsed, etc.), without putting their own lifee in danger;

b. Advise Security and the Supervisor concerned as to the situation, as rapidly as possible; and

c. If there is no way to control the situation, withdraw to a safe place and wait for instructions from the Supervisor or the Director of Mine Rescue Operations.

4. Role of Employees:

If they smell any odour like rotten eggs/rotten cabbage (= mercaptan ("stink" gas):

a) Stop work immediately;

b) Proceed at once to the closest mine refuge site;

c) Warn everyone they see that they urgently need to go to a mine refuge site;

d) If the mine refuge site is not accessible (due to smoke or blocked access), go instead to the emergency exit (ventilation shaft) and move up to the surface, unless the smoke is travelling down from the surface;

e) If the mine refuge site and the emergency exit are both inaccessible, go down into a gallery where there is compressed air, build as complete a barrier as possible with the material available, including smoke barriers, and open up the compressed air system;

f) Never try to exit from the mine using the main mine access ramp, unless specifically instructed to do so by the Supervisor or the Camp Coordinator.

Once inside the Mine Refuge:

a) Keep the door closed at all times except to enable people to move in or out, and keep the smallest possible number of lamps lit;

b) No smoking allowed;

c) If the Supervisor is not in the shelter, choose someone who will be responsible for answering the phone and keeping track of who is present;

d) Identify yourself to the person responsible for keeping track of who is present, and note on the attendance sheet the time of your arrival and if you are a member of the Mine Rescue Team;

e) Use clay to fill in any cracks or holes in the walls or around the door;

f) Open the shelter air supply only minimally;

g) Save as much food and liquids as possible in case rescue is delayed;

h) Wait for the Mine Rescue Team to call and follow their instructions. If no call has come in after 30 minutes, use the Emergency Phone to contact Security;

i) Sit down and stay calm. Stay in the shelter until you are officially instructed to leave; and

j) Remember that just one person needs to move around in the shelter from time to time to help air circulate.

5. Role of Security:

a. Take careful note of all details of the call from the first person to call in the emergency. If the emergency or fire is out of control, activate the mercaptan gas alarm;

b. Immediately notify the on-duty **Director of Rescue Operations**, the Director General, the HSE Coordinator, medical personnel and the Director of Human Resources of the situation and follow any instructions from the Director of Rescue Operations;

c. Deny access to the mine site, except to authorized persons, and do not forward any outside calls, unless there is an emergency;

d. Take careful note of the details of all underground calls and pass them on to the Director of Rescue Operations;

e. Check that ventilators are working properly and, if need be, inform the Director of Rescue Operations. Shut off or reverse ventilation system fans only if instructed to do so by the Director of Rescue Operations.

6. Role of the Director of Mine Rescue Operations:

a. Direct the mine rescue operation;

b. Promptly advise the HSE Coordinator and proceed to the rescue station to help coordinate the implementation of emergency measures;

c. Advise the Infirmary Personnel;

d. Ensure the Rapid Response and Mine Rescue Team are ready to act;

e. Ensure the required rapid response material is available;

f. Coordinate the emergency measures. Ensure that the mercaptan gas alarm has been activated, if the situation warrants it;

g. Direct and coordinate the actions of the Rapid Response and Mine Rescue teams;

h. Designate a person to be responsible for calling mine refuges and drawing up a list of the people trapped underground. This same person should also keep a register of all those who have come up from the mine or who go underground for rescue purposes;

i. Designate a person responsible for standing at the entrance to the mine emergency exit and taking note of any person entering or leaving the mine;

j. Advise the Directors concerned;

k. If the fire or other emergency appears to constitute a threat to the integrity of the site, initiate Site Evacuation Procedures;

l. Ensure that no work is carried out at the location where the incident occurred, unless there is potential immediate danger for workers in the vicinity. To facilitate any accident inquiry, the scene of an accident should remain undisturbed;

m. Remain available in case you are needed;

n. Contact the CSST Mine Rescue Service and request their assistance;

o. Alert CSST Inspection Services, the Sûreté du Québec, and the Air-Medic emergency helicopter evacuation service, as necessary;

p. Alert Senior Management at Head Office, ask for the resources you might need during the emergency, keep them fully informed as to the progress of the emergency operation; and

q. Re-authorize access to the underground mine only once the emergency operation is fully over and the underground mine is safe again.

7. Role of Technical Assistants to the Director of Mine Rescue Operations:

a. Carry out any duties assigned by the Director of Mine Rescue Operations.

8. Role of Underground Mine Supervisor:

a) Proceed immediately to the mine Assembly Point (mine shelter if the mercaptan gas alarm has been activated);

b) Identify all employees there that he/she is responsible for and fill out the attendance register;

c) Answer the emergency telephone in the shelter. Inform the caller of the number of employees present, and follow any instructions they may give;

d) Ensure that employees remain calmly at the shelter until they receive any instructions for evacuation; and

e) Remain available in case you are needed.

9. Role of Coordinator for Health, Safety and the Environment:

a) Proceed immediately to the Mine Rescue Station and stay available for whatever actions are needed by the Director of Mine Rescue Operations;

10. Role of Nursing Services:

a) Remain available to respond to whatever needs arise;

b) Be ready to treat people who may be suffering from smoke inhalation or have sustained other injuries.

11. Role of the Director of Human Resources:

a) Keep families and employees informed as to the progress of the emergency operation;

b) Issue press releases in liaison with the Director of Mine Rescue Operations and Head Office Senior Management; and

c) Provide well-chosen assistance to media on site.

12. Return to the Workplace:

a) The Director of Mine Rescue Operations is the only person authorized to allow a return to the workplace, and this, only, after ensuring that the workplace is safe again and does not represent any danger for employees.

EM-10 Procedures in the event of a major spill of hazardous substances, fuel, etc.

Hazardous substances are flammable, corrosive, reactive, toxic or leachable substances, or any other substance that at a certain level of concentration represents a risk for living organisms or affects the environment. Accidental spills of such substances call for rapid, safe and effective actions so as to protect both people and the environment. Propane-related accidents are the subject of a separate specific Procedures Measure (EM-11).

Any accidental spill of the following hazardous substances can constitute an environmental risk:

- **Hydrocarbons:** gasoline, diesel, fuel oil, motor oil, hydraulic oil, waste oil, grease, degreasers and hydrocarbon-contaminated waste;
- **Acids, bases and water treatment reagents.**

Actions to be taken in the event of a spill of a hazardous substance

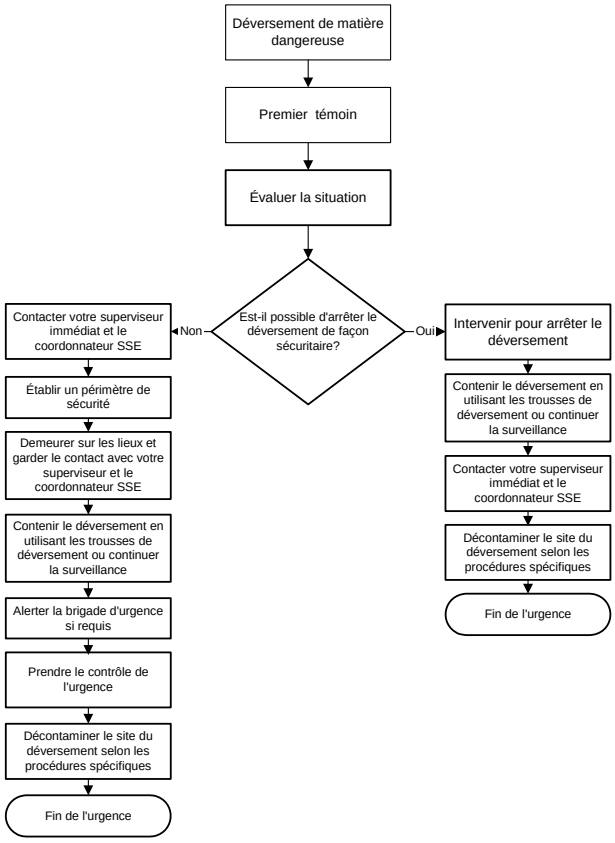


Figure EM- 10.1 Emergency Response Process in the Event of a Spill

The procedures diagram shown in Figure EM-10.01 identifies the actions to be taken in the event of a spill of hazardous substances.

1. Role of witnesses to the event:

Any employee who witnesses a spill of a hazardous substance must:

1) Cease any work-related activity;
2) Try to stop the spillage or control the spill area (See Spill Containment Kits, Appendix EM-10.2);
3) Notify their Supervisor and the HSE Coordinator;
4) Stay at the spill site without exposing themselves to any danger;
5) Remain available to respond in whatever way is needed.

2. Role of Supervisor:

When advised as to the spill of a hazardous substance, the Supervisor must:

1) Proceed to the spill site to take stock of the nature and size of the spill;
2) Notify the HSE Coordinator of the situation;
3) Coordinate the recovery of the hazardous substance and all contaminated material;
4) Take photographs of the spill site both before and after the recovery operation;
5) Take down the G.P.S. coordinates of the exact site of the spill;
6) Depending on the quantities of material to be recovered, either give instructions for it to be placed in hermetically-sealable containers and send it to the hazardous substances storage depot or have it placed on sheets of canvas and hermetically sealed;
7) Identify each container of contaminated material, indicating the nature of the product, and the date of storage;
8) Complete an Environmental Incident Report (Appendix EM-10.1).

3. Role of HSE Coordinator:

When advised as to the spill of a hazardous substance, the HSE Coordinator must:

1) Proceed to the spill site;
2) Work in collaboration with the Supervisor in the coordination of the recovery and disposal of the contaminated material;
3) Ensure that containers are correctly identified before they are put into storage;
4) Collaborate with the Supervisor in writing up the Environmental Incident Report;
5) Advise relevant Company Managers;
6) When this is required provincially or federally, advise Quebec's Ministère du Développement durable, Environnement et Parcs that a major spill has occurred, and forward a copy of the Environmental Incident Report to the Minister's office, as well as advising Environment Canada of the spill; and
7) Enter the incident into the Company's Spills Register.

Appendix EM-10.1– Environmental Incident Report

- Description of the Environmental Incident
- Names of witnesses
- Description of the Contaminant
    - Estimate of the number of litres of contaminant spilled
    - Estimate of the number of m^3 of contaminated soil collected
        - Enter into the Company's Accidental Spills Register
- Photographs before and after cleanup
- G.P.S. of the site of the spill
- Storage method and site
- Non-compliance, corrective and preventive action

* * * * * * *

APPENDIX EM-10.2 – Contents: Spill Containment/Cleanup Kit

50 x 17 X 19 ‘’ Absorbent sheets;

3 x 5 X120’’ Absorbent boom snakes;

5 x 3X48’’ Absorbent socks;

1 x 25-lb bag of Absorbent granules;

1 x 36X36” Neoprene drain cover;

5 x Disposable bags;

1 x Retractable shovel;

2 x Safety goggles;

2 x Pairs of nitrile gloves;

2 x Tyvek suits;

2 x Dust masks;

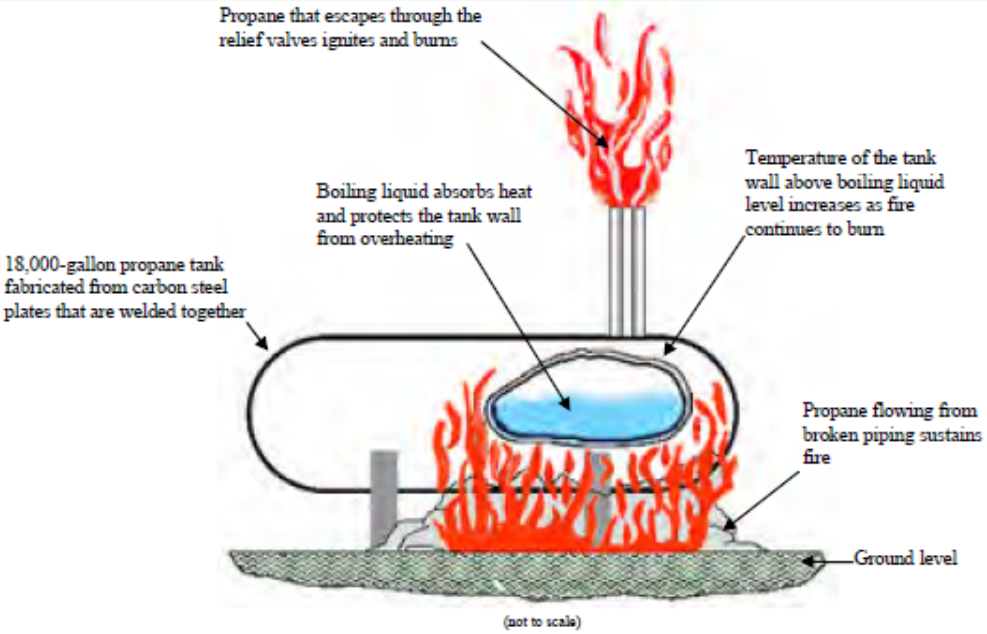
1 x List of contents; and

1 x 205 litre barrel.

EM-11 Procedures in the event of a propane-related accident

Definitions:

- **BLEVE:** Boiling Liquid Expanding Vapour Explosion – An incident of this kind can occur when a vessel containing pressurized liquid is heated by a flame. Pressure increases with the temperature of the liquid in the container. While a pressure relief valve prevents the occurrence of **overpressure** in normal conditions, metal in the area above the level of the liquid overheats and softens. Eventually, the container ruptures and its content explodes and is projected outward. If the product is flammable, it catches fire immediately, producing a fireball and shock wave and projecting fragments in all directions.



Boiling Liquid Expanding Vapor Explosion (BLEVE)

1. After the piping is broken, propane begins leaking from the tank and flows along the ground surface.
2. Soon after ignition of the leaking propane, a fire burns out of control in the vicinity of the 18,000-gallon tank.
3. The fire heats the propane inside the tank, causing it to boil and vaporize.
4. The pressure inside the tank increases as the temperature of the propane increases.
5. When pressure inside the tank reaches about 250 psi, the relief valves open to vent the tank. The propane escaping from the relief valves ignites and burns.
6. As boiling continues, the pressure inside the tank exceeds 250 psi, the temperature of the tank wall increases, and the strength of the steel used to construct the tank decreases.
7. At some point, the weakened steel can no longer resist pressure-induced forces inside the tank so the wall of the tank ruptures, allowing propane to escape rapidly into the surrounding atmosphere.
8. Immediately following rupture, the escaping propane ignites, resulting in an explosion that causes the tank wall to separate into at least 36 pieces. Fire quickly consumes the remaining propane.
9. Tank fragments are propelled at a high velocity in many different directions.

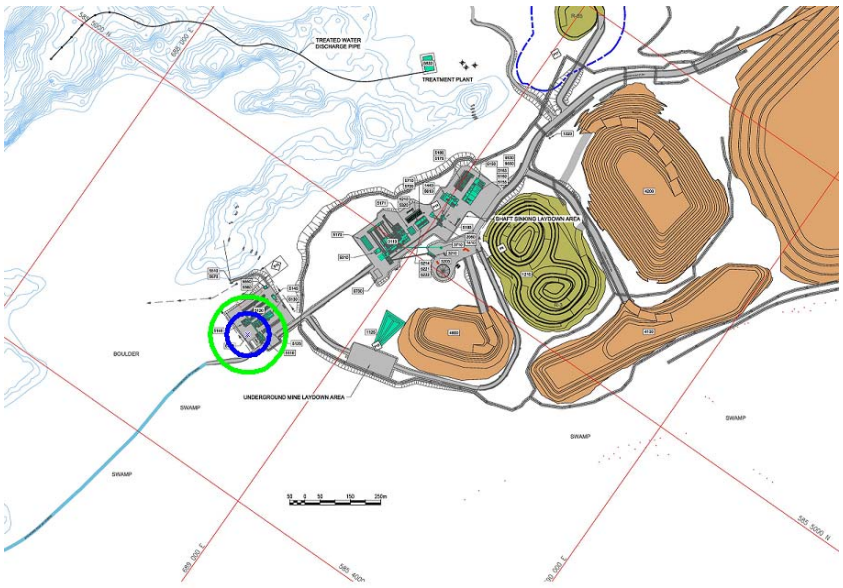
THERMAL LOAD: When combustion occurs, flame emits thermal radiation of varying intensity that heats any exposed surface. Calculations of thermal load factor in both the degree of intensity of the thermal radiation and the duration of exposure. Thermal radiation can cause serious burns. Three thermal radiation intensity thresholds have been established for normally-clothed people exposed to thermal radiation:

- **1800 $(kW/m^2)^{4/3}.s$:** Thermal load criteria level considered dangerous for an average clothed population. Thermal load resulting in fatal burns for more than 50 % of the population exposed.
- **1000 $(kW/m^2)^{4/3}.s$:** Thermal load criteria level considered dangerous for an average clothed population. Thermal load resulting in serious burns and a low percentage of deaths: 1 %.
- **500 $(kW/m^2)^{4/3}.s$:** Thermal load criteria level considered dangerous for a vulnerable population. Second degree burns can be fatal in certain cases.

Propane Inventories:

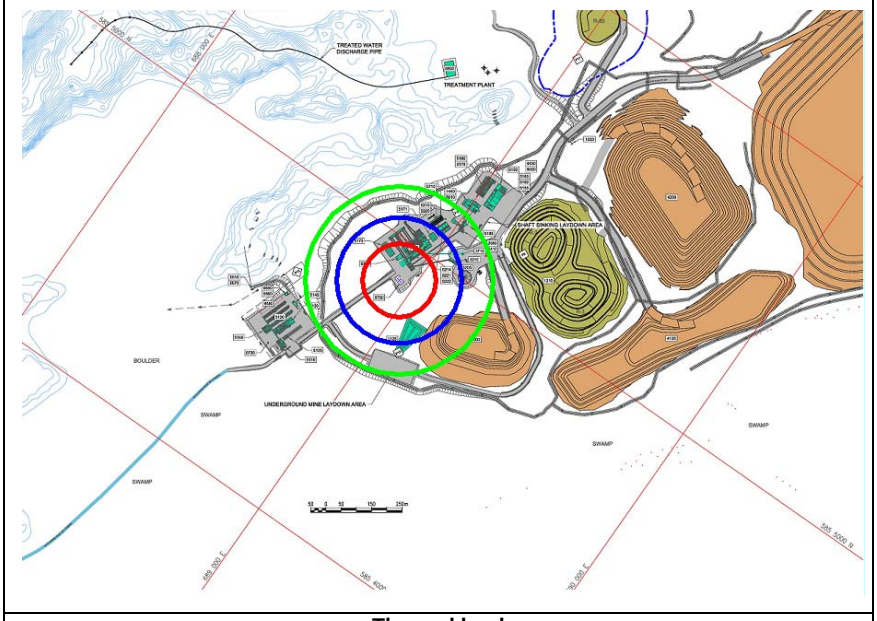
- 18925 litre storage tank (5000 USWG) – for Kitchen area and Housing and Service Complex;
- 2 x 113560 litre storage tanks (30000 USWG) – for heating of mine ventilation system; and
- 18925 litre storage tank (5000 USWG) – for Miners' Dry Room.

Simulations of the effects of a BLEVE: The following Figures show the results of BLEVE explosion simulations for propane storage facilities.



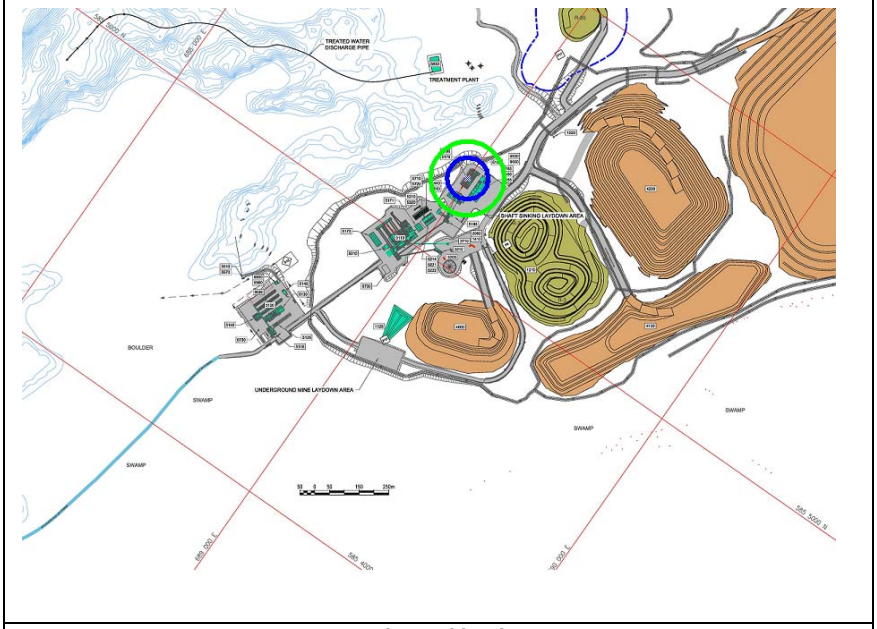
Thermal load		
1800 $(kW/m^2)^{4/3}.s$	1000 $(kW/m^2)^{4/3}.s$	500 $(kW/m^2)^{4/3}.s$
Not achieved	70 m	125 m

Figure EM-11.1 Kitchen area - 5000 USWG of propane



Thermal load		
1800 (kW/m^2) $^{4/3}$. s	1000 (kW/m^2) $^{4/3}$. s	500 (kW/m^2) $^{4/3}$. s
120 m	205 m	305 m

Figure EM-11.2 Heating of mine ventilation system - 30000 USWG of propane



Thermal load		
1800 (kW/m^2) $^{4/3}$. s	1000 (kW/m^2) $^{4/3}$. s	500 (kW/m^2) $^{4/3}$. s
Not achieved	70 m	125 m

Figure EM-11.3 Miners' Dry Room - 5000 USWG of propane

1. Evacuation Assembly Points

Debris from a BLEVE explosion can be projected over considerable distances. Quebec's civil security services recommend the following evacuation distances: for 30,800 imperial gallon tanks (140,000 L), the preferred evacuation distance is 2,200 m and the minimum evacuation distance is 1,715 m. Such distances would be difficult to achieve in the case of the Renard Project. To offset this difficulty, Evacuation Assembly Points will need to be located outside the radius of the thermal load criteria level of 500 $(kW/m^2)^{4/3}$.s, but behind buildings so they can act as barriers to intercept debris.

Figure EM-11.4 shows the recommended Evacuation Assembly Points.

Figure EM-11.4 Evacuation Assembly Points

- **5,000 USWG Tank – Kitchen area:** Evacuate the Housing and Service Complex and proceed to Point A ;
- **30,000 USWG Tank – Heating of mine ventilation system**: Evacuate the Housing and Service Complex and proceed to Point B, and evacuate the Process Plant and other infrastructures and proceed to Point D.
- **5,000 USWG Tank** – Miners' Dry Room: Evacuate the Process Plant and other infrastructures and proceed to Point C.

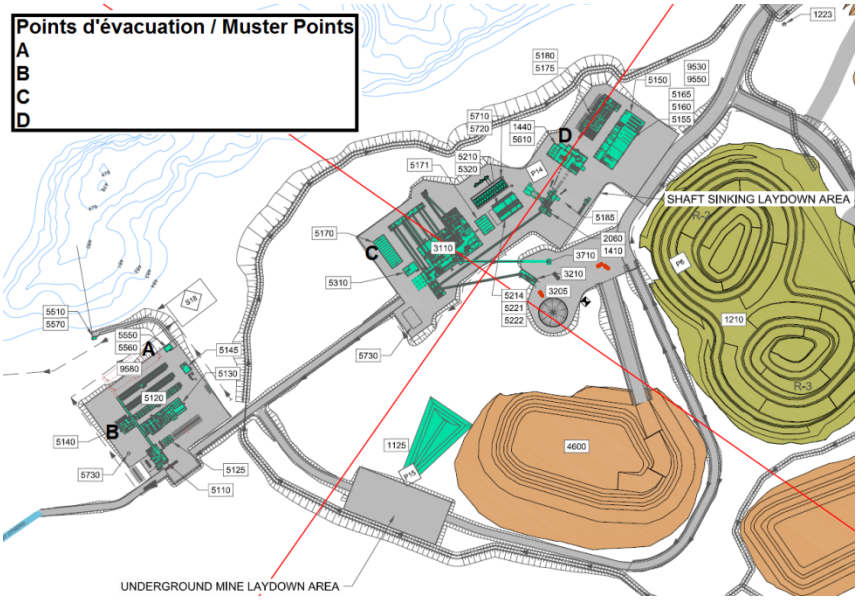


Figure M-11.04 Location of Evacuation Assembly Points

2. Role of Employees:

a) Alert Security immediately in the event of a propane gas leak, including damaged hoses, and provide the following information:

- Is the leak burning?
- If the leak is burning, is the flame reaching the propane tank?
- Is there a propane cloud?

b) Stop the propane leak, if possible, by shutting off the propane valves;

c) Shut down all equipment that could cause the propane cloud to catch fire, including vehicle engines.

3. Role of Security:

a) Register and identify the alarm;

b) If the propane is burning and the flame is reaching the propane tank, call for an evacuation of the area to the previously identified Evacuation Assembly Points.

c) If the propane is not burning, call for an immediate stop to circulation of all vehicles in the area and launch a preventive alert, asking people to remain on standby for further instructions;

d) Alert the Emergency Response Team.

3. Role of the Emergency Response Team and First Responders

a) Wait for instructions from Security;

b) For the Emergency Response Team, go first to the emergency equipment holding area and pick up the equipment needed for the response in question: fire extinguishers, stretchers, first aid kits and emergency vehicles;

c) Proceed to the location of the incident;

d) Assess the situation;

e) Evacuate the site if the flame is already in contact with the storage tank and if the tank pressure relief valve is making warning sounds, as a BLEVE is at risk of occurring very rapidly – in less than 10 minutes – after flames have reached the storage tank;

f) If there is no fire already present, create a security perimeter and carry out flammable gas tests, with hand-held flammable gas detectors;

g**)** Isolate the leak without putting themselves at risk.

4. Role of Supervisors:

a) Proceed immediately to the Evacuation Assembly Point;

b) Carry out an inventory of all employees for which they are responsible;

c) Advise the Camp Coordinator of the number of employees from their section who are at the Assembly Point;

d) Ensure that those employees remain calm and stay in one place.

e) Remain available for whatever action is needed.

5. Role of Coordinator for Health, Safety and the Environment:

a) Coordinate the emergency response at the location of the leak / fire;

b) Provide support to actions carried out by the Rapid Response Team;

c) Advise Infirmary Services;

d) Advise the Directors concerned;

e) Ensure that the water used for firefighting does not escape into tributaries around the camp;

f) If the fire seems to potentially threaten the integrity of the mine site, initiate Site Evacuation Procedures.

6. Role of Infirmary Services:

a) Remain available to respond to future needs;

b) Be ready to assist anyone suffering from the effects of smoke inhalation or who has suffered burns.

16. Directory of Resources

A Directory of Resources identifying government resources, emergency response partners and equipment and service providers to be drawn on in emergency situations, remains to be included in this section of the Report.

Appendix 12.4

HAZOP Report

ANNEXE 12.4
RAPPORT HAZOP

STORNOWAY RENARD PROJECT HAZOP REPORT

CLIENT: **Les diamants Stornoway**

PROJECT: **STORNOWAY RENARD PROJECT**

Prepared by: Linda Lucia Restrepo

Reviewed by: France Dubuc.ing

Approved by: Andre Landry.ing

ing 14/11/2011

11.11.18

STORNOWAY RENARD PROJECT HAZOP REPORT

ENGINEERING REPORT REVISION INDEX

Revision #	By	App.	Date	Pages Revised	Remarks
00	FD	AL	2011-11-11		Issued for study

CLIENT: **ARCELORMITTAL MINES CANADA INC.**

INSTRUCTION TO PRINT CONTROL (Indicate X where applicable)

☐ Entire report revised. Reissue all pages

☐ Reissue revised pages only

STAMP THE ENGINEERING REPORT AS FOLLOWS:

☐ Issued for comments and approval

☐ Released for bid

☐ Released for purchase

☐ Released for fabrication (equipment report only)

☐ Released for construction (installation report only)

☐ Released for design

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General

Administration:

Facility Information:

Company: Stornoway Renard Project

Location: the Renard property located in the region of James Bay, Northern Quebec

Unit: Diamond recovery plant.

Project Description: The property contains nine kimberlite bodies (Renard 1 to 10, with 5 and 6 renamed Renard 65) and a number of dykes, including Lynx and Hibou dykes. Pipes 2, 3 and 4 are considered economically viable for mining.
Mine capacity will be based on 6,000 tonnes per day, 360 days per year, for a total of 2, 60,000 tonnes feed to the process plant per annum. The process plant will be designed with a utilization factor of 78% factor, or 6,830 hours per year, at a rate of 315 tonnes per hour feed. The design life of the plant will be 20 years.

Project ID: 504421

Study Duration:

Start: 2011-04-04

End: 2011-04-13

Methodology

Methodology:

Scope: This facilitation is conducted on the [process/system] and is limited to the causes identified for the equipment, vessels, and the control systems shown in drawings [P&ID, PFD or reference to Drawings tab]

Study: What-If Analysis

Objective: This study would identify [hazards/failures] specifically for the [above process/system]. It will focus on the [design, construction, operability, startup/shutdown/maintenance] issues.

Process:

Major Concerns: [Shortlist of obvious major concerns for this particular study.]

1. Operational disruption
2. Leakage, rupture,
3. Toxic release
4. Hazards to personnel, Environment
5. Property damage

Process is intended to: [functions of the process/system in question for this study.]
* expected to operate 24/7 with minimal downtime
* largely automated, and recipe driven
etc...

Process is intended not to: [malfunctions of the process/system in question for this study.]
* allow oxygen into the tank (maintain inert atmosphere in tank)
* expose operators to [hazardous substances electrical discharge]
* expose the plant to [fire, explosion] hazards

Team Members

First Name	Last Name	Title	Company	Department	Expertise	Phone #	Comment
France	Dubuc	Facilitator	SNC Lavalin	Mining and Metallurgy			
Linda Lucia	Restrepo	Scribe	SNC Lavalin	Mining and Metallurgy			
Andre	Landry	Engineer Director	SNC Lavalin	Mining and Metallurgy			
Robert	Beaulieu	Engineering and Construction Manager	Stornoway				
Paul	Gendreau	Project Manager	SNC Lavalin	Mining and Metallurgy			
Joe Lai	Fong	Lead Instrumentation and Controls	AMEC			(604) 664-4514	
Harry	Ryans	Study Manager/Process Lead	AMEC			(604) 664-3194	

Sessions

Date	Duration	Description	Leader	Scribe	Comment
1. 2011-04-04	8.00		France Dubuc	Linda Lucia Restrepo	
2. 2011-04-05	8.00		France Dubuc	France Dubuc	
3. 2011-04-20	3.00		France Dubuc	France Dubuc	

Drawings

Drawing	Place(s) Used	File Path	File Attachment	Comment
1100-49D4-0003	Processes: 1 Nodes: 1.1			
1100-49D4-0001	Processes: 1 Nodes: 1.1			
1100-49D4-0002	Processes: 1 Nodes: 1.1			
3200-49D4-0001	Processes: 1 Nodes: 1.2			
3200-49D4-0002	Processes: 1 Nodes: 1.3			
3200-49D4-0003	Processes: 1 Nodes: 1.4			
3200-49D4-0004	Processes: 1 Nodes: 1.5			
3500-49D4-0011	Processes: 1 Nodes: 1.17			
3600-49D4-0003	Processes: 1 Nodes: 1.19			
3600-49D4-0004	Processes: 1 Nodes: 1.20			
3600-49D4-0005	Processes: 1 Nodes: 1.21			
3600-49D4-0006	Processes: 1 Nodes: 1.22			
3600-49D4-0007	Processes: 1 Nodes: 1.23			
3200-49D4-0006	Processes: 1 Nodes: 1.6			
3200-49D4-00067	Nodes: 1.6			
3200-49D4-0008	Processes: 1 Nodes: 1.6			
3300-49D4-0001	Processes: 1 Nodes: 1.7			
3300-49D4-0002	Processes: 1 Nodes: 1.7			
3400-49D4-0001	Processes: 1 Nodes: 1.8			
3400-49D4-0002	Processes: 1 Nodes: 1.8			
3400-49D4-0003	Processes: 1 Nodes: 1.8, 1.14			
3400-49D4-0009	Processes: 1 Nodes: 1.9			

Drawing	Place(s) Used	File Path	File Attachment	Comment
3400-49D4-00010	Processes: 1 Nodes: 1.10			
3400-49D4-0005	Processes: 1 Nodes: 1.10, 1.14			
3400-49D4-00011	Processes: 1 Nodes: 1.11			
3400-49D4-0006	Processes: 1 Nodes: 1.11			
3400-49D4-0007	Processes: 1 Nodes: 1.12			
	Processes: 1			
3400-49D4-0012	Processes: 1 Nodes: 1.12			
3500-49D4-0001	Processes: 1 Nodes: 1.13			
3500-49D4-0002	Processes: 1 Nodes: 1.13			
3500-49D4-0004	Processes: 1			
3500-49D4-0005	Processes: 1			
3500-49D4-0003	Processes: 1			
3500-49D4-0007	Processes: 1 Nodes: 1.15			
3500-49D4-0006	Processes: 1 Nodes: 1.15			
3500-49D4-0009	Processes: 1 Nodes: 1.16			
3500-49D4-0010	Processes: 1 Nodes: 1.16			
3500-49D4-0008	Processes: 1 Nodes: 1.16			
3600-49D4-0002	Processes: 1 Nodes: 1.18			
3600-49D4-0001	Processes: 1 Nodes: 1.18			
3400-49D4-0004	Processes: 1 Nodes: 1.9, 1.14			
3200-49D4-0007	Processes: 1			
3400-49D4-0008	Nodes: 1.24			

1. List Process "Nodes"

Process: 1. Diamond recovery plant.

Nodes	Type	Design Conditions/Parameters	Drawings	Session	Rev. #	Revision Date	Comment
1. Underground primary crushing	Conveyor		1100-49D4-0001				
	Feeder		1100-49D4-0002				
	Bin		1100-49D4-0003				
	Feeder						
	Screen						
	Fan						
2. Underground Hoisting and coarse ore conveying	Bin		3200-49D4-0001				Upper unloading information not available.
	Conveyors						
	Feeder						
3. Primary crushing	Bin		3200-49D4-0002				
	Feeder						
	Conveyor						
	Jaw Crusher						
	Bag House						
4. Coarse ore bin and transfer	Conveyor		3200-49D4-0003				
	Feeder						
	Bin						
	Conveyor						
5. Secondary crushing	Conveyor		3200-49D4-0004				
	Screen						
	Cone Crusher						
6. Tertiary crushing	Conveyor		3200-49D4-0006				
	Bin		3200-49D4-00067				
	Feeder		3200-49D4-0008				
	HPGR						
	Pump box						
	Dust Scrubber						
	Spillage Pump						
7. Scrubbing & cleaning	Conveyor		3300-49D4-0001				
	Scrubber		3300-49D4-0002				
	Screen						
	Pump box						
	Spillage Pump						
8. DMS feed preparation	Conveyor		3400-49D4-0001				
	Bin		3400-49D4-0002				
	Feeder		3400-49D4-0003				
	Screen						

Process: 1. Diamond recovery plant.

Nodes	Type	Design Conditions/Parameters	Drawings	Session	Rev. #	Revision Date	Comment
9. DMS module 1 mixing	Box		3400-49D4-0004				
	Pump		3400-49D4-0009				
10. DMS module 1 screens	Cyclone		3400-49D4-0005				
	Screen		3400-49D4-00010				
	Pump						
11. DMS module 1 pumping	Pump box		3400-49D4-0006				
	Pump		3400-49D4-00011				
	Spillage Pump						
12. DMS module 1 separator	Distribution box		3400-49D4-0007				
	Magnetic Separator		3400-49D4-0012				
	Cyclone						
	Pump						
	Pump box						
13. Recovery sizing & storage	Bin		3500-49D4-0001				
	Feeder		3500-49D4-0002				
	Conveyor						
	Screen						
	Spillage Pump						
14. Recovery fines middle & coarse X-ray	X-ray Sorter		3400-49D4-0003				
			3400-49D4-0004				
			3400-49D4-0005				
15. Recovery grease tables & screens	Grease Table		3500-49D4-0006				
	Screen		3500-49D4-0007				
	Conveyor						
16. Recovery dryers, X-ray and screens	Feeder		3500-49D4-0008				
	Dryer		3500-49D4-0009				
	Bin		3500-49D4-0010				
	Feeder						
	Conveyor						
	X-ray Sorter						
	Bag House						
	Pump box						
	Pump						
	Screen						
17. Recovery - diamond cleaning room	Furnace Heater		3500-49D4-0011				
18. Degritting	Pump		3600-49D4-0001				
	Pump box		3600-49D4-0002				
	Spillage Pump						
	Cyclone						

Process: 1. Diamond recovery plant.

Nodes	Type	Design Conditions/Parameters	Drawings	Session	Rev. #	Revision Date	Comment
19. Thickener slimes	Box		3600-49D4-0003				
	Thickener						
	Pump						
20. Rejects transport	Conveyor		3600-49D4-0004				
	Bin						
	Feeder						
	Pump box						
	Pump						
21. Rejects Centrifuges	Tank		3600-49D4-0005				
	Centrifuge						
	Pump box						
	Pump						
22. Make-up water	Tank		3600-49D4-0006				
	Pump						
23. Clarified and make-up water	Tank		3600-49D4-0007				
	Pump						
	Filter						
24. FeSi Make-up circuit.	Hopper		3400-49D4-0008				
	Feeder						
	Pump box						
	Pump						
	Dust Collector						
25. General							

2. Develop Worksheet

Process: 1. Diamond recovery plant.

Node: 1. Underground primary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. There is too much accumulation of ore in the ore pass?	1. Blockage of ore pass.	1. Loss of production	1. Grizzly prevents oversize lumps.	2	3	2	1. Confirm ore pass sizing.	Harry Ryans
			2. Underground and above ground stockpiles.					
	2. Clearing of the ore pass.	1. People injury		4	2	3	2. Ensure that standard operations procedures are prepared.	Robert Beaulieu
2. The ore contains a lot of oversize material?	1. Caving of the ore.	1. Loss of production	1. Blast hole pattern, mining technique.					
		2. Equipment damage	2. Draw points management.	2	3	2		
3. The chain curtain is malfunctioning?	1. Fails open.	1. Equipment damage	1. None	1	2	1	3. Install limit position switches on curtain chain 1150-XX-0001/0002/0003.	Harry Ryans
		2. Maintenance issue					4. Provide a hoist for maintenance on all chain curtains.	
4. Any of the apron feeders stop.	1. Pull cord pulled.	1. Loss of production	1. None					
	2. Equipment jammed by the rocks.	1. Equipment damage	1. CC TV for a visual monitoring of the area.	2	4	3	5. Consider that reverse toggle is provided on each apron feeder.	Harry Ryans
							6. Ensure that the CC TV is located properly.	Harry Ryans
5. The conveyor 1150-CV-0001/2 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				7. Consider in feasibility fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					
6. The ore conveyor 1150-CV-0001 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of production	2. Alignment alarms.	3	2	2		
			3. Spare belt available in warehouse.					
7. The ore and waste conveyor 1150-CV-0002 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.				8. Ensure spare belts are available and located underground.	Robert Beaulieu
		2. Loss of production	2. Alignment alarms.	3	2	2	9. Add a metal recovery bin.	Harry Ryans
			3. Spare belt available in warehouse.					
			4. Metal remover on ore circuit.					
8. The self cleaning magnet doesn't work.	1. Belt conveyor damage. See point 7.							
9. Jaw crusher malfunction	1. Liners wear	1. No consequence.						

Process: 1. Diamond recovery plant.

Node: 1. Underground primary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
(breakdown).	2. Toggle plates damage.	1. No consequence.						
	3. Jaw crusher blockage.	1. Loss of production	1. None.	3	3	3	10. Install a chute plug detection system above the jaw crusher.	Harry Ryans
10. Leak of hydraulic oil?	1. Equipment or instrument failures	1. Environmental impact	1. None	1	1	1	11. Ensure that the hydraulic system package includes a pan.	Harry Ryans
		2. Fire		4	2	3	7. Consider in feasibility fire detection and fire protection system.	Harry Ryans
11. Excessive contaminant (metal, plastics etc.) from the mine?	1. Bad underground housekeeping. Causes blockages downstream of the operation.	1. Loss of production	1. Metal detector.	3	2	2	13. Ensure that standard operations procedures are prepared includes proper housekeeping.	Robert Beaulieu
		2. Maintenance issue	2. None for plastics.	3	3	3		
12. Loss of signal from main control system?	1.	1. Loss of production	1. None.	3	2	2	12. Ensure a localized control panel is located underground.	Harry Ryans
13. Chute blocks?	1. Oversize material.	1. Loss of production	1. Plugged chute detectors.	2	3	2	14. Ensure appropriate shutdown sequence.	Harry Ryans
							15. Add plugged chute detector on chute 1150-CH-0004/12	Harry Ryans
14. Excessive dust?	1. Bag house fan doesn't work.	1. People injury	1. Motor status.	2	3	2		
15. Excessive spalling of ore passes, over-time?	1. Design.	1. Rock mechanics instability.	1. None	3	2	2	16. Ensure proper design reviews of ore pass.	Harry Ryans
16. Loss of compress air?	1. Motor stops	1. Maintenance issue	1. Stand-by air compressor is installed.					
		2. Loss of production		3	2	2		
17. Ventilation system doesn't work?	1. Out of scope.							

Process: 1. Diamond recovery plant.

Node: 2. Underground Hoisting and coarse ore conveying

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The transfer car malfunction?	1. Waste material into the ore conveyor.	1. No consequence.	1. None.	3	3	3	17. Ensure positions switches are installed on the transfer car.	Harry Ryans
2. The conveyor 1155-CV-001 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				18. Consider to add in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					
3. The ore conveyor 1155-CV-001 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of	2. Alignment alarms.	3	2	2		

Process: 1. Diamond recovery plant.

Node: 2. Underground Hoisting and coarse ore conveying

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
		production	3. Spare belt available in warehouse.					
4. Chute blocks?	1. Downstream equipment stops.	1. Loss of production	1. Plugged chute detection on CH-002	2	3	2	19. Add plugged chute detector on chute downstream of 1155-FE-001	Harry Ryans
			2. CC TV for a visual monitoring of the area.					
5. The bin overflows?	1. Bin blockage or feeder stops.	1. Loss of production	1. CC TV for a visual monitoring of the area.	3	2	2	20. Ensure proper equipment layout and secure area.	Harry Ryans
		2. People injury	2. Level detector LAHH-0130	4	1	2	21. Consider closed bin.	Harry Ryans
		3. Environmental impact		4	1	2	22. Review dust collection requirement.	Harry Ryans
6. Feeder stops?	1. Bin overflows.	1. See point 5.	1. Motor status.					

Process: 1. Diamond recovery plant.

Node: 3. Primary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The ore contains a lot of oversize material?	1. Improper open pit blasting pattern.	1. Loss of production	1. Blast hole pattern, mining technique.	2	4	3	23. Ensure proper mining operating procedures to minimize oversize.	Robert Beaulieu
		2. Equipment damage (rock breaker).		2	3	2		
2. Apron feeder 3210-FE-001 stop.	1. Pull cord pulled.	1. Loss of production	1. None					
	2. Equipment jammed by the rocks.	1. Equipment damage	1. CC TV for a visual monitoring of the area.	2	4	3	5. Consider that reverse toggle is provided on each apron feeder.	Harry Ryans
							6. Ensure that the CC TV is located properly.	Harry Ryans
3. The conveyor 3210-CV-001 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					
4. The ore conveyor 3210-CV-001 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of production	2. Alignment alarms.	3	2	2		
			3. Spare belt available in warehouse.					
5. The self cleaning magnet doesn't work.	1. See point 4.							
6. Jaw crusher malfunction (breakdown).	1. Liners wear	1. No consequence.						
	2. Toggle plates damage.	1. No consequence.						
	3. Jaw crusher blockage.	1. Loss of production	1. None.	3	3	3	10. Install a chute plug detection system above the jaw crusher.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 3. Primary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	L	RR	Recommendations	Responsibility
7. Leak of hydraulic oil?	1. Equipment or instrument failures	1. Environmental impact	1. None	1	1	1	25. Ensure that the hydraulic system package includes a pan.	Harry Ryans
		2. Fire		4	2	3	26. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
8. Excessive contaminant (metal, plastics etc.) from the mine?	1. Bad surface housekeeping. Causes blockages downstream of the operation.	1. Loss of production	1. Metal detector.	3	2	2	13. Ensure that standard operations procedures are prepared includes proper housekeeping.	Robert Beaulieu
		2. Maintenance issue	2. None for plastics.	3	3	3		
9. Loss of signal from main control system?		1. Loss of production	1. None.	3	2	2	27. Consider a localized control panel is installed around the primary crushing area.	Harry Ryans
10. Chute blocks?	1. Oversize material.	1. Loss of production	1. Plugged chute detectors.	2	3	2	14. Ensure appropriate shutdown sequence.	Harry Ryans
							28. Add plugged chute detector on chute 3210-CH-003	Harry Ryans
11. Excessive dust?	1. Bag house fan doesn't work.	1. People injury	1. Motor status.	2	3	2		
12. Loss of compress air?	1. Motor stops	1. Maintenance issue for bag house.	1. Stand-by air compressor is installed.	2	2	1		
13. Bin overflows?	1. Bin blockage or feeder stops.	1. Loss of production	1. CC TV for a visual monitoring of the area.	3	2	2	20. Ensure proper equipment layout and secure area.	Harry Ryans
			2. Level detector LAHH-0200				29. Consider adding an additional CC TV for the bin.	Harry Ryans
14. Front-end loader drives into the grizzly.	1. Operator error.	1. Equipment damage	1. Mechanical stop.	3	1	1		
		2. People injury						

Process: 1. Diamond recovery plant.

Node: 4. Coarse ore bin and transfer

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	L	RR	Recommendations	Responsibility
1. Apron feeder 3210-FE-002/3 stop.	1. Pull cord pulled.	1. Loss of production	1. None					
	2. Equipment jammed by the rocks.	1. Equipment damage	1. CC TV for a visual monitoring of the area.	2	2	1	5. Consider that reverse toggle is provided on each apron feeder.	Harry Ryans
							6. Ensure that the CC TV is located properly.	Harry Ryans
2. The conveyor 3210-CV-002/3 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					

Process: 1. Diamond recovery plant.

Node: 4. Coarse ore bin and transfer

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
3. The ore conveyor 3210-CV-002/3 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of production	2. Alignment alarms.	3	1	1		
			3. Spare belt available in warehouse.					
4. The self cleaning magnet doesn't work.	1. See point 3.							
5. Loss of signal from main control system?	1.	1. Loss of production	1. None.	3	2	2	30. Consider localized HMI panel throughout the plant.	Harry Ryans
6. Chute blocks?	1. Oversize material.	1. Loss of production	1. Plugged chute detectors LAHH-0319/29/39/49	2	3	2	14. Ensure appropriate shutdown sequence.	Harry Ryans
7. Excessive dust?	1. Bag house fan doesn't work.	1. People injury	1. Motor status.	2	3	2		
8. Loss of compress air?	1. Motor stops	1. Maintenance issue for bag house.	1. Stand-by air compressor is installed.	2	2	1		
9. Bin overflows?	1. Bin blockage or feeder stops.	1. Loss of production	1. CC TV for a visual monitoring of the area.	2	2	1	20. Ensure proper equipment layout and secure area.	Harry Ryans
			2. Level detector LAHH-0300/0301					
10. Leak of hydraulic oil?	1. Equipment or instrument failures	1. Environmental impact	1. None	1	1	1	25. Ensure that the hydraulic system package includes a pan.	Harry Ryans
		2. Fire		4	2	3	24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
11. Belt scale malfunction. 3210-WT-0350	1.	1. Loss of production and mass balance issue.	1. Redundant belt scale 1155-SC-001/3210-SC-001	2	2	1		

Process: 1. Diamond recovery plant.

Node: 5. Secondary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The conveyor 3210-CV-004 or 3220-CV-001 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					
2. The ore conveyor 3210-CV-004 or 3220-CV-001 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of production	2. Alignment alarms.	3	1	1		
			3. Spare belt available in warehouse.					
3. Chute blocks?	1. Oversize material.	1. Loss of production	1. Plugged chute detectors LAHH-0370	2	3	2	14. Ensure appropriate shutdown sequence.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 5. Secondary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
4. Cone crusher blocks.	1. Over feed, or material hardness variation.	1. Loss of production	1. LAH-0400 2. Self cleaning magnet upstream	2	1	1		
5. Cone crusher malfunction (breakdown).	1. Liners wear	1. No consequence.	1. Gap measurement, during plant maintenance.	2	3	2		
6. Cone crusher bearings overheat.	1. Hydraulic system failure.	1. Equipment damage	1. None.	4	2	3	31. Ensure that all appropriate safeguards are provided and installed for the hydraulic system of the cone crusher.	Harry Ryans
7. Leak of hydraulic oil?	1. Equipment or instrument failures	1. Environmental impact	1. None	1	1	1	32. Ensure that the hydraulic system package includes a pan.	Harry Ryans
		2. Fire		4	2	3	24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
8. Screen plugged.	1. Material hardness variation.	1. Loss of production	1. Ore dressing studies.	3	2	2		
	2. Sticky (clayish) material.	1. Loss of production	1. Ore dressing studies.	3	2	2		
	3. Improper media selection.	1. Loss of production	1. None	3	2	2	33. Review equipment specifications to ensure proper media selection and sizing.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 6. Tertiary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The conveyor 3220-CV-002, 3230-CV-001/2/3/4/5 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms. 3. Alignment alarms.	3	2	2		
2. The conveyor 3220-CV-002, 3230-CV-001/2/3/4/5 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of production	2. Alignment alarms. 3. Spare belt available in warehouse.	3	1	1		
3. Feeder 3230-FE-001 stops.	1. Pull cord pulled.	1. Loss of production	1. None					
	2. Equipment jammed by the rocks.	1. Equipment damage	1. CC TV for a visual monitoring of the area.	2	2	1	5. Consider that reverse toggle is provided on each apron feeder.	Harry Ryans
							6. Ensure that the CC TV is located properly.	Harry Ryans
4. The self cleaning magnet doesn't work.	1. See point 2.							

Process: 1. Diamond recovery plant.

Node: 6. Tertiary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
5. Metal detector 3230-MD-001 doesn't work.	1. Metal detector failure.	1. Equipment damage	1. None.	4	3	4	34. Consider installing a by-pass around the HPGR when metal is detected.	Harry Ryans
							35. Ensure that trouble alarm is provided with metal detector.	Harry Ryans
							36. Ensure two spare rolls are available in the warehouse.	Harry Ryans
6. Loss of signal from main control system?	1.	1. Loss of production	1. None.	3	2	2	37. Consider proper communication network with back-up.	Harry Ryans
7. Chute blocks?	1. Oversize material.	1. Loss of production	1. Plugged chute detectors LAHH-3206/3410	2	3	2	14. Ensure appropriate shutdown sequence.	Harry Ryans
							38. Review installation of the plugged chute detector on 3230-CH-006 and ensure alignment with chute 3230-CH-007 (LAH-0598).	Harry Ryans
8. Loss of compress air?	1. Motor stops	1. Maintenance issue for bag house.	1. Stand-by air compressor is installed.	2	2	1		
9. Bin 3230-BI-001 overflows?	1. Bin blockage or feeder stops.	1. Loss of production	1. Level detector LAHH-0540.	2	2	1		
10. Belt scale malfunction, 3230-SC-001	1.	1. Loss of production	1. Level detector LAHH/LL-0540.	2	2	1	39. Add low alarm on LIT-0559.	Harry Ryans
			2. LIT-0559.					
11. HPGR blocks.	1. No cause.							
12. HPGR malfunction (breakdown).	1. Liners wear.	1. Loss of production.	1. Gap measurement, during plant maintenance.	4	3	4	40. Ensure critical spare is available in the warehouse.	Harry Ryans
			2. Wear measurement.				41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
	2. Stud breakage.	1. Loss of production.	1. Metal detection.	4	3	4	34. Consider installing a by-pass around the HPGR when metal is detected.	Harry Ryans
							35. Ensure that trouble alarm is provided with metal detector.	Harry Ryans
							36. Ensure two spare rolls are available in the warehouse.	Harry Ryans
13. HPGR gear box leak of oil?	1. Equipment or instrument failures	1. Environmental impact	1. None	1	1	1	25. Ensure that the hydraulic system package includes a pan.	Harry Ryans
		2. Fire		4	2	3	24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 6. Tertiary crushing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
14. HPGR hydraulic system fails.	1. Hydraulic system failure.	1. Loss of production	1. None.	4	2	3	42. Ensure that all appropriate safeguards are provided and installed for the hydraulic system of HPGR.	Harry Ryans
15. Excessive dust?	1. Bag house fan doesn't work.	1. People injury	1. Motor status.	2	3	2		
16. No process water to the scrubber.	1.	1. People injury	1. LALL-0620 on pump box 3230-BX-001.	3	3	3	43. Manual by-pass around valve LV-0620.	Harry Ryans
		2. Loss of production.		3	3	3	44. Manual by-pass around valve HV-0605.	Harry Ryans
							45. Consider adding a low flow switch on the main process water line.	Harry Ryans
17. Bag house fan stops.	1. See point 15.							
18. Scrubber fan stops	1. See point 16.							
19. Water content in the ore increases above 5%.	1.	1. Reduced production.	1. None.	4	2	3	46. Consider using HPGR studded rolls.	Harry Ryans Robert Beaulieu
		2. Increased power consumption.		4	2	3		

Process: 1. Diamond recovery plant.

Node: 7. Scrubbing & cleaning

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The conveyor 3300-CV-001/2/5 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					
2. The conveyor 3300-CV-001/2/5 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of production	2. Alignment alarms.	3	1	1		
			3. Spare belt available in warehouse.					
3. Chute blocks?	1. No water.	1. Loss of production	1. Plugged chute detectors LAH-0658	2	3	2	14. Ensure appropriate shutdown sequence.	Harry Ryans
			2. Flow meter FIT-0670				47. Review installation of the plugged chute detector on all chutes.	Harry Ryans
							48. Add a low flow alarm on FIT-0670.	Harry Ryans
4. No process water to the rotary scrubber.	1. Valve failure.	1. Loss of production.	1. Flow meter FIT-0670	3	3	3	48. Add a low flow alarm on FIT-0670.	Harry Ryans
5. Rotary Scrubber stops?	1. Mechanical failure.	1. Loss of production.	1. Motor status.	3	3	3	40. Ensure critical spare is available in the warehouse.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 7. Scrubbing & cleaning

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
							49. Implement preventive maintenance program.	Robert Beaulieu
6. Trommel blockage.	1. Ore properties variation.	1. Loss of production.	1. Ore dressing studies.	4	2	3	50. Review equipment specifications to ensure proper media selection and sizing.	Harry Ryans
7. Screen plugged.	1. Ore properties variation.	1. Loss of production	1. Ore dressing studies.	3	2	2	52. Regular inspection of the screen media.	Robert Beaulieu
	2. Improper media selection.	1. Loss of production/ of diamonds.	1. None	3	2	2	33. Review equipment specifications to ensure proper media selection and sizing.	Harry Ryans
8. Screen media wear?	1. Normal operation.	1. Increased bottom size cut-off. Loss of diamonds.	1. None.	4	4	5	51. Regular inspection and preventive replacement of the screen media.	Robert Beaulieu
							53. Consider adding sampling point downstream of the screen on the -1mm stream.	Harry Ryans
9. No wash water to screens.	1. Valve failure.	1. Loss of production.	1. ZSC-0705	4	3	4	54. Ensure from the CC TV, a visual inspection of the screen is possible.	Harry Ryans
10. Slurry Pump stops	1.	1. Pump box overflow, and material spillage.	1. Motor status.	2	3	2	55. In detailed engineering optimize tank sizing.	Harry Ryans
		2. Emergency shutdown of the area.	2. LAHH-0710.	2	3	2	56. Consider having pump spare part in warehouse.	
							41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
11. Pump box overflow?	1. See point 10.							
12. Pump discharge line blocked?	1. No cause.							
13. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-0726	3	2	2		

Process: 1. Diamond recovery plant.

Node: 8. DMS feed preparation

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The conveyor 3300-CV-003/4 3410-CV-001 3420-CV-001 stops.	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					

Process: 1. Diamond recovery plant.

Node: 8. DMS feed preparation

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
2. The conveyor 3300-CV-003/4 3410-CV-001 3420-CV-001 spills.	1.	1. People injury		4	2	3	57. Review requirements for drip trays installation under the all elevated conveyors.	Harry Ryans
							58. Ensure conveyors are properly aligned (all elevated conveyors).	Robert Beaulieu
							59. Proper signage on work floor to indicate elevated equipment (all elevated conveyors).	Robert Beaulieu
3. The conveyor 3300-CV-003/4 3410-CV-001 3420-CV-001 belt rips.	1. Metal objects falling into the belt. Material spillage.	1. Equipment damage	1. Motor status.					
		2. Loss of production	2. Alignment alarms.	3	1	1		
			3. Spare belt available in warehouse.					
4. Chute blocks?	1. Liner falls.	1. Loss of production	1. Plugged chute detectors LAH-1008/1018/1048/1158	2	2	1	14. Ensure appropriate shutdown sequence.	Harry Ryans
							47. Review installation of the plugged chute detector on all chutes.	Harry Ryans
5. Bin 3300-BI-001 overflows?	1. Bin blockage or feeder stops.	1. Loss of production	1. Level detector LAHH-1020/5.	2	2	1		
6. Feeder 3410-FE-001, 3420-FE-001 stops.	1. Pull cord pulled.	1. Loss of production	1. None					
	2. Equipment failure.	1. Loss of production	1. CC TV for a visual monitoring of the area.	3	3	3	6. Ensure that the CC TV is located properly.	Harry Ryans
			2. LAHH-1020/25.				41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
			3. Motor status.					
			4. Belt scale WALL-1050/1150					
7. Screen plugged.	1. Ore properties variation.	1. Loss of production	1. Ore dressing studies.	3	2	2	51. Regular inspection and preventive replacement of the screen media.	Robert Beaulieu
	2. Improper media selection.	1. Loss of production	1. None	3	2	2	33. Review equipment specifications to ensure proper media selection and sizing.	Harry Ryans
8. Screen media wear?	1. Normal operation.	1. Increased bottom size cut-off. Loss of diamonds.	1. None.	4	4	5	51. Regular inspection and preventive replacement of the screen media.	Robert Beaulieu
							53. Consider adding sampling point downstream of the screen on the -1mm stream.	Harry Ryans
9. No wash water to screens.	1. Valve failure.	1. Loss of production.	1. ZSC-1055/1155	3	3	3	54. Ensure from the CC TV, a visual inspection of the screen is possible.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 8. DMS feed preparation

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
10. Slurry Pump stops?	1.	1. Pump box overflow, and material spillage.	1. Motor status.	2	3	2	55. In detailed engineering optimize tank sizing.	Harry Ryans
		2. Emergency shutdown of the train.	2. LAHH-1070/1170.	2	3	2	60. Ensure having pump spare parts in warehouse.	Harry Ryans Robert Beaulieu
							41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
11. Pump box overflow?	1. See point 10.							
12. Pump discharge line blocked?	1. No cause.							
13. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-1081/1181.	3	2	2		
14. Belt scale malfunction, 3410-SC-001, and 3420-SC-001?	1.	1. Loss of production	1. None.	2	2	1	61. Consider adding a deviation calculation on bin level LIT-1020/1025.	Harry Ryans
							62. Consider adding an interlock on the VFD to limit the speed of the feeders.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 9. DMS module 1 mixing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Distribution box 3410-BX-001/3420-BX-001 plugs?	1. Scale build-up on box underflow pipe.	1. Mixing box starved, process stop.	1. Overflow can take the entire flow.	2	1	1		
			2. LAHH-1200/1430 on the mix box					
2. HV-1205 /1435 fails?	1.	1. Loss of production.	1. None.	3	3	3	63. Ensure proper valve selection.	Harry Ryans
3. Mixing box 3410-BX-002/3420-BX-002 plugs?	1. Loss of circulating medium.	1. Loss of production.	1. LAHH-1210/1440 on the mix box	3	3	3	64. Ensure appropriate control strategy.	Harry Ryans
			2. Overflow can take the entire flow.					
4. Slurry pump stops?	1.	1. Mixing box overflow, and material spillage.	1. Motor status.	3	3	3	55. In detailed engineering optimize tank sizing.	Harry Ryans
		2. Emergency shutdown of the train.	2. LAHH-1210/1440.	3	3	3	60. Ensure having pump spare parts in warehouse.	Harry Ryans Robert Beaulieu
			3. Drain valve HV-1205/1435				41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
5. Pump box overflow?	1. See point 4.							
6. Pump discharge line blocked?	1. High density slurry (70%)	1. Loss of production.	1. PALL-1230/5/1460/70	3	3	3	65. Ensure proper shutdown sequence.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 9. DMS module 1 mixing

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
			2. Automatic line flushing and line slope design.					
7. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-1226/1452.	3	2	2		
8. No clarified water.	1. Valve failure.	1. Line blockage.	1. None.	3	3	3	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu

Process: 1. Diamond recovery plant.

Node: 10. DMS module 1 screens

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Distribution box 3410-FD-001, 3420-FD-001 blockage.	1. Trommel screen damage (liners disengaging).	1. Loss of production.	1. PALL-1230/5/1460/70	2	2	1		
2. Cyclone inlet blockage?	1. Same as above.							
3. Cyclone apex blockage?	1. Same as above.							
4. Cyclone has a bad separation?	1. Water content variation.	1. Loss of production.	1. Media density DALL-1300/1530. 2. Marcy scale.	3	4	4	66. Ensure that standard operations procedures are followed.	Robert Beaulieu
	2. Malfunction of the density gauge.	1. Loss of production.	1. PALL-1230/5/1460/70 2. Marcy scale.	3	4	4	66. Ensure that standard operations procedures are followed.	Robert Beaulieu
	3. Cyclone feed at wrong pressure.	1. Loss of production.	1. PALL-1230/5/1460/70	3	4	4	66. Ensure that standard operations procedures are followed.	Robert Beaulieu
	4. Size distribution of FeSi.	1. Loss of production.	1. Operational procedure.	3	4	4	66. Ensure that standard operations procedures are followed.	Robert Beaulieu
5. Sink screen 3410-SN-004/5/ 3420-SN-004/5 blinded.	1. Medium density too high, leading to screen blinding.	1. Loss of production.	1. PALL-1230/5/1460/70 2. Media density DALL-1300/1530.	3	3	3	67. Ensure that standard operations procedures and maintenance procedures are followed.	Robert Beaulieu
6. Sink screen 3410-SN-004/5/ 3420-SN-004/5 media wear?	1. Secure area, lack of preventive maintenance.	1. Increased bottom size cut-off. Increased concentrate into the dilute media. Diamond loss.	1. CC TV for a visual monitoring of the area. 2. Screen design.	4	3	4	51. Regular inspection and preventive replacement of the screen media.	Robert Beaulieu
7. No wash water to sink screens 3410-SN-004/5/ 3420-SN-004/5.	1. Valve failure.	1. Loss of production.	1. ZSC-1242/1485	3	3	3	54. Ensure from the CC TV, a visual inspection of the screen is possible.	Harry Ryans
8. Float screen 3410-SN-002/3 3420-SN-002/3 blinded, bottom deck.	1. None.							

Process: 1. Diamond recovery plant.

Node: 10. DMS module 1 screens

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
9. Float screen 3410-SN-002/3 3420-SN-002/3 media wear bottom deck.	1. Normal operation.	1. Increased bottom size cut-off. Medium pollution. Bad separation. Loss of diamonds.	1. Densifiying circuit.	3	2	2	51. Regular inspection and preventive replacement of the screen media.	Robert Beaulieu
							53. Consider adding sampling point downstream of the screen on the -1mm stream.	Harry Ryans
10. Float screen 3410-SN-002/3 3420-SN-002/3 blinded, top deck?	1. Improper media selection.	1. Loss of production	1. None	3	2	2	33. Review equipment specifications to ensure proper media selection and sizing.	Harry Ryans
11. Float screen 3410-SN-002/3 3420-SN-002/3 media wear top deck?	1. Normal operation.	1. Increased quantity of material to rejects. Loss of diamonds.	1. Sampling.	3	3	3	67. Ensure that standard operations procedures and maintenance procedures are followed.	Robert Beaulieu
12. No wash water to float screens 3410-SN-002/3 3420-SN-002/3.	1. Valve failure.	1. Loss of production.	1. ZSC-1247/1495.	3	3	3	54. Ensure from the CC TV, a visual inspection of the screen is possible.	Harry Ryans
13. Chute blocks?	1. No cause.							

Process: 1. Diamond recovery plant.

Node: 11. DMS module 1 pumping

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Slurry pump 3410-PU-002/3420-PU-002 stops?	1. VFD failure.	1. Pump box overflow, and material spillage.	1. Motor status.	2	4	3	55. In detailed engineering optimize tank sizing.	Harry Ryans
		2. Emergency shutdown of the train.	2. LAHH-1250/1500.	2	4	3	60. Ensure having pump spare parts in warehouse.	Harry Ryans Robert Beaulieu
							41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
	2. Density too high.	1. same as above						
2. The suction valve on 3410-PU-002/3420-PU-002 doesn't open?	1. Valve blockage (sticky).	1. Pump box overflow, and material spillage.	1. Valve positioners ZSO-1265/1505.	2	4	3	68. Consider adding manual flushing system to the isolation valve.	Harry Ryans
			2. Over sizing of actuator.					
3. Slurry pump 3410-PU-007/3420-PU-007 stops?	1.	1. Material spillage when flushing discharge line.	1. Motor status.	2	3	2	60. Ensure having pump spare parts in warehouse.	Harry Ryans Robert Beaulieu
							41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
4. The suction valve on 3410-PU-007/3420-PU-007 doesn't	1. Valve blockage (sticky).	1. Pump box overflow, and	1. Valve positioners ZSO-1255/1515.	2	4	3	68. Consider adding manual flushing system	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 11. DMS module 1 pumping

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
open?		material spillage.	2. Over sizing of actuator.				to the isolation valve.	
5. Pump box 3410/3420-BX-010 overflow?	1. See point 1.							
6. Pump discharge line blocked?	1. Normal shutdown.	1. Cannot re-start.	1. Automatic line flushing and line slope design.	2	2	1		
7. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-1262/72/1512/1522.	2	2	1		
8. No clarified water.	1. Valve failure.	1. Line blockage.	1. None.	3	3	3	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
9. No process air?	1. Valve failure.	1. Less agitation, during start-up. Loss of production.	1. None.	3	3	3		
	2. Line plugged.	1. Less agitation, during start-up. Loss of production.	1. None.	3	4	4	69. Ensure proper piping arrangement to be able to dismantle the process air line in case of blockage.	Harry Ryans
10. No make-up water?	1. Valve failure.	1. Loss of production.	1. DAHH-1300/1530	3	3	3	70. Ensure having valve spare parts in warehouse.	Harry Ryans Robert Beaulieu
							71. Ensure proper preventive maintenance is implemented on site.	Robert Beaulieu

Process: 1. Diamond recovery plant.

Node: 12. DMS module 1 separator

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Slurry pump 3410-PU-006/3420-PU-006 stops?	1. Motor failure.	1. Pump box overflow 3410/3420-BX-011, and material spillage.	1. Motor status.	2	3	2	55. In detailed engineering optimize tank sizing.	Harry Ryans
		2. Emergency shutdown of the train. Loss of production	2. LAHH-1340/1600.	2	3	2	60. Ensure having pump spare parts in warehouse.	Harry Ryans Robert Beaulieu
							41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
2. The suction valve on 3410-PU-006/3420-PU-006 doesn't open?	1. Valve blockage (sticky).	1. Pump box overflow, and material spillage.	1. Valve positioners ZSO-1345/1605.	2	3	2	68. Consider adding manual flushing system to the isolation valve.	Harry Ryans
			2. Over sizing of actuator.				72. Ensure optimizing piping design of suction pipes.	Harry Ryans
							73. Consider over sizing of actuator.	Harry Ryans
3. Pump box 3410/3420-BX-011 overflow?	1. See point 1.							

Process: 1. Diamond recovery plant.

Node: 12. DMS module 1 separator

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
4. Pump discharge line blocked?	1. FeSi settling in line.	1. Loss of production.	1. LALL-1320/1570.	2	3	2		
5. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-1352/1622.	2	2	1		
6. Magnetic separators 3410/3420-MS-001/002 stops?	1. Motor failure.	1. Loss of production.	1. Motor status.	2	2	1		
	2. Gear box failure.	1. Loss of production.	1. None.	2	2	1	74. Ensure proper maintenance of the gear box is implemented on site.	Robert Beaulieu
7. Wrong split of the splitter 3410/3420-BX-008?	1. No cause.							
8. Wrong split of the splitter 3410/3420-BX-005?	1. Broken actuator.	1. Over dilution of the medium.	1. ZI-1360/1630	2	2	1		
9. Demagnetizing coil 34103420-DM-001 doesn't work?	1. Equipment failure.	1. High viscous medium.	1. None.	2	2	1	75. Ensure having spare unit in warehouse.	Harry Ryans Robert Beaulieu

Process: 1. Diamond recovery plant.

Node: 13. Recovery sizing & storage

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Bin 3500-BI-001 overflows?	1. Bin blockage	1. Concentrate spillage.	1. Level detector LAHH-2000/5.	3	2	2		
	2. Feeder stops.	1. Concentrate spillage.	1. Level detector LAHH-2005.	3	2	2		
	3. Malfunction of the level instruments.	1. Concentrate spillage.	1. None.	3	3	3	80. Ensure proper preventive maintenance is implemented for instrumentation on site.	Robert Beaulieu
							81. Consider add level switches on chutes 3410/3420-CH-006	Harry Ryans
2. Feeder 3500-FE-001/2 stops?	1. Equipment failure.	1. No consequence.	1. Motor status.	1	2	1		
			2. One feeder can take full capacity.					
3. The conveyor 3500-CV-001/2 stops?	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					
4. Belt scale malfunction. 3500-WE-2030?	1. Instrument failure.	1. Loss of production and mass balance issue.	1. Balance between weight feeders 3500-FE-003 to 006 and feed to recovery plant WE-2030.	2	2	1		
5. Chute blocks?	1. Screen malfunction.	1. Loss of production	1. Plugged chute detectors LAHH-2012/17/28/48.	2	3	2		

Process: 1. Diamond recovery plant.

Node: 13. Recovery sizing & storage

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
6. Sieve bend plugged?	1. Sieve bin wear.	1. Bad separation.	1. None.	2	3	2	82. Regular inspection and preventive replacement of the sieve media.	Robert Beaulieu
7. Screen plugged?	1. Improper media selection.	1. Loss of production	1. None	3	2	2	33. Review equipment specifications to ensure proper media selection and sizing.	Harry Ryans
8. Screen media wear?	1. Normal operation.	1. Improper distribution of concentrate.	1. None.	4	2	3	51. Regular inspection and preventive replacement of the screen media.	Robert Beaulieu
		2. Loss of production/ of diamonds.		4	2	3	53. Consider adding sampling point downstream of the screen on the -1mm stream.	Harry Ryans
9. No wash water to screens.	1. Valve failure.	1. Loss of production.	1. ZSC-2050	3	3	3	54. Ensure from the CC TV, a visual inspection of the screen is possible.	Harry Ryans
10. Bin 3500-BI-002 to 6 overflows?	1. Bin blockage or feeder stops.	1. Loss of production	1. Level detector LAHH-2100//20/40/60/80.	2	2	1		
		2. Screen damage.						
	2. Malfunction of the level instruments.	1. Loss of production	1. None.	2	2	1	80. Ensure proper preventive maintenance is implemented for instrumentation on site.	Robert Beaulieu
		2. Screen damage.					83. Consider add level switches on bins inlet pipes.	Harry Ryans
11. Wrong split in the bins?	1. Screen wear.	1. See point 8.						
12. Weight feeder 3500-FE-003 to 7 stops.	1. Equipment failure.	1. See point 10.	1. Motor status.	2	2	1		
			2. Speed switches SSL-2107/27/47/67/87.					

Process: 1. Diamond recovery plant.

Node: 14. Recovery fines middles & coarses X-ray

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. X-ray tube failure?	1. Normal wears of equipment.	1. Loss of production.	1. Fault alarms XA-2203.	2	3	2	84. Ensure having spare parts in warehouse.	Harry Ryans Robert Beaulieu
	2. No chilled water.	1. Loss of production.	1. Low flow switch.	2	3	2	85. Verify with vendor if temperature alarms are provided on the chilled water.	Harry Ryans
2. More feed?	1. Bad distribution on upstream feed.	1. Loss of production/ of diamonds.	1. Weight feeder.	2	3	2	86. Ensure proper feeder calibration procedures are implemented.	Robert Beaulieu

Process: 1. Diamond recovery plant.

Node: 14. Recovery fines middles & coarses X-ray

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
	2. Internal feeder malfunction	1. Loss of production/ of diamonds.	1. None.	2	3	2	86. Ensure proper feeder calibration procedures are implemented.	Robert Beaulieu
3. Concentrate yield is too high?	1. Excessive granite in concentrate.	1. Increase load in the re-concentrate unit, and slows down the production.	1. Filter system, part of the x-ray unit.	3	3	3	87. Ensure proper operation DMS.	Robert Beaulieu
	2. Presence of ceramic liner.	1. Increase load in the re-concentrate unit, and slows down the production.	1. Filter system, part of the x-ray unit.	3	2	2	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
	3. Excessive feed.	1. same point 2						
4. No chilled water?	1. Chiller failure.	1. see point 1		2	3	2	88. Consider adding a connection from make-up water to the X-rays unit.	Harry Ryans
5. No make-up water?	1.	1. Build-up material.	1. None.	2	2	1	89. Add isolating valve on the make-up water.	Harry Ryans
6. Presence of contaminants?	1. Bad housekeeping operation.	1. Equipment blockage.	1. None.	3	3	3	90. Consider adding contaminant capture screen at the end of the prep. Screen (DMS area).	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 15. Recovery grease tables & screens

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. No make-up water?	1. Valve failure.	1. No water, reduced recovery efficiency.	1. Position switches on valves.	2	3	2		
			2. Installed stand-by.					
2. Bad make-up water quality?	1. Sand filter backwash failure.	1. Reduced recovery efficiency.	1. Dedicated water filter system.	2	3	2		
3. Water temperature too low or too high?	1. Water heater fails. low temperature	1. Poor recovery efficiency.	1. XA-2500	2	3	2		
	2. Temperature controls fails.	1. Poor recovery efficiency.	1. XA-2500	2	3	2		
	3. High temperature.	1. No recovery, grease spillage.	1. XA-2500	2	3	2		
4. Operator doesn't apply grease?	1. Operator error.	1. Loss of production.	1. Standard operating procedures.	3	3	3	91. Ensure proper operator training.	Robert Beaulieu
			2. CC TV for a visual monitoring of the area.					
5. No vibration?	1. Equipment failure.	1. Loss of production.	1. Motor status.	2	2	1		
6. Table not cleaned?	1. Operator error.	1. Loss of production.	1. Standard operating procedures.	3	3	3	91. Ensure proper operator training.	Robert Beaulieu

Process: 1. Diamond recovery plant.

Node: 15. Recovery grease tables & screens

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
			2. CC TV for a visual monitoring of the area.					
7. Screen plugged?	1. Presence grease in screen feed.	1. Too much water to the stockpile.	1. CC TV for a visual monitoring of the area.	2	3	2	92. Consider providing drainage facility for outside stockpile.	Harry Ryans
	2. Motor stops	1. Loss of production.	1. Motor status.	3	2	2	93. Review the surge capacity of the recovery plant.	Harry Ryans
8. Screen media wear?	1. Normal operation.	1. Too much water to the stockpile.	1. CC TV for a visual monitoring of the area.	2	3	2	51. Regular inspection and preventive replacement of the screen media.	Robert Beaulieu
9. The conveyor 3500-CV-003 stops?	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	1	1		
			3. Alignment alarms.					
10. Chute blocks?	1. Cold climate (ice).	1. Loss of production	1. None.	2	3	2	94. Consider removing chute CH-036	Harry Ryans
11. Slurry pump 3500-PU-001 stops?	1. Motor failure.	1. Screen pan overflow.	1. Motor status.	3	2	2	60. Ensure having pump spare parts in warehouse.	Harry Ryans Robert Beaulieu
		2. Loss of production.	2. Interlock system.	3	2	2	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
12. The suction valve on 3500-PU-001 doesn't open?	1. No cause.							
13. Pump discharge line blocked?	1. Screen panel lifts-up.	1. Loss of production.	1. CC TV for a visual monitoring of the area.	3	2	2		

Process: 1. Diamond recovery plant.

Node: 16. Recovery dryers, X-ray and screens

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Dryer doesn't dry?	1. Over feed.	1. Wet concentrate. Loss production.	1. Temperature detection.	2	3	2	95. Consider add a by-pass around the dryer to BX-001. Or consider using vacuum cleaning truck.	Harry Ryans
			2. Moisture detection					
	2. Infrared light lamps failure.	1. Loss of production.	1. Moisture detection	2	3	2	96. Ensure critical spare is available in the warehouse.	Harry Ryans
			2. Temperature detection.					
			3. Fault alarms.					
2. Dryer doesn't cool?	1. Equipment failure.	1. Loss of production/ of diamonds.	1. Temperature detection.	2	2	1		
		2. Equipment damage (HIMS belt).		2	2	1		

Process: 1. Diamond recovery plant.

Node: 16. Recovery dryers, X-ray and screens

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
3. Bin 3500-BI-007/8 level detector fails.	1. Feeder stops.	1. Material will back-up, concentrate spillage.	1. Level detectors.	2	2	1		
	2. Malfunction of the level instruments.	1. Material will back-up, concentrate spillage.	1. None.	2	2	1	80. Ensure proper preventive maintenance is implemented for instrumentation on site.	Robert Beaulieu
4. Magnetic separators 3500-MS-001/002 stops?	1. Motor failure.	1. Loss of production.	1. Motor status.	2	2	1		
	2. Gear box failure.	1. Loss of production.	1. None.	2	2	1	74. Ensure proper maintenance of the gear box is implemented on site.	Robert Beaulieu
5. Magnetic separators 3500-MS-001/002 belt drifts?	1. Improper equipment set-up.	1. Material spillage.	1. CC TV for a visual monitoring of the area.	2	3	2	97. Review specification during detail engineering.	Harry Ryans
6. X-rays failure?	1. See node 14.							
7. Chute blocks?	1. No cause							
8. Excessive dust?	1. Bag house fan doesn't work.	1. People injury	1. Motor status.	2	3	2	98. Consider alternative type of dust collector.	Harry Ryans
9. Slurry pump 3500-PU-002 stops?	1. Motor failure.	1. Pump box overflow 3500-BX-001, and material spillage.	1. Motor status.	2	3	2	101. Consider having an installed stand-by pump.	Harry Ryans
		2. Emergency shutdown of the train. Loss of production	2. LAHH-2690.	2	3	2	100. Ensure proper maintenance is implemented on site.	Robert Beaulieu
							99. Install an overflow.	Harry Ryans
10. The suction valve on 3500-PU-002 doesn't open?	1. No cause.							
11. Pump box 3500-BX-001 overflow?	1. See point 9.							
12. Pump discharge line blocked?	1. Lack of water.	1. Loss of production.	1. LALL-2690.	2	3	2		
13. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-2697.	2	2	1		
14. Bin 3500-BI-010/11 level detector fails.	1. No cause.							
15. Operator error, glove box area.	1. Sabotage.	1. Loss of production/ of diamonds.	1. None.	3	3	3	91. Ensure proper operator training.	Robert Beaulieu

Process: 1. Diamond recovery plant.

Node: 17. Recovery - diamond cleaning room

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Fumes emission?	1. Scrubber fan stops.	1. People injury	1. Fume hood.	4	3	4	102. Turn-off the heat sources.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 17. Recovery - diamond cleaning room

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
							103. Close fume hood, operating procedure.	Robert Beaulieu
							104. Add a local light and horn when fan fails.	Harry Ryans
2. Acid spillage?	1. Operator error.	1. People injury	1. Proper personal protection.	4	3	4	105. Ensure appropriate operational procedures are implemented.	Robert Beaulieu
							106. Ensure safety shower and eyewash unit is provided.	Harry Ryans
3. Presence of caustic fumes.	1. Normal operation.	1. People injury	1. None.	4	3	4	107. Ensure proper HVAC design considering caustic fumes.	Harry Ryans
4. To be reviewed when vendor information is available.								

Process: 1. Diamond recovery plant.

Node: 18. Degritting

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Pump box 3600-BX-001 overflow?	1. When pump PU-001 stops.	1. Material spillage.	1. Motor status.	2	3	2		
			2. Overflow pipe.					
			3. LAHH-3000.					
	2. Valve failure, LV-3000	1. Material spillage.	1. LAHH-3000.	2	3	2		
			2. Overflow pipe.					
			3. Motor status.					
2. Slurry pump 3600-PU-001 stops?	1. Motor failure.	1. Pump box overflow 3500-BX-001, and material spillage.	1. Motor status.	2	3	2	108. Consider having an installed stand-by pump and/or provision for future pump installation.	Harry Ryans
		2. Emergency shutdown of the train. Loss of production	2. LAHH-3000.	3	3	3	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
3. The suction valve on 3600-PU-001 doesn't open?	1. Valve failure.	1. Delay for start-up.	1. Valve positioners ZC-3005	3	2	2		
4. Pump discharge line blocked?	1. Slug slurry.	1. Loss of production.	1. LAHH-3000.	2	3	2	109. Consider adding flushing connection the discharge line.	Harry Ryans
			2. Flushing connection					
5. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-3013	2	2	1		
6. Cyclone blockage?	1. Slug of slurry.	1. Loss of production.	1. PAHH-3055	2	2	1	110. Add hose connection for cyclone flushing.	Harry Ryans
			2. Installed cyclone spare.					

Process: 1. Diamond recovery plant.

Node: 18. Degritting

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
7. Slurry pump 3600-PU-015 stops?	1. Motor failure.	1. Pump box overflow 3600-BX-004, and material spillage.	1. Motor status.	2	3	2	108. Consider having an installed stand-by pump and/or provision for future pump installation.	Harry Ryans
		2. Emergency shutdown of the train. Loss of production	2. LAHH-3060	3	3	3	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
8. The suction valve on 3600-PU-015 don't open?	1. Valve failure.	1. Delay for start-up.	1. Valve positioners ZC-3065	3	2	2		
			2. Automatic line flushing sequence.					
9. Pump box 3600-BX-004 overflow?	1. See point 7.							
10. Pump discharge line blocked?	1. Lack of water.	1. Loss of production.	1. LALL-3060	2	3	2		
			2. DAHH-3080					
	2. Density meter malfunction.	1. Loss of production.	1. LALL-3060	2	3	2		
11. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-3072.	2	2	1		
12. Density to centrifuge too high?	1. No dilution.	1. Blocking centrifuge feed.	1. DAHH-3080	3	2	2		
			2. Automatic line flushing sequence.					

Process: 1. Diamond recovery plant.

Node: 19. Thickener slimes

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The bed level too high?	1. Downstream equipment stops.	1. Dirty water overflow. Loss of production	1. LIC-3105	2	4	3	111. Show alarms alarm on thickener level and torque instrumentation.	Harry Ryans
			2. Rake torque alarm.				112. Consider adding a turbidity meter on thickener overflow.	Harry Ryans
			3. Flocculant addition					
			4. CC TV for a visual monitoring of the area.					
2. The bed mass too high	1. Same as above.							
3. The rake motor failure?	1.	1. Equipment damage	1. Motor status.	4	2	3	113. Show alarms on thickener level and torque instrumentation.	Harry Ryans
			2. Rake torque alarm.				105. Ensure appropriate operational procedures are implemented.	Robert Beaulieu
			3. Rake lift mechanism.				96. Ensure critical spare is available in the warehouse.	Harry Ryans
4. Rake shaft breaks?	1. Instrumentation failure.	1. Loss of production.	1. Rake torque alarm.	4	2	3	114. Show alarms on thickener level and torque instrumentation.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 19. Thickener slimes

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
			2. Motor status.				105. Ensure appropriate operational procedures are implemented.	Robert Beaulieu
			3. Rake lift mechanism.					
5. Low underflow density?	1. Insufficient flocculant.	1. Poor settling rate.	1. Recirculation mode.	3	2	2		
		2. Plant shutdown.	2. Density DALL-3180	3	2	2		
	2. Less feed.	1. Poor settling rate.	1. Recirculation mode.	3	2	2		
		2. Plant shutdown.	2. Density DALL-3180	3	2	2		
6. Thickener underflow pump suction line blockage?	1. High slurry density.	1. Loss of production.	1. Spare underflow line with dedicated pump.	3	2	2		
			2. Automatic line flushing sequence.					
7. Thickener underflow 3600-PU-004/17 pump stops	1. Motor failure.	1. Line blockage.	1. Installed stand-by pump.	3	2	2		
			2. Motor status.					
8. Thickener O/F pump 3600-PU-014 stops.	1. Equipment failure.	1. Plant shutdown.	1. Motor status.	4	2	3	115. Consider alternative type of thickener to eliminate overflow pump PU-014.	Harry Ryans
							116. Consider adding a stand-by pump.	Harry Ryans
9. Dirty thickener water overflow?	1. See point 1.							
10. No flocculant?	1. see point 5							

Process: 1. Diamond recovery plant.

Node: 20. Rejects transport

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. The conveyor 3700-CV-001/2 stops?	1. Misalignment leading to fire.	1. Loss of production	1. Motor status.				24. Consider adding in feasibility study fire detection and fire protection system.	Harry Ryans
		2. Fire	2. Pull cords alarms.	3	2	2		
			3. Alignment alarms.					
2. Belt scale malfunction 3700-SC-001/2?	1. Instrument failure.	1. Mass balance issue.	1. None.	2	2	1		
3. Bin 3700-BI-001 overflows?	1. Malfunction of the level instruments.	1. Material spillage.	1. Redundancy on level instruments LAHH-3225. LAH-3217	2	2	1	80. Ensure proper preventive maintenance is implemented for instrumentation on site.	Robert Beaulieu
							81. Consider add level switches on chutes 3410/3420-CH-006	Harry Ryans
	2. Cold climate (bin freezing).	1. Loss of production	1. Redundancy on level instruments LAHH-3225. LAH-3217	2	3	2	117. Ensure proper room temperature control.	Harry Ryans
4. Feeder 3700-FE-001 fails?	1. Equipment failure.	1. Loss of	1. Motor status.	1	2	1	118. Consider adding a	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 20. Rejects transport

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
		production.	2. Bin level interlock with conveyors.				timer or local disconnect.	
5. Chute blocks?	1. See point 3.							
6. Slurry pump 3700-PU-003 stops?	1. Motor failure.	1. Pump box overflow 3700-BX-002, and material spillage.	1. Motor status.	1	3	1	119. Ensure critical spare is available in the warehouse.	Harry Ryans
		2. Environmental impact	2. LAHH-3240	3	3	3	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
7. The suction valve on 3700-PU-003 doesn't open?	1. Valve failure.	1. Delay for start-up.	1. Valve positioners ZC-3242	1	3	1		
8. Pump box 3700-BX-002 overflow?	1. See point 6.							
9. Pump discharge line blocked?	1. No cause.							
10. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-3247.	2	2	1		

Process: 1. Diamond recovery plant.

Node: 21. Rejects Centrifuges

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Pump box 3600-BX-005 overflow?	1. When pump PU-016 stops.	1. Material spillage.	1. Motor status. 2. Pipe overflow. 3. LAHH-3500.	3	3	3	108. Consider having an installed stand-by pump and/or provision for future pump installation.	Harry Ryans
	2. Valve failure, HV-3510.	1. Material spillage.	1. Motor status. 2. Pipe overflow. 3. LAHH-3500. 4. Valve status ZIO/C-3510.	3	2	2		
	3. More flow from centrifuge.	1. Material spillage.	1. LAHH-3500. 2. Pipe overflow. 3. Motor status. 4. Torque measurement on centrifuge.	3	2	2		
2. Slurry pump 3600-PU-016 stops?	1. Motor failure.	1. Pump box overflow 3600-BX-005, and material spillage.	1. Motor status.	3	3	3	108. Consider having an installed stand-by pump and/or provision for future pump installation.	Harry Ryans
		2. Emergency shutdown of the rejects line. Loss of production.		3	3	3	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
	2. Discharge or suction blockage.	1. same as above	1. Motor status. 2. LAHH-3500.	3	2	2		

Process: 1. Diamond recovery plant.

Node: 21. Rejects Centrifuges

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
	3. No seal water to pump 3600-PU-016	1. Equipment damage	1. FSL-3522.	3	2	2		
3. No seal water to slurry pump?	1. See point 2.3.							
4. The suction valve on 3600-PU-016 doesn't open?	1. Valve failure.	1. Delay for start-up.	1. Motor status. 2. LAHH-3500. 3. Valve positioners ZC-3510	3	2	2		
5. Feed density to centrifuge too high?	1. No dilution.	1. Blocking centrifuge feed.	1. DAHH-3080 2. Automatic line flushing sequence (HV-3315/3415).	3	2	2		
	2. Density gauge malfunction DIT-3080.	1. Blocking centrifuge feed.	1. Motor status.	3	3	3	41. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
		2. Loss of production.		3	3	3	121. Consider adding sampling point near density meter DIT-3080 (PID 3600-49D4-0002).	Harry Ryans
	3. Agitator in 3600-AG-001 in 3600-TK-003 stops?	1. Blocking centrifuge feed.	1. Motor status.	3	3	3	122. Consider over sizing agitator motor and gear box.	Harry Ryans
		2. Loss of production.		3	3	3		
6. The centrifuge lube system not working?	1. Cooling water failure.	1. Loss of production.	1. FALL-3360/3460	3	2	2		
	2. Lube oil general failure.	1. Loss of production.	1. None.	3	2	2		
7. One centrifuge is off line?	1. Lube oil general failure.	1. Loss of production.	1. None.	3	3	3	120. Investigate adding a third centrifuge.	Harry Ryans
	2. Feed blockage.	1. Loss of production.	1. None.	3	3	3	120. Investigate adding a third centrifuge.	Harry Ryans
8. Tank TK-003 is blocked?	1. High density feed.	1. See point 5.						
	2. Agitation stops.	1. see point 5.3						
	3. Density gauge malfunction DIT-3080.	1. see point 5.2						
9. No agitation in TK-003	1. see point 5.3							
10. One of the level valves LCV-3260A/B fails close.	1. Line blockage.	1. Loss of production.	1. Centrifuge motor status.	3	3	3	120. Investigate adding a third centrifuge.	Harry Ryans
11. No clarified water?	1. Valve failure.	1. No flushing when on shutdown mode.	1. Positioners on valves.	2	3	2		
	2. Clarified water pump failure.	1. No flushing when on shutdown mode.	1. Motor status. 2. Spare clarified water pump.	2	2	1		
12. No makeup water?	1. Valve failure.	1. Centrifuge shutdown.	1. Positioners on valves.	3	3	3	123. Consider replacing actuated valves by manual valves.	Harry Ryans
	2. Makeup water pumps failure.	1. Centrifuge shutdown.	1. Spare makeup water pump.	3	2	2		

Process: 1. Diamond recovery plant.

Node: 22. Make-up water

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Makeup water pump 3600-PU-009/010 stops.	1. Equipment failure.	1. Overflow on the ground	1. LAHH-3600 2. Stand-by pump. 3. Spillage pump 3600-PU-002/3	2	2	1		
2. Tank 3600-TK-002 overflows.	1. Pump failure.	1. Overflow on the ground	1. LAHH-3600. 2. Stand-by pump. 3. Spillage pumps 3600-PU-002/3.	2	2	1		
	2. Valve failure LCV-3600.	1. Overflow on the ground	1. LAHH-3600 2. By-pass valves.	2	3	2		
3. No make-up water to tank 3600-TK-002?	1. Valve failure LCV-3600.	1. Lose the level in tank. Leading to an emergency shutdown.	1. LALL-3600 2. By-pass valves. 3. FIT-3610.	3	3	3	124. Consider configuring a low flow alarm on FIT-3600. 125. Ensure proper instrument maintenance is implemented on site.	Harry Ryans Robert Beaulieu
	2. Supply pump from sedimentation pound fails.	1. same as above						
4. No clarified water from filter?	1. Filter pump (3600-PU-013) fails.	1. Lose the level in tank. Leading to an emergency shutdown.	1. Motor status (3600-PU-013).	3	3	3	126. Configure a low flow alarm on FIC-3695.	Harry Ryans
	2. Filter 3600-FL-001 is dirty.	1. Reduced flow rate.	1. Internal backwash system.	3	3	3	127. Ensure there is an adequate backwash system and associated instrumentation.	Harry Ryans
5. HP pumps PU-011/12 stops?	1. Equipment failure.	1. Emergency shutdown.	1. Flow switches on each slurry pumps. 2. Stand-by HP pump.	3	2	2	128. Evaluate if these HP pumps are required depending on slurry pumps vendor info.	Harry Ryans
6. LCV 3600 fails?	1. see point 2.2							
7. Any valve fails?	1. See pump stops.							

Process: 1. Diamond recovery plant.

Node: 23. Clarified and make-up water

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Clarified water pump 3600-PU-006/7/8 stops.	1. Equipment failure.	1. Overflow on the ground	1. LAHH-3680 2. Stand-by pump. 3. Spillage pumps 3600-PU-002/3.	2	2	1		
2. Tank 3600-TK-001 overflows.	1. Pump failure.	1. Overflow on the ground	1. LAHH-3680. 2. Stand-by pump. 3. Spillage pumps 3600-PU-002/3.	2	2	1		

Process: 1. Diamond recovery plant.

Node: 23. Clarified and make-up water

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
	2. Valve failure LCV-3680.	1. Overflow on the ground	1. LAHH-3680	2	3	2		
			2. By-pass valves.					
3. No make-up water to tank 3600-TK-001 from sedimentation pump?	1. Valve failure LCV-3680.	1. Decreasing the level in tank. Leading to an emergency shutdown.	1. LALL-3680	3	3	3	129. Consider configuring a low flow alarm on FIT-3670.	Harry Ryans
			2. By-pass valves.				125. Ensure proper instrument maintenance is implemented on site.	Robert Beaulieu
			3. FIT-3670.				130. Ensure that stand-by sedimentation pump is provided.	Harry Ryans
	2. Supply pump from sedimentation pound fails.	1. same as above						
4. No clarified water from thickeners overflow pumps 3600-PU-014?	1. Thickener O/F pump (3600-PU-014) fails.	1. Decreasing the level in tank. Leading to an emergency shutdown.	1. Motor status (3600-PU-014).	3	3	3	116. Consider adding a stand-by pump.	Harry Ryans
							100. Ensure proper maintenance is implemented on site.	Robert Beaulieu
5. Filter pump (3600-PU-013) fails.	1. Equipment failure.	1. Decreasing the level in tank. Leading to an emergency shutdown.	1. Motor status (3600-PU-013).	3	3	3	126. Configure a low flow alarm on FIC-3695.	Harry Ryans
6. No instrument air to filter?	1. Air compressor failure.	1. No backwash. Dirty water.	1. None.	3	3	3	127. Ensure there is an adequate backwash system and associated instrumentation.	Harry Ryans
							131. Consider adding a pressure indicator at the filter inlet.	Harry Ryans
7. LCV 3680 fails?	1. see point 2.2							
8. Any valve fails?	1. See pump stops.							

Process: 1. Diamond recovery plant.

Node: 24. FeSi Make-up circuit.

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Feeder 3410-SF-001 stops.	1. Equipment failure.	1. Equipment damage	1. Motor status.	1	2	1		
			2. SSL-1380					
2. Slurry pump 3410-PU-009 stops?	1. Motor failure.	1. No consequence.	1. Motor status.	1	2	1		
			2. LAHH-1400.					
3. The suction valve on 3410-PU-009 doesn't open?	1. Valve blockage (sticky).	1. No consequence.	1. Valve positioners ZSO-1410.	1	3	1	68. Consider adding manual flushing system to the isolation valve.	Harry Ryans
							72. Ensure optimizing piping design of suction pipes.	Harry Ryans

Process: 1. Diamond recovery plant.

Node: 24. FeSi Make-up circuit.

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
4. Pump box 3410-BX-012 overflow?	1. Valve failure HV-1408.	1. Overflow on the ground	1. LAHH-1400.	1	3	1	76. Add a pipe on the overflow.	Harry Ryans
5. What if no agitation?	1. Motor failure.	1. Settling of material.	1. Motor status.	1	2	1	77. Consider adding a drain in the pump box.	Harry Ryans
	2. Gear box failure.	1. same as above		1	2	1	74. Ensure proper maintenance of the gear box is implemented on site.	Robert Beaulieu
6. Pump discharge line blocked?	1. FeSi settling in line.	1. Loss of production.	1. None.	1	3	1	78. Ensure optimizing piping design of discharge lines and adequate slopes.	Harry Ryans
							79. Ensure that proper flushing sequence is followed.	Robert Beaulieu
7. No seal water to slurry pumps?	1.	1. Equipment damage	1. FAL-1417.	1	2	1		
8. Excessive dust?	1. Bag house fan doesn't work.	1. People injury	1. Motor status.	2	3	2		
9. Loss of compress air?	1. See above.							

Process: 1. Diamond recovery plant.

Node: 25. General

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix S	Risk Matrix L	Risk Matrix RR	Recommendations	Responsibility
1. Diamond damage?	1. Cone crusher gap too small, decreased recirculation.	1. Loss of production/ of diamonds.	1. Process design criteria.	4	3	4	132. Ensure proper operational procedures are implemented to reduce diamond damage.	Robert Beaulieu
2. Power failure?	1. Lack of fuel.	1. Emergency shutdown.	1. Stand-by generator.	4	2	3	133. Ensure all equipment can be re-started full load with minimal intervention.	Harry Ryans
3. Fire?	1. Transformer oil.	1. Local fire and loss of production.	1. Fire hydrants loops.	4	2	3	134. Verify if dry transformers are used.	Harry Ryans
			2. Fire water tanks and truck.					
			3. Design based on NFPA standard.					
			4. Fire Sprinklers					
	2. Lube oil.	1. Local fire and loss of production.	1. Fire Sprinklers	4	2	3	135. Consider using self-extinguishing oil and or high flash point.	Harry Ryans
			2. Fire hydrants loops.					
			3. Fire water tanks and truck.					
			4. Design based on NFPA standard.					
	3. Belt drifting.	1. Local fire and loss of production.	1. Fire Sprinklers	3	2	2		
			2. Fire hydrants loops.					

Process: 1. Diamond recovery plant.

Node: 25. General

What ifs	Causes	Consequences	Effective Existing Safeguards	Risk Matrix			Recommendations	Responsibility
				S	L	RR		
			3. Design based on NFPA standard.					

3. Manage Recommendations

Recommendations	Place(s) Used	Max RR	Responsibility	Priority	Status	Comment
1. Confirm ore pass sizing.	Causes: 1.1.1.1	2	Harry Ryans			
2. Ensure that standard operations procedures are prepared.	Causes: 1.1.1.2	3	Robert Beaulieu			
3. Install limit position switches on curtain chain 1150-XX-0001/0002/0003.	Causes: 1.1.3.1	1	Harry Ryans			
4. Provide a hoist for maintenance on all chain curtains.	Causes: 1.1.3.1	1				
5. Consider that reverse toggle is provided on each apron feeder.	Causes: 1.1.4.2, 1.3.2.2, 1.4.1.2, 1.6.3.2	3	Harry Ryans			
6. Ensure that the CC TV is located properly.	Causes: 1.1.4.2, 1.3.2.2, 1.4.1.2, 1.6.3.2, 1.8.6.2	3	Harry Ryans			
7. Consider in feasibility fire detection and fire protection system.	Causes: 1.1.5.1, 1.1.10.1	3	Harry Ryans			
8. Ensure spare belts are available and located underground.	Causes: 1.1.7.1	2	Robert Beaulieu			
9. Add a metal recovery bin.	Causes: 1.1.7.1	2	Harry Ryans			
10. Install a chute plug detection system above the jaw crusher.	Causes: 1.1.9.3, 1.3.6.3	3	Harry Ryans			
11. Ensure that the hydraulic system package includes a pan.	Causes: 1.1.10.1	3	Harry Ryans			
12. Ensure a localized control panel is located underground.	Causes: 1.1.12.1	2	Harry Ryans			
13. Ensure that standard operations procedures are prepared includes proper housekeeping.	Causes: 1.1.11.1, 1.3.8.1	3	Robert Beaulieu			
14. Ensure appropriate shutdown sequence.	Causes: 1.1.13.1, 1.3.10.1, 1.4.6.1, 1.5.3.1, 1.6.7.1, 1.7.3.1, 1.8.4.1	2	Harry Ryans			
15. Add plugged chute detector on chute 1150-CH-0004/12	Causes: 1.1.13.1	2	Harry Ryans			
16. Ensure proper design reviews of ore pass.	Causes: 1.1.15.1	2	Harry Ryans			
17. Ensure positions switches are installed on the transfer car.	Causes: 1.2.1.1	3	Harry Ryans			
18. Consider to add in feasibility study fire detection and fire protection system.	Causes: 1.2.2.1	2	Harry Ryans			
19. Add plugged chute detector on chute downstream of 1155-FE-001	Causes: 1.2.4.1	2	Harry Ryans			
20. Ensure proper equipment layout and secure area.	Causes: 1.2.5.1, 1.3.13.1, 1.4.9.1	2	Harry Ryans			
21. Consider closed bin.	Causes: 1.2.5.1	2	Harry Ryans			
22. Review dust collection requirement.	Causes: 1.2.5.1	2	Harry Ryans			
23. Ensure proper mining operating procedures to minimize oversize.	Causes: 1.3.1.1	3	Robert Beaulieu			

Recommendations	Place(s) Used	Max RR	Responsibility	Priority	Status	Comment
24. Consider adding in feasibility study fire detection and fire protection system.	Causes: 1.3.3.1, 1.4.2.1, 1.4.10.1, 1.5.1.1, 1.5.7.1, 1.6.1.1, 1.6.13.1, 1.7.1.1, 1.8.1.1, 1.13.3.1, 1.15.9.1, 1.20.1.1	3	Harry Ryans			
25. Ensure that the hydraulic system package includes a pan.	Causes: 1.3.7.1, 1.4.10.1, 1.6.13.1	3	Harry Ryans			
26. Consider adding in feasibility study fire detection and fire protection system.	Causes: 1.3.7.1	3	Harry Ryans			
27. Consider a localized control panel is installed around the primary crushing area.	Causes: 1.3.9.1	2	Harry Ryans			
28. Add plugged chute detector on chute 3210-CH-003	Causes: 1.3.10.1	2	Harry Ryans			
29. Consider adding an additional CC TV for the bin.	Causes: 1.3.13.1	2	Harry Ryans			
30. Consider localized HMI panel throughout the plant.	Causes: 1.4.5.1	2	Harry Ryans			
31. Ensure that all appropriate safeguards are provided and installed for the hydraulic system of the cone crusher.	Causes: 1.5.6.1	3	Harry Ryans			
32. Ensure that the hydraulic system package includes a pan.	Causes: 1.5.7.1	3	Harry Ryans			
33. Review equipment specifications to ensure proper media selection and sizing.	Causes: 1.5.8.3, 1.7.7.2, 1.8.7.2, 1.10.10.1, 1.13.7.1	2	Harry Ryans			
34. Consider installing a by-pass around the HPGR when metal is detected.	Causes: 1.6.5.1, 1.6.12.2	4	Harry Ryans			
35. Ensure that trouble alarm is provided with metal detector.	Causes: 1.6.5.1, 1.6.12.2	4	Harry Ryans			
36. Ensure two spare rolls are available in the warehouse.	Causes: 1.6.5.1, 1.6.12.2	4	Harry Ryans			
37. Consider proper communication network with back-up.	Causes: 1.6.6.1	2	Harry Ryans			
38. Review installation of the plugged chute detector on 3230-CH-006 and ensure alignment with chute 3230-CH-007 (LAH-0598).	Causes: 1.6.7.1	2	Harry Ryans			
39. Add low alarm on LIT-0559.	Causes: 1.6.10.1	1	Harry Ryans			
40. Ensure critical spare is available in the warehouse.	Causes: 1.6.12.1, 1.7.5.1	4	Harry Ryans			

Recommendations	Place(s) Used	Max RR	Responsibility	Priority	Status	Comment
41. Ensure proper instrument maintenance is implemented on site.	Causes: 1.6.12.1, 1.7.10.1, 1.8.6.2, 1.8.10.1, 1.9.4.1, 1.9.8.1, 1.11.1.1, 1.11.3.1, 1.11.8.1, 1.12.1.1, 1.14.3.2, 1.15.11.1, 1.18.2.1, 1.18.7.1, 1.20.6.1, 1.21.2.1, 1.21.5.2	4	Robert Beaulieu			
42. Ensure that all appropriate safeguards are provided and installed for the hydraulic system of HPGR.	Causes: 1.6.14.1	3	Harry Ryans			
43. Manual by-pass around valve LV-0620.	Causes: 1.6.16.1	3	Harry Ryans			
44. Manual by-pass around valve HV-0605.	Causes: 1.6.16.1	3	Harry Ryans			
45. Consider adding a low flow switch on the main process water line.	Causes: 1.6.16.1	3	Harry Ryans			
46. Consider using HPGR studded rolls.	Causes: 1.6.19.1	3	Harry Ryans Robert Beaulieu			
47. Review installation of the plugged chute detector on all chutes.	Causes: 1.7.3.1, 1.8.4.1	2	Harry Ryans			
48. Add a low flow alarm on FIT-0670.	Causes: 1.7.3.1, 1.7.4.1	3	Harry Ryans			
49. Implement preventive maintenance program.	Causes: 1.7.5.1	3	Robert Beaulieu			
50. Review equipment specifications to ensure proper media selection and sizing.	Causes: 1.7.6.1	3	Harry Ryans			
51. Regular inspection and preventive replacement of the screen media.	Causes: 1.7.8.1, 1.8.7.1, 1.8.8.1, 1.10.6.1, 1.10.9.1, 1.13.8.1, 1.15.8.1	5	Robert Beaulieu			
52. Regular inspection of the screen media.	Causes: 1.7.7.1	2	Robert Beaulieu			
53. Consider adding sampling point downstream of the screen on the -1mm stream.	Causes: 1.7.8.1, 1.8.8.1, 1.10.9.1, 1.13.8.1	5	Harry Ryans			
54. Ensure from the CC TV, a visual inspection of the screen is possible.	Causes: 1.7.9.1, 1.8.9.1, 1.10.7.1, 1.10.12.1, 1.13.9.1	4	Harry Ryans			
55. In detailed engineering optimize tank sizing.	Causes: 1.7.10.1, 1.8.10.1, 1.9.4.1, 1.11.1.1, 1.12.1.1	3	Harry Ryans			
56. Consider having pump spare part in warehouse.	Causes: 1.7.10.1	2				

Recommendations	Place(s) Used	Max RR	Responsibility	Priority	Status	Comment
57. Review requirements for drip trays installation under the all elevated conveyors.	Causes: 1.8.2.1	3	Harry Ryans			
58. Ensure conveyors are properly aligned (all elevated conveyors).	Causes: 1.8.2.1	3	Robert Beaulieu			
59. Proper signage on work floor to indicate elevated equipment (all elevated conveyors).	Causes: 1.8.2.1	3	Robert Beaulieu			
60. Ensure having pump spare parts in warehouse.	Causes: 1.8.10.1, 1.9.4.1, 1.11.1.1, 1.11.3.1, 1.12.1.1, 1.15.11.1	3	Harry Ryans Robert Beaulieu			
61. Consider adding a deviation calculation on bin level LIT-1020/1025.	Causes: 1.8.14.1	1	Harry Ryans			
62. Consider adding an interlock on the VFD to limit the speed of the feeders.	Causes: 1.8.14.1	1	Harry Ryans			
63. Ensure proper valve selection.	Causes: 1.9.2.1	3	Harry Ryans			
64. Ensure appropriate control strategy.	Causes: 1.9.3.1	3	Harry Ryans			
65. Ensure proper shutdown sequence.	Causes: 1.9.6.1	3	Harry Ryans			
66. Ensure that standard operations procedures are followed.	Causes: 1.10.4.1, 1.10.4.2, 1.10.4.3, 1.10.4.4	4	Robert Beaulieu			
67. Ensure that standard operations procedures and maintenance procedures are followed.	Causes: 1.10.5.1, 1.10.11.1	3	Robert Beaulieu			
68. Consider adding manual flushing system to the isolation valve.	Causes: 1.11.2.1, 1.11.4.1, 1.12.2.1, 1.24.3.1	3	Harry Ryans			
69. Ensure proper piping arrangement to be able to dismantle the process air line in case of blockage.	Causes: 1.11.9.2	4	Harry Ryans			
70. Ensure having valve spare parts in warehouse.	Causes: 1.11.10.1	3	Harry Ryans Robert Beaulieu			
71. Ensure proper preventive maintenance is implemented on site.	Causes: 1.11.10.1	3	Robert Beaulieu			
72. Ensure optimizing piping design of suction pipes.	Causes: 1.12.2.1, 1.24.3.1	2	Harry Ryans			
73. Consider over sizing of actuator.	Causes: 1.12.2.1	2	Harry Ryans			
74. Ensure proper maintenance of the gear box is implemented on site.	Causes: 1.12.6.2, 1.16.4.2, 1.24.5.2	1	Robert Beaulieu			
75. Ensure having spare unit in warehouse.	Causes: 1.12.9.1	1	Harry Ryans Robert Beaulieu			
76. Add a pipe on the overflow.	Causes: 1.24.4.1	1	Harry Ryans			
77. Consider adding a drain in the pump box.	Causes: 1.24.5.1	1	Harry Ryans			

Recommendations	Place(s) Used	Max RR	Responsibility	Priority	Status	Comment
78. Ensure optimizing piping design of discharge lines and adequate slopes.	Causes: 1.24.6.1	1	Harry Ryans			
79. Ensure that proper flushing sequence is followed.	Causes: 1.24.6.1	1	Robert Beaulieu			
80. Ensure proper preventive maintenance is implemented for instrumentation on site.	Causes: 1.13.1.3, 1.13.10.2, 1.16.3.2, 1.20.3.1	3	Robert Beaulieu			
81. Consider add level switches on chutes 3410/3420-CH-006	Causes: 1.13.1.3, 1.20.3.1	3	Harry Ryans			
82. Regular inspection and preventive replacement of the sieve media.	Causes: 1.13.6.1	2	Robert Beaulieu			
83. Consider add level switches on bins inlet pipes.	Causes: 1.13.10.2	1	Harry Ryans			
84. Ensure having spare parts in warehouse.	Causes: 1.14.1.1	2	Harry Ryans Robert Beaulieu			
85. Verify with vendor if temperature alarms are provided on the chilled water.	Causes: 1.14.1.2	2	Harry Ryans			
86. Ensure proper feeder calibration procedures are implemented.	Causes: 1.14.2.1, 1.14.2.2	2	Robert Beaulieu			
87. Ensure proper operation DMS.	Causes: 1.14.3.1	3	Robert Beaulieu			
88. Consider adding a connection from make-up water to the X-rays unit.	Causes: 1.14.4.1	2	Harry Ryans			
89. Add isolating valve on the make-up water.	Causes: 1.14.5.1	1	Harry Ryans			
90. Consider adding contaminant capture screen at the end of the prep. Screen (DMS area).	Causes: 1.14.6.1	3	Harry Ryans			
91. Ensure proper operator training.	Causes: 1.15.4.1, 1.15.6.1, 1.16.15.1	3	Robert Beaulieu			
92. Consider providing drainage facility for outside stockpile.	Causes: 1.15.7.1	2	Harry Ryans			
93. Review the surge capacity of the recovery plant.	Causes: 1.15.7.2	2	Harry Ryans			
94. Consider removing chute CH-036	Causes: 1.15.10.1	2	Harry Ryans			
95. Consider add a by-pass around the dryer to BX-001. Or consider using vacuum cleaning truck.	Causes: 1.16.1.1	2	Harry Ryans			
96. Ensure critical spare is available in the warehouse.	Causes: 1.16.1.2, 1.19.3.1	3	Harry Ryans			
97. Review specification during detail engineering.	Causes: 1.16.5.1	2	Harry Ryans			
98. Consider alternative type of dust collector.	Causes: 1.16.8.1	2	Harry Ryans			
99. Install an overflow.	Causes: 1.16.9.1	2	Harry Ryans			
100. Ensure proper maintenance is implemented on site.	Causes: 1.16.9.1, 1.23.4.1	3	Robert Beaulieu			

Recommendations	Place(s) Used	Max RR	Responsibility	Priority	Status	Comment
101. Consider having an installed stand-by pump.	Causes: 1.16.9.1	2	Harry Ryans			
102. Turn-off the heat sources.	Causes: 1.17.1.1	4	Harry Ryans			
103. Close fume hood, operating procedure.	Causes: 1.17.1.1	4	Robert Beaulieu			
104. Add a local light and horn when fan fails.	Causes: 1.17.1.1	4	Harry Ryans			
105. Ensure appropriate operational procedures are implemented.	Causes: 1.17.2.1, 1.19.3.1, 1.19.4.1	4	Robert Beaulieu			
106. Ensure safety shower and eyewash unit is provided.	Causes: 1.17.2.1	4	Harry Ryans			
107. Ensure proper HVAC design considering caustic fumes.	Causes: 1.17.3.1	4	Harry Ryans			
108. Consider having an installed stand-by pump and/or provision for future pump installation.	Causes: 1.18.2.1, 1.18.7.1, 1.21.1.1, 1.21.2.1	3	Harry Ryans			
109. Consider adding flushing connection the discharge line.	Causes: 1.18.4.1	2	Harry Ryans			
110. Add hose connection for cyclone flushing.	Causes: 1.18.6.1	1	Harry Ryans			
111. Show alarms alarm on thickener level and torque instrumentation.	Causes: 1.19.1.1	3	Harry Ryans			
112. Consider adding a turbidity meter on thickener overflow.	Causes: 1.19.1.1	3	Harry Ryans			
113. Show alarms on thickener level and torque instrumentation.	Causes: 1.19.3.1	3	Harry Ryans			
114. Show alarms on thickener level and torque instrumentation.	Causes: 1.19.4.1	3	Harry Ryans			
115. Consider alternative type of thickener to eliminate overflow pump PU-014.	Causes: 1.19.8.1	3	Harry Ryans			
116. Consider adding a stand-by pump.	Causes: 1.19.8.1, 1.23.4.1	3	Harry Ryans			
117. Ensure proper room temperature control.	Causes: 1.20.3.2	2	Harry Ryans			
118. Consider adding a timer or local disconnect.	Causes: 1.20.4.1	1	Harry Ryans			
119. Ensure critical spare is available in the warehouse.	Causes: 1.20.6.1	3	Harry Ryans			
120. Investigate adding a third centrifuge.	Causes: 1.21.7.1, 1.21.7.2, 1.21.10.1	3	Harry Ryans			
121. Consider adding sampling point near density meter DIT-3080 (PID 3600-49D4-0002).	Causes: 1.21.5.2	3	Harry Ryans			
122. Consider over sizing agitator motor and gear box.	Causes: 1.21.5.3	3	Harry Ryans			
123. Consider replacing actuated valves by manual valves.	Causes: 1.21.12.1	3	Harry Ryans			

Recommendations	Place(s) Used	Max RR	Responsibility	Priority	Status	Comment
124. Consider configuring a low flow alarm on FIT-3600.	Causes: 1.22.3.1	3	Harry Ryans			
125. Ensure proper instrument maintenance is implemented on site.	Causes: 1.22.3.1, 1.23.3.1	3	Robert Beaulieu			
126. Configure a low flow alarm on FIC-3695.	Causes: 1.22.4.1, 1.23.5.1	3	Harry Ryans			
127. Ensure there is an adequate backwash system and associated instrumentation.	Causes: 1.22.4.2, 1.23.6.1	3	Harry Ryans			
128. Evaluate if these HP pumps are required depending on slurry pumps vendor info.	Causes: 1.22.5.1	2	Harry Ryans			
129. Consider configuring a low flow alarm on FIT-3670.	Causes: 1.23.3.1	3	Harry Ryans			
130. Ensure that stand-by sedimentation pump is provided.	Causes: 1.23.3.1	3	Harry Ryans			
131. Consider adding a pressure indicator at the filter inlet.	Causes: 1.23.6.1	3	Harry Ryans			
132. Ensure proper operational procedures are implemented to reduce diamond damage.	Causes: 1.25.1.1	4	Robert Beaulieu			
133. Ensure all equipment can be re-started full load with minimal intervention.	Causes: 1.25.2.1	3	Harry Ryans			
134. Verify if dry transformers are used.	Causes: 1.25.3.1	3	Harry Ryans			
135. Consider using self-extinguishing oil and or high flash point.	Causes: 1.25.3.2	3	Harry Ryans			

Overview

Number of Study Items:

Processes: 1

Nodes: 25

What ifs: 277

Consequences: 335

Safeguards: 408

Recommendations: 135

Comments: 0

Est. Total Cost of Implementation:

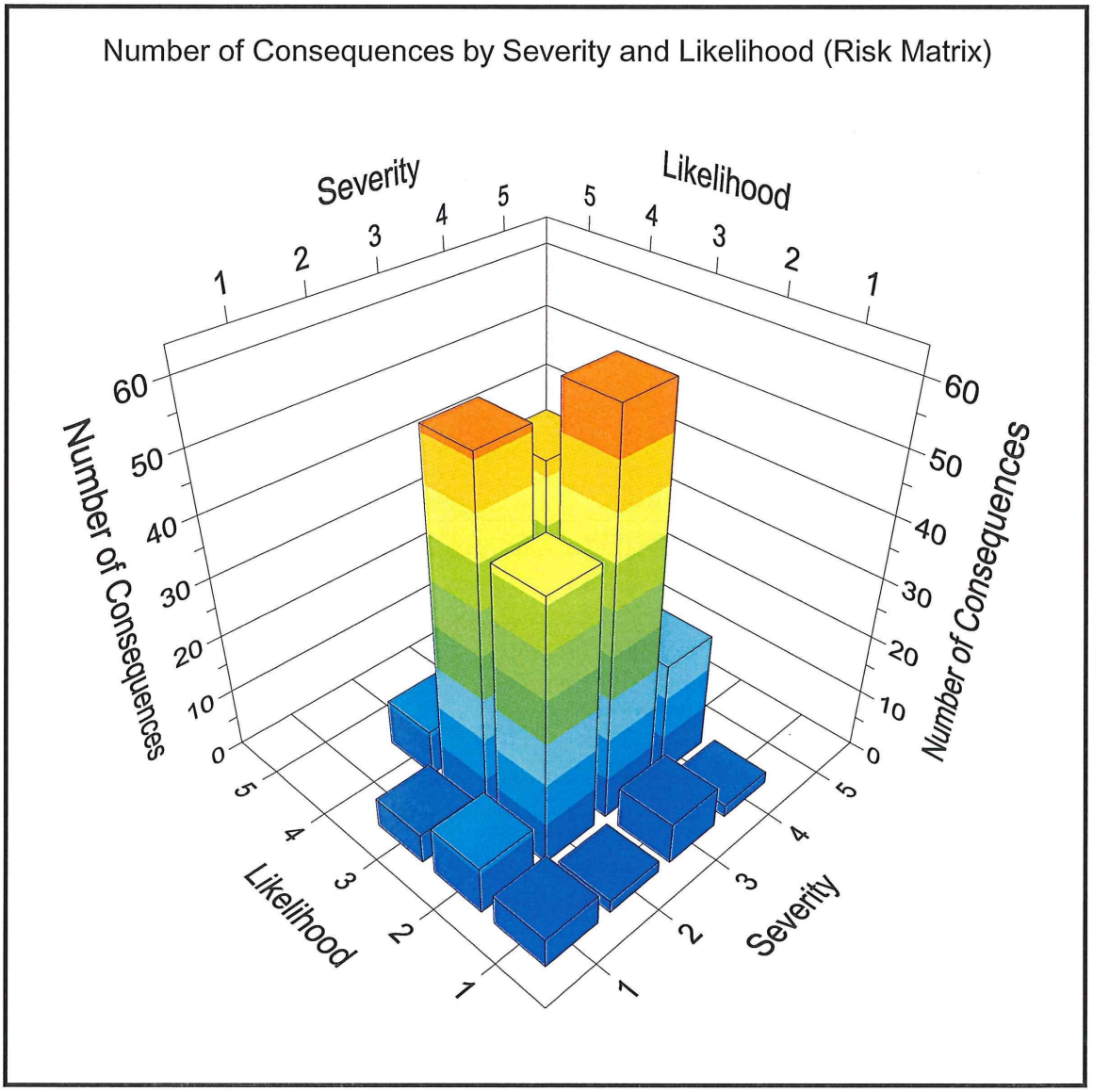
Breakdown by Process

Processes	Number of Study Items				
	Nodes	What ifs	Consequences	Safeguards	Recommendations
1. Diamond recovery plant.	25	277	335	408	244

Breakdown by Node

Processes	Nodes	Number of Study Items			
		What ifs	Consequences	Safeguards	Recommendations
1. Diamond recovery plant.	1. Underground primary crushing	17	27	26	17
	2. Underground Hoisting and coarse ore conveying	6	10	12	6
	3. Primary crushing	17	22	20	13
	4. Coarse ore bin and transfer	11	14	16	8
	5. Secondary crushing	8	13	15	6
	6. Tertiary crushing	19	22	23	22
	7. Scrubbing & cleaning	13	15	18	16
	8. DMS feed preparation	14	17	21	18
	9. DMS module 1 mixing	8	8	12	7
	10. DMS module 1 screens	13	12	16	12
	11. DMS module 1 pumping	10	12	13	11
	12. DMS module 1 separator	9	9	10	8
	13. Recovery sizing & storage	12	19	18	10
	14. Recovery fines middles & coarses X-ray	6	10	8	9
	15. Recovery grease tables & screens	13	17	21	9
	16. Recovery dryers, X-ray and screens	15	15	17	10
	17. Recovery - diamond cleaning room	4	3	3	6
	18. Degritting	12	15	24	6
	19. Thickener slimes	21	10	19	9
	20. Rejects transport	10	10	12	7
	21. Rejects Centrifuges	12	25	32	10
	22. Make-up water	7	8	15	5
	23. Clarified and make-up water	8	8	14	8
	24. FeSi Make-up circuit.	9	9	10	7
	25. General	3	5	13	4

S x L (Risk Matrix)



Parking Lot

	Description	Responsible
1	Consider enclosed conveyors and feeders 3500-CV-001/2 3500-FE-001/2.	Harry Ryans
2	Verify pump box sizing (3600-BX-005).	Harry Ryans

1150-HY-001
HYDRAULIC UNIT –
10260 LEVEL ORE No.1 ROCK BREAKER

1150-HE-001
OIL HEATER

1150-PU-001
HYDRAULIC PUMP

HS 0001

REMOTE CONTROL

1150-RB-001
ROCK BREAKER –
10260 LEVEL ORE NO.1

56 kW

1150-GZ-001
GRIZZLY – 10260
LEVEL STATIC ORE NO.1
600 mm

1150-HY-002
HYDRAULIC UNIT –
10260 LEVEL ORE No.2 ROCK BREAKER

1150-HE-002
OIL HEATER

1150-PU-002
HYDRAULIC PUMP

HS 0002

REMOTE CONTROL

1150-RB-002
ROCK BREAKER –
10260 LEVEL ORE NO.2

56 kW

1150-GZ-002
GRIZZLY – 10260
LEVEL STATIC ORE NO.2
600 mm

1150-HY-003
HYDRAULIC UNIT –
10080 LEVEL ORE No.1 ROCK BREAKER

1150-HE-003
OIL HEATER

1150-PU-003
HYDRAULIC PUMP

HS 0003

1150-RB-003
ROCK BREAKER –
10080 LEVEL ORE NO.1

56 kW

1150-GZ-004
GRIZZLY – 10080
LEVEL STATIC ORE NO.1
600 mm

REMOTE CONTROL

1150-RB-004
ROCK BREAKER –
10080 LEVEL ORE NO.2

56 kW

1150-GZ-005
GRIZZLY – 10080
LEVEL STATIC ORE NO.2
600 mm

REMOTE CONTROL

1150-HY-004
HYDRAULIC UNIT –
10080 LEVEL ORE No.2 ROCK BREAKER

1150-HE-004
OIL HEATER

1150-PU-004
HYDRAULIC PUMP

HS 0004

1150-RB-005
ROCK BREAKER –
9900 LEVEL ORE NO.1

56 kW

1150-GZ-007
GRIZZLY – 9900 LEVEL
STATIC ORE NO.1
600 mm

1150-RB-006
ROCK BREAKER –
9900 LEVEL ORE NO.2

56 kW

1150-GZ-008
GRIZZLY – 9900 LEVEL
STATIC ORE NO.2
600 mm

REMOTE CONTROL

1150-HY-005
HYDRAULIC UNIT –
9900 LEVEL ORE No.1 ROCK BREAKER

1150-HE-005
OIL HEATER

1150-PU-005
HYDRAULIC PUMP

HS 0005

1150-XX-001
CHAIN CURTAIN –
ORE

1.1 kW

1150-HY-006
HYDRAULIC UNIT –
9900 LEVEL ORE No.2 ROCK BREAKER

1150-HE-006
OIL HEATER

1150-PU-006
HYDRAULIC PUMP

HS 0006

REMOTE CONTROL

1150-CH-001
CHUTE – U/G PRIMARY
CRUSHER APRON FEEDER FEED

ORE
1100-49D4-0002
TO PRIMARY CRUSHING APRON FEEDER
1150-FE-001

AIR
DISTRIBUTION

PI 0008 | PAL 0008 | PALL 0008

XA 0008

PIT

HOLD

1150-CO-001
COMPRESSOR

1150-RA-001
AIR RECEIVER

Node 1

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ISSUE REGISTER

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REVISION REGISTER

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Montréal (Québec) Canada H2Z 1Z3

amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: stornoway (renard) inc. – les diamants

PROJECT: RENARD PROJECT

TITLE: UNDERGROUND PRIMARY CRUSHING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	1100	49 D4	0001	PA

504421A1ATHEN – FRAME A1 HORIZONTAL ENGLISH

PLANT AIR
XX*-1150-PA-XXX-PCB2PW
PRV 0073
1150-CK-001
CRANE - U/G PRIMARY CRUSHER AREA OVERHEAD
25/5 t
32.8 kW
1150-BH-001
BAG HOUSE - U/G PRIMARY CRUSHER
3.73 kW
HS 0075 B
HS 0075 A
1150-FA-001
FAN - U/G PRIMARY CRUSHER BAGHOUSE
56 kW
TO ATMOSPHERE
ORE
1100-49D4-0001
FROM ORE CHAIN CURTAIN 1150-XX-001
HA 0012 A
HA 0012 B
START-UP HORN & BEACON
XA 0013
LAH 0018
XS 0013
LSH 0018
HS 0012 A *
HS 0012 B *
HS 0020 A
HS 0020 B
HS 0070
1150-CM-001
CCTV CAMERA
SAL 0010
SSL 0010
SE 0010 *
1150-CH-002
CHUTE - U/G PRIMARY CRUSHER VIBRATING GRIZZLY FEED
1150-CH-004
CHUTE - U/G PRIMARY JAW CRUSHER FEED
HS 0025 B
HS 0025 A
1150-FE-001
APRON FEEDER - PRIMARY CRUSHING
2,400 mm W x 6 m L
22 kW
1150-GZ-010
GRIZZLY - U/G PRIMARY CRUSHER VIBRATING
1,830 mm W x 5.5 m L
45 kW
1150-CH-003
CHUTE - U/G PRIMARY CRUSHING APRON FEEDER SPILLAGE
1150-CH-006
CHUTE - GRIZZLY SCREEN U/S
1150-CH-005
CHUTE - U/G PRIMARYJAW CRUSHER PRODUCT
1150-CR-001
CRUSHER - U/G PRIMARY JAW
1,400 x 1,070 mm
200 kW
START-UP HORN & BEACON
XA 0033
XS 0033
SE 0040 *
SSL 0040 *
SAL 0040
XS 0042
XA 0042
HA 0031 C-D
HS 0031 * C-D
1150-MS-001
SELF CLEANING MAGNET - CRUSHER PRODUCT CONVEYOR
1,067 mm W Belt
13.7 kW
HS 0043 B
HS 0043 A
1150-CH-007
CHUTE - U/G CRUSHER PRODUCT CONVEYOR DISCHARGE
LSH 0044
LAH 0044
-250 mm
1150-HY-007
HYDRAULIC UNIT - PRIMARY CRUSHING APRON FEEDER
1150-HE-007
OIL HEATER
1150-FA-002
FAN - OIL COOLER
1150-PU-007
HYDRAULIC PUMP
HS 0017 B
HS 0017 A
HS 0015 B
HS 0015 A
HIC 0016
SE 0030 *
SSL 0030
SAL 0030
1150-CV-001
CONVEYOR - CRUSHER PRODUCT
1067 mm W x 40 m L
7.5 kW
ZS 0032 C *
ZS 0032 D *
ZA 0032 C,D
HS 0031 A-B *
HA 0031 A-B
ZS 0032 A *
ZS 0032 B *
ZA 0032 A,B
HS 0035 B
HS 0035 A
UT 0045
LI 0045
LAL 0045
LALL 0045
LAH 0045
LAHH 0045
1150-BI-001
BIN - ORE
1,800 t
1150-HY-009
HYDRAULIC UNIT - ORE APRON FEEDER
1150-HE-008
OIL HEATER
1150-FA-003
FAN - OIL COOLER
1150-PU-008
HYDRAULIC PUMP
HS 0057
HS 0055
HIC 0056
1150-XX-003
CHAIN CURTAIN - CRUSHED ORE
1.1 kW
1150-CH-008
CHUTE - ORE APRON FEEDER FEED
1150-HY-010
START-UP HORN & BEACON
HS 0062 A
HS 0062 B
HS 0060 B
HS 0060 A
1150-HE-009
OIL HEATER - GAP ADJUSTMENT
1150-PU-009
GREASE PUMP
1150-PU-010
HYDRAULIC PUMP - GAP ADJUSTMENT
HIC 0063
SE 0050 *
SSL 0050 *
SAL 0050
1150-FE-003
APRON FEEDER - ORE
1,220 mm W x 6 m L
15 kW
HS 0051 A,B *
HA 0051 A,B
START-UP HORN & BEACON
XA 0052
XS 0051
LSH 0053
LAH 0053
1150-CH-009
CHUTE - ORE APRON FEEDER DISCHARGE
1150-CH-010
CHUTE - ORE APRON FEEDER SPILLAGE
ORE
1100-49D4-0003
TO LOADING HOPPER FEED CONVEYOR 1150-CV-002
SPILLAGE
1100-49D4-0003
TO LOADING HOPPER FEED CONVEYOR 1150-CV-002

Model

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SNC-LAVALIN
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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

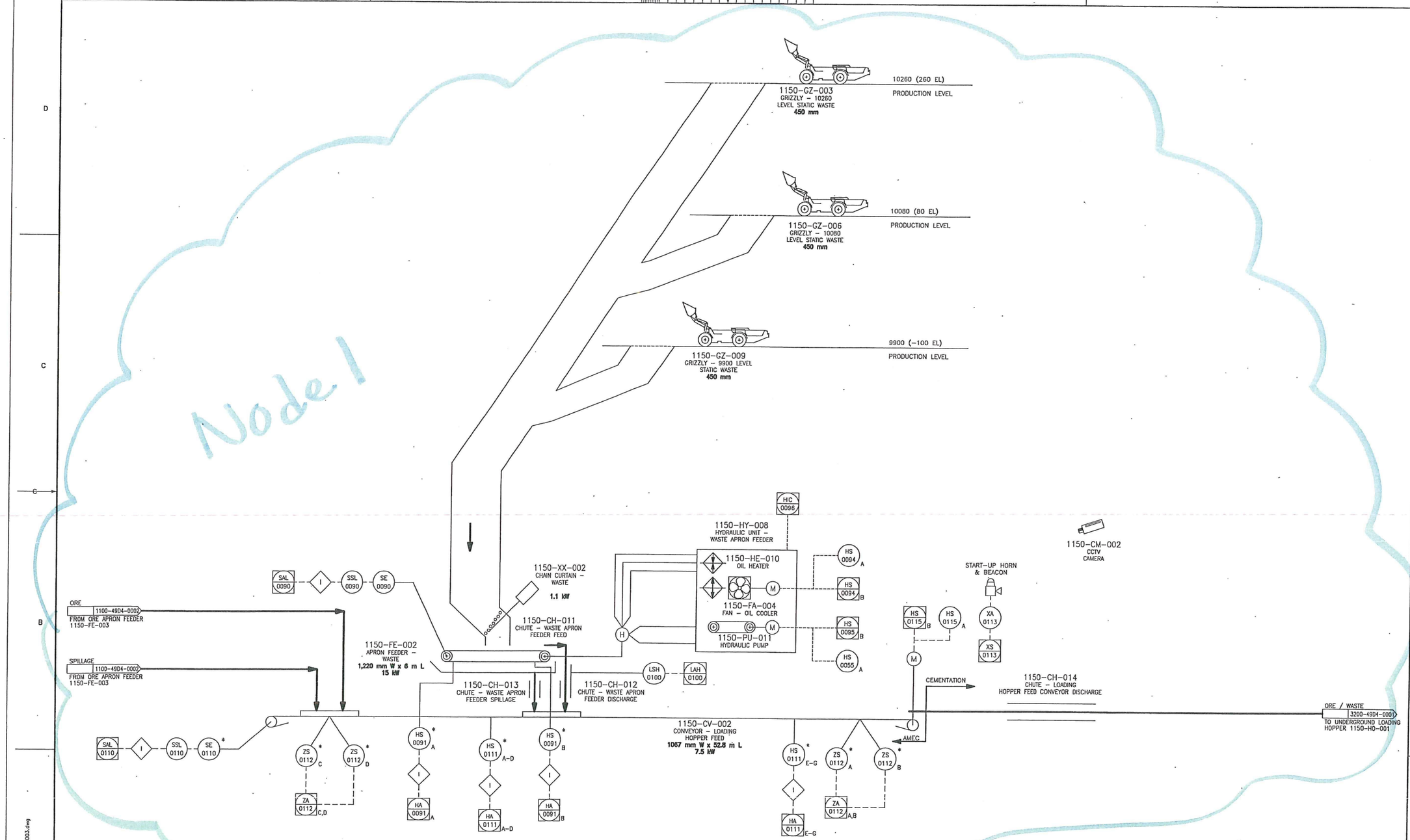
CLIENT
les diamants stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
UNDERGROUND PRIMARY CRUSHING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	1100	49 D4	0002	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH



ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
–	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

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ISSUE REGISTER

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INITIALS: * DESIGNED ** APPROVED

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No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: UNDERGROUND PRIMARY CRUSHING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	1100	49 D4	0003	PA

504421ATHEN – FRAME A1 HORIZONTAL ENGLISH

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PATH: P:\CAD\PRC\P&ID'S\504421-1100-49-D4-0003.dwg

Node1

ORE / WASTE
1100-49D1-0003
FROM LOADING HOPPER FEED CONVEYOR 1150-CV-002

1150-HO-001
HOPPER - UNDERGROUND LOADING

HOLD

UNDERGROUND

HOLD

TRANSFER CAR

LIT 0130

LI 0130 | LAH 0130 | LAHH 0130 | LAL 0130 | LALL 0130

1155-BI-001
BIN - HOISTED ORE
300 t

CEMENTATION

AMEC

1155-CM-001
CCTV CAMERA

HS 0140
HS 0140
VFD
M
HIC 0141
ZI 0151
ZS 0151

1155-FE-001
FEEDER - HOISTED ORE PAN
1067 mm W x 1524 mm L
2.35 kW

SE 0160 *
SSL 0160
I
SAL 0160

START-UP HORN & BEACON
XA 0163 B
XS 0163 B

ZS 0162 * | ZS 0162 *
ZA 0162

HS 0161 C * | HS 0161 D *
I | I
HA 0161 C,D

1155-CV-001
CONVEYOR - COARSE ORE BIN FEED
1067 mm W
45 kW

WE 0190
WIT 0190
WIC 0190 | WIC 0190 | WALL 0190
WQI 0190 | WAH 0190 | WAHH 0190

1155-SC-001
BELT SCALE - COARSE ORE FEED UNDERGROUND

ZS 0162 * | ZS 0162 *
ZA 0162

LAL 0155 | LALL 0155 | LI 0155
LAH 0155 | LAHH 0155
LIT 0155

CRUSHED ORE PILE OR CRUSHED WASTE PILE

U/G ORE
3200-49D4-0002
TO ROM STOCKPILE

TO WASTE PILE

HA 0161 A,B
I | I
HS 0161 A * | HS 0161 B *

1155-CH-002
CHUTE - COARSE ORE BIN FEED CONVEYOR DISCHARGE

M
I
HS 0165 A | HS 0165 B
LSH 0170
LAH 0170

START-UP HORN & BEACON
XA 0163 A
XS 0163 A

ORE
3200-49D4-0003
TO COARSE ORE BIN 3210-BI-002

Node 2

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
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PROFESSIONAL SEAL

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CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT
stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
SURFACE PRIMARY CRUSHING AND UNDERGROUND HOISTING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49 D4	0001	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 4:34pm
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PLANT AIR
PLANT AIR DISTRIBUTION HEADER
XX*-3210-PA-XXX-PCB2PW
PRV 0282
U/G ORE
3200-49D4-001
FROM CRUSHED ORE PILE
ROM
OPEN PIT R2, R3, R4
ROM STOCKPILE
'R' NO DUMP
'G' DUMP
XA 0202 A,B
XS 0202 A,B
3210-HY-004
HYDRAULIC UNIT - PLANT FEED BIN ROCK BREAKER
3210-HE-003
OIL HEATER
3210-PU-003
HYDRAULIC PUMP
HS 0208
HS 0208
3210-BH-001
BAG HOUSE - SURFACE PRIMARY CRUSHER
3.73 kW
HS 0280 B
HS 0280 A
3210-FA-001
FAN - SURFACE PRIMARY CRUSHER BAG HOUSE
56 kW
TO ATMOSPHERE
START-UP HORN & BEACON
HA 0251 A-D
HS 0285 B
HS 0285 A
XA 0253 A
XS 0253 A
HS 0251 A-D
HS 0255 B
HS 0255 A
3210-CH-006
CHUTE - CRUSHER PRODUCT CONVEYOR DISCHARGE
LSH 0258
LAH 0258
ZS 0252 A
ZS 0252 B
ZA 0252 A,B
ORE
3200-4904-0003
TO COARSE ORE BIN 3210-BI-002
DUMP LIGHT
LAHH 0200
LAH 0200
LALL 0200
LAL 0200
LJ 0200
LJT 0200
3210-RB-001
ROCK BREAKER - PLANT FEED BIN
56 kW
3210-CM-001
CCTV CAMERA
3210-BI-001
BIN - PRIMARY CRUSHER FEED
80 tonne
LAH 0212
LSH 0212
SAL 0210
SSL 0210
SE 0210
3210-FE-001
APRON FEEDER - PLANT FEED BIN
2400 mm W x 7.4 m L
22 kW
HS 0211 B
HS 0211 A
HA 0211 B
HA 0211 A
3210-CH-001
CHUTE - PLANT FEED BIN APRON FEEDER DISCHARGE
HS 0220 B
HS 0220 A
HS 0225 B
HS 0225 A
3210-GZ-002
GRIZZLY - PRIMARY CRUSHER VIBRATING
1,830 mm W x 5.5 m L
45 kW
3210-CH-003
CHUTE - JAW CRUSHER FEED
SE 0265
SSL 0265
SAL 0265
3210-CR-001
CRUSHER - PRIMARY JAW
1400 x 1070 mm
200 kW
3210-CH-002
CHUTE - PLANT FEED BIN APRON FEEDER SPILLAGE
3210-CH-005
CHUTE - GRIZZLY SCREEN U/S
3210-CH-004
CHUTE - JAW CRUSHER PRODUCT
HS 0266 B
HS 0266 A
3210-HY-001
HYDRAULIC UNIT - PLANT FEED BIN APRON FEEDER
3210-HE-001
OIL HEATER
3210-FA-001
FAN - SURFACE PRIMARY CRUSHER BAG HOUSE
56 kW
3210-PU-001
HYDRAULIC PUMP
HS 0217 B
HS 0217 A
HS 0215 B
HS 0215 A
SE 0250
SSL 0250
SAL 0250
3210-CV-001
CONVEYOR - CRUSHER PRODUCT
1067 mm W x 150 m L
60 kW
ZS 0252 C
ZS 0252 D
ZA 0252 C,D
HS 0251 E-H
HA 0251 E-H
START-UP HORN & BEACON
XA 0253 B
XS 0253 B
HS 0231 A
HS 0231 B
HS 0230 B
HS 0230 A
3210-HY-
HYDRAULIC UNIT - JAW CRUSHER
3210-HE-002
OIL HEATER - GAP ADJUSTMENT
3210-PU-002
HYDRAULIC PUMP - GAP ADJUSTMENT
2.2 kW
3210-PU-
HYDRAULIC PUMP
3210-SC-001
BELT SCALE - CRUSHER PRODUCT CONVEYOR
WE 0260
WIT 0260
WIC 0260
WIQ 0260
WAL 0260
WALL 0260
WAH 0260
WAHH 0260
3210-MS-001
SELF CLEANING MAGNET - CRUSHER PRODUCT CONVEYOR
1,067 mm W Belt
13.7 kW
WY 0260
Node3

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DRAWN	K. CATO	ENGINEERING MANAGER	
CHECKED		PROJECT MANAGER	
DATE	2011/02/15	CLIENT	
SCALE	NTS		

CLIENT
les diamants
stornoway
(renard) inc.

PROJECT
RENARD PROJECT

TITLE
SURFACE PRIMARY CRUSHING AND UNDERGROUND HOISTING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49 D4	0002	PA

504121A1HEN - FRAME A1 HORIZONTAL ENGLISH

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PATH: P:\C4D\PRC\P&ID's\504421-3200-49-D4-0002.dwg

Node 4

ORE
3200-49D4-0004
FROM SECONDARY CONE CRUSHER 3220-CR-001

ORE
3200-49D4-0001
FROM COARSE ORE BIN FEED CONVEYOR 1155-CV-001

ORE
3200-49D4-0002
FROM CRUSHER PRODUCT CONVEYOR 3210-CV-001

LALL 0300 | LAL 0300 | LI 0300 | LIT 0300
LAHH 0300 | LAH 0300

LIT 0301 | LI 0301 | LAL 0301 | LALL 0301
LAH 0301 | LAHH 0301

3210-BI-002
BIN – COARSE ORE
3,000 tonne

HA 0321 A
I
HS 0321 A *

3210-FE-002
APRON FEEDER – COARSE ORE BIN No.1
1220 mm W x 8100 mm L
22.4 kW

SAL 0320 | I | SSL 0310 * | SE 0310 *

HA 0311 A,B | I | HS 0311 A,B *

3210-FE-003
APRON FEEDER – COARSE ORE BIN No.2
1220 mm W x 8100 mm L
22.4 kW

SAL 0320 | I | SSL 0320 *
SE 0320 *

HA 0321 B | I | HS 0321 B *

3210-HY-003
HYDRAULIC UNIT – COARSE ORE BIN NO.2 APRON FEEDER

3210-HE-005
OIL HEATER
HS 0326 | HS 0326

3210-FA-005
FAN – OIL COOLER
0.37 kW
HS 0325 | HS 0325

3210-PU-005
HYDRAULIC PUMP
HIC 0327
IRSP

DUST
3200-49D4-0008
TO CRUSHER AREA DUST SCRUBBER FAN 3230-FA-001

3210-CM-002
CCTV CAMERA

SE 0355 * | SSL 0355 * | SAL 0355

DUST
3200-49D4-0007
TO TRANSFER TOWER BAG HOUSE 3160-BH-001

HS 0335 A | HS 0335 B | I | XS 0356 * | XA 0356
HS 0357 B
HS 0357 A

START-UP HORN & BEACON
XA 0033
XS 0033

3210-MS-002
SELF CLEANING MAGNET – SIZING SCREEN FEED CONVEYOR
1,067 mm W Belt
13.7 kW

3210-CH-011
CHUTE – SIZING SCREEN FEED NO.1 CONVEYOR DISCHARGE
LSH 0339 | LAH 0339

START-UP HORN & BEACON
XA 0343
XS 0343

HS 0345 | HS 0345

3210-HY-002
HYDRAULIC UNIT – COARSE ORE BIN NO.1 APRON FEEDER

3210-HE-004
OIL HEATER
2 kW
HS 0316 B | HS 0316 A

3210-FA-004
FAN – OIL COOLER
0.37 kW

3210-PU-004
HYDRAULIC PUMP
HS 0315 B | HS 0315 A
HIC 0317
IRSP

3210-CH-008
CHUTE – COARSE ORE BIN NO.1 APRON FEEDER SPILLAGE

3210-CH-010
CHUTE – COARSE ORE BIN NO.2 APRON FEEDER SPILLAGE

LSH 0319 | LAH 0319

3210-CH-007
CHUTE – COARSE ORE BIN NO.1 APRON FEEDER DISCHARGE

3210-CH-009
CHUTE – COARSE ORE BIN NO.2 APRON FEEDER DISCHARGE

LSH 0329 | LAH 0329

SE 0330 * | SSL 0330 * | I | SAL 0330

3210-CV-002
CONVEYOR – SIZING SCREEN FEED No.1
1067 mm W x 125 m L
37.3 kW

ZS 0332 C * | ZS 0332 D *
ZA 0332 C,D

HS 0331 A–D * | I | HA 0331 A–D

WE 0350 * | WIT 0350 | WIC 0350 | WQI 0350 | WAL 0350 | WALL 0350 | WAH 0350 | WAHH 0350
MWIC 0350

3210-SC-002
BELT SCALE – SIZING SCREEN FEED CONVEYOR

ZS 0332 A * | ZS 0332 B *
ZA 0332 A,B

3210-CV-003
CONVEYOR – SIZING SCREEN FEED No.2
1067 mm W x 8.5 m L
7.5 kW

SE 0340 * | SSL 0340 * | I | SAL 0340

HS 0341 A,B * | I | HA 0341 A,B

ZS 0342 A * | ZS 0342 B *
ZA 0342 A,B

~250 mm

3210-CH-012
CHUTE – SIZING SCREEN FEED NO.2 CONVEYOR DISCHARGE
LSH 0349 | LAH 0349

ORE
3200-49D4-0006
TO SIZING SCREEN FEED CONV. NO.3 3210-CV-004

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PROFESSIONAL SEAL

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APPROVAL

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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les éléments stornoway (canada) inc.
PROJECT: RENARD PROJECT
TITLE: SURFACE PRIMARY CRUSHING AND UNDERGROUND HOISTING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49 | D4	0003	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

Node 5

XS 0363 / XA 0363 — START-UP HORN & BEACON

HA 0361 A–D; HS 0361 C,D; HS 0361 A,B

ORE — FROM SIZING SCREEN FEED CONV. NO.2 3210–CV–003 — 3200–49D4–0003

SE 0360; SSL 0360; SAL 0360

ZS 0362 C; ZS 0362 D; ZA 0362 C,D

ZS 0362 A; ZS 0362 B; ZA 0362 A,D

3210–CV–004
CONVEYOR – SIZING
SCREEN FEED No.3
1067 mm W x 90 m L
56 kW

HS 0365 B; HS 0365 A

3210–CH–013
CHUTE – SIZING
SCREEN FEED NO.3 CONVEYOR DISCHARGE

LSH 0370; LAH 0370

HS 0375 B; HS 0375 A

3220–CH–001
CHUTE – SIZING
SCREEN FEED

3220–CH–003
CHUTE – SIZING
SCREEN MIDDLES

3220–SN–001
SCREEN – SIZING
2.44 m W x 5.5 m L
18.7 kW

+50 mm

–50 mm +30 mm

–30 mm

3220–UN–001
UNDERPAN – SIZING SCREEN

HV 0380; HS 0380

3220–DV–001
DIVERTER – HPGR

ZS 0380 A; ZS 0380 B; ZI 0380 A; ZI 0380 B

SAL 0390; SSL 0390; SE 0390

3220–CH–002
CHUTE – SIZING
SCREEN O/S

HA 0391 A,B; HS 0391 B; HS 0391 A

HS 0397 B; HS 0397 A

ZI 0394 A; ZS 0394 A; ZS 0394 B; ZI 0394 B

ZS 0392 A; ZS 0392 B; ZA 0392 A,B

XS 0393 / XA 0393 — START-UP HORN & BEACON

3220–CV–001
CONVEYOR – SECONDARY
CRUSHER FEED

HS 0395 B; HS 0395 A

GAP ADJUSTMENT PANEL

HS 0430 START/STOP; XI 0431 POWER ON; HS 0432 CLOSE SETTING; HS 0433 OPEN SETTING

XI 0434 ADJUST RUN; PI 0435 PRESSURE; XI 0436 CLEAR; XA 0437 LOW CLAMPING PRESSURE; XA 0438 LOW RELEASE PRESSURE

DUST — 3200–49D4–0008 — TO CRUSHER AREA DUST SCRUBBER FAN 3230–FA–001

3220–CM–001
CCTV CAMERA

LE 0400; LIT 0400; LI 0400; LAL 0400; LALL 0400; LAH 0400; LAHH 0400

PSV

3220–CH–005
CHUTE – SECONDARY
CRUSHER FEED

3220–CR–001
CRUSHER – SECONDARY
CONE

3220–PU–001
PUMP – SECONDARY
CRUSHER HYDRAULIC OIL

HS 0425 B; HS 0425 A

3220–HY–001
HYDRAULIC UNIT –
SECONDARY CRUSHER

3220–FA–001
FAN – SECONDARY
CRUSHER LUBE UNIT

HS 0415 A; HS 0415 B

HS 0410 A; HS 0410 B

3220–CH–006
CHUTE – SECONDARY
CRUSHER PRODUCT

3220–HE–001
HEATER – SECONDARY
CRUSHER OIL

PDI; PDI; PDI

3220–HX–001
HEAT EXCHANGER –
LUBE OIL

3220–PU–002
PUMP – SECONDARY
CRUSHER LUBE OIL

HS 0420 B; HS 0420 A

3220–LU–001
LUBE UNIT –
SECONDARY CRUSHER

ORE — 3200–49D4–0003 — TO SIZING SCREEN FEED CONVEYOR NO. 1 3210–CV–002

ORE — 3200–49D4–0005 — TO LDR SURGE BIN FEED CONVEYOR

ORE — 3200–49D4–0005 — TO HPGR SURGE BIN FEED NO. 1 CONVEYOR 3220–CV–002

ORE — 3200–49D4–0005 — TO HPGR SURGE BIN FEED NO. 1 CONVEYOR 3220–CV–002

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PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: SECONDARY CRUSHING AND LARGE DIAMOND RECOVERY PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49	D4	0004	PA

504421ATHEN – FRAME A1 HORIZONTAL ENGLISH

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HOLD

Out of Scope Hazop

NODE 6

CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION

ORE
3200-49D4-0004
FROM HPGR DIVERTER 3220-DV-001

3510-CV-001
CONVEYOR – LDR SURGE BIN FEED
610 mm W

3510-BI-001
BIN – LDR SURGE
100 t

3510-FE-001
FEEDER – LDR PAN
762 mm x 1067 mm

3510-CV-002
CONVEYOR – LDR WASH SCREEN FEED
610 mm W

3510-SN-001
SCREEN – LDR WASH
1,200 mm W x 4,270 mm L

3510-HO-001
HOPPER – X-RAY FEED
5 t

3510-XR-001
SORTER – X-RAY No.1

3510-XR-002
SORTER – X-RAY No.2

R C R C

3510-BX-001
PUMP BOX – LDR WASH SCREEN U/F
1 m3

3510-PU-001
PUMP – LDR WASH SCREEN U/F
4 x 3

SLURRY
3600-49D4-0001
TO DEGRIT PUMPBOX 3600-BX-001

3510-HO-002
HOPPER – GLOVEBOX FEED
500 kg

3510-XX-001
GLOVE BOX

VAULT

3510-CV-003
CONVEYOR – LDR REJECTS
810 mm W

LARGE DIAMOND RECOVERY CIRCUIT

ORE
3200-49D4-0003
FROM HPGR DIVERTER 3220-DV-001

ORE
3200-49D4-0003
FROM SIZING SCREEN 3220-SN-001

3220-CV-002
CONVEYOR – HPGR SURGE BIN FEED NO.1
914 mm W
3.7 kW

SE 0450 *
SSL 0450 *
I
SAL 0450

ZS 0452 C *
ZS 0452 D *
ZA 0452 C,D

HS 0451 C *
HS 0451 D *
I
HA 0451 C,D

HS 0451 A *
HS 0451 B *
I
HA 0451 A,B

ZS 0452 A *
ZS 0452 B *
ZA 0452 A,B

M
HS 0455 B
HS 0455 A
LSH 0457
LAH 0457

ORE
3200-49D4-0006
TO HPGR SURGE BIN FEED NO.2 CONV. 3230-CV-001

START-UP HORN & BEACON
XA 0453
XS 0453

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PROFESSIONAL SEAL

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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT
les diamants stornoway (renard) inc.

PROJECT
RENARD PROJECT

TITLE
SECONDARY CRUSHING AND LARGE DIAMOND RECOVERY PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49 D4	0005	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 3:29pm
PATH: P:\CAD\PROJ\0400's\504421-3200-49-04-0005.dwg

Node6

MOD 1 FLOATS +6 mm
3400-49D4-0009
FROM MOD 1 FLOATS SCREEN 3410-SN-003

MOD 2 FLOATS +6 mm
3400-49D4-0010
FROM MOD 2 FLOATS SCREEN 3420-SN-003

ORE +30mm
3300-49D4-0001
TROMMEL O/S CONVEYOR 3300-CV-005

ORE -50mm
3200-49D4-0005
FROM HPGR FEED CONVEYOR NO.1 3220-CV-002

3220-CH-004
CHUTE - HPGR SURGE BIN FEED NO.1 CONVEYOR DISCHARGE

SE 0500 *
SSL 0500 *
I
SAL 0500

ZS 0502 *
ZA 0502

ZS 0502 *

HS 0501 C *
I
HA 0501 C,D

HS 0501 D *
I

3230-CV-001
CONVEYOR - HPGR SURGE BIN FEED NO.2
914 mm W x 90 m L
11 kW

START-UP HORN & BEACON
XA 0503
XS 0503

HA 0501 A,B

I
HS 0501 A *

I
HS 0501 B *

ZS 0502 A *
ZA 0502 A,B

ZS 0502 B *

M
HS 0505 A
HS 0505 B

3220-CH-001
CHUTE - SIZING SCREEN FEED

LSH 0508
LAH 0508

3230-CV-002
CONVEYOR - HPGR SURGE BIN FEED NO.3
914 mm W x 10 m L
7.5 kW

SE 0510 *
SSL 0510 *
I
SAL 0510

HS 0511 A *
I
HS 0511 B *
I
HA 0511 A,B

ZS 0512 A *
ZS 0512 B *
ZA 0512 A,B

M
HS 0515 A
HS 0515 B

3220-CH-002
CHUTE - SIZING SCREEN O/S

LSH 0518
LAH 0518

START-UP HORN & BEACON
XA 0513
XS 0513

DUST
3200-49D4-0008
TO CRUSHER AREA DUST SCRUBBER FAN 3230-FA-001

3230-MS-001
SELF CLEANING MAGNET - HPGR SURGE BIN FEED CONVEYOR NO.2
914 mm W belt
6.5 kW

HS 0531 A
HS 0531 B
M
XS 0530 *
XA 0530

HS 0525 A
HS 0525 B
M

START-UP HORN & BEACON
XA 0523
XS 0523

LAH 0528
LSH 0528

3220-CH-003
CHUTE - SIZING SCREEN MIDDLES

ZS 0522 A *
ZS 0522 B *
ZA 0522 A,B

HS 0521 A *
I
HS 0521 B *
I
HA 0521 A,B

3230-CV-003
CONVEYOR - HPGR SURGE BIN FEED NO.4
914 mm W x 99 m L
58 kW

SE 0520 *
SSL 0520 *
I
SAL 0520

HS 0521 C *
I
HS 0521 D *
I
HA 0521 C,D

ZS 0522 C *
ZS 0522 D *
ZA 0522 C,D

ORE
3200-49D4-0007
TO HPGR SURGE BIN 3230-BI-001

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
-	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

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REVISION REGISTER

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT
les elements
stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
TERTIARY CRUSHING
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49 D4	0006	PA

504421A1MEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:29pm
PATH: P:\CAD\PRC\P&ID's\504421-3200-49-D4-0006.dwg

DUST
3200-49D4-0003
FROM SIZING SCREEN FEED NO. 2 CONVEYOR

XX"-1150-PA-XXX-PCB2PW

ORE
3200-49D4-0006
FROM HPGR SURGE BIN FEED NO. 4 CONVEYOR 3230-CV-003

3230-BI-001
BIN - HPGR SURGE
250 tonne

LT 0540
LAL 0540
LALL 0540
LI 0540
LAH 0540
LAHH 0540

HS 0545 A
HS 0545 B
VFD
M
WY 0560
~50mm

3230-FE-001
FEEDER - HPGR PAN
1057 mm W x 1524 mm L
2.35 kW

3230-CH-004
CHUTE - HPGR FEEDER DISCHARGE

SE 0550
SSL 0550
SAL 0550
ZS 0552 A
ZS 0552 B
ZA 0552 A,B
HS 0551 A
HS 0551 B
HA 0501 C,D

3230-CV-004
CONVEYOR - HPGR FEED
914 mm W x 29.2 m L
22 kW

3230-SC-001
BELT SCALE - HPGR FEED CONVEYOR

WE 0560
WIT 0560
WIC 0560
WQI 0560
WWIC 0560
WAL 0560
WALL 0560
WAH 0560
WAHH 0560
RATIO
TO FIC-0670

HS 0555 A
HS 0555 B
START-UP HORN & BEACON
XA 0553
XS 0553

3230-MD-001
METAL DETECTOR - HPGR FEED CONVEYOR
1 kW

LSHH 0558
LAHH 0558

XS 0565
XA 0565
LX 0559

UT 0559
LI 0559
LAH 0559
LAHH 0559

3230-CH-005
CHUTE - HPGR FEED

3230-CR-001
HPGR
1.4 m dia. x 1.4 m W
1400 kW

3230-CH-006
CHUTE - HPGR PRODUCT

SE 0590
SAL 0590
SSL 0590
ZS 0592 C
ZS 0592 D
ZA 0592 C,D

3160-BH-001
BAG HOUSE - TRANSFER TOWER

3160-FA-001
FAN - TRANSFER TOWER BAG HOUSE

M
HS 0565 B
HS 0565 A

DUST
3200-49D4-0008
TO CRUSHER AREA DUST SCRUBBER FAN 3230-FA-001

TO ATMOSPHERE

HS 0566 B
HS 0566 A

TOTE

HA 0591 D-F
HS 0591 D
HS 0591 E
HS 0591 F

3230-CV-005
CONVEYOR - SCRUBBER FEED NO.1
914 mm W x 99 m L
37.3 kW

HA 0591 A-C
HS 0591 A
HS 0591 B
HS 0591 C

START-UP HORN & BEACON
HS 0595 A
HS 0595 B
XA 0593
XS 0593

LSH 0598
LAH 0598

ZS 0592 A
ZS 0592 B
ZA 0592 A,B

ORE
3300-49D4-0001
TO SCRUBBER FEED NO.2 CONVEYOR 3300-CV-001

HS 0598 A
HS 0598 B

3"-3230-EP-360-PCB2VS
3300-49D4-0002
TO SCRUBBER DISCHARGE SCREEN 3300-SN-001

LIT 0599
LI 0599
LAH 0599
LAHH 0599

3230-PU-002
PUMP - HPGR AREA SPILLAGE
3
11 kW

HS 0571 A
HS 0571 B
VFD
M
HIC 0572
LIT-0559
TE 0575
TIT 0575
TI 0575
TAH 0575
TAHH 0575
HS 0572 A
HS 0572 B
PDSH 0574
PDAH 0574
HS 0573 A
HS 0573 B

HS 0581 A
HS 0581 B
HIC 0582
LIT-0559
TE 0585
TIT 0585
TI 0585
TAH 0585
TAHH 0585
HS 0582 A
HS 0582 B
PDSH 0584
PDAH 0584
HS 0583 A
HS 0583 B

Node6

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ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

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REVISION REGISTER

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PROFESSIONAL SEAL

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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: stornoway (canada) inc.
PROJECT: RENARD PROJECT
TITLE: TERTIARY CRUSHING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49 D4	0007	PA

504421A1WEN - FRAME A1 HORIZONTAL ENGLISH

Node6

CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
3"-3230-PW-XXX-PCB2PW

DUST COLLECTION
3200-49D4-0004
FROM SECONDARY CRUSHING AREA

DUST COLLECTION
3200-49D4-0003
FROM COARSE ORE APRON FEEDERS 3210-FE-002 & 003

DUST
3200-49D4-0006
FROM HPGR SURGE BIN FEED AREA

DUST
3200-49D4-0007
FROM HRGR AREA

SEAL WATER HEADER
XX"-3230-SH-XXX-PCB2PW

HV 0605
HS 0605
S

3230-FA-001
FAN - CRUSHER AREA DUST SCRUBBER
30 kW

3230-DS-001
DUST SCRUBBER - CRUSHER AREA

TO ATMOSPHERE

LV 0620
O/F

M
HS 0600 A
HS 0600 B

LIT 0620
LIC 0620
LAL 0620
LALL 0620
LAH 0620
LAHH 0620

3230-BX-001
PUMP BOX - CRUSHER AREA DUST SCRUBBER
1 m3

3"-3230-DS-301-PCB2VS
4"-3230-DS-302-PCB2VS

3"-3230-DS-303-PPE2MS
SLURRY
3600-49D4-0001
TO DEGRIT PUMP BOX 3600-BX-001

HS 0630 B
HS 0630 A
M

3230-PU-001
PUMP - CRUSHER AREA DUST SCRUBBER EFFLUENT
1.5 x 1
3.7 kW

HV 0633
S
HS 0633

FS
FSL 0632
FAL 0632

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
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ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

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PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE	

CLIENT: les alamandes stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: TERTIARY CRUSHING PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3200	49 D4	0008	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

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CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
10"-3300-PW-XXX-PCB2PW

FROM WWIC-0560
RSP
FIT 0670
FIC 0670
FCV 0670

START-UP HORN & BEACON
XA 0653
XS 0653

3300-CM-001
CCTV CAMERA

ORE
FROM SCRUBBER FEED NO.1 CONV. 3230-CV-005
3200-49D4-0007

3230-CH-007
CHUTE - SCRUBBER FEED NO.1 CONVEYOR DISCHARGE

HA 0651 C,D
HS 0651 C
HS 0651 D
SE 0650
SSL 0650
SAL 0650
ZS 0652 C
ZS 0652 D
ZA 0652 C,D

3300-CV-001
CONVEYOR - SCRUBBER FEED NO.2
914 mm W x 82.4 m L
30 kW

HA 0651 A,B
HS 0651 A
HS 0651 B
ZS 0652 A
ZS 0652 B
ZA 0652 A,B

HS 0655 A
HS 0655 B

3300-CH-001
CHUTE - SCRUBBER FEED NO.2 CONVEYOR DISCHARGE

LSH 0658
LAH 0658

HS 0675 A
HS 0675 B

3300-SB-001
SCRUBBER - ROTARY
3 m dia. x 7.6 m L
300 kW

3300-CH-002
CHUTE - SCRUBBER DISCHARGE SCREEN FEED

3300-CH-003
CHUTE - TROMMEL O/S

+30 mm

3300-CK-001
CRANE - SCRUBBER/HPGR AREA OVERHEAD
50/10 tonne
58.7 kW

HA 0691 C,D
HS 0691 C
HS 0691 D
HA 0691 A,B
HS 0691 A
HS 0691 B

SE 0690
SSL 0690
SAL 0690
ZS 0692 C
ZS 0692 D
ZA 0692 C,D
ZS 0692 A
ZS 0692 B
ZA 0692 A,B

3300-CV-005
CONVEYOR - TROMMEL O/S
762 mm W x 12 m L
2.2 kW

3300-CH-004
CHUTE - TROMMEL O/S CONVEYOR DISCHARGE

HS 0695 A
HS 0695 B
XA 0693
XS 0693
LSH 0698
LAH 0698

START-UP HORN & BEACON

ORE
TO HPGR SURGE BIN FEED NO.2 CONV. 3230-CV-001
3200-49D4-0008

ORE
TO SCRUBBER DISCHARGE SCREEN 3300-SN-001
3300-49D4-0002

Node7

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
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ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

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REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE	

CLIENT
les diamants stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
SCRUBBING AND SCREENING
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3300	49 D4	0001	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:30pm
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CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
4"-3300-PW-XXX-PCB2PW

CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
8"-3300-PW-XXX-PCB2PW

ORE
FROM ROTARY SCRUBBER 3300-SB-001
3300-49D4-0001

ORE
FROM HPGR SPILLAGE PUMP 3230-PU-002
3200-49D4-0007
3"-3230-EP-360-PCB2VS

3"-3300-EP-460-PCB2VS

LCV 0710

HV 0705
HS 0705
ZSC 0705
ZSO 0705
ZIC 0705
ZIO 0705

HS 0700 A
HS 0700 B
M

3300-SN-001
SCREEN - SCRUBBER DISCHARGE
3 m W x 6.7 m L
45 kW

-30+6mm
-6+1mm

LSH 0708
LAH 0708

3300-CH-005
CHUTE - SCRUBBER DISCHARGE SCREEN PRODUCT

HA 0731 C,D
HS 0731 C
HS 0731 D

SE 0730
SSL 0730
SAL 0730
ZS 0732 C
ZS 0732 D
ZA 0732 C,D

3300-CV-002
CONVEYOR - DMS SURGE BIN FEED NO.1
762 mm W
30 kW

START-UP HORN & BEACON
XA 0733
XS 0733

HA 0731 A,B
HS 0731 A
HS 0731 B
HS 0735 A
HS 0735 B
M

ZS 0732 A
ZS 0732 B
ZA 0732 A,B

ORE
TO DMS SURGE BIN FEED NO. 2 CONV. 3300-CV-003
3400-49D4-0001

LALL 0710
LAL 0710
LIC 0710
LAHH 0710
LAH 0710
LIT 0710
LE 0710

ZSC 0721
ZIC 0721
ZSO 0721
ZIO 0721
HS 0721
HV 0721

HS 0750 A
HS 0750 B
M

LIT 0740
LI 0740
LAH 0740
LAHH 0740

TRAMP SCREEN
TRAMP SCREEN

3300-PU-002
PUMP - SCRUBBER AREA SPILLAGE
3
5.6 kW

12"-3300-DS-401-PCB2VS

1 1/2"
1 1/2"
1 1/2"

3300-BX-001
PUMP BOX - SCRUBBER DISCHARGE SCREEN
15 m3

16"-3300-DS-402-PCB2VS

-1 mm

HS 0720 A
HS 0720 B
M

3300-PU-001
PUMP - SCRUBBER DISCHARGE SCREEN U/FLOW
10 x 8
56 kW

14"-3300-DS-403-PPE2MS

SLURRY
TO DEGRIT PUMP BOX 3600-BX-001
3600-49D4-0001

HV 0722
HS 0722
ZSC 0722
ZSO 0722
ZIC 0722
ZIO 0722

FAL 0726
FS 0726
HV 0725
S
HS 0725

SEAL WATER HEADER
XXX"-3300-SH-XXX-PCB2PW.

Node 7

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ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
-	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER
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PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

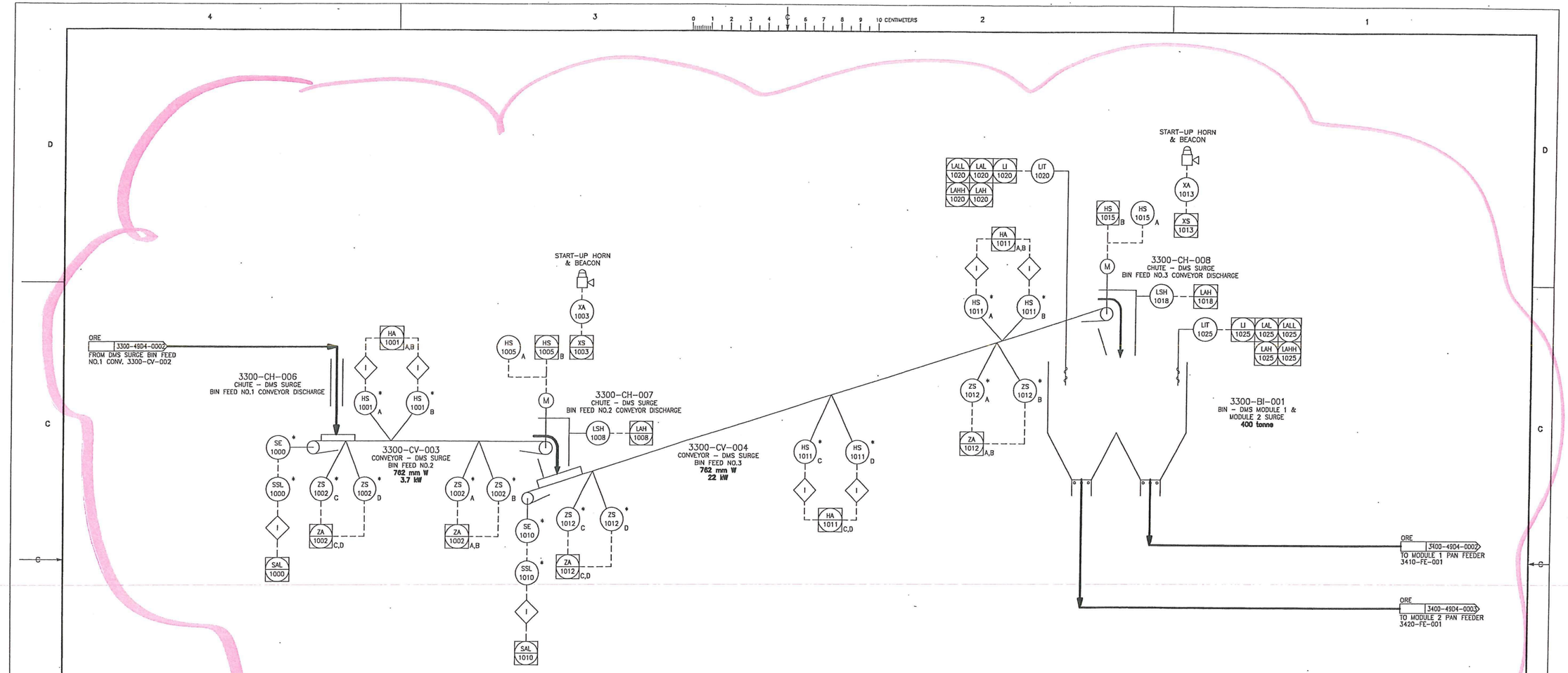
CLIENT
les éléments stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
SCRUBBING AND SCREENING
PIPING AND INSTRUMENTATION

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3300	49 D4	0002	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH



Node 8

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
–	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

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REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT
les diamants stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
DMS FEED PREPARATION
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0001	PA

504421ATHEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 3:31pm
PATH: P:\CAD\PRCV\R&D's\504421-3400-49-D4-0001.dwg

CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION

6"-3410-PW-XXX-PCB2PW

START-UP HORN & BEACON
XA 1043
XS 1043

HV 1055
ZSO 1055
ZIO 1055
ZSC 1055
ZIC 1055
S
HS 1055

3"-3410-EP-560-PCB2VS

3400-49D4-0003
TO MODULE 2 FEED PREP SCREEN 3420-SN-001

ORE
3400-49D4-0001
FROM DMS MODULE 1 AND MODULE 2 SURGE BIN 3300-BI-001

3410-FE-001
FEEDER - MODULE 1
PAN
762 mm W x 1067 mm L
1.4 kW

HS 1030 A
HS 1030 B
VFD
M
WY 1050

HA 1041 C,D
HS 1041 C
HS 1041 D

3410-CH-001
CHUTE - MODULE 1
FEEDER DISCHARGE

3410-CV-001
CONVEYOR - MODULE 1
FEED
762 mm W
7.5 kW

HA 1041 A,B
HS 1041 A
HS 1041 B
HS 1045 A
HS 1045 B

3410-CH-003
CHUTE - MODULE 1
FEED CONVEYOR DISCHARGE

LSH 1048
LAH 1048
HS 1060 A
HS 1060 B

3400-CM-001
CCTV CAMERA

SAL 1040
SSL 1040
SE 1040

3410-SC-001
BELT SCALE - MODULE 1 FEED CONVEYOR

WE 1050
WIT 1050
WIC 1050
WQI 1050
WAL 1050
WALL 1050
WAH 1050
WAHH 1050

ZS 1042 A
ZS 1042 B
ZA 1042 A,B
ZS 1042 C
ZS 1042 D
ZA 1042 C,D

-30+1mm

3410-SN-001
SCREEN - MODULE 1
FEED PREP
3 m W x 8 m L
18 kW

3"-3420-EP-660-PCB2VS

ORE
3400-49D4-0004
TO MODULE 1 MIXING BOX 3410-BX-002

HS 1095 A
HS 1095 B
M
TRAMP SCREEN
TRAMP SCREEN

LIT 1090
LI 1090
LAH 1090
LAHH 1090

3410-PU-003
PUMP - PREP SCREEN AREA SPILLAGE
3
15 kW

LIT 1070
LI 1070
LAL 1070
LALL 1070
LAH 1070
LAHH 1070

HS 1076
ZSC 1076
ZIC 1076
ZSO 1076
ZIO 1076

3410-BX-009
PUMP BOX - MODULE 1
PREP SCREEN U/F
4 m3

6"-3410-DS-532-PCB2VS

1 1/2"
1 1/2"
1 1/2"
1 1/2"

HV 1076
S
8"-3410-DS-533-PCB2VS

3410-PU-001
PUMP - MODULE 1
PREP SCREEN U/F
6 x 4

-1 mm
6"-3410-DS-534-PPE2MS
SLURRY
3600-4904-0001
TO DEGRIT PUMP BOX 3600-BX-001

HS 1080 B
HS 1080 A
HV 1077
HS 1077
ZSO 1077
ZSC 1077
ZIO 1077
ZIC 1077
HV 1078
HS 1078
ZSC 1078
ZIC 1078
ZSO 1078
ZIO 1078

HV 1082
S
HS 1082
FS
FS 1081
FA 1081

SEAL WATER HEADER
XX"-3410-SH-XXX-PCB2PW

Node 8

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
-	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
-				

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
-				

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER
-	

PROFESSIONAL SEAL

SNC-LAVALIN
SNC-LAVALIN
455, René-Lévesque Blvd. West
Montréal (Québec) Canada H2Z 1Z3
amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.
PROJECT: RENARD PROJECT
TITLE: DMS MODULE 1 FEED PREPARATION PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0002	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 4:34pm
PATH: P:\CAD\PRO\R&D\A\504421-3400-49-D4-0002.dwg

CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
6"-3420-PW-XXX-PCB2PW

3400-49D4-0002
FROM PREP SCREEN AREA SPILLAGE PUMP 3410-PU-003
3"-3420-EP-660-PCB2VS

ORE
3400-49D4-0001
FROM DMS MODULE 1 AND MODULE 2 SURGE BIN 3300-BI-001

HV 1155
ZSO 1155
ZIO 1155
ZSC 1155
ZIC 1155
HS 1155
S

START-UP HORN & BEACON
XA 1143
XS 1143

HS 1145 A
HS 1145 B
HA 1141 A,B
I
HS 1041 A
HS 1041 B
M
LSH 1148
LAH 1148

HS 1160 A
HS 1160 B

3420-FE-001
FEEDER - MODULE 2 PAN
762 mm x 1067 mm
1.4 kW
HS 1130 A
HS 1130 B
VFD
M
WY 1150

HA 1141 C,D
HS 1141 C
HS 1141 D
3420-CH-001
CHUTE - MODULE 2 FEEDER DISCHARGE

3420-CV-001
CONVEYOR - DMS MODULE 2 FEED
762 mm W x 38 m L
11 kW

SAL 1140
SSL 1140
SE 1140
ZS 1142 C
ZS 1142 D
ZA 1142 C,D
3420-SC-001
BELT SCALE - MODULE 2 FEED CONVEYOR
WE 1150
WIT 1150
WIC 1150
WQI 1150
WAL 1150
WALL 1150
WAH 1150
WAHH 1150

ZS 1142 A
ZS 1142 B
ZA 1142 A,B
3420-CH-003
CHUTE - MODULE 2 FEED CONVEYOR DISCHARGE

3420-SN-001
SCREEN - MODULE 2 FEED PREP
3 m W x 8 m L
30 kW
-30+1mm
ORE
3400-49D4-0009
TO MODULE 2 MIXING BOX 3420-BX-002

LIT 1170
LAH 1170
LAHH 1170
LI 1170
LAL 1170
LALL 1170

3420-BX-009
PUMP BOX - MODULE 2 PREP SCREEN U/F
4 m3
6"-3420-DS-632-PCB2VS
1 1/2"
1 1/2"
1 1/2"
1 1/2"
S
HS 1176
ZSC 1176
ZIC 1176
ZSO 1176
ZIO 1176
8"-3420-DS-633-PCB2VS
HV 1176
HV 1177
HS 1077
ZSO 1177
ZSC 1177
ZIO 1177
ZIC 1177

-1 mm
6"-3420-DS-634-PPE2MS
SLURRY
3600-49D4-0001
TO DEGRIT PUMPBOX 3600-BX-001

3420-PU-001
PUMP - MODULE 2 PREP SCREEN U/F
8 x 4
7.5 kW
HS 1180 A
HS 1180 B
HV 1178
HS 1178
ZSC 1178
ZIC 1178
ZSO 1178
ZIO 1178

SEAL WATER HEADER
XX"-3420-SH-XXX-PCB2PW
HV 1182
FS
S
HS 1182
FSL 1181
FAL 1181

Node 8

LAST SAVE: 2011/03/25 - 4:35pm
PATH: P:\CAD\PROJ\P&ID's\504421-3400-49-D4-0003.dwg

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
-	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

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ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

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PROFESSIONAL SEAL

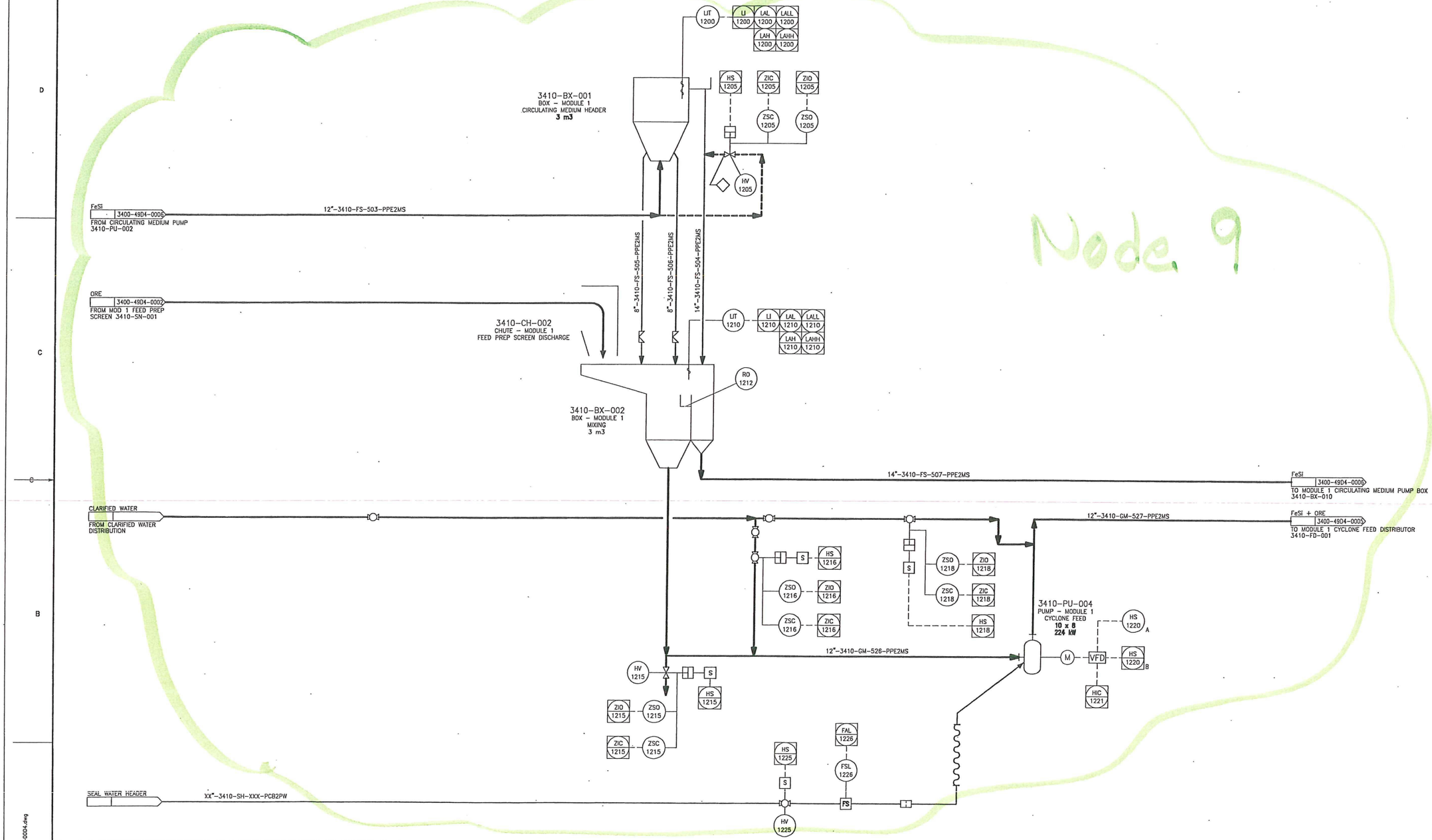
SNC-LAVALIN
SNC-LAVALIN 455, René-Lévesque Blvd. West Montréal (Québec) Canada H2Z 1Z3
amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (renard) inc.
PROJECT: RENARD PROJECT
TITLE: DMS MODULE 2 FEED PREPARATION PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0003	PA

504421A1ATHEN - FRAME A1 HORIZONTAL ENGLISH



Node 9

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
–	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

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ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

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No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC-LAVALIN
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amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: stornoway (renard) inc. – les diamants

PROJECT: RENARD PROJECT

TITLE: DMS MODULE 1
PIPING AND INSTRUMENTATION DIAGRAM
MIXING BOX

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0004	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 4:33pm
PATH: P:\LOAD\PMCVP&ID's\504421-3400-49-D4-0004.dwg

CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
10"-3410-PW-XXX-PCB2PW

FeSi + ORE
3400-49D4-0004
FROM MODULE 1 CYCLONE FEED PUMP 3410-PU-004
12"-3410-GM-527-PPE2MS

3410-FD-001
DISTRIBUTOR - MODULE 1 CYCLONE FEED

PIT 1230 | PI 1230 | PAL 1230 | PALL 1230 | PAH 1230 | PAHH 1230

PIT 1235 | PI 1235 | PAL 1235 | PALL 1235 | PAH 1235 | PAHH 1235

8"-3410-GM-528-PPE2MS
8"-3410-GM-529-PPE2MS
8"-3410-PW-XXX-PCB2PW

ZIC 1242 | ZIO 1242 | ZSC 1242 | ZSO 1242 | HS 1242 | S | HV 1242

3410-CY-001
CYCLONE - MODULE 1 DENSE MEDIUM NO.1
610 mm dia.

3410-CY-002
CYCLONE - MODULE 1 DENSE MEDIUM NO.2
610 mm dia.

3410-BX-004
BOX - MODULE 1 DMS CYCLONE O/F

3410-BX-003
BOX - MODULE 1 DMS CYCLONE U/F

3400-CM-002
CCTV CAMERA

HS 1240 B | HS 1240 A | M

3410-SN-005
SCREEN - MODULE 1 SINKS
1.2 m W x 4.8 m L
11 kW

3410-CH-005
CHUTE - MODULE 1 SINKS DRAIN PANEL FEED

3410-SN-004
DRAIN PANEL - MODULE 1 SINKS

3410-CH-006
CHUTE - MODULE 1 SINKS SCREEN PRODUCT

3410-CH-004
CHUTE - MODULE 1 FLOATS DRAIN PANEL FEED

HS 1245 B | HS 1245 A | M

3410-SN-002
DRAIN PANEL - MODULE 1 FLOATS

3410-SN-003
SCREEN - MODULE 1 FLOATS
3 m W x 6 m L
45 kW

ZIO 1247 | ZIC 1247 | ZSO 1247 | 1247 1247 | HV 1247 | S | HS 1247

3400-CM-003
CCTV CAMERA

3410-CH-007
CHUTE - MODULE 1 FLOATS SCREEN PRODUCT

MOD 1 FLOATS +6mm
3200-49D4-0006
TO FLOATS NO.1 CONV. 3230-CV-001

REJECTS
3600-49D4-0004
TO COARSE REJECTS NO.1 CONV. 3700-CV-001

10"-3410-FD-544-PPE2MS
DILUTE MEDIUM
3400-49D4-0007
TO DILUTE MEDIUM PUMPBOX 3410-BX-011

12"-3410-FS-510-PPE2MS
FeSi
3400-49D4-0006
TO MODULE 1 CIRC. MEDIUM PUMP BOX 3410-BX-010

8"-3410-FS-511-PPE2MS
FeSi
3400-49D4-0006
TO MODULE 1 CIRC. MEDIUM PUMP BOX 3410-BX-010

6"-3410-FD-545-PPE2MS
DILUTE MEDIUM
3400-49D4-0007
TO DILUTE MEDIUM PUMPBOX 3410-BX-011

CONCENTRATE
3500-49D4-0001
TO CONCENTRATE BIN 3500-BI-001

Node 10

LAST SAVE: 2011/03/25 - 3:31pm
PATH: P:\CAD\PRC\P&ID's\504421-3400-49-D4-0005.dwg

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
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ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

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No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC-LAVALIN
SNC-LAVALIN 455, Rond-Léveque Blvd. West Montréal (Québec) Canada H2Z 1Z3

amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: DMS MODULE 1 PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0005	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

Node 11

CLARIFIED WATER — XX"-3410-PW-XXX-PCB2PW — FROM CLARIFIED WATER DISTRIBUTION

DILUTE MEDIUM — 3400-49D4-0007 — 6"-3410-FS-549-PPE2MS — FROM MODULE 1 DENSIFIER O/F SPLITTER 3410-BX-005

FeSi — 3400-49D4-0007 — 6"-3410-FS-516-PPE2MS — FROM MODULE 1 DENSIFYING CYCLONE CLUSTER 3410-CY-003

FeSi — 3400-49D4-0005 — 12"-3410-FS-510-PPE2MS — FROM MODULE 1 FLOATS SCREEN 3410-SN-003

FeSi — 3400-49D4-0005 — 8"-3410-FS-511-PPE2MS — FROM MODULE 1 SINKS SCREEN 3410-SN-005

FeSi — 3400-49D4-0004 — 14"-3410-FS-507-PPE2MS — FROM MODULE 1 MIXING BOX 3410-BX-002

FeSi — 3400-49D4-0007 — 6"-3410-FS-523-PPE2MS — FROM MAG SEPARATORS 3410-MS-001 & 3410-MS-002

FeSi — 3400-49D4-0008 — 4"-3410-FS-521-PPE2MS — FROM FeSI MIXING PUMP 3410-PU-009

PROCESS AIR — 2"-3410-PA-XXX-PCB2PA — FROM PROCESS PLANT AIR DISTRIBUTION

HS 1283 / HV 1283 — HS 1282 / HV 1282 — HS 1281 / HV 1281 — HS 1280 / HV 1280

1"-3410-PA-XXX-PCB2PA

1"-3410-PA-XXX-PCB2PA

1"-3410-PA-XXX-PCB2PA

1"-3410-PA-XXX-PCB2PA

3410-BX-010
PUMP BOX – MODULE 1
CIRCULATING MEDIUM
22 m3

4"

12"-3400-FS-501-PCB2VS

14"-3410-FS-502-PCB2VS

2"-3410-PW-XXX-PCB2PW

HV 1290 — S — HS 1290 — ZSO 1290 — ZIO 1290 — ZSC 1290 — ZIC 1290

HV 1291 — S — HS 1291 — ZSO 1291 — ZIO 1291 — ZSC 1291 — ZIC 1291

HV 1292 — S — HS 1292 — ZSO 1292 — ZIO 1292 — ZSC 1292 — ZIC 1292

HV 1293 — S — HS 1293 — ZSO 1293 — ZIO 1293 — ZSC 1293 — ZIC 1293

LIT 1250 — LAH 1250 — LAHH 1250 — LI 1250 — LAL 1250 — LALL 1250

4"-3410-FS-515-PPE2MS — FeSi 3400-49D4-0007 — TO MODULE 1 DESIFYING CYC. CLUSTER 3410-CY-003

3"-3410-EP-562-PPB2VS

HS 1255 — ZSO 1255 — ZIO 1255 — ZSC 1255 — ZIC 1255 — S — HV 1255

6"-3410-FS-514-PCB2VS

HV 1256 — S — HS 1256 — ZSO 1256 — ZIO 1256 — ZSC 1256 — ZIC 1256

HS 1260 A / HS 1260 B — M — 3410-PU-007 PUMP – MODULE 1 DENSIFIER FEED 4 x 3 37 kW

HS 1310 A / HS 1310 B — M — TRAMP SCREEN — TRAMP SCREEN

LIT 1305 — LI 1305 — LAH 1305 — LAHH 1305

3410-PU-005 PUMP – MODULE 1 FESI SPILLAGE 3 15 kW

HS 1265 — ZSO 1265 — ZIO 1265 — ZSC 1265 — ZIC 1265 — S — HV 1265

HV 1294 — S — ZSC 1294 — ZIC 1294 — ZSO 1294 — ZIO 1294 — HS 1294

HV 1266 — S — HS 1266 — ZSO 1266 — ZIO 1266 — ZSC 1266 — ZIC 1266

HS 1270 A — M — VFD — HS 1270 B — HIC 1271

3410-PU-002 PUMP – MODULE 1 CIRCULATING MEDIUM 10 x 8 224 kW

DX 1300 — DIT 1300 — DIC 1300 — DAL 1300 — DALL 1300 — DAH 1300 — DAHH 1300

12"-3410-FS-503-PPE2MS — FeSi 3400-49D4-0004 — TO MODULE 1 CIRCULATING MEDIUM HEADER BOX 3410-BX-001

MAKE-UP WATER — 1-1/2"-3410-RW-XXX-PCB2PW — FROM MAKE-UP WATER DISTRIBUTION

DCV 1300 — DY 1300

HS 1273 — S — HV 1273 — FS 1272 — FAL 1272

1/2"-3410-SH-XXX-PCB2PW

HS 1263 — S — HV 1263 — FS 1262 — FAL 1262

SEAL WATER HEADER — 1"-3410-SH-XXX-PCB2PW — 1/2"-3410-SH-XXX-PCB2PW

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
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No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC·LAVALIN
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amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: two diamonds stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: DMS MODULE 1 PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0006	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 4:34pm
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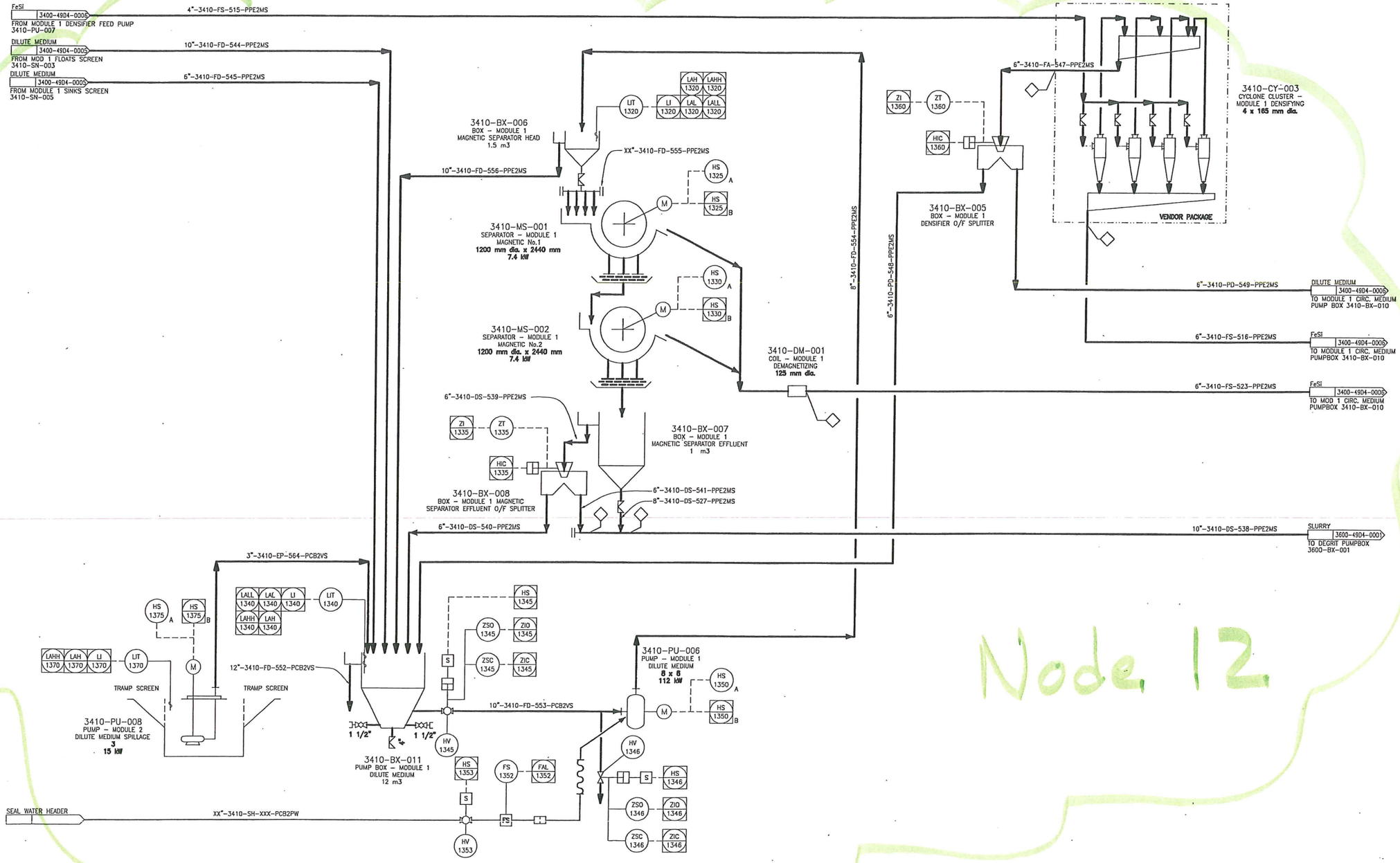

Node 12

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
–	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

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No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC·LAVALIN
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amec

PREPARATION	APPROVAL
DESIGNED: L. JOE	DISCIPLINE ENGINEER: H. RYANS
DRAWN: K. CATO	ENGINEERING MANAGER:
CHECKED:	PROJECT MANAGER:
DATE: 2011/02/15	CLIENT:
SCALE: NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: DMS MODULE 1 - DILUTE MEDIUM PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49_D4	0007	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 4:35pm
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Node P
24

HS
M
3410-HT-001
HOIST - FESI
3 tonne
2.2 kW
PCV 1392
3410-BH-001
DUST COLLECTOR - FESI MIXING
0.37 kW
HS 1390 A
HS 1390 B
TO ATMOSPHERE
PLANT AIR HEADER
XX"-3420-PA-XXX-PCB2PA
3410-FA-001
DUST COLLECTOR - FAN FESI MIXING
3.7 kW
HS 1395 A
HS 1395 B
3410-HO-001
HOPPER - FESI MIXING
1 m3
HS 1385 A
HS 1385 B
4"-3410-FS-519-PCB2VS
HS 1422
ZSO 1422
ZIO 1422
ZSC 1422
ZIC 1422
S
4"-3410-FS-521-PPE2MS
FeSI
3400-49D4-0008
TO MOD 1 CIRC. MEDIUM PUMPBOX 3410-BX-010
HV 1422
SAL 1380
I
SSL 1380 *
SE 1380 *
3410-SF-001
SCREW FEEDER - FESI MIXING
250 mm dia.
2.2 kW
HS 1420
ZSO 1420
ZIO 1420
ZSC 1420
ZIC 1420
HS 1408
ZSO 1408
ZIO 1408
ZSC 1408
ZIC 1408
HS 1405 A
HS 1405 B
4"-3420-FS-619-PPE2MS
FeSI
3400-49D4-0011
TO MOD 2 CIRC. MEDIUM PUMPBOX 3420-BX-010
HV 1420
CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
NNF 2"-3410-PW-XXX-PCB2PW
HV 1380
LIT 1400
LAH 1400
LAHH 1400
LI 1400
LAL 1400
LALL 1400
HS 1410
ZSO 1410
ZIO 1410
ZSC 1410
ZIC 1410
3410-BX-012
PUMP BOX - FESI MIXING
2 m3
3410-PU-009
PUMP - FESI MIXING
4 x 3
15 kW
HS 1415 A
HS 1415 B
6"-3410-FS-520-PCB2VS
HV 1410
HV 1412
HS 1412
ZSO 1412
ZIO 1412
ZSC 1412
ZIC 1412
HS 1418
FS 1417
FAL 1417
FS
SEAL WATER HEADER
XX"-3420-SH-XXX-PCB2PW
HV 1418

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
-	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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REVISION REGISTER

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	INITIALS: * DESIGNED ** APPROVED			

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER
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REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC-LAVALIN
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455, René-Lévesque Blvd. West
Montréal (Québec) Canada H2Z 1Z3

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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT
les diamants stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
DMS MODULE 1 - DILUTE MEDIUM PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0008	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:32pm
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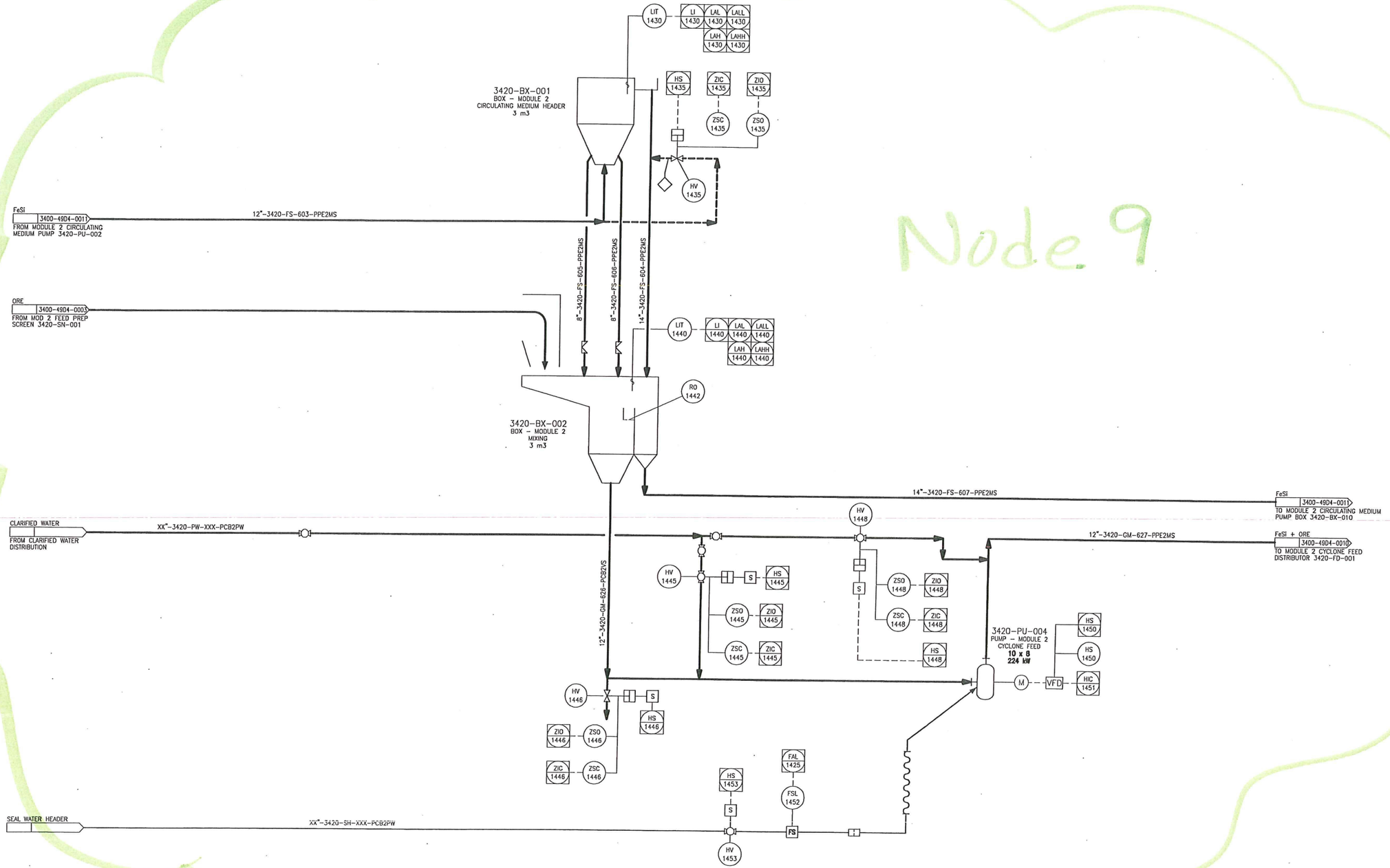

Node 9

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
–	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
–				

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
–				

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: DMS MODULE 2
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 | D4	0009	PA

504421ATHEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 4:33pm
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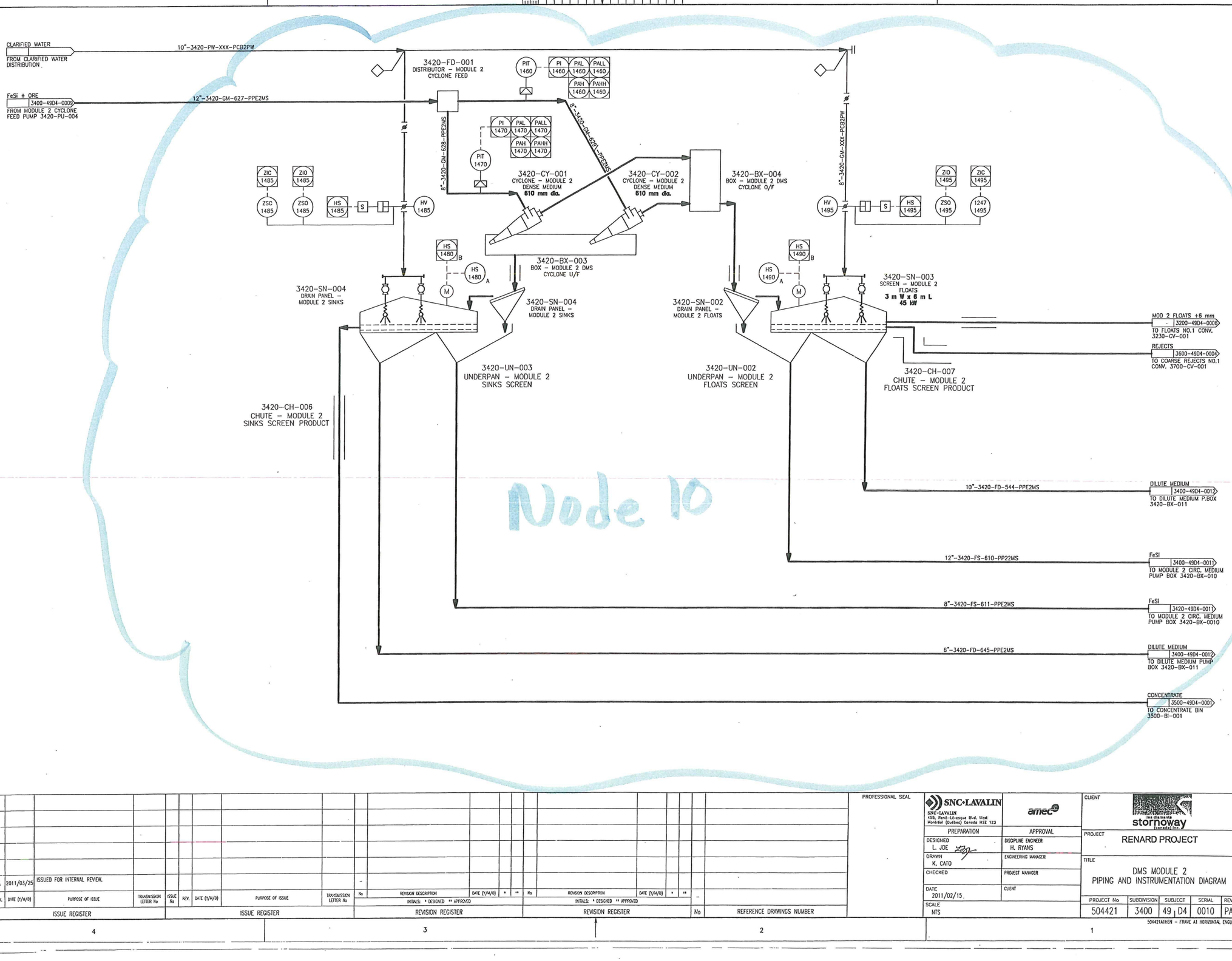

Node 10

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
-	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
-				

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: DMS MODULE 2 PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0010	PA

50442IAIHEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:32pm
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CLARIFIED WATER
FROM CLARIFIED WATER DISTRIBUTION
XX"-3420-PW-XXX-PCB2PW

DILUTE MEDIUM
3400-49D4-0012
FROM MODULE 2 DENSIFIER O/F SPLITTER 3420-BX-005
6"-3420-PD-649-PPE2MS

FeSi
3400-49D4-0012
FROM MODULE 2 DENSIFYING CYCLONE CLUSTER 3420-CY-003
6"-3420-FS-616-PPE2MS

FeSi
3400-49D4-0010
FROM MODULE 2 FLOATS SCREEN 3420-SN-003
12"-3420-FS-610-PPE2MS

FeSi
3400-49D4-0010
FROM MODULE 2 SINKS SCREEN 3420-SN-005
8"-3420-FS-611-PPE2MS

FeSi
3400-49D4-0009
FROM MODULE 2 MIXING BOX 3420-BX-002
14"-3420-FS-607-PPE2MS

FeSi
3400-49D4-0012
FROM MAG SEPARATORS 3410-MS-001 & 3410-MS-002
6"-3420-FS-623-PPE2MS

FeSi
3400-49D4-0008
FROM FeSi MIXING PUMP 3410-PU-009
4"-3420-FS-619-PPE2MS

PROCESS AIR
3600-49D4-0008
FROM PROCESS PLANT AIR RECEIVER 3600-AD-001
2"-3420-PA-XXX-PCB2PW

HS 1550, HS 1551, HS 1552, HS 1553, HV 1550, HV 1551, HV 1552, HV 1553

3420-BX-010
PUMP BOX – MODULE 2
CIRCULATING MEDIUM
22 m3

1"-3420-PA-XXX-PCB2PW
1"-3420-PA-XXX-PCB2PW
1"-3420-PA-XXX-PCB2PW
1"-3420-PA-XXX-PCB2PW

2"-3420-PW-XXX-PCB2PW
2"-3420-PW-XXX-PCB2PW
2"-3420-PW-XXX-PCB2PW
2"-3420-PW-XXX-PCB2PW
2"-3420-PW-XXX-PCB2PW

HV 1560, HS 1560, ZSO 1560, ZIO 1560, ZSC 1560, ZIC 1560
HV 1561, HS 1561, ZSO 1561, ZIO 1561, ZSC 1561, ZIC 1561
HV 1562, HS 1562, ZSO 1562, ZIO 1562, ZSC 1562, ZIC 1562
HV 1563, HS 1563, ZSO 1563, ZIO 1563, ZSC 1563, ZIC 1563

LIT 1500, LAH 1500, LAHH 1500, LI 1500, LAL 1500, LALL 1500

4"-3420-FS-615-PPE2MS
FeSi
3400-49D4-0012
TO MODULE 2 DESIFYING CYC. CLUSTER 3420-CY-003

3"-3420-GM-662-PCB2VS

HS 1515, ZSO 1515, ZIO 1515, ZSC 1515, ZIC 1515

6"-3420-FS-614-PCB2VS

HV 1515

12"-3420-FS-601-PCB2VS

HS 1505, ZSO 1505, ZIO 1505, ZSC 1505, ZIC 1505
HV 1564, ZSC 1564, ZIC 1564, ZSO 1564, ZIO 1564, HS 1564

14"-3420-FS-602-PCB2VS

HV 1505
HV 1506, HS 1506, ZSO 1506, ZIO 1506, ZSC 1506, ZIC 1506

HV 1516, HS 1516, ZSO 1516, ZIO 1516, ZSC 1516, ZIC 1516

3420-PU-007
PUMP – MODULE 2
DENSIFIER FEED
4 x 3
37 kW

HS 1520 A, HS 1520 B

HS 1545 A, HS 1545 B

LIT 1540, LI 1540, LAH 1540, LAHH 1540

TRAMP SCREEN
TRAMP SCREEN

3420-PU-006
PUMP – MODULE 2
DILUTE MEDIUM
8 x 6
112 kW

HS 1510 A, HS 1510 B, VFD, M, HIC 1511

3420-PU-002
PUMP – MODULE 2
CIRCULATING MEDIUM
10 x 8
224 kW

MAKE-UP WATER
FROM MAKE-UP WATER DISTRIBUTION
1-1/2"-3420-RW-XXX-PCB2PW

DCV 1530, DY 1530

HS 1513, S, HV 1513
1/2"-3420-SH-XXX-PCB2PW
FS 1512, FAL 1512

SEAL WATER HEADER
1"-3420-SH-XXX-PCB2PW
1/2"-3420-SH-XXX-PCB2PW

HS 1523, S, HV 1523, FS 1522, FAL 1522

12"-3420-FS-603-PPE2MS
FeSi
3400-49D4-0009
TO MODULE 2 CIRCULATING MEDIUM HEADER BOX 3420-BX-001

DX 1530, DIT 1530, DIC 1530, DAL 1530, DALL 1530, DAHH 1530, DAH 1530

Node 11

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
–	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
–				

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER
–	

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT
les diamants stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
DMS MODULE 2
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49 D4	0011	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 4:34pm
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FeSi
3400-49D4-001
FROM MODULE 2 DENSIFIER FEED PUMP
3420-PU-007
4"-3420-FS-615-PPE2MS

DILUTE MEDIUM
3400-49D4-0010
FROM MOD 2 FLOATS SCREEN
3420-SN-003
10"-3420-FD-644-PPE2MS

DILUTE MEDIUM
3400-49D4-0010
FROM MODULE 2 SINKS SCREEN
3420-SN-005
6"-3420-FD-645-PPE2MS

3420-BX-006
BOX – MODULE 2
DILUTE MEDIUM HEADER
1.5 m3

LIT 1570
LI 1570
LAH 1570
LAHH 1570
LAL 1570
LALL 1570

XX"-3420-MJ-655-PPE2MS

6"-3420-FD-645-PPE2MS

3420-MS-001
SEPARATOR – MODULE 2
MAGNETIC No.1
1200 mm dia. x 2440 mm
7.4 kW

HS 1575 A
HS 1575 B
M

3420-MS-002
SEPARATOR – MODULE 2
MAGNETIC No.2
1200 mm dia. x 2440 mm
7.4 kW

HS 1580 A
HS 1580 B
M

8"-3420-FD-654-PPE2MS

3420-DM-001
COIL – MODULE 2
DEMAGNETIZING
125 mm dia.

6"-3420-DS-639-PPE2MS

ZI 1590
ZT 1590
HIC 1590
HY 1590

3420-BX-007
BOX – MODULE 2
MAGNETIC SEPARATOR EFFLUENT
1 m3

3420-BX-008
BOX – MODULE 2
MAGNETIC SEPARATOR EFFLUENT O/F SPLITTER

6"-3420-DS-641-PPE2MS
8"-3420-DS-637-PPE2MS
6"-3420-DS-640-PPE2MS

3"-3420-EP-664-PCB2VS

HS 1630 A
HS 1630 B
LIT 1635
LI 1635
LAH 1635
LAHH 1635
M

TRAMP SCREEN
TRAMP SCREEN

3420-PU-008
PUMP – MODULE 1
DILUTE MEDIUM SPILLAGE
3
15 kW

LALL 1600
LAL 1600
LI 1600
LIT 1600
LAH 1600
LAHH 1600

12"-3420-FD-652-PCB2VS

HS 1605
ZSO 1605
ZIO 1605
ZSC 1605
ZIC 1605
S
HV 1605
1 1/2"
1 1/2"

3420-BX-011
PUMP BOX – MODULE 2
DILUTE MEDIUM
12 m3

3420-PU-006
PUMP – MODULE 2
DILUTE MEDIUM
8 x 6
112 kW

HS 1620 A
HS 1620 B
M

10"-3420-PD-653-PCB2VS

HV 1616
S
HS 1616
ZSO 1616
ZIO 1616
ZSC 1616
ZIC 1616

HS 1623
FS 1622
FAL 1622
S
FS
HV 1623

SEAL WATER HEADER
XX"-3420-SH-XXX-PCB2PW

ZI 1630
ZT 1630
HIC 1630
3420-BX-005
BOX – MODULE 2
DENSIFIER O/F SPLITTER

6"-3420-FD-647-PPE2MS

3420-CY-003
CYCLONE CLUSTER –
MODULE 2 DENSIFYING
4 x 165 mm dia.

VENDOR PACKAGE

6"-3420-PD-648-PPE2MS

6"-3420-PD-649-PPE2MS
DILUTE MEDIUM
3400-49D4-001
TO MODULE 2 CIRC. MEDIUM
PUMP BOX 3420-BX-010

6"-3420-FS-616-PPE2MS
FeSi
3400-49D4-001
TO MODULE 2 CIRC. MEDIUM
PUMPBOX 3420-BX-010

6"-3420-FS-623-PPE2MS
FeSi
3400-49D4-001
TO MOD 2 CIRC. MEDIUM
PUMPBOX 3420-BX-010

10"-3420-DS-638-PPE2MS
SLURRY
3600-49D4-0001
TO DEGRIT PUMPBOX
J600-BX-001

Node 12

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
–	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/02/15	CLIENT
SCALE NTS	

CLIENT
les diamants stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
DMS MODULE 2 – DILUTE MEDIUM
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3400	49D4	0012	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 4:32pm
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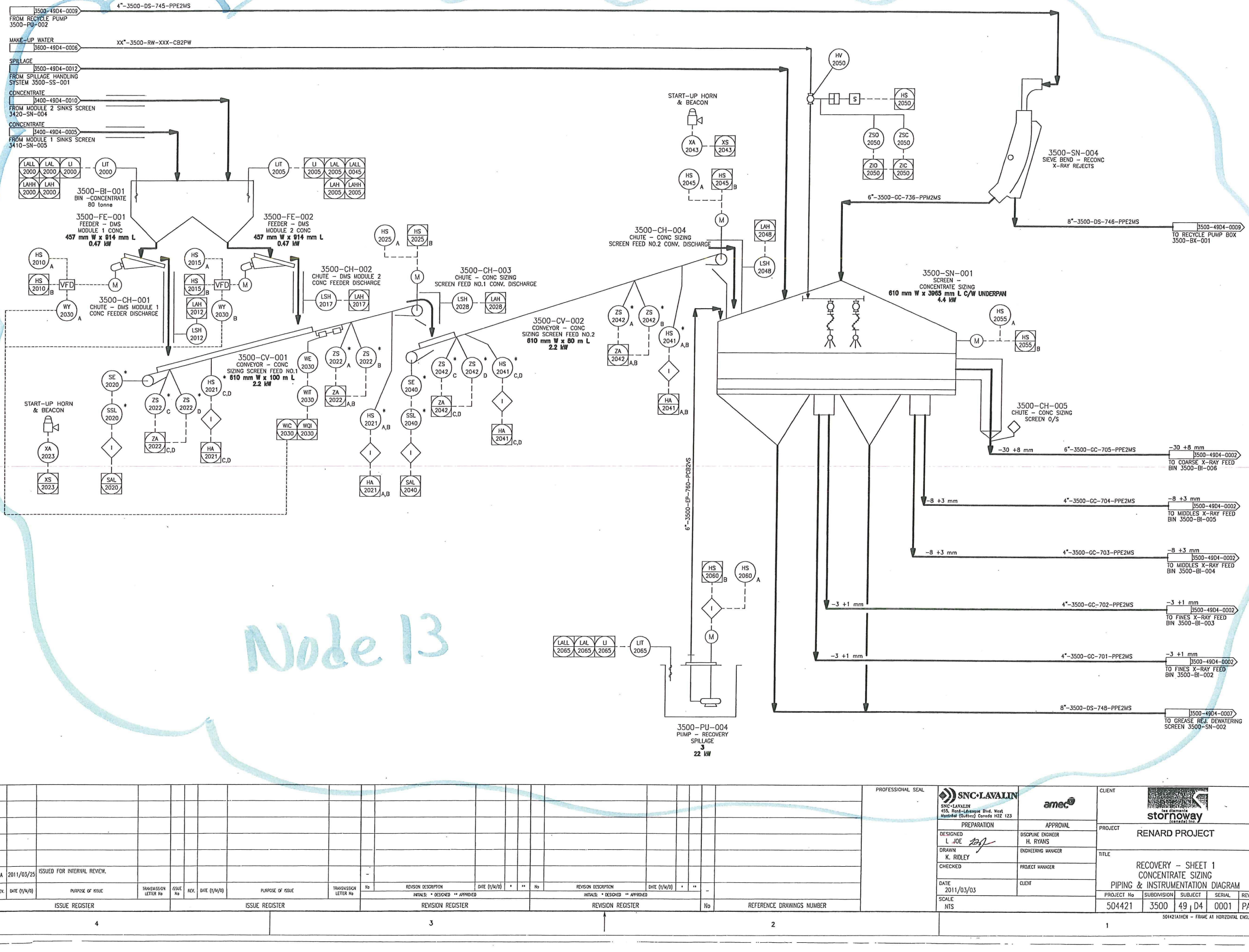

Node 13

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

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REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

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No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE NTS	

CLIENT: stornoway (renard) inc.
PROJECT: RENARD PROJECT
TITLE: RECOVERY - SHEET 1
CONCENTRATE SIZING
PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0001	PA

504421ATHEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:33pm
PATH: P:\CAD\PROJ\400's\504421-3500-49-D4-0001.dwg

P:\C-D\PPC PSID's\504421-3500-49-D4-C2K1.dwg, 3/25/2011 3:33:00 PM, JAN-Plots, KELLY JAN \\AN-Ps1\PUB\pppcl, -NL-UU/AP

-30 +8 mm
3500-49D4-0001
FROM CONCENTRATE SIZING SCREEN 3500-SN-001
6"-3500-GC-705-PPE2MS

-8 +3 mm
3500-49D4-0001
FROM CONCENTRATE SIZING SCREEN 3500-SN-001
4"-3500-GC-704-PPE2MS

-8 +3 mm
3500-49D4-0001
FROM CONCENTRATE SIZING SCREEN 3500-SN-001
4"-3500-GC-703-PPE2MS

-3 +1 mm
3500-49D4-0001
FROM CONCENTRATE SIZING SCREEN 3500-SN-001
4"-3500-GC-702-PPE2MS

-3 +1 mm
3500-49D4-0001
FROM CONCENTRATE SIZING SCREEN 3500-SN-001
4"-3500-GC-701-PPE2MS

LALL 2100 LAL 2100 LI 2100 LIT 2100
LAHH 2100 LAH 2100

3500-BI-002
BIN - FINES
X-RAY FEED NO.1
3 tonne

HV 2102 HS 2102 ZSO 2102 ZSC 2102 ZIO 2102 ZIC 2102

ZSO 2105 * ZIO 2105
ZSC 2106 ZIC 2106

SE 2107 SSL 2107 SAL 2107

3500-FE-003
FEEDER - FINES NO.1 WEIGH
457 mm W
2.2 kW

ZS 2108 A ZS 2108 B WT 2110

HS 2110 A VFD HS 2110 B WIC 2110

LHS 2112 LAH 2112

3500-CH-010
CHUTE - FINES NO.1 WEIGH FEEDER DISCHARGE

LALL 2120 LAL 2120 LI 2120 LIT 2120
LAHH 2120 LAH 2120

3500-BI-003
BIN - FINES
X-RAY FEED NO.2
3 tonne

HV 2122 HS 2122 ZSO 2122 ZSC 2122 ZIO 2122 ZIC 2122

ZSO 2125 * ZIO 2125
ZSC 2126 ZIC 2126

SE 2127 SSL 2127 SAL 2127

3500-FE-004
FEEDER - FINES NO.2 WEIGH
457 mm W
2.2 kW

ZS 2128 A ZS 2128 B WT 2130

HS 2130 A VFD HS 2130 B WIC 2130

LHS 2132 LAH 2132

3500-CH-011
CHUTE - FINES NO.2 WEIGH FEEDER DISCHARGE

LALL 2140 LAL 2140 LI 2140 LIT 2140
LAHH 2140 LAH 2140

3500-BI-004
BIN - MIDDLES
X-RAY FEED NO.1
3 tonne

HV 2142 HS 2142 ZSO 2142 ZSC 2142 ZIO 2142 ZIC 2142

ZSO 2145 * ZIO 2145
ZSC 2146 ZIC 2146

SE 2147 SSL 2147 SAL 2147

3500-FE-005
FEEDER - MIDDLES NO.1 WEIGH
457 mm W
2.2 kW

ZS 2148 A ZS 2148 B WT 2150

HS 2150 A VFD HS 2150 B WIC 2150

LHS 2152 LAH 2152

3500-CH-012
CHUTE - MIDDLES NO.1 WEIGH FEEDER DISCHARGE

LALL 2160 LAL 2160 LI 2160 LIT 2160
LAHH 2160 LAH 2160

3500-BI-005
BIN - MIDDLES
X-RAY FEED NO.2
3 tonne

HV 2162 HS 2162 ZSO 2162 ZSC 2162 ZIO 2162 ZIC 2162

ZSO 2165 * ZIO 2165
ZSC 2166 ZIC 2166

SE 2167 SSL 2167 SAL 2167

3500-FE-006
FEEDER - MIDDLES NO.2 WEIGH
457 mm W
2.2 kW

ZS 2168 A ZS 2168 B WT 2170

HS 2170 A VFD HS 2170 B WIC 2170

LHS 2172 LAH 2172

3500-CH-013
CHUTE - MIDDLES NO.2 WEIGH FEEDER DISCHARGE

LALL 2180 LAL 2180 LI 2180 LIT 2180
LAHH 2180 LAH 2180

3500-BI-006
BIN - COARSE
X-RAY FEED
3 tonne

HV 2182 HS 2182 ZSO 2182 ZSC 2182 ZIO 2182 ZIC 2182

ZSO 2185 * ZIO 2185
ZSC 2186 ZIC 2186

SE 2187 SSL 2187 SAL 2187

3500-FE-007
FEEDER - COARSE WEIGH
457 mm W
2.2 kW

ZS 2188 A ZS 2188 B WT 2190

HS 2190 A VFD HS 2190 B WIC 2190

LHS 2192 LAH 2192

3500-CH-014
CHUTE - COARSE WEIGH FEEDER DISCHARGE

-30 +8 mm
3500-4904-0005
TO COARSE FIRST PASS X-RAY SORTER 3500-XR-009

-8 +3 mm
3500-4904-0004
TO MIDDLES NO.2 FIRST PASS X-RAY SORTER 3500-XR-007

-8 +3 mm
3500-4904-0004
TO MIDDLES NO.1 FIRST PASS X-RAY SORTER 3500-XR-005

-3 +1 mm
3500-4904-0003
TO FINES NO.2 FIRST PASS X-RAY SORTER 3500-XR-003

-3 +1 mm
3500-4904-0003
TO FINES NO.1 FIRST PASS X-RAY SORTER 3500-XR-001

Nod 13

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

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No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER
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PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE	

CLIENT
stornoway
les éléments forestiers

PROJECT
RENARD PROJECT

TITLE
RECOVERY - SHEET 2
CONCENTRATE STORAGE
PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0002	PA

504421ATHEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 4:34pm
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Node 14

-3 +1 mm
3500-49D4-0002
FROM FINES NO.2 WEIGH FEEDER 3500-FE-004

3500-CH-011
CHUTE – FINES NO.2 WEIGH FEEDER DISCHARGE

-3 +1 mm
3500-49D4-0002
FROM FINES NO.1 WEIGH FEEDER 3500-FE-003

3500-CH-010
CHUTE – FINES NO.1 WEIGH FEEDER DISCHARGE

MAKE-UP WATER
3600-49D4-0006
XX"-3500-PW-XXX-PCB2PW

CHILLED WATER
3500-49D4-0012
FROM X-RAY CHILLER 3500-CE-001
XX"-3500-CW-XXX-PCB2PW

INSTRUMENT AIR
3600-49D4-0004
HOLD
XX"-3500-IA-XXX-PCB2RA

3500-XR-001
X-RAY SORTER – FINES NO.1 FIRST PASS
2 kW
3500-XR-001 X-RAY SORTER PLC
VENDOR PACKAGE

XI 2200 POWER ON/OFF
HS 2201 START/STOP
SIC 2202 FEEDER SET POINT
XA 2203 FAULT
XI 2204 READY/STANDBY
XI 2205 RUNNING/STOPPED

LAH 2208 – LSH 2208
LSH 2209 – LAH 2209

3500-CH-020
CHUTE – FINES NO.1 FIRST PASS X-RAY SORTER REJECTS

3500-XR-002
X-RAY SORTER – FINES NO.1 SECOND PASS
2 kW
3500-XR-002 X-RAY SORTER PLC
VENDOR PACKAGE

XI 2210 POWER ON/OFF
HS 2211 START/STOP
SIC 2212 FEEDER SET POINT
XA 2213 FAULT
XI 2214 READY/STANDBY
XI 2215 RUNNING/STOPPED

LAH 2218 – LSH 2218
LSH 2219 – LAH 2219

3"-3500-GC-709-PPE2MS

3500-CH-021
CHUTE – FINES NO.1 SECOND PASS X-RAY SORTER REJECTS

XX"-3500-CW-XXX-PCB2PW

3500-XR-003
X-RAY SORTER – FINES NO.2 FIRST PASS
2 kW
3500-XR-003 X-RAY SORTER PLC
VENDOR PACKAGE

XI 2220 POWER ON/OFF
HS 2221 START/STOP
SIC 2222 FEEDER SET POINT
XA 2223 FAULT
XI 2224 READY/STANDBY
XI 2225 RUNNING/STOPPED

LAH 2228 – LSH 2228
LSH 2229 – LAH 2229

3500-CH-022
CHUTE – FINES NO.2 FIRST PASS X-RAY SORTER REJECTS

3500-XR-004
X-RAY SORTER – FINES NO.2 SECOND PASS
2 kW
3500-XR-004 X-RAY SORTER PLC
VENDOR PACKAGE

XI 2230 POWER ON/OFF
HS 2231 START/STOP
SIC 2232 FEEDER SET POINT
XA 2233 FAULT
XI 2234 READY/STANDBY
XI 2235 RUNNING/STOPPED

LAH 2238 – LSH 2238
LSH 2239 – LAH 2239

3"-3500-GC-710-PPE2MS
3"-3500-GC-711-PPE2MS

3500-CH-023
CHUTE – FINES NO.2 SECOND PASS X-RAY SORTER REJECTS

XX"-3500-CW-XXX-PCB2PW
CHILLED WATER
3500-49D4-0012
TO X-RAY CHILLER 3500-CE-001

3"-3500-GC-708-PPE2MS
-3 +1 mm CONCENTRATE
3500-49D4-0008
TO FINES CONC. DEWATERING FEEDER 3500-FE-009

-3 +1 mm REJECTS
3500-49D4-0006
TO FINES NO.2 GREASE TABLE 3500-GT-002

-3 +1 mm REJECTS
3500-49D4-0006
TO FINES NO.1 GREASE TABLE 3500-GT-001

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE REGISTER

REVISION REGISTER

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC·LAVALIN
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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: RECOVERY – SHEET 3 FINES X-RAY PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0003	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 3:33pm
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Node 14

3500-CH-013
CHUTE – MIDDLES NO.2
WEIGH FEEDER DISCHARGE

−8 +3 mm
3500-49D4-0002
FROM MIDDLES NO.2 WEIGH FEEDER 3500-FE-006

3500-CH-012
CHUTE – MIDDLES NO. 1
WEIGH FEEDER DISCHARGE

−8 +3 mm
3500-49D4-0002
FROM MIDDLES NO.1 WEIGH FEEDER 3500-FE-005

MAKE-UP WATER
3600-49D4-0006
XX"-3500-RW-XXX-PCB2PW

CHILLED WATER
3500-49D4-0012
FROM X-RAY CHILLER 3500-CE-001
XX"-3500-CW-XXX-PCB2PW

INSTRUMENT AIR
3600-49D4-0004
HOLD
XX"-3500-IA-XXX-PCB2RA

3500-XR-005
X-RAY SORTER –
MIDDLES NO.1 FIRST PASS
2 kW
3500-XR-005
X-RAY SORTER PLC
VENDOR PACKAGE

XI 2300 POWER ON/OFF
HS 2301 START/STOP
SIC 2302 FEEDER SET POINT
XA 2303 FAULT
XI 2304 READY/STANDBY
XI 2305 RUNNING/STOPPED

LAH 2308 – LSH 2308
LSH 2309 – LAH 2309

3500-CH-024
CHUTE – MIDDLES NO.1
FIRST PASS X-RAY SORTER REJECTS

3500-XR-006
X-RAY SORTER –
MIDDLES NO.1 SECOND PASS
2 kW
3500-XR-006
X-RAY SORTER PLC
VENDOR PACKAGE

XI 2310 POWER ON/OFF
HS 2311 START/STOP
SIC 2312 FEEDER SET POINT
XA 2313 FAULT
XI 2314 READY/STANDBY
XI 2315 RUNNING/STOPPED

LAH 2318 – LSH 2318
LSH 2319 – LAH 2319

3"-3500-GC-715-PPE2MS

3500-CH-025
CHUTE – MIDDLES NO.1
SECOND PASS X-RAY SORTER REJECTS

3500-XR-007
X-RAY SORTER –
MIDDLES NO.2 FIRST PASS
2 kW
3500-XR-007
X-RAY SORTER PLC
VENDOR PACKAGE

XX"-3500-CW-XXX-PCB2PW

XI 2320 POWER ON/OFF
HS 2321 START/STOP
SIC 2322 FEEDER SET POINT
XA 2323 FAULT
XI 2324 READY/STANDBY
XI 2325 RUNNING/STOPPED

LAH 2328 – LSH 2328
LSH 2329 – LAH 2329

3500-CH-026
CHUTE – MIDDLES NO.2
FIRST PASS X-RAY SORTER REJECTS

3500-XR-008
X-RAY SORTER –
MIDDLES NO.2 SECOND PASS
2 kW
3500-XR-008
X-RAY SORTER PLC
VENDOR PACKAGE

XI 2330 POWER ON/OFF
HS 2331 START/STOP
SIC 2332 FEEDER SET POINT
XA 2333 FAULT
XI 2334 READY/STANDBY
XI 2335 RUNNING/STOPPED

3"-3500-GC-716-PPE2MS
3"-3500-GC-717-PPE2MS

LAH 2338 – LSH 2338
LSH 2339 – LAH 2339

3500-CH-027
CHUTE – MIDDLES NO.2
SECOND PASS X-RAY SORTER REJECTS

XX"-3500-CW-XXX-PCB2PW
CHILLED WATER
3500-49D4-0012
TO X-RAY CHILLER 3500-CE-001

3"-3500-GC-714-PPE2MS
−8 +3 mm CONCENTRATE
3500-49D4-0008
TO MIDDLES CONC. DEWATERING FEEDER 3500-FE-010

−8 +3 mm REJECTS
3500-49D4-0006
TO MIDDLES NO.2 GREASE TABLE 3500-GT-004

−8 +3 mm REJECTS
3500-49D4-0006
TO MIDDLES NO.1 GREASE TABLE 3500-GT-003

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
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ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

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REVISION REGISTER

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REVISION REGISTER

REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
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DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE	

CLIENT: les diamants stornoway exploration

PROJECT: RENARD PROJECT

TITLE: RECOVERY – SHEET 4
MIDDLES X-RAY
PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 | D4	0004	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 – 3:33pm
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3500-CH-014
CHUTE - COARSE WEIGH FEEDER DISCHARGE

-30 +8 mm
3500-49D4-0002
FROM COARSE WEIGH FEEDER 3500-FE-007

CHILLED WATER
3500-49D4-0012
FROM X-RAY CHILLER 3500-CE-001
XX"-3500-CW-XXX-PCB2PW

MAKE-UP WATER
3600-49D4-0006
XX"-3500-RW-XXX-PCB2PW

INSTRUMENT AIR
3600-49D4-0004
HOLD
XX"-3500-IA-XXX-PCB2PW

3500-XR-009
X-RAY SORTER - COARSE FIRST PASS
2 kW
3500-XR-009
X-RAY SORTER PLC
VENDOR PACKAGE

LAH 2408 · LSH 2408 · LSH 2409 · LAH 2409

XI 2400 POWER ON/OFF
HS 2401 START/STOP
SIC 2402 FEEDER SET POINT
XA 2403 FAULT
XI 2404 READY/STANDBY
XI 2405 RUNNING/STOPPED

3500-CH-028
CHUTE - COARSE FIRST PASS X-RAY SORTER REJECTS

3500-XR-010
X-RAY SORTER - COARSE SECOND PASS
2 kW
3500-XR-010
X-RAY SORTER PLC
VENDOR PACKAGE

XI 2410 POWER ON/OFF
HS 2411 START/STOP
SIC 2412 FEEDER SET POINT
XA 2413 FAULT
XI 2414 READY/STANDBY
XI 2415 RUNNING/STOPPED

LAH 2418 · LSH 2418 · LSH 2419 · LAH 2419

XX"-3500-CW-XXX-PCB2PW
CHILLED WATER
3500-49D4-0012
TO X-RAY CHILLER 3500-CE-001

3"-3500-GC-721-PPE2MS

3500-CH-029
CHUTE - COARSE SECOND PASS X-RAY SORTER REJECTS

-30 +8 mm REJECTS
3500-49D4-0008
TO COARSE GREASE TABLE 3500-GT-005

3"-3500-GC-720-PPE2MS
-30 +8 mm CONCENTRATE
3500-49D4-0008
TO COARSE CONC. DEWATERING FEEDER 3500-FE-011

Node 14

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED
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No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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DATE 2011/03/03	CLIENT
SCALE	

CLIENT: les elements stornoway (canada) inc.
PROJECT: RENARD PROJECT
TITLE: RECOVERY - SHEET 5 COARSE X-RAY PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0005	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:34pm
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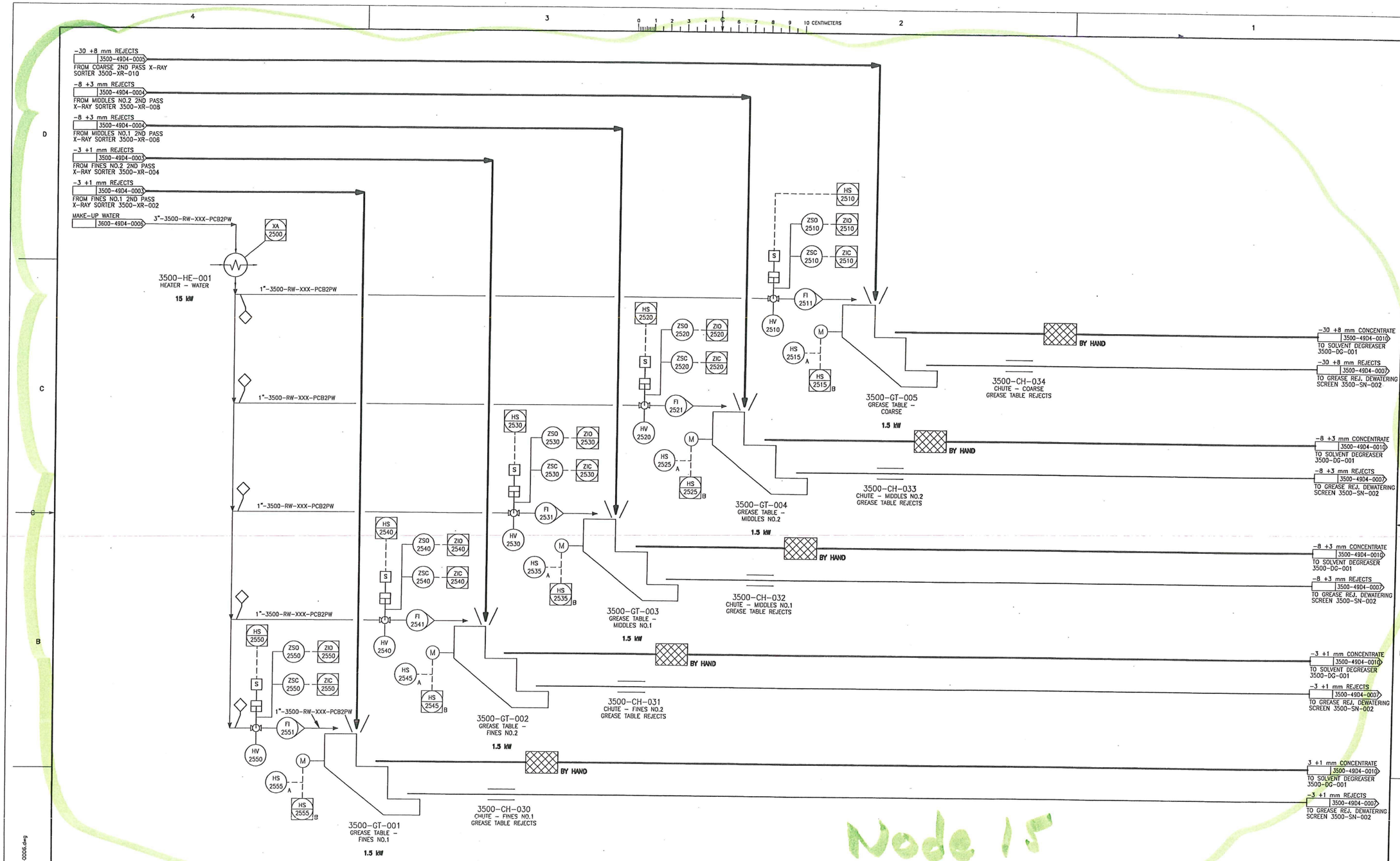

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW.	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

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No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

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No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: RECOVERY - SHEET 6 GREASE TABLES PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0006	PA

504421A1HDN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:34pm
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DUST
3500-49D4-0008
FROM DRYER BAGHOUSE 3500-BH-001
6"-3500-DT-XXX-PCB2VS

REJECTS
3500-49D4-0010
FROM GLOVE BOXES
BY HAND

-30 +8 mm REJECTS
3500-49D4-0005
FROM COARSE GREASE TABLE 3500-GT-005
3500-CH-034 CHUTE - COARSE GREASE TABLE REJECTS

-8 +3 mm REJECTS
3500-49D4-0006
FROM MIDDLES NO.2 GREASE TABLE 3500-GT-004
3500-CH-033 CHUTE - MIDDLES NO.2 GREASE TABLE REJECTS

-8 +3 mm REJECTS
3500-49D4-0006
FROM MIDDLES NO.1 GREASE TABLE 3500-GT-003
3500-CH-032 CHUTE - MIDDLES NO.1 GREASE TABLE REJECTS

-3 +1 mm REJECTS
3500-49D4-0006
FROM FINES NO.2 GREASE TABLE 3500-GT-002
3500-CH-031 CHUTE - FINES NO.2 GREASE TABLE REJECTS

-3 +1 mm REJECTS
3500-49D4-0006
FROM FINES NO.1 GREASE TABLE 3500-GT-001
3500-CH-030 CHUTE - FINES NO.1 GREASE TABLE REJECTS

3500-49D4-0011
FROM FLUME HOOD EFFLUENT PUMP 3500-PU-003
2"-3500-DS-754-PPE2MS

3500-49D4-0008
FROM DRYER FEEDERS 3500-FE-009, -010, -011
3"-3500-DS-750-PPE2MS

3500-49D1-0001
FROM CONCENTRATE SIZING SCREEN 3500-SN-001
8"-3500-DS-748-PPE2MS

HS 2570 B
HS 2570 A
M

3500-SN-002
SCREEN - GREASE REJECTS DEWATERING
610 mm W x 4270 mm L
4.4 kW

3500-CH-035
CHUTE - GREASE REJECTS DEWATERING SCREEN DISCHARGE

3500-CV-003
CONVEYOR - RECOVERY REJECTS
610 mm W x 50 m L
2.2 kW

SAL 2580
SE 2580
SSL 2580
ZS 2582 C
ZS 2582 D
ZA 0032 C,D
HS 2581 C,D
HA 2581 C,D
I

6"-3500-DS-756-PCB2VS

ZIC 2592
ZIO 2592
ZSC 2592
ZSO 2592
HS 2592
HV 2592

3500-PU-001
PUMP - DEWATERING SCREEN U/F
4 x 3
7.5 kW

HS 2590 B
HS 2590 A

FAL 2593
FS 2593
HS 2594
S
FS
HV 2594

SEAL WATER HEADER

START-UP HORN & BEACON
XA 2583
XS 2583
HA 2581 A,B
HS 2185 A
HS 2185 B
HS 2581 A,B
ZS 2582 A
ZS 2582 B
ZA 2582 A,B

3500-CH-036
CHUTE - RECOVERY REJECTS CONVEYOR DISCHARGE
LSH 2587
LAH 2587
LIT 2599
LI 2599
LAH 2599
LAHH 2599
LAL 2599
LALL 2599

RECOVERY REJECTS STOCKPILE

4"-3500-DS-757-PPE2MS
3600-49D4-0001
TO DEGRIT PUMPBOX 3600-BX-001

Node 15

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE NTS	

amec

CLIENT: les diamants stornoway (renard) inc.
PROJECT: RENARD PROJECT
TITLE: RECOVERY SHEET 7 PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0007	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:34pm
PATH: P:\COM\PRC\P&ID's\504421-3500-49-04-0007.dwg

-30 +6 mm CONC
3500-49D4-0005
FROM COARSE X-RAY SORTERS
3"-3500-GC-720-PPE2MS

-6 +3 mm CONC
3500-49D4-0004
FROM MIDDLES X-RAY SORTERS
3"-3500-GC-714-PPE2MS

-3 +1 mm CONC
3500-49D4-0003
FROM FINES X-RAY SORTERS
3"-3500-GC-708-PPE2MS

3500-49D4-0008
FROM RECONC X-RAY SORTERS

3500-FE-009
FEEDER - FINES CONC DEWATERING
0.28 kW

3500-FE-010
FEEDER - MIDDLES CONC DEWATERING
0.28 kW

3500-FE-011
FEEDER - COARSE CONC DEWATERING
0.28 kW

3500-DR-001
DRYER - FINES CONC
13.75 kW

3500-DR-002
DRYER - MIDDLES CONC
13.75 kW

3500-DR-003
DRYER - COARSE CONC
13.75 kW

3500-CH-040
CHUTE - FINES CONC DRYER DISCHARGE

3500-CH-041
CHUTE - MIDDLES CONC DRYER DISCHARGE

3500-CH-042
CHUTE - COARSE CONC DRYER DISCHARGE

3"-3500-DS-751-PPE2MS

3"-3500-DS-752-PPE2MS

3500-FA-001
FAN - DRYER BAG HOUSE
7.5 kW

TO ATMOSPHERE

3500-BH-001
BAG HOUSE - DRYER

6"-3500-DT-XXX-PCB2VS

DUST
3500-49d4-0007
TO RECOVERY REJECTS CONVEYOR 3500-CV-003

3500-49D4-0009
TO COARSE RECONC X-RAY SORTER 3500-XR-013

3"-3500-DS-750-PPE2MS

3500-49D4-0007
TO GREASE REJ. DEWATERING SCREEN 3500-SN-002

3500-BI-007
BIN - FINES HIMS FEED 500 kg

3500-BI-008
BIN - MIDDLES HIMS FEED 500 kg

3500-MS-001
MAG SEP - FINES
0.28 kW

3500-MS-002
MAG SEP - MIDDLES
0.28 kW

3500-CH-043
CHUTE - FINES MAG SEP REJECTS

3500-CH-044
CHUTE - FINES MAG SEP CONC

3500-CH-045
CHUTE - MIDDLES MAG SEP REJECTS

3500-CH-046
CHUTE - MIDDLES MAG SEP CONC

3500-49D4-0009
TO MIDDLES RECONC X-RAY SORTER 3500-XR-012

3500-49D4-0009
TO RECYCLE PUMP BOX 3500-BX-001

3500-49D4-0009
TO FINES RECONC X-RAY SORTER 3500-XR-011

3500-49D4-0008
TO RECYCLE PUMP BOX 3500-BX-001

Node 16

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: RECOVERY SHEET 8 PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0008	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:34pm
PATH: P:\CAD\PRO\PAD'S\504421-35CJ-49-D4-C0008.dwg, 3/25, 2011 3:34:35 PM, JAN-72.pc3, FELIX.JIN \\JAN-FS1\PC0136SC , -NC.OU.EP

P:\C-AD\PRO PAD'S\504421-35CJ-49-D4-C0008.dwg, 3/25, 2011 3:34:35 PM, JAN-72.pc3, FELIX.JIN \\JAN-FS1\PC0136SC , -NC.OU.EP

3500-4904-0008
FROM COARSE CONC DRYER 3500-DR-003

3500-4904-0008
FROM MIDDLES MAG SEP 3500-MS-002

3500-4904-0008
FROM FINES MAG SEP 3500-MS-001

CHILLED WATER
3500-4904-0012
FROM X-RAY CHILLER 3500-CE-001

XX"-3500-CW-XXX-PCB2PW

INSTRUMENT AIR
3600-4901-0004

XX"-3500-IA-XXX-PCB2RA

VENDOR PACKAGE

3500-XR-011
X-RAY SORTER - FINES RECONC
2 kW

3500-XR-XXX
X-RAY SORTER PLC

XI 2660 POWER ON/OFF
HS 2661 START/STOP
SIC 2662 FEEDER SET POINT
XA 2663 FAULT
XI 2664 READY/STANDBY
XI 2665 RUNNING/STOPPED

LAH 2667 LHS 2667 LHS 2668 LAH 2668

VENDOR PACKAGE

3500-XR-012
X-RAY SORTER - MIDDLES RECONC
2 kW

3500-XR-XXX
X-RAY SORTER PLC

XI 2670 POWER ON/OFF
HS 2671 START/STOP
SIC 2672 FEEDER SET POINT
XA 2673 FAULT
XI 2674 READY/STANDBY
XI 2675 RUNNING/STOPPED

LAH 2677 LHS 2677 LHS 2678 LAH 2678

VENDOR PACKAGE

3500-XR-013
X-RAY SORTER - COARSE RECONC
2 kW

3500-XR-XXX
X-RAY SORTER PLC

XI 2680 POWER ON/OFF
HS 2681 START/STOP
SIC 2682 FEEDER SET POINT
XA 2683 FAULT
XI 2684 READY/STANDBY
XI 2685 RUNNING/STOPPED

LAH 2687 LHS 2687 LHS 2688 LAH 2688

3500-4904-0008
TO DRYER BAGHOUSE 3500-BH-001

CHILLED WATER
3500-4904-0012
TO X-RAY CHILLER 3500-CE-001

3"-3500-GC-732-PPE2MS
-30 +8 mm RECONC
3500-4904-0010
TO COARSE CONC BIN 3500-BI-009

3"-3500-GC-731-PPE2MS

3"-3500-GC-729-PPE2MS
-8 +3 mm RECONC
3500-4904-0010
TO 3-WAY FINES/MIDDLES CONC BIN 3500-BI-010

-3 +1 mm RECONC
3500-4904-0010
TO 3-WAY FINES/MIDDLES CONC BIN 3500-49D1-010

3"-3500-GC-728-PPE2MS

3"-3500-GC-726-PPE2MS

3"-3500-GC-725-PPE2MS

3500-4904-0008
FROM MIDDLES MAG SEP 3500-MS-002

3500-4904-0008
FROM FINES MAG SEP 3500-MS-001

MAKE-UP WATER
3600-4901-0003

XX"-3500-PW-XXX-PCB2PW

3500-4904-0001
FROM X-RAY REJECTS SIEVE BEND 3500-SN-004

8"-3500-DS-746-PPE2MS

LIT 2690
LJ 2690 LAL 2690 LALL 2690
LAH 2690 LAHH 2690

3500-BX-001
PUMP BOX - RECYCLE
1 m3

ZIC 2691 ZIO 2691
ZSC 2691 ZSO 2691
HS 2691 S HV 2691

4"-3500-DS-745-PPE2MS

3500-4901-0001
TO RECONC X-RAY REJECTS SIEVE BEND 3500-SN-004

3500-PU-002
PUMP - RECYCLE
3 x 2
15 kW

6"-3500-DS-744-PCB2VS

HS 2695 B
HS 2695 A

FAL 2697
FSL 2697
FS

ZIC 2692 ZSC 2692 ZIO 2692 ZSO 2692
HS 2692 S HV 2692

HV 2698 HS 2698 S

SEAL WATER HEADER

Node 16

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
-				

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
-				

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC-LAVALIN
SNC-LAVALIN 455, Rond-Léveque Blvd. West Montréal (Québec) Canada H2Z 1Z3

amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/03	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: RECOVERY SHEET 9 PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49D4	0009	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 4:33pm
PATH: P:\CAD\PROJ\PA&P\504421-3500-49-D4-0008.dwg

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-30 +8 mm RECONC
3500-49D4-0009
FROM COARSE RECONC X-RAY SORTER 3500-XR-013
3"-3500-GC-732-PPE2MS

LIT 2700
LI 2700
LAL 2700
LALL 2700
LAH 2700
LAHH 2700
3500-BI-009
BIN - COARSE CONC
500 kg

-30 +8 mm CONC
3500-49D4-0006
FROM COARSE GREASE TABLE 3500-GT-005
BY HAND

-8 +3 mm CONC
3500-49D4-0006
FROM MIDDLES NO.2 GREASE TABLE 3500-GT-004
BY HAND

-8 +3 mm CONC
3500-49D4-0006
FROM MIDDLES NO.1 GREASE TABLE 3500-GT-003
BY HAND

-3 +1 mm CONC
3500-49D4-0006
FROM FINES NO.2 GREASE TABLE 3500-GT-002
BY HAND

-3 +1 mm CONC
3500-49D4-0006
FROM FINES NO.1 GREASE TABLE 3500-GT-001
BY HAND

HS 2705A A
HS 2705A B
M
M
HS 2705B B
HS 2705B A
3500-FE-008
FEEDER - COARSE CONC
0.26 kW

3"-3500-GC-733-PPE2MS

-30 +8 mm
-8 +3 mm
-3 +1 mm
3500-DG-001
DEGREASER - SOLVENT

HS 2710 A
HS 2710 B
M
3500-SN-003
SCREEN - COARSE X-RAY CONC SIZING
1.5 kW

-3 +1 mm RECONC
3500-49D4-0008
FROM FINES RECONC X-RAY SORTER 3500-XR-011
3"-3500-GC-726-PPE2MS

-8 +3 mm RECONC
3500-49D4-0009
FROM MIDDLES RECONC X-RAY SORTER 3500-XR-012
3"-3500-GC-729-PPE2MS

LAH 2720
LSH 2720
LAH 2725
LSH 2725
LAH 2730
LSH 2730
LAH 2735
LSH 2735
LAH 2740
LSH 2740
3500-BI-010
BIN - 5 WAY FINES/MIDDLES CONC
5 x 50 kg

LAH 2745
LSH 2745
LAH 2750
LSH 2750
LAH 2755
LSH 2755
LAH 2760
LSH 2760
3500-BI-011
BIN - 4 WAY COARSE CONC
4 x 50 kg

-24 +12 mm
-6 mm
-12 +6 mm
-30 +24 mm

3500-XX-001
GLOVE BOX - FINES/MIDDLES
3500-XX-002
GLOVE BOX - COARSE

BY HAND
REJECTS
3500-49D4-0007
TO RECOVERY REJECTS CONVEYOR 3500-CV-003

BY HAND
3500-49D4-001
TO DIAMOND CLEANING ROOM

Node16

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC-LAVALIN
SNC-LAVALIN
455, Rene-Levesque Blvd. West
Montréal (Québec) Canada H2Z 123
amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/04	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.
PROJECT: RENARD PROJECT
TITLE: RECOVERY SHEET 10 PIPING & INSDTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49	0010	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:34pm
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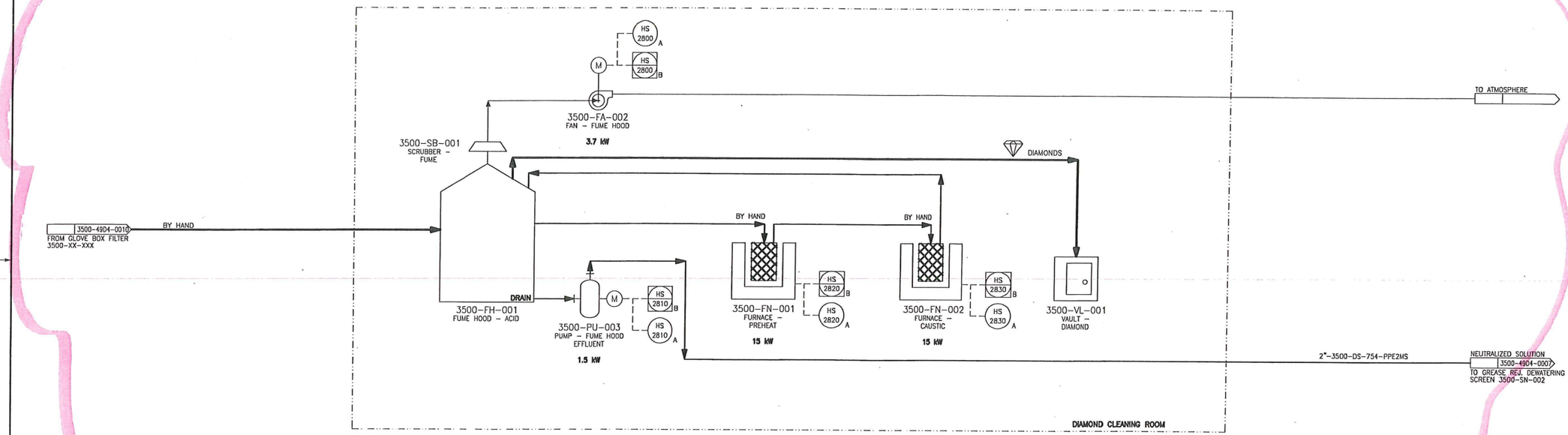

Node 17

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
-				

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER
-	

PROFESSIONAL SEAL

SNC-LAVALIN
SNC-LAVALIN
455, René-Lévesque Blvd. West
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PREPARATION	APPROVAL
DESIGNED: L. JOE	DISCIPLINE ENGINEER: H. RYANS
DRAWN: K. RIDLEY	ENGINEERING MANAGER:
CHECKED:	PROJECT MANAGER:
DATE: 2011/03/04	CLIENT:
SCALE: NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: RECOVERY SHEET 11 PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 D4	0011	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:35pm
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Out of scope of Hazop.

CHILLED WATER 3500-49D4-0005 FROM RECONC X-RAY MACHINES — XX"-3500-CW-XXX-PCB2PW

CHILLED WATER 3500-49D4-0005 FROM FIRST PASS COARSE X-RAY MACHINE 3500-XR-009 — XX"-3500-CW-XXX-PCB2PW

CHILLED WATER 3500-49D4-0004 FROM FIRST PASS MIDDLES X-RAY MACHINES — XX"-3500-CW-XXX-PCB2PW

CHILLED WATER 3500-49D4-0003 FROM FIRST PASS FINES X-RAY MACHINES — XX"-3500-CW-XXX-PCB2PW

LSH 2900 / LAH 2900
LSL 2910 / LAL 2910
M
HS 2920 B
HS 2920 A
VENDOR PACKAGE

3500-CE-001
CHILLER – X-RAY
22 kW

XX"-3500-CW-XXX-PCB2PW

CHILLED WATER 3500-49D4-0005 TO FIRST PASS COARSE X-RAY MACHINE 3500-XR-009

CHILLED WATER 3500-49D4-0004 TO FIRST PASS MIDDLES X-RAY MACHINES

CHILLED WATER 3500-49D4-0003 TO FIRST PASS FINES X-RAY MACHINES

CHILLED WATER 3500-49D4-0009 TO RECONC X-RAY MACHINES

HS 2930 A
HS 2930 B
M

INSTRUMENT AIR — XX"-3500-IA-XXX-PCB2RA

TO ATMOSPHERE

SPILLAGE PICK-UP POINTS LOCATED AS REQUIRED

VENDOR PACKAGE

SPILLAGE 3500-4904-0001 TO CONCENTRATE SIZING SCREEN 3500-SN-001

3500-SS-001
SYSTEM – SPILLAGE HANDLING
30 kW

LAST SAVE: 2011/03/25 – 3:35pm
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ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC·LAVALIN
SNC-LAVALIN
455, René-Lévesque Blvd. West
Montréal (Québec) Canada H2Z 1Z3

amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. RIDLEY	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/04	CLIENT
SCALE NTS	

CLIENT: stornoway (renard) inc.

PROJECT: RENARD PROJECT

TITLE: RECOVERY SHEET 12 PIPING & INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3500	49 04	0012	PA

504421ATHEN – FRAME A1 HORIZONTAL ENGLISH

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CLARIFIED WATER
3600-49D4-0007
FROM CLARIFIED WATER PUMPS
3600-PU-006, -007, OR -008
XX"-3600-PW-XXX-PCB2PW

SLURRY
3300-49D4-0002
FROM SCRUBBER DISCH. SCREEN U/F
PUMP 3300-PU-001
14"-3300-DS-403-PPE2MS

SLURRY
3400-49D4-0003
FROM MOD 2 PREP SCREEN
U/F PUMP 3420-PU-001
6"-3420-DS-634-PPE2MS

SLURRY
3400-49D4-0002
FROM MOD 1 PREP SCREEN
U/F PUMP 3410-PU-001
6"-3410-DS-534-PPE2MS

SLURRY
3400-49D4-0012
FROM MOD 2 MAG. SEP. EFFLUENT BOX
AND O/F SPLITTER 3420-BX-007 & -008
10"-3420-DS-638-PPE2MS

SLURRY
3400-49D4-0007
FROM MOD 1 MAG. SEP. EFFLUENT BOX
AND O/F SPLITTER 3410-BX-007 & -008
10"-3410-DS-538-PPE2MS

SLURRY
3600-49D4-0003
FROM DEGRIT CYCLONE CLUSTER
O/F DIST. BOX 3600-BX-002
18"-3600-DS-806-PPE2MS

SLURRY
3200-49D1-0008
FROM DUST SCRUBBER EFFLUENT
PUMP 3230-PU-001
3"-3230-DS-303-PPE2MS

SLURRY
3600-49D4-0004
FROM REJECTS DEWATERING
FEEDER P.BOX 3700-BX-002
2"-3700-DS-XXX-PCB2VS

FROM RECOVERY
3500-49D4-0007
FROM DEWATERING SCREEN U/F PUMP
3500-PU-001
4"-3500-DS-757-PPE2MS

LY 3000
LCV 3000

3"-3600-EP-846-PCB2VS

LALL 3000 | LAL 3000 | LIC 3000 | LIT 3000
LAHH 3000 | LAH 3000

HS 3020 B
HS 3020 A
M
LAHH 3025 | LAH 3025 | LI 3025 | LIT 3025
TRAMP SCREEN
TRAMP SCREEN

3600-PU-003
PUMP - DEGRIT AREA
SPILLAGE
3
5.6 kW

3"-3600-DS-801-PCB2VS

3600-BX-001
PUMP BOX - DEGRIT
70 m3

1 1/2"
1 1/2"
1 1/2"
1 1/2"

HS 3005
ZSO 3005 | ZIO 3005
ZSC 3005 | ZIC 3005
S
20"-3600-DS-802-PCB2VS
HV 3005

RO 3019
HS 3018
ZSO 3018 | ZIO 3018
ZSC 3018 | ZIC 3018
S
16"-3600-DS-804-PPE2MS
HV 3018

FAL 3013
FSL 3013
FS
HS 3014
S
HV 3014

SEAL WATER HEADER
XX"-3600-SH-XXX-PCB2PW

3600-PU-001
PUMP - DEGRIT
CYCLONE CLUSTER FEED
14 x 12
300 kW
12"x10"
20"x18"
HS 3010 A
HS 3010 B
M
HV 3006
S
HS 3006
ZSC 3006 | ZIC 3006
ZSO 3006 | ZIO 3006

18"-3600-DS-803-PPE2MS

SLURRY
3600-49D4-0002
TO DEGRIT CYCLONE CLUSTER
3600-CY-001

3"-3600-EP-845-PCB2VS

HS 3030 B
HS 3030 A
LAHH 3035
LAH 3035
LI 3035
LIT 3035
M
TRAMP SCREEN
TRAMP SCREEN

3600-PU-002
PUMP - THICKENER
AREA SPILLAGE
3
5.6 kW

Node 18

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

Xs	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC·LAVALIN
SNC-LAVALIN
455, Rond-Levesque Blvd. West
Montréal (Québec) Canada H2Z 1Z3
PREPARATION

amec
APPROVAL

DESIGNED	L. JOE
DRAWN	K. CATO
CHECKED	
DATE	2011/02/04
SCALE	NTS
DISCIPLINE ENGINEER	H. RYANS
ENGINEERING MANAGER	
PROJECT MANAGER	
CLIENT	

CLIENT: les diamants stornoway (canada) inc.
PROJECT: RENARD PROJECT
TITLE: DEGRITTING
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3600	49 | D4	0001	PA

504421AHEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:35pm
PATH: P:\CAD\PRO\PAD'S\504421-3600-49-D4-0001.dwg

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CLARIFIED WATER
3600-49D4-0007
FROM CLARIFIED WATER PUMPS
3600-PU-006, -007, OR -008

SLURRY
3600-49D4-0003
FROM THICKENER U/F No.1 OR No.2 PUMP
3600-PU-004, OR 3600-PU-017

4"-3600-TS-826-PPE2MS

PIT 3055
PI 3055
PAL 3055
PALL 3055
PAH 3055
PAHH 3055

HS 3050 C
ZSC 3050 C
ZIC 3050 C
S
ZSO 3050 C
ZIO 3050 C
HV 3050 C

HS 3050 D
ZSC 3050 D
ZIC 3050 D
S
ZSO 3050 D
ZIO 3050 D
HV 3050 D

HS 3050 A
ZSC 3050 A
ZIC 3050 A
S
ZSO 3050 A
ZIO 3050 A
HV 3050 A

HS 3050 B
ZSC 3050 B
ZIC 3050 B
S
ZSO 3050 B
ZIO 3050 B
HV 3050 B

3600-CY-001
CYCLONE CLUSTER - DEGRIT
4 x 914 mm dia.

SLURRY
3600-49D4-0001
FROM DEGRIT CYCLONE CLUSTER
FEED PUMP 3600-PU-001

18"-3600-DS-803-PPE2MS

LAH 3060
LAHH 3060
LI 3060
LALL 3060
LAL 3060
LIT 3060

10"-3600-DS-807-PPE2MS

10"-3600-TS-832-PCB2VS

3600-BX-004
PUMP BOX - CENTRIFUGE TANK FEED
10 m3

10"-3600-TS-833-PCB2VS

DCV 3080
DY 3080

24"-3600-DS-805-PPE2MS

SLURRY
3600-49D4-0003
TO DEGRIT CYCLONE CLUSTER
O/F DIST. BOX 3600-BX-002

ZIC 3076
ZIO 3076
ZSC 3076
ZSO 3076
HS 3076
HV 3076

ZIO 3075
ZIC 3075
ZSO 3075
ZSC 3075
S
HS 3075
HV 3075

HS 3065
ZSC 3065
ZIC 3065
S
ZSO 3065
ZIO 3065
HV 3065

FAL 3072
HS 3073
FS 3072
S
FS
HV 3073

HS 3066
HV 3066
S
ZSO 3066
ZSC 3066
ZIO 3066
ZIC 3066

-1 mm
8"-3600-TS-834-PPE2MS

SLURRY
3600-4904-0005
TO CENTRIFUGE FEED TANK
3600-TK-003

3600-PU-015
PUMP - CENTRIFUGE TANK FEED
6 x 4
55 kW

M
HS 3070 B
HS 3070 A

DX 3080
DIT 3080
DIC 3080
DAL 3080
DALL 3080
DAH 3080
DAHH 3080

SEAL WATER HEADER
XX"-3600-SH-XXX-PCB2PW

Node 18

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC-LAVALIN
SNC-LAVALIN
455, René-Lévesque Blvd. West
Montréal (Québec) Canada H2Z 1Z3

amec

PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/04	CLIENT
SCALE NTS	

CLIENT
ios diamonds
stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
DEGRITTING
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3600	49 D4	0002	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:35pm
PATH: P:\GDV\PRC\PAID's\504421-3600-49-D4-0002.dwg

P:\C-D\PRC Paid's\504421-3600-49-D4-0002.dwg, 3/25/2011 3:35:31 PM, A4N-70.pc3, FELIP.JAN

CLARIFIED WATER
3600-49D4-0007
FROM CLARIFIED WATER PUMPS
3600-PU-006, -007, OR -008

XX"-3600-PW-XXX-PCB2PW

NNF

3600-49D4-0005
FROM PUMP-CENTRATE
3600-PU-016

6"-3600-DS-819-PPE2MS

SLURRY
3600-49D1-0001
FROM DEGRIT CYCLONE CLUSTER
3600-CY-001

24"-3600-DS-805-PPE2MS

3600-BX-002
BOX - DEGRIT CYCLONE
CLUSTER O/F DISTRIBUTION

24"-3600-DS-810-PPE2MS

24"-3600-DS-811-PPE2MS

HV 3114 | S | HS 3114 | ZSO 3114 | ZIO 3114 | ZSC 1314 | ZIC 3114

HV 3134 | S | HS 3134 | ZSO 3134 | ZIO 3134 | ZSC 3134 | ZIC 3134

CCTV
3600-CM-001

HS 3154 | S | HV 3154 | ZSC 3154 | ZIC 3154 | ZSO 3154 | ZIO 3154

LCV 3105
LY 3105

18"-3600-DS-806-PPE2MS

SLURRY
3600-49D4-0001
TO DEGRIT PUMPBOX
3600-BX-001

FLOCULANT
XX"-3600-FL-XXX-PCB2NR

3600-ZZ-001
PACKAGE - FLOCULANT
MIXING & DOSING SYSTEM
100 kg/day
1 kW

HS 3100 B | HS 3100 A | M

4"-3600-TS-829-PPE2MS

18"-3600-PW-852-PCB2PW

CLARIFIED WATER
3600-49D4-0007
TO CLARIFIED WATER TANK
3600-TK-001

24"-3600-DS-812-PPE2MS

LIT 3150 | LI 3150 | LAL 3150 | LALL 3150 | LAH 3150 | LAHH 3150

HS 3155 B | HS 3155 A | ZIO 3116 | ZIC 3116 | HS 3116 | ZSO 3116 | ZSC 3116

ZSC 3185 | ZIC 3185 | ZSO 3185 | ZIO 3185 | HV 3185

DAL 3180 | DALL 3180 | DAH 3180 | DAHH 3180 | DI 3180 | FI 3180 MASSFLOW | FI 3180 FLOWMETER | DT 3180 | FIT 3180 | DX 3180 | FE 3180

XC 3185

3600-TH-001
THICKENER - SLIMES
16 m dia
5.5 kW

LIC 3105 | LIT 3105

HS 3110 | ZIO 3110 | ZIC 3110 | ZSO 3110 | ZSC 3110 | HV 3110 | S

3600-BX-003
BOX - THICKENER O/F
STAND PIPE

20"-3600-PW-851-PCB2PW

3600-PU-014
PUMP - THICKENER O/F

4"-3600-TS-826-PPE2MS

SLURRY
3600-49D4-0002
TO CENTRIFUGE TANK FEED
PUMP BOX 3600-BX-004

1 1/2"
6"-3600-TS-825-PCB2VS

1 1/2"

HS 3130 | ZIO 3130 | ZIC 3130 | ZSO 3130 | ZSC 3130 | HV 3130 | S

HV 3112 | S | HS 3112 | ZSO 3112 | ZIO 3112 | ZSC 3112 | ZIC 3112

3600-PU-004
PUMP - THICKENER
U/F NO.1
4 x 3
30 kW

HS 3115 A | HS 3115 B

HV 3116 | HV 3136 | S | HS 3136 | ZSO 3136 | ZIO 3136 | ZSC 3136 | ZIC 3136

4"-3600-TS-828-PPE2MS

FAL 3157 | FS 3157 | HS 3158 | HV 3158 | FS 3117 | FAL 3117 | HS 3118 | HV 3118 | HV 3138 | HS 3138 | FS 3137 | FAL 3137

6"-3600-TS-827-PCB2VS

SEAL WATER HEADER
XX"-3600-SH-XXX-PCB2PW

HV 3132 | S | HS 3132 | ZSO 3132 | ZIO 3132 | ZSC 3132 | ZIC 3132

3600-PU-017
PUMP - THICKENER U/F
NO.2
4 x 3
30 kW

HS 3135 A | HS 3135 B

Node 19

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

SNC·LAVALIN
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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/04	CLIENT
SCALE NTS	

CLIENT
les élements stornoway (renards) inc.

PROJECT
RENARD PROJECT

TITLE
THICKENING, SLIMES & PK DISPOSAL
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3600	49 D4	0003	PA

504421A1HEN - FRAME A1 HORIZONTAL ENGLISH

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PATH: P:\CAD\PRGV\P&ID's\504421-3600-49-04-0003.dwg

P:\CAD\PRGV\P&ID's\504421-3600-49-04-0003.dwg, 3/25/2011 3:35:44 PM, IAN-AUTO.pc3, -LUT.JIN \\vn-FS1\PO016556C, -NCAD/EP

REJECTS
3600-49D4-0005
FROM CENTRIFUGE - FINES No.2
3600-CG-002

REJECTS
3600-49D4-0005
FROM CENTRIFUGE - FINES No.1
3600-CG-001

REJECTS
3400-49D1-0005
FROM MOD 1 FLOATS SCREEN
3410-SN-003

REJECTS
3400-49D1-0010
FROM MOD 2 FLOATS SCREEN
3420-SN-003

3700-SC-001
BELT SCALE - DMS REJECTS

SE 3190
ZS 3192
ZS 3192
SSL 3190
SAL
ZA 3192
WE 3200
WIT 3200
WQI 3200
WI 3200
HS 3191 A
HS 3191 B
HA 3191 A,B

3700-CV-001
CONVEYOR - COARSE REJECTS NO.1
762 mm W x 43 m L
22 kW

ZS 3192 A
ZS 3192 B
ZA 3192 A,B
SE 3210
ZS 3212 C
ZS 3212 D
SSL 3210
SAL 3210
ZA 3212 C,D

XS 3193
XA 3193
START-UP HORN & BEACON

HS 3195 B
HS 3195 A
M
LAH 3198
LSH 3198

HA 3211 A,B
HS 3211 A
HS 3211 B

3700-CV-002
CONVEYOR - COARSE REJECTS NO.2
762 mm W x 84 m L
30 kW

ZA 3212 A,B
ZS 3212 A
ZS 3212 B

XS 3213
XA 3213
START-UP HORN & BEACON

HS 3215 A
HS 3215 B
M
CCTV
3600-CM-002

LSH 3217
LAH 3217
LIT 3225
LJ 3225
LAL 3225
LALL 3225
LAH 3225
LAHH 3225

3700-BI-001
BIN - REJECTS LOADOUT
500 t

HS 3230 A
HS 3230 B
M
3700-FE-001
FEEDER - REJECTS DEWATERING
762 mm W x 1219 mm L
7.5 kW

ZI 3235 A
ZT 3235 A
ZT 3235 B
ZI 3235 B
HIC 3235 A
HIC 3235 B

REJECTS
TO DRY STACK AREA

LIT 3240
LI 3240
LAL 3240
LALL 3240
LAH 3240
LAHH 3240

HS 3242
S
ZIO 3242
ZIC 3242
ZSO 3242
ZSC 3242

2"-3700-DS-XXX-PC82VS
SLURRY
3600-49D4-0001
TO DEGRIT PUMPBOX
3600-BX-001

3700-BX-002
PUMP BOX - REJECTS DEWATERING FEEDER U/F
1 m3

1 1/2"
1 1/2"
HV 3242
3"-3700-DS-XXX-PC82VS

HS 3245 A
M
HS 3245 B
3700-PU-003
PUMP - REJECTS DEWATERING FEEDER U/F
1.5 x 1
2.2 kW

HV 3243
HS 3243
S
ZSC 3243
ZSO 3243
ZIC 3243
ZIO 3243

SEAL WATER HEADER

HS 3248
S
HV 3248
FAL 3247
FSL 3247
FS

Node 20

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
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INITIALS: * DESIGNED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER
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PROFESSIONAL SEAL

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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/04	CLIENT
SCALE NTS	

CLIENT
les placements stornoway (canada) inc.

PROJECT
RENARD PROJECT

TITLE
THICKENING, SLIMES & PK DISPOSAL
PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3600	49 D4	0004	PA

504421ATHEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/25 - 3:55pm
PATH: P:\504421-36CU-49-D4-0004.dwg

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SLURRY
3600-49D4-0002
FROM CENTRIFUGE TANK FEED PUMP 3600-PU-015
8"-3600-TS-834-PPE2MS

SLUDGE
3600-49D4-0007
FROM CLARIFIED WATER FILTER 3600-FL-001
4"-3600-TS-839-PCB2VS

CLARIFIED WATER
XX"-3600-PW-XXX-PCB2PW

MAKE-UP WATER
3600-49D1-0003
FROM MAKE-UP WATER PUMPS 3600-PU-009, -010
XX"-3600-RW-XXX-PCB2PW

HS 3265 A, HS 3265 B, M, LIC 3260 A, LIC 3260 B, LIT 3260, LY 3260A, LY 3260B, LCV 3260A, LCV 3260B

8"-3600-TS-835-PPE2MS
8"-3600-TS-836-PPE2MS

3600-AG-001
AGITATOR - CENTRIFUGE FEED TANK

3600-TK-003
TANK - CENTRIFUGE FEED
30 m3

3600-CK-001
CRANE - THICKENER AREA OVERHEAD
10 tonne

ZSO 3350, ZIO 3350, ZSC 3350, ZIC 3350, HV 3350, HS 3350, S, HS 3355 A, HS 3355 B, M, PI, FT, FI 3360, FAL 3360, FALL 3360, LUBE OIL, LUBE OIL HEAT EXCHANGER, GEARBOX, OUTBOARD BEARING, INBOARD BEARING

LUBE UNIT FINES CENTRIFUGE No.1

3600-CG-001
CENTRIFUGE - FINES NO.1
1100 mm x 2250 mm
225 kW

ZSO 3315, ZIO 3315, ZSC 3315, ZIC 3315, HV 3315, HS 3315, S, HV 3320, HS 3320, ZSC 3320, ZSO 3320, ZIC 3320, ZIO 3320, HS 3300 A, HS 3300 B, M, VFD, HIC 3310

6"-3600-DS-815-PPE2MS

ZSO 3450, ZIO 3450, ZSC 3450, ZIC 3450, HV 3450, HS 3450, S, HS 3455 A, HS 3455 B, M, PI, FT, FI 3460, FAL 3460, FALL 3460, LUBE OIL, LUBE OIL HEAT EXCHANGER, GEARBOX, OUTBOARD BEARING, INBOARD BEARING

LUBE UNIT FINES CENTRIFUGE No.2

ZSO 3415, ZIO 3415, ZSC 3415, ZIC 3415, HV 3415, HS 3415, S, HV 3420, ZSC 3420, ZSO 3420, ZIC 3420, ZIO 3420, HS 3400 A, HS 3400 B, M, VFD, HIC 3410

3600-CG-002
CENTRIFUGE - FINES NO.2
1100 mm x 2250 mm
225 kW

6"-3600-DS-816-PPE2MS

REJECTS
3600-49D4-0004
TO CONVEYOR - COARSE REJECTS 3700-CV-001

LSH 3430, LAH 3430

ZIO 3510, ZIC 3510, HS 3510, ZSO 3510, ZSC 3510, S, HV 3510, HS 3520 A, HS 3520 B, M, 6"-3600-DS-818-PCB2VS

3600-PU-016
PUMP - CENTRATE
4 x 3
7.5 kW

LIT 3500, LI 3500, LAL 3500, LALL 3500, LAH 3500, LAHH 3500, 8"-3600-DS-817-PCB2VS, DRAIN

3600-BX-005
PUMP BOX - CENTRATE
1 m3

LSH 3330, LAH 3330

REJECTS
3600-49D4-0004
TO CONVEYOR - COARSE REJECTS 3700-CV-001

6"-3600-DS-819-PPE2MS

SLURRY
3600-49D4-0003
CLUSTER O/F DISTRIBUTION 3600-BX-002

HS 3523, S, FSL 3522, FAL 3522, FS, HV 3523, SEAL WATER HEADER

Node 21

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	PA	2011/03/25	ISSUED FOR INTERNAL REVIEW	

ISSUE REGISTER

ISSUE REGISTER

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REVISION REGISTER

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INITIALS: * DESCHED ** APPROVED

REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/04	CLIENT
SCALE NTS	

CLIENT: stornoway diamond inc.

PROJECT: RENARD PROJECT

TITLE: THICKENING, SLIMES & PK DISPOSAL PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3600	49 D4	0005	PA

504421ATHEN - FRAME A1 HORIZONTAL ENGLISH

LAST SAVE: 2011/03/28 - 10:47am
PATH: P:\CAD\PROJECTS\504421-3600-49-D4-0005.dwg

Node 22

MAKE-UP WATER
FROM PKC OR SEDIMENTATION POND

6"-3600-RW-XXX-PCB2PW

6"-3600-RW-XXX-PCB2PW

MAKE-UP WATER
3500-49D4-0007
TO CLARIFIED WATER TANK 3600-TK-001

M
FE 3610
FIT 3610
FI 3610
FQI 3610
PIT 3620
PI 3620
PAL 3620
PALL 3620

8"-3600-RW-XXX-PCB2PW

LCV 3600
LY 3600

6"-3600-RW-873-PCB2PW

MAKE-UP WATER
TO MAKE-UP WATER DITRIBUTION

MAKE-UP WATER
TO LP GLAND SEAL WATER DISTRIBUTION

3"-3600-RW-879-PCB2PW

MAKE-UP WATER
TO HP GLAND SEAL WATER DISTRIBUTION

RO

2"-3600-RW-881-PCB2PW

HS 3665
ZIO 3665
ZIC 3665
HV 3665
S
ZSO 3665
ZSC 3665

HS 3666
ZIO 3666
ZIC 3666
HV 3666
S
ZSO 3666
ZSC 3666

3"-3600-RW-880-PCB2PW

ZSO 3656
ZIO 3656
ZSC 3656
ZIC 3656
HV 3656
S
HS 3656

HS 3660 B
M
HS 3660 A

3600-PU-012
PUMP – HP GLAND SEAL WATER NO.2
1.5 x 3
11 kW

4"-3600-RW-878-PCB2PW

HV 3320

HS 3650 B
M
HS 3650 A

3600-PU-011
PUMP – HP GLAND SEAL WATER NO.2
1.5 x 3
11 kW

ZSC 3655
ZSO 3655
ZIC 3655
ZIO 3655
HS 3655

CLARIFIED WATER
3600-49D4-0007
FILTER – CLARIFIED WATER
3600-FL-001

10"-3600-PW-XXX-PCB2PW

2"-3600-RW-875-PCB2PW

RO

HS 3646
ZIO 3646
ZIC 3646
HV 3646
S
ZSO 3646
ZSC 3646

6"-3600-RW-874-PCB2PW

HS 3645
ZIO 3645
ZIC 3645
HV 3645
S
ZSO 3645
ZSC 3645

20"-3600-RW-870-PCB2PW

LAL 3600
LALL 3600
LIC 3600
LAH 3600
LAHH 3600
LIT 3600

6"-3600-RW-872-PCB2PW

HS 3640 B
M
HS 3640 A

HV 3636
S
HS 3636
ZSO 3636
ZSC 3636
ZIC 3636
ZIO 3636

HS 3635
ZIO 3635
ZIC 3635
HV 3635
S
ZSO 3635
ZSC 3635

3600-PU-010
PUMP – MAKE-UP WATER NO.2
3 x 4
30 kW

6"-3600-RW-871-PCB2PW

HS 3630 B
M
HS 3630 A

3600-PU-009
PUMP – MAKE-UP WATER NO.1
3 x 4
30 kW

3600-TK-002
TANK – MAKE-UP WATER
100 m3

HS 3643
FSL 3642
FAL 3642
HV 3643
S
FS

SEAL WATER HEADER

HV 3633
S
HS 3633
FSL 3632
FAL 3632
FS

HV 3663
S
HS 3663
FSL 3662
FAL 3662
FS

HV 3653
S
HS 3653
FSL 3652
FAL 3652
FS

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ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
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ISSUE REGISTER

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**
-				

INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

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INITIALS: * DESIGNED ** APPROVED
REVISION REGISTER

No	REFERENCE DRAWINGS NUMBER

PROFESSIONAL SEAL

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PREPARATION	APPROVAL
DESIGNED L. JOE	DISCIPLINE ENGINEER H. RYANS
DRAWN K. CATO	ENGINEERING MANAGER
CHECKED	PROJECT MANAGER
DATE 2011/03/04	CLIENT
SCALE NTS	

CLIENT: les diamants stornoway (canada) inc.

PROJECT: RENARD PROJECT

TITLE: MAKE-UP WATER PIPING AND INSTRUMENTATION DIAGRAM

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
504421	3600	49 D4	0006	PA

504421A1HEN – FRAME A1 HORIZONTAL ENGLISH