



Février 2017

PR10.1 - Renseignements  
complémentaires

# ÉVALUATION DE LA NATURE NON DÉLÉTÈRE DES ROCHES STÉRILES ENTREPOSÉES AU LAC JEANNINE, QUÉBEC

**Présenté à:**

Mme Julie Gravel  
ArcelorMittal Exploitation Minière Canada  
1010, de Sérigny, suite 201  
Longueuil (QC) J4K 5G7

RAPPORT



**Numéro de projet:** 004-1655754\_RF\_Rev1

**Distribution:**

1 copie électronique : ArcelorMittal Exploitation  
Minière Canada, Longueuil, QC  
1 exemplaire papier : Golder Associés Ltée, Montréal,  
QC





## Table des matières

<b>1.0 INTRODUCTION.....</b>	<b>1</b>
1.1 Objectifs.....	1
1.2 Approche .....	1
1.3 Documents consultés .....	2
<b>2.0 DESCRIPTION DU SITE.....</b>	<b>2</b>
<b>3.0 MÉTHODES.....</b>	<b>3</b>
3.1 Sélection des échantillons et méthodes d'échantillonnage.....	3
3.1.1 Roches stériles .....	3
3.1.2 Eau de surface.....	3
3.2 Programme analytique.....	3
3.2.1 Essais géochimiques sur les stériles.....	3
3.2.2 Qualité des eaux de surface .....	4
3.2.3 Essais de toxicité .....	4
3.3 Critères comparatifs : stériles et eau de contact.....	5
3.3.1 Détermination du potentiel de génération d'acide.....	5
3.3.2 Composition chimique des stériles.....	5
3.3.3 Critères de qualité de l'eau de surface.....	6
<b>4.0 RÉSULTATS.....</b>	<b>6</b>
4.1 Composition des stériles.....	6
4.1.1 Potentiel de génération d'acide .....	6
4.1.2 Éléments majeurs .....	7
4.1.3 Éléments traces .....	7
4.1.4 Potentiel de lixiviation (test SFE) .....	8
4.2 Qualité de l'eau de surface .....	9
4.3 Évaluation de la toxicité de l'eau du Lac Jeannine et son émissaire .....	10
4.3.1 Assurance de la qualité/contrôle de la qualité.....	10
4.3.2 Réaction des organismes.....	10
4.3.2.1 Tests de toxicité aigüe.....	11



# ÉVALUATION DE LA NATURE NON DÉLÉTÈRE DES STÉRILES DE LAC JEANNINE - CONFIDENTIEL

4.3.2.2	Tests de toxicité chronique .....	11
4.3.3	Évaluation des résultats des tests.....	14
<b>5.0</b>	<b>DISCUSSION.....</b>	<b>15</b>
<b>6.0</b>	<b>CONCLUSIONS.....</b>	<b>19</b>
<b>7.0</b>	<b>UTILISATION DU RAPPORT ET DE SON CONTENU .....</b>	<b>19</b>
<b>8.0</b>	<b>RÉFÉRENCES.....</b>	<b>21</b>

## TABLEAUX

Tableau 1: Essais de toxicité aiguë et chronique .....	4
Tableau 2: Sommaire des propriétés acido-basiques des 30 échantillons de stérile. ....	6
Tableau 3: Métaux lixiviables ayant des teneurs supérieures aux valeurs des critères. ....	9
Tableau 4: Résumé des résultats des essais de toxicité aiguë et chronique .....	11
Tableau 5: Reproduction (nombre de néonates) de <i>Ceriodaphnia dubia</i> par adulte et pourcentage de la reproduction moyenne en comparaison à l'échantillon de contrôle pour les séries de dilution des échantillons LJ-ES1 and LJ-ES2. ....	12
Tableau 6: Production cellulaire de <i>P. subcapitata</i> exprimée en pourcentage des valeurs de l'échantillon de contrôle pour les séries de dilution de LJ-ES1 et LJ-ES2. ....	12
Tableau 7: Croissance de <i>L. minor</i> exprimée en pourcentage des valeurs de l'échantillon de contrôle pour les séries de dilution de LJ-ES1 et LJ-ES2. ....	13
Tableau 8: Résultats des essais de toxicité chronique sur la truite arc-en-ciel. ....	13

## FIGURES

Figure 1: Teneur en métaux traces des stériles de la série LJ-ST2 et comparaison aux critères provinciaux (Québec) de sol A - Province de Grenville (PSRTC, 2016).....	8
Figure 2: Résultats du test d'extraction SFE pour 15 échantillons de stérile et comparaison aux critères CCME; des dépassements au-dessus de 2 fois la valeur des critères CCME sont observés pour les paramètres encadrés. ....	9

## ANNEXES

### ANNEXE A

Figures

### ANNEXE B

Résultats des essais géochimiques sur les stériles et analyses de l'eau de surface

### ANNEXE C

Certificats d'analyse chimique et de tests de toxicité



## 1.0 INTRODUCTION

ArcelorMittal Exploitation Minière (AMEM) planifie le développement d'un plan compensatoire sur l'ancien site minier du Lac Jeannine en raison de l'expansion de la mine Mont Wright et de l'impact de ces travaux sur des plans d'eau naturels et sur l'habitat du poisson. Le plan restauratif consiste à stabiliser le parc à résidus du site du Lac Jeannine, à aménager des seuils-bassins et à créer un lac artificiel en vue d'augmenter l'habitat du poisson. AMEM propose d'utiliser approximativement 145 000 m<sup>3</sup> de roche stérile de l'ancienne mine du Lac Jeannine pour construire les aménagements restauratifs qui seront en contact direct et indirect avec l'eau de surface et l'habitat du poisson sur le site minier. La roche stérile est déjà en contact avec l'eau, avec la présence d'une halde dans le Lac Jeannine. Cette étude vise à démontrer que ces roches sont non délétères et ne présentent pas d'effets négatifs sur la qualité de l'eau ni sur les organismes qui vivent dans le milieu aquatique.

## 1.1 Objectifs

Golder Associés Ltée (Golder) a été mandatée pour entreprendre l'étude de caractérisation des stériles et des eaux de contact du Lac Jeannine, afin d'établir que les roches stériles sont de nature non délétère, et convenables pour la construction d'aménagements restauratifs. L'étude de caractérisation comprend : 1) des essais géochimiques statiques sur les échantillons de stériles prélevés au site pour estimer leur potentiel de génération d'acide et de lixiviation de métaux, 2) des analyses de l'eau du Lac Jeannine et de son émissaire, et 3) des tests de toxicité sur ces eaux. Les tests réalisés visent à évaluer la toxicité de l'eau qui est en contact avec les stériles depuis plus de 40 ans.

## 1.2 Approche

Dans le cadre du plan compensatoire, le Ministère des Pêches et Océans Canada (MPO) a demandé à AMEM d'obtenir l'aval de Environnement et Changements Climatiques Canada (ECCC) afin de pouvoir utiliser des stériles qui seront en contact avec l'habitat du poisson. Des discussions ont eu lieu entre AMEM et ECCC pour définir les attentes techniques d'ECCC pour l'évaluation de la nocivité des stériles. Le protocole d'évaluation des stériles du Lac Jeannine est basé sur les recommandations d'ECCC ainsi que sur l'expérience de Golder dans la caractérisation de stériles miniers et l'évaluation de la nocivité des stériles faites sur d'autres projets miniers au Canada.

La méthode d'analyse a été présentée dans une lettre à ECCC (Golder, 2016<sup>1</sup>) et est décrite dans la section 3 de ce rapport. Golder a effectué l'échantillonnage de stériles miniers et des eaux de surface du Lac Jeannine et de son exutoire. Des essais géochimiques ont été complétés sur les stériles, des analyses chimiques sur les échantillons d'eau, ainsi que cinq tests de toxicité sur ces eaux ont été complétés à l'été 2016. Ces résultats ont été présentés à ECCC en septembre 2016 lors d'un appel conférence entre Golder, AMEM et ECCC. Suite à cet appel, ECCC a recommandé des tests additionnels, dont des tests d'extraction SFE (« shake flask extraction ») sur les stériles (complété au mois d'octobre 2016) et un sixième test de toxicité sur l'eau de surface (essai sur des salmonidés [truite arc-en-ciel] aux premiers stades de leur cycle biologique, complété au mois de novembre 2016). De nouveaux échantillons d'eau de surface ont été prélevés en octobre 2016 à cette fin puis ont été envoyés au laboratoire pour réaliser cet essai de toxicité. Ce rapport comprend la totalité des résultats obtenus dans le cadre de cette étude, incluant une comparaison avec les résultats antérieurs d'une étude des stériles et eaux de surface réalisée par WSP (2015)<sup>2</sup>.



L'échantillonnage, les tests et l'interprétation des données ont été faits selon le protocole fédéral (NEDEM-MEND 1.20.1, 2009<sup>3</sup>). La qualité de l'eau de contact et des lixiviats a été comparée aux critères fédéraux de qualité de l'eau de surface : *Recommandations pour la qualité des eaux : protection de la vie aquatique, exposition à long terme* du Conseil canadien des ministres de l'environnement (CCME)<sup>4</sup>. La comparaison avec ces critères est faite en vue d'identifier des contaminants potentiels d'intérêt.

### 1.3 Documents consultés

- Protocole d'essais pour l'évaluation de la nocivité des roches stériles déposées sur le site minier abandonné du Lac Jeannine. Division des Mines et Traitements, Environnement et Changement Climatique Canada, mai, 2016.
- Utilisation des stériles dans le cadre du projet de compensation de l'habitat du poisson et des milieux humides à l'ancien site minier du Lac Jeannine. WSP Canada Inc., 12 février 2016.
- Caractérisation géochimique sur les résidus et stériles de l'ancien site minier du Lac Jeannine. WSP Canada Inc., 25 novembre 2015.
- Agrandissement des parcs à résidus et projet de compensation; ArcelorMittal Exploitation Minière, présentation lors de la rencontre avec ECCC, 6 avril 2016.

## 2.0 DESCRIPTION DU SITE

L'ancienne mine du Lac Jeannine est située dans le territoire de Rivière-Mouchalagane sur la Côte-Nord au Québec, à 8 km à l'est de l'ancienne ville minière de Gagnon, et à environ 180 km au sud-ouest de Fermont et de la mine Mont Wright. Le gisement de fer du Lac Jeannine fait partie d'une formation de fer fortement métamorphosée suite à l'orogène de Grenville. Le gisement de fer a été exploité entre 1958 et 1977 sous l'entreprise Québec Cartier. Bien que l'exploitation de la mine ait pris fin aux années 70, le concentrateur du Lac Jeannine est resté en utilisation jusqu'au milieu des années 80 pour traiter le minerai provenant de la mine Fire Lake (située à environ 100 km au nord-est de Lac Jeannine). Les résidus miniers de ces opérations ont été entreposés dans un parc à résidus non confiné par des digues (figure A-1) et, suite à des épisodes d'érosion, des résidus miniers se sont retrouvés en aval de l'aire d'accumulation des résidus, formant des bancs en bordure des cours d'eau sur plusieurs dizaines de kilomètres. Le site a été restauré selon les standards de l'époque puis retourné à la Couronne. Il fait maintenant partie des sites orphelins abandonnés.

En amont du parc à résidus se trouvent des empilements de stériles qui s'étendent jusqu'au Lac Jeannine, et qui retranchent le tiers de la superficie originelle du lac. Les empilements s'étendent aussi de part et d'autre de l'émissaire du Lac Jeannine, de manière que l'émissaire devient souterrain, pour ensuite faire résurgence à l'extrémité sud de l'empilement de stériles (figure A-1).

Les plans d'eau du bassin versant du Lac Jeannine montrent des signes de productivité autant aux secteurs affectés par les opérations minières qu'en milieu naturel, où des populations de poissons sont abondantes malgré le contact prolongé de l'eau de surface avec les stériles depuis plus de 40 ans, depuis l'arrêt des opérations d'extraction du minerai de fer (WSP 2015).



## 3.0 MÉTHODES

La liste des échantillons solides et d'eau de surface ainsi que des méthodes d'analyse utilisées sont présentées dans l'annexe B, tableau B-1.

### 3.1 Sélection des échantillons et méthodes d'échantillonnage

#### 3.1.1 Roches stériles

La sélection des échantillons de stériles a été basée sur les indications faites par AMEM concernant les régions des empilements d'où les stériles seront extraits pour construire les aménagements. Les stériles proviennent du secteur de construction de la nouvelle canalisation pour l'émissaire du Lac Jeannine et sont identifiés dans les encadrés jaunes sur la figure A-1. La zone d'échantillonnage de stérile LJ-ST1 mesure approximativement 100 m par 300 m et la zone LJ-ST2 a un diamètre approximatif de 200 m. Au total, 30 échantillons de roche ont été prélevés au mois d'août 2016 dans ces deux secteurs, dont 17 à LJ-ST1 et 13 à LJ-ST2. Ce nombre d'échantillons satisfait les recommandations du guide NEDEM-MEND (2009) et, tenant compte de l'étendue de la zone d'échantillonnage et l'espacement entre échantillons, fournira un aperçu de la variabilité compositionnelle des stériles.

Les échantillons LJ-ST1-1 à 17 et LJ-ST2-1 à 13 ont été prélevés à la pelle et tamisés afin de collecter des particules de taille inférieure à 5 cm. Cette taille maximale de particules a été choisie afin d'échantillonner des particules plus fines, qui contribuent davantage aux échanges chimiques avec l'eau que les particules plus grossières. Approximativement 20 à 25 kg de stériles ont été échantillonnés de cette manière pour chaque point, dans des chaudières de 20 L doublées de sacs en plastique.

#### 3.1.2 Eau de surface

Les emplacements des stations d'échantillonnage d'eau (figure A-1) ont été sélectionnés de manière à représenter la qualité de l'eau en contact avec les stériles. La station LJ-ES1 est située sur l'émissaire du Lac Jeannine, à l'endroit où il fait résurgence de l'empilement de stériles. La station LJ-ES2 est située au bord du Lac Jeannine, où l'eau est en contact avec l'empilement de stériles. Ces deux points d'échantillonnage ont été revus et acceptés par le représentant de l'ECCC lors de la visite du site au mois de juillet 2016.

Lors de la deuxième campagne d'échantillonnage (au mois d'octobre 2016), le point d'échantillonnage initial LJ-ES2 a été déplacé (pour des raisons de sécurité d'accès) au point LJ-ES2(a) indiqué sur la figure A-1, à un endroit où l'eau du lac est aussi visiblement en contact avec les stériles.

Dans les deux cas (échantillonnage du mois d'août et octobre 2016), l'échantillonnage a été fait à partir du bord de l'eau en utilisant une perche de 12 pieds avec un contenant de 2 L attaché au bout de la perche. L'eau a été échantillonnée en surface, afin d'éviter l'échantillonnage d'eau boueuse plus en profondeur. L'eau a été collectée dans des chaudières de 20 L doublées de sacs en plastique, et gardée au frais avec de la glace pendant le transport. Des mesures de pH et de conductivité ont été prises lors de l'échantillonnage.

## 3.2 Programme analytique

### 3.2.1 Essais géochimiques sur les stériles

Tous les échantillons de stériles ont été analysés au laboratoire SGS Canada de Lakefield, en Ontario. Les tests ont compris :



- Le test acido-basique (ABA) par la méthode Sobek modifiée (NEDEM-MEND 2009). Cette analyse comprend le soufre total, sulfate, sulfure, le pH en pâte et le potentiel neutralisant digéré par la méthode Sobek modifiée.
- L'analyse des éléments majeurs sous forme d'oxyde par fluorescence à rayon X (ou XRF : « X-ray fluorescence »).
- L'analyse des éléments traces par digestion à l'aqua regia (méthode MA200) et l'analyse par ICP-MS pour les éléments listés dans ECCC 2016, soit : Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, F, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Ra, Sb, Se, Si, Sn, Sr, Ti, Tl, U, V, W, Zn et Zr.
- Shake Flask Extraction Test (SFE, de Price 1997, référée dans NEDEM-MEND 2009) avec l'analyse du lixiviat pour les éléments en liste au tableau 1 de ECCC (2016) : pH, Al, Ag, As, B, Cd, Cl, Cr VI, Cr III, Co, Cu, Fe, F, Hg, Mo, Ni, N-NH<sub>3</sub>, NO<sub>2</sub>, NO<sub>3</sub>, P, Pb, Se, Th, U, Zn, en plus des éléments suivants : sulfate, alcalinité, conductivité, Ca, K, Na, Mg, Mn et Fe. Deux exceptions sont : le cyanure, qui ne sera pas analysé puisque ce composé typiquement utilisé pour l'extraction de l'or n'a jamais été employé au site, et le méthyl mercure qui est un composé transformé par la matière organique, celle-ci étant absente dans les roches. Par contre, ces deux composés seront analysés de l'eau de surface.

### 3.2.2 Qualité des eaux de surface

Des mesures du pH et de conductivité ont été effectuées à la prise de chaque échantillon et ces mesures ont été reprises au laboratoire ALS à Burnaby, en Colombie-Britannique. Les eaux ont aussi été analysées chez ALS pour les paramètres chimiques du tableau 1 d'ECCC (2016) : pH, Al, Ag, As, B, Cd, Cl, Cr VI, Cr III, Co, Cu, Fe, F, Hg, méthyl-Hg, Mo, Ni, CN-libre, N-NH<sub>3</sub>, NO<sub>2</sub>, NO<sub>3</sub>, P, Pb, Se, Th, U, Zn, en plus des éléments suivants : sulfate, Ca, K, Na, Mg, Mn, Fe, alcalinité, conductivité, dureté et matières en suspension.

### 3.2.3 Essais de toxicité

Six essais de toxicité spécifiés dans le tableau 1 ont été complétés pour évaluer le potentiel de toxicité aiguë et chronique des échantillons d'eau de contact de la mine du Lac Jeannine (LJ-ES1 et LJ-ES2). Les essais ont été complétés aux laboratoires de Nautilus Environmental (Calgary, Alberta et Burnaby, Colombie-Britannique). Les cinq premiers tests de toxicité ont été effectués en utilisant l'eau prélevée lors du premier échantillonnage au mois d'août 2016. Le sixième essai, sur les salmonidés aux premiers stades de leur cycle biologique, a été effectué en utilisant l'eau de contact prélevée lors du deuxième échantillonnage au mois d'octobre 2016 (LJ-ES1[a] et LJ-ES2[a]). Les analyses de la composition chimique des échantillons d'eau, ainsi que le contrôle de la qualité de l'eau pendant le test de toxicité chronique sur les salmonidés (ayant une durée de 30 jours) ont été effectués au laboratoire d'ALS de Burnaby, Colombie-Britannique comme décrit dans la section 3.2.2.

**Tableau 1 : Essais de toxicité aiguë et chronique**

	Méthode	Description du test	Espèce testée	Durée du test (jours)
1	SPE 1/RM/13 Environnement Canada (2000)	Tests de létalité aiguë	Truite arc-en-ciel ( <i>Oncorhynchus mykiss</i> )	4
2	SPE 1/RM/14 Environnement Canada (2000)		Crustacé planctonique ( <i>Daphnia magna</i> )	2
3	SPE 1/RM/21 Environnement Canada (2007)	Test de reproduction d'invertébrés	Cladocère ou puce d'eau ( <i>Ceriodaphnia dubia</i> )	7



## ÉVALUATION DE LA NATURE NON DÉLÉTÈRE DES STÉRILES DE LAC JEANNINE - CONFIDENTIEL

	Méthode	Description du test	Espèce testée	Durée du test (jours)
4	SPE 1/RM/25 Environnement Canada (2007)	Tests de toxicité sur les algues et plantes	Algue verte ( <i>Pseudokirchneriella subcapitata</i> )	3
5	SPE 1/RM/37 Environnement Canada (2007)		Petite lentille d'eau ( <i>Lemna minor</i> )	7
6	SPE 1/RM/28 Environnement Canada (1998)	Test aux premiers stades du développement des poissons	Truite arc-en-ciel ( <i>Oncorhynchus mykiss</i> )	30

Les essais de toxicité ont été faits suivant les procédures standards des protocoles indiqués dans le tableau 1, et comprennent un échantillon de contrôle qui consiste à suivre le comportement des organismes dans l'eau propre de laboratoire. Les tests de toxicité aigüe sur la truite arc-en-ciel et *D. magna* ont été faits avec une seule concentration de l'eau du Lac Jeannine (à 100 % v/v) et un échantillon de contrôle. Des séries de dilutions variables (% v/v) de l'eau de contact du site ont été utilisées pour les tests de toxicité chronique sur *C. dubia*, *P. subcapitata*, *L. minor* et la truite arc-en-ciel.

La performance des organismes dans les échantillons de contrôle a été vérifiée pour chaque protocole afin d'évaluer si les tests sont conformes aux critères concernant l'historique de la santé et la sensibilité des organismes. L'état des organismes suite à leur exposition à l'eau du Lac Jeannine a été comparé à leur état dans l'échantillon de contrôle, étant donné qu'un échantillon de référence n'a pas été inclus dans cette étude. Les paramètres statistiques des tests ont été calculés au besoin tenant compte des protocoles standards, exprimés en LC<sub>50</sub> (concentration létale sur 50 % des organismes), EC<sub>25</sub> (concentration causant un effet nocif dans 25 % des organismes) et IC<sub>25</sub> (concentration inhibitrice causant une réduction de 25 % dans la réaction des organismes) relativement à l'échantillon de contrôle. De plus, la composition chimique des échantillons d'eau de contact du site a été examinée pour évaluer des possibles corrélations entre l'état des organismes et la qualité des échantillons d'eau, particulièrement pour les métaux et ions majeurs ayant des concentrations élevées.

### 3.3 Critères comparatifs : stériles et eau de contact

#### 3.3.1 Détermination du potentiel de génération d'acide

La classification du potentiel de génération d'acide des stériles a été faite en utilisant la méthode NEDEM-MEND (2009), selon laquelle un échantillon est classifié comme potentiellement générateur d'acide si le rapport du potentiel de neutralisation (PN) sur le potentiel d'acidité (PA) ou RPN est inférieur à 1; si  $1 < RPN < 2$ , le potentiel de génération d'acide demeure incertain; si  $RPN > 2$  l'échantillon est classifié comme étant non générateur d'acide.

#### 3.3.2 Composition chimique des stériles et de leur lixiviat

Les résultats des métaux extractibles des solides obtenus par la méthode MA200 ont été comparés à titre informatif aux critères québécois des sols A (Province de Grenville) du *Guide d'intervention – Protection des sols et des terrains contaminés* (PSRTC), MDDELCC, 2016<sup>5</sup> et aux abondances des éléments dans la croûte terrestre (Price, 1997)<sup>6</sup>.

Les critères fédéraux de qualité de l'eau de surface ont été utilisés pour comparer les résultats des tests d'extraction (« shake flask extraction [SFE] test ») : *Recommandations pour la qualité des eaux : protection de la*





vie aquatique, exposition à long terme du Conseil canadien des ministres de l'environnement (CCME). Ces critères tiennent compte de la valeur de la dureté du milieu récepteur (8 à 31 mg/L CaCO<sub>3</sub>).

Il est important de noter que le test d'extraction réalisé (SFE) dans le but de définir les éléments aptes à être relâchés dans l'eau du lac est très conservateur de par la méthode utilisée (concassage du roc et agitation sur 18 heures dans un flasque fermé). Ceci résulte en une extraction substantiellement plus agressive que l'exposition actuelle et future de blocs de roche stérile dans l'eau du lac. Par conséquent, la comparaison à des critères de qualité d'eau de surface représente une évaluation très prudente du risque potentiel des résidus. De plus, plusieurs des critères CCME comprennent un facteur de sécurité afin d'assurer la protection de la vie aquatique (CCME 2007), de sorte qu'un dépassement de ces critères n'est pas nécessairement indicateur d'effet sur la vie aquatique du milieu en question.

### 3.3.3 Critères de qualité de l'eau de surface

Les critères applicables pour les eaux de contact du site proviennent également des *Recommandations pour la qualité des eaux : protection de la vie aquatique, exposition à long terme* du Conseil canadien des ministres de l'environnement (CCME). Ces critères tiennent compte de la valeur de la dureté des eaux de surface mesurés au site (31 et 8 mg/L CaCO<sub>3</sub>).

La qualité de l'eau de surface a été aussi comparée à titre informatif avec les critères provinciaux : *Critères de qualité de l'eau de surface*, Ministère du Développement durable de l'Environnement de la Faune et des Parcs (MDDEFP) 2013<sup>7</sup>.

## 4.0 RÉSULTATS

### 4.1 Composition des stériles

Les résultats de la caractérisation géochimique des stériles sont présentés dans l'annexe A, figures A-2 à A-4, et dans les tableaux B-2 à B-5 de l'annexe B, qui comprennent l'évaluation du potentiel de génération acide, la composition chimique (teneur en éléments majeurs et éléments traces) et les résultats des tests d'extraction (SFE).

#### 4.1.1 Potentiel de génération d'acide

Un sommaire des résultats du test acido-basique (ABA) est présenté dans le tableau 2 et les résultats complets se trouvent dans l'annexe B, tableau B-2. Selon la classification NEDEM-MEND (2009) les 30 échantillons de stérile sont non-acidogènes, étant donné que le rapport du potentiel neutralisant RPN est nettement supérieur à 2, à une valeur de 402 en moyenne. La faible teneur en soufre total et en sulfures (généralement en dessous des limites de détection), ainsi qu'un faible PA (0,36 en moyenne) et un PN significatif (80 en moyenne) appuient cette conclusion. Le pH moyen de la pâte est égal à 9,2 et indique que les 30 échantillons n'ont pas de potentiel de relâcher de l'acidité.

**Tableau 2 : Sommaire des propriétés acido-basiques des 30 échantillons de stériles**

Paramètre	Plage de données	Moyenne
S <sub>total</sub> (%)	<0,005 à 0,053	0,011
Sulfure (%)	<0,02 à 0,02	N.C.



Paramètre	Plage de données	Moyenne
Potentiel acidogène (PA)	<0,16 à 1,66	0,36
Potentiel neutralisant (PN)	3,7 à 873	80
Rapport du potentiel neutralisant (RPN = PN/PA)	12,7 à 5456	402

N.C. - non calculé en raison d'une majorité de résultats en dessous de la limite de détection.

### 4.1.2 Éléments majeurs

Les résultats de la teneur en éléments majeurs des stériles obtenus par fluorescence de rayon X (XRF) indiquent que les 30 échantillons de stérile contiennent du Si, Al, Fe, Mg, Ca, Na et K comme éléments majeurs (tableau B-3). Les échantillons de la zone LJ-ST1 démontrent une faible hétérogénéité dans les teneurs en Al, Fe, Na et K en comparaison à la série LJ-ST2 (figure A-2). Cette variabilité compositionnelle est vraisemblablement due au caractère des roches stériles, qui démontrent occasionnellement une alternance de rubans riches en minéraux aluminosilicatés et minéraux mafiques; ceci est seulement basé sur des observations visuelles faites sur le terrain. La teneur variable en calcium et magnésium de la série LJ-ST2 (figure A-2) est probablement due à des teneurs variables en minéraux carbonatés, dont la calcite ou la dolomite.

### 4.1.3 Éléments traces

Les résultats des métaux extractibles par la méthode MA200 indiquent une faible variabilité compositionnelle pour la série LJ-ST1, notamment pour le Ba, Cr, Ti et Zn (figure A-3). Une comparaison a été faite à titre informatif aux critères de sol A (Province de Grenville) et peu de dépassements sont observés. La majorité des éléments chimiques sont présents en concentration largement inférieure aux critères de qualité de sol du Québec. De faibles dépassements sont notés sur cinq échantillons de la zone LJ-ST1 pour Ba, et un échantillon pour le chrome (tableau B-4). La teneur en éléments traces des stériles LJ-ST2 est homogène et aucun dépassement des critères des sols est observé (figure 1, A-3 et tableau B-4).

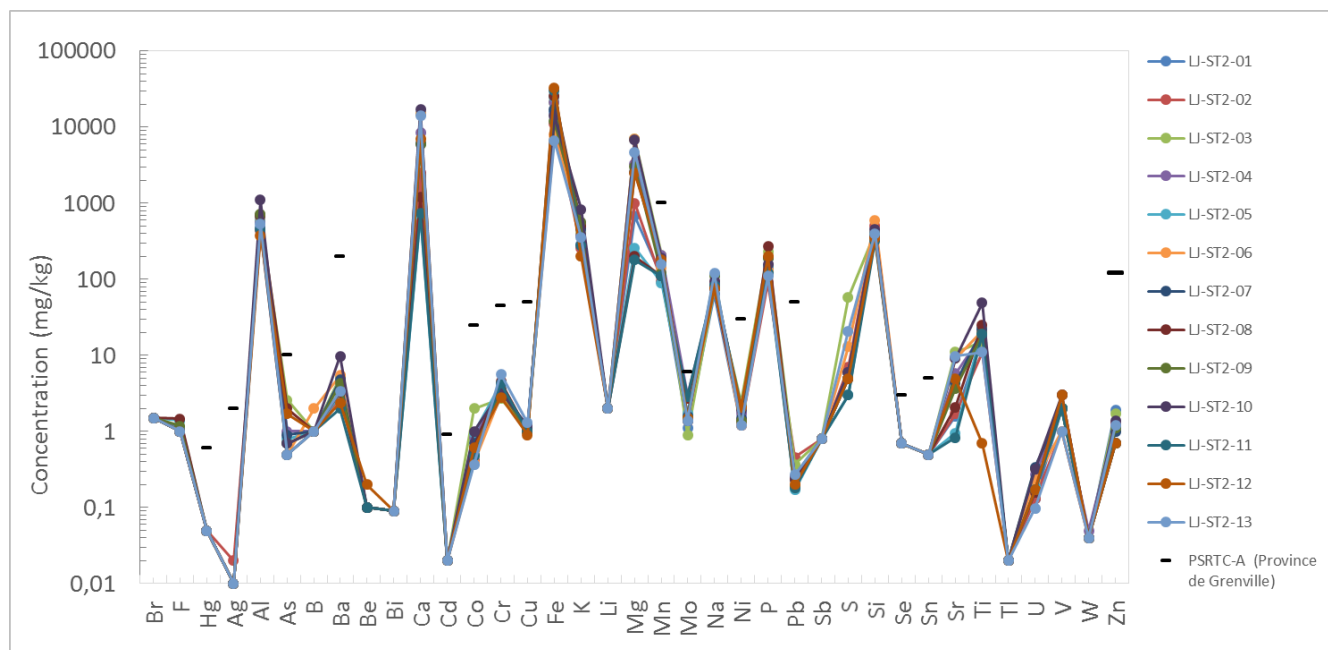


Figure 1 : Teneur en métaux traces des stériles de la série LJ-ST2 et comparaison aux critères provinciaux (Québec) de sol A - Province de Grenville (PSRTC, 2016)

#### 4.1.4 Potentiel de lixiviation (test SFE)

Le potentiel de lixiviation des métaux a été déterminé de façon conservatrice (voir section 3.3.2) pour 15 échantillons représentatifs des deux endroits échantillonnés (des endroits d'où proviendront le stérile pour la construction). Les échantillons choisis pour cet essai sont représentatifs de l'écart compositionnel des stériles pour les éléments majeurs dont Si, Al, Fe, et des métaux extractibles, dont Ba et Cr; ils ont été choisis de sorte à capter la plage de la composition moyenne et la plage supérieure des concentrations de ces paramètres.

Les résultats du test SFE (figure 2, A-4 et tableau B-5) montrent des dépassements des critères CCME pour certains paramètres, dont Al, As, Cr, Cu, Fe et Se. Les dépassements sont généralement faibles ou se situent à l'intérieur du facteur de sécurité des critères CCME (valeurs en dessous de 10 fois le critère selon CCME [2007]). Les paramètres et le nombre de dépassements des critères CCME sont résumés dans le tableau 3 et illustrés dans la figure 2.

Les dépassements pour l'arsenic et le chrome sont marginaux, à 0,00052 mg/L vs. le critère de 0,0005 mg/L pour l'arsenic; et 0,0012 et 0,0023 mg/L vs. le critère de 0,001 mg/L pour le chrome. L'aluminium dépasse légèrement le critère CCME (jusqu'à un peu plus de 2x le critère) pour cinq échantillons de la série LJ-ST1 et trois échantillons de la série LJ-ST2. Seulement un échantillon sur 15 montre un dépassement marginal du fer (un peu plus de 2x le critère), les autres dépassements étant proches de la valeur du critère (0,34 et 0,5 vs. le critère de 0,3 mg/L). Un dépassement du cuivre sur 15 échantillons est au-dessus de 10 fois la valeur du critère, les autres dépassements étant proche du critère et majoritairement en dessous de 3 fois la valeur du critère.

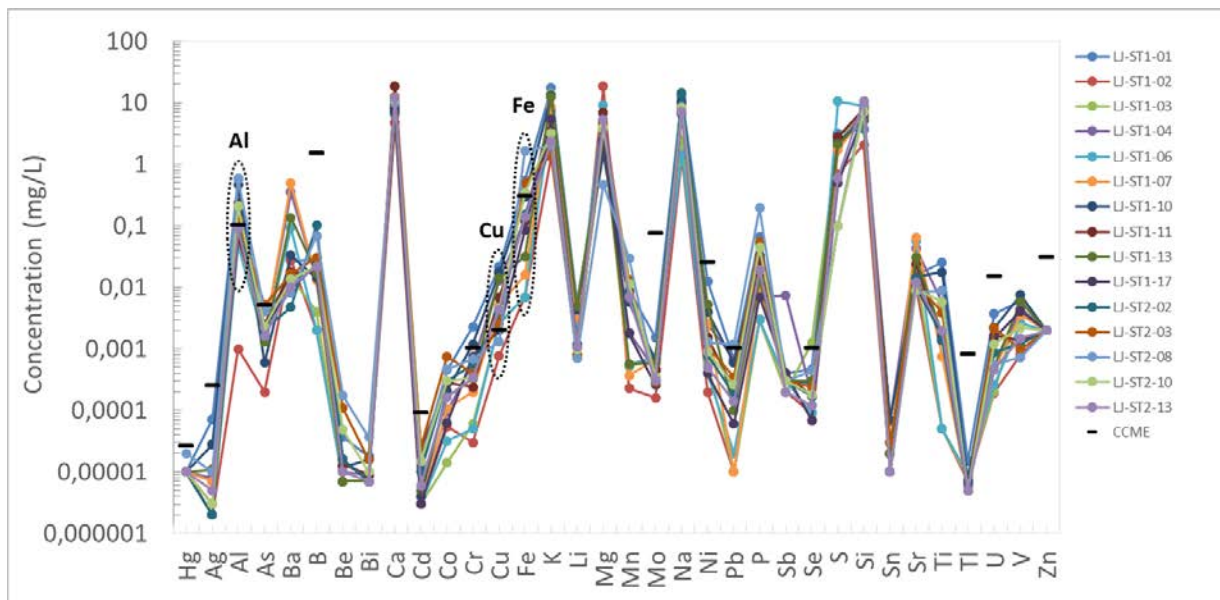


Figure 2 : Résultats du test d'extraction SFE pour 15 échantillons de stérile et comparaison aux critères CCME; des dépassements au-dessus de 2 fois la valeur des critères CCME sont observés pour les paramètres encerclés

Tableau 3 : Métaux lixiviables ayant des teneurs supérieures aux valeurs des critères

Essai	Série d'échantillons	Nombre d'échantillons analysés	Dépassements des critères observés (nombre de dépassements)
SFE <sup>(1)</sup>	LJ-ST1	10	Al(5), Cu(8), Cr(2), Fe(1), Se(1)
	LJ-ST2	5	Al(3), Cu(4), Fe(3), As(1), Pb(1)

<sup>(1)</sup> Comparaison aux critères de la protection de la vie aquatique (à long terme) du Conseil canadien des ministres de l'environnement (CCME).

Étant donné la nature conservatrice des tests d'extraction réalisés, il est considéré que ces dépassements ne représentent pas de risques significatifs à la qualité de l'eau de surface.

## 4.2 Qualité de l'eau de surface

Les paramètres physiques et la composition chimique des eaux de contact du Lac Jeannine et de son émissaire avec les stériles sont donnés dans l'annexe B, tableau B-6. Les échantillons montrent des compositions similaires pour les deux échantillonnages effectués aux mois d'août et octobre 2016. Tous les échantillons ont des valeurs de pH proche de la neutralité. Des différences de conductivité, de dureté et d'alcalinité sont notés entre la chimie des échantillons LJ-ES1 et LJ-ES2 : la conductivité a une valeur maximale autour de 82 uS/cm pour LJ-ES1 et 28 uS/cm pour LJ-ES2; la dureté et l'alcalinité suivent cette tendance aussi, étant approximativement 4 fois supérieurs dans l'échantillon LJ-ES1. Les différences entre les deux échantillons sont dans leur teneur en sulfate, calcium et magnésium, qui sont environ quatre fois plus élevées dans l'échantillon LJ-ES1.



L'aluminium est le seul paramètre qui dépasse faiblement le critère CCME, et ce, seulement dans l'échantillon LJ-ES2 du Lac Jeannine. Les teneurs en aluminium des échantillons LJ-ES2 et LJ-ES2(a) du mois d'août et octobre sont autour de 2 fois la valeur du critère de l'aluminium (0,1 mg/L), à des valeurs de 0,225 et 0,173 mg/L.

Contrairement aux résultats des tests SFE, le cuivre ne montre aucun dépassement dans les échantillons d'eau de contact; la teneur du cuivre dissous et total dans les eaux de surface du site varie de <0,0010 à 0,0013 mg/L pour un critère du Cu de 0,002 mg/L. Aucun dépassement n'est observé dans l'eau de l'émissaire du Lac Jeannine qui traverse la halde de stériles (échantillons LJ-ES1 et LS-ES1[a]).

### 4.3 Évaluation de la toxicité de l'eau du Lac Jeannine et son émissaire

#### 4.3.1 Assurance de la qualité/contrôle de la qualité

La validité des essais de toxicité aiguë et chronique a été basée sur l'assurance de la qualité/contrôle de la qualité pour chacun des tests comme décrit :

- L'historique de la santé des organismes utilisés dans les essais a été acceptable et conforme aux protocoles d'Environnement Canada.
- Les critères d'acceptabilité des échantillons de contrôle ont été respectés pour chacun des tests.
- Pendant la durée des tests, les paramètres de la qualité de l'eau sont restés à l'intérieur des limites prescrites par le protocole.
- Il n'y a pas eu de déviation des protocoles, sauf pour deux cas : les essais chroniques sur *Lemna minor* et la truite arc-en-ciel. En ce qui concerne *L. minor*, l'acclimatation des frondes a été faite pour une période de 48 h avant le début de l'essai, en raison d'un délai de livraison (déviation de la période de 24 h suggérée dans le protocole). Ceci est une déviation mineure, et il est attendu que la qualité et la fiabilité des résultats ne soient pas affectés. Une deuxième déviation consiste en la réduction de la fréquence des changements d'eau pendant le test chronique d'une durée de 30 jours sur la truite arc-en-ciel. Dans ce cas également, il est attendu que la déviation du protocole n'aie pas d'effets sur la fiabilité des résultats, étant donné que les teneurs en métaux et les paramètres physiques sont restés constants pendant la durée des essais. Ceci est illustré par des analyses de la qualité de l'eau qui ont été complétées pendant la durée du test (tableau B-6).
- Les résultats des essais avec un produit toxique de référence s'inscrivent dans des plages acceptables pour la performance des organismes (moyenne et deux écarts type); ceci est basé sur des résultats historiques obtenus par le laboratoire et indique que la sensibilité des organismes a été acceptable.

#### 4.3.2 Réaction des organismes

Les résultats des essais de toxicité aiguë et chronique sont résumés dans le tableau 4, et discutés plus bas et dans la section 4.3.3. Les protocoles des essais ainsi que les résultats détaillés sont présentés dans les rapports de laboratoire (voir annexe C).



Tableau 4 : Résumé des résultats des essais de toxicité aigüe et chronique

Espèce	Durée de l'essai (jours)	LJ-ES1	LJ-ES2
Truite arc-en-ciel	4	Pas de mortalité	Pas de mortalité
<i>D. magna</i>	2	Pas de mortalité ou immobilité	Pas de mortalité ou immobilité
<i>C. dubia</i>	7	LC <sub>50</sub> > 100 % IC <sub>25</sub> = 99 % (44 % NC)	LC <sub>50</sub> > 100 % IC <sub>25</sub> > 100 %
<i>P. subcapitata</i>	3	IC <sub>25</sub> > 91 %	IC <sub>25</sub> > 91 %
<i>L. minor</i>	7	IC <sub>25</sub> > 97 % nombre de frondes et masse sèche	IC <sub>25</sub> > 97 % nombre de frondes et masse sèche
Truite arc-en-ciel	30	EC <sub>25</sub> > 100 % survie et viabilité	EC <sub>25</sub> > 100 % survie et viabilité

Les paramètres statistiques sont présentés en pourcentage de volume (%v/v) de la concentration initiale (100 % v/v) des échantillons LJ-ES1 et LJ-ES2.

LC<sub>50</sub> – concentration médiane létale.

EC<sub>25</sub> – concentration causant l'incidence d'un effet nocif à 25 %.

IC<sub>25</sub> – concentration inhibitrice, causant une réduction de réponse de 25 % relative à l'échantillon de contrôle.

NC – résultat non calculable (en dehors des limites de résultats plausibles).

#### 4.3.2.1 Tests de toxicité aigüe

Aucun impact sur la survie (100 % survie) ni aucune indication de stress n'ont été observés ni dans les essais sur la truite arc-en-ciel pour les échantillons LJ-ES1 et LJ-ES2 (concentrés à 100 % v/v), ni dans l'échantillon de contrôle du laboratoire pendant la durée du test (4 jours).

Aucun impact sur la survie (100 % survie) ni aucune indication d'immobilité n'ont été observés pour *D. magna* ni dans les échantillons LJ-ES1 et LJ-ES2 concentrés à 100 % v/v, ni dans l'échantillon de contrôle du laboratoire pendant la durée du test (2 jours).

Ensemble, ces résultats suggèrent que les échantillons d'eau du Lac Jeannine et de son émissaire ne présentent pas de toxicité aigüe.

#### 4.3.2.2 Tests de toxicité chronique

##### *Ceriodaphnia dubia*

Les essais chroniques sur *C. dubia* ne montrent pas de mortalité significative dans les échantillons LJ-ES1 et LJ-ES2 (survie à 90-100 % dans tous les traitements). Le taux de survie à 90 % se situe à l'intérieur des limites normales de la plage de variabilité de l'essai, et est dû à une seule incidence de mortalité d'une femelle adulte *C. dubia* (c.à.d. le test expose une femelle enceinte par réplica du test, et chacune produit de multiples couvées). Les résultats de ces tests sont illustrés dans le tableau 5 de deux manières différentes : en fonction du nombre de néonates<sup>a</sup> produits par adulte, et en fonction du nombre moyen de néonates produit. Ces résultats sont comparés à l'essai fait dans l'échantillon de contrôle (en utilisant de l'eau propre de laboratoire) qui est considéré dans la détermination de la réussite du test. Une baisse de la reproduction de 24 % et 17 % (nombre moyen de

<sup>a</sup> Nouveaux nés de la puce d'eau *C. dubia*



## ÉVALUATION DE LA NATURE NON DÉLÉTÈRE DES STÉRILES DE LAC JEANNINE - CONFIDENTIEL

néonates produits) a été observée dans les échantillons LJ-ES1 et LJ-ES2 (à 100 % v/v), respectivement, en relation à l'échantillon de contrôle (tableau 5); ces résultats sont discutés plus en détail dans la section 4.3.3.

En ce qui concerne l'inhibition de la reproduction de *C. dubia*, le IC<sub>25</sub> est de 99 % v/v pour l'eau de l'émissaire du Lac Jeannine (LJ-ES1) et >100 % v/v pour l'eau du lac (LJ-ES2). Ce paramètre indique que les effets d'inhibition pour 25 % de la population sont non significatifs dans l'eau non-diluée (LJ-ES2), ou faiblement diluée (à 99 % v/v pour LJ-ES1).

**Tableau 5 : Reproduction (nombre de néonates) de *Ceriodaphnia dubia* par adulte et pourcentage de la reproduction moyenne en comparaison à l'échantillon de contrôle pour les séries de dilution des échantillons LJ-ES1 and LJ-ES2**

Échantillon	Type de données	Contrôle	Dilutions						
			1,6 % v/v	3,1 % v/v	6,3 % v/v	13 % v/v	25 % v/v	50 % v/v	100 % v/v
LJ-ES1	Nombre de néonates par adulte	15±3	14±5	15±4	14±3	16±4	16±3	14±5	11±4
	% de reproduction vs. l'échantillon contrôle		97 %	99 %	97 %	105 %	111 %	95 %	76 %
LJ-ES2	Nombre de néonates par adulte	19±2	18±3	19±3	19±4	19±7	18±7	24±3	15±3
	% de reproduction vs. l'échantillon contrôle		96 %	100 %	101 %	102 %	96 %	127 %	83 %

### *Pseudokirchneriella subcapitata*

Aucune déficience n'a été observée concernant le développement ni la croissance de *P. subcapitata* dans les échantillons LJ-ES1 et LJ-ES2 en comparaison aux échantillons de contrôle. Des effets stimulateurs (augmentation de production cellulaire) ont été observés aux concentrations plus élevées (46 et 91 % v/v) pour l'eau de l'émissaire (LJ-ES1), ainsi que pour l'eau du lac (LJ-ES2) à la plus basse dilution (2,8 % v/v). Dans le cas de LJ-ES2, la croissance a été réduite par 15 % pour la concentration la plus élevée de l'échantillon (91 % v/v) (tableau 6).

**Tableau 6 : Production cellulaire de *P. subcapitata* exprimée en pourcentage des valeurs de l'échantillon de contrôle pour les séries de dilution de LJ-ES1 et LJ-ES2**

Échantillon	Contrôle	2,8 % v/v	5,7 % v/v	11 % v/v	23 % v/v	46 % v/v	91 % v/v
LJ-ES1	100±6,3	100±7,6	97±1,3	101±2,9	107±3,5	149±1,7	116±5,5
LJ-ES2	100±6,4	127±13,6	99±4,6	99±0	102±2,8	97±5,6	85±3,2

De plus, le IC<sub>25</sub> pour l'inhibition de la croissance est à une valeur > 91 % v/v pour les deux échantillons, c'est-à-dire qu'il n'y a pas d'effet d'inhibition de croissance sur l'échantillon le moins dilué. Il n'y a aucune indication que les échantillons à 100 % v/v présenteraient une toxicité chronique significative (à noter que l'essai a été fait avec une dilution maximale de 91 % v/v étant donné l'introduction de nutriments à l'échantillon pour la performance normale de l'essai, comme requis et spécifié dans le protocole).



**Lemna minor**

Aucune déficience n'a été observée dans la croissance de *L. minor* dans les échantillons LJ-ES1 et LJ-ES2 en comparaison à l'échantillon de contrôle. Au contraire, la croissance (exprimée en nombre de frondes et masse sèche) a été stimulée dans le cas des deux échantillons d'eau à partir d'une concentration de 12 % v/v, et augmente avec la concentration (tableau 7).

**Tableau 7 : Croissance de *L. minor* exprimée en pourcentage des valeurs de l'échantillon de contrôle pour les séries de dilution de LJ-ES1 et LJ-ES2**

Échantillon	Observation	Contrôle	Dilutions						
			1,5 % v/v	3 % v/v	6,1 % v/v	12,1 % v/v	24 % v/v	49 % v/v	97 % v/v
LJ-ES1	Nombre frondes (% de l'échantillon de contrôle)	100±8,7	104±8,5	110±6,6	99±7,4	111±6,6	119±12,2	141±9,3	149±3,9
	Masse sèche (% de l'échantillon de contrôle)	100±8,2	103±11,3	104±15,9	101±21,3	111±6	141±16,3	153±16,1	189±15,7
LJ-ES2	Nombre frondes (% de l'échantillon de contrôle)	100±9,5	102±17,2	94±18,6	94±15,3	124±16,9	135±9,5	163±11,8	151±11,7
	Masse sèche (% de l'échantillon de contrôle)	100±8,5	109±9,4	93±16,4	92±13,0	129±18,4	150±11,4	196±5,2	185±8,3

Le IC<sub>25</sub> de l'inhibition de la croissance est 97 % v/v pour les deux échantillons d'eau. L'amélioration de la performance à des concentrations élevées n'indique pas un effet nocif ou l'eutrophication; des effets stimulateurs sont observés couramment pour ce test en raison des conditions bénéfiques dont la présence de nutriments dans des échantillons d'eau de surface naturelle relativement à un échantillon de contrôle qui est propre.

**Essai sur des salmonidés (truite arc-en-ciel) aux premiers stades de leur cycle biologique**

Cet essai ne montre aucun effet défavorable sur la survie ou sur la normalité des alevins de truites arc-en-ciel pour l'eau du Lac Jeannine et l'eau de son émissaire. Le taux moyen de survie et éclosion d'alevins normaux a été >90 % dans tous les essais (tableau 8).

**Tableau 8 : Résultats des essais de toxicité chronique sur la truite arc-en-ciel**

Concentration	LJ-ES1(a)		LJ-ES2(a)	
	Survie	Normalité	Survie	Normalité
Échantillon de contrôle	95,4 ± 7,2	92,9 ± 6,2	97,5 ± 3,2	95,8 ± 4,2
50 % v/v	95,2 ± 5,6	93,5 ± 4,6	95,0 ± 3,3	93,3 ± 4,7
100 % v/v	96,7 ± 2,7	95,0 ± 4,3	93,3 ± 9,0	90,8 ± 7,4

Les valeurs du LC<sub>50</sub> et le EC<sub>25</sub> pour la survie et normalité ont été >100% v/v pour les deux échantillons du Lac Jeannine (LJ-ES1[a] et LJ-ES2[a]), c'est-à-dire que l'échantillon non dilué n'a pas de toxicité chronique. Les





paramètres finaux de la survie et du développement normal pour les deux échantillons se situent à l'intérieur des limites de performance des échantillons de contrôle.

### 4.3.3 Évaluation des résultats des tests

Les résultats des essais de toxicité chronique et aiguë sur les échantillons d'eau du Lac Jeannine et de son émissaire ne montrent pas d'effets défavorables.

On remarque par contre une réduction de 24 % de la reproduction de *C. dubia*, observée dans l'échantillon 100 % v/v LJ-ES1. Ce taux de réponse des organismes (24 %) se situe dans la plage de réponses définies par CCME (2007)<sup>8</sup> comme représentant un seuil de faible effet toxique (EC<sub>15-25</sub> ou IC<sub>15-25</sub>). Ce résultat est considéré ambigu, étant donné la faible ampleur de l'effet, et le manque de cohérence de l'effet dose-réponse pour les deux échantillons d'eau (c.à.d. l'ampleur de la réponse à 50 % v/v était négative pour LJ-ES2, ce qui indique un effet positif sur la reproduction). Les variations de reproduction de *C. dubia* observées dans les échantillons les plus concentrés (25 %, 50 % and 100 % v/v) n'indiquent pas une réponse provoquée par un contaminant.

Lors de la sélection des seuils définissant l'importance ou l'ampleur de l'effet, que ce soit au niveau provincial ou fédéral, l'emphase est mise sur l'ampleur de la réponse plutôt que sur les mesures de signification statistique. La plupart des essais de toxicité utilisés dans l'évaluation de toxicité chronique ont le pouvoir statistique de déterminer effectivement une déviation entre l'échantillon et le contrôle qui varie de 20 à 30%<sup>9-11</sup>. Ainsi, les effets défavorables situés à l'intérieur de cette plage sont utilisés habituellement dans l'évaluation des risques écologiques aquatiques pour distinguer la toxicité chronique. À titre indicatif, le choix de seuils à effets toxiques faibles défini par CCME (c.à.d. EC<sub>15-25</sub>/IC<sub>15-25</sub>) est soutenu par les sources suivantes en Amérique du Nord :

- L'EPA (Environmental Protection Agency, États-Unis) utilise le seuil EC<sub>20</sub>/IC<sub>20</sub> pour représenter un effet faible pour les critères de la vie aquatique (eau douce) dans des dérivés d'eau ambiante<sup>12-13</sup>. Ce seuil est utilisé pour approximer un niveau faible d'un effet qui serait statistiquement différent des effets des échantillons de contrôle, mais pas assez sévère pour causer des impacts chroniques au niveau de la population<sup>11</sup>.
- Les critères d'évaluation de risques écologiques recommandent l'utilisation de résultats EC<sub>20</sub>/IC<sub>20</sub> pour définir un niveau permmissible, c'est-à-dire que le niveau d'un effet d'environ 20 % serait acceptable basé sur les réglementations de l'EPA, et serait dans ce cas considéré comme étant un effet minimal<sup>10</sup>.
- L'utilisation d'un niveau d'impact de 20 % est suggérée comme protection contre des effets nocifs sur les populations d'invertébrés. Par exemple, pour les poissons, des réductions d'environ 20 % dans la croissance ou la survie pendant une première année seraient considérées comme soutenables dans des populations de poissons qui sont relativement stables, où les habitats sont intacts et les conditions environnementales ne sont pas sévères<sup>14</sup>.

Le seul résultat des essais de toxicité sur l'eau du site du Lac Jeannine qui a produit une réponse défavorable à plus de 20 % a été pour l'échantillon LJ-ES1 (reproduction de *C. dubia*). Par contre, la détermination de la signification environnementale de ce résultat nécessite la considération de facteurs additionnels :

- Évaluation de la qualité de l'eau : La composition chimique des échantillons utilisés dans les essais de toxicité a été comparée aux critères de qualité de l'eau pour la protection de la vie aquatique du CCME, et seulement l'aluminium dépasse ces critères dans l'échantillon LJ-ES2 (et LJ-ES2[a]), avec une concentration maximale de 0,225 mg/L à un pH de 6,44 (comparé à une valeur de 0,1 mg/L à pH neutre).



- Évaluation dose-réponse : Une relation dose-réponse n'a pas pu être établie pour le test de reproduction de *C. dubia*, pour lequel un effet maximal >20 % a été observé dans l'échantillon concentré LJ-ES1. Aucun paramètre des échantillons d'eau du Lac Jeannine ne montre une tendance qui suggérerait que la réponse observée dans l'eau de l'émissaire (LJ-ES1) soit de nature toxicologique.
- Contrôle de cohérence : Les effets sont observés sur la reproduction de *C. dubia* seulement pour l'eau de l'émissaire (LJ-ES1) et n'impliquent pas l'aluminium comme potentiel produit toxique étant donné le faible effet observé seulement dans l'échantillon ayant une teneur en aluminium en dessous des critères CCME. Les résultats de ces tests dans l'échantillon ayant des teneurs en Al plus élevées (LJ-ES2) ne fournissent pas d'indice de toxicité significative.

En conclusion, les deux échantillons d'eau du Lac Jeannine qui sont en contact avec le stérile depuis plusieurs dizaines d'années ne montrent pas d'indices de toxicité aiguë. L'échantillon d'eau du lac (LJ-ES2) ne montre pas de toxicité chronique, tandis que l'eau de l'émissaire (LJ-ES1) est vraisemblablement non-toxique. Cette conclusion ne peut pas être définitive en raison du résultat ambigu pour la reproduction de *C. dubia*, qui a été observé seulement dans l'échantillon non dilué. Toutefois, aucun paramètre chimique de l'échantillon LJ-ES2 ne peut être relié aux faibles effets observés lors de l'essai sur *C. dubia*.

## 5.0 DISCUSSION

Les données des essais géochimiques montrent que la composition des 30 échantillons de stériles est homogène quant à la teneur en éléments majeurs et éléments traces, et leur caractère non-acidogène. Des résultats similaires ont été obtenus dans l'étude de WSP (2015), où quatre échantillons de stérile ont été analysés. L'étude de WSP a classifié les stériles comme étant non générateurs d'acide d'après les indications de la Directive 019 (Gouvernement du Québec), basé sur la teneur en soufre total inférieure à 0,3 %. La caractérisation approfondie réalisée sur 30 échantillons de stérile faite dans la présente étude et suivant les recommandations NEDEM-MEND (2009) soutient les conclusions quant au caractère non générateur d'acide de ces roches (de par la très faible quantité de soufre et la bonne capacité neutralisante) et démontre que les stériles sont peu lixiviables.

Le test d'extraction réalisé sur le stérile dans le but de définir les éléments aptes à être relâchés dans l'eau du lac est très conservateur, de par la méthode utilisée. Ceci résulte en une extraction substantiellement plus agressive que l'exposition actuelle et future de blocs de roche stérile dans l'eau du lac. De plus, plusieurs des critères CCME comprennent un facteur de sécurité afin d'assurer la protection de la vie aquatique (CCME 2007) de sorte qu'un dépassement de ces critères n'est pas nécessairement indicateur d'effet sur la vie aquatique du milieu en question. Par conséquent, la comparaison des résultats des tests d'extraction aux critères CCME de qualité d'eau de surface représente une évaluation très prudente du risque potentiel des résidus.

Les résultats des tests SFE montrent quelques dépassements généralement marginaux des critères CCME pour Al, As, Cr, Cu, Fe, Pb, et Se. L'ampleur des dépassements est largement inférieure au facteur de sécurité<sup>b</sup> inclus dans le développement des critères CCME, soit, inférieur à 10 fois la valeur de chaque critère<sup>15</sup> (section 3.3.2).

<sup>b</sup> Le facteur de sécurité est appliqué dans la dérivation des critères d'eau de surface pour les métaux énumérés (Al, As, Cr, Cu, Fe, Pb, et Se) de manière que la concentration acceptable la plus faible obtenue lors d'études de toxicité est divisée par 10 pour dériver la valeur spécifique de chaque critère; ceci représente un critère de Type B. Ces critères ont été dérivés dans les années 80 (voir critères CCME présentement en effet), et sont toujours utilisés, malgré que la méthodologie de dérivation des critères a été réévaluée depuis (dérivation de critères de Type A)<sup>15</sup>.



Le nombre de dépassements ainsi que leur ampleur dans les lixiviats SFE sont nettement inférieurs à ceux notés dans les tests d'extraction CTEU-9 réalisés antérieurement (WSP, 2015). Ceci, en combinaison avec les résultats de qualité d'eau du Lac Jeannine, confirme que les tests CTEU-9 sont peu représentatifs des conditions au site. De manière similaire, les tests SFE sont aussi conservateurs, et considérés plus agressifs que les conditions de lixiviation en milieu naturel (les échantillons sont broyés, le test est effectué sous agitation continue). En effet, la qualité de l'eau des échantillons prélevés dans le Lac Jeannine et dans son émissaire, qui sont en contact avec le stérile de plus de 40 ans, ne corrobore pas, et est bien inférieur aux résultats des tests conservateurs d'extraction SFE.

Les dépassements de critères CCME pour chacun des paramètres (Al, As, Cr, Cu, Fe, Pb, et Se) sont discutés plus bas, en comparaison avec les données des eaux de surface du site et des teneurs de fond de la région afin de renforcer les conclusions sur la non nocivité des stériles.

### Aluminium

La teneur en aluminium des lixiviats SFE dépasse le critère CCME pour huit échantillons sur un total de 15 échantillons analysés. La teneur en aluminium varie entre 0,13 et 0,58 mg/L, ayant une moyenne de 0,2 mg/L, qui est 2 fois plus supérieure à la valeur du critère (0,1 mg/L), mais bien en dessous du facteur de sécurité de 10 fois du CCME. Étant donné que les tests SFE sont plus agressifs, ces résultats représentent vraisemblablement une valeur limite supérieure pour la lixiviation de l'aluminium en milieu naturel. La teneur moyenne de 0,2 mg/L Al dans ces lixiviats suggère que le risque de lixiviation au-delà de cette valeur en milieu naturel n'est pas significatif.

En ce qui concerne les teneurs en aluminium mesurées dans les eaux de surface du Lac Jeannine et de son émissaire, celles-ci sont en moyenne 0,2 et 0,08 mg/L respectivement, montrant un dépassement marginal de 2 fois du critère pour l'eau du lac. Des mesures effectuées dans la région du Lac Jeannine en aval des stériles et résidus miniers montrent que, dans un lac de la région où il n'y a pas d'apport d'eau ni de résidus de l'ancienne mine (lac H, WSP 2016)<sup>16</sup>, la teneur en aluminium détectée est de 0,14 mg/L. Cette valeur pourrait correspondre à une teneur de fond naturelle pour l'aluminium, et se rapproche des valeurs observées dans l'eau du Lac Jeannine.

Malgré que les teneurs en aluminium dépassent légèrement le critère CCME, les tests de toxicité réalisés dans cette étude ne montrent aucune indication de toxicité aiguë ou chronique pour cet élément; les essais de toxicité ont été faits en utilisant l'eau de surface qui est en contact (et probablement à l'équilibre) avec les stériles depuis plus de 40 ans, ce qui indique que la teneur en aluminium observée, qui est similaire aux teneurs de fond de la région, ne pose pas de risque à la vie aquatique.

### Arsenic

Seulement un dépassement négligeable est observé sur 13 échantillons analysés (échantillon LJ-ST2-03). La teneur mesurée dans le lixiviat est de 0,0052 mg/L, pour un critère CCME de 0,005 mg/L. Ce dépassement n'est pas significatif en raison du faible écart avec la valeur du critère et de l'erreur et la précision des mesures analytiques. De plus, la teneur en arsenic dans l'eau du Lac Jeannine et de son émissaire est en dessous de la limite de détection (<0,0005 mg/L), ce qui suggère que l'arsenic ne pose pas de risque de lixiviation dans les eaux de surface en contact avec les stériles.



### Chrome

Deux faibles dépassements (de 0,0023 mg/L et un autre de 0,0012 mg/L) sont observés pour le chrome suite à la lixiviation SFE comparativement au critère du chrome (0,001 mg/L) et bien en dessous du facteur de sécurité de 10 fois du CCME<sup>15</sup>. Il est aussi à noter que le critère CCME choisi ici est défini pour le chrome (VI), et est plus conservateur que le critère du chrome (III), qui a une valeur de 0,0089 mg/L.

En milieu naturel non contaminé par des activités industrielles, le chrome se trouve rarement sous forme de Cr(VI), dans des conditions spécifiques, suite à des réactions d'oxydation du chrome (III) en présence d'oxydes de manganèse<sup>17</sup> par exemple. Dans le cas des stériles du Lac Jeannine, il est peu probable que l'oxydation du chrome soit favorisée, étant donné la faible teneur en Mn (<0,01 à 0,11 %). Le choix initial du critère CCME du chrome a été fait de manière conservatrice; les résultats SFE rencontrent le critère pour chrome (III) de 0,0089 mg/L. La teneur en chrome mesurée dans les eaux de surface du site est en dessous des limites de détection (<0,001 mg/L), ce qui indique que la lixiviation du chrome ne pose pas de risque.

### Cuivre

Le cuivre dépasse marginalement le critère CCME sur 12 des 15 échantillons (valeurs entre 0,0025 et 0,022 mg/L avec une moyenne de 0,0068 mg/L). La moyenne est d'environ 4 fois le critère de 0,002 mg/L. Majoritairement, les dépassements se trouvent en dessous de ce facteur de sécurité<sup>15</sup>, à environ 3 fois la valeur du critère. Seul un échantillon dépasse le critère de plus de 10 fois dans des conditions de test qui sont plus agressives qu'en milieu naturel (échantillon broyé, agitation constante lors de l'essai).

La teneur du cuivre est en effet faible dans l'eau qui est en contact avec les stériles depuis des décennies : dans l'eau du Lac Jeannine, la teneur en cuivre est inférieure aux limites de détection (<0,001 mg/L); l'émissaire du lac a une teneur de 0,0013 mg/L, qui est inférieure au critère d'eau de surface du CCME. À partir de ces résultats il est attendu que la lixiviation du cuivre ne soit pas favorisée à long terme sous conditions similaires. De plus, les essais de toxicité inclus dans ce rapport ne démontrent pas d'effet toxique pour le cuivre à ces concentrations.

Il est aussi important de souligner qu'une concentration d'origine naturelle significative de 0,051 mg/L a été mesurée pour le cuivre en aval du site à un endroit non impacté par les activités minières. Malgré la teneur élevée en cuivre, des études ichthyologiques sur ce lac montrent des populations de poissons en bonne condition et relativement abondantes<sup>16</sup>.

### Fer

Le fer dépasse le critère CCME (0,3 mg/L Fe) pour quatre lixiviats SFE sur 13, à des concentrations de 0,34 mg/L, 0,5 mg/L, 0,54 mg/L et 1,7 mg/L. Ces dépassements sont faibles. En moyenne, les lixiviats SFE ont une teneur en fer de 0,27 mg/L, qui se trouve largement en dessous du facteur de sécurité de CCME. Comme dans le cas de l'aluminium et le cuivre, il est attendu que les valeurs obtenues par lixiviation SFE représentent une limite supérieure de lixiviation du fer. Pourtant, les teneurs en fer de l'eau de surface du site ont une teneur maximale en fer de 0,16 mg/L, qui est bien en dessous des valeurs obtenues par le test SFE et du critère CCME pour le fer (0,3 mg/L). Étant donné que la teneur en fer des eaux de contact est faible, il est attendu que les stériles ne représentent pas une source de fer lixiviable significative à long terme.

De plus, les tests de toxicité ne montrent aucune indication de toxicité aiguë ou chronique pour le fer; les essais de toxicité ont été faits en utilisant l'eau de surface qui est en contact (et probablement à l'équilibre) avec les



stériles depuis plus de 40 ans, ce qui indique que la teneur en fer observée ne pose pas de risque à la vie aquatique.

La teneur du fer au site du Lac Jeannine est inférieure aux teneurs de fond de la région dont le lac H, qui a une teneur naturelle en fer de 0,27 mg/L<sup>16</sup>.

### Plomb

Seulement un dépassement marginal est noté pour le plomb, à une valeur de 0,0012 mg/L, pour un critère CCME de 0,001 mg/L. Étant donné que l'écart entre cette mesure et le critère est faible, qu'en moyenne la teneur en Pb du lixiviat de 13 échantillons est de 0,0003 mg/L, et que le plomb n'est pas détecté dans l'eau de surface du site du Lac Jeannine (à une limite de détection de 0,0005 mg/L), il n'est pas attendu que ce métal présente un risque de lixiviation à ce site.

### Selenium

Un dépassement négligeable est aussi observé pour le sélénium, à une valeur de 0,0013 mg/L pour un critère CCME de 0,01 mg/L. Comme pour le plomb et l'arsenic, ce dépassement n'est pas significatif en raison du faible écart avec la valeur du critère, de l'erreur et la précision des mesures analytiques, et des résultats statistiques qui montrent en moyenne une teneur en Se de 0,0003 mg/L (pour 13 échantillons), bien en dessous de la valeur du critère. De plus, la teneur en sélénium dans l'eau de surface du site varie entre <0,00005 et 0,0002 mg/L pour le Lac Jeannine et son émissaire, respectivement; ces valeurs indiquent des concentrations bien en dessous du critère CCME. Il n'est pas attendu que la lixiviation du sélénium présente un risque à ce site.

Selon les résultats de WSP (2015), la qualité des échantillons d'eau de contact du Lac Jeannine et de son émissaire est meilleure en comparaison aux plans d'eau du bassin versant du Lac Jeannine. Nombreux plans d'eau en aval de l'aire d'accumulation des résidus montrent des concentrations en fer et en cuivre supérieures aux critères CCME, en plus des teneurs en aluminium comparables à celles du Lac Jeannine (WSP 2015). Malgré ces dépassements, les conditions actuelles dans le bassin versant du Lac Jeannine sont favorables à la présence et la viabilité des populations de poisson, et le Lac Jeannine est un plan d'eau productif (WSP 2015).

Les essais de toxicité faits avec l'eau du Lac Jeannine et l'eau de son émissaire confirment ces observations. Ces eaux de surface ont été en contact avec les stériles depuis plus de 40 ans, ce qui est équivalent à des essais cinétiques à grande échelle et à long terme. Les deux échantillons d'eau ne montrent pas de dépassements significatifs des critères d'eau de surface, ni des indices de toxicité aigüe. L'échantillon du lac (LJ-ES2) ne montre pas de toxicité chronique et l'eau de l'émissaire du Lac Jeannine (LJ-ES1) est considérée comme étant non-toxique en ce qui concerne la présence et la teneur en métaux requis par les critères CCME. L'évaluation des résultats des essais de toxicité en parallèle avec les données chimiques des échantillons d'eau ne montrent aucun lien entre des paramètres toxiques d'intérêt énumérés plus haut et la faible réaction observée pour *C. dubia* lors des essais de toxicité. Il est à noter que l'aluminium est le seul paramètre qui dépasse les critères CCME dans l'eau du Lac Jeannine, et qu'aucun effet toxique n'a pu être établi sur les organismes testés en raison de sa présence.



### 6.0 CONCLUSIONS

Les tests réalisés pour cette étude visent à définir la probabilité d'effets du roc sur la qualité de l'eau de surface avec lequel il sera en contact. Par contre, des données actuelles de qualité et de toxicité de l'eau en contact avec le roc indiquent peu d'effets. Le milieu duquel les échantillons d'eau ont été prélevés s'apparente à un essai cinétique (tel recommandé dans le guide ECCC) à grandeur réelle, réalisé sur plusieurs dizaines d'années. Les résultats de qualité d'eau obtenues des points d'échantillonnage du Lac Jeannine et de son émissaire sont davantage représentatifs des conditions anticipées que les tests d'extraction sur le stérile réalisés en laboratoire.

L'ensemble des résultats nous permet de confirmer que le stérile a une composition homogène et ne contient pas de zones de composition variable ou plus réactives que d'autres zones dans les secteurs étudiés. Les tests de toxicité réalisés selon les règles de l'art sont également concluants sur la non nocivité des stériles en contact avec l'eau de surface du Lac Jeannine ou en contact avec l'eau de l'émissaire du Lac Jeannine qui passe à travers le stérile. Le contact prolongé des stériles avec l'eau de surface du site équivaut à une lixiviation à l'échelle naturelle réalisée sur une durée de plus de 40 ans. Ceci est adéquatement représentatif des conditions anticipées suite à la construction des aménagements restauratifs proposés. Étant donné que les eaux du Lac Jeannine sont favorables à l'habitat du poisson, et tenant compte des résultats des tests de toxicité qui ne montrent pas de toxicité aiguë ni de toxicité chronique significative sur différents organismes et que le lac Jeannine est un plan d'eau actuellement productif malgré la présence de stériles en contact avec son eau, il est anticipé que les stériles ne soient pas problématiques pour la qualité de l'eau et pour la vie aquatique lorsqu'utilisés pour la construction d'infrastructures de compensation. Les résultats indiquent que le stérile peut être utilisé pour la construction de ces infrastructures sans effets négatifs sur la qualité de l'eau ni de l'habitat du poisson.

### 7.0 UTILISATION DU RAPPORT ET DE SON CONTENU

Ce rapport a été préparé pour l'usage exclusif d'ArcelorMittal Exploitation Minière ou de ses agents. Les données factuelles, les interprétations, les commentaires ainsi que les recommandations qu'il contient sont spécifiques à l'étude qu'il couvre et ne s'appliquent à aucun autre projet ou autre site. Ce rapport doit être lu dans son ensemble, puisque des sections pourraient être faussement interprétées lorsque prises individuellement ou hors contexte.

Les descriptions du roc qui sont présentées dans ce rapport ont été recueillies uniquement pour des fins environnementales. Ces informations ne doivent en aucun cas être utilisées à des fins géotechniques pour dans la planification et l'élaboration de projets de construction, ou à d'autres fins que ce soit, à moins que cela ne soit clairement indiqué dans le texte de ce rapport ou formellement autorisé par Golder.

À moins d'avis contraire, les interprétations, commentaires et les recommandations présentés dans ce rapport ont été formulés suite à une évaluation des conditions du site conformément à la portée de l'étude et aux limitations générales décrites sur cette page de même qu'à la lumière de nos connaissances concernant l'utilisation courante et/ou prévue du site, les règlements, normes et critères environnementaux en vigueur ainsi que les règles et pratiques professionnelles reconnues et acceptées au moment de l'étude, tenant compte dans tous les cas de l'emplacement du site. Les références aux lois et règlements contenues dans ce rapport sont fournies à titre indicatif, sur une base technique. Comme les lois et règlements sont sujets à interprétation, Golder recommande au Client de consulter ses conseillers juridiques afin d'obtenir les avis appropriés.



Golder ne pourra être tenue responsable de dommages résultant de conditions qui lui seraient inconnues, de l'inexactitude de données provenant d'autres sources que Golder et de changements ultérieurs aux conditions du site à moins d'avoir été prévenue par le Client de tout événement, activité, information, découverte passée ou future susceptible de modifier les conditions souterraines décrites dans ce rapport et d'avoir eu la possibilité de réviser les interprétations, commentaires et recommandations formulés dans ce rapport. De plus, Golder ne pourra être tenue responsable de dommages résultant de toutes modifications futures aux règlements, normes ou critères applicables, de toute utilisation faite du présent rapport par un tiers et/ou à des fins autres que celles pour lesquelles il a été rédigé, de perte de valeur réelle ou perçue du site ou de la propriété, ni de l'échec d'une quelconque transaction en raison des informations factuelles contenues dans ce rapport.

Les travaux d'investigation effectués par Golder et décrits dans ce rapport furent réalisés conformément aux règles et pratiques professionnelles reconnues et acceptées au moment de leur réalisation. À moins d'avis contraire, les résultats de travaux antérieurs ou simultanés, provenant d'autres sources que Golder, cités et/ou utilisés dans ce rapport furent considérés comme ayant été obtenus en respectant les règles et pratiques professionnelles reconnues et acceptées et, conséquemment, comme étant valides.

Certaines mesures et observations consignées dans ce rapport, tels les résultats analytiques, sont valables pour les échantillons pris par Golder aux dates spécifiées. La qualité de l'eau peut varier selon les saisons, les années ou suite à des activités ou événements sur le site à l'étude ou sur des sites adjacents.



## 8.0 RÉFÉRENCES

1. Protocole d'évaluation proposé pour démontrer la non-nocivité des stériles du Lac Jeannine, projet de compensation pour l'expansion de la mine Mont Wright, Québec. Golder Associés, 15 août 2016.
2. Caractérisation géochimique sur les résidus et stériles de l'ancien site minier du lac Jeannine. WSP Canada Inc, 25 novembre 2015.
3. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials, NEDEM-MEND report 1.20.1, December 2009.
4. *Recommandations pour la qualité des eaux : protection de la vie aquatique, exposition à long terme* du Conseil canadien des ministres de l'environnement (CCME)
5. Beaulieu, Michel. 2016. *Guide d'intervention - Protection des sols et réhabilitation des terrains contaminés*. Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques, ISBN 978-2-550-76171-6, 210 p.
6. Price, W.A., 1997. Guidelines and recommended methods for the prediction of metal leaching and acid rock drainage at minesites in British Columbia : British Columbia Ministry of Employment and Investment, Energy, and Minerals Division, Smithers, B.C.m 143p.
7. Ministère du Développement durable de l'Environnement de la Faune et des Parcs (MDDEFP), 2013, Critères de qualité de l'eau de surface, 3<sup>e</sup> édition, Québec, Direction du suivi de l'état de l'environnement, 510 p. et 16 annexes.
8. CCME (Canadian Council of Ministers of the Environment). 2007. A Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life 2007. Canadian Council of Ministers of the Environment, Winnipeg MB. April 2007.
9. Nautilus (Nautilus Environmental Inc.) and Zajdlik (Zajdlik and Associates). 2011. Review Comments: BC Ministry of Environment Draft Water Quality Guideline for Sulphate. Submitted to: The Mining Association of British Columbia, Vancouver, BC. Nautilus Environmental Inc., Burnaby, BC and Zajdlik and Associates, Rockwood, ON. December 15, 2011.
10. Suter GW II, Cornaby BW, Hadden CT, Hull RN, Stack M. Zafran FA. 1995. An approach for balancing health and ecological risks at hazardous waste sites. Risk Anal 15:221-231.
11. US EPA. 2013. Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater. EPA-822-R-13-001.
12. US EPA (United States Environmental Protection Agency). 1999. Update of Ambient Water Quality Criteria for Ammonia. Supersedes 1998 Update. U.S. Environmental Protection Agency, Office of Water (Office of Science and Technology, Washington, D.C.) and Office of Research and Development (Mid-Continent Ecology Division, Duluth, Minnesota).
13. US EPA. 2007. Aquatic Life Ambient Freshwater Quality Criteria – Copper. 2007 Revision. February 2007. U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, Washington, DC.
14. Mebane CA. 2010. Cadmium risks to freshwater life: Derivation and validation of low-effect criteria values using laboratory and field studies (version 1.2): U.S. Geological Survey Scientific Investigations Report 2006-5245, 130 p.





15. CCME (Canadian Council of Ministers of the Environment). 2007. A protocol for the derivation of water quality guidelines for the protection of aquatic life. In Canadian environmental quality guidelines, 1999.
16. WSP, 2016. Programme de compensation pour les pertes d'habitat de poisson. Projet 2045.
17. Oze C., Bird, D.K., Fendorf, S. 2007. Genesis of hexavalent chromium from natural sources in soil and groundwater, PNAS, 104, 6544-6549.

**GOLDER ASSOCIÉS LTÉE**

Valérie Bertrand, M.Sc.A., géo  
Associée, géochimiste

Cristina Cismasu, Ph.D.  
Professionnelle en environnement

VB/CC/jlm

Golder, Golder Associés et le concept GA sur son logo sont des marques de commerce de Golder Associates Corporation.

\\golder.gds\gal\montreal\actif\2016\3 proj\1655754 arcelormittal lac jeannine qcl5 préparation livrables\004 rapport\004-1655754\_rf\_rev1\004-1655754\_rf\_rev1\_24feb2017.docx

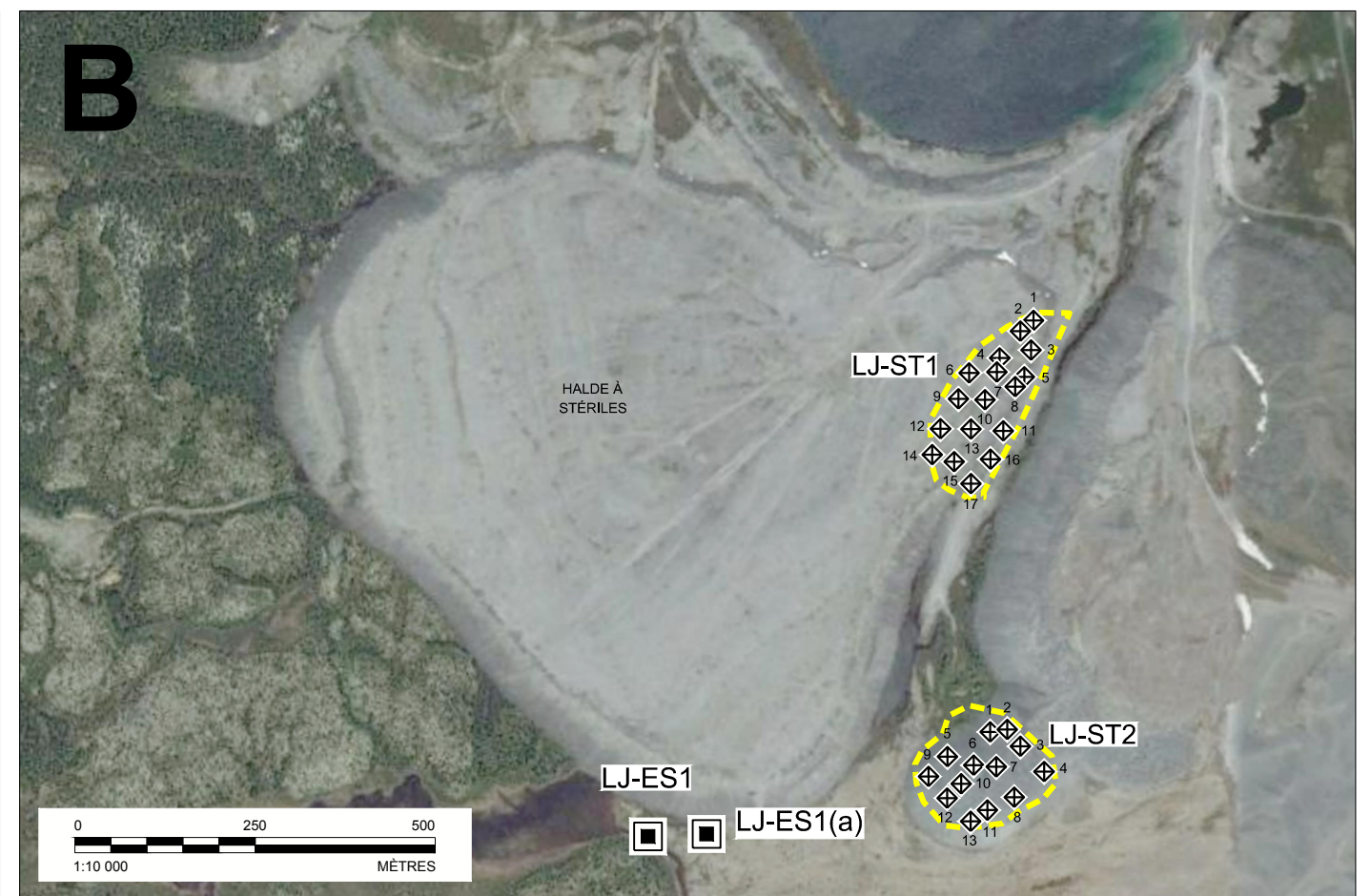


# **ANNEXE A**

## **Figures**



VUE EN PLAN  
ÉCHELLE 1 : 20 000



AGRANDISSEMENT  
ÉCHELLE 1 : 10 000

**LÉGENDE**

- STATION D'ÉCHANTILLONNAGE D'EAU DE SURFACE
- ⊕ STATION D'ÉCHANTILLONNAGE DE STÉRILES

**NOTE**

SYSTÈME DE COORDONNÉES: UTM NAD 83, ZONE 19

**RÉFÉRENCE**

IMAGE GOOGLE EARTH, 2014

**COORDONNÉES DES STATIONS D'ÉCHANTILLONNAGE**

ID	X (EST)	Y (NORD)	ID	X (EST)	Y (NORD)
LJ-ST1-01	563543.92	5744761.21	LJ-ST2-01	563483.7	5744190.14
LJ-ST1-02	563525.78	5744746.29	LJ-ST2-02	563507.63	5744193.45
LJ-ST1-03	563540.64	5744720.12	LJ-ST2-03	563525.56	5744170.1
LJ-ST1-04	563497.11	5744708.89	LJ-ST2-04	563558.52	5744135.14
LJ-ST1-05	563530.99	5744682.74	LJ-ST2-05	563424.6	5744155.92
LJ-ST1-06	563454.52	5744688.44	LJ-ST2-06	563460.92	5744143.81
LJ-ST1-07	563492.95	5744689.48	LJ-ST2-07	563492.3	5744141.65
LJ-ST1-08	563518.35	5744669.34	LJ-ST2-08	563517.09	5744099.35
LJ-ST1-09	563439.61	5744652.21	LJ-ST2-09	563398.15	5744128.44
LJ-ST1-10	563476.76	5744651.12	LJ-ST2-10	563443.61	5744118
LJ-ST1-11	563501.9	5744607.95	LJ-ST2-11	563480.04	5744081.53
LJ-ST1-12	563415	5744610.86	LJ-ST2-12	563423.95	5744098.4
LJ-ST1-13	563456.95	5744610.49	LJ-ST2-13	563456.74	5744066.12
LJ-ST1-14	563403.53	5744574.78	LJ-ES1	563009.09	5744045.12
LJ-ST1-15	563433.82	5744565.26	LJ-ES1(a)	563090.43	5744048.41
LJ-ST1-16	563484.21	5744568.57	LJ-ES2	564075.47	5746669.19
LJ-ST1-17	563457.29	5744534.64	LJ-ES2(a)	564028	5746293

**PRÉLIMINAIRE**

CLIENT  
ARCELORMITTAL EXPLOITATION MINIÈRE

CONSULTANT

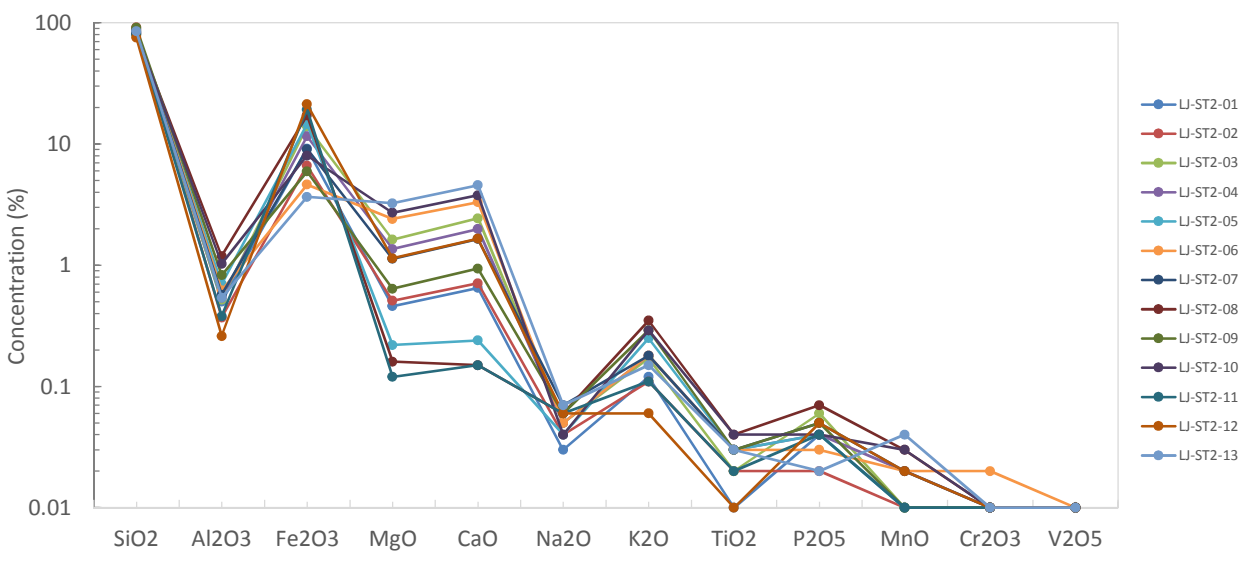
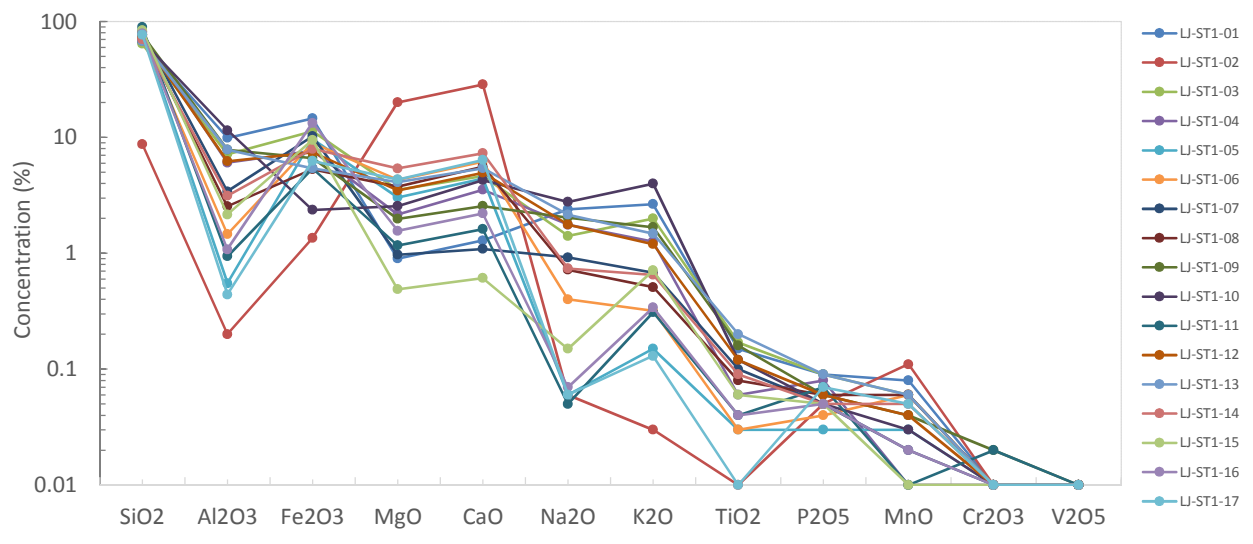


AAAA-MM-JJ 2016-12-14  
DESSINÉ R. Gravel  
PROJETÉ C. Cismasu  
RÉVISÉ C.-E. Moriset  
APPROUVÉ V. Bertrand

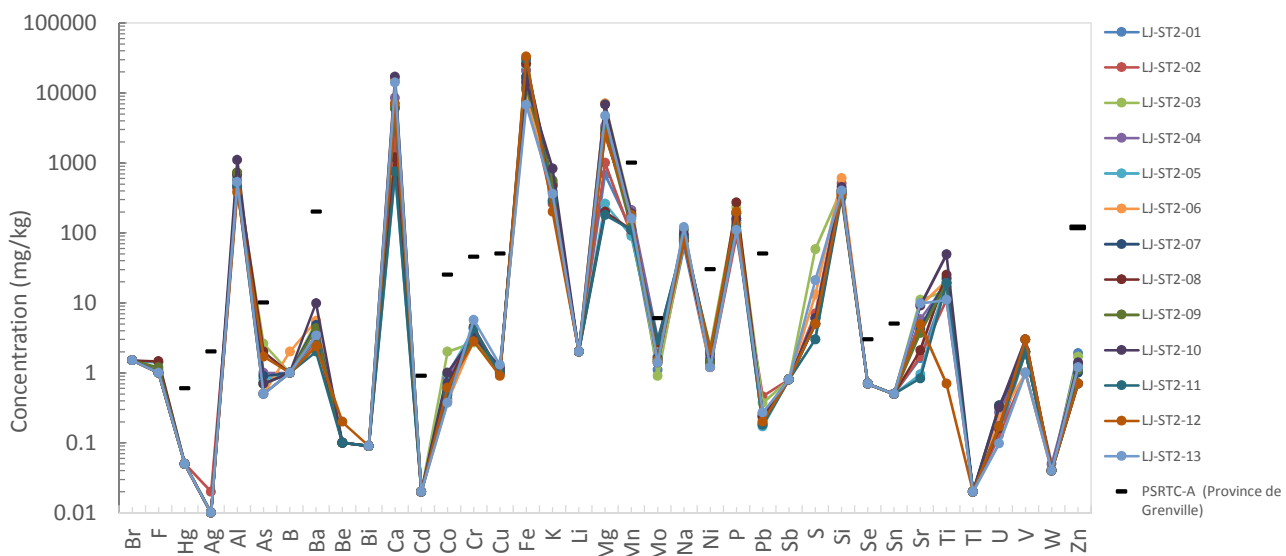
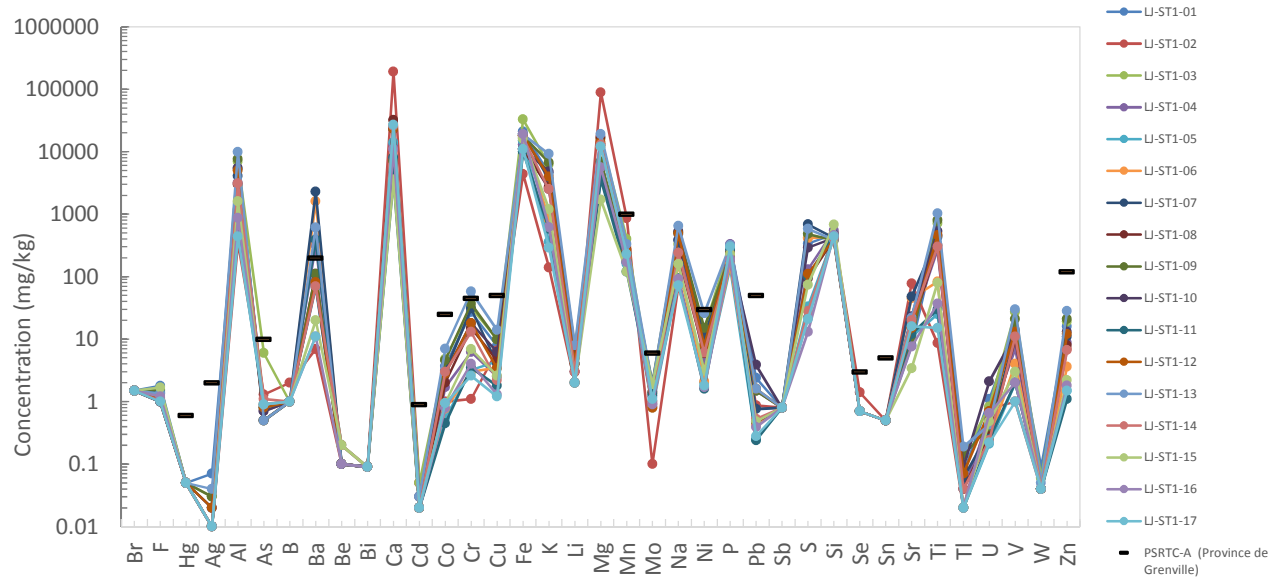
PROJET  
ARCELORMITTAL  
LAC JEANNINE

TITRE  
**ÉVALUATION DE NATURE NON DÉLÉTÈRE DES ROCHES  
STÉRILES ENTREPOSÉES À LAC JEANNINE, QC**

N° PROJET 1655754 PHASE 3000 RÉV. A FIGURE A-1

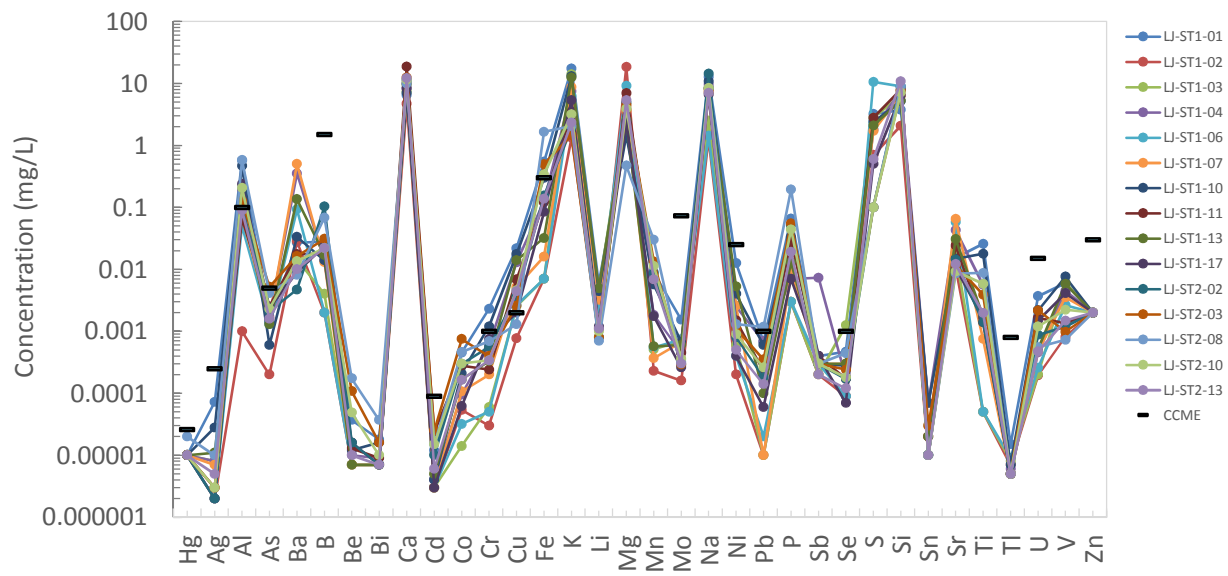


	<b>Caractérisation géochimique statique: Résultats XRF pour éléments majeurs - séries de stériles LJ-ST1 et LS-ST2</b>			DESSINÉ CC DATE déc. 2016
	Lac Jeannine ArcelorMittal Exploitation Minière			VÉRIFIÉ 0 NO DE PROJET 1655754
				RÉVISÉ VJB FIGURE A-2



**Caractérisation géochimique statique: Résultats MA200 pour éléments traces - séries de stériles LJ-ST1 et LJ-ST2**  
**Lac Jeannine**  
**ArcelorMittal Exploitation Minière**

DESSINE	CC	DATE	déc. 2016
VERIFIE	0	NO DE PROJET	1655754
REVISE	VJB	FIGURE	A-3



**Caractérisation géochimique statique: Résultats de lixiviation Shake Flask - séries de stériles LJ-ST1 et LJ-ST2**

**Lac Jeannine  
ArcelorMittal Exploitation Minière**

DESSINÉ	CC	DATE	déc. 2016
VÉRIFIÉ	0	NO DE PROJET	1655754
RÉVISÉ	VJB	FIGURE	A-4



# **ANNEXE B**

## **Résultats des essais géochimiques sur les stériles et analyses de l'eau de surface**

Tableau B-1 Liste des échantillons collectés au site de l'ancienne mine Lac Jeannine

ArcelorMittal Exploitation Minière

Échantillon	Type d'échantillon	Date	Analyses	pH	Conductivité (uS/cm)	Echantillonné par
LJ-ES-1	Eau de surface (émissaire du Lac Jeannine)	3 août, 2016	Chimie de l'eau, 5 essais de toxicité	6,89	68	Golder
LJ-ES-1(a)	Eau de surface (émissaire du Lac Jeannine)	22 octobre, 2016	Chimie de l'eau, 1 essai de toxicité	6,98	79	Golder
LJ-ES-2	Eau de surface (Lac Jeannine)	3 août, 2016	Chimie de l'eau, 5 essais de toxicité	6,6	20	Golder
LJ-ES-2(a)	Eau de surface (Lac Jeannine)	22 octobre, 2016	Chimie de l'eau, 1 essai de toxicité	6,93	33	Golder
LJ-ST1-01	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-02	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-03	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-04	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-05	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-06	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-07	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-08	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-09	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-10	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-11	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-12	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-13	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-14	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-15	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-16	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST1-17	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-01	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-02	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-03	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-04	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-05	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-06	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-07	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-08	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-09	Stérile	2 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-10	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-11	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-12	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder
LJ-ST2-13	Stérile	4 août, 2016	ABA, XRF MA200, SFE	-	-	Golder



Tableau B-2  
Composition des stériles de Lac Jeannine: Détermination du potentiel de génération d'acide - Résultats ABA

ArcelorMittal Exploitation Minière

Échantillon	Type échantillon	pH de la pâte	Soufre total	Sulfure	Carbone total	Carbonate	PN <sup>2</sup>	PA <sup>3</sup>	PNN	RPN	Potentiel de génération acide (MEND 2009) <sup>4</sup>
			% poids	% poids	% poids	% poids	kg CaCO <sub>3</sub> /t	kg CaCO <sub>3</sub> /t	-	-	-
	Directive 019 <sup>1</sup>		>0,3						<20	<3	
LJ-ST1-01	Stérile	9,7	0,018	< 0,02	0,15	0,35	15	0,56	14	27	Non-PGA
LJ-ST1-02	Stérile	9,4	< 0,005	< 0,02	10	39	873	<0,16	873	5456	Non-PGA
LJ-ST1-03	Stérile	9,8	0,028	0,020	1,3	5,9	108	0,88	107	123	Non-PGA
LJ-ST1-04	Stérile	9,7	0,0080	< 0,02	0,59	2,6	52	0,25	52	208	Non-PGA
LJ-ST1-05	Stérile	9,4	< 0,005	< 0,02	0,62	2,6	52	<0,16	52	325	Non-PGA
LJ-ST1-06	Stérile	9,5	0,033	< 0,02	1,3	5,7	104	1,0	103	101	Non-PGA
LJ-ST1-07	Stérile	9,6	0,053	0,020	0,19	0,67	21	1,7	19	13	Non-PGA
LJ-ST1-08	Stérile	9,6	0,0070	< 0,02	1,7	7,7	138	0,22	138	631	Non-PGA
LJ-ST1-09	Stérile	9,8	0,034	0,020	0,29	1,1	27	1,1	26	25	Non-PGA
LJ-ST1-10	Stérile	9,9	0,013	< 0,02	1,1	5,2	98	0,41	98	241	Non-PGA
LJ-ST1-11	Stérile	9,2	0,0080	< 0,02	0,39	1,5	33	0,25	33	132	Non-PGA
LJ-ST1-12	Stérile	9,8	0,0060	< 0,02	1,2	5,3	100	0,19	100	533	Non-PGA
LJ-ST1-13	Stérile	9,9	0,035	0,020	1,3	5,8	110	1,1	109	101	Non-PGA
LJ-ST1-14	Stérile	9,6	< 0,005	< 0,02	1,2	5,3	100	<0,16	100	625	Non-PGA
LJ-ST1-15	Stérile	9,2	0,0060	< 0,02	0,20	0,55	16	0,19	16	85	Non-PGA
LJ-ST1-16	Stérile	9,4	< 0,005	< 0,02	0,60	2,4	51	<0,16	51	319	Non-PGA
LJ-ST1-17	Stérile	9,4	< 0,005	< 0,02	1,4	6,0	112	<0,16	112	700	Non-PGA
LJ-ST2-01	Stérile	9,0	< 0,005	< 0,02	0,071	0,23	8,6	<0,16	8,4	54	Non-PGA
LJ-ST2-02	Stérile	9,0	< 0,005	< 0,02	0,24	0,36	11	<0,16	11	69	Non-PGA
LJ-ST2-03	Stérile	9,3	0,0050	< 0,02	0,78	3,3	64	0,16	64	410	Non-PGA
LJ-ST2-04	Stérile	9,3	< 0,005	< 0,02	0,39	1,6	33	<0,16	33	206	Non-PGA
LJ-ST2-05	Stérile	8,8	< 0,005	< 0,02	0,018	< 0,025	4,0	<0,16	3,8	25	Non-PGA
LJ-ST2-06	Stérile	9,2	< 0,005	< 0,02	0,74	3,2	62	<0,16	62	388	Non-PGA
LJ-ST2-07	Stérile	9,2	< 0,005	< 0,02	0,27	1,1	24	<0,16	24	150	Non-PGA
LJ-ST2-08	Stérile	8,6	< 0,005	< 0,02	0,062	< 0,025	4,6	<0,16	4,4	29	Non-PGA
LJ-ST2-09	Stérile	9,2	< 0,005	< 0,02	0,31	1,2	27	<0,16	27	169	Non-PGA
LJ-ST2-10	Stérile	9,4	< 0,005	< 0,02	0,79	3,4	64	<0,16	64	400	Non-PGA
LJ-ST2-11	Stérile	8,6	< 0,005	< 0,02	0,036	< 0,025	3,7	<0,16	3,5	23	Non-PGA
LJ-ST2-12	Stérile	9,1	< 0,005	< 0,02	0,32	1,2	26	<0,16	26	163	Non-PGA
LJ-ST2-13	Stérile	9,3	< 0,005	< 0,02	0,63	2,7	51	<0,16	51	319	Non-PGA
	MINIMUM	8,6	<0,005	<0,02	0,018	<0,025	3,7	<0,16	3,5	12,68	
	MAXIMUM	9,9	0,053	0,020	10	39	873	1,7	873	5456	
	MOYENNE	9,2	0,011	N.C.	0,94	3,9	80	0,36	79	402	
	MÉDIANE	9,4	0,0050	N.C.	0,59	2,5	51	0,16	51	166	
	ÉCART TYPE	0,35	0,012	N.C.	1,8	7,0	155	0,38	155	975	
	25e CENTILE	9,2	0,0050	N.C.	0,24	0,76	22	0,16	20	73	
	75e CENTILE	9,6	0,0080	N.C.	1,2	5,2	100	0,25	99	372	

**Notes:**

PA =potentiel acidogène; PN=potentiel de neutralisation; PNN = potentiel de neutralisation net (PN-PA), RPN = ratio du potentiel de neutralisation (PN/PA)

1 - Comparaison à titre informatif avec la Directive 019 sur l'industrie minière (MDDELCC, Mars 2012); le potentiel de génération acide (PGA) déterminé si: S<sub>total</sub>>0.3 % en poids et PNN<20 ou RPN<3. Aucun échantillon dépasse la teneur en soufre total de 0,3% en poids.

2 - Potentiel de neutralisation (PN) déterminé à partir de la méthode Sobek modifiée (MEND 2009).

3 - Le potentiel acidogène (PA) a été calculé à partir des concentrations de soufre total; la valeur de limite de détection a été utilisée pour les calculs.

4 - PGA déterminé en fonction de MEND (2009): si RPN<1 = PGA; si 1<RPN<2 = incertain; si RPN>2 =non-PGA.

Les valeurs de la limite de détection sont utilisées pour le calcul des statistiques.

N.C. non calculé.

Tableau B-3  
Composition des stériles de Lac Jeannine: Éléments majeurs - Résultats XRF

ArcelorMittal Exploitation Minière

Échantillon	Type échantillon	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	TiO <sub>2</sub>	P <sub>2</sub> O <sub>5</sub>	MnO	Cr <sub>2</sub> O <sub>3</sub>	V <sub>2</sub> O <sub>5</sub>	Perte au feu	Somme
		%	%	%	%	%	%	%	%	%	%	%	%	%	%
LJ-ST1-01	Stérile	66	9,9	15	0,90	1,3	2,4	2,7	0,15	0,090	0,080	0,010	< 0,01	1,1	100
LJ-ST1-02	Stérile	8,7	0,20	1,4	20	29	0,060	0,030	< 0,01	0,050	0,11	< 0,01	< 0,01	40	99
LJ-ST1-03	Stérile	64	7,2	11	3,5	4,7	1,4	2,0	0,17	0,090	0,060	0,010	< 0,01	5,0	100
LJ-ST1-04	Stérile	76	6,1	7,7	2,2	3,5	1,8	1,3	0,060	0,080	0,010	0,010	< 0,01	2,2	101
LJ-ST1-05	Stérile	80	0,55	9,7	3,0	4,4	0,060	0,15	0,030	0,030	0,030	0,010	< 0,01	1,9	100
LJ-ST1-06	Stérile	73	1,5	9,0	4,3	6,2	0,40	0,32	0,030	0,040	0,060	< 0,01	< 0,01	4,2	99
LJ-ST1-07	Stérile	82	3,4	10	0,97	1,1	0,92	0,68	0,10	0,050	0,020	0,010	< 0,01	0,77	100
LJ-ST1-08	Stérile	77	2,5	5,3	3,8	5,6	0,72	0,51	0,080	0,060	0,060	< 0,01	< 0,01	6,0	101
LJ-ST1-09	Stérile	77	7,8	6,6	2,0	2,6	2,0	1,7	0,16	0,060	0,040	0,020	< 0,01	1,2	101
LJ-ST1-10	Stérile	68	12	2,4	2,6	4,3	2,8	4,0	0,12	0,050	0,030	0,010	< 0,01	4,3	100
LJ-ST1-11	Stérile	89	0,94	5,4	1,2	1,6	0,050	0,31	0,040	0,070	0,010	0,020	< 0,01	1,3	100
LJ-ST1-12	Stérile	71	6,2	7,4	3,5	4,9	1,8	1,2	0,12	0,060	0,040	< 0,01	< 0,01	4,4	101
LJ-ST1-13	Stérile	68	7,8	5,4	4,1	5,4	2,2	1,5	0,20	0,090	0,060	< 0,01	< 0,01	4,9	99
LJ-ST1-14	Stérile	70	3,1	8,0	5,4	7,3	0,74	0,65	0,090	0,050	0,050	0,010	0,010	4,4	100
LJ-ST1-15	Stérile	84	2,2	9,5	0,49	0,61	0,15	0,71	0,060	0,050	< 0,01	< 0,01	< 0,01	0,78	98
LJ-ST1-16	Stérile	79	1,1	13	1,6	2,2	0,070	0,34	0,040	0,050	0,020	< 0,01	< 0,01	2,1	100
LJ-ST1-17	Stérile	77	0,44	6,3	4,3	6,4	0,060	0,13	0,010	0,070	0,050	< 0,01	< 0,01	4,7	99
LJ-ST2-01	Stérile	89	0,50	9,2	0,46	0,65	0,030	0,12	0,010	0,040	< 0,01	0,010	< 0,01	0,24	101
LJ-ST2-02	Stérile	92	0,37	6,6	0,51	0,71	0,040	0,11	0,020	0,020	< 0,01	< 0,01	< 0,01	0,60	101
LJ-ST2-03	Stérile	79	0,52	14	1,6	2,4	0,050	0,17	0,020	0,060	0,010	< 0,01	< 0,01	2,5	101
LJ-ST2-04	Stérile	84	0,54	12	1,4	2,0	0,050	0,18	0,030	0,040	0,020	< 0,01	< 0,01	1,2	101
LJ-ST2-05	Stérile	84	0,70	15	0,22	0,24	0,040	0,25	0,030	0,040	< 0,01	0,010	< 0,01	0,050	100
LJ-ST2-06	Stérile	87	0,62	4,6	2,4	3,3	0,050	0,18	0,030	0,030	0,020	0,020	< 0,01	2,4	101
LJ-ST2-07	Stérile	86	0,57	9,1	1,1	1,7	0,070	0,18	0,030	0,050	0,020	< 0,01	< 0,01	0,80	100
LJ-ST2-08	Stérile	82	1,2	17	0,16	0,15	0,060	0,35	0,040	0,070	0,030	< 0,01	< 0,01	0,22	101
LJ-ST2-09	Stérile	91	0,83	5,9	0,64	0,94	0,060	0,29	0,030	0,050	< 0,01	< 0,01	< 0,01	1,3	101
LJ-ST2-10	Stérile	82	1,0	8,0	2,7	3,8	0,040	0,29	0,040	0,040	0,030	< 0,01	< 0,01	3,0	101
LJ-ST2-11	Stérile	81	0,38	19	0,12	0,15	0,060	0,11	0,020	0,040	< 0,01	< 0,01	< 0,01	0,36	101
LJ-ST2-12	Stérile	76	0,26	21	1,1	1,7	0,060	0,060	0,010	0,050	0,020	< 0,01	< 0,01	1,2	101
LJ-ST2-13	Stérile	85	0,54	3,7	3,3	4,6	0,070	0,15	0,030	0,020	0,040	< 0,01	< 0,01	2,4	100
MINIMUM		8,7	0,20	1,4	0,12	0,15	0,030	0,030	< 0,01	0,020	< 0,01	< 0,01	< 0,01	0,050	98
MAXIMUM		92	12	21	20	29	2,8	4,0	0,20	0,090	0,11	0,020	0,010	40	101
MOYENNE		77	2,7	9,3	2,7	3,8	0,61	0,68	0,060	0,053	0,033	N.C.	N.C.	3,5	100
MÉDIANE		80	0,99	8,5	1,8	2,5	0,065	0,30	0,035	0,050	0,025	N.C.	N.C.	2,0	100
ÉCART TYPE		15	3,3	4,8	3,6	5,1	0,86	0,90	0,054	0,019	0,025	N.C.	N.C.	7,0	0,74
25e CENTILE		74	0,54	6,0	0,92	1,1	0,053	0,16	0,030	0,040	0,010	N.C.	N.C.	0,87	100
75e CENTILE		84	3,3	12	3,4	4,6	0,88	0,70	0,088	0,060	0,048	N.C.	N.C.	4,3	101

Les valeurs de la limite de détection sont utilisées pour le calcul des statistiques.

N.C. non calculé



Tableau B-5  
Composition des stériles de Lac Jeannine: test d'extraction SFE

ArcelorMittal Exploitation Minière

Échantillon	Type échantillon	Poids	Volume eau DI	pH	Alcalinité	Conductivité	Carbonate	Bicarbonate	Cl	SO <sub>4</sub>	Br	NO <sub>2</sub>	NO <sub>3</sub>	Phosphore total réactif
		g	mL	-	mg/L (CaCO <sub>3</sub> )	uS/cm	mg/L (CaCO <sub>3</sub> )	mg/L (CaCO <sub>3</sub> )	mg/L	mg/L	mg/L	mg/L (N)	mg/L (N)	mg/L
<b>CCME</b> <sup>1</sup>				6,5-9,5					<b>120</b>			<b>0,06</b>	<b>13</b>	
LJ-ST1-01	Stérile	250	750	9,3	47	148	13	35	4,1	7,6	< 3	< 0,3	< 0,6	0,040
LJ-ST1-02	Stérile	250	750	9,5	86	165	31	55	2,5	2,2	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-03	Stérile	250	750	8,9	48	122	7,0	42	< 2	6,6	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-04	Stérile	250	750	9,5	49	123	22	28	< 2	5,5	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-06	Stérile	250	750	9,1	41	158	11	30	< 2	30	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-07	Stérile	250	750	9,4	59	135	21	38	< 2	4,8	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-10	Stérile	250	750	9,4	50	131	15	35	< 2	3,6	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-11	Stérile	250	750	9,1	76	171	15	61	< 2	7,4	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-13	Stérile	250	750	9,4	59	142	21	39	< 2	4,5	< 3	< 0,3	< 0,6	< 0,03
LJ-ST1-17	Stérile	250	750	9,3	48	105	15	33	< 2	2,3	< 3	< 0,3	< 0,6	< 0,03
LJ-ST2-02	Stérile	250	750	9,4	70	143	28	42	< 2	< 2	< 3	< 0,3	< 0,6	< 0,03
LJ-ST2-03	Stérile	250	750	9,4	60	122	21	39	< 2	< 2	< 3	< 0,3	< 0,6	0,030
LJ-ST2-08	Stérile	250	750	9,1	40	90	9,0	31	2,1	< 2	< 3	< 0,3	< 0,6	0,10
LJ-ST2-10	Stérile	250	750	9,4	60	123	23	37	< 2	< 2	< 3	< 0,3	< 0,6	< 0,03
LJ-ST2-13	Stérile	250	750	9,4	61	127	25	36	< 2	< 2	< 3	< 0,3	< 0,6	< 0,03
LJ-ES1	Eau de surface <sup>2</sup>			7,3	26	68	-	-	0,55	7,5	<0.050	<0.0010	0,11	-
LJ-ES2	Eau de surface <sup>2</sup>			6,4	5,3	18	-	-	<0.50	1,3	<0.050	<0.0010	<0.0050	-
	MINIMUM			8,9	40	90	7,0	28	< 2	< 2	< 3	< 0,3	< 0,6	< 0,03
	MAXIMUM			9,5	86	171	31	61	4,1	30	< 3	< 0,3	< 0,6	0,10
	MOYENNE			9,3	57	134	18	39	N.C.	5,6	N.C.	N.C.	N.C.	N.C.
	MÉDIANE			9,4	59	131	21	37	N.C.	3,6	N.C.	N.C.	N.C.	N.C.
	ÉCART TYPE			0,17	13	22	7,0	8,9	N.C.	7,1	N.C.	N.C.	N.C.	N.C.
	25e CENTILE			9,2	48	123	14	34	N.C.	2,0	N.C.	N.C.	N.C.	N.C.
	75e CENTILE			9,4	61	146	23	41	N.C.	6,1	N.C.	N.C.	N.C.	N.C.

1- Critères de la protection de la vie aquatique (à long terme) du Conseil canadien des ministres de l'environnement (CCME); les critères de la qualité de l'eau tiennent compte de la dureté du milieu receveur - eau de surface LJ-ES1 et LJ-ES2 - ayant une dureté de 31 et 8 mg/L CaCO<sub>3</sub> respectivement.

2- Composition (métaux totaux) de l'eau de surface de l'exutoire de Lac Jeannine (LJ-ES1) et de l'eau du Lac Jeannine (LJ-ES2); ces valeurs ne sont pas incluses dans les calculs des statistiques.

Les valeurs de la limite de détection sont utilisées pour le calcul des statistiques.

N.C. non calculé

Tableau B-5  
Composition des stériles de Lac Jeannine: test d'extraction SFE

ArcelorMittal Exploitation Minière

Échantillon	Type échantillon	Ammoniac total	Cyanure (libre)	Hg	Ag	Al	As	Ba	B	Be	Bi	Ca
		mg/L (N)	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
<b>CCME<sup>1</sup></b>			<b>0,005</b>	<b>0,000026</b>	<b>0,00025</b>	<b>0,1</b>	<b>0,005</b>		<b>1,5</b>			
LJ-ST1-01	Stérile	< 0,1	< 0,005	< 0,00001	0,000072	<b>0,57</b>	0,0014	0,027	0,028	0,000037	0,000018	6,5
LJ-ST1-02	Stérile	0,20	< 0,005	< 0,00001	< 0,000002	< 0,001	< 0,0002	0,029	< 0,002	< 0,000007	< 0,000007	4,7
LJ-ST1-03	Stérile	< 0,1	< 0,005	< 0,00001	0,0000080	<b>0,14</b>	0,0024	0,015	0,0040	< 0,000007	< 0,000007	7,4
LJ-ST1-04	Stérile	0,10	< 0,005	< 0,00001	0,0000080	<b>0,19</b>	0,0017	0,35	0,014	0,000010	0,000090	8,4
LJ-ST1-06	Stérile	< 0,1	< 0,005	< 0,00001	< 0,000002	0,050	0,0013	0,093	< 0,002	< 0,000007	< 0,000007	10
LJ-ST1-07	Stérile	< 0,1	< 0,005	< 0,00001	0,0000070	0,072	0,0016	0,50	0,013	< 0,000007	< 0,000007	10
LJ-ST1-10	Stérile	< 0,1	< 0,005	< 0,00001	0,000028	<b>0,47</b>	0,00060	0,033	0,014	0,000012	0,000016	7,1
LJ-ST1-11	Stérile	0,10	< 0,005	0,000010	0,0000030	0,066	0,0025	0,018	0,018	0,000013	0,000090	19
LJ-ST1-13	Stérile	0,10	< 0,005	< 0,00001	0,000011	0,10	0,0013	0,14	0,017	< 0,000007	0,000070	9,6
LJ-ST1-17	Stérile	< 0,1	< 0,005	< 0,00001	< 0,000002	<b>0,24</b>	0,0024	0,0090	0,024	0,000016	< 0,000007	8,3
LJ-ST2-02	Stérile	0,10	< 0,005	< 0,00001	0,0000020	0,10	0,0021	0,0047	0,10	0,000016	0,000070	11
LJ-ST2-03	Stérile	< 0,1	< 0,005	< 0,00001	0,0000030	<b>0,13</b>	<b>0,0052</b>	0,016	0,031	0,000011	0,000016	13
LJ-ST2-08	Stérile	< 0,1	< 0,005	0,000020	0,000010	<b>0,58</b>	0,0041	0,0082	0,068	0,000017	0,000037	10,0
LJ-ST2-10	Stérile	0,10	< 0,005	0,000010	0,0000030	<b>0,21</b>	0,0023	0,014	0,022	0,000049	0,000010	12
LJ-ST2-13	Stérile	0,20	< 0,005	0,000010	0,0000050	0,090	0,0016	0,010	0,022	0,000010	0,000070	12
LJ-ES1	Eau de surface <sup>2</sup>	-	-	0,0000071	< 0,000020	0,10	< 0,00050	0,032	< 0,10	< 0,0010	< 0,20	9,0
LJ-ES2	Eau de surface <sup>2</sup>	-	-	0,0000055	< 0,000020	<b>0,23</b>	< 0,00050	< 0,020	< 0,10	< 0,0010	< 0,20	2,3
	MINIMUM	< 0,1	< 0,005	< 0,00001	< 0,000002	< 0,001	< 0,0002	0,0047	< 0,002	< 0,000007	< 0,000007	4,7
	MAXIMUM	0,20	< 0,005	0,000020	0,000072	<b>0,58</b>	<b>0,0052</b>	0,50	0,10	0,000017	0,000037	19
	MOYENNE	N.C.	N.C.	N.C.	0,000011	<b>0,20</b>	0,0020	0,084	0,025	0,000032	0,000011	9,9
	MÉDIANE	N.C.	N.C.	N.C.	0,0000050	<b>0,13</b>	0,0017	0,018	0,018	0,000012	0,000070	10,0
	ÉCART TYPE	N.C.	N.C.	N.C.	0,000018	0,19	0,0013	0,15	0,027	0,000048	0,000081	3,3
	25e CENTILE	N.C.	N.C.	N.C.	0,0000025	0,081	0,0014	0,012	0,014	0,0000070	0,000070	7,8
	75e CENTILE	N.C.	N.C.	N.C.	0,0000090	<b>0,22</b>	0,0024	0,063	0,026	0,000027	0,000013	11

1- Critères de la protection de la vie aquatique (à long terme) du Conseil canadien des ministres de l'environnement (CCME); les critères de la qualité de l'eau tiennent compte de la dureté du milieu receveur - eau de surface LJ-ES1 et LJ-ES2 - ayant une dureté de 31 et 8 mg/L CaCO<sub>3</sub> respectivement.

2- Composition (métaux totaux) de l'eau de surface de l'exutoire de Lac Jeannine (LJ-ES1) et de l'eau du Lac Jeannine (LJ-ES2); ces valeurs ne sont pas incluses dans les calculs des statistiques.

Les valeurs de la limite de détection sont utilisées pour le calcul des statistiques.

N.C. non calculé

Tableau B-5  
Composition des stériles de Lac Jeannine: test d'extraction SFE

ArcelorMittal Exploitation Minière

Échantillon	Type échantillon	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	Pb
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
<b>CCME<sup>1</sup></b>		<b>0,00009</b>		<b>0,001</b>	<b>0,002</b>	<b>0,3</b>					<b>0,073</b>		<b>0,025</b>	<b>0,001</b>
LJ-ST1-01	Stérile	0,000012	0,00045	<b>0,0023</b>	<b>0,022</b>	<b>0,54</b>	17	0,0059	1,7	0,0090	0,0015	13	0,013	0,00068
LJ-ST1-02	Stérile	0,0000030	0,000054	< 0,00003	0,00077	< 0,007	1,3	0,0011	19	0,00023	0,00016	1,3	0,00020	< 0,00001
LJ-ST1-03	Stérile	< 0,000003	0,000014	0,000060	<b>0,0025</b>	< 0,007	14	0,0045	3,8	0,00051	0,00071	2,5	0,00060	< 0,00001
LJ-ST1-04	Stérile	0,0000040	0,000095	0,00059	<b>0,013</b>	0,12	7,5	0,0038	1,9	0,0018	0,00045	9,6	0,0025	0,00069
LJ-ST1-06	Stérile	< 0,000003	0,000032	0,000050	<b>0,0027</b>	< 0,007	6,3	0,0023	9,1	0,00055	0,00074	1,4	0,00040	0,000020
LJ-ST1-07	Stérile	< 0,000003	0,00011	0,00020	<b>0,0052</b>	0,016	8,7	0,0032	3,6	0,00037	0,00067	8,0	0,0026	< 0,00001
LJ-ST1-10	Stérile	0,0000040	0,00021	<b>0,0012</b>	<b>0,018</b>	0,30	13	0,0044	1,5	0,0057	0,00066	11	0,0040	0,00060
LJ-ST1-11	Stérile	0,000024	0,00028	0,00024	<b>0,0069</b>	0,12	3,5	0,0011	7,0	0,0069	0,00045	8,5	0,0015	0,00023
LJ-ST1-13	Stérile	0,0000050	0,00017	0,00033	<b>0,014</b>	0,032	12	0,0049	2,6	0,00057	0,00060	8,2	0,0053	0,00010
LJ-ST1-17	Stérile	0,0000030	0,000062	0,00075	0,0020	0,084	5,4	0,0012	2,4	0,0018	0,00026	6,7	0,00040	0,000060
LJ-ST2-02	Stérile	0,000010	0,00030	0,00056	<b>0,0036</b>	0,15	1,9	0,00080	4,9	0,0086	0,00029	14	0,00080	0,00018
LJ-ST2-03	Stérile	0,000025	0,00075	0,00040	<b>0,0026</b>	<b>0,50</b>	1,5	0,00080	4,5	0,013	0,00029	7,3	0,0011	0,00035
LJ-ST2-08	Stérile	0,000015	0,00046	0,00069	0,0013	<b>1,7</b>	2,1	0,00070	0,47	0,030	0,00032	8,5	0,0013	<b>0,0012</b>
LJ-ST2-10	Stérile	0,000015	0,00030	0,00034	<b>0,0046</b>	<b>0,34</b>	3,2	0,0010	3,9	0,011	0,00036	8,4	0,00090	0,00026
LJ-ST2-13	Stérile	0,0000060	0,00016	0,00034	<b>0,0044</b>	0,14	2,3	0,0011	5,3	0,0069	0,00030	7,1	0,00050	0,00014
LJ-ES1	Eau de surface <sup>2</sup>	<0,0000050	<0,00030	<0,0010	0,0013	0,12	<2,0	<0,0010	2,5	0,0060	<0,0010	<2,0	<0,0010	<0,00050
LJ-ES2	Eau de surface <sup>2</sup>	0,0000074	<0,00030	<0,0010	<0,0010	0,14	<2,0	<0,0010	0,73	0,0070	<0,0010	<2,0	<0,0010	<0,00050
	MINIMUM	< 0,000003	0,000014	< 0,00003	0,00077	< 0,007	1,3	0,00070	0,47	0,00023	0,00016	1,3	0,00020	< 0,00001
	MAXIMUM	0,000025	0,00075	<b>0,0023</b>	<b>0,022</b>	<b>1,7</b>	17	0,0059	19	0,030	0,0015	14	0,013	<b>0,0012</b>
	MOYENNE	0,0000090	0,00023	0,00054	<b>0,0068</b>	0,27	6,7	0,0025	4,7	0,0065	0,00052	7,7	0,0023	0,00030
	MÉDIANE	0,0000050	0,00017	0,00034	<b>0,0044</b>	0,12	5,4	0,0012	3,8	0,0057	0,00045	8,2	0,0011	0,00018
	ÉCART TYPE	0,0000076	0,00020	0,00058	0,0065	0,42	5,3	0,0018	4,4	0,0078	0,00034	3,7	0,0032	0,00034
	25e CENTILE	0,0000030	0,000079	0,00022	<b>0,0026</b>	0,024	2,2	0,0011	2,1	0,00056	0,00030	6,9	0,00055	0,000040
	75e CENTILE	0,000014	0,00030	0,00064	<b>0,0099</b>	<b>0,32</b>	11	0,0041	5,1	0,0088	0,00067	9,0	0,0026	0,00048

1- Critères de la protection de la vie aquatique (à long terme) du Conseil canadien des ministres de l'environnement (CCME); les critères de la qualité de l'eau tiennent compte de la dureté du milieu receveur - eau de surface LJ-ES1 et LJ-ES2 - ayant une dureté de 31 et 8 mg/L CaCO<sub>3</sub> respectivement.

2- Composition (métaux totaux) de l'eau de surface de l'exutoire de Lac Jeannine (LJ-ES1) et de l'eau du Lac Jeannine (LJ-ES2); ces valeurs ne sont pas incluses dans les calculs des statistiques.

Les valeurs de la limite de détection sont utilisées pour le calcul des statistiques.

N.C. non calculé

Tableau B-5  
Composition des stériles de Lac Jeannine: test d'extraction SFE

ArcelorMittal Exploitation Minière

Échantillon	Type échantillon	P	Sb	Se	S	Si	Sn	Sr	Ti	Tl	U	V	Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
<b>CCME<sup>1</sup></b>				<b>0,001</b>						<b>0,0008</b>	<b>0,015</b>		<b>0,03</b>
LJ-ST1-01	Stérile	0,066	0,00040	0,00047	3,2	3,7	0,000070	0,015	0,026	0,000015	0,0037	0,0060	< 0,002
LJ-ST1-02	Stérile	< 0,003	< 0,0002	0,000090	0,70	2,1	< 0,00001	0,011	< 0,00005	0,0000070	0,00019	0,00081	< 0,002
LJ-ST1-03	Stérile	0,0030	0,00020	<b>0,0013</b>	2,8	6,4	< 0,00001	0,018	< 0,00005	0,0000080	0,00020	0,0062	< 0,002
LJ-ST1-04	Stérile	0,0070	0,0073	0,00018	1,8	7,7	0,000070	0,043	0,0056	0,0000060	0,00046	0,0045	< 0,002
LJ-ST1-06	Stérile	< 0,003	0,00030	0,000090	11	9,0	< 0,00001	0,058	< 0,00005	0,0000090	0,00026	0,0027	< 0,002
LJ-ST1-07	Stérile	0,0090	0,00030	0,00030	1,7	6,4	0,000020	0,065	0,00075	< 0,000005	0,00048	0,0035	< 0,002
LJ-ST1-10	Stérile	0,033	0,00030	0,00028	2,4	5,2	0,000070	0,015	0,018	0,0000070	0,0022	0,0076	< 0,002
LJ-ST1-11	Stérile	0,028	0,00040	0,00017	2,8	7,9	0,000020	0,024	0,0014	< 0,000005	0,0016	0,0014	< 0,002
LJ-ST1-13	Stérile	0,013	0,00030	0,00030	2,1	5,3	0,000020	0,031	0,0018	< 0,000005	0,00053	0,0058	< 0,002
LJ-ST1-17	Stérile	0,0070	0,00040	0,000070	0,50	6,4	< 0,00001	0,011	0,0016	< 0,000005	0,0015	0,0041	< 0,002
LJ-ST2-02	Stérile	0,051	0,00030	0,00017	< 0,1	8,9	0,000010	0,014	0,0014	< 0,000005	0,00088	0,0012	< 0,002
LJ-ST2-03	Stérile	0,055	0,00030	0,00024	< 0,1	7,5	0,000030	0,012	0,0039	< 0,000005	0,0022	0,00098	< 0,002
LJ-ST2-08	Stérile	0,20	0,00030	0,00044	< 0,1	9,0	< 0,00001	0,0086	0,0088	< 0,000005	0,00055	0,00073	< 0,002
LJ-ST2-10	Stérile	0,044	0,00030	0,00018	< 0,1	7,1	0,000010	0,0093	0,0059	< 0,000005	0,0012	0,0022	< 0,002
LJ-ST2-13	Stérile	0,019	0,00020	0,00012	0,60	11	0,000010	0,012	0,0020	< 0,000005	0,00047	0,0015	< 0,002
LJ-ES1	Eau de surface <sup>2</sup>	0,0025	<0,00050	0,00013	-	2,2	<0,00050	0,023	<0,010	<0,00020	0,00098	<0,00050	<0,0050
LJ-ES2	Eau de surface <sup>2</sup>	0,0032	<0,00050	<0,000050	-	1,9	<0,00050	0,010	<0,010	<0,00020	<0,00020	<0,00050	0,0073
	MINIMUM	< 0,003	< 0,0002	0,000070	< 0,1	2,1	< 0,00001	0,0086	< 0,00005	< 0,000005	0,00019	0,00073	< 0,002
	MAXIMUM	0,20	0,0073	<b>0,0013</b>	11	11	0,000070	0,065	0,026	0,000015	0,0037	0,0076	< 0,002
	MOYENNE	0,036	0,00077	0,00029	2,0	6,9	0,000025	0,023	0,0051	N.C.	0,0011	0,0033	N.C.
	MÉDIANE	0,019	0,00030	0,00018	1,7	7,1	0,000010	0,015	0,0018	N.C.	0,00055	0,0027	N.C.
	ÉCART TYPE	0,049	0,0018	0,00029	2,6	2,2	0,000024	0,018	0,0074	N.C.	0,00099	0,0023	N.C.
	25e CENTILE	0,0070	0,00030	0,00015	0,30	5,8	0,000010	0,011	0,0011	N.C.	0,00047	0,0013	N.C.
	75e CENTILE	0,048	0,00035	0,00030	2,6	8,4	0,000025	0,028	0,0057	N.C.	0,0016	0,0052	N.C.

1- Critères de la protection de la vie aquatique (à long terme) du Conseil canadien des ministres de l'environnement (CCME); les critères de la qualité de l'eau tiennent compte de la dureté du milieu receveur - eau de surface LJ-ES1 et LJ-ES2 - ayant une dureté de 31 et 8 mg/L CaCO<sub>3</sub> respectivement.

2- Composition (métaux totaux) de l'eau de surface de l'exutoire de Lac Jeannine (LJ-ES1) et de l'eau du Lac Jeannine (LJ-ES2); ces valeurs ne sont pas incluses dans les calculs des statistiques.

Les valeurs de la limite de détection sont utilisées pour le calcul des statistiques.

N.C. non calculé







# **ANNEXE C**

## **Certificats d'analyse chimique et de tests de toxicité**



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - KOL 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

**Golder Associates**

Attn : Cristina Cismasu

9200, Boul de l'Acadie, bureau 10  
Montreal, Quebec  
H4N 2T2,

Phone: 514-383-0990  
Fax:514-383-5332

ABA - Modified Sobek

25-August-2016

Date Rec. : 11 August 2016  
LR Report: CA11005-AUG16  
Reference: 1655754

Copy: #1

# CERTIFICATE OF ANALYSIS

## Final Report

Analysis	3: Approval Date	4: Approval Time	5: LJ-ST1-01	6: LJ-ST1-02	7: LJ-ST1-03	8: LJ-ST1-04	9: LJ-ST1-05	10: LJ-ST1-06	11: LJ-ST1-07	12: LJ-ST1-08
Sample Date & Time			02-Aug-16 10:36	02-Aug-16 11:35	02-Aug-16 14:29	02-Aug-16 11:43	02-Aug-16 14:40	02-Aug-16 11:57	02-Aug-16 11:53	02-Aug-16 14:53
Paste pH	24-Aug-16	17:45	9.71	9.42	9.77	9.73	9.44	9.46	9.60	9.61
Fizz Rate [---]	24-Aug-16	17:45	1	2	2	2	2	2	1	2
Sample weight [g]	24-Aug-16	17:45	2.01	2.00	1.98	2.01	2.04	2.01	1.97	1.96
HCl Added [mL]	24-Aug-16	17:45	20.00	496.80	72.40	30.90	29.90	66.30	24.80	76.90
HCl [Normality]	24-Aug-16	17:45	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	24-Aug-16	17:45	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to [pH=8.3 mL]	24-Aug-16	17:45	14.04	148	29.68	10.10	8.58	24.48	16.62	22.73
Final pH	24-Aug-16	17:45	1.47	1.62	1.56	1.86	1.82	1.58	1.55	1.66
NP [t CaCO3/1000 t]	24-Aug-16	17:45	15	873	108	52	52	104	21	138
AP [t CaCO3/1000 t]	---	---	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Net NP [t CaCO3/1000 t]	---	---	14.2	873	107	51.1	51.6	103	20.2	138
NP/AP [ratio]	---	---	23.9	1408	173	83.4	84.2	168	33.3	223
Sulphur (total) [%]	23-Aug-16	11:03	0.018	< 0.005	0.028	0.008	< 0.005	0.033	0.053	0.007
Acid Leachable SO4-S [%]	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.03	< 0.02
Sulphide [%]	23-Aug-16	15:59	< 0.02	< 0.02	0.02	< 0.02	< 0.02	< 0.02	0.02	< 0.02
Carbon (total) [%]	23-Aug-16	11:03	0.148	10.1	1.30	0.587	0.618	1.27	0.186	1.69
Carbonate [%]	23-Aug-16	14:31	0.345	38.7	5.93	2.61	2.58	5.69	0.669	7.66



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - KOL 2HO  
Phone: 705-652-2000 FAX: 705-652-6365

Analysis	13: LJ-ST1-09	14: LJ-ST1-10	15: LJ-ST1-11	16: LJ-ST1-12	17: LJ-ST1-13	18: LJ-ST1-14	19: LJ-ST1-15	20: LJ-ST1-16	21: LJ-ST1-17
Sample Date & Time	02-Aug-16 12:36	02-Aug-16 12:26	02-Aug-16 15:02	02-Aug-16 14:04	02-Aug-16 13:20	02-Aug-16 13:44	02-Aug-16 13:34	02-Aug-16 15:13	02-Aug-16 15:24
Paste pH	9.82	9.88	9.22	9.82	9.90	9.61	9.21	9.38	9.43
Fizz Rate [---]	2	2	2	2	2	2	1	2	2
Sample weight [g]	2.00	2.01	1.98	1.97	2.02	1.98	1.97	1.97	1.97
HCl Added [mL]	25.70	69.40	20.00	67.60	73.80	80.00	20.00	29.80	69.50
HCl [Normality]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to [pH=8.3 mL]	14.95	30.22	6.89	28.38	29.45	40.50	13.80	9.85	25.51
Final pH	1.60	1.56	1.88	1.57	1.59	1.55	1.42	1.78	1.58
NP [t CaCO3/1000 t]	27	98	33	100	110	100	16	51	112
AP [t CaCO3/1000 t]	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Net NP [t CaCO3/1000 t]	26.3	96.9	32.5	98.9	109	99.2	15.1	50.0	111
NP/AP [ratio]	43.0	157	53.4	160	176	161	25.3	81.6	180
Sulphur (total) [%]	0.034	0.013	0.008	0.006	0.035	< 0.005	0.006	< 0.005	< 0.005
Acid Leachable SO4-S [%]	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Sulphide [%]	0.02	< 0.02	< 0.02	< 0.02	0.02	< 0.02	< 0.02	< 0.02	< 0.02
Carbon (total) [%]	0.285	1.14	0.390	1.20	1.32	1.21	0.203	0.598	1.35
Carbonate [%]	1.07	5.17	1.54	5.34	5.80	5.27	0.545	2.44	6.02

Analysis	22: LJ-ST2-01	23: LJ-ST2-02	24: LJ-ST2-03	25: LJ-ST2-04	26: LJ-ST2-05	27: LJ-ST2-06	28: LJ-ST2-07	29: LJ-ST2-08	30: LJ-ST2-09
Sample Date & Time	02-Aug-16 16:53	04-Aug-16 09:33	04-Aug-16 09:29	04-Aug-16 17:45	04-Aug-16 16:36	04-Aug-16 09:49	04-Aug-16 09:45	02-Aug-16 18:06	02-Aug-16 16:09
Paste pH	9.02	8.96	9.28	9.26	8.77	9.24	9.17	8.62	9.18
Fizz Rate [---]	1	1	2	2	1	2	2	1	1
Sample weight [g]	2.05	1.98	1.99	1.97	2.01	1.97	1.99	2.03	2.04
HCl Added [mL]	20.00	20.00	42.00	20.00	20.00	40.70	20.00	20.00	20.00
HCl [Normality]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to [pH=8.3 mL]	16.47	15.70	16.64	7.04	18.39	16.34	10.26	18.15	8.84
Final pH	1.24	1.29	1.60	1.87	1.23	1.59	1.56	1.24	1.68
NP [t CaCO3/1000 t]	8.6	11	64	33	4.0	62	24	4.6	27
AP [t CaCO3/1000 t]	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Net NP [t CaCO3/1000 t]	7.98	10.3	63.1	32.3	3.38	61.2	23.9	3.98	26.8
NP/AP [ratio]	13.9	17.6	103	53.1	6.45	99.7	39.5	7.42	44.2

Analysis	22: LJ-ST2-01	23: LJ-ST2-02	24: LJ-ST2-03	25: LJ-ST2-04	26: LJ-ST2-05	27: LJ-ST2-06	28: LJ-ST2-07	29: LJ-ST2-08	30: LJ-ST2-09
Sulphur (total) [%]	< 0.005	< 0.005	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Acid Leachable SO4-S [%]	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Sulphide [%]	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Carbon (total) [%]	0.071	0.235	0.781	0.390	0.018	0.738	0.272	0.062	0.313
Carbonate [%]	0.225	0.360	3.32	1.58	< 0.025	3.16	1.05	< 0.025	1.24

Analysis	31: LJ-ST2-10	32: LJ-ST2-11	33: LJ-ST2-12	34: LJ-ST2-13
Sample Date & Time	04-Aug-16 08:16	04-Aug-16 07:46	04-Aug-16 08:07	04-Aug-16 07:57
Paste pH	9.38	8.59	9.13	9.27
Fizz Rate [---]	2	1	1	2
Sample weight [g]	1.98	2.00	2.00	1.98
HCl Added [mL]	42.00	20.00	20.00	29.60
HCl [Normality]	0.10	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10	0.10
NaOH to [pH=8.3 mL]	16.50	18.51	9.52	9.39
Final pH	1.61	1.20	1.59	1.77
NP [t CaCO3/1000 t]	64	3.7	26	51
AP [t CaCO3/1000 t]	0.62	0.62	0.62	0.62
Net NP [t CaCO3/1000 t]	63.8	3.08	25.6	50.4
NP/AP [ratio]	104	5.97	42.3	82.3
Sulphur (total) [%]	< 0.005	< 0.005	< 0.005	< 0.005
Acid Leachable SO4-S [%]	< 0.02	< 0.02	< 0.02	< 0.02
Sulphide [%]	< 0.02	< 0.02	< 0.02	< 0.02
Carbon (total) [%]	0.785	0.036	0.315	0.634
Carbonate [%]	3.37	< 0.025	1.19	2.67

\*NP (Neutralization Potential)  
= 50 x (N of HCL x Total HCL added - N NaOH x NaOH added)  
-----  
Weight of Sample

\*AP (Acid Potential) = % Sulphide Sulphur x 31.25

\*Net NP (Net Neutralization Potential) = NP-AP

NP/AP Ratio = NP/AP

\*Results expressed as tonnes CaCO3 equivalent/1000 tonnes of material

Samples with a % Sulphide value of <0.01 will be calculated using a 0.01 value.



**SGS Canada Inc.**

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - KOL 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

**ABA - Modified Sobek**

**LR Report : CA11005-AUG16**

---

*Brian Graham B.Sc.  
Project Specialist  
Environmental Services, Analytical*



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - K0L 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

**Golder Associates**

Attn : Cristina Cismasu

9200, Boul de l'Acadie, bureau 10  
Montreal, Quebec  
H4N 2T2,

Phone: 514-383-0990  
Fax:514-383-5332

22-August-2016

**Date Rec. :** 11 August 2016  
**LR Report:** CA11006-AUG16  
**Reference:** 1655754

**Copy:** #1

# CERTIFICATE OF ANALYSIS

## Final Report

Sample ID	Sample Date & Time	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %
5: LJ-ST1-01	02-Aug-16 10:36	66.4	9.90	14.6	0.90	1.29	2.40	2.66	0.15	0.09	0.08	0.01	< 0.01	1.07	99.6
6: LJ-ST1-02	02-Aug-16 11:35	8.74	0.20	1.35	20.1	28.6	0.06	0.03	< 0.01	0.05	0.11	< 0.01	< 0.01	39.7	99.0
7: LJ-ST1-03	02-Aug-16 14:29	64.3	7.15	11.3	3.54	4.65	1.41	1.99	0.17	0.09	0.06	0.01	< 0.01	4.98	99.7
8: LJ-ST1-04	02-Aug-16 11:43	75.6	6.05	7.68	2.17	3.54	1.76	1.26	0.06	0.08	0.01	0.01	< 0.01	2.22	100.5
9: LJ-ST1-05	02-Aug-16 14:40	80.3	0.55	9.67	3.03	4.41	0.06	0.15	0.03	0.03	0.03	0.01	< 0.01	1.93	100.2
10: LJ-ST1-06	02-Aug-16 11:57	73.4	1.46	8.95	4.30	6.16	0.40	0.32	0.03	0.04	0.06	< 0.01	< 0.01	4.23	99.4
11: LJ-ST1-07	02-Aug-16 11:53	81.9	3.41	10.2	0.97	1.09	0.92	0.68	0.10	0.05	0.02	0.01	< 0.01	0.77	100.2
12: LJ-ST1-08	02-Aug-16 14:53	76.7	2.54	5.32	3.77	5.58	0.72	0.51	0.08	0.06	0.06	< 0.01	< 0.01	5.96	101.3
13: LJ-ST1-09	02-Aug-16 12:36	76.8	7.81	6.62	1.98	2.55	2.03	1.68	0.16	0.06	0.04	0.02	< 0.01	1.24	101.0
14: LJ-ST1-10	02-Aug-16 12:26	68.0	11.5	2.37	2.56	4.27	2.77	3.98	0.12	0.05	0.03	0.01	< 0.01	4.33	100.0
15: LJ-ST1-11	02-Aug-16 15:02	89.4	0.94	5.41	1.17	1.62	0.05	0.31	0.04	0.07	0.01	0.02	< 0.01	1.32	100.3
16: LJ-ST1-12	02-Aug-16 14:04	70.9	6.22	7.43	3.48	4.94	1.77	1.20	0.12	0.06	0.04	< 0.01	< 0.01	4.36	100.5
17: LJ-ST1-13	02-Aug-16 13:20	67.6	7.83	5.42	4.10	5.42	2.15	1.48	0.20	0.09	0.06	< 0.01	< 0.01	4.86	99.3
18: LJ-ST1-14	02-Aug-16 13:44	70.4	3.13	7.95	5.39	7.30	0.74	0.65	0.09	0.05	0.05	0.01	0.01	4.44	100.2
19: LJ-ST1-15	02-Aug-16 13:34	83.7	2.16	9.50	0.49	0.61	0.15	0.71	0.06	0.05	< 0.01	< 0.01	< 0.01	0.78	98.2
20: LJ-ST1-16	02-Aug-16 15:13	78.9	1.08	13.3	1.56	2.21	0.07	0.34	0.04	0.05	0.02	< 0.01	< 0.01	2.05	99.6
21: LJ-ST1-17	02-Aug-16 15:24	76.9	0.44	6.25	4.34	6.38	0.06	0.13	0.01	0.07	0.05	< 0.01	< 0.01	4.67	99.3
22: LJ-ST2-01	02-Aug-16 16:53	89.4	0.50	9.19	0.46	0.65	0.03	0.12	0.01	0.04	< 0.01	0.01	< 0.01	0.24	100.6
23: LJ-ST2-02	04-Aug-16 09:33	91.6	0.37	6.63	0.51	0.71	0.04	0.11	0.02	0.02	< 0.01	< 0.01	< 0.01	0.60	100.6
24: LJ-ST2-03	04-Aug-16 09:29	79.4	0.52	14.0	1.63	2.44	0.05	0.17	0.02	0.06	0.01	< 0.01	< 0.01	2.48	100.8

Sample ID	Sample Date & Time	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %
25: LJ-ST2-04	04-Aug-16 17:45	83.5	0.54	11.6	1.36	1.99	0.05	0.18	0.03	0.04	0.02	< 0.01	< 0.01	1.18	100.6
26: LJ-ST2-05	04-Aug-16 16:36	84.0	0.70	14.6	0.22	0.24	0.04	0.25	0.03	0.04	< 0.01	0.01	< 0.01	0.05	100.1
27: LJ-ST2-06	04-Aug-16 09:49	87.1	0.62	4.63	2.41	3.32	0.05	0.18	0.03	0.03	0.02	0.02	< 0.01	2.37	100.8
28: LJ-ST2-07	04-Aug-16 09:45	86.2	0.57	9.08	1.13	1.65	0.07	0.18	0.03	0.05	0.02	< 0.01	< 0.01	0.80	99.7
29: LJ-ST2-08	02-Aug-16 18:06	81.7	1.19	17.2	0.16	0.15	0.06	0.35	0.04	0.07	0.03	< 0.01	< 0.01	0.22	101.1
30: LJ-ST2-09	02-Aug-16 16:09	91.0	0.83	5.94	0.64	0.94	0.06	0.29	0.03	0.05	< 0.01	< 0.01	< 0.01	1.33	101.1
31: LJ-ST2-10	04-Aug-16 08:16	81.6	1.03	8.03	2.71	3.78	0.04	0.29	0.04	0.04	0.03	< 0.01	< 0.01	3.03	100.6
32: LJ-ST2-11	04-Aug-16 07:46	80.5	0.38	19.2	0.12	0.15	0.06	0.11	0.02	0.04	< 0.01	< 0.01	< 0.01	0.36	100.9
33: LJ-ST2-12	04-Aug-16 08:07	75.7	0.26	21.3	1.14	1.66	0.06	0.06	0.01	0.05	0.02	< 0.01	< 0.01	1.23	101.4
34: LJ-ST2-13	04-Aug-16 07:57	85.3	0.54	3.66	3.25	4.58	0.07	0.15	0.03	0.02	0.04	< 0.01	< 0.01	2.39	100.0



*Brian Graham B.Sc.  
Project Specialist  
Environmental Services, Analytical*



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - KOL 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

**Golder Associates**

Attn : Cristina Cismasu

9200, Boul de l'Acadie, bureau 10  
Montreal, Quebec  
H4N 2T2,

Phone: 514-383-0990  
Fax:514-383-5332

29-August-2016

Date Rec. : 11 August 2016  
LR Report: CA11004-AUG16  
Reference: 1655754

Copy: #1

# CERTIFICATE OF ANALYSIS

## Final Report

Analysis	1:	2:	3:	4:	5:	6:	7:	8:	9:	10:	11:	12:	13:	14:	15:	16:	17:
	Analysis Start Date	Analysis Start Time	Analysis Approval Date	Analysis Approval Time	LJ-ST1-01	LJ-ST1-02	LJ-ST1-03	LJ-ST1-04	LJ-ST1-05	LJ-ST1-06	LJ-ST1-07	LJ-ST1-08	LJ-ST1-09	LJ-ST1-10	LJ-ST1-11	LJ-ST1-12	LJ-ST1-13
Bromide [µg/g]	25-Aug-16	10:32	26-Aug-16	10:47	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Fluoride [µg/g]	23-Aug-16	11:23	24-Aug-16	08:48	1.78	< 1	1.52	< 1	< 1	< 1	1.37	< 1	1.51	< 1	1.36	1.12	1.35
Mercury [µg/g]	24-Aug-16	13:53	24-Aug-16	17:48	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Silver [µg/g]	24-Aug-16	16:00	25-Aug-16	14:15	0.07	< 0.01	0.03	0.02	< 0.01	< 0.01	0.01	< 0.01	0.03	0.02	< 0.01	0.02	0.04
Aluminum [µg/g]	24-Aug-16	15:00	25-Aug-16	09:58	5300	350	6900	3200	530	1200	4100	3000	7600	5500	800	5000	9900
Arsenic [µg/g]	24-Aug-16	16:00	25-Aug-16	14:15	0.9	1.3	6.0	0.7	0.8	0.8	< 0.5	< 0.5	< 0.5	0.7	0.8	0.8	< 0.5
Boron [µg/g]	24-Aug-16	16:00	25-Aug-16	14:15	< 1	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:15	86	6.9	78	320	67	1600	2300	110	110	73	390	81	610
Beryllium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:15	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bismuth [µg/g]	24-Aug-16	16:00	25-Aug-16	14:15	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Calcium [µg/g]	24-Aug-16	15:00	25-Aug-16	09:58	3600	190000	25000	13000	14000	25000	4400	32000	7100	23000	8100	23000	26000
Cadmium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	0.02	0.05	0.05	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.02	0.03	< 0.02	< 0.02	0.03
Cobalt [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	3.7	1.0	4.8	1.7	0.54	0.77	3.1	2.0	4.6	2.9	0.45	2.8	7.0
Chromium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	27	1.1	32	6.2	3.2	3.0	31	15	37	18	3.5	18	58
Copper [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	7.8	6.5	10	2.5	4.4	3.5	4.1	4.5	9.9	6.2	1.8	3.4	14
Iron [µg/g]	24-Aug-16	15:00	25-Aug-16	09:58	21000	4400	33000	13000	15000	18000	19000	11000	18000	11000	10000	18000	19000
Potassium [µg/g]	24-Aug-16	15:00	25-Aug-16	09:58	4500	140	6200	2500	360	820	3600	2700	6700	4800	580	4000	9200
Lithium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	4	< 2	7	3	< 2	< 2	4	3	7	5	< 2	4	8
Magnesium [µg/g]	24-Aug-16	15:00	25-Aug-16	09:58	3800	89000	16000	6800	5400	12000	4300	17000	6900	13000	3600	14000	19000
Manganese [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	170	860	400	170	160	290	180	270	230	240	120	260	330
Molybdenum [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	1.0	< 0.1	1.4	1.2	0.8	0.8	1.9	0.9	2.0	1.4	1.3	0.8	1.9

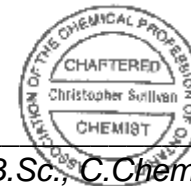
OnLine LIMS

0000768825



Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: LJ-ST1-01	6: LJ-ST1-02	7: LJ-ST1-03	8: LJ-ST1-04	9: LJ-ST1-05	10: LJ-ST1-06	11: LJ-ST1-07	12: LJ-ST1-08	13: LJ-ST1-09	14: LJ-ST1-10	15: LJ-ST1-11	16: LJ-ST1-12	17: LJ-ST1-13
Sodium [µg/g]	24-Aug-16	15:00	25-Aug-16	09:58	480	70	330	390	86	160	380	220	510	530	94	490	650
Nickel [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	9.8	3.6	14	4.9	2.0	2.1	11	5.9	15	7.2	1.6	8.0	26
Phosphorus [µg/g]	24-Aug-16	15:00	25-Aug-16	09:58	320	240	320	330	140	160	190	240	220	220	270	230	320
Lead [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	2.4	0.87	1.5	1.5	0.25	0.42	0.76	0.47	1.5	3.9	0.24	1.6	1.6
Antimony [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Sulphur [µg/g]	24-Aug-16	15:00	25-Aug-16	09:59	340	22	420	130	33	410	690	94	480	290	99	110	580
Silicon [µg/g]	24-Aug-16	15:00	25-Aug-16	09:59	480	500	430	550	440	440	420	400	380	420	470	400	390
Selenium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	< 0.7	1.4	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Strontium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	8.0	78	18	16	11	45	48	15	9.7	23	12	15	22
Titanium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	460	8.6	710	270	25	83	430	320	800	530	30	460	1030
Thallium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	0.07	< 0.02	0.14	0.04	< 0.02	< 0.02	0.06	0.04	0.14	0.09	< 0.02	0.07	0.19
Uranium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	1.1	0.77	0.83	0.51	0.21	0.25	0.33	0.29	0.40	2.1	0.25	0.70	0.43
Vanadium [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	14	1	27	7	2	4	12	10	21	12	2	13	30
Tungsten [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	0.09	< 0.04	0.06	< 0.04	< 0.04	< 0.04	< 0.04	0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.05
Zinc [µg/g]	24-Aug-16	16:00	25-Aug-16	14:16	16	6.9	19	8.8	1.5	3.6	11	8.0	21	13	1.1	12	28

*Chris Sullivan*



**Chris Sullivan, B.Sc., C.Chem**  
**Project Specialist**  
**Environmental Services, Analytical**



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - KOL 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

**Golder Associates**

Attn : Cristina Cismasu

9200, Boul de l'Acadie, bureau 10  
Montreal, Quebec  
H4N 2T2,

Phone: 514-383-0990  
Fax:514-383-5332

29-August-2016

Date Rec. : 11 August 2016  
LR Report: CA11004-AUG16  
Reference: 1655754

Copy: #1

# CERTIFICATE OF ANALYSIS

## Final Report

Analysis	18: LJ-ST1-14	19: LJ-ST1-15	20: LJ-ST1-16	21: LJ-ST1-17	22: LJ-ST2-01	23: LJ-ST2-02	24: LJ-ST2-03	25: LJ-ST2-04	26: LJ-ST2-05	27: LJ-ST2-06	28: LJ-ST2-07	29: LJ-ST2-08	30: LJ-ST2-09	31: LJ-ST2-10	32: LJ-ST2-11	33: LJ-ST2-12	34: LJ-ST2-13
Bromide [µg/g]	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Fluoride [µg/g]	1.03	1.67	1.21	< 1	1.09	< 1	< 1	< 1	1.40	< 1	< 1	1.46	1.19	< 1	< 1	< 1	< 1
Mercury [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Silver [µg/g]	0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aluminum [µg/g]	3100	1600	870	440	480	440	590	560	630	670	680	710	730	1100	460	380	530
Arsenic [µg/g]	1.1	0.9	0.9	0.9	0.7	< 0.5	2.6	1.0	0.8	< 0.5	0.9	2.0	0.7	0.7	0.5	1.7	< 0.5
Boron [µg/g]	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1	1	< 1	< 1	< 1	< 1	< 1
Barium [µg/g]	70	20	11	11	5.0	2.8	5.2	3.2	3.1	5.5	4.8	3.3	4.3	9.8	2.0	2.4	3.4
Beryllium [µg/g]	0.2	0.2	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.0
Bismuth [µg/g]	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Calcium [µg/g]	26000	3600	11000	27000	2300	2500	15000	8500	690	15000	6200	1200	6000	17000	750	7000	14000
Cadmium [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cobalt [µg/g]	3.0	0.94	0.79	0.94	0.50	0.42	2.0	0.83	0.95	0.39	0.70	0.62	0.58	1.00	0.48	0.61	0.37
Chromium [µg/g]	13	6.9	4.0	2.6	2.8	3.2	2.7	3.5	4.2	3.0	3.6	4.5	3.4	3.3	4.3	2.8	5.7
Copper [µg/g]	2.2	2.6	1.3	1.2	1.1	1.1	1.1	1.1	1.0	1.2	1.1	1.0	1.0	1.2	1.0	0.9	1.3
Iron [µg/g]	17000	16000	19000	11000	16000	11000	21000	21000	25000	8000	17000	26000	12000	14000	30000	33000	6700
Potassium [µg/g]	2500	1200	620	290	290	260	400	380	460	530	470	500	560	830	280	200	360
Lithium [µg/g]	3	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Magnesium [µg/g]	13000	1700	5600	12000	680	1000	7000	3300	260	7000	2600	200	3000	6800	180	2500	4700
Manganese [µg/g]	210	120	170	230	110	95	210	210	90	140	170	110	120	190	110	180	160
Molybdenum [µg/g]	1.0	1.9	0.9	1.1	1.1	1.7	0.9	3.0	1.7	1.4	1.6	2.7	1.5	1.4	2.9	1.5	1.4
Sodium [µg/g]	240	160	91	72	64	91	76	77	85	80	83	77	110	95	83	76	120

Online LIMS


0000768829

Analysis	18: LJ-ST1-14	19: LJ-ST1-15	20: LJ-ST1-16	21: LJ-ST1-17	22: LJ-ST2-01	23: LJ-ST2-02	24: LJ-ST2-03	25: LJ-ST2-04	26: LJ-ST2-05	27: LJ-ST2-06	28: LJ-ST2-07	29: LJ-ST2-08	30: LJ-ST2-09	31: LJ-ST2-10	32: LJ-ST2-11	33: LJ-ST2-12	34: LJ-ST2-13
Nickel [µg/g]	6.1	3.1	1.7	1.8	1.2	1.2	2.4	1.7	2.1	1.2	1.5	1.4	1.4	1.9	2.1	2.1	1.2
Phosphorus [µg/g]	190	230	190	300	140	90	230	150	150	130	190	270	190	160	120	200	110
Lead [µg/g]	0.53	0.48	0.39	0.28	0.18	0.46	0.37	0.24	0.17	0.20	0.23	0.24	0.19	0.26	0.18	0.20	0.27
Antimony [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Sulphur [µg/g]	28	74	13	21	5	7	58	5	< 3	13	6	5	5	6	< 3	5	21
Silicon [µg/g]	420	680	460	440	370	510	410	400	380	600	390	360	400	450	320	350	400
Selenium [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Strontium [µg/g]	20	3.4	7.6	16	1.6	1.7	11	5.8	0.95	9.1	4.3	2.1	3.7	9.1	0.83	4.9	9.8
Titanium [µg/g]	300	79	37	15	17	11	15	19	23	21	22	25	19	49	19	15	11
Thallium [µg/g]	0.04	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Uranium [µg/g]	0.24	0.48	0.65	0.22	0.13	0.13	0.33	0.27	0.19	0.23	0.34	0.16	0.17	0.32	0.17	0.17	0.098
Vanadium [µg/g]	11	3	2	1	2	1	2	2	2	1	2	3	2	3	2	3	< 1
Tungsten [µg/g]	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.05	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Zinc [µg/g]	6.7	2.2	1.8	1.5	1.9	1.3	1.7	1.2	< 0.7	< 0.7	1.0	< 0.7	1.1	1.4	< 0.7	< 0.7	1.2

### Method Descriptions

Parameter	SGS Method Code	Reference Method Code
Anions by IC	ME-CA-[ENV]IC-LAK-AN-001	EPA300/MA300-Ions1.3
Flouride by Specific Ion Electrode	ME-CA-[ENV]EWL-LAK-AN-014	E3263
Mercury by CVAAS	ME-CA-[ENV]SPE-LAK-AN-004	EPA 7471A/EPA 245
Metals, ICP-MS	ME-CA-[ENV]SPE-LAK-AN-007	MA200_MET.1.2
Metals, ICP-OES	ME-CA-[ENV]SPE-LAK-AN-001	MA200.MET.1.2/200.7

*Chris Sullivan*



**Chris Sullivan, B.Sc., C.Chem**  
Project Specialist  
Environmental Services, Analytical

## Quality Control Report

Parameter	Reporting Limit	Unit	Method Blank	Inorganic Analysis									
				Duplicate				LCS / Spike Blank			Matrix Spike / Reference Material		
				Result 1	Result 2	RPD	Acceptance Criteria	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
									Low	High		Low	High
<i>Anions by IC - QCBatchID: DIO0378-AUG16</i>													
Bromide	1.5	µg/g	<1.5			ND	20	104	80	120	103	75	125
<i>Anions by IC - QCBatchID: DIO0393-AUG16</i>													
Bromide	1.5	µg/g	<1.5			ND	20	100	80	120	107	75	125
<i>Fluoride by Specific Ion Electrode - QCBatchID: EWL0336-AUG16</i>													
Fluoride	1	µg/g	0.01			ND	30	100	80	120	NV	70	130
<i>Mercury by CVAAS - QCBatchID: EHG0032-AUG16</i>													
Mercury	0.05	µg/g	<0.05			ND	20	105	80	120	118	70	130
<i>Metals, ICP-MS - QCBatchID: EMS0109-AUG16</i>													
Antimony	0.8	µg/g	<0.8			12	20	103	70	130	148	70	130
Arsenic	0.5	µg/g	<0.5			10	20	97	70	130	110	70	130
Barium	0.01	µg/g	<0.01			0	20	101	70	130	102	70	130
Beryllium	0.02	µg/g	<0.02			2	20	97	70	130	102	70	130
Bismuth	0.09	µg/g	<0.09			ND	20	94	70	130	NV	70	130
Boron	1	µg/g	<1			2	20	103	70	130	NV	70	130
Cadmium	0.02	µg/g	<0.02			7	20	102	70	130	106	70	130
Chromium	0.5	µg/g	<0.5			3	20	97	70	130	122	70	130
Cobalt	0.01	µg/g	<0.01			3	20	97	70	130	109	70	130
Copper	0.1	µg/g	<0.1			1	20	97	70	130	105	70	130
Lead	0.05	µg/g	<0.05			16	20	95	70	130	108	70	130
Lithium	2	µg/g	<2			0	20	96	70	130	121	70	130
Manganese	0.1	µg/g	<0.1			1	20	98	70	130	104	70	130
Molybdenum	0.1	µg/g	<0.1			2	20	99	70	130	109	70	130
Nickel	0.1	µg/g	<0.1			0	20	96	70	130	101	70	130
Selenium	0.7	µg/g	<0.7			ND	20	100	70	130	NV	70	130
Silver	0.01	µg/g	<0.01			ND	20	92	70	130	120	70	130
Strontium	0.02	µg/g	<0.02			2	20	100	70	130	84	70	130
Thallium	0.02	µg/g	<0.02			6	20	92	70	130	112	70	130
Tin	0.5	µg/g	<0.5			ND	20	97	70	130	75	70	130
Titanium	0.1	µg/g	<0.1			0	20	100	70	130	NV	70	130
Tungsten	0.04	µg/g	< 0.04			4	20	100	70	130	NV	70	130
Uranium	0.002	µg/g	<0.002			9	20	98	70	130	102	70	130
Vanadium	1	µg/g	<1			0	20	97	70	130	120	70	130
Zinc	0.7	µg/g	<0.7			2	20	99	70	130	103	70	130
<i>Metals, ICP-OES - QCBatchID: ESG0095-AUG16</i>													
Aluminum	1	µg/g	<1			0	20	100	80	120	113	70	130



**SGS Canada Inc.**  
P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - KOL 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

Inorganic Analysis													
Parameter	Reporting Limit	Unit	Method Blank	Duplicate				LCS / Spike Blank			Matrix Spike / Reference Material		
				Result 1	Result 2	RPD	Acceptance Criteria	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
									Low	High		Low	High
Calcium	1	µg/g	<1			1	20	100	80	120	105	70	130
Iron	0.3	µg/g	<0.3			1	20	99	80	120	123	70	130
Magnesium	0.1	µg/g	<0.1			0	20	98	80	120	111	70	130
Phosphorus	3	µg/g	<3			ND	20	99	80	120	103	70	130
Potassium	0.3	µg/g	<0.3			0	20	105	80	120	121	70	130
Silicon	3	µg/g	<1			3	20	93	80	120	NV	70	130
Sodium	1	µg/g	<1			ND	20	99	80	120	119	70	130
Sulphur	3	µg/g	< 1			ND	20	108	80	120	NV	70	130



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - K0L 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

**Golder Associates**

Attn : Cristina Cismasu

9200, Boul de l'Acadie, bureau 10  
Montreal, Quebec  
H4N 2T2,

Phone: 514-383-0990  
Fax:514-383-5332

07-October-2016

Date Rec. : 28 September 2016  
LR Report: CA11023-SEP16

Copy: #1

# CERTIFICATE OF ANALYSIS

## Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: LJ-ST1-01	6: LJ-ST1-02	7: LJ-ST1-03	8: LJ-ST1-04	9: LJ-ST1-06	10: LJ-ST1-07	11: LJ-ST1-10
Sample Date & Time			02-Aug-16 10:36	02-Aug-16 11:35	02-Aug-16 14:29	02-Aug-16 11:43	02-Aug-16 11:57	02-Aug-16 11:53	02-Aug-16 12:26
Sample weight [g]	06-Oct-16	09:54	250	250	250	250	250	250	250
Volume D.I. Water [mL]	06-Oct-16	09:54	750	750	750	750	750	750	750
Initial pH	06-Oct-16	09:54	9.12	9.83	9.77	9.74	9.82	9.74	9.71
Final pH	06-Oct-16	09:54	9.02	9.62	9.38	9.50	9.45	9.42	9.40
pH [no unit]	07-Oct-16	14:39	9.28	9.46	8.88	9.50	9.09	9.38	9.35
Alkalinity [mg/L as CaCO3]	07-Oct-16	14:39	47	86	48	49	41	59	50
Conductivity [uS/cm]	07-Oct-16	14:39	148	165	122	123	158	135	131
Carbonate [mg/L as CaCO3]	07-Oct-16	14:39	13	31	7	22	11	21	15
Bicarbonate [mg/L as CaCO3]	07-Oct-16	14:39	35	55	42	28	30	38	35
Chloride [mg/L]	07-Oct-16	14:25	4.1	2.5	< 2	< 2	< 2	< 2	< 2
Sulphate [mg/L]	07-Oct-16	14:25	7.6	2.2	6.6	5.5	30	4.8	3.6
Bromide [mg/L]	07-Oct-16	14:29	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Nitrite (as N) [mg/L]	07-Oct-16	14:29	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nitrate (as N) [mg/L]	07-Oct-16	14:29	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Phosphorus (total reactive) [mg/L]	07-Oct-16	14:18	0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Ammonia+Ammonium (N) [mg/L]	07-Oct-16	11:16	< 0.1	0.2	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Cyanide (free) [mg/L]	07-Oct-16	14:08	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Mercury [mg/L]	07-Oct-16	14:30	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	07-Oct-16	14:14	0.000072	< 0.000002	0.000008	0.000008	< 0.000002	0.000007	0.000028
Aluminum [mg/L]	07-Oct-16	14:14	0.573	< 0.001	0.138	0.191	0.050	0.072	0.466

OnLine LIMS

0000802005



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.

Lakefield - Ontario - KOL 2HO

Phone: 705-652-2000 FAX: 705-652-6365

LR Report :

CA11023-SEP16

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: LJ-ST1-01	6: LJ-ST1-02	7: LJ-ST1-03	8: LJ-ST1-04	9: LJ-ST1-06	10: LJ-ST1-07	11: LJ-ST1-10
Arsenic [mg/L]	07-Oct-16	14:14	0.0014	< 0.0002	0.0024	0.0017	0.0013	0.0016	0.0006
Barium [mg/L]	07-Oct-16	14:14	0.0269	0.0286	0.0148	0.353	0.0925	0.500	0.0334
Boron [mg/L]	07-Oct-16	14:14	0.028	< 0.002	0.004	0.014	< 0.002	0.013	0.014
Beryllium [mg/L]	07-Oct-16	14:14	0.000037	< 0.000007	< 0.000007	0.000010	< 0.000007	< 0.000007	0.000012
Bismuth [mg/L]	07-Oct-16	14:14	0.000018	< 0.000007	< 0.000007	0.000009	< 0.000007	< 0.000007	0.000016
Calcium [mg/L]	07-Oct-16	14:14	6.46	4.71	7.37	8.39	10.0	10.1	7.05
Cadmium [mg/L]	07-Oct-16	14:14	0.000012	0.000003	< 0.000003	0.000004	< 0.000003	< 0.000003	0.000004
Cobalt [mg/L]	07-Oct-16	14:14	0.000454	0.000054	0.000014	0.000095	0.000032	0.000107	0.000209
Chromium [mg/L]	07-Oct-16	14:14	0.00229	< 0.00003	0.00006	0.00059	0.00005	0.00020	0.00120
Copper [mg/L]	07-Oct-16	14:14	0.0217	0.00077	0.00253	0.0129	0.00265	0.00517	0.0175
Iron [mg/L]	07-Oct-16	14:14	0.544	< 0.007	< 0.007	0.124	< 0.007	0.016	0.296
Potassium [mg/L]	07-Oct-16	14:14	17.3	1.33	14.1	7.47	6.25	8.69	13.1
Lithium [mg/L]	07-Oct-16	14:14	0.0059	0.0011	0.0045	0.0038	0.0023	0.0032	0.0044
Magnesium [mg/L]	07-Oct-16	14:14	1.66	18.5	3.76	1.89	9.11	3.57	1.47
Manganese [mg/L]	07-Oct-16	14:14	0.00901	0.00023	0.00051	0.00184	0.00055	0.00037	0.00568
Molybdenum [mg/L]	07-Oct-16	14:14	0.00154	0.00016	0.00071	0.00045	0.00074	0.00067	0.00066
Sodium [mg/L]	07-Oct-16	14:14	12.8	1.28	2.51	9.63	1.43	8.02	10.8
Nickel [mg/L]	07-Oct-16	14:14	0.0126	0.0002	0.0006	0.0025	0.0004	0.0026	0.0040
Lead [mg/L]	07-Oct-16	14:14	0.00068	< 0.00001	< 0.00001	0.00069	0.00002	< 0.00001	0.00060
Phosphorus [mg/L]	07-Oct-16	14:14	0.066	< 0.003	0.003	0.007	< 0.003	0.009	0.033
Antimony [mg/L]	07-Oct-16	14:14	0.0004	< 0.0002	0.0002	0.0073	0.0003	0.0003	0.0003
Selenium [mg/L]	07-Oct-16	14:14	0.00047	0.00009	0.00125	0.00018	0.00009	0.00030	0.00028
Sulfur [mg/L]	07-Oct-16	14:14	3.2	0.7	2.8	1.8	10.6	1.7	2.4
Silicon [mg/L]	07-Oct-16	14:14	3.74	2.07	6.37	7.68	8.96	6.36	5.17
Tin [mg/L]	07-Oct-16	14:14	0.00007	< 0.00001	< 0.00001	0.00007	< 0.00001	0.00002	0.00007
Strontium [mg/L]	07-Oct-16	14:14	0.0153	0.0109	0.0182	0.0431	0.0577	0.0647	0.0148
Titanium [mg/L]	07-Oct-16	14:14	0.0258	< 0.00005	< 0.00005	0.00559	< 0.00005	0.00075	0.0178
Thallium [mg/L]	07-Oct-16	14:14	0.000015	0.000007	0.000008	0.000006	0.000009	< 0.000005	0.000007
Uranium [mg/L]	07-Oct-16	14:14	0.00369	0.000194	0.000202	0.000459	0.000259	0.000477	0.00219
Vanadium [mg/L]	07-Oct-16	14:14	0.00599	0.00081	0.00615	0.00450	0.00265	0.00354	0.00761
Zinc [mg/L]	07-Oct-16	14:14	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.  
Lakefield - Ontario - K0L 2H0  
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : CA11023-SEP16

Analysis	12: LJ-ST1-11	13: LJ-ST1-13	14: LJ-ST1-17	15: LJ-ST2-02	16: LJ-ST2-03	17: LJ-ST2-08	18: LJ-ST2-10	19: LJ-ST2-13
Sample Date & Time	02-Aug-16 15:02	02-Aug-16 13:20	02-Aug-16 15:24	04-Aug-16 09:33	04-Aug-16 09:29	02-Aug-16 18:06	04-Aug-16 08:16	04-Aug-16 07:57
Sample weight [g]	250	250	250	250	250	250	250	250
Volume D.I. Water [mL]	750	750	750	750	750	750	750	750
Initial pH	9.57	9.70	9.74	9.53	9.58	7.65	9.57	9.73
Final pH	9.00	9.36	9.50	9.07	9.27	8.59	9.31	9.49
pH [no unit]	9.08	9.39	9.31	9.42	9.39	9.14	9.43	9.38
Alkalinity [mg/L as CaCO3]	76	59	48	70	60	40	60	61
Conductivity [uS/cm]	171	142	105	143	122	90	123	127
Carbonate [mg/L as CaCO3]	15	21	15	28	21	9	23	25
Bicarbonate [mg/L as CaCO3]	61	39	33	42	39	31	37	36
Chloride [mg/L]	< 2	< 2	< 2	< 2	< 2	2.1	< 2	< 2
Sulphate [mg/L]	7.4	4.5	2.3	< 2	< 2	< 2	< 2	< 2
Bromide [mg/L]	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Nitrite (as N) [mg/L]	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nitrate (as N) [mg/L]	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Phosphorus (total reactive) [mg/L]	< 0.03	< 0.03	< 0.03	< 0.03	0.03	0.10	< 0.03	< 0.03
Ammonia+Ammonium (N) [mg/L]	0.1	0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.2
Cyanide (free) [mg/L]	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Mercury [mg/L]	0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00002	0.00001	0.00001
Silver [mg/L]	0.000003	0.000011	< 0.000002	0.000002	0.000003	0.000010	0.000003	0.000005
Aluminum [mg/L]	0.066	0.100	0.238	0.100	0.127	0.579	0.206	0.090
Arsenic [mg/L]	0.0025	0.0013	0.0024	0.0021	0.0052	0.0041	0.0023	0.0016
Barium [mg/L]	0.0175	0.136	0.00900	0.00472	0.0164	0.00815	0.0136	0.0101
Boron [mg/L]	0.018	0.017	0.024	0.103	0.031	0.068	0.022	0.022
Beryllium [mg/L]	0.000013	< 0.000007	0.000016	0.000016	0.000109	0.000174	0.000049	0.000010
Bismuth [mg/L]	0.000009	0.000007	< 0.000007	0.000007	0.000016	0.000037	0.000010	0.000007
Calcium [mg/L]	18.7	9.55	8.30	11.3	12.5	9.99	11.5	12.1
Cadmium [mg/L]	0.000024	0.000005	0.000003	0.000010	0.000025	0.000015	0.000015	0.000006
Cobalt [mg/L]	0.000279	0.000166	0.000062	0.000299	0.000751	0.000464	0.000303	0.000164
Chromium [mg/L]	0.00024	0.00033	0.00075	0.00056	0.00040	0.00069	0.00034	0.00034
Copper [mg/L]	0.00685	0.0140	0.00199	0.00360	0.00260	0.00130	0.00461	0.00443
Iron [mg/L]	0.120	0.032	0.084	0.154	0.498	1.65	0.340	0.138
Potassium [mg/L]	3.48	12.4	5.35	1.92	1.47	2.05	3.18	2.33
Lithium [mg/L]	0.0011	0.0049	0.0012	0.0008	0.0008	0.0007	0.0010	0.0011
Magnesium [mg/L]	6.97	2.57	2.38	4.89	4.48	0.472	3.94	5.33
Manganese [mg/L]	0.00687	0.00057	0.00176	0.00861	0.0133	0.0299	0.0113	0.00688

OnLine LIMS

0000802005



Analysis	12: LJ-ST1-11	13: LJ-ST1-13	14: LJ-ST1-17	15: LJ-ST2-02	16: LJ-ST2-03	17: LJ-ST2-08	18: LJ-ST2-10	19: LJ-ST2-13
Molybdenum [mg/L]	0.00045	0.00060	0.00026	0.00029	0.00029	0.00032	0.00036	0.00030
Sodium [mg/L]	8.45	8.22	6.67	14.3	7.31	8.45	8.41	7.06
Nickel [mg/L]	0.0015	0.0053	0.0004	0.0008	0.0011	0.0013	0.0009	0.0005
Lead [mg/L]	0.00023	0.00010	0.00006	0.00018	0.00035	0.00118	0.00026	0.00014
Phosphorus [mg/L]	0.028	0.013	0.007	0.051	0.055	0.195	0.044	0.019
Antimony [mg/L]	0.0004	0.0003	0.0004	0.0003	0.0003	0.0003	0.0003	0.0002
Selenium [mg/L]	0.00017	0.00030	0.00007	0.00017	0.00024	0.00044	0.00018	0.00012
Sulfur [mg/L]	2.8	2.1	0.5	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Silicon [mg/L]	7.93	5.28	6.39	8.87	7.53	8.99	7.12	10.8
Tin [mg/L]	0.00002	0.00002	< 0.00001	0.00001	0.00003	< 0.00001	0.00001	0.00001
Strontium [mg/L]	0.0242	0.0308	0.0107	0.0143	0.0118	0.00860	0.00926	0.0121
Titanium [mg/L]	0.00139	0.00176	0.00164	0.00140	0.00390	0.00876	0.00585	0.00196
Thallium [mg/L]	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Uranium [mg/L]	0.00163	0.000525	0.00148	0.000876	0.002180	0.000554	0.00120	0.000471
Vanadium [mg/L]	0.00135	0.00582	0.00411	0.00119	0.00098	0.00073	0.00222	0.00148
Zinc [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

\_\_\_\_\_  
**Brian Graham B.Sc.**  
Project Specialist  
Environmental Services, Analytical



GOLDER ASSOCIATES LTD.  
ATTN: Caroline-Emmanuelle Morisset  
9200, Boul De L'Acadie, bureau 10  
Montreal QC H4N 2T2

Date Received: 06-AUG-16  
Report Date: 15-AUG-16 13:29 (MT)  
Version: FINAL

Client Phone: 514-383-0990

## Certificate of Analysis

Lab Work Order #: L1809502  
Project P.O. #: NOT SUBMITTED  
Job Reference:  
C of C Numbers:  
Legal Site Desc:

Amber Springer, B.Sc  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700  
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1809502-1	L1809502-2		
		Description	WATER	WATER		
		Sampled Date	06-AUG-16	06-AUG-16		
		Sampled Time	11:30	12:00		
		Client ID	LJ-ES1	LJ-ES2		
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Conductivity (uS/cm)		67.6	18.4		
	Hardness (as CaCO3) (mg/L)		31.4	8.32		
	pH (pH)		7.31	6.44		
	Total Suspended Solids (mg/L)		<3.0	<3.0		
<b>Anions and Nutrients</b>	Alkalinity, Bicarbonate (as CaCO3) (mg/L)		25.8	5.3		
	Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)		25.8	5.3		
	Ammonia, Total (as N) (mg/L)		<0.0050	0.0060		
	Bromide (Br) (mg/L)		<0.050	<0.050		
	Chloride (Cl) (mg/L)		0.55	<0.50		
	Fluoride (F) (mg/L)		0.021	<0.020		
	Nitrate (as N) (mg/L)		0.108	<0.0050		
	Nitrite (as N) (mg/L)		<0.0010	<0.0010		
	Phosphorus (P)-Total (mg/L)		0.0025	0.0032		
	Sulfate (SO4) (mg/L)		7.45	1.33		
	<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)		0.100	0.225	
Antimony (Sb)-Total (mg/L)			<0.00050	<0.00050		
Arsenic (As)-Total (mg/L)			<0.00050	<0.00050		
Barium (Ba)-Total (mg/L)			0.032	<0.020		
Beryllium (Be)-Total (mg/L)			<0.0010	<0.0010		
Bismuth (Bi)-Total (mg/L)			<0.20	<0.20		
Boron (B)-Total (mg/L)			<0.10	<0.10		
Cadmium (Cd)-Total (mg/L)			<0.0000050	0.0000074		
Calcium (Ca)-Total (mg/L)			9.04	2.27		
Chromium (Cr)-Total (mg/L)			<0.0010	<0.0010		
Cobalt (Co)-Total (mg/L)			<0.00030	<0.00030		
Copper (Cu)-Total (mg/L)			0.0013	<0.0010		
Iron (Fe)-Total (mg/L)			0.118	0.141		
Lead (Pb)-Total (mg/L)			<0.00050	<0.00050		
Lithium (Li)-Total (mg/L)			<0.0010	<0.0010		
Magnesium (Mg)-Total (mg/L)			2.47	0.73		
Manganese (Mn)-Total (mg/L)			0.00600	0.00697		
Mercury (Hg)-Total (mg/L)			0.0000071	0.0000055		
Molybdenum (Mo)-Total (mg/L)			<0.0010	<0.0010		
Nickel (Ni)-Total (mg/L)			<0.0010	<0.0010		
Phosphorus (P)-Total (mg/L)			<0.30	<0.30		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1809502-1	L1809502-2		
		Description	WATER	WATER		
		Sampled Date	06-AUG-16	06-AUG-16		
		Sampled Time	11:30	12:00		
		Client ID	LJ-ES1	LJ-ES2		
Grouping	Analyte					
<b>WATER</b>						
<b>Total Metals</b>	Potassium (K)-Total (mg/L)	<2.0	<2.0			
	Selenium (Se)-Total (mg/L)	0.000129	<0.000050			
	Silicon (Si)-Total (mg/L)	2.15	1.94			
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020			
	Sodium (Na)-Total (mg/L)	<2.0	<2.0			
	Strontium (Sr)-Total (mg/L)	0.0230	0.0104			
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020			
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050			
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010			
	Uranium (U)-Total (mg/L)	0.00098	<0.00020			
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0050	0.0073			
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD			
	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	0.0894	0.199			
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050			
	Arsenic (As)-Dissolved (mg/L)	<0.00050	<0.00050			
	Barium (Ba)-Dissolved (mg/L)	0.030	<0.020			
	Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20			
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10			
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	0.0000066			
	Calcium (Ca)-Dissolved (mg/L)	8.69	2.20			
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010			
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030			
	Copper (Cu)-Dissolved (mg/L)	0.0011	<0.0010			
	Iron (Fe)-Dissolved (mg/L)	0.086	0.075			
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050			
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010			
	Magnesium (Mg)-Dissolved (mg/L)	2.36	0.68			
	Manganese (Mn)-Dissolved (mg/L)	0.00269	0.00165			
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	0.0000114			
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010			
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	<0.0010			
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30			
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0			
	Selenium (Se)-Dissolved (mg/L)	0.000086	<0.000050			

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1809502-1	L1809502-2			
		Description	WATER	WATER			
		Sampled Date	06-AUG-16	06-AUG-16			
		Sampled Time	11:30	12:00			
		Client ID	LJ-ES1	LJ-ES2			
Grouping	Analyte						
<b>WATER</b>							
<b>Dissolved Metals</b>	Silicon (Si)-Dissolved (mg/L)	2.11	1.86				
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020				
	Sodium (Na)-Dissolved (mg/L)	<2.0	<2.0				
	Strontium (Sr)-Dissolved (mg/L)	0.0219	0.0098				
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020				
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050				
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010				
	Uranium (U)-Dissolved (mg/L)	0.00092	<0.00020				
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	0.0073				
<b>Speciated Metals</b>	Methyl Mercury-Total (ug/L)	0.000150	0.000076				

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## Reference Information

### QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Calcium (Ca)-Total	B	L1809502-1, -2
Duplicate	Bromide (Br)	DLDS	L1809502-1, -2
Duplicate	Nitrite (as N)	DLDS	L1809502-1, -2
Duplicate	Nitrate (as N)	DLDS	L1809502-1, -2
Duplicate	Nitrite (as N)	DLDS	L1809502-1, -2
Duplicate	Nitrate (as N)	DLDS	L1809502-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Manganese (Mn)-Total	MS-B	L1809502-1, -2
Matrix Spike	Uranium (U)-Total	MS-B	L1809502-1, -2
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1809502-1, -2
Matrix Spike	Selenium (Se)-Dissolved	MS-B	L1809502-1, -2

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
<b>ALK-TITR-VA</b>	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
<b>BR-L-IC-N-VA</b>	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>CL-IC-N-VA</b>	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>EC-PCT-VA</b>	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
<b>F-IC-N-VA</b>	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>HARDNESS-CALC-VA</b>	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO <sub>3</sub> equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
<b>HG-D-CVAA-VA</b>	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
<b>HG-MEHG-TOT-GCAFS-VA</b>	Water	Total Methyl Mercury in Water by GCAFS	EPA 1630
This procedure is carried out using the US EPA Method 1630. Water samples are distilled to isolate methyl mercury from the sample matrix. The distillate is analyzed by aqueous phase ethylation and purge and trap, followed by capillary gas chromatography. Highly selective and sensitive detection is achieved by Atomic Fluorescence Spectrometry (AFS) after pyrolytic decomposition of the GC eluent. Results are reported "as MeHg".			
<b>HG-T-CVAA-VA</b>	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

## Reference Information

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

**MET-D-CCMS-VA** Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

**MET-DIS-ICP-VA** Water Dissolved Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

**MET-T-CCMS-VA** Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

**MET-TOT-ICP-VA** Water Total Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

**NH3-F-VA** Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

**NH3-F-VA** Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

**NO2-L-IC-N-VA** Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**NO3-L-IC-N-VA** Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**P-T-PRES-COL-VA** Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

**PH-PCT-VA** Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

**PH-PCT-VA** Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

**SO4-IC-N-VA** Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**TSS-VA** Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

## Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

---

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

---

### Chain of Custody Numbers:

#### GLOSSARY OF REPORT TERMS

*Surrogate* - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

*mg/kg* - milligrams per kilogram based on dry weight of sample.

*mg/kg wwt* - milligrams per kilogram based on wet weight of sample.

*mg/kg lwt* - milligrams per kilogram based on lipid-adjusted weight of sample.

*mg/L* - milligrams per litre.

*<* - Less than.

*D.L.* - The reported Detection Limit, also known as the Limit of Reporting (LOR).

*N/A* - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.





## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 1 of 12

Client: GOLDER ASSOCIATES LTD.  
 9200, Boul De L'Acadie, bureau 10  
 Montreal QC H4N 2T2  
 Contact: Caroline-Emmanuelle Morisset

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>ALK-TITR-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3524333</b>							
<b>WG2364947-3</b>	<b>CRM</b>	<b>VA-ALK-TITR-CONTROL</b>						
Alkalinity, Total (as CaCO3)			94.3		%		85-115	11-AUG-16
<b>WG2364947-8</b>	<b>CRM</b>	<b>VA-ALK-TITR-CONTROL</b>						
Alkalinity, Total (as CaCO3)			95.7		%		85-115	11-AUG-16
<b>WG2364947-5</b>	<b>DUP</b>	<b>L1809502-2</b>						
Alkalinity, Total (as CaCO3)		5.3	4.8		mg/L	9.9	20	11-AUG-16
<b>WG2364947-1</b>	<b>MB</b>							
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	11-AUG-16
<b>WG2364947-6</b>	<b>MB</b>							
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	11-AUG-16
<b>BR-L-IC-N-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3523245</b>							
<b>WG2364860-2</b>	<b>LCS</b>							
Bromide (Br)			102.9		%		85-115	10-AUG-16
<b>WG2364860-1</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	10-AUG-16
<b>WG2364860-10</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	10-AUG-16
<b>WG2364860-13</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	10-AUG-16
<b>WG2364860-4</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	10-AUG-16
<b>WG2364860-7</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	10-AUG-16
<b>CL-IC-N-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3523245</b>							
<b>WG2364860-2</b>	<b>LCS</b>							
Chloride (Cl)			103.4		%		90-110	10-AUG-16
<b>WG2364860-1</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	10-AUG-16
<b>WG2364860-10</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	10-AUG-16
<b>WG2364860-13</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	10-AUG-16
<b>WG2364860-4</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	10-AUG-16
<b>WG2364860-7</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	10-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 2 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>EC-PCT-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3524333</b>							
<b>WG2364947-4</b>	<b>CRM</b>	<b>VA-EC-PCT-CONTROL</b>						
Conductivity			98.2		%		90-110	11-AUG-16
<b>WG2364947-9</b>	<b>CRM</b>	<b>VA-EC-PCT-CONTROL</b>						
Conductivity			98.2		%		90-110	11-AUG-16
<b>WG2364947-5</b>	<b>DUP</b>	<b>L1809502-2</b>						
Conductivity		18.4	18.1		uS/cm	1.7	10	11-AUG-16
<b>WG2364947-1</b>	<b>MB</b>							
Conductivity			<2.0		uS/cm		2	11-AUG-16
<b>WG2364947-6</b>	<b>MB</b>							
Conductivity			<2.0		uS/cm		2	11-AUG-16
<b>F-IC-N-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3523245</b>							
<b>WG2364860-2</b>	<b>LCS</b>							
Fluoride (F)			99.6		%		90-110	10-AUG-16
<b>WG2364860-1</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	10-AUG-16
<b>WG2364860-10</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	10-AUG-16
<b>WG2364860-13</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	10-AUG-16
<b>WG2364860-4</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	10-AUG-16
<b>WG2364860-7</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	10-AUG-16
<b>HG-D-CVAA-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3523196</b>							
<b>WG2364512-2</b>	<b>LCS</b>							
Mercury (Hg)-Dissolved			98.0		%		80-120	10-AUG-16
<b>WG2364512-1</b>	<b>MB</b>	<b>NP</b>						
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	10-AUG-16
<b>WG2364512-5</b>	<b>MS</b>	<b>L1809502-1</b>						
Mercury (Hg)-Dissolved			91.2		%		70-130	10-AUG-16
<b>HG-MEHG-TOT-GCAFS-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3524704</b>							
<b>WG2366772-2</b>	<b>LCS</b>							
Methyl Mercury-Total			88.9		%		80-120	11-AUG-16
<b>WG2366772-1</b>	<b>MB</b>							
Methyl Mercury-Total			<0.000050		ug/L		0.00005	11-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 3 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>HG-T-CVAA-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523196</b>							
<b>WG2364949-2</b>	<b>LCS</b>							
Mercury (Hg)-Total			98.3		%		80-120	10-AUG-16
<b>WG2364949-1</b>	<b>MB</b>							
Mercury (Hg)-Total			<0.000005C		mg/L		0.000005	10-AUG-16
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523278</b>							
<b>WG2364511-2</b>	<b>LCS</b>							
Aluminum (Al)-Dissolved			102.6		%		80-120	10-AUG-16
Antimony (Sb)-Dissolved			94.2		%		80-120	10-AUG-16
Arsenic (As)-Dissolved			98.1		%		80-120	10-AUG-16
Beryllium (Be)-Dissolved			99.6		%		80-120	10-AUG-16
Cadmium (Cd)-Dissolved			92.1		%		80-120	10-AUG-16
Chromium (Cr)-Dissolved			95.2		%		80-120	10-AUG-16
Cobalt (Co)-Dissolved			96.0		%		80-120	10-AUG-16
Copper (Cu)-Dissolved			95.3		%		80-120	10-AUG-16
Lead (Pb)-Dissolved			100.2		%		80-120	10-AUG-16
Lithium (Li)-Dissolved			102.5		%		80-120	10-AUG-16
Manganese (Mn)-Dissolved			99.9		%		80-120	10-AUG-16
Molybdenum (Mo)-Dissolved			103.4		%		80-120	10-AUG-16
Nickel (Ni)-Dissolved			97.6		%		80-120	10-AUG-16
Selenium (Se)-Dissolved			97.5		%		80-120	10-AUG-16
Silver (Ag)-Dissolved			102.2		%		80-120	10-AUG-16
Thallium (Tl)-Dissolved			99.1		%		80-120	10-AUG-16
Tin (Sn)-Dissolved			95.7		%		80-120	10-AUG-16
Uranium (U)-Dissolved			100.5		%		80-120	10-AUG-16
Vanadium (V)-Dissolved			100.2		%		80-120	10-AUG-16
<b>WG2364511-1</b>	<b>MB</b>	<b>NP</b>						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	10-AUG-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	10-AUG-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	10-AUG-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	10-AUG-16
Cadmium (Cd)-Dissolved			<0.000005C		mg/L		0.000005	10-AUG-16
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	10-AUG-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	10-AUG-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	10-AUG-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	10-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 4 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523278</b>							
<b>WG2364511-1</b>	<b>MB</b>	<b>NP</b>						
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	10-AUG-16
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	10-AUG-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	10-AUG-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	10-AUG-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	10-AUG-16
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	10-AUG-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	10-AUG-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	10-AUG-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	10-AUG-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	10-AUG-16
<b>MET-DIS-ICP-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523050</b>							
<b>WG2364511-2</b>	<b>LCS</b>							
Barium (Ba)-Dissolved			92.5		%		80-120	10-AUG-16
Bismuth (Bi)-Dissolved			101.8		%		80-120	10-AUG-16
Boron (B)-Dissolved			98.3		%		80-120	10-AUG-16
Calcium (Ca)-Dissolved			103.0		%		80-120	10-AUG-16
Iron (Fe)-Dissolved			90.1		%		80-120	10-AUG-16
Magnesium (Mg)-Dissolved			93.8		%		80-120	10-AUG-16
Phosphorus (P)-Dissolved			102.3		%		80-120	10-AUG-16
Potassium (K)-Dissolved			91.0		%		80-120	10-AUG-16
Silicon (Si)-Dissolved			99.6		%		80-120	10-AUG-16
Sodium (Na)-Dissolved			98.1		%		80-120	10-AUG-16
Strontium (Sr)-Dissolved			92.5		%		80-120	10-AUG-16
Titanium (Ti)-Dissolved			98.0		%		80-120	10-AUG-16
Zinc (Zn)-Dissolved			98.4		%		80-120	10-AUG-16
<b>WG2364511-1</b>	<b>MB</b>	<b>NP</b>						
Barium (Ba)-Dissolved			<0.010		mg/L		0.01	10-AUG-16
Bismuth (Bi)-Dissolved			<0.20		mg/L		0.2	10-AUG-16
Boron (B)-Dissolved			<0.10		mg/L		0.1	10-AUG-16
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	10-AUG-16
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	10-AUG-16
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	10-AUG-16
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	10-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 5 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-DIS-ICP-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523050</b>							
<b>WG2364511-1</b>	<b>MB</b>	<b>NP</b>						
Potassium (K)-Dissolved			<2.0		mg/L		2	10-AUG-16
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	10-AUG-16
Sodium (Na)-Dissolved			<2.0		mg/L		2	10-AUG-16
Strontium (Sr)-Dissolved			<0.0050		mg/L		0.005	10-AUG-16
Titanium (Ti)-Dissolved			<0.010		mg/L		0.01	10-AUG-16
Zinc (Zn)-Dissolved			<0.0050		mg/L		0.005	10-AUG-16
<b>MET-T-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523278</b>							
<b>WG2364510-2</b>	<b>LCS</b>							
Aluminum (Al)-Total			114.5		%		80-120	10-AUG-16
Arsenic (As)-Total			111.6		%		80-120	10-AUG-16
Cadmium (Cd)-Total			111.8		%		80-120	10-AUG-16
Chromium (Cr)-Total			111.4		%		80-120	10-AUG-16
Cobalt (Co)-Total			110.8		%		80-120	10-AUG-16
Copper (Cu)-Total			109.7		%		80-120	10-AUG-16
Manganese (Mn)-Total			113.8		%		80-120	10-AUG-16
Nickel (Ni)-Total			111.2		%		80-120	10-AUG-16
Selenium (Se)-Total			112.8		%		80-120	10-AUG-16
Tin (Sn)-Total			112.0		%		80-120	10-AUG-16
Vanadium (V)-Total			114.9		%		80-120	10-AUG-16
<b>WG2364510-1</b>	<b>MB</b>							
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-16
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-16
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-16
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	10-AUG-16
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	10-AUG-16
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-16
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-16
Copper (Cu)-Total			<0.00050		mg/L		0.0005	10-AUG-16
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-16
Lithium (Li)-Total			<0.0010		mg/L		0.001	10-AUG-16
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	10-AUG-16
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-16
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	10-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 6 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523278</b>							
<b>WG2364510-1</b>	<b>MB</b>							
Selenium (Se)-Total			<0.000050		mg/L		0.00005	10-AUG-16
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-16
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	10-AUG-16
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-16
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-16
Vanadium (V)-Total			<0.00050		mg/L		0.0005	10-AUG-16
<b>Batch</b>	<b>R3523820</b>							
<b>WG2364510-2</b>	<b>LCS</b>							
Antimony (Sb)-Total			92.2		%		80-120	10-AUG-16
Beryllium (Be)-Total			92.4		%		80-120	10-AUG-16
Lead (Pb)-Total			94.6		%		80-120	10-AUG-16
Lithium (Li)-Total			91.1		%		80-120	10-AUG-16
Molybdenum (Mo)-Total			96.2		%		80-120	10-AUG-16
Silver (Ag)-Total			93.6		%		80-120	10-AUG-16
Thallium (Tl)-Total			92.4		%		80-120	10-AUG-16
Uranium (U)-Total			97.6		%		80-120	10-AUG-16
<b>Batch</b>	<b>R3524572</b>							
<b>WG2364510-3</b>	<b>DUP</b>	<b>L1809502-2</b>						
Aluminum (Al)-Total		0.225	0.225		mg/L	0.2	20	12-AUG-16
Antimony (Sb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-AUG-16
Arsenic (As)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-AUG-16
Beryllium (Be)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	12-AUG-16
Cadmium (Cd)-Total		0.0000074	0.0000077		mg/L	3.0	20	12-AUG-16
Chromium (Cr)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	12-AUG-16
Cobalt (Co)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-AUG-16
Copper (Cu)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	12-AUG-16
Lead (Pb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-AUG-16
Lithium (Li)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	12-AUG-16
Manganese (Mn)-Total		0.00697	0.00711		mg/L	1.9	20	12-AUG-16
Molybdenum (Mo)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	12-AUG-16
Nickel (Ni)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	12-AUG-16
Selenium (Se)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-AUG-16
Silver (Ag)-Total		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	12-AUG-16
Thallium (Tl)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 7 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3524572</b>							
<b>WG2364510-3</b>	<b>DUP</b>	<b>L1809502-2</b>						
Tin (Sn)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-AUG-16
Uranium (U)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-AUG-16
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-AUG-16
<b>MET-TOT-ICP-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523050</b>							
<b>WG2364510-2</b>	<b>LCS</b>							
Barium (Ba)-Total			97.4		%		80-120	10-AUG-16
Bismuth (Bi)-Total			105.4		%		80-120	10-AUG-16
Boron (B)-Total			102.1		%		80-120	10-AUG-16
Calcium (Ca)-Total			104.0		%		80-120	10-AUG-16
Iron (Fe)-Total			94.4		%		80-120	10-AUG-16
Magnesium (Mg)-Total			97.5		%		80-120	10-AUG-16
Phosphorus (P)-Total			103.8		%		80-120	10-AUG-16
Potassium (K)-Total			95.6		%		80-120	10-AUG-16
Silicon (Si)-Total			103.6		%		80-120	10-AUG-16
Sodium (Na)-Total			99.9		%		80-120	10-AUG-16
Strontium (Sr)-Total			97.4		%		80-120	10-AUG-16
Titanium (Ti)-Total			99.5		%		80-120	10-AUG-16
Zinc (Zn)-Total			100.4		%		80-120	10-AUG-16
<b>Batch</b>	<b>R3523772</b>							
<b>WG2364510-1</b>	<b>MB</b>							
Barium (Ba)-Total			<0.010		mg/L		0.01	10-AUG-16
Bismuth (Bi)-Total			<0.20		mg/L		0.2	10-AUG-16
Boron (B)-Total			<0.10		mg/L		0.1	10-AUG-16
Calcium (Ca)-Total			0.060	B	mg/L		0.05	10-AUG-16
Iron (Fe)-Total			<0.030		mg/L		0.03	10-AUG-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	10-AUG-16
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-16
Potassium (K)-Total			<2.0		mg/L		2	10-AUG-16
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-16
Sodium (Na)-Total			<2.0		mg/L		2	10-AUG-16
Strontium (Sr)-Total			<0.0050		mg/L		0.005	10-AUG-16
Titanium (Ti)-Total			<0.010		mg/L		0.01	10-AUG-16
Zinc (Zn)-Total			<0.0050		mg/L		0.005	10-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 8 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-TOT-ICP-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3524105</b>							
<b>WG2364510-3</b>	<b>DUP</b>	<b>L1809502-2</b>						
Barium (Ba)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	10-AUG-16
Bismuth (Bi)-Total		<0.20	<0.20	RPD-NA	mg/L	N/A	20	10-AUG-16
Boron (B)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	10-AUG-16
Calcium (Ca)-Total		2.27	2.26		mg/L	0.2	20	10-AUG-16
Iron (Fe)-Total		0.141	0.139		mg/L	1.2	20	10-AUG-16
Magnesium (Mg)-Total		0.73	0.71		mg/L	2.0	20	10-AUG-16
Phosphorus (P)-Total		<0.30	<0.30	RPD-NA	mg/L	N/A	20	10-AUG-16
Potassium (K)-Total		<2.0	<2.0	RPD-NA	mg/L	N/A	20	10-AUG-16
Silicon (Si)-Total		1.94	1.92		mg/L	1.3	20	10-AUG-16
Sodium (Na)-Total		<2.0	<2.0	RPD-NA	mg/L	N/A	20	10-AUG-16
Strontium (Sr)-Total		0.0104	0.0102		mg/L	1.9	20	10-AUG-16
Titanium (Ti)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	10-AUG-16
Zinc (Zn)-Total		0.0073	0.0083		mg/L	13	20	10-AUG-16
<b>NH3-F-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3524010</b>							
<b>WG2365466-10</b>	<b>LCS</b>							
Ammonia, Total (as N)			105.0		%		85-115	11-AUG-16
<b>WG2365466-9</b>	<b>MB</b>							
Ammonia, Total (as N)			<0.0050		mg/L		0.005	11-AUG-16
<b>NO2-L-IC-N-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3523245</b>							
<b>WG2364860-2</b>	<b>LCS</b>							
Nitrite (as N)			101.0		%		90-110	10-AUG-16
<b>WG2364860-1</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	10-AUG-16
<b>WG2364860-10</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	10-AUG-16
<b>WG2364860-13</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	10-AUG-16
<b>WG2364860-4</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	10-AUG-16
<b>WG2364860-7</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	10-AUG-16
<b>NO3-L-IC-N-VA</b>								
	<b>Water</b>							





## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 9 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO3-L-IC-N-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3523245</b>							
<b>WG2364860-2</b>	<b>LCS</b>							
Nitrate (as N)			103.8		%		90-110	10-AUG-16
<b>WG2364860-1</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	10-AUG-16
<b>WG2364860-10</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	10-AUG-16
<b>WG2364860-13</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	10-AUG-16
<b>WG2364860-4</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	10-AUG-16
<b>WG2364860-7</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	10-AUG-16
<b>P-T-PRES-COL-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3523456</b>							
<b>WG2364578-6</b>	<b>CRM</b>	<b>VA-ERA-PO4</b>						
Phosphorus (P)-Total			104.7		%		80-120	10-AUG-16
<b>WG2364578-5</b>	<b>MB</b>							
Phosphorus (P)-Total			<0.0020		mg/L		0.002	10-AUG-16
<b>PH-PCT-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3524333</b>							
<b>WG2364947-2</b>	<b>CRM</b>	<b>VA-PH7-BUF</b>						
pH			6.96		pH		6.9-7.1	11-AUG-16
<b>WG2364947-7</b>	<b>CRM</b>	<b>VA-PH7-BUF</b>						
pH			6.99		pH		6.9-7.1	11-AUG-16
<b>WG2364947-5</b>	<b>DUP</b>	<b>L1809502-2</b>						
pH		6.44	6.47	J	pH	0.03	0.3	11-AUG-16
<b>SO4-IC-N-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3523245</b>							
<b>WG2364860-2</b>	<b>LCS</b>							
Sulfate (SO4)			104.0		%		90-110	10-AUG-16
<b>WG2364860-1</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	10-AUG-16
<b>WG2364860-10</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	10-AUG-16
<b>WG2364860-13</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	10-AUG-16
<b>WG2364860-4</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	10-AUG-16



## Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 10 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>SO4-IC-N-VA</b>	<b>Water</b>							
Batch	R3523245							
<b>WG2364860-7 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	10-AUG-16
<b>TSS-VA</b>	<b>Water</b>							
Batch	R3523299							
<b>WG2364590-5 LCS</b>								
Total Suspended Solids			101.4		%		85-115	10-AUG-16
<b>WG2364590-4 MB</b>								
Total Suspended Solids			<3.0		mg/L		3	10-AUG-16

# Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 11 of 12

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

---

# Quality Control Report

Workorder: L1809502

Report Date: 15-AUG-16

Page 12 of 12

## Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Physical Tests</b>							
pH by Meter (Automated)							
	1	06-AUG-16 11:30	11-AUG-16 07:48	0.25	116	hours	EHTR-FM
	2	06-AUG-16 12:00	11-AUG-16 07:48	0.25	116	hours	EHTR-FM
<b>Anions and Nutrients</b>							
Nitrate in Water by IC (Low Level)							
	1	06-AUG-16 11:30	10-AUG-16 16:24	3	4	days	EHT
	2	06-AUG-16 12:00	10-AUG-16 16:24	3	4	days	EHT
Nitrite in Water by IC (Low Level)							
	1	06-AUG-16 11:30	10-AUG-16 16:24	3	4	days	EHT
	2	06-AUG-16 12:00	10-AUG-16 16:24	3	4	days	EHT

## Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.  
EHTR: Exceeded ALS recommended hold time prior to sample receipt.  
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.  
EHT: Exceeded ALS recommended hold time prior to analysis.  
Rec. HT: ALS recommended hold time (see units).

### Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.  
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1809502 were received on 06-AUG-16 14:20.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.





GOLDER ASSOCIATES LTD.  
ATTN: Cristina Cismasu  
9200, Boul De L'Acadie, bureau 10  
Montreal QC H4N 2T2

Date Received: 31-OCT-16  
Report Date: 07-NOV-16 12:53 (MT)  
Version: FINAL

Client Phone: 514-383-0990

## Certificate of Analysis

Lab Work Order #: L1851241  
Project P.O. #: NOT SUBMITTED  
Job Reference:  
C of C Numbers:  
Legal Site Desc:

---

Amber Springer, B.Sc  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700  
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1851241-1	L1851241-2		
<b>Grouping</b>	<b>Analyte</b>				
<b>WATER</b>					
<b>Physical Tests</b>	Conductivity (uS/cm)	82.3	27.6		
	Hardness (as CaCO3) (mg/L)	37.1	12.8		
	pH (pH)	7.57	7.03		
	Total Suspended Solids (mg/L)	<3.0	<3.0		
<b>Anions and Nutrients</b>	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	31.4	9.4		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)	31.4	9.4		
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050		
	Bromide (Br) (mg/L)	<0.050	<0.050		
	Chloride (Cl) (mg/L)	0.53	<0.50		
	Fluoride (F) (mg/L)	<0.020	<0.020		
	Nitrate (as N) (mg/L)	0.111	0.0283		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010		
	Phosphorus (P)-Total (mg/L)	<0.0020	0.0028		
	Sulfate (SO4) (mg/L)	8.41	2.29		
	<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.0848	0.173	
Antimony (Sb)-Total (mg/L)		<0.00050	<0.00050		
Arsenic (As)-Total (mg/L)		<0.00050	<0.00050		
Barium (Ba)-Total (mg/L)		0.033	0.020		
Beryllium (Be)-Total (mg/L)		<0.0010	<0.0010		
Bismuth (Bi)-Total (mg/L)		<0.20	<0.20		
Boron (B)-Total (mg/L)		<0.10	<0.10		
Cadmium (Cd)-Total (mg/L)		<0.0000050	<0.0000050		
Calcium (Ca)-Total (mg/L)		10.3	3.51		
Chromium (Cr)-Total (mg/L)		<0.0010	<0.0010		
Cobalt (Co)-Total (mg/L)		<0.00030	<0.00030		
Copper (Cu)-Total (mg/L)		0.0011	<0.0010		
Iron (Fe)-Total (mg/L)		0.125	0.158		
Lead (Pb)-Total (mg/L)		<0.00050	<0.00050		
Lithium (Li)-Total (mg/L)		<0.0010	<0.0010		
Magnesium (Mg)-Total (mg/L)		2.79	1.06		
Manganese (Mn)-Total (mg/L)		0.00827	0.0151		
Mercury (Hg)-Total (mg/L)		<0.0000050	<0.0000050		
Molybdenum (Mo)-Total (mg/L)		<0.0010	<0.0010		
Nickel (Ni)-Total (mg/L)		<0.0010	<0.0010		
Phosphorus (P)-Total (mg/L)	<0.30	<0.30			

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1851241-1	L1851241-2		
<b>Grouping</b>	<b>Analyte</b>				
<b>WATER</b>					
<b>Total Metals</b>	Potassium (K)-Total (mg/L)	<2.0	<2.0		
	Selenium (Se)-Total (mg/L)	0.000146	<0.000050		
	Silicon (Si)-Total (mg/L)	2.28	2.15		
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020		
	Sodium (Na)-Total (mg/L)	<2.0	<2.0		
	Strontium (Sr)-Total (mg/L)	0.0245	0.0122		
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020		
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.00109	0.00023		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	<0.0050	0.0089		
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	LAB	LAB		
	Dissolved Metals Filtration Location	LAB	LAB		
	Aluminum (Al)-Dissolved (mg/L)	0.0763	0.149		
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Arsenic (As)-Dissolved (mg/L)	<0.00050	<0.00050		
	Barium (Ba)-Dissolved (mg/L)	0.032	<0.020		
	Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20		
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10		
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050		
	Calcium (Ca)-Dissolved (mg/L)	10.3	3.43		
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030		
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010		
	Iron (Fe)-Dissolved (mg/L)	0.097	0.090		
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010		
	Magnesium (Mg)-Dissolved (mg/L)	2.75	1.04		
	Manganese (Mn)-Dissolved (mg/L)	0.00446	0.00222		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010		
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	<0.0010		
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30		
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0		
	Selenium (Se)-Dissolved (mg/L)	0.000131	<0.000050		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.



# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description	L1851241-1	L1851241-2		
	Sampled Date Sampled Time Client ID	22-OCT-16 13:45 LJ-ES1	22-OCT-16 10:30 LJ-ES2		
Grouping	Analyte				
<b>WATER</b>					
<b>Dissolved Metals</b>	Silicon (Si)-Dissolved (mg/L)	2.22	2.09		
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020		
	Sodium (Na)-Dissolved (mg/L)	<2.0	<2.0		
	Strontium (Sr)-Dissolved (mg/L)	0.0247	0.0122		
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020		
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.00103	0.00021		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	0.0067		
<b>Speciated Metals</b>	Methyl Mercury-Total (ug/L)	0.000105	0.000063		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## Reference Information

### Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

### QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1851241-1, -2
Matrix Spike	Iron (Fe)-Total	MS-B	L1851241-1, -2
Matrix Spike	Silicon (Si)-Total	MS-B	L1851241-1, -2
Matrix Spike	Strontium (Sr)-Total	MS-B	L1851241-1, -2

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
<b>ALK-TITR-VA</b>	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
<b>BR-L-IC-N-VA</b>	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>CL-IC-N-VA</b>	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>EC-PCT-VA</b>	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
<b>F-IC-N-VA</b>	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>HARDNESS-CALC-VA</b>	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO <sub>3</sub> equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
<b>HG-D-CVAA-VA</b>	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
<b>HG-MEHG-TOT-GCAFS-VA</b>	Water	Total Methyl Mercury in Water by GCAFS	EPA 1630
This procedure is carried out using the US EPA Method 1630. Water samples are distilled to isolate methyl mercury from the sample matrix. The distillate is analyzed by aqueous phase ethylation and purge and trap, followed by capillary gas chromatography. Highly selective and sensitive detection is achieved by Atomic Fluorescence Spectrometry (AFS) after pyrolytic decomposition of the GC eluent. Results are reported "as MeHg".			
<b>HG-T-CVAA-VA</b>	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
<b>MET-D-CCMS-VA</b>	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
<b>MET-DIS-ICP-VA</b>	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
<b>MET-T-CCMS-VA</b>	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

## Reference Information

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

<b>MET-TOT-ICP-VA</b>	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
<b>NO2-L-IC-N-VA</b>	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>NO3-L-IC-N-VA</b>	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>P-T-PRES-COL-VA</b>	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
<b>PH-PCT-VA</b>	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
<b>PH-PCT-VA</b>	Water	pH by Meter (Automated)	APHA 4500-H pH Value
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
<b>SO4-IC-N-VA</b>	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>TSS-VA</b>	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.			

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

## Reference Information

### GLOSSARY OF REPORT TERMS

*Surrogate* - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

*mg/kg* - milligrams per kilogram based on dry weight of sample.

*mg/kg wwt* - milligrams per kilogram based on wet weight of sample.

*mg/kg lwt* - milligrams per kilogram based on lipid-adjusted weight of sample.

*mg/L* - milligrams per litre.

*<* - Less than.

*D.L.* - The reported Detection Limit, also known as the Limit of Reporting (LOR).

*N/A* - Result not available. Refer to qualifier code and definition for explanation.

*Test results reported relate only to the samples as received by the laboratory.*

**UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.**

*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 1 of 11

Client: GOLDER ASSOCIATES LTD.  
 9200, Boul De L'Acadie, bureau 10  
 Montreal QC H4N 2T2

Contact: Cristina Cismasu

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>ALK-TITR-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3586183</b>							
<b>WG2423465-23 CRM</b>		<b>VA-ALK-TITR-CONTROL</b>						
Alkalinity, Total (as CaCO3)			99.1		%		85-115	02-NOV-16
<b>WG2423465-21 MB</b>								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	02-NOV-16
<b>BR-L-IC-N-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3585959</b>							
<b>WG2423374-15 LCS</b>								
Bromide (Br)			99.6		%		85-115	01-NOV-16
<b>WG2423374-2 LCS</b>								
Bromide (Br)			99.5		%		85-115	01-NOV-16
<b>WG2423374-1 MB</b>								
Bromide (Br)			<0.050		mg/L		0.05	01-NOV-16
<b>WG2423374-10 MB</b>								
Bromide (Br)			<0.050		mg/L		0.05	01-NOV-16
<b>WG2423374-13 MB</b>								
Bromide (Br)			<0.050		mg/L		0.05	01-NOV-16
<b>WG2423374-4 MB</b>								
Bromide (Br)			<0.050		mg/L		0.05	01-NOV-16
<b>WG2423374-7 MB</b>								
Bromide (Br)			<0.050		mg/L		0.05	01-NOV-16
<b>CL-IC-N-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3585959</b>							
<b>WG2423374-15 LCS</b>								
Chloride (Cl)			100.8		%		90-110	01-NOV-16
<b>WG2423374-2 LCS</b>								
Chloride (Cl)			100.8		%		90-110	01-NOV-16
<b>WG2423374-1 MB</b>								
Chloride (Cl)			<0.50		mg/L		0.5	01-NOV-16
<b>WG2423374-10 MB</b>								
Chloride (Cl)			<0.50		mg/L		0.5	01-NOV-16
<b>WG2423374-13 MB</b>								
Chloride (Cl)			<0.50		mg/L		0.5	01-NOV-16
<b>WG2423374-4 MB</b>								
Chloride (Cl)			<0.50		mg/L		0.5	01-NOV-16
<b>WG2423374-7 MB</b>								
Chloride (Cl)			<0.50		mg/L		0.5	01-NOV-16
<b>EC-PCT-VA</b>								
	<b>Water</b>							



## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 2 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>EC-PCT-VA</b>								
Batch R3586183								
<b>WG2423465-24</b>	<b>CRM</b>	<b>VA-EC-PCT-CONTROL</b>						
Conductivity			101.6		%		90-110	02-NOV-16
<b>WG2423465-21</b>	<b>MB</b>							
Conductivity			<2.0		uS/cm		2	02-NOV-16
<b>F-IC-N-VA</b>								
Batch R3585959								
<b>WG2423374-15</b>	<b>LCS</b>							
Fluoride (F)			99.1		%		90-110	01-NOV-16
<b>WG2423374-2</b>	<b>LCS</b>							
Fluoride (F)			98.1		%		90-110	01-NOV-16
<b>WG2423374-1</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	01-NOV-16
<b>WG2423374-10</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	01-NOV-16
<b>WG2423374-13</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	01-NOV-16
<b>WG2423374-4</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	01-NOV-16
<b>WG2423374-7</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	01-NOV-16
<b>HG-D-CVAA-VA</b>								
Batch R3584993								
<b>WG2423318-2</b>	<b>LCS</b>							
Mercury (Hg)-Dissolved			103.0		%		80-120	01-NOV-16
<b>WG2423318-1</b>	<b>MB</b>	<b>LF</b>						
Mercury (Hg)-Dissolved			<0.000005C		mg/L		0.000005	01-NOV-16
<b>HG-MEHG-TOT-GCAFS-VA</b>								
Batch R3588895								
<b>WG2427316-3</b>	<b>DUP</b>	<b>L1851241-2</b>						
Methyl Mercury-Total		0.000063	0.000065		ug/L	2.7	20	04-NOV-16
<b>WG2427316-2</b>	<b>LCS</b>							
Methyl Mercury-Total			88.8		%		80-120	04-NOV-16
<b>WG2427316-1</b>	<b>MB</b>							
Methyl Mercury-Total			<0.000050		ug/L		0.00005	04-NOV-16
<b>HG-T-CVAA-VA</b>								
Batch R3588895								



## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 3 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>HG-T-CVAA-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3584993</b>							
<b>WG2423574-2</b>	<b>LCS</b>							
Mercury (Hg)-Total			101.9		%		80-120	01-NOV-16
<b>WG2423574-1</b>	<b>MB</b>							
Mercury (Hg)-Total			<0.000005C		mg/L		0.000005	01-NOV-16
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3586339</b>							
<b>WG2423318-2</b>	<b>LCS</b>							
Aluminum (Al)-Dissolved			104.2		%		80-120	01-NOV-16
Antimony (Sb)-Dissolved			96.6		%		80-120	01-NOV-16
Arsenic (As)-Dissolved			107.5		%		80-120	01-NOV-16
Beryllium (Be)-Dissolved			103.7		%		80-120	01-NOV-16
Cadmium (Cd)-Dissolved			93.8		%		80-120	01-NOV-16
Chromium (Cr)-Dissolved			99.97		%		80-120	01-NOV-16
Cobalt (Co)-Dissolved			103.0		%		80-120	01-NOV-16
Copper (Cu)-Dissolved			101.2		%		80-120	01-NOV-16
Lead (Pb)-Dissolved			103.3		%		80-120	01-NOV-16
Lithium (Li)-Dissolved			104.9		%		80-120	01-NOV-16
Manganese (Mn)-Dissolved			105.8		%		80-120	01-NOV-16
Molybdenum (Mo)-Dissolved			105.9		%		80-120	01-NOV-16
Nickel (Ni)-Dissolved			104.3		%		80-120	01-NOV-16
Selenium (Se)-Dissolved			103.7		%		80-120	01-NOV-16
Silver (Ag)-Dissolved			101.8		%		80-120	01-NOV-16
Thallium (Tl)-Dissolved			103.4		%		80-120	01-NOV-16
Tin (Sn)-Dissolved			102.7		%		80-120	01-NOV-16
Uranium (U)-Dissolved			104.7		%		80-120	01-NOV-16
Vanadium (V)-Dissolved			103.0		%		80-120	01-NOV-16
<b>WG2423318-1</b>	<b>MB</b>	<b>LF</b>						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	01-NOV-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	01-NOV-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	01-NOV-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	01-NOV-16
Cadmium (Cd)-Dissolved			<0.000005C		mg/L		0.000005	01-NOV-16
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	01-NOV-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	01-NOV-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	01-NOV-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	01-NOV-16

## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 4 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3586339</b>							
<b>WG2423318-1</b>	<b>MB</b>	<b>LF</b>						
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	01-NOV-16
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	01-NOV-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	01-NOV-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	01-NOV-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	01-NOV-16
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	01-NOV-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	01-NOV-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	01-NOV-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	01-NOV-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	01-NOV-16
<b>MET-DIS-ICP-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3585114</b>							
<b>WG2423318-2</b>	<b>LCS</b>							
Barium (Ba)-Dissolved			93.5		%		80-120	01-NOV-16
Bismuth (Bi)-Dissolved			94.6		%		80-120	01-NOV-16
Boron (B)-Dissolved			97.6		%		80-120	01-NOV-16
Calcium (Ca)-Dissolved			101.9		%		80-120	01-NOV-16
Iron (Fe)-Dissolved			96.2		%		80-120	01-NOV-16
Magnesium (Mg)-Dissolved			101.0		%		80-120	01-NOV-16
Phosphorus (P)-Dissolved			98.2		%		80-120	01-NOV-16
Potassium (K)-Dissolved			100.7		%		80-120	01-NOV-16
Silicon (Si)-Dissolved			102.6		%		80-120	01-NOV-16
Sodium (Na)-Dissolved			100.9		%		80-120	01-NOV-16
Strontium (Sr)-Dissolved			94.7		%		80-120	01-NOV-16
Titanium (Ti)-Dissolved			100.4		%		80-120	01-NOV-16
Zinc (Zn)-Dissolved			97.3		%		80-120	01-NOV-16
<b>WG2423318-1</b>	<b>MB</b>	<b>LF</b>						
Barium (Ba)-Dissolved			<0.010		mg/L		0.01	01-NOV-16
Bismuth (Bi)-Dissolved			<0.20		mg/L		0.2	01-NOV-16
Boron (B)-Dissolved			<0.10		mg/L		0.1	01-NOV-16
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	01-NOV-16
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	01-NOV-16
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	01-NOV-16
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	01-NOV-16





## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 5 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-DIS-ICP-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3585114</b>							
<b>WG2423318-1</b>	<b>MB</b>	<b>LF</b>						
Potassium (K)-Dissolved			<2.0		mg/L		2	01-NOV-16
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	01-NOV-16
Sodium (Na)-Dissolved			<2.0		mg/L		2	01-NOV-16
Strontium (Sr)-Dissolved			<0.0050		mg/L		0.005	01-NOV-16
Titanium (Ti)-Dissolved			<0.010		mg/L		0.01	01-NOV-16
Zinc (Zn)-Dissolved			<0.0050		mg/L		0.005	01-NOV-16
<b>MET-T-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3586444</b>							
<b>WG2423435-2</b>	<b>LCS</b>							
Aluminum (Al)-Total			104.2		%		80-120	01-NOV-16
Antimony (Sb)-Total			105.2		%		80-120	01-NOV-16
Arsenic (As)-Total			102.7		%		80-120	01-NOV-16
Beryllium (Be)-Total			103.6		%		80-120	01-NOV-16
Cadmium (Cd)-Total			93.3		%		80-120	01-NOV-16
Chromium (Cr)-Total			104.0		%		80-120	01-NOV-16
Cobalt (Co)-Total			102.4		%		80-120	01-NOV-16
Copper (Cu)-Total			101.1		%		80-120	01-NOV-16
Lead (Pb)-Total			102.9		%		80-120	01-NOV-16
Lithium (Li)-Total			105.9		%		80-120	01-NOV-16
Manganese (Mn)-Total			106.7		%		80-120	01-NOV-16
Molybdenum (Mo)-Total			108.9		%		80-120	01-NOV-16
Nickel (Ni)-Total			100.4		%		80-120	01-NOV-16
Selenium (Se)-Total			100.1		%		80-120	01-NOV-16
Silver (Ag)-Total			103.4		%		80-120	01-NOV-16
Thallium (Tl)-Total			104.7		%		80-120	01-NOV-16
Tin (Sn)-Total			100.1		%		80-120	01-NOV-16
Uranium (U)-Total			103.4		%		80-120	01-NOV-16
Vanadium (V)-Total			105.1		%		80-120	01-NOV-16
<b>WG2423435-1</b>	<b>MB</b>							
Aluminum (Al)-Total			<0.0030		mg/L		0.003	01-NOV-16
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	01-NOV-16
Arsenic (As)-Total			<0.00010		mg/L		0.0001	01-NOV-16
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	01-NOV-16
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	01-NOV-16



## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 6 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3586444</b>							
<b>WG2423435-1 MB</b>								
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	01-NOV-16
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	01-NOV-16
Copper (Cu)-Total			<0.00050		mg/L		0.0005	01-NOV-16
Lead (Pb)-Total			<0.000050		mg/L		0.00005	01-NOV-16
Lithium (Li)-Total			<0.0010		mg/L		0.001	01-NOV-16
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	01-NOV-16
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	01-NOV-16
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	01-NOV-16
Selenium (Se)-Total			<0.000050		mg/L		0.00005	01-NOV-16
Silver (Ag)-Total			<0.000010		mg/L		0.00001	01-NOV-16
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	01-NOV-16
Tin (Sn)-Total			<0.00010		mg/L		0.0001	01-NOV-16
Uranium (U)-Total			<0.000010		mg/L		0.00001	01-NOV-16
Vanadium (V)-Total			<0.00050		mg/L		0.0005	01-NOV-16
<b>MET-TOT-ICP-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3585247</b>							
<b>WG2423435-2 LCS</b>								
Barium (Ba)-Total			99.5		%		80-120	01-NOV-16
Bismuth (Bi)-Total			96.8		%		80-120	01-NOV-16
Boron (B)-Total			94.5		%		80-120	01-NOV-16
Calcium (Ca)-Total			98.5		%		80-120	01-NOV-16
Iron (Fe)-Total			97.9		%		80-120	01-NOV-16
Magnesium (Mg)-Total			99.9		%		80-120	01-NOV-16
Phosphorus (P)-Total			92.4		%		80-120	01-NOV-16
Potassium (K)-Total			99.4		%		80-120	01-NOV-16
Silicon (Si)-Total			111.8		%		80-120	01-NOV-16
Sodium (Na)-Total			97.2		%		80-120	01-NOV-16
Strontium (Sr)-Total			96.6		%		80-120	01-NOV-16
Titanium (Ti)-Total			99.3		%		80-120	01-NOV-16
Zinc (Zn)-Total			96.6		%		80-120	01-NOV-16
<b>WG2423435-1 MB</b>								
Barium (Ba)-Total			<0.010		mg/L		0.01	01-NOV-16
Bismuth (Bi)-Total			<0.20		mg/L		0.2	01-NOV-16
Boron (B)-Total			<0.10		mg/L		0.1	01-NOV-16

## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 7 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-TOT-ICP-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3585247</b>							
<b>WG2423435-1</b>	<b>MB</b>							
Calcium (Ca)-Total			<0.050		mg/L		0.05	01-NOV-16
Iron (Fe)-Total			<0.030		mg/L		0.03	01-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	01-NOV-16
Phosphorus (P)-Total			<0.30		mg/L		0.3	01-NOV-16
Potassium (K)-Total			<2.0		mg/L		2	01-NOV-16
Silicon (Si)-Total			<0.050		mg/L		0.05	01-NOV-16
Sodium (Na)-Total			<2.0		mg/L		2	01-NOV-16
Strontium (Sr)-Total			<0.0050		mg/L		0.005	01-NOV-16
Titanium (Ti)-Total			<0.010		mg/L		0.01	01-NOV-16
Zinc (Zn)-Total			<0.0050		mg/L		0.005	01-NOV-16
<b>NH3-F-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3587553</b>							
<b>WG2424649-10</b>	<b>LCS</b>							
Ammonia, Total (as N)			99.8		%		85-115	03-NOV-16
<b>WG2424649-9</b>	<b>MB</b>							
Ammonia, Total (as N)			<0.0050		mg/L		0.005	03-NOV-16
<b>NO2-L-IC-N-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3585959</b>							
<b>WG2423374-15</b>	<b>LCS</b>							
Nitrite (as N)			99.9		%		90-110	01-NOV-16
<b>WG2423374-2</b>	<b>LCS</b>							
Nitrite (as N)			99.7		%		90-110	01-NOV-16
<b>WG2423374-1</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	01-NOV-16
<b>WG2423374-10</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	01-NOV-16
<b>WG2423374-13</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	01-NOV-16
<b>WG2423374-4</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	01-NOV-16
<b>WG2423374-7</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	01-NOV-16
<b>NO3-L-IC-N-VA</b>		<b>Water</b>						



## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 8 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO3-L-IC-N-VA</b>								
<b>Batch R3585959</b>								
<b>WG2423374-15</b>	<b>LCS</b>							
Nitrate (as N)			101.5		%		90-110	01-NOV-16
<b>WG2423374-2</b>	<b>LCS</b>							
Nitrate (as N)			101.5		%		90-110	01-NOV-16
<b>WG2423374-1</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	01-NOV-16
<b>WG2423374-10</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	01-NOV-16
<b>WG2423374-13</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	01-NOV-16
<b>WG2423374-4</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	01-NOV-16
<b>WG2423374-7</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	01-NOV-16
<b>P-T-PRES-COL-VA</b>								
<b>Batch R3586965</b>								
<b>WG2424721-2</b>	<b>CRM</b>	<b>VA-ERA-PO4</b>						
Phosphorus (P)-Total			96.7		%		80-120	03-NOV-16
<b>WG2424721-1</b>	<b>MB</b>							
Phosphorus (P)-Total			<0.0020		mg/L		0.002	03-NOV-16
<b>PH-PCT-VA</b>								
<b>Batch R3586183</b>								
<b>WG2423465-22</b>	<b>CRM</b>	<b>VA-PH7-BUF</b>						
pH			7.01		pH		6.9-7.1	02-NOV-16
<b>SO4-IC-N-VA</b>								
<b>Batch R3585959</b>								
<b>WG2423374-15</b>	<b>LCS</b>							
Sulfate (SO4)			101.5		%		90-110	01-NOV-16
<b>WG2423374-2</b>	<b>LCS</b>							
Sulfate (SO4)			101.3		%		90-110	01-NOV-16
<b>WG2423374-1</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	01-NOV-16
<b>WG2423374-10</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	01-NOV-16
<b>WG2423374-13</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	01-NOV-16
<b>WG2423374-4</b>	<b>MB</b>							



## Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 9 of 11

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>SO4-IC-N-VA</b>								
Batch	R3585959							
<b>WG2423374-4</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	01-NOV-16
<b>WG2423374-7</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	01-NOV-16
<b>TSS-VA</b>								
Batch	R3585072							
<b>WG2423265-8</b>	<b>LCS</b>							
Total Suspended Solids			94.2		%		85-115	01-NOV-16
<b>WG2423265-7</b>	<b>MB</b>							
Total Suspended Solids			<3.0		mg/L		3	01-NOV-16

# Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 10 of 11

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

# Quality Control Report

Workorder: L1851241

Report Date: 07-NOV-16

Page 11 of 11

**Hold Time Exceedances:**

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Physical Tests</b>							
Total Suspended Solids by Gravimetric							
	1	22-OCT-16 13:45	01-NOV-16 07:33	7	10	days	EHTR
	2	22-OCT-16 10:30	01-NOV-16 07:33	7	10	days	EHTR
pH by Meter (Automated)							
	1	22-OCT-16 13:45	02-NOV-16 07:09	0.25	258	hours	EHTR-FM
	2	22-OCT-16 10:30	02-NOV-16 07:09	0.25	261	hours	EHTR-FM
<b>Anions and Nutrients</b>							
Nitrate in Water by IC (Low Level)							
	1	22-OCT-16 13:45	01-NOV-16 06:34	3	10	days	EHTR
	2	22-OCT-16 10:30	01-NOV-16 06:34	3	10	days	EHTR
Nitrite in Water by IC (Low Level)							
	1	22-OCT-16 13:45	01-NOV-16 06:34	3	10	days	EHTR
	2	22-OCT-16 10:30	01-NOV-16 06:34	3	10	days	EHTR

**Legend & Qualifier Definitions:**

- EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
- EHTR: Exceeded ALS recommended hold time prior to sample receipt.
- EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
- EHT: Exceeded ALS recommended hold time prior to analysis.
- Rec. HT: ALS recommended hold time (see units).

Notes\*:  
 Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.  
 Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1851241 were received on 31-OCT-16 17:55.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.







GOLDER ASSOCIATES LTD.  
ATTN: Cristina Cismasu  
9200, Boul De L'Acadie, bureau 10  
Montreal QC H4N 2T2

Date Received: 21-NOV-16  
Report Date: 28-NOV-16 14:40 (MT)  
Version: FINAL

Client Phone: 514-383-0990

## Certificate of Analysis

Lab Work Order #: L1860536  
Project P.O. #: NOT SUBMITTED  
Job Reference:  
C of C Numbers: 15-590413  
Legal Site Desc:

---

Amber Springer, B.Sc  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700  
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1860536-1	L1860536-2		
		Description	Water	Water		
		Sampled Date	21-NOV-16	21-NOV-16		
		Sampled Time	15:00	15:00		
		Client ID	LJ-ES1	LJ-ES2		
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Conductivity (uS/cm)		79.8	29.1		
	Hardness (as CaCO3) (mg/L)		35.4	12.5		
	pH (pH)		7.62	7.09		
	Total Suspended Solids (mg/L)		<3.0	<3.0		
<b>Anions and Nutrients</b>	Alkalinity, Bicarbonate (as CaCO3) (mg/L)		31.0	9.2		
	Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)		31.0	9.2		
	Ammonia, Total (as N) (mg/L)		<0.0050	<0.0050		
	Bromide (Br) (mg/L)		<0.050	<0.050		
	Chloride (Cl) (mg/L)		0.53	<0.50		
	Fluoride (F) (mg/L)		<0.020	<0.020		
	Nitrate (as N) (mg/L)		0.112	0.0219		
	Nitrite (as N) (mg/L)		<0.0010	<0.0010		
	Phosphorus (P)-Total (mg/L)		0.052	0.0081		
	Sulfate (SO4) (mg/L)		8.59	2.41		
	<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)		0.0812	0.161	
Antimony (Sb)-Total (mg/L)			<0.00050	<0.00050		
Arsenic (As)-Total (mg/L)			<0.00050	<0.00050		
Barium (Ba)-Total (mg/L)			0.031	<0.020		
Beryllium (Be)-Total (mg/L)			<0.0010	<0.0010		
Bismuth (Bi)-Total (mg/L)			<0.20	<0.20		
Boron (B)-Total (mg/L)			<0.10	<0.10		
Cadmium (Cd)-Total (mg/L)			0.0000073	0.0000070		
Calcium (Ca)-Total (mg/L)			10.1	3.32		
Chromium (Cr)-Total (mg/L)			<0.0010	<0.0010		
Cobalt (Co)-Total (mg/L)			<0.00030	<0.00030		
Copper (Cu)-Total (mg/L)			0.0012	<0.0010		
Iron (Fe)-Total (mg/L)			0.122	0.156		
Lead (Pb)-Total (mg/L)			<0.00050	<0.00050		
Lithium (Li)-Total (mg/L)			<0.0010	<0.0010		
Magnesium (Mg)-Total (mg/L)			2.81	1.02		
Manganese (Mn)-Total (mg/L)			0.00531	0.0134		
Mercury (Hg)-Total (mg/L)			<0.0000050	<0.0000050		
Molybdenum (Mo)-Total (mg/L)			0.0010	<0.0010		
Nickel (Ni)-Total (mg/L)			0.0010	<0.0010		
Phosphorus (P)-Total (mg/L)			<0.30	<0.30		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1860536-1 Water 21-NOV-16 15:00 LJ-ES1	L1860536-2 Water 21-NOV-16 15:00 LJ-ES2		
Grouping	Analyte				
<b>WATER</b>					
<b>Total Metals</b>	Potassium (K)-Total (mg/L)	<2.0	<2.0		
	Selenium (Se)-Total (mg/L)	0.000195	0.000053		
	Silicon (Si)-Total (mg/L)	2.24	2.15		
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020		
	Sodium (Na)-Total (mg/L)	<2.0	<2.0		
	Strontium (Sr)-Total (mg/L)	0.0252	0.0123		
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020		
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.00115	0.00024		
	Vanadium (V)-Total (mg/L)	0.00079	0.00083		
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050		
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	LAB	LAB		
	Dissolved Metals Filtration Location	LAB	LAB		
	Aluminum (Al)-Dissolved (mg/L)	0.0833	0.163		
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Arsenic (As)-Dissolved (mg/L)	<0.00050	<0.00050		
	Barium (Ba)-Dissolved (mg/L)	0.035	0.020		
	Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20		
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10		
	Cadmium (Cd)-Dissolved (mg/L)	0.0000074	0.0000068		
	Calcium (Ca)-Dissolved (mg/L)	10.0	3.40		
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030		
	Copper (Cu)-Dissolved (mg/L)	0.0011	<0.0010		
	Iron (Fe)-Dissolved (mg/L)	0.089	0.077		
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010		
	Magnesium (Mg)-Dissolved (mg/L)	2.53	0.96		
	Manganese (Mn)-Dissolved (mg/L)	0.00126	0.00107		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010		
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	<0.0010		
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30		
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0		
	Selenium (Se)-Dissolved (mg/L)	0.000146	0.000055		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1860536-1	L1860536-2		
	Description	Water	Water		
	Sampled Date	21-NOV-16	21-NOV-16		
	Sampled Time	15:00	15:00		
	Client ID	LJ-ES1	LJ-ES2		
Grouping	Analyte				
<b>WATER</b>					
<b>Dissolved Metals</b>	Silicon (Si)-Dissolved (mg/L)	2.30	2.16		
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020		
	Sodium (Na)-Dissolved (mg/L)	<2.0	<2.0		
	Strontium (Sr)-Dissolved (mg/L)	0.0244	0.0122		
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020		
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.00105	0.00022		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## Reference Information

### Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

### QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1860536-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1860536-1, -2
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1860536-1, -2
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1860536-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1860536-1, -2
Matrix Spike	Calcium (Ca)-Total	MS-B	L1860536-1, -2
Matrix Spike	Copper (Cu)-Total	MS-B	L1860536-1, -2
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1860536-1, -2
Matrix Spike	Strontium (Sr)-Total	MS-B	L1860536-1, -2

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
<b>ALK-TITR-VA</b>	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
		This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.	
<b>BR-L-IC-N-VA</b>	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
<b>CL-IC-N-VA</b>	Water	Chloride in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
<b>EC-PCT-VA</b>	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
		This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.	
<b>F-IC-N-VA</b>	Water	Fluoride in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
<b>HARDNESS-CALC-VA</b>	Water	Hardness	APHA 2340B
		Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO <sub>3</sub> equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.	
<b>HG-D-CVAA-VA</b>	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
		Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.	
<b>HG-T-CVAA-VA</b>	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
		Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.	
<b>MET-D-CCMS-VA</b>	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
		Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.	
		Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.	
<b>MET-T-CCMS-VA</b>	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
		Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.	
		Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.	
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	APHA 4500 NH <sub>3</sub> -NITROGEN (AMMONIA)

## Reference Information

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

**NH3-F-VA** Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

**NO2-L-IC-N-VA** Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**NO3-L-IC-N-VA** Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**P-T-PRES-COL-VA** Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

**PH-PCT-VA** Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

**PH-PCT-VA** Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

**SO4-IC-N-VA** Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**TSS-VA** Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

### Chain of Custody Numbers:

15-590413

### GLOSSARY OF REPORT TERMS

*Surrogate* - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

*mg/kg* - milligrams per kilogram based on dry weight of sample.

*mg/kg wwt* - milligrams per kilogram based on wet weight of sample.

*mg/kg lwt* - milligrams per kilogram based on lipid-adjusted weight of sample.

*mg/L* - milligrams per litre.

< - Less than.

*D.L.* - The reported Detection Limit, also known as the Limit of Reporting (LOR).

*N/A* - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 1 of 12

Client: GOLDER ASSOCIATES LTD.  
 9200, Boul De L'Acadie, bureau 10  
 Montreal QC H4N 2T2

Contact: Cristina Cismasu

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>ALK-TITR-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3601708</b>							
<b>WG2436963-18</b>	<b>CRM</b>	<b>VA-ALK-TITR-CONTROL</b>						
Alkalinity, Total (as CaCO3)			100.7		%		85-115	22-NOV-16
<b>WG2436963-16</b>	<b>MB</b>							
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	22-NOV-16
<b>BR-L-IC-N-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3602285</b>							
<b>WG2439073-9</b>	<b>DUP</b>	<b>L1860536-1</b>						
Bromide (Br)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	23-NOV-16
<b>WG2439073-18</b>	<b>LCS</b>							
Bromide (Br)			99.2		%		85-115	23-NOV-16
<b>WG2439073-2</b>	<b>LCS</b>							
Bromide (Br)			98.2		%		85-115	23-NOV-16
<b>WG2439073-1</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	23-NOV-16
<b>WG2439073-10</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	23-NOV-16
<b>WG2439073-13</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	23-NOV-16
<b>WG2439073-16</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	23-NOV-16
<b>WG2439073-4</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	23-NOV-16
<b>WG2439073-7</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	23-NOV-16
<b>CL-IC-N-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3602285</b>							
<b>WG2439073-9</b>	<b>DUP</b>	<b>L1860536-1</b>						
Chloride (Cl)		0.53	0.54		mg/L	0.9	20	23-NOV-16
<b>WG2439073-18</b>	<b>LCS</b>							
Chloride (Cl)			98.6		%		90-110	23-NOV-16
<b>WG2439073-2</b>	<b>LCS</b>							
Chloride (Cl)			98.9		%		90-110	23-NOV-16
<b>WG2439073-1</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	23-NOV-16
<b>WG2439073-10</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	23-NOV-16
<b>WG2439073-13</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	23-NOV-16



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 2 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>CL-IC-N-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3602285</b>							
<b>WG2439073-16</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	23-NOV-16
<b>WG2439073-4</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	23-NOV-16
<b>WG2439073-7</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	23-NOV-16
<b>EC-PCT-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3601708</b>							
<b>WG2436963-19</b>	<b>CRM</b>	<b>VA-EC-PCT-CONTROL</b>						
Conductivity			101.9		%		90-110	22-NOV-16
<b>WG2436963-16</b>	<b>MB</b>							
Conductivity			<2.0		uS/cm		2	22-NOV-16
<b>F-IC-N-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3602285</b>							
<b>WG2439073-9</b>	<b>DUP</b>	<b>L1860536-1</b>						
Fluoride (F)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	23-NOV-16
<b>WG2439073-18</b>	<b>LCS</b>							
Fluoride (F)			97.8		%		90-110	23-NOV-16
<b>WG2439073-2</b>	<b>LCS</b>							
Fluoride (F)			96.9		%		90-110	23-NOV-16
<b>WG2439073-1</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	23-NOV-16
<b>WG2439073-10</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	23-NOV-16
<b>WG2439073-13</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	23-NOV-16
<b>WG2439073-16</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	23-NOV-16
<b>WG2439073-4</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	23-NOV-16
<b>WG2439073-7</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	23-NOV-16
<b>HG-D-CVAA-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3601611</b>							
<b>WG2438233-3</b>	<b>DUP</b>	<b>L1860536-1</b>						
Mercury (Hg)-Dissolved		<0.0000050	<0.0000050	RPD-NA	mg/L	N/A	20	23-NOV-16
<b>WG2438233-2</b>	<b>LCS</b>							
Mercury (Hg)-Dissolved			102.8		%		80-120	23-NOV-16



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 3 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>HG-D-CVAA-VA</b>								
<b>Batch R3601611</b>								
<b>WG2438233-1 MB</b>		<b>LF</b>						
Mercury (Hg)-Dissolved	Water		<0.000005C		mg/L		0.000005	23-NOV-16
<b>HG-T-CVAA-VA</b>								
<b>Batch R3601770</b>								
<b>WG2439185-4 DUP</b>		<b>L1860536-2</b>						
Mercury (Hg)-Total	Water	<0.0000050	0.0000055	RPD-NA	mg/L	N/A	20	23-NOV-16
<b>WG2439185-2 LCS</b>								
Mercury (Hg)-Total			101.6		%		80-120	23-NOV-16
<b>WG2439185-1 MB</b>								
Mercury (Hg)-Total			<0.000005C		mg/L		0.000005	23-NOV-16
<b>MET-D-CCMS-VA</b>								
<b>Batch R3601615</b>								
<b>WG2438233-2 LCS</b>								
Aluminum (Al)-Dissolved	Water		99.1		%		80-120	23-NOV-16
Antimony (Sb)-Dissolved			97.4		%		80-120	23-NOV-16
Arsenic (As)-Dissolved			99.1		%		80-120	23-NOV-16
Barium (Ba)-Dissolved			99.9		%		80-120	23-NOV-16
Beryllium (Be)-Dissolved			104.2		%		80-120	23-NOV-16
Bismuth (Bi)-Dissolved			100.6		%		80-120	23-NOV-16
Boron (B)-Dissolved			94.6		%		80-120	23-NOV-16
Cadmium (Cd)-Dissolved			100.3		%		80-120	23-NOV-16
Calcium (Ca)-Dissolved			101.9		%		80-120	23-NOV-16
Chromium (Cr)-Dissolved			100.6		%		80-120	23-NOV-16
Cobalt (Co)-Dissolved			101.4		%		80-120	23-NOV-16
Copper (Cu)-Dissolved			97.4		%		80-120	23-NOV-16
Iron (Fe)-Dissolved			102.9		%		80-120	23-NOV-16
Lead (Pb)-Dissolved			102.9		%		80-120	23-NOV-16
Lithium (Li)-Dissolved			104.7		%		80-120	23-NOV-16
Magnesium (Mg)-Dissolved			105.4		%		80-120	23-NOV-16
Manganese (Mn)-Dissolved			101.5		%		80-120	23-NOV-16
Molybdenum (Mo)-Dissolved			104.3		%		80-120	23-NOV-16
Nickel (Ni)-Dissolved			100.1		%		80-120	23-NOV-16
Phosphorus (P)-Dissolved			95.1		%		80-120	23-NOV-16
Potassium (K)-Dissolved			99.4		%		80-120	23-NOV-16
Selenium (Se)-Dissolved			98.9		%		80-120	23-NOV-16



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 4 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3601615</b>							
<b>WG2438233-2</b>	<b>LCS</b>							
Silicon (Si)-Dissolved			107.4		%		80-120	23-NOV-16
Silver (Ag)-Dissolved			102.8		%		80-120	23-NOV-16
Sodium (Na)-Dissolved			100.1		%		80-120	23-NOV-16
Strontium (Sr)-Dissolved			111.0		%		80-120	23-NOV-16
Thallium (Tl)-Dissolved			100.0		%		80-120	23-NOV-16
Tin (Sn)-Dissolved			99.6		%		80-120	23-NOV-16
Titanium (Ti)-Dissolved			97.8		%		80-120	23-NOV-16
Uranium (U)-Dissolved			108.0		%		80-120	23-NOV-16
Vanadium (V)-Dissolved			103.8		%		80-120	23-NOV-16
Zinc (Zn)-Dissolved			94.3		%		80-120	23-NOV-16
<b>WG2438233-1</b>	<b>MB</b>	<b>LF</b>						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	23-NOV-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	23-NOV-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	23-NOV-16
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	23-NOV-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	23-NOV-16
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	23-NOV-16
Boron (B)-Dissolved			<0.010		mg/L		0.01	23-NOV-16
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	23-NOV-16
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	23-NOV-16
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	23-NOV-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	23-NOV-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	23-NOV-16
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	23-NOV-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	23-NOV-16
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	23-NOV-16
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	23-NOV-16
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	23-NOV-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	23-NOV-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	23-NOV-16
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	23-NOV-16
Potassium (K)-Dissolved			<0.050		mg/L		0.05	23-NOV-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	23-NOV-16
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	23-NOV-16



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 5 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3601615</b>							
<b>WG2438233-1</b>	<b>MB</b>	<b>LF</b>						
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	23-NOV-16
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	23-NOV-16
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	23-NOV-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	23-NOV-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	23-NOV-16
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	23-NOV-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	23-NOV-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	23-NOV-16
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	23-NOV-16
<b>Batch</b>	<b>R3602451</b>							
<b>WG2438233-3</b>	<b>DUP</b>	<b>L1860536-1</b>						
Aluminum (Al)-Dissolved		0.0833	0.0835		mg/L	0.2	20	23-NOV-16
Antimony (Sb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	23-NOV-16
Arsenic (As)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	23-NOV-16
Barium (Ba)-Dissolved		0.035	0.035		mg/L	0.8	20	23-NOV-16
Beryllium (Be)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	23-NOV-16
Bismuth (Bi)-Dissolved		<0.20	<0.20	RPD-NA	mg/L	N/A	20	23-NOV-16
Boron (B)-Dissolved		<0.10	<0.10	RPD-NA	mg/L	N/A	20	23-NOV-16
Cadmium (Cd)-Dissolved		0.0000074	0.0000060	J	mg/L	0.000001	0.00001	23-NOV-16
Calcium (Ca)-Dissolved		10.0	9.94		mg/L	0.7	20	23-NOV-16
Chromium (Cr)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	23-NOV-16
Cobalt (Co)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	23-NOV-16
Copper (Cu)-Dissolved		0.0011	0.0011		mg/L	2.2	20	23-NOV-16
Iron (Fe)-Dissolved		0.089	0.087		mg/L	2.6	20	23-NOV-16
Lead (Pb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	23-NOV-16
Lithium (Li)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	23-NOV-16
Magnesium (Mg)-Dissolved		2.53	2.56		mg/L	1.0	20	23-NOV-16
Manganese (Mn)-Dissolved		0.00126	0.00133		mg/L	5.3	20	23-NOV-16
Molybdenum (Mo)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	23-NOV-16
Nickel (Ni)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	23-NOV-16
Phosphorus (P)-Dissolved		<0.30	<0.30	RPD-NA	mg/L	N/A	20	23-NOV-16
Potassium (K)-Dissolved		<2.0	<2.0	RPD-NA	mg/L	N/A	20	23-NOV-16
Selenium (Se)-Dissolved		0.000146	0.000135		mg/L	7.7	20	23-NOV-16
Silicon (Si)-Dissolved		2.30	2.27		mg/L	1.0	20	23-NOV-16



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 6 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3602451</b>							
<b>WG2438233-3</b>	<b>DUP</b>	<b>L1860536-1</b>						
Silver (Ag)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	23-NOV-16
Sodium (Na)-Dissolved		<2.0	<2.0	RPD-NA	mg/L	N/A	20	23-NOV-16
Strontium (Sr)-Dissolved		0.0244	0.0241		mg/L	1.3	20	23-NOV-16
Thallium (Tl)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	23-NOV-16
Tin (Sn)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	23-NOV-16
Titanium (Ti)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	23-NOV-16
Uranium (U)-Dissolved		0.00105	0.00103		mg/L	1.6	20	23-NOV-16
Vanadium (V)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	23-NOV-16
Zinc (Zn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	23-NOV-16
<b>MET-T-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3601615</b>							
<b>WG2438219-2</b>	<b>LCS</b>							
Aluminum (Al)-Total			104.5		%		80-120	23-NOV-16
Antimony (Sb)-Total			105.5		%		80-120	23-NOV-16
Arsenic (As)-Total			106.1		%		80-120	23-NOV-16
Barium (Ba)-Total			108.8		%		80-120	23-NOV-16
Beryllium (Be)-Total			109.2		%		80-120	23-NOV-16
Bismuth (Bi)-Total			106.9		%		80-120	23-NOV-16
Boron (B)-Total			100.5		%		80-120	23-NOV-16
Cadmium (Cd)-Total			105.9		%		80-120	23-NOV-16
Calcium (Ca)-Total			107.1		%		80-120	23-NOV-16
Chromium (Cr)-Total			105.8		%		80-120	23-NOV-16
Cobalt (Co)-Total			105.7		%		80-120	23-NOV-16
Copper (Cu)-Total			103.3		%		80-120	23-NOV-16
Iron (Fe)-Total			108.8		%		80-120	23-NOV-16
Lead (Pb)-Total			108.9		%		80-120	23-NOV-16
Lithium (Li)-Total			109.3		%		80-120	23-NOV-16
Magnesium (Mg)-Total			109.9		%		80-120	23-NOV-16
Manganese (Mn)-Total			106.8		%		80-120	23-NOV-16
Molybdenum (Mo)-Total			110.3		%		80-120	23-NOV-16
Nickel (Ni)-Total			105.5		%		80-120	23-NOV-16
Phosphorus (P)-Total			107.6		%		80-120	23-NOV-16
Potassium (K)-Total			106.1		%		80-120	23-NOV-16
Selenium (Se)-Total			104.7		%		80-120	23-NOV-16



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 7 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3601615</b>							
<b>WG2438219-2</b>	<b>LCS</b>							
Silver (Ag)-Total			108.9		%		80-120	23-NOV-16
Sodium (Na)-Total			104.4		%		80-120	23-NOV-16
Strontium (Sr)-Total			117.7		%		80-120	23-NOV-16
Thallium (Tl)-Total			106.0		%		80-120	23-NOV-16
Tin (Sn)-Total			105.4		%		80-120	23-NOV-16
Titanium (Ti)-Total			101.2		%		80-120	23-NOV-16
Uranium (U)-Total			114.6		%		80-120	23-NOV-16
Vanadium (V)-Total			107.4		%		80-120	23-NOV-16
Zinc (Zn)-Total			100.8		%		80-120	23-NOV-16
<b>WG2438219-1</b>	<b>MB</b>							
Aluminum (Al)-Total			<0.0030		mg/L		0.003	23-NOV-16
Arsenic (As)-Total			<0.00010		mg/L		0.0001	23-NOV-16
Barium (Ba)-Total			<0.000050		mg/L		0.00005	23-NOV-16
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	23-NOV-16
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	23-NOV-16
Boron (B)-Total			<0.010		mg/L		0.01	23-NOV-16
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	23-NOV-16
Calcium (Ca)-Total			<0.050		mg/L		0.05	23-NOV-16
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	23-NOV-16
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	23-NOV-16
Copper (Cu)-Total			<0.00050		mg/L		0.0005	23-NOV-16
Iron (Fe)-Total			<0.010		mg/L		0.01	23-NOV-16
Lead (Pb)-Total			<0.000050		mg/L		0.00005	23-NOV-16
Lithium (Li)-Total			<0.0010		mg/L		0.001	23-NOV-16
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	23-NOV-16
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	23-NOV-16
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	23-NOV-16
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	23-NOV-16
Phosphorus (P)-Total			<0.050		mg/L		0.05	23-NOV-16
Potassium (K)-Total			<0.050		mg/L		0.05	23-NOV-16
Selenium (Se)-Total			<0.000050		mg/L		0.00005	23-NOV-16
Silicon (Si)-Total			<0.050		mg/L		0.05	23-NOV-16
Silver (Ag)-Total			<0.000010		mg/L		0.00001	23-NOV-16
Sodium (Na)-Total			<0.050		mg/L		0.05	23-NOV-16



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 8 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3601615</b>							
<b>WG2438219-1</b>	<b>MB</b>							
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	23-NOV-16
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	23-NOV-16
Tin (Sn)-Total			<0.00010		mg/L		0.0001	23-NOV-16
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	23-NOV-16
Uranium (U)-Total			<0.000010		mg/L		0.00001	23-NOV-16
Vanadium (V)-Total			<0.00050		mg/L		0.0005	23-NOV-16
Zinc (Zn)-Total			<0.0030		mg/L		0.003	23-NOV-16
<b>Batch</b>	<b>R3601712</b>							
<b>WG2438219-1</b>	<b>MB</b>							
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	23-NOV-16
<b>NH3-F-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3600991</b>							
<b>WG2438241-10</b>	<b>LCS</b>							
Ammonia, Total (as N)			105.2		%		85-115	23-NOV-16
<b>WG2438241-9</b>	<b>MB</b>							
Ammonia, Total (as N)			<0.0050		mg/L		0.005	23-NOV-16
<b>NO2-L-IC-N-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3602285</b>							
<b>WG2439073-9</b>	<b>DUP</b>	<b>L1860536-1</b>						
Nitrite (as N)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	23-NOV-16
<b>WG2439073-18</b>	<b>LCS</b>							
Nitrite (as N)			97.7		%		90-110	23-NOV-16
<b>WG2439073-2</b>	<b>LCS</b>							
Nitrite (as N)			98.5		%		90-110	23-NOV-16
<b>WG2439073-1</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	23-NOV-16
<b>WG2439073-10</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	23-NOV-16
<b>WG2439073-13</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	23-NOV-16
<b>WG2439073-16</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	23-NOV-16
<b>WG2439073-4</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	23-NOV-16
<b>WG2439073-7</b>	<b>MB</b>							



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 9 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO2-L-IC-N-VA</b>								
Water								
Batch R3602285								
WG2439073-7	MB							
Nitrite (as N)			<0.0010		mg/L		0.001	23-NOV-16
<b>NO3-L-IC-N-VA</b>								
Water								
Batch R3602285								
WG2439073-9	DUP	L1860536-1						
Nitrate (as N)		0.112	0.111		mg/L	1.1	20	23-NOV-16
WG2439073-18	LCS							
Nitrate (as N)			99.5		%		90-110	23-NOV-16
WG2439073-2	LCS							
Nitrate (as N)			99.9		%		90-110	23-NOV-16
WG2439073-1	MB							
Nitrate (as N)			<0.0050		mg/L		0.005	23-NOV-16
WG2439073-10	MB							
Nitrate (as N)			<0.0050		mg/L		0.005	23-NOV-16
WG2439073-13	MB							
Nitrate (as N)			<0.0050		mg/L		0.005	23-NOV-16
WG2439073-16	MB							
Nitrate (as N)			<0.0050		mg/L		0.005	23-NOV-16
WG2439073-4	MB							
Nitrate (as N)			<0.0050		mg/L		0.005	23-NOV-16
WG2439073-7	MB							
Nitrate (as N)			<0.0050		mg/L		0.005	23-NOV-16
<b>P-T-PRES-COL-VA</b>								
Water								
Batch R3600630								
WG2437430-2	CRM	VA-ERA-PO4						
Phosphorus (P)-Total			105.4		%		80-120	22-NOV-16
WG2437430-1	MB							
Phosphorus (P)-Total			<0.0020		mg/L		0.002	22-NOV-16
Batch R3601100								
WG2438429-6	CRM	VA-ERA-PO4						
Phosphorus (P)-Total			108.9		%		80-120	23-NOV-16
WG2438429-5	MB							
Phosphorus (P)-Total			<0.0020		mg/L		0.002	23-NOV-16
<b>PH-PCT-VA</b>								
Water								



## Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 10 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>PH-PCT-VA</b>								
Batch	R3601708							
WG2436963-17	CRM	VA-PH7-BUF						
pH			7.00		pH		6.9-7.1	22-NOV-16
<b>SO4-IC-N-VA</b>								
Batch	R3602285							
WG2439073-9	DUP	L1860536-1						
Sulfate (SO4)		8.59	8.61		mg/L	0.2	20	23-NOV-16
WG2439073-18	LCS							
Sulfate (SO4)			99.5		%		90-110	23-NOV-16
WG2439073-2	LCS							
Sulfate (SO4)			99.8		%		90-110	23-NOV-16
WG2439073-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	23-NOV-16
WG2439073-10	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	23-NOV-16
WG2439073-13	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	23-NOV-16
WG2439073-16	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	23-NOV-16
WG2439073-4	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	23-NOV-16
WG2439073-7	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	23-NOV-16
<b>TSS-VA</b>								
Batch	R3603398							
WG2439778-2	LCS							
Total Suspended Solids			99.5		%		85-115	24-NOV-16
WG2439778-1	MB							
Total Suspended Solids			<3.0		mg/L		3	24-NOV-16



# Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 11 of 12

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

---

# Quality Control Report

Workorder: L1860536

Report Date: 28-NOV-16

Page 12 of 12

## Hold Time Exceedances:

---

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Physical Tests</b>							
pH by Meter (Automated)							
	1	21-NOV-16 15:00	22-NOV-16 20:59	0.25	30	hours	EHTR-FM
	2	21-NOV-16 15:00	22-NOV-16 20:59	0.25	30	hours	EHTR-FM

## Legend & Qualifier Definitions:

- 
- EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
  - EHTR: Exceeded ALS recommended hold time prior to sample receipt.
  - EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
  - EHT: Exceeded ALS recommended hold time prior to analysis.
  - Rec. HT: ALS recommended hold time (see units).

## Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.  
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1860536 were received on 21-NOV-16 17:20.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



<b>Report To</b> Contact and company name below will appear on the final report		<b>Report Format / Distribution</b>			<b>Select Service Level Below - Please confirm all E&amp;P TATs with your AM - surcharges will apply</b>					
Company:	Golden	Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply					
Contact:	Cristina Cismaru	Quality Control (QC) Report with Report <input type="checkbox"/> YES <input type="checkbox"/> NO			<b>PROPERTY (Business Days)</b>		<b>EMERGENCY</b>			
Phone:		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked			4 day [P4]	<input type="checkbox"/>	1 Business day [E1]			<input type="checkbox"/>
Company address below will appear on the final report		Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			3 day [P3]	<input type="checkbox"/>	Same Day, Weekend or Statutory holiday [E0]			<input type="checkbox"/>
Street:		Email 1 or Fax <u>Cristina.Cismaru@goldr.com</u>			<b>Date and Time Required for all E&amp;P TATs:</b>					
City/Province:		Email 2			For tests that can not be performed according to the service level selected, you will be contacted.					
Postal Code:		Email 3			<b>Analysis Request</b>					
Invoice To Same as Report To <input type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below					
Copy of Invoice with Report <input type="checkbox"/> YES <input type="checkbox"/> NO		Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX								
Company:		Email 1 or Fax								
Contact:		Email 2								
<b>Project Information</b>		<b>Oil and Gas Required Fields (client use)</b>								
ALS Account # / Quote #		AFE/Cost Center:		PO#						
Job #:	See Amber Springer for info	Major/Minor Code:		Routing Code:						
PO / AFE:		Requisitioner:								
LSD:		Location:								
ALS Lab Work Order # (lab use only)		ALS Contact:		Sampler:						
<b>ALS Sample # (lab use only)</b>	<b>Sample Identification and/or Coordinates</b> (This description will appear on the report)			<b>Date</b> (dd-mmm-yy)	<b>Time</b> (hh:mm)	<b>Sample Type</b>	<i>General analysis</i>			<b>Number of Containers</b>
	LJ-951		21-Nov-16	15:00	water	X	X	X	3	
	LJ-952		21-Nov-16	15:00	water	X	X	X	3	

**Short Holding Time**  
*Rush Processing*

Drinking Water (DW) Samples<sup>1</sup> (client use)  
Are samples taken from a Regulated DW System?  
 YES  NO  
Are samples for human drinking water use?  
 YES  NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)  
*Samples for dissolved metals not filtered or preserved.*

**SAMPLE CONDITION AS RECEIVED (lab use only)**  
Frozen  SIF Observations Yes  No   
Ice Packs  Ice Cubes  Custody seal intact Yes  No   
Cooling Initiated   
INITIAL COOLER TEMPERATURES °C: \_\_\_\_\_  
FINAL COOLER TEMPERATURES °C: 10.8

**SHIPMENT RELEASE (client use)**  
Released by: Krista Kearney Date: Nov 21 110 Time: 1700

**INITIAL SHIPMENT RECEPTION (lab use only)**  
Received by: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

**FINAL SHIPMENT RECEPTION (lab use only)**  
Received by: [Signature] Date: Nov 21 Time: 1720



GOLDER ASSOCIATES LTD.  
ATTN: Cristina Cismasu  
9200, Boul De L'Acadie, bureau 10  
Montreal QC H4N 2T2

Date Received: 23-NOV-16  
Report Date: 30-NOV-16 13:58 (MT)  
Version: FINAL

Client Phone: 514-383-0990

## Certificate of Analysis

Lab Work Order #: L1861769  
Project P.O. #: NOT SUBMITTED  
Job Reference:  
C of C Numbers:  
Legal Site Desc:

---

Amber Springer, B.Sc  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700  
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1861769-1	L1861769-2		
		Description	WATER	WATER		
		Sampled Date	23-NOV-16	23-NOV-16		
		Sampled Time	10:00	10:00		
		Client ID	LJ ES1	LJ ES2		
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Conductivity (uS/cm)		95.6	40.0		
	Hardness (as CaCO3) (mg/L)		37.4	13.7		
	pH (pH)		7.59	7.16		
	Total Suspended Solids (mg/L)		8.4	4.5		
<b>Anions and Nutrients</b>	Alkalinity, Bicarbonate (as CaCO3) (mg/L)		34.7	13.2		
	Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)		34.7	13.2		
	Ammonia, Total (as N) (mg/L)		1.01	1.01		
	Bromide (Br) (mg/L)		<0.050	<0.050		
	Chloride (Cl) (mg/L)		1.23	0.69		
	Fluoride (F) (mg/L)		0.023	<0.020		
	Nitrate (as N) (mg/L)		0.117	0.0350		
	Nitrite (as N) (mg/L)		0.0063	0.0065		
	Phosphorus (P)-Total (mg/L)		0.0189	0.0148		
	Sulfate (SO4) (mg/L)		9.04	2.90		
	<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)		0.0835	0.215	
Antimony (Sb)-Total (mg/L)			<0.00050	<0.00050		
Arsenic (As)-Total (mg/L)			<0.00050	<0.00050		
Barium (Ba)-Total (mg/L)			0.034	0.021		
Beryllium (Be)-Total (mg/L)			<0.0010	<0.0010		
Bismuth (Bi)-Total (mg/L)			<0.20	<0.20		
Boron (B)-Total (mg/L)			<0.10	<0.10		
Cadmium (Cd)-Total (mg/L)			<0.0000050	0.0000105		
Calcium (Ca)-Total (mg/L)			11.5	3.99		
Chromium (Cr)-Total (mg/L)			<0.0010	0.0029		
Cobalt (Co)-Total (mg/L)			<0.00030	<0.00030		
Copper (Cu)-Total (mg/L)			0.0011	0.0015		
Iron (Fe)-Total (mg/L)			0.092	0.237		
Lead (Pb)-Total (mg/L)			<0.00050	<0.00050		
Lithium (Li)-Total (mg/L)			<0.0010	<0.0010		
Magnesium (Mg)-Total (mg/L)			3.07	1.26		
Manganese (Mn)-Total (mg/L)			0.00284	0.0253		
Molybdenum (Mo)-Total (mg/L)			0.0018	<0.0010		
Nickel (Ni)-Total (mg/L)			0.0010	0.0010		
Phosphorus (P)-Total (mg/L)			<0.30	<0.30		
Potassium (K)-Total (mg/L)			<2.0	<2.0		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1861769-1 WATER 23-NOV-16 10:00 LJ ES1	L1861769-2 WATER 23-NOV-16 10:00 LJ ES2		
Grouping	Analyte				
<b>WATER</b>					
<b>Total Metals</b>	Selenium (Se)-Total (mg/L)	0.000214	0.000130		
	Silicon (Si)-Total (mg/L)	2.32	2.18		
	Silver (Ag)-Total (mg/L)	<0.000020	0.000035		
	Sodium (Na)-Total (mg/L)	<2.0	<2.0		
	Strontium (Sr)-Total (mg/L)	0.0290	0.0144		
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020		
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.00112	0.00024		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	<0.0050	0.0083		
<b>Dissolved Metals</b>	Dissolved Metals Filtration Location	LAB	LAB		
	Aluminum (Al)-Dissolved (mg/L)	0.0735	0.140		
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Arsenic (As)-Dissolved (mg/L)	<0.00050	<0.00050		
	Barium (Ba)-Dissolved (mg/L)	0.033	<0.020		
	Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20		
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10		
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050		
	Calcium (Ca)-Dissolved (mg/L)	10.1	3.58		
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030		
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010		
	Iron (Fe)-Dissolved (mg/L)	0.062	0.054		
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010		
	Magnesium (Mg)-Dissolved (mg/L)	2.94	1.16		
	Manganese (Mn)-Dissolved (mg/L)	0.00047	0.00062		
	Molybdenum (Mo)-Dissolved (mg/L)	0.0016	<0.0010		
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	<0.0010		
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30		
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0		
	Selenium (Se)-Dissolved (mg/L)	0.000171	0.000098		
	Silicon (Si)-Dissolved (mg/L)	2.23	2.00		
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020		
	Sodium (Na)-Dissolved (mg/L)	<2.0	<2.0		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1861769-1	L1861769-2		
	Description	WATER	WATER		
	Sampled Date	23-NOV-16	23-NOV-16		
	Sampled Time	10:00	10:00		
	Client ID	LJ ES1	LJ ES2		
Grouping	Analyte				
<b>WATER</b>					
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)	0.0253	0.0126		
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020		
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.00097	<0.00020		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## Reference Information

### Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

### QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1861769-1, -2
Matrix Spike	Calcium (Ca)-Total	MS-B	L1861769-1, -2
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1861769-1, -2
Matrix Spike	Manganese (Mn)-Total	MS-B	L1861769-1, -2
Matrix Spike	Potassium (K)-Total	MS-B	L1861769-1, -2
Matrix Spike	Silicon (Si)-Total	MS-B	L1861769-1, -2
Matrix Spike	Sodium (Na)-Total	MS-B	L1861769-1, -2
Matrix Spike	Strontium (Sr)-Total	MS-B	L1861769-1, -2

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
<b>ALK-TITR-VA</b>	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
<b>BR-L-IC-N-VA</b>	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>CL-IC-N-VA</b>	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>EC-PCT-VA</b>	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
<b>F-IC-N-VA</b>	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>HARDNESS-CALC-VA</b>	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO <sub>3</sub> equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
<b>MET-D-CCMS-VA</b>	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
<b>MET-T-CCMS-VA</b>	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
<b>NO2-L-IC-N-VA</b>	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)



## Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**NO3-L-IC-N-VA**                      Water              Nitrate in Water by IC (Low Level)                      EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**P-T-PRES-COL-VA**                      Water              Total P in Water by Colour                      APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

**PH-PCT-VA**                      Water              pH by Meter (Automated)                      APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

**PH-PCT-VA**                      Water              pH by Meter (Automated)                      APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

**SO4-IC-N-VA**                      Water              Sulfate in Water by IC                      EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

**TSS-VA**                      Water              Total Suspended Solids by Gravimetric                      APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

---

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

---

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

---

**Chain of Custody Numbers:**

**GLOSSARY OF REPORT TERMS**

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*

- mg/kg - milligrams per kilogram based on dry weight of sample.*
- mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
- mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
- mg/L - milligrams per litre.*
- < - Less than.*

*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*  
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*  
**UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.**  
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 1 of 12

Client: GOLDER ASSOCIATES LTD.  
 9200, Boul De L'Acadie, bureau 10  
 Montreal QC H4N 2T2

Contact: Cristina Cismasu

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>ALK-TITR-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3602645</b>							
<b>WG2439220-23</b>	<b>CRM</b>	<b>VA-ALK-TITR-CONTROL</b>						
Alkalinity, Total (as CaCO3)			99.9		%		85-115	24-NOV-16
<b>WG2439220-21</b>	<b>MB</b>							
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	24-NOV-16
<b>BR-L-IC-N-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3603245</b>							
<b>WG2440212-2</b>	<b>LCS</b>							
Bromide (Br)			98.6		%		85-115	25-NOV-16
<b>WG2440212-21</b>	<b>LCS</b>							
Bromide (Br)			99.0		%		85-115	25-NOV-16
<b>WG2440212-1</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	25-NOV-16
<b>WG2440212-10</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	25-NOV-16
<b>WG2440212-13</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	25-NOV-16
<b>WG2440212-16</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	25-NOV-16
<b>WG2440212-19</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	25-NOV-16
<b>WG2440212-4</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	25-NOV-16
<b>WG2440212-7</b>	<b>MB</b>							
Bromide (Br)			<0.050		mg/L		0.05	25-NOV-16
<b>CL-IC-N-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3603245</b>							
<b>WG2440212-2</b>	<b>LCS</b>							
Chloride (Cl)			98.9		%		90-110	25-NOV-16
<b>WG2440212-21</b>	<b>LCS</b>							
Chloride (Cl)			99.0		%		90-110	25-NOV-16
<b>WG2440212-1</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	25-NOV-16
<b>WG2440212-10</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	25-NOV-16
<b>WG2440212-13</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	25-NOV-16
<b>WG2440212-16</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	25-NOV-16



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 2 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>CL-IC-N-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3603245</b>							
<b>WG2440212-19</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	25-NOV-16
<b>WG2440212-4</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	25-NOV-16
<b>WG2440212-7</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	25-NOV-16
<b>EC-PCT-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3602645</b>							
<b>WG2439220-24</b>	<b>CRM</b>	<b>VA-EC-PCT-CONTROL</b>						
Conductivity			100.6		%		90-110	24-NOV-16
<b>WG2439220-21</b>	<b>MB</b>							
Conductivity			<2.0		uS/cm		2	24-NOV-16
<b>F-IC-N-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3603245</b>							
<b>WG2440212-2</b>	<b>LCS</b>							
Fluoride (F)			96.4		%		90-110	25-NOV-16
<b>WG2440212-21</b>	<b>LCS</b>							
Fluoride (F)			97.0		%		90-110	25-NOV-16
<b>WG2440212-1</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	25-NOV-16
<b>WG2440212-10</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	25-NOV-16
<b>WG2440212-13</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	25-NOV-16
<b>WG2440212-16</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	25-NOV-16
<b>WG2440212-19</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	25-NOV-16
<b>WG2440212-4</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	25-NOV-16
<b>WG2440212-7</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	25-NOV-16
<b>MET-D-CCMS-VA</b>								
<b>Water</b>								
<b>Batch</b>	<b>R3603039</b>							
<b>WG2439884-2</b>	<b>LCS</b>							
Aluminum (Al)-Dissolved			104.4		%		80-120	24-NOV-16
Antimony (Sb)-Dissolved			99.9		%		80-120	24-NOV-16
Arsenic (As)-Dissolved			104.3		%		80-120	24-NOV-16



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 3 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3603039</b>							
<b>WG2439884-2</b>	<b>LCS</b>							
Barium (Ba)-Dissolved			100.2		%		80-120	24-NOV-16
Beryllium (Be)-Dissolved			100.9		%		80-120	24-NOV-16
Bismuth (Bi)-Dissolved			104.7		%		80-120	24-NOV-16
Boron (B)-Dissolved			96.7		%		80-120	24-NOV-16
Cadmium (Cd)-Dissolved			99.4		%		80-120	24-NOV-16
Calcium (Ca)-Dissolved			100.0		%		80-120	24-NOV-16
Chromium (Cr)-Dissolved			102.9		%		80-120	24-NOV-16
Cobalt (Co)-Dissolved			101.3		%		80-120	24-NOV-16
Copper (Cu)-Dissolved			102.5		%		80-120	24-NOV-16
Iron (Fe)-Dissolved			98.6		%		80-120	24-NOV-16
Lead (Pb)-Dissolved			103.7		%		80-120	24-NOV-16
Lithium (Li)-Dissolved			101.9		%		80-120	24-NOV-16
Magnesium (Mg)-Dissolved			99.9		%		80-120	24-NOV-16
Manganese (Mn)-Dissolved			104.2		%		80-120	24-NOV-16
Molybdenum (Mo)-Dissolved			106.2		%		80-120	24-NOV-16
Nickel (Ni)-Dissolved			102.5		%		80-120	24-NOV-16
Phosphorus (P)-Dissolved			109.2		%		80-120	24-NOV-16
Potassium (K)-Dissolved			103.6		%		80-120	24-NOV-16
Selenium (Se)-Dissolved			98.8		%		80-120	24-NOV-16
Silicon (Si)-Dissolved			113.0		%		80-120	24-NOV-16
Silver (Ag)-Dissolved			101.3		%		80-120	24-NOV-16
Sodium (Na)-Dissolved			101.8		%		80-120	24-NOV-16
Strontium (Sr)-Dissolved			97.3		%		80-120	24-NOV-16
Thallium (Tl)-Dissolved			104.7		%		80-120	24-NOV-16
Tin (Sn)-Dissolved			100.8		%		80-120	24-NOV-16
Titanium (Ti)-Dissolved			103.0		%		80-120	24-NOV-16
Uranium (U)-Dissolved			104.3		%		80-120	24-NOV-16
Vanadium (V)-Dissolved			107.0		%		80-120	24-NOV-16
Zinc (Zn)-Dissolved			97.6		%		80-120	24-NOV-16
<b>WG2439884-1</b>	<b>MB</b>	<b>LF</b>						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	24-NOV-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	24-NOV-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	24-NOV-16
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	24-NOV-16



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 4 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3603039</b>							
<b>WG2439884-1</b>	<b>MB</b>	<b>LF</b>						
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	24-NOV-16
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	24-NOV-16
Boron (B)-Dissolved			<0.010		mg/L		0.01	24-NOV-16
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	24-NOV-16
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	24-NOV-16
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	24-NOV-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	24-NOV-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	24-NOV-16
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	24-NOV-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	24-NOV-16
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	24-NOV-16
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	24-NOV-16
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	24-NOV-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	24-NOV-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	24-NOV-16
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	24-NOV-16
Potassium (K)-Dissolved			<0.050		mg/L		0.05	24-NOV-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	24-NOV-16
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	24-NOV-16
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	24-NOV-16
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	24-NOV-16
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	24-NOV-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	24-NOV-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	24-NOV-16
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	24-NOV-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	24-NOV-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	24-NOV-16
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	24-NOV-16
<b>Batch</b>	<b>R3606264</b>							
<b>WG2439884-3</b>	<b>DUP</b>	<b>L1861769-1</b>						
Aluminum (Al)-Dissolved		0.0735	0.0757		mg/L	2.9	20	28-NOV-16
Antimony (Sb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	28-NOV-16
Arsenic (As)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	28-NOV-16
Barium (Ba)-Dissolved		0.033	0.033		mg/L	1.6	20	28-NOV-16



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 5 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3606264</b>							
<b>WG2439884-3</b>	<b>DUP</b>	<b>L1861769-1</b>						
Beryllium (Be)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	28-NOV-16
Bismuth (Bi)-Dissolved		<0.20	<0.20	RPD-NA	mg/L	N/A	20	28-NOV-16
Boron (B)-Dissolved		<0.10	<0.10	RPD-NA	mg/L	N/A	20	28-NOV-16
Cadmium (Cd)-Dissolved		<0.0000050	<0.0000050	RPD-NA	mg/L	N/A	20	28-NOV-16
Calcium (Ca)-Dissolved		10.1	10.9		mg/L	7.5	20	28-NOV-16
Chromium (Cr)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	28-NOV-16
Cobalt (Co)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	28-NOV-16
Copper (Cu)-Dissolved		<0.0010	0.0010	RPD-NA	mg/L	N/A	20	28-NOV-16
Iron (Fe)-Dissolved		0.062	0.063		mg/L	1.1	20	28-NOV-16
Lead (Pb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	28-NOV-16
Lithium (Li)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	28-NOV-16
Magnesium (Mg)-Dissolved		2.94	3.00		mg/L	1.8	20	28-NOV-16
Manganese (Mn)-Dissolved		0.00047	0.00046		mg/L	2.3	20	28-NOV-16
Molybdenum (Mo)-Dissolved		0.0016	0.0017		mg/L	4.7	20	28-NOV-16
Nickel (Ni)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	28-NOV-16
Phosphorus (P)-Dissolved		<0.30	<0.30	RPD-NA	mg/L	N/A	20	28-NOV-16
Potassium (K)-Dissolved		<2.0	<2.0	RPD-NA	mg/L	N/A	20	28-NOV-16
Selenium (Se)-Dissolved		0.000171	0.000173		mg/L	0.7	20	28-NOV-16
Silicon (Si)-Dissolved		2.23	2.09		mg/L	6.5	20	28-NOV-16
Silver (Ag)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	28-NOV-16
Sodium (Na)-Dissolved		<2.0	<2.0	RPD-NA	mg/L	N/A	20	28-NOV-16
Strontium (Sr)-Dissolved		0.0253	0.0277		mg/L	9.0	20	28-NOV-16
Thallium (Tl)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	28-NOV-16
Tin (Sn)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	28-NOV-16
Titanium (Ti)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	28-NOV-16
Uranium (U)-Dissolved		0.00097	0.00104		mg/L	6.8	20	28-NOV-16
Vanadium (V)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	28-NOV-16
Zinc (Zn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	28-NOV-16
<b>Batch</b>	<b>R3607070</b>							
<b>WG2439884-4</b>	<b>MS</b>	<b>L1861769-2</b>						
Aluminum (Al)-Dissolved			98.9		%		70-130	29-NOV-16
Antimony (Sb)-Dissolved			94.7		%		70-130	29-NOV-16
Arsenic (As)-Dissolved			98.3		%		70-130	29-NOV-16
Beryllium (Be)-Dissolved			99.2		%		70-130	29-NOV-16



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 6 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3607070</b>							
<b>WG2439884-4</b>	<b>MS</b>	<b>L1861769-2</b>						
Bismuth (Bi)-Dissolved			90.4		%		70-130	29-NOV-16
Boron (B)-Dissolved			96.7		%		70-130	29-NOV-16
Cadmium (Cd)-Dissolved			100.3		%		70-130	29-NOV-16
Calcium (Ca)-Dissolved			94.9		%		70-130	29-NOV-16
Chromium (Cr)-Dissolved			99.9		%		70-130	29-NOV-16
Cobalt (Co)-Dissolved			98.7		%		70-130	29-NOV-16
Copper (Cu)-Dissolved			101.6		%		70-130	29-NOV-16
Iron (Fe)-Dissolved			98.6		%		70-130	29-NOV-16
Lead (Pb)-Dissolved			96.8		%		70-130	29-NOV-16
Lithium (Li)-Dissolved			102.5		%		70-130	29-NOV-16
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	29-NOV-16
Manganese (Mn)-Dissolved			97.9		%		70-130	29-NOV-16
Molybdenum (Mo)-Dissolved			100.6		%		70-130	29-NOV-16
Nickel (Ni)-Dissolved			99.8		%		70-130	29-NOV-16
Phosphorus (P)-Dissolved			98.9		%		70-130	29-NOV-16
Potassium (K)-Dissolved			113.1		%		70-130	29-NOV-16
Selenium (Se)-Dissolved			96.5		%		70-130	29-NOV-16
Silicon (Si)-Dissolved			95.5		%		70-130	29-NOV-16
Silver (Ag)-Dissolved			92.4		%		70-130	29-NOV-16
Strontium (Sr)-Dissolved			98.0		%		70-130	29-NOV-16
Thallium (Tl)-Dissolved			93.7		%		70-130	29-NOV-16
Tin (Sn)-Dissolved			96.6		%		70-130	29-NOV-16
Titanium (Ti)-Dissolved			101.4		%		70-130	29-NOV-16
Uranium (U)-Dissolved			98.2		%		70-130	29-NOV-16
Vanadium (V)-Dissolved			99.8		%		70-130	29-NOV-16
Zinc (Zn)-Dissolved			94.4		%		70-130	29-NOV-16
<b>MET-T-CCMS-VA</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R3605360</b>							
<b>WG2440846-2</b>	<b>LCS</b>							
Aluminum (Al)-Total			103.5		%		80-120	26-NOV-16
Antimony (Sb)-Total			103.8		%		80-120	26-NOV-16
Arsenic (As)-Total			103.8		%		80-120	26-NOV-16
Barium (Ba)-Total			103.3		%		80-120	26-NOV-16
Beryllium (Be)-Total			107.3		%		80-120	26-NOV-16



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 7 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3605360</b>							
<b>WG2440846-2</b>	<b>LCS</b>							
Bismuth (Bi)-Total			104.0		%		80-120	26-NOV-16
Boron (B)-Total			94.8		%		80-120	26-NOV-16
Cadmium (Cd)-Total			105.3		%		80-120	26-NOV-16
Calcium (Ca)-Total			105.0		%		80-120	26-NOV-16
Chromium (Cr)-Total			101.9		%		80-120	26-NOV-16
Cobalt (Co)-Total			103.0		%		80-120	26-NOV-16
Copper (Cu)-Total			101.8		%		80-120	26-NOV-16
Iron (Fe)-Total			102.9		%		80-120	26-NOV-16
Lead (Pb)-Total			106.1		%		80-120	26-NOV-16
Lithium (Li)-Total			108.7		%		80-120	26-NOV-16
Magnesium (Mg)-Total			101.8		%		80-120	26-NOV-16
Manganese (Mn)-Total			107.5		%		80-120	26-NOV-16
Molybdenum (Mo)-Total			107.9		%		80-120	26-NOV-16
Nickel (Ni)-Total			104.3		%		80-120	26-NOV-16
Phosphorus (P)-Total			100.9		%		80-120	26-NOV-16
Potassium (K)-Total			106.2		%		80-120	26-NOV-16
Selenium (Se)-Total			101.1		%		80-120	26-NOV-16
Silicon (Si)-Total			114.2		%		80-120	26-NOV-16
Silver (Ag)-Total			105.9		%		80-120	26-NOV-16
Sodium (Na)-Total			105.1		%		80-120	26-NOV-16
Strontium (Sr)-Total			114.2		%		80-120	26-NOV-16
Thallium (Tl)-Total			103.1		%		80-120	26-NOV-16
Tin (Sn)-Total			103.9		%		80-120	26-NOV-16
Titanium (Ti)-Total			103.1		%		80-120	26-NOV-16
Uranium (U)-Total			107.6		%		80-120	26-NOV-16
Vanadium (V)-Total			106.5		%		80-120	26-NOV-16
Zinc (Zn)-Total			101.3		%		80-120	26-NOV-16
<b>WG2440846-1</b>		<b>MB</b>						
Aluminum (Al)-Total			<0.0030		mg/L		0.003	26-NOV-16
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	26-NOV-16
Arsenic (As)-Total			<0.00010		mg/L		0.0001	26-NOV-16
Barium (Ba)-Total			<0.000050		mg/L		0.00005	26-NOV-16
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	26-NOV-16
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	26-NOV-16





## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 8 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3605360</b>							
<b>WG2440846-1</b>	<b>MB</b>							
Boron (B)-Total			<0.010		mg/L		0.01	26-NOV-16
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	26-NOV-16
Calcium (Ca)-Total			<0.050		mg/L		0.05	26-NOV-16
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	26-NOV-16
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	26-NOV-16
Copper (Cu)-Total			<0.00050		mg/L		0.0005	26-NOV-16
Iron (Fe)-Total			<0.010		mg/L		0.01	26-NOV-16
Lead (Pb)-Total			<0.000050		mg/L		0.00005	26-NOV-16
Lithium (Li)-Total			<0.0010		mg/L		0.001	26-NOV-16
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	26-NOV-16
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	26-NOV-16
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	26-NOV-16
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	26-NOV-16
Phosphorus (P)-Total			<0.050		mg/L		0.05	26-NOV-16
Potassium (K)-Total			<0.050		mg/L		0.05	26-NOV-16
Selenium (Se)-Total			<0.000050		mg/L		0.00005	26-NOV-16
Silicon (Si)-Total			<0.050		mg/L		0.05	26-NOV-16
Silver (Ag)-Total			<0.000010		mg/L		0.00001	26-NOV-16
Sodium (Na)-Total			<0.050		mg/L		0.05	26-NOV-16
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	26-NOV-16
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	26-NOV-16
Tin (Sn)-Total			<0.00010		mg/L		0.0001	26-NOV-16
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	26-NOV-16
Uranium (U)-Total			<0.000010		mg/L		0.00001	26-NOV-16
Vanadium (V)-Total			<0.00050		mg/L		0.0005	26-NOV-16
Zinc (Zn)-Total			<0.0030		mg/L		0.003	26-NOV-16
<b>NH3-F-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3603427</b>							
<b>WG2440164-2</b>	<b>LCS</b>							
Ammonia, Total (as N)			100.7		%		85-115	25-NOV-16
<b>WG2440164-1</b>	<b>MB</b>							
Ammonia, Total (as N)			<0.0050		mg/L		0.005	25-NOV-16
<b>NO2-L-IC-N-VA</b>		<b>Water</b>						



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 9 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO2-L-IC-N-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3603245</b>							
<b>WG2440212-2</b>	<b>LCS</b>							
Nitrite (as N)			97.5		%		90-110	25-NOV-16
<b>WG2440212-21</b>	<b>LCS</b>							
Nitrite (as N)			98.2		%		90-110	25-NOV-16
<b>WG2440212-1</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	25-NOV-16
<b>WG2440212-10</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	25-NOV-16
<b>WG2440212-13</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	25-NOV-16
<b>WG2440212-16</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	25-NOV-16
<b>WG2440212-19</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	25-NOV-16
<b>WG2440212-4</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	25-NOV-16
<b>WG2440212-7</b>	<b>MB</b>							
Nitrite (as N)			<0.0010		mg/L		0.001	25-NOV-16
<b>NO3-L-IC-N-VA</b>		<b>Water</b>						
<b>Batch</b>	<b>R3603245</b>							
<b>WG2440212-2</b>	<b>LCS</b>							
Nitrate (as N)			99.8		%		90-110	25-NOV-16
<b>WG2440212-21</b>	<b>LCS</b>							
Nitrate (as N)			99.8		%		90-110	25-NOV-16
<b>WG2440212-1</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	25-NOV-16
<b>WG2440212-10</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	25-NOV-16
<b>WG2440212-13</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	25-NOV-16
<b>WG2440212-16</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	25-NOV-16
<b>WG2440212-19</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	25-NOV-16
<b>WG2440212-4</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	25-NOV-16
<b>WG2440212-7</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	25-NOV-16



## Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 10 of 12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>P-T-PRES-COL-VA</b>								
Batch R3602388								
<b>WG2439322-10 CRM</b>		<b>VA-ERA-PO4</b>						
Phosphorus (P)-Total			102.6		%		80-120	24-NOV-16
Batch R3602388								
<b>WG2439322-9 MB</b>								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	24-NOV-16
<b>PH-PCT-VA</b>								
Batch R3602645								
<b>WG2439220-22 CRM</b>		<b>VA-PH7-BUF</b>						
pH			7.01		pH		6.9-7.1	24-NOV-16
<b>SO4-IC-N-VA</b>								
Batch R3603245								
<b>WG2440212-2 LCS</b>								
Sulfate (SO4)			99.8		%		90-110	25-NOV-16
Batch R3603245								
<b>WG2440212-21 LCS</b>								
Sulfate (SO4)			99.9		%		90-110	25-NOV-16
Batch R3603245								
<b>WG2440212-1 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	25-NOV-16
Batch R3603245								
<b>WG2440212-10 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	25-NOV-16
Batch R3603245								
<b>WG2440212-13 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	25-NOV-16
Batch R3603245								
<b>WG2440212-16 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	25-NOV-16
Batch R3603245								
<b>WG2440212-19 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	25-NOV-16
Batch R3603245								
<b>WG2440212-4 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	25-NOV-16
Batch R3603245								
<b>WG2440212-7 MB</b>								
Sulfate (SO4)			<0.30		mg/L		0.3	25-NOV-16
<b>TSS-VA</b>								
Batch R3605957								
<b>WG2441997-2 LCS</b>								
Total Suspended Solids			97.8		%		85-115	28-NOV-16
Batch R3605957								
<b>WG2441997-1 MB</b>								
Total Suspended Solids			<3.0		mg/L		3	28-NOV-16

# Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 11 of 12

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

---

# Quality Control Report

Workorder: L1861769

Report Date: 30-NOV-16

Page 12 of 12

## Hold Time Exceedances:

---

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Physical Tests</b>							
pH by Meter (Automated)							
	1	23-NOV-16 10:00	24-NOV-16 12:29	0.25	26	hours	EHTR-FM
	2	23-NOV-16 10:00	24-NOV-16 12:29	0.25	26	hours	EHTR-FM

## Legend & Qualifier Definitions:

---

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.  
EHTR: Exceeded ALS recommended hold time prior to sample receipt.  
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.  
EHT: Exceeded ALS recommended hold time prior to analysis.  
Rec. HT: ALS recommended hold time (see units).

## Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.  
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1861769 were received on 23-NOV-16 15:15.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



<b>Report To</b>		<b>Report Format / Distribution</b>			<b>Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)</b>														
Company: <u>Golder</u>		Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)														
Contact: <u>Cristina Cismasu</u>		Quality Control (QC) Report with Report <input type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT														
Address:		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT														
Phone:		Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge														
		Email 1 or Fax: <u>Cristina_Cismasu@golder.com</u>			Specify Date Required for E2,E or P:														
		Email 2:			<b>Analysis Request</b>														
<b>Invoice To</b>		<b>Invoice Distribution</b>			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below														
Same as Report To <input type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																	
Copy of Invoice with Report <input type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax:																	
Company:		Email 2:																	
Contact:																			
<b>Project Information</b>		<b>Oil and Gas Required Fields (client use)</b>																	
ALS Quote #:		Approver ID:			Cost Center:														
Job #: <u>See Amber Springer for info</u>		GL Account:			Routing Code:														
PO / AFE:		Activity Code:																	
LSD:		Location:																	
ALS Lab Work Order # (lab use only)		ALS Contact:			Sampler:														
<b>ALS Sample # (lab use only)</b>	<b>Sample Identification and/or Coordinates (This description will appear on the report)</b>			<b>Date (dd-mm-yy)</b>	<b>Time (hh:mm)</b>	<b>Sample Type</b>	<b>General analysis</b>			<b>Total metals</b>			<b>Dissolved metals</b>			<b>Number of Containers</b>			
	<u>LJ ES1</u>			<u>23-Nov-16</u>	<u>10:00</u>	<u>Water</u>	<u>X</u>	<u>X</u>	<u>X</u>							<u>3</u>			
	<u>LJ ES2</u>			<u>23-Nov-16</u>	<u>10:00</u>	<u>Water</u>	<u>X</u>	<u>X</u>	<u>X</u>							<u>3</u>			
<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b>		<b>Special Instructions / Specify Criteria to add on report (client use)</b>			<b>SAMPLE CONDITION AS RECEIVED (lab use only)</b>														
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		<u>Samples for dissolved metals <u>not</u> filtered or preserved.</u>			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>														
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>														
					Cooling Initiated <input type="checkbox"/>														
					INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C									
<b>SHIPMENT RELEASE (client use)</b>		<b>INITIAL SHIPMENT RECEPTION (lab use only)</b>			<b>FINAL SHIPMENT RECEPTION (lab use only)</b>														
Released by: <u>Krista Pearcey</u>		Date: <u>Nov 23/16</u>	Time: <u>1700h</u>	Received by: <u>KLG</u>	Date: <u>NOV 23</u>	Time: <u>15:15</u>	Received by:	Date:	Time:										

9-8-



**ATTN: Caroline-Emmanuelle Morisse; Valerie Bertrand**  
Golder Associates  
9200, boulevard de l'Acadie, bureau 10  
Montréal, Québec  
Canada H4N 2T2

Received: 2016/08/06  
Report Date: 2016-08-25  
Version: FINAL

## Test Report

**Client:** GAL100  
**Reference:** 16-0965  
**Billing:** 16-05 REV

---

Senior Verifier

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling or transport of the sample, application or interpretation of the test data or results in part or in whole.

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1  
Tel (403) 253-7121 Fax (403) 252-9363 [www.nautilusenvironmental.ca](http://www.nautilusenvironmental.ca)

**Results Summary**

Client: GAL100 Reference: 16-0965-01-AGD
---

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES1

**Collection:** collected on 2016/08/03 at 0829 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/09

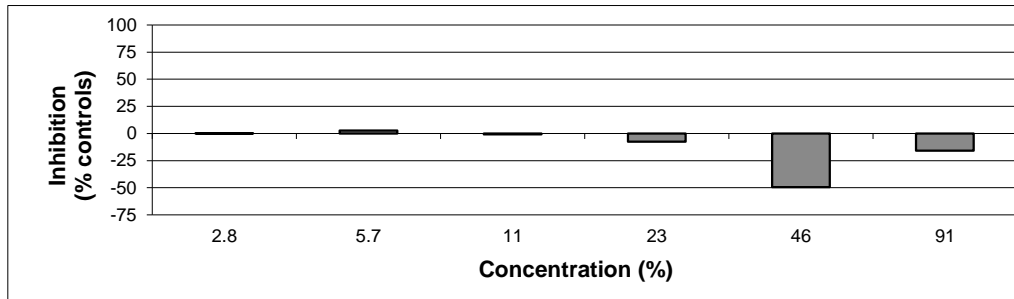
**Results:**

	Endpoint (72-hour)	Value	Confidence Limits (95%)		Method Calculated
			lower	upper	
Chronic: Growth Inhibition	IC25	>91		%	could not be calculated

Notes: ICx, concentrations inhibiting growth by 'x' percent relative to controls; CV, coefficient of variation (%); SD, standard deviation

	Stimulation Observed	Test Concentrations		Method Calculated
		yes	%	
Chronic: Growth Stimulation	yes	91, 46	%	Fligner-Wolfe

Notes: Stimulation refers to increased response at all concentrations or at high concentrations



The test data and results are authorized and verified correct.



Senior Verifier



## Test Conditions

Client: GAL100 Reference: 16-0965-01-AGD
---

**Method:** Biological Test Method: Growth Inhibition Test Using a Freshwater Alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum*). Environment Canada, EPS 1/RM/25, 2nd Edition, March 2007

**Test type:** Algal Growth Inhibition Test (WTR-ME-034)

**Species:** *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum* and *Raphidocelis subcapitata*)

**Organism source:** In-house culture (original source: Canadian Phycological Culture Centre; strain: UTCC 37)

**Culture age:** The test was started with 4-day old algae.

**Culture observations:** No unusual appearance or treatment of the algae was noted prior to or during the conduct of the test.

**Sample initial chemistry:** pH: 7.0; EC: 78 ( $\mu\text{S}/\text{cm}$ ); DO: 7.2 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 26; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq$  3 days)

**Sample storage:** 4  $\pm$  2°C in darkness

**Test concentrations:** 10 effluent concentrations (0.2, 0.4, 0.7, 1.4, 2.8, 5.7, 11, 23, 46, and 91% (v/v), plus a negative control) ( $\geq$ 6 enumerated; see Test Result Comments)

**Test vessel:** The test was conducted in disposable, 96-well U-bottomed microplates. Test concentrations were isolated from each other with microplate sealing film.

**Test replicates:** 5 replicate wells per test concentration ( $\geq$ 3 enumerated)  
10 replicate wells per control (8 enumerated).

**Test volume:** 220  $\mu\text{L}$  final volume in each well with 200  $\mu\text{L}$  of sample;  
10  $\mu\text{L}$  of enrichment medium and 10  $\mu\text{L}$  of algal inoculum.

**Inoculum:** The initial cell density of the inoculum was 9702 (cells/mL), it was prepared less than 3 hours before test initiation.

**Control/dilution water:** Made up with 85% deionized and 15% dechlorinated City of Calgary water spiked with nutrients as per EPS 1/RM/25

**Sample Filtration:** 100 mL filtered through a 0.45  $\mu\text{m}$  pore diameter membrane.

**Sample treatment:** Sample spiked with nutrients as per EPS 1/RM/25; no other chemicals added.

**Measurements:** Final cell densities were determined using an electronic particle counter.

**Aeration:** Not required

**pH Adjustment:** Not required

**Lighting:** The plates were incubated under continuous light:  
(cool white fluorescent bulbs)

3857.5 lux

54.005  $\mu\text{mol}/(\text{m}^2 \cdot \text{S})$

**Test temperature:** 24  $\pm$  2°C

Note: Outlined sections are protocol deviations explained on the comment page

**Test Conditions**

Client: GAL100 Reference: 16-0965-01-AGD
---

**Endpoint:** Growth, 72-h IC25 (with 95% confidence limits)  
Test endpoint was bracketed by at least 1 test concentration  
(except for <1.4% or >91%)  
No outliers were observed within the data set.

**Test validity:** Control growth was a 25-fold increase over the inoculum. (Must be >16-fold)  
The CV of the standard control wells was 6.3%. (Must be ≤20%)

**Statistics:** See Data Analysis section.  
Mann-Kendall trend analysis was not performed as the control CV was <10%

**Reference toxicant:** 72-h test with Zinc ( $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ ) initiated August 16, 2016; current results  
(72-h IC25 and 95% confidence limits) = 1.52 (1.51-1.54) log ( $\mu\text{g Zn}^{2+}/\text{L}$ )  
historical results:  
(72-h IC25 and 95% confidence limits) = 1.44 (1.20-1.68) log ( $\mu\text{g Zn}^{2+}/\text{L}$ )

The reference toxicant test was performed under the same conditions as those used during this test.

Note: Outlined sections are protocol deviations explained on the comment page

## Test Data

Client: GAL100 Reference: 16-0965-01-AGD
---

### Test Log:

Date	Day	Technician	Time	Rotated	Temperature (°C)
2016/08/06	0	ML	1545	N/A	25
2016/08/07	1	JW	0800	Yes	25
2016/08/08	2	EP	1400	Yes	25
2016/08/09	3	EP	1505	Yes	25

### pH Measurements:

Initial cell density (cells/mL): 9702

Concentration	Initial Value	Final Value
100%	7.5	-
control (well D6)	7.3	-
control (well D7)	-	7.5

### Standard Control Well Final Cell Densities (D Row):

Column	Final Cell Density (x10 <sup>3</sup> cells/mL)	Cell Yield (x10 <sup>3</sup> cells/mL)
2	251	242
3	263	254
4	245	236
5	263	254
8	245	236
9	215	206
10	251	242
11	245	236
Average	-	238
SD	-	15
CV (%)	-	6.3
Fold Growth (x)		25

### Test Well Final Cell Densities:

Concentration (%)	Calculated Final Cell Density (x10 <sup>3</sup> cells/mL)				
	Row				
	B	C	E	F	G
0.2	-	-	-	-	-
0.4	-	-	-	-	-
0.7	-	-	-	-	-
1.4	-	-	-	-	-
2.8	251	263	227	*	*
5.7	239	245	239	*	*
11	245	245	257	*	*
23	257	263	275	*	*
46	365	359	371	*	*
91	269	299	287	*	*

### Cell Yield Results:

Concentration (%)	Cell Yield (x10 <sup>3</sup> cells/mL)						Percent Controls	Inhibition (%)	Stimulation (%)		
	Row					Mean				SD	CV (%)
	B	C	E	F	G						
0.2	-	-	-	-	-	-	-	-	-		
0.4	-	-	-	-	-	-	-	-	-		
0.7	-	-	-	-	-	-	-	-	-		
1.4	-	-	-	-	-	-	-	-	-		
2.8	242	254	218	*	*	<b>238</b>	18	8	100	0	0
5.7	230	236	230	*	*	<b>232</b>	3	1	97	3	-3
11	236	236	248	*	*	<b>240</b>	7	3	101	-1	1
23	248	254	265	*	*	<b>256</b>	9	4	107	-7	7
46	355	349	361	*	*	<b>355</b>	6	2	149	-49	49
91	260	289	277	*	*	<b>275</b>	15	5	116	-16	16

\*see test result comments

### Test Validity Criteria:

Control growth was a 25-fold increase over the inoculum. (Must be >16-fold)
The CV of the standard control wells was 6.3%. (Must be ≤20%)
Mann-Kendall trend analysis was not performed as the control CV was <10%



# Algae Test Report

## Comments/Statistics

Client: GAL100 Reference: 16-0965-01-AGD
---

### Test Result Comments:

Electronic enumeration using a Beckman-Coulter particle counter was performed on the same day as test termination. A minimum of 3 replicates were enumerated for each concentration. Additional replicates were enumerated for concentrations with high variability between replicates.

Only six concentrations were enumerated as inhibitory effects did not occur.

### Data Analysis:

Significant stimulatory effects in growth were observed in the 46 and 91% concentrations as calculated by ANOVA analysis with CETIS v. 1.9.0.8. (Fligner-Wolfe).

Endpoints for growth inhibition could not be calculated. Inhibitory effects did not occur.

### Protocol Deviations:

None

**Result Summary**

Client: GAL100
Reference: 16-0965-01-CDD

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES1

**Collection:** collected on 2016/08/03 at 0829 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

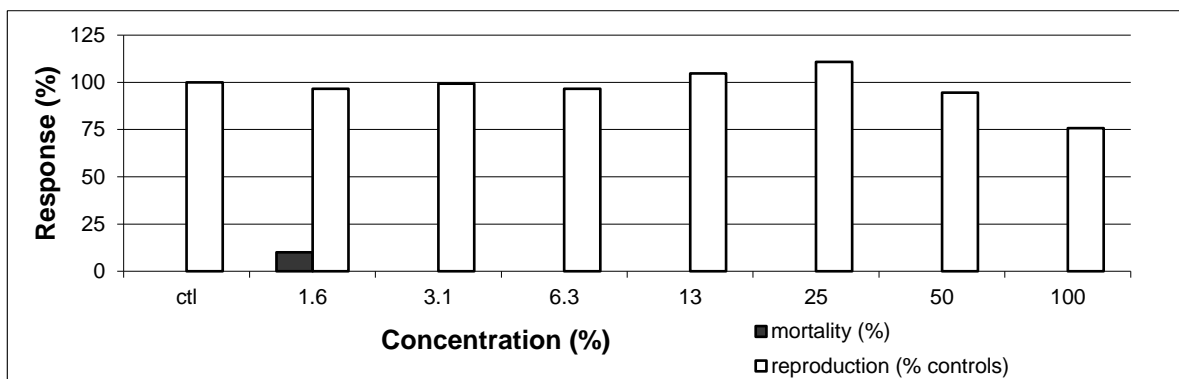
**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/07

**Result:**

	Endpoint (7-day)	Value	Confidence Limits (95%) lower      upper		Units	Method Calculated
Acute: (survival)	LC50	>100			%	could not be calculated
Chronic: (fecundity)	IC25	99	43	na	%	Linear Interpolation

Notes: LCx & ICx, concentrations lethal or inhibitory to 'x' percent of the test population; fecundity, reproduction as the number of young produced



The test data and results are authorized and verified correct.



Senior Verifier

**Test Conditions**

Client: GAL100 Reference: 16-0965-01-CDD
---

**Method:** Biological Test method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia*. Environment Canada, EPS 1/RM/21, 2nd Edition, February 2007.

**Test type:** *Ceriodaphnia* Survival and Reproduction Static Renewal Test (WTR-ME-018)

**Species:** *Ceriodaphnia dubia*

**Age:** <24 hours old; all from same brood source within 12 hours of the same age.

**Organism source:** in-house cultures; cultures from a single brood organism to provide test organisms.

**Culture health:** Culture mortality was 8% (must be  $\leq$  20%).

**7-d prior to test initiation:** No ephippia were noted in the cultures at any time.

Average young produced per adult in the first three broods was 20 (must be  $\geq$  15)

Number of young produced by each brood organism in the last complete brood before use was 9 (must be  $\geq$  8).

**Organism observations:** No unusual behavior, appearance or treatment of test organisms was noted prior to or during the test. All first-generation mortality was recorded on the day it was observed.

**Sample initial chemistry:** pH: 7.0; EC: 78 ( $\mu$ S/cm); DO: 7.2 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 26; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq$  3 days); The test was conducted with three subsamples samples a, b, and c were for days 0 to 2, 3 to 4, and 5 to 7 respectively

**Sample storage:** 4  $\pm$  2°C in darkness

**Test vessel:** The tests were conducted in 30 mL plastic vessels (2 cm depth).

**Test volume:** 15 mL of solution (1 cm depth); replenished daily.

**Control/dilution water:** Moderately hard water (20% Perrier) supplemented with vitamin B12 (2  $\mu$ g/L) and Na<sub>2</sub>SeO<sub>4</sub> (5  $\mu$ g/L).

**Test concentrations:** 7 effluent concentrations (1.6, 3.1, 6.3, 13, 25, 50, 100% (v/v) plus a negative control)

**Test replicates:** One neonate <24 hours old was loaded per test vessel;  
10 replicates/concentration

**Feeding:** The test organisms were fed daily a mixture of fermented trout chow, yeast, Cerophyll, and the green alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum* and *Raphidocelis subcapitata*).

Food expiration date: 2016/08/28

**Measurements:** pH, conductivity, dissolved oxygen and temperature were measured daily.

**Sample pre-treatment:** The sample was not filtered, aerated, or pH adjusted prior to or during testing.

The dissolved oxygen concentration (mg/L) was: 7.3

The sample pH was: 7.7

**Lighting:** Overhead full spectrum fluorescent lights

**Photoperiod:** 16h light:8h dark

**Test temperature:** 25  $\pm$  1°C

Note: Outlined sections are protocol deviations explained on the comment page

**Test Conditions**

Client: GAL100 Reference: 16-0965-01-CDD
---

**Endpoints:** Survival, 7-d LC50 (with 95% confidence limits)  
Reproduction, 7-d IC25 (with 95% confidence limits)  
Test endpoints were bracketed by at least 1 test concentration  
(except for <1.6% or >100 %)  
No outliers were observed within the data set.

**Test completion:** 90% of the control organisms had  $\geq 3$  broods on day 7 (must be  $\geq 60\%$  within 8 days) Any neonates produced after third brood were not included in the mean young per adult calculation.

**Test validity:** The control had 100% survival (must  $\geq 80\%$ )  
Number of young produced by each surviving control adult within the first three broods was 15 (must be  $\geq 15$ ).

**Reference toxicant:** 7-d test with NaCl initiated on July 26, 2016;  
(must be evaluated within 14 days before or after test is started or during it)  
current results: (7-d LC50 and 95% confidence limits) =  
3.09 (3.00-3.17) log (mg/L NaCl)  
historical results: (7-d LC50 and 95% confidence limits)=  
3.15 (3.06-3.24) log (mg/L NaCl)  
current results: (7-d IC50 and 95% confidence limits) =  
3.10 (3.06-3.13) log (mg/L NaCl)  
historical results: (7-d IC50 and 95% confidence limits)=  
3.11 (3.05-3.17) log (mg/L NaCl)  
The reference toxicant test was performed under the same conditions as those used during this test.

Note: Outlined sections are protocol deviations explained on the comment page



# Ceriodaphnia (6-8d LC50/IC25) Test Report

## Test Data

Client: GAL100  
Reference: 16-0965-01-CDD

### Test Log:

Date	Day	Time	Technicians
2016/08/06	0	1430	EP
2016/08/07	1	0930	JN
2016/08/08	2	0935	JN
2016/08/09	3	1050	JW
2016/08/10	4	0825	ML
2016/08/11	5	1500	JW
2016/08/12	6	1130	EP
2016/08/13	7	1350	LC

### Chemistry Summary Tables:

Conc. %	New Solutions								Old Solutions							
	ctl	1.6	3.1	6.3	13	25	50	100	ctl	1.6	3.1	6.3	13	25	50	100

#### Average Values

pH	7.9	8.0	8.0	8.0	8.0	8.0	7.9	7.8	8.0	8.1	8.1	8.1	8.1	8.1	8.0	7.9
cond.	211	215	207	207	200	182	157	87	219	231	232	220	217	200	165	111
DO	7.3	7.3	7.4	7.4	7.4	7.3	7.4	7.4	7.4	7.3	7.4	7.4	7.4	7.4	7.3	7.3
temp.	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

#### Coefficients of Variation (%)

pH	1	2	2	1	1	1	1	2	1	1	1	1	1	1	1	1
cond.	7	5	9	4	6	7	5	20	7	5	5	5	5	8	6	7
DO	3	3	3	3	3	3	2	4	2	2	2	1	2	2	2	2
temp.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2



**Test Data**

Client: GAL100
Reference: 16-0965-01-CDD

**Biology (number of young produced):**

Day	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Replicate

	Control							
1	0	0	0	0	4	6	10	
2	0	0	0	3	5	0	7	
3	0	0	0	2	6	7	-	
4	0	0	0	2	6	5	-	
5	0	0	0	2	5	9	-	
6	0	0	0	0	4	4	0	
7	0	0	0	0	5	6	8	
8	0	0	0	2	5	6	-	
9	0	0	0	4	0	5	6	
10	0	0	0	2	0	5	7	

	13%							
1	0	0	0	3	0	8	6	
2	0	0	0	4	7	0	7	
3	0	0	0	3	5	0	9	
4	0	0	0	3	5	0	6	
5	0	0	0	2	6	0	7	
6	0	0	0	0	5	7	6	
7	0	0	0	0	4	7	10	
8	0	0	0	4	5	0	0	
9	0	0	0	3	4	0	8	
10	0	0	0	0	5	6	0	

	1.6%							
1	0	0	0	0	5	7	6	
2	0	0	0	3	6	0	7	
3	0	0	0	5	6	0	7	
4	0	0	0	3	<b>0</b>	X	X	
5	0	0	0	2	4	0	8	
6	0	0	0	0	4	6	10	
7	0	0	0	0	5	6	0	
8	0	0	0	3	5	6	-	
9	0	0	0	4	0	6	0	
10	0	0	0	0	6	6	7	

	25%							
1	0	0	0	2	6	0	9	
2	0	0	0	3	6	0	8	
3	0	0	0	2	0	3	5	
4	0	0	0	3	0	8	7	
5	0	0	0	2	6	0	10	
6	0	0	0	3	0	7	9	
7	0	0	0	0	3	5	8	
8	0	0	0	3	7	0	8	
9	0	0	0	2	6	0	9	
10	0	0	0	0	4	10	0	

	3.1%							
1	0	0	0	3	0	5	8	
2	0	0	0	3	6	0	7	
3	0	0	0	3	7	0	8	
4	0	0	0	4	0	8	5	
5	0	0	0	2	4	0	8	
6	0	0	0	0	4	7	0	
7	0	0	0	0	6	7	6	
8	0	0	0	4	0	6	0	
9	0	0	0	2	5	0	0	
10	0	0	0	0	5	5	9	

	50%							
1	0	0	0	0	7	0	5	
2	0	0	0	3	8	0	8	
3	0	0	0	3	5	0	9	
4	0	0	0	2	4	3	-	
5	0	0	0	0	8	0	9	
6	0	0	0	0	3	6	6	
7	0	0	0	0	4	9	7	
8	0	0	0	3	5	0	7	
9	0	0	0	0	5	0	7	
10	0	0	0	0	4	0	0	

Notes: #, young produced; 0, no young; X, dead; bold #, number of young the test organism had the day it died; —, young produced after third brood



# Ceriodaphnia (6-8d LC50/IC25) Test Report

## Test Data

Client: GAL100  
Reference: 16-0965-01-CDD

### Biology (number of young produced):

Day	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
-----	---	---	---	---	---	---	---	---	--	---	---	---	---	---	---	---	---

Replicate

6.3%

1	0	0	0	2	5	0	7	
2	0	0	0	3	0	8	6	
3	0	0	0	2	4	6	-	
4	0	0	0	2	5	5	-	
5	0	0	0	0	6	6	0	
6	0	0	0	4	0	7	10	
7	0	0	0	2	3	0	10	
8	0	0	0	4	0	7	4	
9	0	0	0	3	4	6	-	
10	0	0	0	2	5	0	5	

100%

0	0	0	3	0	3	4	
0	0	0	2	6	0	9	
0	0	0	0	6	0	10	
0	0	0	0	7	0	9	
0	0	0	0	5	0	6	
0	0	0	0	4	5	0	
0	0	0	0	3	6	0	
0	0	0	3	0	5	0	
0	0	0	0	4	3	0	
0	0	0	0	0	4	5	

Notes: #, young produced; 0, no young; X, dead; bold #, number of young the test organism had the day it died;  
—, young produced after third brood

### Biology Summary Tables:

Conc. %	ctl	1.6	3.1	6.3	13	25	50	100
---------	-----	-----	-----	-----	----	----	----	-----

ctl	1.6	3.1	6.3	13	25	50	100
-----	-----	-----	-----	----	----	----	-----

Day

Number of Organism Alive

0	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10
5	10	9	10	10	10	10	10	10
6	10	9	10	10	10	10	10	10
7	10	9	10	10	10	10	10	10
8								

Day

Daily Young Production

0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	17	20	21	24	22	20	11	8
5	40	41	37	32	46	38	53	35
6	53	37	38	45	28	33	18	26
7	38	45	51	42	59	73	58	43
8								

Percent Mortality (%)

mean	0	10	0	0	0	0	0	0
------	---	----	---	---	---	---	---	---

Total	148	143	147	143	155	164	140	112
-------	-----	-----	-----	-----	-----	-----	-----	-----

Replicate

Total Young Produced by Each Adult

1	20	18	16	14	17	17	12	10
2	15	16	16	17	18	17	19	17
3	15	18	18	12	17	10	17	16
4	13	3	17	12	14	18	9	16
5	16	14	14	12	15	18	17	11
6	8	20	11	21	18	19	15	9
7	19	11	19	15	21	16	20	9
8	13	14	10	15	9	18	15	8
9	15	10	7	13	15	17	12	7
10	14	19	19	12	11	14	4	9

Young Per Adult (within first three broods)

mean	15	14	15	14	16	16	14	11
sd	3.33	5.19	4.11	2.91	3.54	2.63	4.88	3.71
cv(%)	22.5	36.3	28	20.3	22.8	16.1	34.8	33.1

Young Production as a Percent of Controls

100	97	99	97	105	111	95	76
-----	----	----	----	-----	-----	----	----



# Ceriodaphnia (6-8d LC50/IC25) Test Report

## Test Data

Client: GAL100  
Reference: 16-0965-01-CDD

### Chemistry:

#### New Solutions

Conc. %	ctl	1.6	3.1	6.3	13	25	50	100
---------	-----	-----	-----	-----	----	----	----	-----

#### Old Solutions

ctl	1.6	3.1	6.3	13	25	50	100
-----	-----	-----	-----	----	----	----	-----

Day

pH (units)

0	8.0	8.1	8.1	8.1	8.1	8.1	7.9	7.7
1	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.6
2	7.9	7.9	8.0	8.0	8.0	8.0	8.0	7.8
3	8.0	8.1	8.1	8.1	8.1	8.1	8.0	8.0
4	7.8	7.9	7.9	8.0	8.0	8.0	7.9	7.9
5	8.0	8.1	8.1	8.1	8.1	8.0	8.0	7.8
6	8.1	8.1	8.1	8.1	8.1	8.0	8.0	7.8
7								
8								

pH (units)

8.0	8.0	8.0	8.0	8.0	8.0	7.9	7.8	
8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.0	
8.0	8.1	8.1	8.1	8.1	8.1	8.0	7.9	
8.0	8.0	8.1	8.1	8.1	8.0	8.0	7.8	
8.0	8.0	8.1	8.1	8.1	8.0	8.0	7.8	
8.1	8.2	8.2	8.2	8.1	8.1	8.0	7.8	
8.1	8.1	8.2	8.2	8.2	8.1	8.1	8.0	

Conductivity (µS/cm)

0	201	211	206	202	196	179	150	62
1	206	207	206	200	192	178	150	63
2	199	206	171	199	182	160	149	92
3	198	207	207	203	196	180	156	97
4	216	227	222	219	213	183	164	101
5	225	225	226	218	212	195	166	100
6	235	225	213	211	211	196	161	96
7								
8								

Conductivity (µS/cm)

207	219	218	212	205	188	159	99	
199	221	220	210	204	186	158	107	
204	224	225	210	208	188	150	106	
218	232	240	226	219	203	173	120	
232	252	246	235	236	232	179	121	
234	238	240	222	222	198	165	111	
236	233	233	228	223	205	174	116	

Dissolved Oxygen (mg/L)

0	7.5	7.5	7.5	7.4	7.4	7.4	7.4	7.3
1	7.3	7.3	7.4	7.4	7.4	7.5	7.5	7.9
2	7.1	7.1	7.2	7.2	7.2	7.2	7.3	7.6
3	7.2	7.2	7.3	7.2	7.3	7.2	7.2	7.1
4	7.0	7.2	7.2	7.4	7.4	7.3	7.3	7.3
5	7.6	7.7	7.9	7.8	7.8	7.7	7.6	7.4
6	7.3	7.4	7.2	7.1	7.2	7.1	7.2	7.2
7								
8								

Dissolved Oxygen (mg/L)

7.3	7.3	7.4	7.4	7.3	7.4	7.4	7.3	
7.3	7.3	7.4	7.4	7.4	7.4	7.4	7.3	
7.2	7.1	7.2	7.2	7.2	7.2	7.2	7.1	
7.3	7.3	7.3	7.4	7.3	7.3	7.2	7.1	
7.5	7.5	7.5	7.5	7.6	7.6	7.5	7.6	
7.4	7.4	7.5	7.5	7.4	7.4	7.3	7.3	
7.5	7.5	7.5	7.5	7.4	7.5	7.4	7.4	

Temperature (°C)

0	25	25	25	25	25	25	25	25
1	25	25	25	25	25	25	25	25
2	25	25	25	25	25	25	25	25
3	25	25	25	25	25	25	25	25
4	24	24	24	24	24	24	24	24
5	25	25	25	25	25	25	25	25
6	25	25	25	25	25	25	25	25
7								
8								

Temperature (°C)

25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	
24	24	24	24	24	24	24	24	
25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	



**Ceriodaphnia  
(6-8d LC50/IC25)  
Test Report**

**Comments/Statistics**

Client: GAL100
Reference: 16-0965-01-CDD

**Test Result Comments:**

None

**Data Analysis:**

Endpoints for mortality could not be calculated. No effect occurred.

Regression analysis was attempted on the data, but the assumptions of normality and homoscedasticity of residuals were not met. Therefore, endpoints for reproduction were calculated using a Linear Interpolation model using CETIS v. 1.9.0.8

**Protocol Deviations:**

Three separate subsamples were not submitted for analysis. Three subsamples were created at the lab upon receipt, samples a, b, and c were for days 0 to 2, 3 to 4, and 5 to 7 respectively.



**Quality Assurance Information**

**Culture history for adults used in the test for reference 16-0965:**

**Number of young produced per brood adult:**

(Note: The third brood per adult may be on the day the test is set)

row/replicate	A6	A8	A11	C6	D6	D8	E6	E7	E8		
---------------	----	----	-----	----	----	----	----	----	----	--	--

number of young											
number of adults											

	A6	A8	A11	C6	D6	D8	E6	E7	E8		
number of young											
number of adults											

	A6	A8	A11	C6	D6	D8	E6	E7	E8		
number of young											
number of adults											

	A6	A8	A11	C6	D6	D8	E6	E7	E8		
number of young	4	4	6	4	4	2	4	4	4		
number of adults	1	1	1	1	1	1	1	1	1		

	A6	A8	A11	C6	D6	D8	E6	E7	E8		
number of young	6	7	7	9	8	7	9	8	8		
number of adults	1	1	1	1	1	1	1	1	1		

	A6	A8	A11	C6	D6	D8	E6	E7	E8		
number of young	8	7	10	9	8	9	8	7	7		
number of adults	1	1	1	1	1	1	1	1	1		

DAY USED	A6	A8	A11	C6	D6	D8	E6	E7	E8		
2016/08/06	9	9	10	10	11	8	10	9	8		
	1	1	1	1	1	1	1	1	1		

	A6	A8	A11	C6	D6	D8	E6	E7	E8		
totals	18	18	23	22	20	18	21	19	19		
(# of young in first 3 broods)											

Number of young produced per organism in the last brood before use 9

Mean number of surviving young per adult over the first three broods 20

Culture mortality over the last seven days 8

**Result Summary**

Client: GAL100 Reference: 16-0965-01-LMD
---

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES1

**Collection:** collected on 2016/08/03 at 0829 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/13

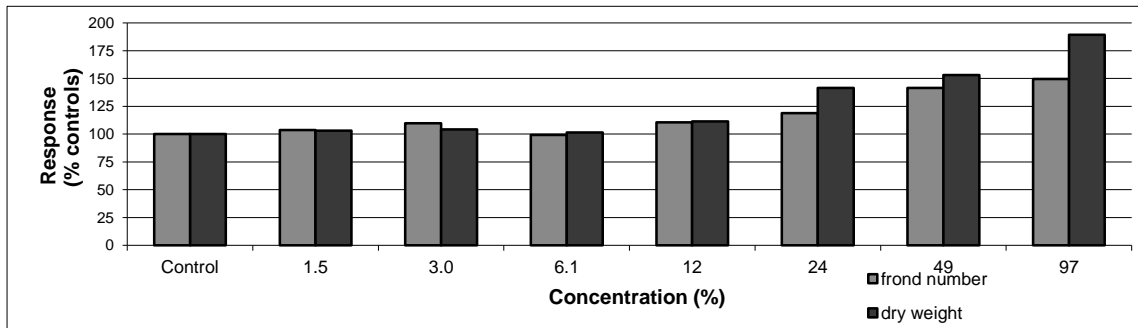
**Result:**

	Endpoint (7-day)	Value	Confidence Limits (95%) lower upper	Units	Method Calculated
<b>Chronic:</b>					
Fronde Number Inhibition	IC25	>97		%	could not be calculated
Dry Weight Inhibition	IC25	>97		%	could not be calculated

Notes: ICx, concentrations lethal or inhibitory to 'x' percent of the test population;

	Stimulation Observed	Test Concentrations	Units	Method Calculated
<b>Chronic:</b>				
Fronde Number Stimulation	yes	91, 46, 24	%	Dunnett Multiple Comparison
Dry Weight Stimulation	yes	91, 46, 24	%	Dunnett Multiple Comparison

Notes: Stimulation refers to increased response at all concentrations or at high concentrations



The test data and results are authorized and verified correct.



Senior Verifier

## Test Conditions

Client: GAL100 Reference: 16-0965-01-LMD
---

**Method:** Biological Test Method: Test for Measuring the Inhibition of Growth Using the Freshwater Macrophyte, *Lemna minor*. Environment Canada, EPS 1/RM/37 2nd Edition, January 2007

**Test type:** *Lemna* 7-d Inhibition of Growth Static Test (WTR-ME-030)

**Species:** *Lemna minor*

**Organism source:** in-house culture,  $\geq 3$  weeks in age (original source: UTCC 492, clone 7730)

**Culture health:** The fronds were acclimated in test media ( $\geq 2$ cm) for 48 hours prior to test initiation.

The test culture was axenic prior to testing.

There was an 11 fold increase in frond number of culture over last 7 days.

Test loaded with 3 frond daughter plants, all with light green fronds and short roots.

**Culture age:** The test was started with 9 day old fronds.

**Culture media:** modified Hoagland's E+ medium

**Organism observation:** No unusual behaviour, appearance or treatment of test organisms was noted prior to or during the test.

**Sample initial chemistry:** pH: 7.0; EC: 78 ( $\mu$ S/cm); DO: 7.2 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 26; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq 3$  days)

**Sample storage:** 4  $\pm$  2°C in darkness

**Test vessel:** The test was a static test conducted in 200 mL polyethylene plastic containers with clear lids. Test vessel size is adequate to ensure no overlapping of fronds occurs.

**Test volume:** The test volume was 150 mL, depth of  $\geq 4$  cm

**Test concentrations:** 7 effluent concentrations (1.5, 3.0, 6.1, 12.1, 24, 49, 97% (v/v) plus a negative control)

**Test replicates:** There were four replicates per treatment with two 3 frond daughter plants per replicate; replicates are randomly rotated daily.

**Control/dilution water:** Test media (modified APHA medium) made up with deionized City of Calgary water water spiked with nutrients as per Environment Canada EPS 1/RM/37, 2007. made by adding 60 mL of each of the three stock solutions to 5.82 L of DRO  
The media aerated for 2 hours and was pH adjusted to 8.3  $\pm$  0.1 with 6N HCl or NaOH.  
The test media was not filtered.

**Elutriate preparation:** 2016/08/06

**Sample pre-treatment:** 1455 mL of sample spiked with 15 mL of each of the three APHA stock solutions, no other chemicals added. The sample was not pH adjusted or filtered prior to testing.

**Aeration:** The sample was pre-aerated for 20 minutes at a rate of 100 bubbles/minute with oil free filtered compressed air from a 1 mL glass pipette attached to an air pump.

Note: Outlined sections are protocol deviations explained on the comment page

**Test Conditions**

Client: GAL100
Reference: 16-0965-01-LMD

**Lighting:** The cups were incubated under continuous full-spectrum light. The light levels were measured at the sample surface, at three locations on the testing bench, during testing:

left:	4810	lux	≈	77	μmol/m <sup>2</sup> •S
centre:	4570	lux	≈	73	μmol/m <sup>2</sup> •S
right:	4070	lux	≈	65	μmol/m <sup>2</sup> •S

**Measurements:**

pH, conductivity, dissolved oxygen and temperature at test initiation and termination; temperature in the control, low, middle and high concentrations are recorded daily.

**Test temperature:** 25 ± 2°C

**Endpoint:** Growth (based on increase in frond number), 7-d IC25 (with 95% confidence limits)  
Growth (based on dry weight), 7-d IC25 (with 95% confidence limits)  
Test endpoints were bracketed by at least 1 test concentration.  
(except for <1.5% or >97 %)

No outliers were observed within the data set

**Test validity:** The mean number of fronds in the controls have increased 12 times (must be ≥ 8 time increase). The average number attained at test termination was 75 (must be ≥48 fronds per test vessel).

**Reference toxicant:** 7-d test with Potassium Chloride (KCl) initiated August 4, 2016;

current results:

(Frond Number; 7-d IC25 and 95% confidence limits) = 3.41 (3.32-3.46) log(mg KCl/L)

Historical results:

(Frond Number, 7-d IC25 and 95% confidence limits) = 3.31 (3.10-3.52) log(mg KCl/L)

current results:

(Dry Weight; 7-d IC25 and 95% confidence limits) = 3.49 (3.30-3.62) log (mg KCl/L)

Historical results:

(Dry Weight; 7-d IC25 and 95% confidence limits) = 3.57 (3.25-3.89) log (mg KCl/L)

The reference toxicant test was performed under the same conditions as those used during this test .

Note: Outlined sections are protocol deviations explained on the comment page



**Test Data**

Client: GAL100
Reference: 16-0965-01-LMD

**Test Log:**

Date	Day	Time	Technicians	Rotate	Temperature (°C)			
					Control	3.0%	24%	97%
2016/08/06	0	1455	ML	na	26	26	26	26
2016/08/07	1	0800	JW	yes	25	25	25	25
2016/08/08	2	0800	EP	yes	25	25	25	25
2016/08/09	3	0815	LC	yes	25	25	25	25
2016/08/10	4	0815	LC	yes	25	25	25	25
2016/08/11	5	0810	JW	yes	25	25	25	25
2016/08/12	6	0930	LC	yes	25	25	25	25
2016/08/13	7	0750	JP	na	25	25	25	25

**Chemistry:**

Conc.(%)	Control	1.5	3.0	6.1	12	24	49	97
----------	---------	-----	-----	-----	----	----	----	----

Day 0

pH	8.3	8.4	8.4	8.4	8.4	8.4	8.3	8.3
cond.	780	870	887	903	914	930	957	1034
DO	7.5	7.5	7.5	7.5	7.4	7.4	7.4	7.4
temp.	26	26	26	26	26	26	26	26

Day 7

pH	8.7	8.7	8.6	8.8	8.7	8.6	8.6	8.6
cond.	976	1003	1014	1054	1061	1084	1092	1178
DO	9.2	9.3	9.2	9.1	9.4	9.1	8.9	8.8
temp.	25	25	25	25	25	25	25	25

Notes: pH, units; cond., conductivity (µS/cm); DO, dissolved oxygen (mg/L); temp., temperature (°C)

**FronD Appearance:**

Concentration (%)	Day 0	Day 7
Control	green, short roots, healthy	medium green, long roots, healthy
1.5	green, short roots, healthy	medium green, long roots, healthy
3.0	green, short roots, healthy	medium green, long roots, healthy
6.1	green, short roots, healthy	medium green, long roots, healthy
12.1	green, short roots, healthy	medium green, long roots, healthy
24	green, short roots, healthy	medium green, long roots, healthy
49	green, short roots, healthy	medium green, long roots, healthy
97	green, short roots, healthy	medium green, long roots, healthy

Notes: chl, chlorotic; nec, necrotic; asf, abnormally sized fronds; gib, gibbosity; cd, colony destroyed; rd, roots destroyed; lb, loss of buoyancy; ag, algae

**Test Data**

Client: GAL100
Reference: 16-0965-01-LMD

**FronD number:**

Conc.(%)	Control	1.5	3.0	6.1	12.1	24	49	97
----------	---------	-----	-----	-----	------	----	----	----

Replicate

Day 0

a	6	6	6	6	6	6	6	6
b	6	6	6	6	6	6	6	6
c	6	6	6	6	6	6	6	6
d	6	6	6	6	6	6	6	6

Day 7

a	72	77	85	73	80	85	90	106
b	77	75	75	71	80	75	108	105
c	68	71	81	72	79	93	106	110
d	82	86	85	81	89	98	109	114

average	75	77	82	74	82	88	103	109
fold increase	12	13	14	12	14	15	17	18

**Increase in FronD Number Compared to the Control:**

a	66	71	79	67	74	79	84	100
b	71	69	69	65	74	69	102	99
c	62	65	75	66	73	87	100	104
d	76	80	79	75	83	92	103	108

average	69	71	76	68	76	82	97	103
sd	6	6	5	5	5	10	9	4
cv	9	9	6	7	6	12	9	4
% ctls	100	104	110	99	111	119	141	149
% stim	0	4	10	-1	11	19	41	49

**Total Dry Weights (mg):**

Conc.(%)	Control	1.5	3.0	6.1	12.1	24	49	97
----------	---------	-----	-----	-----	------	----	----	----

Replicate

Day 7

a	5.7	5.6	7.8	5.1	6.6	7.5	7.6	9.8
b	6.7	5.8	5.8	5.2	6.2	7.2	10.1	10.1
c	5.6	7.1	5.8	6.6	7.0	9.7	8.5	13.3
d	6.3	6.4	5.9	7.7	7.1	9.9	10.9	12.7

Day 7

average	6.1	6.2	6.3	6.1	6.7	8.6	9.3	11.5
sd	0.5	0.7	1.0	1.3	0.4	1.4	1.5	1.8
cv	8	11	16	20	6	16	16	16
%ctls	100	103	104	101	111	141	153	189
% stim	0	3	4	1	11	41	53	89

Notes: cv, coefficient of variation; %ctls, percent of controls; sd, standard deviation, % stim, percent stimulation

**Comments/Statistics**

Client: GAL100 Reference: 16-0965-01-LMD
---

**Test Result Comments:**

None

**Data Analysis:**

Endpoints for frond number could not be calculated. No inhibitory effect occurred.

Endpoints for dry weight could not be calculated. No inhibitory effect occurred.

Significant stimulatory effects in frond number were observed in the 24, 46 and 91% concentrations as calculated by ANOVA analysis with CETIS v. 1.9.0.8. (Dunnett Multiple Comparison).

Significant stimulatory effects in dry weight were observed in the 24, 46, and 91% concentrations as calculated by ANOVA analysis with CETIS v. 1.9.0.8 (Dunnett Multiple Comparison).

**Protocol Deviations:**

Due to a shipping delay, fronds were acclimated for >24 hours prior to testing.

## Result Summary

Client: GAL100
Reference: 16-0965-01-TRS

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES1

**Collection:** collected on 2016/08/03 at 0829 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

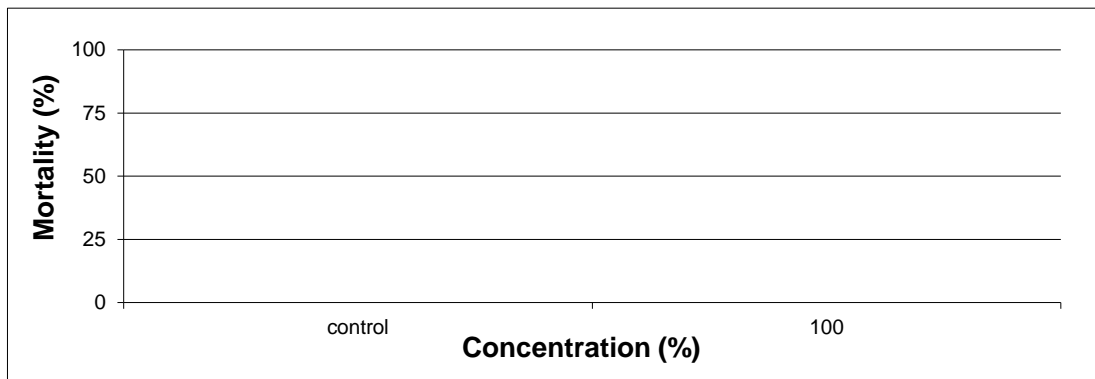
**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/10

**Result:**

Sample	Client Code	Mortality (%)	Comment
control	lab control	0	
100%	LJ-ES1	0	none



The test data and results are authorized and verified correct.



Senior Verifier

## Test Conditions

Client: GAL100 Reference: 16-0965-01-TRS
---

**Method:** Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout, 2000. Environment Canada, EPS 1/RM/13. Second Edition (2000; amended May 2007 and February 2016).

**Test type:** Trout 96-h Static Acute Test (WTR-ME-041)

**Species:** *Oncorhynchus mykiss*

**Organism source:** Miracle Springs (Batch 20160706TR)

**Acclimation:** 31 days (must be  $\geq 2$  weeks)

**Stock mortality:** 0% (seven days preceding testing)

**Sample initial chemistry:** pH: 7.0; EC: 78 ( $\mu\text{S}/\text{cm}$  @ 25°C); DO: 7.2 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 26; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq 5$  days)

**Sample storage:** 4  $\pm$  2°C in darkness

**Test vessel:** The test was conducted in 22 L plastic pails with polyethylene liners

**Test volume:** 19 Litres (depth of solution in each test vessel  $\geq 15\text{cm}$ )

**Sample pre-treatment:** All test solutions and controls were pre-aerated for 30 minutes at 6.5  $\pm$  1 mL/min/L  
Dissolved oxygen in full strength sample was 7.6 mg/L after pre-aeration  
The sample was not filtered or pH adjusted prior to or during testing

**Loading density:** 0.189 g/Litre (must be  $\leq 0.5$  g/Litre)

**Control water:** Dechlorinated City of Calgary water acclimated to test conditions

**Test concentrations:** Undiluted sample plus a negative control

**Test replicates:** One replicate per treatment; 10 fish per replicate

**Feeding:** Fish are not fed 24 hours before test initiation and no feeding during test

**Measurements:** pH, conductivity, dissolved oxygen and temperature measured at test initiation and termination

**Aeration:** All treatments aerated at 6.5  $\pm$  1 mL/min/L by oil-free compressed air passed through airline tubes connected to disposable air stones

**Lighting:** Overhead full spectrum fluorescent lights

**Photoperiod:** 16h light:8h dark

**Test temperature:** 15  $\pm$  1°C

**Endpoint:** Mortality, % mortality at 96-h

**Test validity:** The control had 100% survival (must  $\geq 90\%$ )

The control had 0 percent (%) stressed behaviour (must  $\leq 10\%$ )

**Reference toxicant:** 96-h test with Potassium Chloride (KCl) initiated July 20, 2016; current results  
(96-h LC50 and 95% confidence limits) = 0.47 (0.38-0.53) log (g/L KCl)  
historical results:  
(96-h LC50 and 95% confidence limits) = 0.52 (0.37-0.68) log (g/L KCl)

Note: Outlined sections are protocol deviations explained on the comment page; v/v, volume per volume



# Trout (Single Concentration) Test Report

## Test Data

Client: GAL100
Reference: 16-0965-01-TRS

### Test Log:

Date	Day	Time	Technician
2016/08/06	0	1330	EP
2016/08/07	1	1005	JN
2016/08/08	2	0750	JW
2016/08/09	3	0845	LC
2016/08/10	4	1025	LC

### Chemistry:

Conc. (%)	control	100
-----------	---------	-----

Day

	pH (units)	
0	7.6	7.5
4	7.6	7.5

Conductivity ( $\mu\text{S}/\text{cm}$  @ 25°C)

0	471	86
4	471	89

Dissolved Oxygen (mg/L)

0	8.0	7.6
4	8.9	8.9

Temperature (°C)

0	16	16
4	14	14

### Number Alive (In brackets number stressed):

Conc. (%)	control	100
-----------	---------	-----

Day

0	10	10
1	10	10
2	10	10
3	10	10
4	10	10

Mortality (%)

4	0	0
---	---	---

Stressed (%)

4	0	0
---	---	---



# Trout (Single Concentration) Test Report

## Test Data

Client: GAL100
Reference: 16-0965-01-TRS

### Biology Summary Tables:

Control Fish	Length (cm)	Wet Weight(g)
1	3.4	0.4
2	3.1	0.3
3	3.2	0.4
4	3.3	0.4
5	3.1	0.3
6	3.0	0.3
7	3.2	0.4
8	3.2	0.4
9	3.1	0.4
10	3.0	0.3

Sample	Group Wet Weight (g)
control	3.6
100	3.5

average	3.2	0.4
sd	0.1	0.1
cv(%)	4.0	14.3

Notes: nd, not done; na, not applicable;  
sd, standard deviation; cv(%), coefficient of variation

## Comments/Statistics

### Test Result Comments:

None

### Data Analysis:

None

### Protocol Deviations:

None



**Result Summary**

Client: GAL100  
Reference: 16-0965-01-DAS

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES1

**Collection:** collected on 2016/08/03 at 0829 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condtion, but lids were slightly warped with seals and no initials

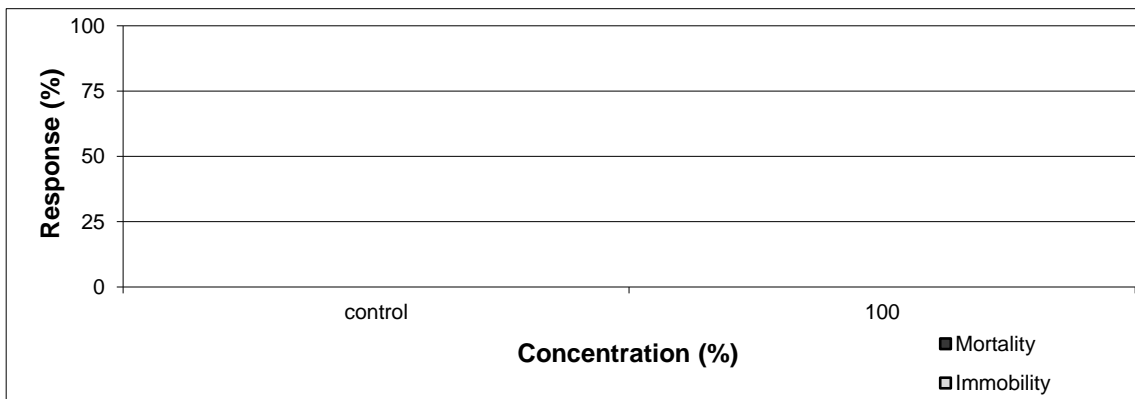
**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/08

**Result:**

Sample	Client Code	Average		Comment
		Mortality (%)	Immobility (%)	
control	lab control	0	0	
100	LJ-ES1	0	0	none

Notes: sd, sample standard deviation; cv, coefficient of variation; nd, not done; na, not applicable;



The test data and results are authorized and verified correct.

Senior Verifier



**Test Conditions**

Client: GAL100 Reference: 16-0965-01-DAS
---

**Method:** Biological Test method: Reference Method for Determining Acute Lethality of Effluents to *Daphnia magna*, 2000. Environ. Can., EPS 1/RM/14. Second Edition. (December 2000; amended February 2016)

**Test type:** *Daphnia* 48-h Static Acute Test (WTR-ME-015)

**Species:** *Daphnia magna*

**Age:** < 24 hours old

**Organism source:** in-house culture

**Stock mortality:** 0%

**Culture brood data:** 8 days to first brood  
23 neonates per average brood

**Sample initial chemistry:** pH: 7.0; EC: 78 ( $\mu\text{S}/\text{cm}$  @ 25°C); DO: 7.2 (mg/L); temperature: 21 °C  
hardness (mg  $\text{CaCO}_3/\text{L}$ ): 26; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq$  5 days)

**Sample storage:**  $4 \pm 2^\circ\text{C}$  in darkness

**Test vessel:** 385 mL plastic vessels

**Test volume:** 150 mL

**Sample pre-treatment:** The sample was not filtered or pH adjusted prior to or during testing  
The sample was pre-aerated for 0 minutes (rate of  $37.5 \pm 12.5$  mL/min.L-1)  
The hardness of the sample was not adjusted (mg  $\text{CaCO}_3/\text{L}$ ) prior to or during testing

**Loading density:** One daphnid/15 mL (must  $\leq$  1 organism/15 mL)

**Control water:** Moderately hard reconstituted water supplemented with vitamin B12 (2  $\mu\text{g}/\text{L}$ )  
and  $\text{Na}_2\text{SeO}_4$  (2  $\mu\text{g}/\text{L}$ )

The hardness of the control/dilution water was 85 mg  $\text{CaCO}_3/\text{L}$

**Test concentrations:** Undiluted sample plus a negative control

**Test replicates:** Three replicates per treatment, 10 daphnids per replicate

**Feeding:** None

**Aeration:** None

**Measurements:** pH, conductivity, dissolved oxygen and temperature at test initiation and termination

**Lighting:** Cool white fluorescent lights

**Photoperiod:** 16h light:8h dark

**Test temperature:**  $20 \pm 2^\circ\text{C}$

Note: Outlined sections are protocol deviations explained on the comment page



## Test Conditions

Client: GAL100 Reference: 16-0965-01-DAS
---

**Endpoint:** Mortality, % mortality at 48-h  
Immobility, % immobility at 48-h

**Test validity:** The control had 100% survival (must  $\geq$  90%)  
Control had 0% abnormal behaviour (must  $\leq$  10%), e.g. immobility

**Reference toxicant:** 48-h test with NaCl initiated August 15, 2016 current results  
(48-h LC50 and 95% confidence limits) = 0.67 (0.64-0.69) log (g/L NaCl)  
historical results:  
(48-h LC50 and 95% confidence limits) = 0.74 (0.64-0.83) log (g/L NaCl)

Note: Outlined sections are protocol deviations explained on the comment page



**Test Data**

Client: GAL100
Reference: 16-0965-01-DAS

**Test Log:**

Date	Day	Time	Technician
2016/08/06	0	1330	EP
2016-08-07	1	0930	JW
2016-08-08	2	1030	JW

**Chemistry:**

Conc (%)	control			100		
replicate	a	b	c	a	b	c

Day	pH (units)					
0	7.9	7.9	8.0	7.5	7.3	7.2
2	7.8	7.9	7.9	7.7	7.6	7.6

Day	Conductivity ( $\mu$ S/cm @ 25°C)					
0	322	326	323	87	82	82
2	313	328	332	87	84	81

Day	Dissolved Oxygen (mg/L)					
0	7.9	8.0	8.0	7.9	7.8	7.7
2	7.7	7.7	7.7	7.7	7.7	7.7

Day	Temperature (°C)					
0	19	19	19	20	20	20
2	21	21	21	21	21	21

**Biology:**

Conc (%)	control			100		
replicate	a	b	c	a	b	c

Day	Number Alive and Behavior (behavior is in brackets)					
1	10 (1F)	10	10	10	10	10
2	10	10	10	10	10	10

Notes: F, floating; I, immobile; B, stuck on bubble; D, caught in debris

Day	Mortality (%)					
2	0	0	0	0	0	0

Day	Immobility (%)					
2	0	0	0	0	0	0



**Comments/Statistics**

Client: GAL100 Reference: 16-0965-01-DAS
---

**Test Result Comments:**  
None

**Data Analysis:**  
None

**Protocol Deviations:**  
None

## GENERAL TERMS AND CONDITIONS:

These terms and conditions are incorporated into and form part of the Chain of Custody between HydroQual Laboratories Ltd. ("HydroQual") and the party named in the Chain of Custody (the "Client").

1. **Definitions:** Capitalized terms shall have the definition ascribed as such in these General Terms and Conditions and the Chain of Custody.
2. **The Services:** HydroQual will provide the Services to the Client as listed and described in the Chain of Custody.
3. **Prices:** HydroQual may review and change all prices, fees, surcharges or other charges as set out in proposals and/or price quotations if there are changes to HydroQual's cost beyond HydroQual's control, including changes in legislative requirements, Client variations of sample numbers and Client requests for changes to standard reporting requirements. Notwithstanding condition 3, all quotations are reviewed and updated on a yearly basis.
4. **Payment Terms:** The Client shall pay HydroQual within 30 days of the invoice date as provided by HydroQual. HydroQual may, for reasonable business reasons, require the Client to arrange for payment in advance.
5. **Quotation Numbers:** The Client shall provide the proposal and/or price quotation number to HydroQual (where applicable) to ensure correct pricing.
6. **Taxes:** Applicable taxes are not included in prices, surcharges and additional fees and will be added at the time of invoicing.
7. **No Guarantee of Results:** The Client is responsible for informing itself on the limitation of the results and acknowledges that the results are not guaranteed.
8. **Standard of Care:** HydroQual will use reasonable care and diligence as required by the laws of the province or territory where the sample is tested, subject to that level of care and skill ordinarily exercised by other laboratories currently practicing under similar conditions in the same locality, subject to the time limits and financial, physical or other constraints applicable to the Services. No warranty, express or implied, is made.
9. **Storage:** Where possible, HydroQual will store samples until a final report is issued to the Client, after which time HydroQual may discard the sample.
10. **Holds:** If the Client requests a sample be placed on hold, HydroQual will store the sample for the mutually agreed upon written time and price, after which HydroQual will invoice the Client and discard the sample.
11. **Archives:** If the Client requests a sample be archived, HydroQual will store the sample for a mutually agreed upon written time frame and price, after which HydroQual will invoice the Client and discard the sample.
12. **Handling Protocol:** Legal sample handling protocol must be arranged, and provided in writing, before samples are collected. HydroQual will provide a price quotation for legal sample protocol. Samples processed under legal protocol are stored indefinitely, subject to a storage charge as advised by HydroQual.
13. **Samples:** The quality, condition, content and source of samples stored and tested are not known to HydroQual except as declared and described on the Chain of Custody completed and submitted by the Client and accompanying the sample.
14. **Risk of Loss:** HydroQual will use reasonable care to protect samples during storage, however, all samples are stored at the Client's risk and the Client is responsible for obtaining appropriate insurance, if desired. The Client acknowledges that during the performance of the Services samples may be altered, lost, damaged or destroyed and the client forever releases HydroQual from any and all claims the Client may have for any loss or damage to the sample.
15. **Environmental:** the Client must comply with all applicable environmental legislation, including labeling all hazardous samples to comply with Canada's *Workplace Hazardous Materials Information System* and the Alberta *Transfer of Dangerous Goods* regulations, and must provide appropriate material safety data sheets that include the nature of the hazard and a contact name and phone number to call for information. The Client shall defend, indemnify and hold harmless HydroQual for all loss or damages, including any fine or cost of complying with an order of any government authority, resulting from the Client's breach of this paragraph.
16. **Hazardous Materials Disposal:** HydroQual may return, at the Client's cost, hazardous material to the Client for disposal.
17. **Hazardous Materials Surcharge:** HydroQual may apply an additional surcharge for handling of hazardous samples or samples with Naturally Occurring Radioactive Materials ("NORM"), such as and including without limitation, H<sub>2</sub>S and CN.
18. **Sample Containers:** HydroQual may ship sample containers to the Client's location by the most cost effective means using HydroQual's preferred courier suppliers, within the specified project timeline. Shipping will be charged back to the Client.
19. **Additional Charges:** HydroQual may charge the Client:
  - (a) for pick-up and delivery services when provided subject in each instance to a minimum charge of \$50.00; and,
  - (b) for rush service (processing samples and/or reporting).
20. **Large Bottle Orders:** The Client shall provide HydroQual with not less than 24 hours' notice for large bottle orders.
21. **Re-Tests:** HydroQual reserves the right to re-test any samples that remain in HydroQual's possession. Re-tests requested by the Client may be charged to Client and Client agrees to pay for such charges.
22. **Waiver:** The Client is responsible for making any assessment regarding the suitability of the Services and the intended results for the Client's purposes and waives any and all claims against HydroQual that the Client may have against HydroQual as a result of the interpretation of the results provided to the Client. The Client shall defend, indemnify and save harmless HydroQual for any and all claims made by any third party against HydroQual in respect of all losses however arising from the performance of the Services or the use of any report provided in the performance of the Services.
23. **LIMITATION OF LIABILITY:** IN NO EVENT SHALL HYDROQUAL BE RESPONSIBLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY OR PUNITIVE DAMAGES, WHETHER FORESEEABLE OR UNFORESEEABLE (INCLUDING CLAIMS FOR LOSS OF PROFITS OR REVENUE OR LOSSES CAUSED BY STOPPAGE OF OTHER WORK OR IMPAIRMENT OF OTHER ASSETS) INCURRED BY THE CLIENT ARISING OUT OF BREACH OR FAILURE OF EXPRESS OF IMPLIED WARRANTY, BREACH OF CONTRACT, BREACH OF WARRANTY, MISREPRESENTATION, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE. IN ANY EVENT, THE LIABILITY OF HYDROQUAL TO THE CLIENT SHALL BE LIMITED TO THE COST OF TESTING THE SAMPLE AS REQUESTED IN THE CHAIN OF CUSTODY UNDER WHICH THE SAMPLE WAS ORIGINALLY DEPOSITED. FOR THE PURPOSES OF THIS PARAGRAPH AND PARAGRAPHS 7, 14, 15, 22, AND 24, AS APPLICABLE, "HYDROQUAL" INCLUDES WITHOUT LIMITATIONS ITS DIRECTORS, OFFICERS, EMPLOYEES AND AFFILIATES AND THE "CLIENT" INCLUDES WITHOUT LIMITATION ANY THIRD PARTY THAT MAY HAVE A CLAIM AGAINST HYDROQUAL THROUGH THE CLIENT.
24. **Notice of Liability:** Notwithstanding paragraph 23, HydroQual shall not be liable to the Client unless the Client provides notice in writing to HydroQual of such loss or damage, together with full particulars thereof, within 30 days of the Client's receipt of the report of the analysis of the sample giving rise to such liability. The provisions of this paragraph allocate the risk between the Client and HydroQual, and the fees to be paid by the Client to HydroQual reflect this allocation of any such risks and the limitations of liability in these General Terms and Conditions.
25. **Entire Agreement:** These General Terms and Conditions, the Chain of Custody and price quotations constitute the entire agreement between the parties and supersede and take precedence over any terms and conditions contained in any documentation provided by the Client. HydroQual's execution of any subsequent documentation from the Client only acknowledges receipt and not acceptance of any terms or conditions therein unless expressly stipulated otherwise by HydroQual. If there is a conflict between these General Terms and Conditions and any other document, these General Terms and Conditions prevail.



**ATTN: Caroline-Emmanuelle Morisse; Valerie Bertrand**  
Golder Associates  
9200, boulevard de l'Acadie, bureau 10  
Montréal, Québec  
Canada H4N 2T2

Received: 2016/08/06  
Report Date: 2016/08/25  
Version: FINAL

## Test Report

**Client:** GAL100  
**Reference:** 16-0966  
**Billing:** 16-05 REV

---

Senior Verifier

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling or transport of the sample, application or interpretation of the test data or results in part or in whole.

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1  
Tel (403) 253-7121 Fax (403) 252-9363 [www.nautilusenvironmental.ca](http://www.nautilusenvironmental.ca)

## Results Summary

Client: GAL100  
Reference: 16-0966-01-AGD

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES2

**Collection:** collected on 2016/08/03 at 0936 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/09

**Results:**

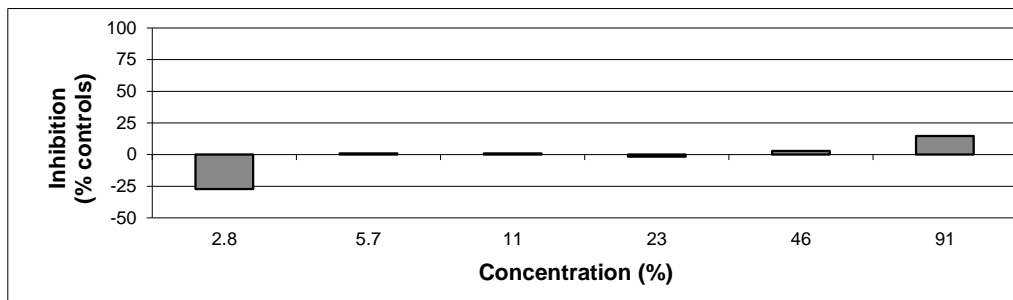
	Endpoint (72-hour)	Value	Confidence Limits (95%)		Method Calculated
			lower	upper	
Chronic: Growth Inhibition	IC25	>91		%	could not be calculated

Notes: ICx, concentrations inhibiting growth by 'x' percent relative to controls; CV, coefficient of variation (%); SD, standard deviation

	Stimulation Observed	Test Concentrations		Method Calculated
Chronic: Growth Stimulation	yes*	2.8	%	Flinger-Wolfe

\*see data analysis

Notes: Stimulation refers to increased response at all concentrations or at high concentrations



The test data and results are authorized and verified correct.



Senior Verifier

## Test Conditions

Client: GAL100 Reference: 16-0966-01-AGD
---

**Method:** Biological Test Method: Growth Inhibition Test Using a Freshwater Alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum*). Environment Canada, EPS 1/RM/25, 2nd Edition, March 2007

**Test type:** Algal Growth Inhibition Test (WTR-ME-034)

**Species:** *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum* and *Raphidocelis subcapitata*)

**Organism source:** In-house culture (original source: Canadian Phycological Culture Centre; strain: UTCC 37)

**Culture age:** The test was started with 4-day old algae.

**Culture observations:** No unusual appearance or treatment of the algae was noted prior to or during the conduct of the test.

**Sample initial chemistry:** pH: 6.7; EC: 23 ( $\mu\text{S}/\text{cm}$ ); DO: 7.4 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 6; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq$  3 days)

**Sample storage:** 4  $\pm$  2°C in darkness

**Test concentrations:** 10 effluent concentrations (0.2, 0.4, 0.7, 1.4, 2.8, 5.7, 11, 23, 46, and 91% (v/v), plus a negative control) ( $\geq$ 6 enumerated; see Test Result Comments)

**Test vessel:** The test was conducted in disposable, 96-well U-bottomed microplates. Two microplates (the test plate and a backup plate for use only in the case of an invalid test plate) were run. Test concentrations were isolated from each other with microplate sealing film.

**Test replicates:** 5 replicate wells per test concentration ( $\geq$ 3 enumerated)  
10 replicate wells per control (8 enumerated).

**Test volume:** 220  $\mu\text{L}$  final volume in each well with 200  $\mu\text{L}$  of sample;  
10  $\mu\text{L}$  of enrichment medium and 10  $\mu\text{L}$  of algal inoculum.

**Inoculum:** The initial cell density of the inoculum was 9702 (cells/mL), it was prepared less than 3 hours before test initiation.

**Control/dilution water:** Made up with 85% deionized and 15% dechlorinated City of Calgary water spiked with nutrients as per EPS 1/RM/25

**Sample Filtration:** 100 mL filtered through a 0.45  $\mu\text{m}$  pore diameter membrane.

**Sample treatment:** Sample spiked with nutrients as per EPS 1/RM/25; no other chemicals added.

**Measurements:** Final cell densities were determined using an electronic particle counter.

**Aeration:** Not required

**pH Adjustment:** Not required

**Lighting:** The plates were incubated under continuous light: 4065 lux  
(cool white fluorescent bulbs) 56.91  $\mu\text{mol}/(\text{m}^2 \cdot \text{S})$

**Test temperature:** 24  $\pm$  2°C

Note: Outlined sections are protocol deviations explained on the comment page



**Test Conditions**

Client: GAL100 Reference: 16-0966-01-AGD
---

**Endpoint:** Growth, 72-h IC25 (with 95% confidence limits)  
Test endpoint was bracketed by at least 1 test concentration  
(except for <1.4% or >91%)  
No outliers were observed within the data set.

**Test validity:** Control growth was a 23-fold increase over the inoculum. (Must be >16-fold)  
The CV of the standard control wells was 6.5%. (Must be ≤20%)

**Statistics:** See Data Analysis section.  
Mann-Kendall trend analysis was not performed as the control CV was <10%

**Reference toxicant:** 72-h test with Zinc ( $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ ) initiated August 16, 2016; current results  
(72-h IC25 and 95% confidence limits) = 1.52 (1.51-1.54) log ( $\mu\text{g Zn}^{2+}/\text{L}$ )  
historical results:  
(72-h IC25 and 95% confidence limits) = 1.44 (1.20-1.68) log ( $\mu\text{g Zn}^{2+}/\text{L}$ )

The reference toxicant test was performed under the same conditions as those used during this test.

Note: Outlined sections are protocol deviations explained on the comment page

## Test Data

Client: GAL100
Reference: 16-0966-01-AGD

### Test Log:

Date	Day	Technician	Time	Rotated	Temperature (°C)
2016/08/06	0	ML	1545	N/A	25
2016/08/07	1	JW	0800	Yes	25
2016/08/08	2	EP	1400	Yes	25
2016/08/09	3	JP	1350	Yes	25

### pH Measurements:

Initial cell density (cells/mL): 9702

Concentration	Initial Value	Final Value
100%	7.5	-
control (well D6)	7.3	-
control (well D7)	-	7.5

### Standard Control Well Final Cell Densities (D Row):

Column	Final Cell Density (x10 <sup>3</sup> cells/mL)	Cell Yield (x10 <sup>3</sup> cells/mL)
2	251	242
3	239	230
4	203	194
5	221	212
8	227	218
9	227	218
10	239	230
11	227	218
Average	-	220
SD	-	14
CV (%)	-	6.5
Fold Growth (x)	-	23

### Test Well Final Cell Densities:

Concentration (%)	Calculated Final Cell Density (x10 <sup>3</sup> cells/mL)				
	Row				
	B	C	E	F	G
0.2	-	-	-	-	-
0.4	-	-	-	-	-
0.7	-	-	-	-	-
1.4	-	-	-	-	-
2.8	233	311	323	269	311
5.7	233	233	215	*	*
11	227	227	227	*	*
23	239	227	233	*	*
46	227	233	209	*	*
91	191	197	203	*	*

### Cell Yield Results:

Concentration (%)	Cell Yield (x10 <sup>3</sup> cells/mL)						Percent Controls	Inhibition (%)	Stimulation (%)		
	Row					Mean				SD	CV (%)
	B	C	E	F	G						
0.2	-	-	-	-	-	-	-	-	-		
0.4	-	-	-	-	-	-	-	-	-		
0.7	-	-	-	-	-	-	-	-	-		
1.4	-	-	-	-	-	-	-	-	-		
2.8	224	301	313	260	301	<b>280</b>	38	13	127	-27	27
5.7	224	224	206	*	*	<b>218</b>	10	5	99	1	-1
11	218	218	218	*	*	<b>218</b>	0	0	99	1	-1
23	230	218	224	*	*	<b>224</b>	6	3	102	-2	2
46	218	224	200	*	*	<b>214</b>	12	6	97	3	-3
91	182	188	194	*	*	<b>188</b>	6	3	85	15	-15

\*see test result comments

### Test Validity Criteria:

Control growth was a 23-fold increase over the inoculum. (Must be >16-fold)
The CV of the standard control wells was 6.5%. (Must be ≤20%)
Mann-Kendall trend analysis was not performed as the control CV was <10%

**Comments/Statistics**

Client: GAL100 Reference: 16-0966-01-AGD
---

**Test Result Comments:**

Electronic enumeration using a Beckman-Coulter particle counter was performed on the same day as test termination. A minimum of 3 replicates were enumerated for each concentration. Additional replicates were enumerated for concentrations with high variability between replicates.

Only six concentrations were enumerated as inhibitory effects did not occur.

**Data Analysis:**

Endpoints for growth inhibition could not be calculated. Inhibitory effects did not occur.

Effects are only considered significant by Environment Canada if stimulation is observed in all high concentrations, however, in this case, stimulation was only observed in the 2.8 concentration as calculated by ANOVA analysis with CETIS v. 1.9.0.8. (Dunnnett Multiple Comparison).

**Protocol Deviations:**

None

**Result Summary**

Client: GAL100
Reference: 16-0966-01-CDD

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES2

**Collection:** collected on 2016/08/03 at 0936 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

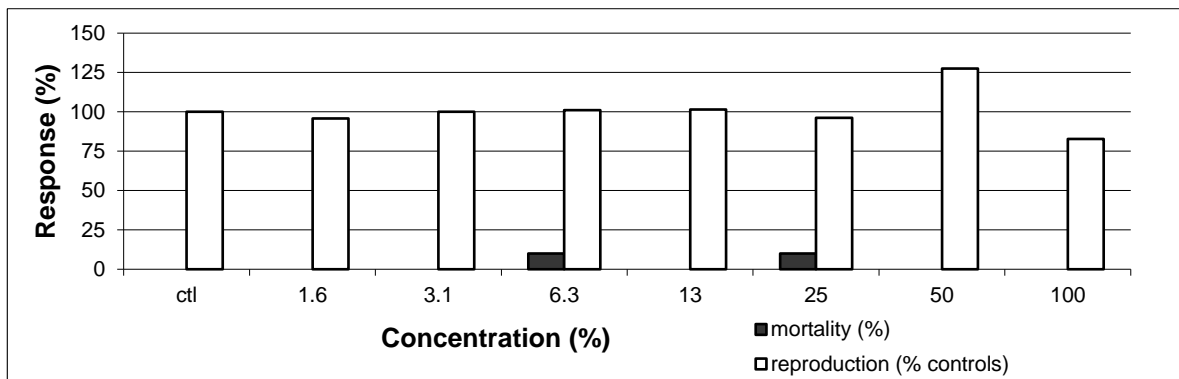
**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/14

**Result:**

	Endpoint (8-day)	Value	Confidence Limits (95%) lower      upper	Units	Method Calculated
Acute: (survival)	LC50	>100		%	could not be calculated
Chronic: (fecundity)	IC25	>100		%	could not be calculated

Notes: LCx & ICx, concentrations lethal or inhibitory to 'x' percent of the test population; fecundity, reproduction as the number of young produced



The test data and results are authorized and verified correct.

*Jacklyn Force*

Senior Verifier

## Test Conditions

Client: GAL100 Reference: 16-0966-01-CDD
---

**Method:** Biological Test method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia*. Environment Canada, EPS 1/RM/21, 2nd Edition, February 2007.

**Test type:** *Ceriodaphnia* Survival and Reproduction Static Renewal Test (WTR-ME-018)

**Species:** *Ceriodaphnia dubia*

**Age:** <24 hours old; all from same brood source within 12 hours of the same age.

**Organism source:** in-house cultures; cultures from a single brood organism to provide test organisms.

**Culture health:** Culture mortality was 2% (must be  $\leq 20\%$ ).

**7-d prior to test initiation:** No ephippia were noted in the cultures at any time.

Average young produced per adult in the first three broods was 22 (must be  $\geq 15$ )

Number of young produced by each brood organism in the last complete brood before use was 10 (must be  $\geq 8$ ).

**Organism observations:** No unusual behavior, appearance or treatment of test organisms was noted prior to or during the test. All first-generation mortality was recorded on the day it was observed.

**Sample initial chemistry:** pH: 6.7; EC: 23 ( $\mu\text{S}/\text{cm}$ ); DO: 7.4 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 6; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq 3$  days); The test was conducted with three subsamples samples a, b, and c were for days 0 to 2, 3 to 4, and 5 to 7 respectively

**Sample storage:** 4  $\pm$  2°C in darkness

**Test vessel:** The tests were conducted in 30 mL plastic vessels (2 cm depth).

**Test volume:** 15 mL of solution (1 cm depth); replenished daily.

**Control/dilution water:** Moderately hard water (20% Perrier) supplemented with vitamin B12 (2  $\mu\text{g}/\text{L}$ ) and Na<sub>2</sub>SeO<sub>4</sub> (5  $\mu\text{g}/\text{L}$ ).

**Test concentrations:** 7 effluent concentrations (1.6, 3.1, 6.3, 13, 25, 50, 100% (v/v) plus a negative control)

**Test replicates:** One neonate <24 hours old was loaded per test vessel;  
10 replicates/concentration

**Feeding:** The test organisms were fed daily a mixture of fermented trout chow, yeast, Cerophyll, and the green alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum* and *Raphidocelis subcapitata*).

Food expiration date: 2016/08/28

**Measurements:** pH, conductivity, dissolved oxygen and temperature were measured daily.

**Sample pre-treatment:** The sample was filtered through a 60  $\mu\text{m}$  Nitex screen prior to testing. The sample was not aerated or pH adjusted prior to or during testing.

The dissolved oxygen concentration (mg/L) was: 7.3

The sample pH was: 7.2

**Lighting:** Overhead full spectrum fluorescent lights

**Photoperiod:** 16h light:8h dark

**Test temperature:** 25  $\pm$  1°C

Note: Outlined sections are protocol deviations explained on the comment page

**Test Conditions**

Client: GAL100 Reference: 16-0966-01-CDD
---

**Endpoints:** Survival, 8-d LC50 (with 95% confidence limits)  
Reproduction, 8-d IC25 (with 95% confidence limits)  
Test endpoints were bracketed by at least 1 test concentration  
(except for <1.6% or >100 %)  
No outliers were observed within the data set.

**Test completion:** 100% of the control organisms had  $\geq 3$  broods on day 8 (must be  $\geq 60\%$  within 8 days) Any neonates produced after third brood were not included in the mean young per adult calculation.

**Test validity:** The control had 100% survival (must  $\geq 80\%$ )  
Number of young produced by each surviving control adult within the first three broods was 19 (must be  $\geq 15$ ).

**Reference toxicant:** 7-d test with NaCl initiated on July 26, 2016;  
(must be evaluated within 14 days before or after test is started or during it)  
current results: (7-d LC50 and 95% confidence limits) =  
3.09 (3.00-3.17) log (mg/L NaCl)  
historical results: (7-d LC50 and 95% confidence limits)=  
3.15 (3.06-3.24) log (mg/L NaCl)  
current results: (7-d IC50 and 95% confidence limits) =  
3.10 (3.06-3.13) log (mg/L NaCl)  
historical results: (7-d IC50 and 95% confidence limits)=  
3.11 (3.05-3.17) log (mg/L NaCl)  
The reference toxicant test was performed under the same conditions as those used during this test.

Note: Outlined sections are protocol deviations explained on the comment page



# Ceriodaphnia (6-8d LC50/IC25) Test Report

## Test Data

Client: GAL100  
Reference: 16-0966-01-CDD

### Test Log:

Date	Day	Time	Technicians
2016/08/06	0	1430	EP
2016/08/07	1	0910	JN
2016/08/08	2	0800	ML
2016/08/09	3	0930	LC
2016/08/10	4	1115	EP
2016/08/11	5	1345	LC
2016/08/12	6	0905	ML
2016/08/13	7	0930	HS
2016/08/14	8	1050	JN

### Chemistry Summary Tables:

Conc. %	New Solutions								Old Solutions							
	ctl	1.6	3.1	6.3	13	25	50	100	ctl	1.6	3.1	6.3	13	25	50	100

#### Average Values

pH	7.8	7.9	7.9	8.0	7.9	7.9	7.9	7.4	7.9	8.0	8.0	8.0	8.0	8.0	7.9	7.6
cond.	216	219	206	207	194	172	128	34	236	226	222	214	207	186	137	43
DO	7.3	7.3	7.3	7.4	7.4	7.5	7.5	7.6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
temp.	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

#### Coefficients of Variation (%)

pH	2	2	1	1	1	1	1	2	2	1	1	1	1	1	1	2
cond.	7	7	3	4	5	5	5	11	7	4	4	5	6	7	6	10
DO	2	2	2	2	2	1	2	3	2	1	2	1	2	2	1	2
temp.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

**Test Data**

Client: GAL100
Reference: 16-0966-01-CDD

**Biology (number of young produced):**

Day	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Replicate

	Control							
1	0	0	0	0	4	0	7	8
2	0	0	0	0	5	0	8	8
3	0	0	0	3	6	0	9	-
4	0	0	0	0	4	6	0	7
5	0	0	0	2	0	0	6	8
6	0	0	0	4	5	7	-	-
7	0	0	0	0	4	0	8	8
8	0	0	0	0	6	0	7	10
9	0	0	0	3	6	0	8	-
10	0	0	0	0	3	0	6	10

	13%							
1	0	0	0	3	0	6	10	-
2	0	0	0	3	6	0	8	-
3	0	0	0	3	5	0	10	-
4	0	0	0	3	6	0	10	-
5	0	0	0	0	0	7	8	9
6	0	0	0	3	6	0	8	-
7	0	0	0	3	5	0	9	-
8	0	0	0	3	6	0	6	-
9	0	0	0	3	0	9	12	-
10	0	0	0	0	0*	0	0	0

\*see test result comments

	1.6%							
1	0	0	0	3	5	0	8	-
2	0	0	0	3	3	0	8	-
3	0	0	0	0	5	0	6	10
4	0	0	0	3	6	0	6	-
5	0	0	0	4	0	7	8	-
6	0	0	0	3	0	7	11	-
7	0	0	0	0	5	6	8	-
8	0	0	0	3	5	0	8	-
9	0	0	0	3	0	5	9	-
10	0	0	0	3	0	7	0	10

	25%							
1	0	0	0	3	6	0	11	-
2	0	0	0	0	3	0	6	12
3	0	0	0	3	5	0	10	-
4	0	0	0	3	5	0	8	-
5	0	0	0	3	5	0	8	-
6	0	0	0	3	6	0	8	-
7	0	0	0	0	6	0	9	10
8	0	0	0	0	7	9	0	9
9	0	0	0	0	<b>0</b>	X	X	X
10	0	0	0	0	6	5	0	10

	3.1%							
1	0	0	0	0	3	7	0	11
2	0	0	0	3	0	8	8	-
3	0	0	0	4	5	0	7	-
4	0	0	0	3	0	0	7	9
5	0	0	0	4	5	0	7	-
6	0	0	0	3	7	0	8	-
7	0	0	0	3	6	0	8	-
8	0	0	0	0	7	7	0	9
9	0	0	0	0	5	0	9	0
10	0	0	0	0	3	0	8	12

	50%							
1	0	0	0	0	5	12	0	12
2	0	0	0	0	0	12	0	10
3	0	0	0	5	0	10	11	-
4	0	0	0	3	6	0	10	-
5	0	0	0	3	0	8	14	-
6	0	0	0	0	3	10	11	-
7	0	0	0	0	6	8	0	10
8	0	0	0	4	0	9	13	-
9	0	0	0	3	0	3	12	-
10	0	0	0	3	7	0	14	-

Notes: #, young produced; 0, no young; X, dead; bold #, number of young the test organism had the day it died; —, young produced after third brood





# Ceriodaphnia (6-8d LC50/IC25) Test Report

## Test Data

Client: GAL100  
Reference: 16-0966-01-CDD

### Biology (number of young produced):

Day	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
-----	---	---	---	---	---	---	---	---	--	---	---	---	---	---	---	---	---

Replicate	6.3%							
1	0	0	0	3	3	0	9	-
2	0	0	0	3	0	7	0	8
3	0	0	0	3	7	0	9	-
4	0	0	0	0	6	0	8	11
5	0	0	0	5	0	9	9	-
6	0	0	0	4	5	0	8	-
7	0	0	0	4	0	7	8	-
8	0	0	0	4	0	6	9	-
9	0	0	0	3	8	0	10	-
10	0	0	0	4	8	<b>0</b>	X	X

								100%								
1	0	0	0	0	3	0	6	10	0	0	0	0	3	0	6	10
2	0	0	0	0	3	0	5	9	0	0	0	0	3	0	5	9
3	0	0	0	3	7	0	9	-	0	0	0	3	8	0	8	-
4	0	0	0	0	6	0	8	11	0	0	0	0	3	0	0	9
5	0	0	0	5	0	9	9	-	0	0	0	3	6	0	0	9
6	0	0	0	4	5	0	8	-	0	0	0	0	5	0	0	9
7	0	0	0	4	0	7	8	-	0	0	0	0	4	0	0	7
8	0	0	0	4	0	6	9	-	0	0	0	0	0	0	6	7
9	0	0	0	3	8	0	10	-	0	0	0	0	3	0	6	9
10	0	0	0	4	8	<b>0</b>	X	X	0	0	0	0	5	0	0	8

Notes: #, young produced; 0, no young; X, dead; bold #, number of young the test organism had the day it died;  
—, young produced after third brood

### Biology Summary Tables:

Conc. %	ctl	1.6	3.1	6.3	13	25	50	100
---------	-----	-----	-----	-----	----	----	----	-----

ctl	1.6	3.1	6.3	13	25	50	100
-----	-----	-----	-----	----	----	----	-----

Day	Number of Organism Alive							
0	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10
5	10	10	10	10	10	9	10	10
6	10	10	10	9	10	9	10	10
7	10	10	10	9	10	9	10	10
8	10	10	10	9	10	9	10	10

Day	Daily Young Production							
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	12	25	20	33	24	15	21	6
5	43	29	41	37	34	49	27	40
6	13	32	22	29	22	14	72	0
7	59	72	62	70	81	60	85	31
8	59	20	41	19	9	41	32	77

Percent Mortality (%)								
mean	0	0	0	10	0	10	0	0

Total	186	178	186	188	170	179	237	154
-------	-----	-----	-----	-----	-----	-----	-----	-----

Replicate	Total Young Produced by Each Adult							
1	19	16	21	15	19	20	29	19
2	21	14	19	18	17	21	22	17
3	18	21	16	19	18	18	26	19
4	17	15	19	25	19	16	19	12
5	16	19	16	23	24	16	25	18
6	16	21	18	17	17	17	24	14
7	20	19	17	19	17	25	24	11
8	23	16	23	19	15	25	26	13
9	17	17	14	21	24	0	18	18
10	19	20	23	12	0	21	24	13

Young Per Adult (within first three broods)								
mean	19	18	19	19	19	18	24	15
sd	2.27	2.53	3.03	3.74	6.67	7.09	3.3	3.1
cv(%)	12.2	14.2	16.3	19.9	35.3	39.6	13.9	20.1

Young Production as a Percent of Controls								
100	96	100	101	102	96	127	83	



# Ceriodaphnia (6-8d LC50/IC25) Test Report

## Test Data

Client: GAL100  
Reference: 16-0966-01-CDD

### Chemistry:

#### New Solutions

Conc. %	ctl	1.6	3.1	6.3	13	25	50	100
---------	-----	-----	-----	-----	----	----	----	-----

#### Old Solutions

ctl	1.6	3.1	6.3	13	25	50	100
-----	-----	-----	-----	----	----	----	-----

Day

pH (units)

0	8.0	8.1	8.1	8.1	8.1	8.0	7.8	7.2
1	8.0	8.0	8.0	7.9	7.9	7.9	7.9	7.2
2	7.7	7.8	7.8	7.9	7.9	7.9	7.8	7.3
3	7.9	7.9	8.0	8.0	8.0	8.0	8.0	7.5
4	7.6	7.7	7.8	7.8	7.8	7.8	7.8	7.5
5	7.7	7.9	7.9	7.9	7.9	7.9	7.8	7.6
6	8.0	8.0	8.0	8.0	7.9	7.9	7.8	7.5
7	7.8	7.9	7.9	8.0	8.0	8.0	7.9	7.6
8								

pH (units)

8.0	8.0	8.0	8.0	8.0	8.0	7.9	7.5	
8.0	8.0	8.0	8.0	8.0	8.0	7.9	7.9	
8.1	8.1	8.1	8.1	8.1	8.1	8.0	7.9	
7.9	8.0	8.0	8.0	8.0	7.9	7.9	7.5	
7.9	8.0	8.0	8.0	8.0	7.9	7.9	7.6	
7.7	7.9	8.0	8.0	8.0	8.0	7.9	7.6	
7.8	7.9	7.9	7.9	7.9	8.0	7.8	7.5	
7.8	7.8	7.9	7.9	7.9	7.9	7.7	7.6	

Conductivity (µS/cm)

0	209	211	204	203	190	162	120	30
1	202	205	204	197	188	166	125	36
2	200	205	203	194	185	165	124	39
3	201	211	210	203	186	170	131	31
4	220	225	220	216	206	181	134	37
5	225	226	198	218	207	183	132	39
6	225	221	207	211	201	178	137	32
7	242	251	200	214	190	172	124	31
8								

Conductivity (µS/cm)

211	217	214	209	198	177	134	39	
221	211	209	203	198	173	131	36	
224	216	213	205	203	177	130	41	
253	231	230	222	220	203	147	41	
252	232	228	223	221	198	149	49	
238	240	234	231	225	206	143	46	
240	231	216	199	192	178	134	45	
250	230	228	221	200	177	130	47	

Dissolved Oxygen (mg/L)

0	7.1	7.3	7.3	7.3	7.3	7.4	7.3	7.3
1	7.2	7.2	7.2	7.3	7.3	7.4	7.4	7.9
2	7.4	7.5	7.4	7.5	7.5	7.5	7.5	7.4
3	7.4	7.5	7.5	7.6	7.6	7.6	7.6	7.4
4	7.5	7.6	7.6	7.5	7.6	7.6	7.6	7.4
5	7.1	7.1	7.3	7.4	7.4	7.5	7.6	7.7
6	7.2	7.3	7.2	7.3	7.3	7.3	7.3	8.0
7	7.1	7.2	7.2	7.3	7.3	7.4	7.6	7.6
8								

Dissolved Oxygen (mg/L)

7.3	7.3	7.3	7.4	7.3	7.3	7.3	7.2	
7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	
7.5	7.5	7.6	7.5	7.6	7.6	7.5	7.5	
7.4	7.3	7.4	7.3	7.2	7.1	7.2	7.1	
7.2	7.2	7.2	7.3	7.3	7.4	7.4	7.4	
7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.1	
7.2	7.2	7.3	7.3	7.3	7.4	7.3	7.4	
7.3	7.3	7.3	7.2	7.2	7.2	7.3	7.2	

Temperature (°C)

0	25	25	25	25	25	25	25	25
1	25	25	25	25	25	25	25	25
2	25	25	25	25	25	25	25	25
3	25	25	25	25	25	25	25	25
4	25	25	25	25	25	25	25	25
5	25	25	25	25	25	25	25	25
6	24	24	24	24	24	24	24	24
7	25	25	25	25	25	25	25	25
8								

Temperature (°C)

25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	
24	24	24	24	24	24	24	24	
25	25	25	25	25	25	25	25	
25	25	25	25	25	25	25	25	



**Ceriodaphnia  
(6-8d LC50/IC25)  
Test Report**

**Comments/Statistics**

Client: GAL100
Reference: 16-0966-01-CDD

**Test Result Comments:**

Replicate 10 in the 13% concentration was identified to be a male and was excluded from reproduction calculations

**Data Analysis:**

Endpoints for mortality could not be calculated. No effect occurred.

Endpoints for reproduction could not be calculated. No effect occurred.

**Protocol Deviations:**

Three separate subsamples were not submitted for analysis. Three subsamples were created at the lab upon receipt, samples a, b, and c were for days 0 to 2, 3 to 4, and 5 to 7 respectively.

**Quality Assurance Information**

**Culture history for adults used in the test for reference 16-0966:**

A8

**Number of young produced per brood adult:**

(Note: The third brood per adult may be on the day the test is set)

row/replicate	A8	B6	B8	C8	D8	E7	B10	A9	B10		
---------------	----	----	----	----	----	----	-----	----	-----	--	--

number of young											
number of adults											

	A8	B6	B8	C8	D8	E7	B10	A9	B10		
number of young											
number of adults											

	A8	B6	B8	C8	D8	E7	B10	A9	B10		
number of young											
number of adults											

	A8	B6	B8	C8	D8	E7	B10	A9	B10		
number of young	4	2	5	5	3	4	4	3	3		
number of adults	1	1	1	1	1	1	1	1	1		

	A8	B6	B8	C8	D8	E7	B10	A9	B10		
number of young	9	4	9	9	9	10	6	9	9		
number of adults	1	1	1	1	1	1	1	1	1		

	A8	B6	B8	C8	D8	E7	B10	A9	B10		
number of young	10	9	10	12	12	12	12	8	10		
number of adults	1	1	1	1	1	1	1	1	1		

DAY USED		A8	B6	B8	C8	D8	E7	B10	A9	B10		
2016/08/06	number of young	10	9	8	12	10	15	10	8	11		
	number of adults	1	1	1	1	1	1	1	1	1		

		A8	B6	B8	C8	D8	E7	B10	A9	B10		
totals	number of young	23	15	24	26	24	26	22	20	22		
(# of young in first 3 broods)	number of adults											

Number of young produced per organism in the last brood before use 10

Mean number of surviving young per adult over the first three broods 22

Culture mortality over the last seven days 2

**Result Summary**

Client: GAL100 Reference: 16-0966-01-LMD
---

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES2

**Collection:** collected on 2016/08/03 at 0936 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/13

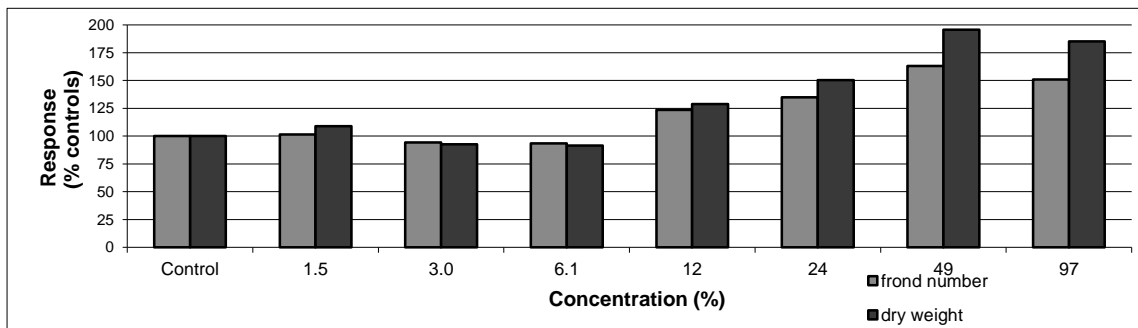
**Result:**

	Endpoint (7-day)	Value	Confidence Limits (95%)		Units	Method Calculated
			lower	upper		
<b>Chronic:</b>						
Fronde Number Inhibition	IC25	>97	-	-	%	could not be calculated
Dry Weight Inhibition	IC25	>97	-	-	%	could not be calculated

Notes: ICx, concentrations lethal or inhibitory to 'x' percent of the test population;

	Stimulation Observed	Test Concentrations		Method Calculated
		91	49, 25	
<b>Chronic:</b>				
Fronde Number Stimulation	yes	91, 49, 25	%	Dunnett Multiple Comparison
Dry Weight Stimulation	yes	91, 49, 25, 12	%	Dunnett Multiple Comparison

Notes: Stimulation refers to increased response at all concentrations or at high concentrations



The test data and results are authorized and verified correct.



Senior Verifier

## Test Conditions

Client: GAL100 Reference: 16-0966-01-LMD
---

**Method:** Biological Test Method: Test for Measuring the Inhibition of Growth Using the Freshwater Macrophyte, *Lemna minor*. Environment Canada, EPS 1/RM/37 2nd Edition, January 2007

**Test type:** *Lemna* 7-d Inhibition of Growth Static Test (WTR-ME-030)

**Species:** *Lemna minor*

**Organism source:** in-house culture,  $\geq 3$  weeks in age (original source: UTCC 492, clone 7730)

**Culture health:** The fronds were acclimated in test media ( $\geq 2$ cm) for 24 hours prior to test initiation.

The test culture was axenic prior to testing.

There was an 11 fold increase in frond number of culture over last 7 days.

Test loaded with 3 frond daughter plants, all with light green fronds and short roots.

**Culture age:** The test was started with 9 day old fronds.

**Culture media:** modified Hoagland's E+ medium

**Organism observation:** No unusual behaviour, appearance or treatment of test organisms was noted prior to or during the test.

**Sample initial chemistry:** pH: 6.7; EC: 23 ( $\mu$ S/cm); DO: 7.4 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 6; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq 3$  days)

**Sample storage:** 4  $\pm$  2°C in darkness

**Test vessel:** The test was a static test conducted in 200 mL polyethylene plastic containers with clear lids. Test vessel size is adequate to ensure no overlapping of fronds occurs.

**Test volume:** The test volume was 150 mL, depth of  $\geq 4$  cm

**Test concentrations:** 7 effluent concentrations (1.5, 3.0, 6.1, 12.1, 24, 49, 97% (v/v) plus a negative control)

**Test replicates:** There were four replicates per treatment with two 3 frond daughter plants per replicate; replicates are randomly rotated daily.

**Control/dilution water:** Test media (modified APHA medium) made up with deionized City of Calgary water water spiked with nutrients as per Environment Canada EPS 1/RM/37, 2007. made by adding 60 mL of each of the three stock solutions to 5.82 L of DRO  
The media aerated for 2 hours and was pH adjusted to 8.3  $\pm$  0.1 with 6N HCl or NaOH.  
The test media was not filtered.

**Elutriate preparation:** 2016/08/06

**Sample pre-treatment:** 1455 mL of sample spiked with 15 mL of each of the three APHA stock solutions, no other chemicals added. The sample was not pH adjusted or filtered prior to testing.

**Aeration:** The sample was pre-aerated for 20 minutes at a rate of 100 bubbles/minute with oil free filtered compressed air from a 1 mL glass pipette attached to an air pump.

Note: Outlined sections are protocol deviations explained on the comment page

**Test Conditions**

Client: GAL100
Reference: 16-0966-01-LMD

**Lighting:** The cups were incubated under continuous full-spectrum light. The light levels were measured at the sample surface, at three locations on the testing bench, during testing:

left:	5170	lux	≈	83	μmol/m <sup>2</sup> •S
centre:	5150	lux	≈	82	μmol/m <sup>2</sup> •S
right:	4790	lux	≈	77	μmol/m <sup>2</sup> •S

**Measurements:**

pH, conductivity, dissolved oxygen and temperature at test initiation and termination; temperature in the control, low, middle and high concentrations are recorded daily.

**Test temperature:** 25 ± 2°C

**Endpoint:** Growth (based on increase in frond number), 7-d IC25 (with 95% confidence limits)  
Growth (based on dry weight), 7-d IC25 (with 95% confidence limits)  
Test endpoints were bracketed by at least 1 test concentration.  
(except for <1.5% or >97 %)

No outliers were observed within the data set

**Test validity:** The mean number of fronds in the controls have increased 11 times (must be ≥ 8 time increase). The average number attained at test termination was 69 (must be ≥48 fronds per test vessel).

**Reference toxicant:** 7-d test with Potassium Chloride (KCl) initiated August 4, 2016;

current results:

(Frond Number; 7-d IC25 and 95% confidence limits) = 3.41 (3.32-3.46) log(mg KCl/L)

Historical results:

(Frond Number, 7-d IC25 and 95% confidence limits) = 3.31 (3.10-3.52) log(mg KCl/L)

current results:

(Dry Weight; 7-d IC25 and 95% confidence limits) = 3.49 (3.30-3.62) log (mg KCl/L)

Historical results:

(Dry Weight; 7-d IC25 and 95% confidence limits) = 3.57 (3.25-3.89) log (mg KCl/L)

The reference toxicant test was performed under the same conditions as those used during this test .

Note: Outlined sections are protocol deviations explained on the comment page

**Test Data**

Client: GAL100
Reference: 16-0966-01-LMD

**Test Log:**

Date	Day	Time	Technicians	Rotate	Temperature (°C)			
					Control	3.0%	24%	97%
2016/08/06	0	1455	ML	na	26	26	26	26
2016/08/07	1	0800	JW	yes	25	25	25	25
2016/08/08	2	0800	EP	yes	25	25	25	25
2016/08/09	3	0815	LC	yes	25	25	25	25
2016/08/10	4	0815	LC	yes	25	25	25	25
2016/08/11	5	0805	JW	yes	25	25	25	25
2016/08/12	6	0930	LC	yes	25	25	25	25
2016/08/13	7	0850	JP	na	25	25	25	25

**Chemistry:**

Conc.(%)	Control	1.5	3.0	6.1	12	24	49	97
----------	---------	-----	-----	-----	----	----	----	----

Day 0

pH	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.2
cond.	814	839	833	833	840	847	868	906
DO	7.4	7.4	7.6	7.6	7.3	7.5	7.5	7.4
temp.	26	26	26	26	26	26	26	26

Day 7

pH	8.9	8.9	8.8	8.6	8.6	8.6	8.5	8.5
cond.	968	1137	1034	1018	1049	1036	1090	1128
DO	8.9	9.1	9.3	9.0	8.6	8.5	8.4	8.2
temp.	25	25	25	25	25	25	25	25

Notes: pH, units; cond., conductivity (µS/cm); DO, dissolved oxygen (mg/L); temp., temperature (°C)

**FronD Appearance:**

Concentration (%)	Day 0	Day 7
Control	green, short roots, healthy	medium green, long roots, healthy
1.5	green, short roots, healthy	medium green, long roots, healthy
3.0	green, short roots, healthy	medium green, long roots, healthy
6.1	green, short roots, healthy	medium green, long roots, healthy
12.1	green, short roots, healthy	medium green, long roots, healthy
24	green, short roots, healthy	medium green, long roots, healthy
49	green, short roots, healthy	medium green, long roots, healthy
97	green, short roots, healthy	medium green, long roots, healthy

Notes: chl, chlorotic; nec, necrotic; asf, abnormally sized fronds; gib, gibbosity; cd, colony destroyed; rd, roots destroyed; lb, loss of bouyancy; ag, algae



**Test Data**

Client: GAL100
Reference: 16-0966-01-LMD

**FronD number:**

Conc.(%)	Control	1.5	3.0	6.1	12.1	24	49	97
----------	---------	-----	-----	-----	------	----	----	----

Replicate

Day 0

a	6	6	6	6	6	6	6	6
b	6	6	6	6	6	6	6	6
c	6	6	6	6	6	6	6	6
d	6	6	6	6	6	6	6	6

Day 7

a	63	69	60	74	97	87	98	113
b	75	59	80	58	80	100	125	87
c	73	85	65	71	89	92	103	105
d	63	65	55	55	67	82	106	96

average	<b>69</b>	70	65	65	83	90	108	100
fold increase	<b>11</b>	12	11	11	14	15	18	17

**Increase in FronD Number Compared to the Control:**

a	57	63	54	68	91	81	92	107
b	69	53	74	52	74	94	119	81
c	67	79	59	65	83	86	97	99
d	57	59	49	49	61	76	100	90

average	63	64	59	59	77	84	102	94
sd	6	11	11	9	13	8	12	11
cv	10	18	18	16	17	9	12	12
% ctls	100	102	94	94	124	135	163	151
% stim	0	2	-6	-6	24	35	63	51

**Total Dry Weights (mg):**

Conc.(%)	Control	1.5	3.0	6.1	12.1	24	49	97
----------	---------	-----	-----	-----	------	----	----	----

Replicate

Day 7

a	5.5	6.0	5.6	4.9	8.9	8.2	11.6	10.9
b	6.2	5.9	6.6	5.4	7.3	9.8	12.2	9.7
c	6.5	7.3	5.0	6.3	8.4	9.6	10.7	11.9
d	5.4	6.5	4.6	4.8	5.7	7.8	11.5	11.2

Day 7

average	5.9	6.4	5.5	5.4	7.6	8.8	11.5	10.9
sd	0.5	0.6	0.9	0.7	1.4	1.0	0.6	0.9
cv	9	10	17	13	19	11	5	8
%ctls	100	109	93	92	129	150	196	185
% stim	0	9	-7	-8	29	50	96	85

Notes: cv, coefficient of variation; %ctls, percent of controls; sd, standard deviation, % stim, percent stimulation



# **Lemna minor**

## **Test Report**

### **Comments/Statistics**

Client: GAL100 Reference: 16-0966-01-LMD
---

**Test Result Comments:**

None

**Data Analysis:**

Endpoints for frond number could not be calculated. No inhibitory effect occurred.

Endpoints for dry weight could not be calculated. No inhibitory effect occurred.

Significant stimulatory effects in frond number were observed in the 25, 49, and 91% concentrations as calculated by ANOVA analysis with CETIS v. 1.9.0.8. (Dunnett Multiple Comparison).

Significant stimulatory effects in dry weight were observed in the 12, 25, 49, and 91% concentrations as calculated by ANOVA analysis with CETIS v. 1.9.0.8 (Dunnett Multiple Comparison).

**Protocol Deviations:**

Due to a shipping delay, fronds were acclimated for >24 hours prior to testing.

## Result Summary

Client: GAL100
Reference: 16-0966-01-TRS

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES2

**Collection:** collected on 2016/08/03 at 0936 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

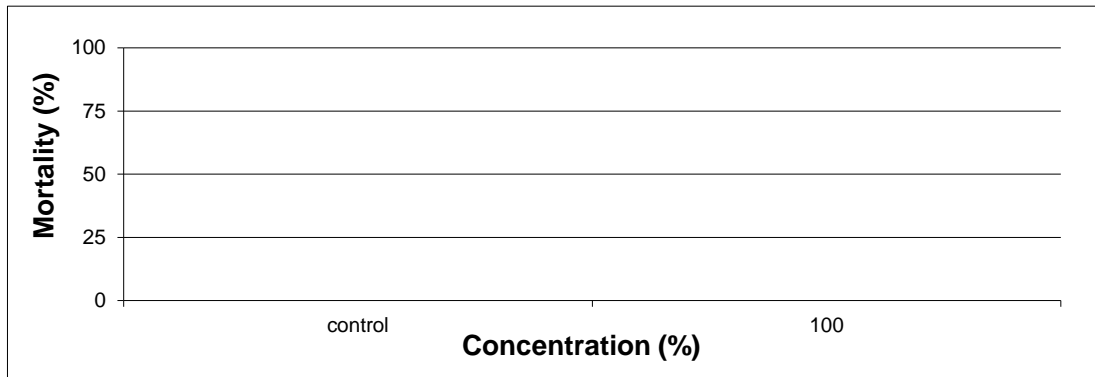
**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with seals and no initials

**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/06/10

**Result:**

Sample	Client Code	Mortality (%)	Comment
control	lab control	0	
100%	LJ-ES2	0	none



The test data and results are authorized and verified correct.



Senior Verifier

## Test Conditions

Client: GAL100 Reference: 16-0966-01-TRS
---

**Method:** Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout, 2000. Environment Canada, EPS 1/RM/13. Second Edition (2000; amended May 2007 and February 2016).

**Test type:** Trout 96-h Static Acute Test (WTR-ME-041)

**Species:** *Oncorhynchus mykiss*

**Organism source:** Miracle Springs (Batch 20160706TR)

**Acclimation:** 31 days (must be  $\geq 2$  weeks)

**Stock mortality:** 0% (seven days preceding testing)

**Sample initial chemistry:** pH: 6.7; EC: 23 ( $\mu\text{S}/\text{cm}$  @ 25°C); DO: 7.4 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 6; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq 5$  days)

**Sample storage:** 4  $\pm$  2°C in darkness

**Test vessel:** The test was conducted in 22 L plastic pails with polyethylene liners

**Test volume:** 19 Litres (depth of solution in each test vessel  $\geq 15\text{cm}$ )

**Sample pre-treatment:** All test solutions and controls were pre-aerated for 30 minutes at 6.5  $\pm$  1 mL/min/L  
Dissolved oxygen in full strength sample was 7.7 mg/L after pre-aeration  
The sample was not filtered or pH adjusted prior to or during testing

**Loading density:** 0.142 g/Litre (must be  $\leq 0.5$  g/Litre)

**Control water:** Dechlorinated City of Calgary water acclimated to test conditions

**Test concentrations:** Undiluted sample plus a negative control

**Test replicates:** One replicate per treatment; 10 fish per replicate

**Feeding:** Fish are not fed 24 hours before test initiation and no feeding during test

**Measurements:** pH, conductivity, dissolved oxygen and temperature measured at test initiation and termination

**Aeration:** All treatments aerated at 6.5  $\pm$  1 mL/min/L by oil-free compressed air passed through airline tubes connected to disposable air stones

**Lighting:** Overhead full spectrum fluorescent lights

**Photoperiod:** 16h light:8h dark

**Test temperature:** 15  $\pm$  1°C

**Endpoint:** Mortality, % mortality at 96-h

**Test validity:** The control had 100% survival (must  $\geq 90\%$ )

The control had 0 percent (%) stressed behaviour (must  $\leq 10\%$ )

**Reference toxicant:** 96-h test with Potassium Chloride (KCl) initiated July 20, 2016; current results  
(96-h LC50 and 95% confidence limits) = 0.47 (0.38-0.53) log (g/L KCl)  
historical results:  
(96-h LC50 and 95% confidence limits) = 0.52 (0.37-0.68) log (g/L KCl)

Note: Outlined sections are protocol deviations explained on the comment page; v/v, volume per volume



# Trout (Single Concentration) Test Report

## Test Data

Client: GAL100
Reference: 16-0966-01-TRS

### Test Log:

Date	Day	Time	Technician
2016/08/06	0	1330	EP
2016/08/07	1	1005	JN
2016/08/08	2	0750	JW
2016/08/09	3	0845	LC
2016/08/10	4	1020	LC

### Chemistry:

Conc. (%)	control	100
-----------	---------	-----

Day

	pH (units)	
0	7.4	7.3
4	7.9	7.0

Conductivity ( $\mu\text{S}/\text{cm}$  @ 25°C)

0	460	35
4	448	38

Dissolved Oxygen (mg/L)

0	8.7	7.7
4	8.9	8.9

Temperature (°C)

0	16	16
4	14	14

### Number Alive (In brackets number stressed):

Conc. (%)	control	100
-----------	---------	-----

Day

0	10	10
1	10	10
2	10	10
3	10	10
4	10	10

Mortality (%)

4	0	0
---	---	---

Stressed (%)

4	0	0
---	---	---



# Trout (Single Concentration) Test Report

## Test Data

Client: GAL100
Reference: 16-0966-01-TRS

### Biology Summary Tables:

Control Fish	Length (cm)	Wet Weight(g)
1	3.3	0.4
2	3.2	0.3
3	3.1	0.3
4	2.8	0.2
5	3.1	0.3
6	3.0	0.3
7	2.7	0.2
8	3.0	0.3
9	2.6	0.2
10	2.6	0.2

Sample	Group Wet Weight (g)
control	2.7
100	3.2

average	2.9	0.3
sd	0.3	0.1
cv(%)	8.5	25.0

Notes: nd, not done; na, not applicable;  
sd, standard deviation; cv(%), coefficient of variation

## Comments/Statistics

### Test Result Comments:

None

### Data Analysis:

None

### Protocol Deviations:

None



**Result Summary**

Client: GAL100  
Reference: 16-0966-01-DAS

**Client:** Golder Associates; operation Montréal

**Sample:** LJ-ES2

**Collection:** collected on 2016/08/03 at 0936 by none

**Receipt:** received on 2016/08/06 at 1045 by ML

**Containers:** received 2 x 20L pails at 21 °C, in good condition, but lids were slightly warped with

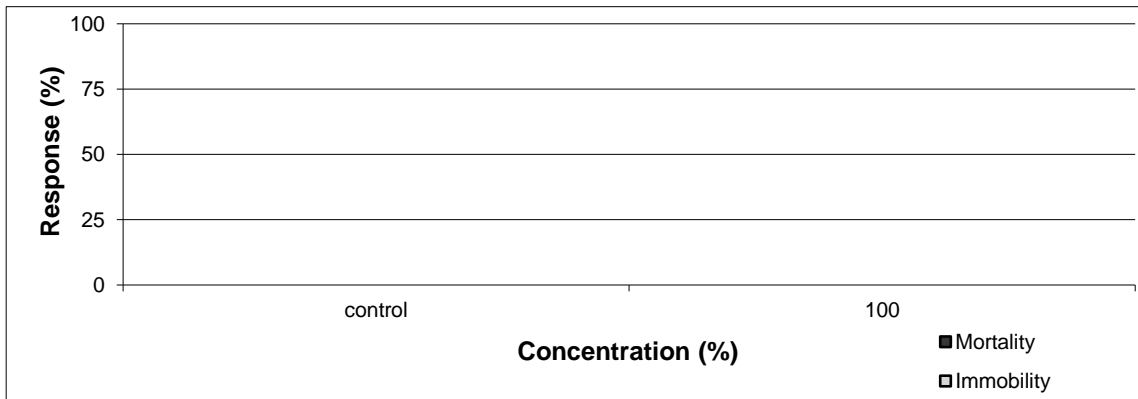
**Description:** type: water, collection method: not given

**Test:** started on 2016/08/06 ; ended on 2016/08/08

**Result:**

Sample	Client Code	Average Mortality (%)	Average Immobility (%)	Comment
control	lab control	0	0	
100	LJ-ES2	0	0	none

Notes: sd, sample standard deviation; cv, coefficient of variation; nd, not done; na, not applicable;



The test data and results are authorized and verified correct.

Senior Verifier

**Test Conditions**

Client: GAL100 Reference: 16-0966-01-DAS
---

**Method:** Biological Test method: Reference Method for Determining Acute Lethality of Effluents to *Daphnia magna*, 2000. Environ. Can., EPS 1/RM/14. Second Edition. (December 2000; amended February 2016)

**Test type:** *Daphnia* 48-h Static Acute Test (WTR-ME-015)

**Species:** *Daphnia magna*

**Age:** < 24 hours old

**Organism source:** in-house culture

**Stock mortality:** 0%

**Culture brood data:** 8 days to first brood  
23 neonates per average brood

**Sample initial chemistry:** pH: 6.7; EC: 23 ( $\mu\text{S}/\text{cm}$  @ 25°C); DO: 7.4 (mg/L); temperature: 21 °C  
hardness (mg CaCO<sub>3</sub>/L): 6; colour: yellow; odour: -

**Sample holding time:** 3 days (must be  $\leq$  5 days)

**Sample storage:** 4  $\pm$  2°C in darkness

**Test vessel:** 385 mL plastic vessels

**Test volume:** 150 mL

**Sample pre-treatment:** The sample was not filtered or pH adjusted prior to or during testing  
The sample was pre-aerated for 0 minutes (rate of 37.5  $\pm$  12.5 mL/min.L-1)  
The hardness of the sample was adjusted to 29 (mg CaCO<sub>3</sub>/L) prior to or during testing

**Loading density:** One daphnid/15 mL (must  $\leq$  1 organism/15 mL)

**Control water:** Moderately hard reconstituted water supplemented with vitamin B12 (2  $\mu\text{g}/\text{L}$ )  
and Na<sub>2</sub>SeO<sub>4</sub> (2  $\mu\text{g}/\text{L}$ )

The hardness of the control/dilution water was 85 mg CaCO<sub>3</sub>/L

**Test concentrations:** Undiluted sample plus a negative control

**Test replicates:** Three replicates per treatment, 10 daphnids per replicate

**Feeding:** None

**Aeration:** None

**Measurements:** pH, conductivity, dissolved oxygen and temperature at test initiation and termination

**Lighting:** Cool white fluorescent lights

**Photoperiod:** 16h light:8h dark

**Test temperature:** 20  $\pm$  2°C

Note: Outlined sections are protocol deviations explained on the comment page





## Test Conditions

Client: GAL100 Reference: 16-0966-01-DAS
---

**Endpoint:** Mortality, % mortality at 48-h  
Immobility, % immobility at 48-h

**Test validity:** The control had 100% survival (must  $\geq$  90%)  
Control had 0% abnormal behaviour (must  $\leq$  10%), e.g. immobility

**Reference toxicant:** 48-h test with NaCl initiated August 4, 2016 current results  
(48-h LC50 and 95% confidence limits) = 0.74 (0.70-0.78) log (g/L NaCl)  
historical results:  
(48-h LC50 and 95% confidence limits) = 0.74 (0.64-0.84) log (g/L NaCl)

Note: Outlined sections are protocol deviations explained on the comment page



**Test Data**

Client: GAL100
Reference: 16-0966-01-DAS

**Test Log:**

Date	Day	Time	Technician
2016/08/06	0	1330	EP
2016-08-07	1	0930	JW
2016-08-08	2	1030	JW

**Chemistry:**

Conc (%)	control			100		
replicate	a	b	c	a	b	c

Day	pH (units)					
0	7.7	7.9	7.9	7.5	7.1	7.0
2	7.8	7.9	7.9	7.7	7.6	7.6

Day	Conductivity (µS/cm @ 25°C)					
0	320	322	327	137	130	131
2	318	328	328	151	148	153

Day	Dissolved Oxygen (mg/L)					
0	7.8	7.8	8.0	7.8	7.8	7.7
2	7.7	7.7	7.8	7.7	7.7	7.8

Day	Temperature (°C)					
0	19	19	19	20	20	20
2	21	21	20	20	20	20

**Biology:**

Conc (%)	control			100		
replicate	a	b	c	a	b	c

Day	Number Alive and Behavior (behavior is in brackets)					
1	10	10	10	10	10	10
2	10	10	10	10	10	10

Notes: F, floating; I, immobile; B, stuck on bubble; D, caught in debris

Day	Mortality (%)					
2	0	0	0	0	0	0

Day	Immobility (%)					
2	0	0	0	0	0	0



**Comments/Statistics**

Client: GAL100 Reference: 16-0966-01-DAS
---

**Test Result Comments:**  
None

**Data Analysis:**  
None

**Protocol Deviations:**  
None

## GENERAL TERMS AND CONDITIONS:

These terms and conditions are incorporated into and form part of the Chain of Custody between HydroQual Laboratories Ltd. ("HydroQual") and the party named in the Chain of Custody (the "Client").

1. **Definitions:** Capitalized terms shall have the definition ascribed as such in these General Terms and Conditions and the Chain of Custody.
2. **The Services:** HydroQual will provide the Services to the Client as listed and described in the Chain of Custody.
3. **Prices:** HydroQual may review and change all prices, fees, surcharges or other charges as set out in proposals and/or price quotations if there are changes to HydroQual's cost beyond HydroQual's control, including changes in legislative requirements, Client variations of sample numbers and Client requests for changes to standard reporting requirements. Notwithstanding condition 3, all quotations are reviewed and updated on a yearly basis.
4. **Payment Terms:** The Client shall pay HydroQual within 30 days of the invoice date as provided by HydroQual. HydroQual may, for reasonable business reasons, require the Client to arrange for payment in advance.
5. **Quotation Numbers:** The Client shall provide the proposal and/or price quotation number to HydroQual (where applicable) to ensure correct pricing.
6. **Taxes:** Applicable taxes are not included in prices, surcharges and additional fees and will be added at the time of invoicing.
7. **No Guarantee of Results:** The Client is responsible for informing itself on the limitation of the results and acknowledges that the results are not guaranteed.
8. **Standard of Care:** HydroQual will use reasonable care and diligence as required by the laws of the province or territory where the sample is tested, subject to that level of care and skill ordinarily exercised by other laboratories currently practicing under similar conditions in the same locality, subject to the time limits and financial, physical or other constraints applicable to the Services. No warranty, express or implied, is made.
9. **Storage:** Where possible, HydroQual will store samples until a final report is issued to the Client, after which time HydroQual may discard the sample.
10. **Holds:** If the Client requests a sample be placed on hold, HydroQual will store the sample for the mutually agreed upon written time and price, after which HydroQual will invoice the Client and discard the sample.
11. **Archives:** If the Client requests a sample be archived, HydroQual will store the sample for a mutually agreed upon written time frame and price, after which HydroQual will invoice the Client and discard the sample.
12. **Handling Protocol:** Legal sample handling protocol must be arranged, and provided in writing, before samples are collected. HydroQual will provide a price quotation for legal sample protocol. Samples processed under legal protocol are stored indefinitely, subject to a storage charge as advised by HydroQual.
13. **Samples:** The quality, condition, content and source of samples stored and tested are not known to HydroQual except as declared and described on the Chain of Custody completed and submitted by the Client and accompanying the sample.
14. **Risk of Loss:** HydroQual will use reasonable care to protect samples during storage, however, all samples are stored at the Client's risk and the Client is responsible for obtaining appropriate insurance, if desired. The Client acknowledges that during the performance of the Services samples may be altered, lost, damaged or destroyed and the client forever releases HydroQual from any and all claims the Client may have for any loss or damage to the sample.
15. **Environmental:** the Client must comply with all applicable environmental legislation, including labeling all hazardous samples to comply with Canada's *Workplace Hazardous Materials Information System* and the Alberta *Transfer of Dangerous Goods* regulations, and must provide appropriate material safety data sheets that include the nature of the hazard and a contact name and phone number to call for information. The Client shall defend, indemnify and hold harmless HydroQual for all loss or damages, including any fine or cost of complying with an order of any government authority, resulting from the Client's breach of this paragraph.
16. **Hazardous Materials Disposal:** HydroQual may return, at the Client's cost, hazardous material to the Client for disposal.
17. **Hazardous Materials Surcharge:** HydroQual may apply an additional surcharge for handling of hazardous samples or samples with Naturally Occurring Radioactive Materials ("NORM"), such as and including without limitation, H<sub>2</sub>S and CN.
18. **Sample Containers:** HydroQual may ship sample containers to the Client's location by the most cost effective means using HydroQual's preferred courier suppliers, within the specified project timeline. Shipping will be charged back to the Client.
19. **Additional Charges:** HydroQual may charge the Client:
  - (a) for pick-up and delivery services when provided subject in each instance to a minimum charge of \$50.00; and,
  - (b) for rush service (processing samples and/or reporting).
20. **Large Bottle Orders:** The Client shall provide HydroQual with not less than 24 hours' notice for large bottle orders.
21. **Re-Tests:** HydroQual reserves the right to re-test any samples that remain in HydroQual's possession. Re-tests requested by the Client may be charged to Client and Client agrees to pay for such charges.
22. **Waiver:** The Client is responsible for making any assessment regarding the suitability of the Services and the intended results for the Client's purposes and waives any and all claims against HydroQual that the Client may have against HydroQual as a result of the interpretation of the results provided to the Client. The Client shall defend, indemnify and save harmless HydroQual for any and all claims made by any third party against HydroQual in respect of all losses however arising from the performance of the Services or the use of any report provided in the performance of the Services.
23. **LIMITATION OF LIABILITY:** IN NO EVENT SHALL HYDROQUAL BE RESPONSIBLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY OR PUNITIVE DAMAGES, WHETHER FORESEEABLE OR UNFORESEEABLE (INCLUDING CLAIMS FOR LOSS OF PROFITS OR REVENUE OR LOSSES CAUSED BY STOPPAGE OF OTHER WORK OR IMPAIRMENT OF OTHER ASSETS) INCURRED BY THE CLIENT ARISING OUT OF BREACH OR FAILURE OF EXPRESS OR IMPLIED WARRANTY, BREACH OF CONTRACT, BREACH OF WARRANTY, MISREPRESENTATION, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE. IN ANY EVENT, THE LIABILITY OF HYDROQUAL TO THE CLIENT SHALL BE LIMITED TO THE COST OF TESTING THE SAMPLE AS REQUESTED IN THE CHAIN OF CUSTODY UNDER WHICH THE SAMPLE WAS ORIGINALLY DEPOSITED. FOR THE PURPOSES OF THIS PARAGRAPH AND PARAGRAPHS 7, 14, 15, 22, AND 24, AS APPLICABLE, "HYDROQUAL" INCLUDES WITHOUT LIMITATIONS ITS DIRECTORS, OFFICERS, EMPLOYEES AND AFFILIATES AND THE "CLIENT" INCLUDES WITHOUT LIMITATION ANY THIRD PARTY THAT MAY HAVE A CLAIM AGAINST HYDROQUAL THROUGH THE CLIENT.
24. **Notice of Liability:** Notwithstanding paragraph 23, HydroQual shall not be liable to the Client unless the Client provides notice in writing to HydroQual of such loss or damage, together with full particulars thereof, within 30 days of the Client's receipt of the report of the analysis of the sample giving rise to such liability. The provisions of this paragraph allocate the risk between the Client and HydroQual, and the fees to be paid by the Client to HydroQual reflect this allocation of any such risks and the limitations of liability in these General Terms and Conditions.
25. **Entire Agreement:** These General Terms and Conditions, the Chain of Custody and price quotations constitute the entire agreement between the parties and supersede and take precedence over any terms and conditions contained in any documentation provided by the Client. HydroQual's execution of any subsequent documentation from the Client only acknowledges receipt and not acceptance of any terms or conditions therein unless expressly stipulated otherwise by HydroQual. If there is a conflict between these General Terms and Conditions and any other document, these General Terms and Conditions prevail.



# Toxicity testing using rainbow trout embryo-alevins

Samples L J-ES1 and L J-ES2

Final Report

December 8, 2016

Submitted to: **Golder Associates**  
Montreal, QC

---

## TABLE OF CONTENTS

	Page
Signature Page.....	ii
Summary .....	iii
1.0 Introduction .....	1
2.0 Methods.....	1
3.0 Results.....	3
4.0 QA/QC.....	4
5.0 References.....	5

## List of Tables

Table 1.	Summary of test conditions: rainbow trout ( <i>Oncorhynchus mykiss</i> ) embryo-alevin.....	2
Table 2.	Results: rainbow trout ( <i>Oncorhynchus mykiss</i> ) embryo-alevin.....	3
Table 3.	Reference toxicant test results. ....	4

## List of Appendices

APPENDIX A – *Oncorhynchus mykiss* Toxicity Test Data

APPENDIX B – Chain-of-Custody Form

---

**SIGNATURE PAGE**

---

Report By:  
Kania Lywe, B.Sc.  
Laboratory Biologist



---

Reviewed By:  
James Elphick, R.P.Bio  
Environmental Toxicologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

## SUMMARY

A summary of sample information and test results from the rainbow trout (*Oncorhynchus mykiss*) toxicity test are provided in the tables below. Testing was initiated on October 25, 2016 at the Nautilus Environmental laboratory in Burnaby, BC.

### Sample and Test Type Information

Sample ID	L J-ES1 and L J-ES2
Sample collection date	October 22, 2016
Sample receipt date	October 24, 2016
Sample receipt temperature	8.5°C
Test type	Rainbow trout ( <i>Oncorhynchus mykiss</i> ) embryo-alevin survival and development

### Results

Endpoint	% v/v	
	L J-ES1	L J-ES2
EC25 (survival)	>100	>100
EC50 (survival)	>100	>100
EC25 (viability)	>100	>100
EC50 (viability)	>100	>100



## 1.0 INTRODUCTION

Nautilus Environmental conducted an early life stage embryo-alevin toxicity test using rainbow trout (*Oncorhynchus mykiss*) for Golder Associates on two samples identified as LJ-ES1 and LJ-ES2. Samples were collected on October 22, 2016 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on October 24, 2016. The toxicity test was initiated on October 25, 2016. The samples were transported in 20-L plastic containers. They were received at a temperature of 8.5°C and stored in the dark at 4 ± 2°C prior to testing. Testing was conducted using sample collected on October 22, 2016 only; no refresh samples were provided.

This report describes the results of the toxicity tests. Copies of raw laboratory data sheets and statistical analyses are provided in Appendix A. The chain-of-custody form is provided in Appendix B.

## 2.0 METHODS

Methods for the toxicity test using rainbow trout are summarized in Table 1. Testing was conducted according to procedures described by Environment Canada (1998) and Canaria *et al.* (1999). Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013).

**Table 1. Summary of test conditions: rainbow trout (*Oncorhynchus mykiss*) embryo-alevin.**

Test species	<i>Oncorhynchus mykiss</i>
Organism source	Hatchery
Organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static-renewal
Test duration	Test terminated 7 days after $\geq 50\%$ of controls hatch
Test vessel	2-L plastic container
Test volume	2 L
Test solution depth	17 cm
Test concentrations	Two concentrations, plus laboratory control
Test replicates	4 per treatment
Number of organisms	30 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	Monday, Wednesday and Friday (80% renewal)
Test temperature	$14 \pm 1^\circ\text{C}$
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured upon arrival; survival checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/28; Canaria et al. (1999)
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival, normal development
Test acceptability criteria for controls	$\geq 65\%$ normal alevins
Reference toxicant	Sodium dodecyl sulphate (SDS)

### 3.0 RESULTS

Results of the early life stage embryo-alevin test on samples L J-ES1 and L J-ES2 are provided below in Table 2. Survival and normal hatched alevins were >90% in all test treatments for both samples. There were no adverse effects exhibited for survival or normality; the EC25 and EC50 values for both endpoints were >100% (v/v).

**Table 2. Results: rainbow trout (*Oncorhynchus mykiss*) embryo-alevin.**

Concentration (% v/v)	(% (Mean ± SD))			
	L J-ES1		L J-ES2	
	Survival	Normal	Survival	Normal
Laboratory Control	95.4 ± 7.2	92.9 ± 6.2	97.5 ± 3.2	95.8 ± 4.2
50	95.2 ± 5.6	93.5 ± 4.6	95.0 ± 3.3	93.3 ± 4.7
100	96.7 ± 2.7	95.0 ± 4.3	93.3 ± 9.0	90.8 ± 7.4
<b>Test endpoint (% v/v)</b>				
EC25	>100	>100	>100	>100
EC50	>100	>100	>100	>100

SD = Standard Deviation, EC = Effect Concentration

#### 4.0 QA/QC

The health history of the test organisms used in the exposures was acceptable and met the requirements of the test method. The tests met control acceptability criteria and water quality remained within ranges specified in the protocols throughout the tests. Uncertainty associated with these tests is best described by the standard deviations around the means.

Gametes from four female and four male fish were provided by the supplier; however, no sperm motility was observed in milt from one of the male fish. Thus, milt from three males was used to fertilize the eggs, rather than four males as indicated in the Environment Canada method. The eggs were exposed using a blocked design (i.e., eggs from one fish was used for replicate A of each test concentration, eggs from the second fish for replicate B, and so on); this approach deviates from the Environment Canada test method, which indicates that the eggs should be pooled prior to testing. However, this modification is considered appropriate because it reduces the risk of non-viable eggs affecting the test results, since in the event that one of the batches of eggs had been non-viable, it would have been possible to exclude data for that replicate.

The full volume of the samples required for the entire duration of the tests was collected during one sampling event, and water renewals were conducted three times per week during the test rather than daily. These were planned deviations that were discussed with the client in order to accommodate sampling constraints (i.e., to limit the volume of sample and frequency of collection that was needed), and were considered appropriate because the contaminants of concern were expected to be consistent in the samples over time (i.e., would not be expected to degrade or volatilize). There were no other deviations from the test method.

Results of the reference toxicant test conducted during the testing program are summarized in Table 3. Results for this test fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in these tests was appropriate.

**Table 3. Reference toxicant test results.**

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
<i>O. mykiss</i>	Viability (EC50): 5.5 mg/L SDS	4.0 (2.1 - 7.4)	37	October 25, 2016

SD = Standard Deviation, CV = Coefficient of Variation, EC = Effect Concentration

## 5.0 REFERENCES

Canaria, E.C., J.R. Elphick and H.C. Bailey. 1999. A simplified procedure for conducting small-scale short-term embryo toxicity tests with salmonids. *Environ. Toxicol.* 14:301-307.

Environment Canada. 1998. Biological test method: toxicity tests using early life stages of salmonid fish (rainbow trout). Environmental Protection Series EPS 1/RM/28. Second Edition, July 1998. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 102 pp.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.8.7.16 Tidepool Scientific Software, McKinleyville, CA. 222 pp.

**APPENDIX A – *Oncorhynchus mykiss* Toxicity Test Data**

---

## Rainbow Trout Early Life Stage Summary Sheet

Client: Golden Start Date/Time: Oct 25/16 01625h  
 Work Order No.: 161147 Test Species: Oncorhynchus mykiss

**Sample Information:**

Sample ID: LS-ES1  
 Sample Date: Oct 22/16  
 Date Received: Oct 24/16  
 Sample Volume: 9 x 20L (sampled once)

**Dilution Water:**

Type: Dechlorinated Tap Water  
 Hardness (mg/L CaCO<sub>3</sub>): 7-10  
 Alkalinity (mg/L CaCO<sub>3</sub>): 2-5

**Test Organism Information:**

Batch No.: 102516  
 Source: Vancouver Island Trout Hatchery  
 Loading Density: 1.0g/L

Number of male broodstock used: 3  
 Number of female broodstock used: 4  
 Sperm motility check: Verification of sperm motility using a compound microscope

**SDS Reference Toxicant Results:**

Reference Toxicant ID: RTG89  
 Stock Solution ID: 16502 (1000mg/L SDS)  
 Date Initiated: Oct 25/16  
 7-d EC50 (95% CL): 5.5 (5.2 - 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.0 (2.1 - 7.4) mg/L SDS  
 Reference Toxicant CV (%): 37

**Test Results:**

	Sample ID	
	LS-ES1	
EC25 % (v/v) (95% CL)	>100	
EC50 % (v/v) (95% CL)	>100	

Reviewed by: JGB

Date reviewed: Dec 6/16

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Colder  
 Sample ID: LJ-ES1  
 Work Order #: 161147

Start Date & Time: 06/25/16 01:25h  
 Stop Date & Time: Nov 24/16 01:00h.  
 Test Species: Oncorhynchus mykiss

Concentration Control	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5	14.5	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0	
DO (mg/L)	10.9	10.1	10.1	/	10.2	10.0	10.1	/	9.8	/	9.8	10.0	10.0	
pH	7.1	6.9	6.9	/	6.9	6.9	6.8	/	7.2	/	7.2	6.9	6.9	
Cond. (µS/cm)	28	28		/		28		/		/		28		
Initials	KL	K		K		K		AS		AS		K		

Concentration S0	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.0	14.0	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0	
DO (mg/L)	10.2	10.2	10.1	/	10.2	10.1	10.1	/	9.8	/	9.9	9.8	10.0	
pH	7.2	7.2	7.2	/	7.1	6.4	6.9	/	7.2	/	7.2	7.1	7.3	
Cond. (µS/cm)	55	55		/		55		/		/		55		
Initials	KL	K		K		K		AS		AS		KL		

Concentration W0	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.5	14.0	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0	
DO (mg/L)	10.3	10.2	10.1	/	10.2	10.2	10.1	/	9.9	/	9.8	9.8	10.0	
pH	7.3	7.2	7.3	/	7.4	7.3	7.1	/	7.2	/	7.3	7.2	7.5	
Cond. (µS/cm)	81	81		/		81		/		/		81		
Initials	KL	K		K		K		AS		AS		K		

Concentration	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3    DO meter: DO-2    pH meter: PH-1    Conductivity meter: C-2

	Control	W0	S0	W0
Hardness*	10	44	/	/
Alkalinity*	4	26	/	/

Analysts: AWD, KL

Reviewed by: JW

Date reviewed: Dec. 6/16

\* mg/L as CaCO3

Sample Description: light yellow, slightly cloudy, odourless, some particulates

Comments: \_\_\_\_\_



## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Golder  
 Sample ID: LS-251  
 Work Order #: 161147

Start Date & Time: 9/25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1100h  
 Test Species: Oncorhynchus mykiss

% (v/v) Concentration control	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.5	14.0	/	14.0	14.5	13.5	/	14.0	/	14.5	15.0	15.0
DO (mg/L)	/	10.2	9.8	9.8	/	10.1	10.1	10.1	/	10.1	/	9.8	9.8	9.7
pH	/	6.9	6.9	6.9	/	6.9	7.1	7.0	/	7.0	/	6.9	6.9	6.8
Cond. (µS/cm)	/		28		/		27		/		/		28	
Initials	/	K	K		/	K	K		/	A	/	A	K	

Concentration 50	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.5	14.0	/	14.0	14.0	13.5	/	14.0	/	14.5	14.5	15.0
DO (mg/L)	/	10.2	9.8	9.8	/	10.1	10.2	10.1	/	10.1	/	9.8	9.9	9.7
pH	/	7.3	7.1	7.3	/	7.1	7.2	7.3	/	7.2	/	7.1	7.0	7.1
Cond. (µS/cm)	/		56		/		55		/		/		56	
Initials	/	K	K		/	K	K		/	A	/	K	K	

Concentration 100	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.5	14.0	/	14.0	14.0	13.5	/	14.0	/	14.5	14.0	15.0
DO (mg/L)	/	10.2	9.9	9.8	/	10.1	10.2	10.1	/	10.2	/	9.8	9.9	9.7
pH	/	7.5	7.3	7.5	/	7.3	7.3	7.5	/	7.4	/	7.4	7.2	7.3
Cond. (µS/cm)	/		81		/		81		/		/		76	
Initials	/	K	K		/	K	K		/	A	/	K	K	

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 DO meter: DO-2 pH meter: pH-1 Conductivity meter: C-2/3

Hardness*	Control 9	100% 44		
Alkalinity*	4	26		

Analysts: AWD, K  
 Reviewed by: JBL  
 Date reviewed: Dec 6/16

\* mg/L as CaCO3

Sample Description: light yellow, slightly cloudy, odorless, some particulates

Comments: \_\_\_\_\_

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Corder  
 Sample ID: L5-255  
 Work Order #: 161147

Start Date & Time: Oct 25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1100h  
 Test Species: Oncorhynchus mykiss

% (v/v) Concentration Control	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	9.9	9.8	10.1	10.0	/	10.0	9.9	10.0	/	10.1	/	9.9	10.0	10.1
pH	/	6.8	7.0	7.0	/	6.9	7.0	6.9	/	7.1	/	7.2	7.2	6.9
Cond. (µS/cm)	88		28		/		26		/		/		27	
Initials	W		W		W		VYL		A		W		W	

Concentration SO	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	9.8	10.1	10.0	/	10.0	9.8	10.1	/	10.2	/	9.9	10.0	10.1
pH	/	7.0	7.1	7.2	/	7.0	7.1	7.2	/	7.2	/	7.3	7.3	7.4
Cond. (µS/cm)	/		28.55		/		54		/		/		56	
Initials	W		W		W		VYL		A		W		W	

Concentration W0	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.5	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	9.8	10.1	10.0	/	10.0	9.9	10.1	/	10.1	/	9.9	10.0	10.1
pH	/	7.2	7.2	7.3	/	7.2	7.1	7.2	/	7.2	/	7.3	7.3	7.4
Cond. (µS/cm)	/		81		/		82		/		/		83	
Initials	W		W		W		VYL		A		W		W	

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3    DO meter: DO-2    pH meter: pH-1    Conductivity meter: C-2

	Control	100%		
Hardness*	7	44	/	
Alkalinity*	5	26	/	

Analysts: AWB, VYL, W

Reviewed by: JLW

Date reviewed: Dec. 6/16

\* mg/L as CaCO<sub>3</sub>

Sample Description: light yellow, slightly cloudy, odourless, some particulates.

Comments: \_\_\_\_\_

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Bolder  
 Sample ID: LS-ES-1  
 Work Order #: 161147

Start Date & Time: Oct 25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1100h  
 Test Species: Oncorhynchus mykiss

% (v/v) Concentration <small>(control)</small>	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.0	14.0	/	13.5	14.0	14.0	/	14.0	/	14.0	14.5	13.5
DO (mg/L)	/	10.1	10.1	9.9	/	10.1	10.0	9.9	/	9.9	/	9.8	10.0	10.0
pH	/	6.8	7.0	6.8	/	6.8	7.0	6.8	/	7.2	/	7.1	6.5	6.5
Cond. (µS/cm)				28				26		X <sub>m</sub>				27
Initials		K		K		K		K		A		A		K

Concentration S <sub>0</sub>	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.0	14.0	/	13.5	14.0	14.0	/	14.0	/	14.0	14.5	13.5
DO (mg/L)	/	10.1	10.0	10.0	/	10.1	9.8	9.8	/	9.8	/	9.9	9.9	10.0
pH	/	7.1	7.1	6.9	/	6.7	7.0	6.9	/	7.1	/	7.2	6.6	6.6
Cond. (µS/cm)				56				55						54
Initials		K		K		K		K		A		A		K

Concentration W <sub>00</sub>	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.0	14.0	/	13.5	14.0	14.0	/	14.0	/	14.0	14.5	13.5
DO (mg/L)	/	10.1	10.1	10.0	/	10.1	9.9	9.8	/	9.9	/	9.8	9.9	9.9
pH	/	7.0	7.1	6.9	/	7.0	7.0	7.1	/	7.0	/	7.2	6.8	6.9
Cond. (µS/cm)				83				82						85
Initials		K		K		K		K		A		A		K

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 DO meter: DO-2 pH meter: pH-1 Conductivity meter: C-2

	Control	100%/-		
Hardness*	7	44		
Alkalinity*	2	26		

Analysts: AWD, KL  
 Reviewed by: JGL  
 Date reviewed: Dec 6/16

\* mg/L as CaCO<sub>3</sub>

Sample Description: light yellow, slightly cloudy, odorless, some particulates

Comments: \_\_\_\_\_

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Wolder  
 Sample ID: LJ-ES I  
 Work Order #: 161147

Start Date & Time: Oct 25/16 @ 1625h.  
 Stop Date & Time: Nov 24/16 @ 1100h  
 Test Species: Oncorhynchus mykiss

Concentration Control	Days													
	28		29		Final 30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	14.5	13.5	13.5									
DO (mg/L)		9.7	9.8	9.8	10.1									
pH		6.7	6.8	6.7	6.6									
Cond. (µS/cm)			27		30									
Initials		K	K		K									

Concentration 50	Days													
	28		29		Final 30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	14.5	13.5	13.5									
DO (mg/L)		9.8	9.8	9.8	10.1									
pH		6.9	6.8	7.0	6.9									
Cond. (µS/cm)			55 8+K		62									
Initials		K	K		K									

Concentration 100	Days													
	28		29		Final 30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	14.5	13.5	13.5									
DO (mg/L)		9.8	9.8	9.8	10.1									
pH		7.1	6.9	7.1	7.2									
Cond. (µS/cm)			82		86									
Initials		K	K		K									

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp 3 DO meter: DO-2 pH meter: pH-1 Conductivity meter: C-2

	Control	100%		
Hardness*	7	44		
Alkalinity*	2	26		

Analysts: K

Reviewed by: JGK

Date reviewed: Dec 6/16

Sample Description: light yellow, slightly cloudy, odorless, some particulates

Comments: \_\_\_\_\_

## Embryo-Alevin Toxicity Test Daily Mortality

Client: Golder  
 Sample ID: LS-ES1  
 Work Order #: 16147

Start Date & Time: 0925/16 P 1625h  
 Stop Date & Time: Nov 24/16 P 1100h  
 Test Species: Oncorhynchus mykiss

Concentration % (v/v)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
Control	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	1	0	0	0	0	0	0	1
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
50	1	1	0	0	0	0	0	0	1	0	0	0	0	2
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	1	0	1	0	0	0	0	2
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
100	1	0	0	0	0	0	1	0	0	0	0	0	0	1
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		JK	JK	JK	JK	JK	JK	JK	JK	JK	JK	JK	JK	JK

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Reviewed by: JK Date reviewed: Dec-6/16  
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

## Embryo-Alevin Toxicity Test Daily Mortality

Client: Holder  
 Sample ID: LJ-ESI  
 Work Order #: 161147

Start Date & Time: Oct 25/16 e 1625h  
 Stop Date & Time: Nov 24/16 e 1100h  
 Test Species: Oncorhynchus mykiss

Concentration % (v/v)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13	14	15	16	17	18	19	20	21	22	23	24	
control	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	1	↓	↓	↓	2
50	1	↓	↓	↓	↓	↓	↓	↓	0	0	↓	↓	↓	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
100	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		K	K	K	K	MM	A	K	K	K	K	K	K	K

Comments: ① at eyed stage ② start to hatch ③ >50% hatched in control

Reviewed by: JGK Date reviewed: Dec. 6/16

## Embryo-Alevin Toxicity Test Daily Mortality

Client: Golder  
 Sample ID: LJ-ESI  
 Work Order #: 161147

Start Date & Time: Oct 25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1100h  
 Test Species: Oncorhynchus mykiss

Concentration % (V/V)	Rep	Day of Test - No. of Mortalities						Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched <small>(abnormal)</small>	Total No. Alevins <small>% Normal</small>	Total Exposed Eggs
		25	26	27	28	29	30				
Control	1	0	0	0	0	0	0	0	2	28	30
	2		0					0	0	30	30
	3							1	1	28	30
	4						30	5	0	28	33
50	1						1	3	0	29	32
	2						30	0	2	28	30
	3			1				3	0	27	30
	4			0				0	0	30	30
100	1			0				1	1	28	30
	2			1				1	0	29	30
	3			0	2			2	1	27	30
	4			0	0			0	0	30	30
	1										
	2										
	3										
	4										
	1										
	2										
	3										
	4										
	1										
	2										
	3										
	4										
	1										
	2										
	3										
	4										
Tech Initials		M	n	n	n	n	n	n	n	n	n

Comments: ① 1 undeveloped egg and 2 eggs that are at eyed stage

Reviewed by: JGH Date reviewed: Dec. 6/16

Client: Golder

Sample ID: LJ-ES1

WO#: 161147

Test Initiation Date: October 25, 2016

Test Termination Date: November 24, 2016

Test Species: Oncorhynchus mykiss

Mortality Counts

Test Conc. (% v/v)	Rep	Day 1-12	Day 13-24	Day 25-30	Total Dead	Abnormal Alevins	Normal Alevins	Total No. Alevins	Total No. Exposed
Control	1	0	0	0	0	2 ①	28	30	30
	2	0	0	0	0	0	30	30	30
	3	1	0	0	1	1 ②	28	29	30
	4	0	2	3	5	0	28	28	33
50	1	2	0	1	3	0	29	29	32
	2	0	0	0	0	2 ③	28	30	30
	3	2	0	1	3	0	27	27	30
	4	0	0	0	0	0	30	30	30
100	1	1	0	0	1	1 ④	28	29	30
	2	0	0	1	1	0	29	29	30
	3	0	0	2	2	1 ④	27	28	30
	4	0	0	0	0	0	30	30	30

Survival

100.0  
100.0  
96.7  
84.8  
90.6  
100.0  
90.0  
100.0  
96.7  
96.7  
93.3  
100.0

**Mean**  
95.4

**SD**  
7.2

Normal Alevins

93.3  
100.0  
93.3  
84.8  
90.6  
93.3  
90.0  
100.0  
93.3  
96.7  
90.0  
100.0

**Mean**  
92.9

**SD**  
6.2

**Mean**  
95.2

**SD**  
5.6

**Mean**  
93.5

**SD**  
4.6

**Mean**  
96.7

**SD**  
2.7

**Mean**  
95.0

**SD**  
4.3

① 1 lordosis; ② 1 jaw deformity w/ discoloration ~~at~~, ③ 1 jaw deformity,

④ 1 yolk sac edema; 1 yolk sac edema, lordosis and pale, ⑤ 1 jaw deformity, yolk sac edema and pale / discoloration

JGL  
Dec. 6/16



**CETIS Analytical Report**

Report Date: 29 Nov-16 17:01 (p 1 of 2)  
 Test Code: 161147a | 10-5254-2320

**Salmonid Embryo-Alevin Survival and Development Test**

**Nautilus Environmental**

<b>Analysis ID:</b> 07-9813-7684	<b>Endpoint:</b> Survival Rate	<b>CETIS Version:</b> CETISv1.8.7
<b>Analyzed:</b> 29 Nov-16 16:52	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Official Results:</b> Yes
<b>Batch ID:</b> 12-7735-7020	<b>Test Type:</b> Survival-Development	<b>Analyst:</b> Kania Lywe
<b>Start Date:</b> 25 Oct-16 16:25	<b>Protocol:</b> EC/EPS 1/RM/28	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 24 Nov-16 11:00	<b>Species:</b> Oncorhynchus mykiss	<b>Brine:</b>
<b>Duration:</b> 29d 19h	<b>Source:</b> Vancouver Island Trout Hatchery	<b>Age:</b>
<b>Sample ID:</b> 19-7864-6846	<b>Code:</b> 75EFC13E	<b>Client:</b> Golder
<b>Sample Date:</b> 22 Oct-16 13:45	<b>Material:</b> Water Sample	<b>Project:</b>
<b>Receive Date:</b> 24 Oct-16 15:35	<b>Source:</b> Golder	
<b>Sample Age:</b> 75h (8.5 °C)	<b>Station:</b> LJ-ES1	

**Linear Interpolation Options**

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1659629	200	Yes	Two-Point Interpolation

**Point Estimates**

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

**Survival Rate Summary**

**Calculated Variate(A/B)**

C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.9538	0.8485	1	0.03597	0.07194	7.54%	0.0%	117	123
50		4	0.9516	0.9	1	0.02799	0.05599	5.88%	0.23%	116	122
100		4	0.9667	0.9333	1	0.01361	0.02722	2.82%	-1.35%	116	120

**Survival Rate Detail**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	1	1	0.9667	0.8485
50		0.9063	1	0.9	1
100		0.9667	0.9667	0.9333	1

**Survival Rate Binomials**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	30/30	30/30	29/30	28/33
50		29/32	30/30	27/30	30/30
100		29/30	29/30	28/30	30/30



**CETIS Analytical Report**

Report Date: 29 Nov-16 17:01 (p 1 of 2)  
 Test Code: 161147a | 10-5254-2320

**Salmonid Embryo-Alevin Survival and Development Test**

**Nautilus Environmental**

<b>Analysis ID:</b> 07-5268-5930	<b>Endpoint:</b> Proportion Normal	<b>CETIS Version:</b> CETISv1.8.7
<b>Analyzed:</b> 29 Nov-16 16:52	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Official Results:</b> Yes
<b>Batch ID:</b> 12-7735-7020	<b>Test Type:</b> Survival-Development	<b>Analyst:</b> Kania Lywe
<b>Start Date:</b> 25 Oct-16 16:25	<b>Protocol:</b> EC/EPS 1/RM/28	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 24 Nov-16 11:00	<b>Species:</b> Oncorhynchus mykiss	<b>Brine:</b>
<b>Duration:</b> 29d 19h	<b>Source:</b> Vancouver Island Trout Hatchery	<b>Age:</b>
<b>Sample ID:</b> 19-7864-6846	<b>Code:</b> 75EFC13E	<b>Client:</b> Golder
<b>Sample Date:</b> 22 Oct-16 13:45	<b>Material:</b> Water Sample	<b>Project:</b>
<b>Receive Date:</b> 24 Oct-16 15:35	<b>Source:</b> Golder	
<b>Sample Age:</b> 75h (8.5 °C)	<b>Station:</b> LJ-ES1	

**Linear Interpolation Options**

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1475694	200	Yes	Two-Point Interpolation

**Point Estimates**

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

**Proportion Normal Summary**

**Calculated Variate(A/B)**

C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.9288	0.8485	1	0.03104	0.06208	6.68%	0.0%	114	123
50		4	0.9349	0.9	1	0.02288	0.04575	4.89%	-0.66%	114	122
100		4	0.95	0.9	1	0.02152	0.04303	4.53%	-2.28%	114	120

**Proportion Normal Detail**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.9333	1	0.9333	0.8485
50		0.9063	0.9333	0.9	1
100		0.9333	0.9667	0.9	1

**Proportion Normal Binomials**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	28/30	30/30	28/30	28/33
50		29/32	28/30	27/30	30/30
100		28/30	29/30	27/30	30/30

# CETIS Analytical Report

Report Date: 29 Nov-16 17:01 (p 2 of 2)  
Test Code: 161147a | 10-5254-2320

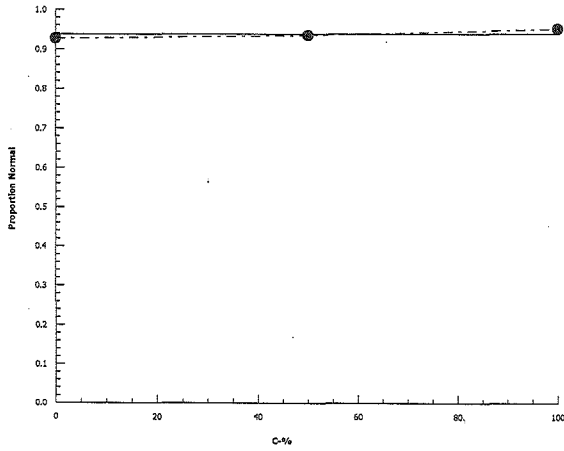
Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 07-5268-5930      Endpoint: Proportion Normal  
Analyzed: 29 Nov-16 16:52      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7  
Official Results: Yes

## Graphics



## Rainbow Trout Early Life Stage Summary Sheet

Client: Goldier Start Date/Time: Oct 25/16 @ 1625h.

Work Order No.: 161147 Test Species: Oncorhynchus mykiss

**Sample Information:**

Sample ID: LS-ES2  
 Sample Date: Oct 22/16  
 Date Received: Oct 24/16  
 Sample Volume: 9x20L (sampled once)

**Dilution Water:**

Type: Dechlorinated Tap Water  
 Hardness (mg/L CaCO<sub>3</sub>): 7-10  
 Alkalinity (mg/L CaCO<sub>3</sub>): 2-5

**Test Organism Information:**

Batch No.: 102516  
 Source: Vancouver Island Trout Hatchery  
 Loading Density: 1.0g/L

Number of male broodstock used: 3  
 Number of female broodstock used: 4  
 Sperm motility check: Verification of sperm motility using a compound microscope

**SDS Reference Toxicant Results:**

Reference Toxicant ID: ATE-89  
 Stock Solution ID: 16502 (1000mg/L SDS)  
 Date Initiated: Oct 25/16  
 7-d EC50 (95% CL): 5.5 (5.2 - 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.0 (2.1 - 7.4) mg/L SDS  
 Reference Toxicant CV (%): 37

**Test Results:**

	Sample ID		
	LS-ES2		
EC25 % (v/v) (95% CL)	>100		
EC50 % (v/v) (95% CL)	>100		

Reviewed by: JOK

Date reviewed: Dec. 6/16

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Holder  
 Sample ID: LS-ES2  
 Work Order #: 161147

Start Date & Time: 0425/16 @ 1625h  
 Stop Date & Time: Nov 24/16 1130h.  
 Test Species: Oncorhynchus mykiss

Concentration 6 <sup>th</sup> control	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.5	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	9.9	10.1	10.1	/	10.1	10.0	10.1	/	9.8	/	9.9	10.0	10.0
pH	7.1	6.9	6.9	/	6.9	6.9	6.8	/	7.2	/	7.2	6.9	6.9
Cond. (µS/cm)	28	28		/	/	18		/	/	/	/	28	
Initials	KL	KL		/	/	KL		/	/	/	/	KL	

Concentration 50	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	14.0	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	10.3	10.3	10.1	/	10.1	10.2	10.1	/	9.9	/	9.8	9.9	10.0
pH	7.2	7.0	6.9	/	7.1	7.1	6.9	/	7.1	/	7.1	6.9	7.0
Cond. (µS/cm)	29	29		/	/	28		/	/	/	/	30	
Initials	KL	KL		/	/	KL		/	/	/	/	KL	

Concentration 100	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.5	14.0	14.0	/	14.0	14.5	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	10.3	10.3	10.1	/	10.1	10.2	10.1	/	9.9	/	9.8	9.9	10.0
pH	7.0	6.9	6.9	/	7.1	6.9	6.9	/	7.1	/	7.0	6.8	6.9
Cond. (µS/cm)	30	29		/	/	29		/	/	/	/	32	
Initials	KL	KL		/	/	KL		/	/	/	/	KL	

Concentration	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Thermometer: Temp-3    DO meter: DO-2    pH meter: PH-1    Conductivity meter: C-2

	Control	100%		
Hardness*	10	20	/	/
Alkalinity*	4	2	/	/

Analysts: AWD, KL  
 Reviewed by: JOK  
 Date reviewed: Dec. 6/16

\* mg/L as CaCO3

Sample Description: clear, dark yellow, odorless, some particulates.

Comments: \_\_\_\_\_

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: holder  
 Sample ID: LS-ES2  
 Work Order #: 161147

Start Date & Time: Oct 25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1306h  
 Test Species: Oncorhynchus mykiss

Concentration <i>Control</i>	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.5	14.0	/	14.0	14.5	13.5	/	14.0	14.5	15.0	15.0	
DO (mg/L)	/	10.2	9.8	9.7	/	10.1	10.1	10.1	/	10.2	9.8	9.8	9.7	
pH	/	6.9	6.9	6.9	/	6.9	7.1	7.0	/	7.1	6.9	6.9	6.8	
Cond. (µS/cm)	/		23		/		27		/				28	
Initials		K	K			K	K			A	K		K	

Concentration <i>50</i>	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.5	14.0	/	14.0	14.5	13.5	/	14.0	14.5	14.0	15.0	
DO (mg/L)	/	10.3	9.9	9.7	/	10.1	10.1	10.1	/	10.1	9.8	9.9	9.7	
pH	/	7.1	6.9	7.0	/	6.9	7.0	6.9	/	7.0	7.0	6.9	6.8	
Cond. (µS/cm)	/		28		/		28		/				29	
Initials		K	K			K	K			A	K		K	

Concentration <i>100</i>	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.5	14.0	/	14.0	14.5	13.5	/	14.0	14.5	13.0	15.0	
DO (mg/L)	/	10.2	9.9	9.7	/	10.1	10.1	10.1	/	10.1	9.8	9.9	9.7	
pH	/	7.0	6.8	7.0	/	6.9	6.9	6.9	/	6.8	7.0	6.8	6.8	
Cond. (µS/cm)	/		32		/		28		/				30	
Initials		K	K			K	K			A	K		K	

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp 3 DO meter: DO-2 pH meter: pH-1 Conductivity meter: C-2

Hardness*	Control 9	100% 20	
Alkalinity*	4	2	

Analysts: AWD, K

Reviewed by: JGH

Date reviewed: Dec-6/16

Sample Description: Clear, dark yellow, odorless, some particulates.

Comments: \_\_\_\_\_

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Waldw  
 Sample ID: LS-ES2  
 Work Order #: 161147

Start Date & Time: Oct 25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1130h  
 Test Species: Oncorhynchus mykiss

% (v/v) Concentration Control	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.5	14.0		14.0	14.5	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.8	10.1	9.9		10.0	10.1	10.0		10.1		10.0	10.0	10.2
pH		6.8	7.0	7.0		6.9	6.9	7.0		7.2		7.2	7.2	6.9
Cond. (µS/cm)				28				26						27
Initials		K		K		K		YML		A		K		K

Concentration 50	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.5	14.0		14.0	14.5	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.8	10.1	9.9		10.0	9.9	10.0		10.1		10.0	10.0	10.2
pH		7.0	7.1	7.0		7.0	7.0	7.1		7.2		7.2	7.2	7.3
Cond. (µS/cm)				28				28						33
Initials		K		K		K		YML		A		K		K

Concentration 100	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.5	14.0		14.0	14.5	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.8	10.1	9.9		10.0	9.8	9.9		9.9		10.0	10.0	10.2
pH		7.0	6.9	7.0		6.9	7.0	7.0		7.1		7.2	7.1	7.2
Cond. (µS/cm)				29				31						31
Initials		K		K		K		YML		A		K		K

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 DO meter: DO-2 pH meter: pH-1 Conductivity meter: C-2

	Control	100%	
Hardness*	7	20	
Alkalinity*	5	2	

Analysts: AWD, YML, K

Reviewed by: JBL  
 Date reviewed: Dec 8/16

\* mg/L as CaCO<sub>3</sub>

Sample Description: clear, dark yellow, odourless, some particulates.

Comments: \_\_\_\_\_



## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Golder  
 Sample ID: LJ-ES2  
 Work Order #: 161147

Start Date & Time: Oct 25/16 C 1125h  
 Stop Date & Time: Nov 24/16 C 1130h.  
 Test Species: Oncorhynchus mykiss

Concentration Control	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	14.0		13.5	14.0	14.0		14.0		14.0	14.5	13.5
DO (mg/L)		10.1	10.1	10.0		10.1	10.0	9.9		9.9		9.8	10.0	9.9
pH		6.8	7.0	6.8		6.8	7.0	6.8		7.1		7.2	6.5	6.5
Cond. (µS/cm)				28				26						27
Initials		K		K		K		K		A		A		K

Concentration 50	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	14.0		13.5	14.0	14.0		14.2		14.0	14.5	13.5
DO (mg/L)		10.1	10.0	10.0		10.2	9.9	9.9		9.8		9.8	9.8	9.9
pH		7.0	7.1	7.0		6.9	7.2	7.1		7.0		7.2	6.4	6.6
Cond. (µS/cm)				29				28						28
Initials		K		K		K		K		A		A		K

Concentration 100	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	14.0		13.5	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	10.1	10.0		10.2	9.9	9.9		9.8		9.7	9.8	9.9
pH		6.9	6.7	6.9		6.8	7.0	6.9		7.0		7.3	6.3	6.6
Cond. (µS/cm)				30				29						31
Initials		K		K		K		K		A		A		K

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp 3 DO meter: DO-2 pH meter: pH-1 Conductivity meter: C-2

	Control	100%		
Hardness*	7	20		
Alkalinity*	2	2		

Analysts: AWD, M  
 Reviewed by: JGL  
 Date reviewed: Dec. 6/16

\* mg/L as CaCO<sub>3</sub>

Sample Description: Clear, dark yellow, odorous, some particulates.

Comments: \_\_\_\_\_

## Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Golder  
 Sample ID: LJ-ES2  
 Work Order #: 161147

Start Date & Time: Oct 25/16 P 1625h  
 Stop Date & Time: Nov 24/16 P 1130h  
 Test Species: Oncorhynchus mykiss

0/0 (v/v) Concentration Control	Days													
	28		29		Final 30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	13.5	14.5	13.5	13.5	/			/		/			
DO (mg/L)	/	9.7	9.8	9.8	10.1	/			/		/			
pH	/	6.9	6.8	6.8	6.8	/			/		/			
Cond. (µS/cm)			27		32									
Initials		K	K		K				A		A			

Concentration 50	Days													
	28		29		Final 30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	13.5	14.5	13.5	13.5	/			/		/			
DO (mg/L)	/	9.7	9.8	9.8	10.1	/			/		/			
pH	/	6.9	7.1	7.0	6.9	/			/		/			
Cond. (µS/cm)			30		36									
Initials		K	K		K				A		A			

Concentration 100	Days													
	28		29		Final 30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	13.5	14.0	13.5	13.5	/			/		/			
DO (mg/L)	/	9.7	9.7	9.8	10.1	/			/		/			
pH	/	6.8	6.9	6.9	6.9	/			/		/			
Cond. (µS/cm)			30		35									
Initials		K	K		K				A		A			

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 DO meter: DO-2 pH meter: pH-1 Conductivity meter: C-2

	Control	100.0		
Hardness*	7	20	/	
Alkalinity*	2	2	/	

Analysts: K  
 Reviewed by: Jole  
 Date reviewed: Dec. 6/16

\* mg/L as CaCO<sub>3</sub>

Sample Description: Clear, dark yellow, some particulates, odorless

Comments: \_\_\_\_\_

## Embryo-Alevin Toxicity Test Daily Mortality

Client: Goldor  
 Sample ID: LS-652  
 Work Order #: 161147

Start Date & Time: Dec 25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1130h  
 Test Species: Oncorhynchus mykiss

Concentration % (w/v)	Rep	Day of Test - No. of Mortalities											Total Dead Eggs/Embryos/ Alevins	
		1	2	3	4	5	6	7	8	9	10	11		12
Control	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	2	↓	↓	↓	↓	2
	4	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	↓	↓	0
50	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
100	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		u	u	u	a	a	u	u	u	u	u	u	u	u

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Reviewed by: Joh

Date reviewed: Dec. 6/16

## Embryo-Alevin Toxicity Test Daily Mortality

Client: Goldor Start Date & Time: Oct 25/16 0 1625h  
 Sample ID: LJ-632 Stop Date & Time: Nov 24/16 02<sup>h</sup> 1130h  
 Work Order #: 161147 Test Species: Oncorhynchus mykiss

Concentration (%W/V)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		① 13	14	15	16	17	18	19	② 20	21	22	③ 23	24	
Control	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
50	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
100	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	4
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		ku	ku	ku	ku	ku	ku	ku	ku	ku	ku	ku	ku	ku

Comments: ① at eyed stage stage ② start to hatch ③ >50% hatched in control

Reviewed by: [Signature] Date reviewed: Dec. 6/16  
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

## Embryo-Alevin Toxicity Test Daily Mortality

Client: Colder  
 Sample ID: LS-ES2  
 Work Order #: 161147

Start Date & Time: Oct 25/16 @ 1625h  
 Stop Date & Time: Nov 24/16 @ 1130h  
 Test Species: Oncorhynchus mykiss

Concentration % (v/v)	Rep	Day of Test - No. of Mortalities						Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (Abnormal)	Total No. Alevins (Normal)	Total Exposed Eggs
		25	26	27	28	29	30				
Control	1	0	0	0	0	0	0	1	29	30	
	2	0	0	0	0	0	0	0	30	30	
	3	0	0	0	0	0	2	1	27	30	
	4	0	0	0	0	0	1	0	29	30	
50	1	0	1	0	↓	0	1	2	28	30	
	2	0	0	0	1	0	1	2	27	30	
	3	0	0	0	0	0	0	2	27	30	
	4	0	0	0	0	0	0	0	30	30	
100	1	0	0	0	1	0	1	1	28	30	
	2	0	0	0	0	0	↓	0	29	30	
	3	0	0	0	0	0	1	6	24	30	
	4	↓	↓	↓	0	↓	1	1	28	30	
	1										
	2										
	3										
	4										
	1										
	2										
	3										
	4										
	1										
	2										
	3										
	4										
	1										
	2										
	3										
	4										
Tech Initials		as	as	as	as	as	as	as	as	as	

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Reviewed by: JCh Date reviewed: Dec. 6/16

Client: Golder  
 Sample ID: LJ-ES2  
 WO#: 161147

Test Initiation Date: October 25, 2016  
 Test Termination Date: November 24, 2016  
 Test Species: Oncorhynchus mykiss

Mortality Counts

Test Conc. (% v/v)	Rep	Mortality Counts			Total Dead	Abnormal Alevins	Normal Alevins	Total No. Alevins	Total No. Exposed
		Day 1-12	Day 13-24	Day 25-30					
Control	1	0	0	0	0	1 ①	29	30	30
	2	0	0	0	0	0	30	30	30
	3	2	0	0	2	1 ①	27	28	30
	4	0	0	1	1	0	29	29	30
50	1	0	0	2	2	0	28	28	30
	2	0	0	2	2	1 ②	27	28	30
	3	1	1	0	2	1 ③	27	28	30
	4	0	0	0	0	0	30	30	30
100	1	0	0	1	1	1 ④	28	29	30
	2	0	0	0	0	1 ①	29	30	30
	3	1	4	1	6	0	24	24	30
	4	0	0	1	1	1 ⑤	28	29	30

Survival	Normal Alevins			
100.0			96.7	
100.0			100.0	
93.3	<b>Mean</b>	<b>SD</b>	90.0	<b>Mean</b> <b>SD</b>
96.7	97.5	3.2	96.7	95.8 4.2
93.3			93.3	
93.3			90.0	
93.3	<b>Mean</b>	<b>SD</b>	90.0	<b>Mean</b> <b>SD</b>
100.0	95.0	3.3	100.0	93.3 4.7
96.7			93.3	
100.0			96.7	
80.0	<b>Mean</b>	<b>SD</b>	80.0	<b>Mean</b> <b>SD</b>
96.7	93.3	9.0	93.3	90.8 7.4

① 1 small tail fin, ② 1 jaw deformity, yolk sac edema and pale, ③ 1 jaw deformity and yolk sac edema,  
 ④ 1 yolk sac edema and jaw deformity, ⑤ 1 jaw deformity.

JGU  
 Dec 6/16

**CETIS Analytical Report**

Report Date: 29 Nov-16 17:01 (p 1 of 2)  
 Test Code: 161147b | 07-5057-2137

**Salmonid Embryo-Alevin Survival and Development Test**

**Nautilus Environmental**

<b>Analysis ID:</b> 01-9454-0191	<b>Endpoint:</b> Survival Rate	<b>CETIS Version:</b> CETISv1.8.7
<b>Analyzed:</b> 29 Nov-16 17:00	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Official Results:</b> Yes
<b>Batch ID:</b> 13-8308-5355	<b>Test Type:</b> Survival-Development	<b>Analyst:</b> Kania Lywe
<b>Start Date:</b> 25 Oct-16 16:25	<b>Protocol:</b> EC/EPS 1/RM/28	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 24 Nov-16 11:30	<b>Species:</b> Oncorhynchus mykiss	<b>Brine:</b>
<b>Duration:</b> 29d 19h	<b>Source:</b> Vancouver Island Trout Hatchery	<b>Age:</b>
<b>Sample ID:</b> 06-8883-5661	<b>Code:</b> 290ECC4D	<b>Client:</b> Golder
<b>Sample Date:</b> 22 Oct-16 10:30	<b>Material:</b> Water Sample	<b>Project:</b>
<b>Receive Date:</b> 24 Oct-16 15:35	<b>Source:</b> Golder	
<b>Sample Age:</b> 78h (8.5 °C)	<b>Station:</b> LJ-ES2	

**Linear Interpolation Options**

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1582082	200	Yes	Two-Point Interpolation

**Point Estimates**

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

**Survival Rate Summary**

**Calculated Variate(A/B)**

C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.975	0.9333	1	0.01596	0.03191	3.27%	0.0%	117	120
50		4	0.95	0.9333	1	0.01667	0.03333	3.51%	2.56%	114	120
100		4	0.9333	0.8	1	0.04513	0.09027	9.67%	4.27%	112	120

**Survival Rate Detail**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	1	1	0.9333	0.9667
50		0.9333	0.9333	0.9333	1
100		0.9667	1	0.8	0.9667

**Survival Rate Binomials**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	30/30	30/30	28/30	29/30
50		28/30	28/30	28/30	30/30
100		29/30	30/30	24/30	29/30

# CETIS Analytical Report

Report Date: 29 Nov-16 17:01 (p 2 of 2)  
Test Code: 161147b | 07-5057-2137

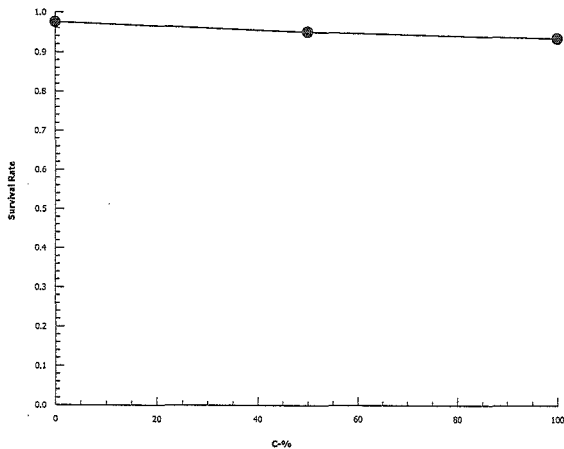
## Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 01-9454-0191      Endpoint: Survival Rate  
Analyzed: 29 Nov-16 17:00      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7  
Official Results: Yes

### Graphics





**CETIS Analytical Report**

Report Date: 29 Nov-16 17:01 (p 1 of 2)  
 Test Code: 161147b | 07-5057-2137

**Salmonid Embryo-Alevin Survival and Development Test**

**Nautilus Environmental**

<b>Analysis ID:</b> 15-9919-7118	<b>Endpoint:</b> Proportion Normal	<b>CETIS Version:</b> CETISv1.8.7
<b>Analyzed:</b> 29 Nov-16 17:01	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Official Results:</b> Yes
<b>Batch ID:</b> 13-8308-5355	<b>Test Type:</b> Survival-Development	<b>Analyst:</b> Kania Lywe
<b>Start Date:</b> 25 Oct-16 16:25	<b>Protocol:</b> EC/EPS 1/RM/28	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 24 Nov-16 11:30	<b>Species:</b> Oncorhynchus mykiss	<b>Brine:</b>
<b>Duration:</b> 29d 19h	<b>Source:</b> Vancouver Island Trout Hatchery	<b>Age:</b>
<b>Sample ID:</b> 06-8883-5661	<b>Code:</b> 290ECC4D	<b>Client:</b> Golder
<b>Sample Date:</b> 22 Oct-16 10:30	<b>Material:</b> Water Sample	<b>Project:</b>
<b>Receive Date:</b> 24 Oct-16 15:35	<b>Source:</b> Golder	
<b>Sample Age:</b> 78h (8.5 °C)	<b>Station:</b> LJ-ES2	

**Linear Interpolation Options**

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1280675	200	Yes	Two-Point Interpolation

**Point Estimates**

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	94.41	N/A	N/A	1.059	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

**Proportion Normal Summary**

**Calculated Variate(A/B)**

C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.9583	0.9	1	0.02097	0.04194	4.38%	0.0%	115	120
50		4	0.9333	0.9	1	0.02357	0.04714	5.05%	2.61%	112	120
100		4	0.9083	0.8	0.9667	0.03696	0.07391	8.14%	5.22%	109	120

**Proportion Normal Detail**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.9667	1	0.9	0.9667
50		0.9333	0.9	0.9	1
100		0.9333	0.9667	0.8	0.9333

**Proportion Normal Binomials**

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	29/30	30/30	27/30	29/30
50		28/30	27/30	27/30	30/30
100		28/30	29/30	24/30	28/30

# CETIS Analytical Report

Report Date: 29 Nov-16 17:01 (p 2 of 2)  
Test Code: 161147b | 07-5057-2137

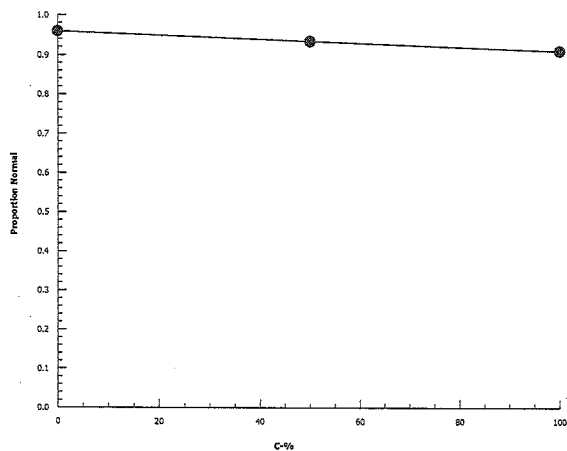
## Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 15-9919-7118      Endpoint: Proportion Normal  
Analyzed: 29 Nov-16 17:01      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7  
Official Results: Yes

### Graphics





**APPENDIX B – Chain-of-Custody Form**

---



**END OF REPORT**

---

Propriété de ses employés et forte d'une expérience de plus de 50 ans, Golder Associés, une organisation d'envergure mondiale, a pour raison d'être de contribuer au développement de la Terre tout en préservant son intégrité. Nous fournissons à nos clients des solutions durables comprenant une gamme étendue de services spécialisés en consultation, conception et construction dans les domaines des sciences de la Terre, de l'environnement et de l'énergie.

Pour en savoir plus, visitez [golder.com](http://golder.com)

Afrique	+ 27 11 254 4800
Asie	+ 86 21 6258 5522
Océanie	+ 61 3 8862 3500
Europe	+ 44 1628 851851
Amérique du Nord	+ 1 800 275 3281
Amérique du Sud	+ 56 2 2616 2000

[solutions@golder.com](mailto:solutions@golder.com)  
[www.golder.com](http://www.golder.com)

**Golder Associés Ltée**  
**7250, rue du Mile End, 3e étage,**  
**Montréal (Québec) H2R 3A4**  
**Canada**  
**T: +1 (514) 383 0990**

