Québec

Demande d'autorisation et de certificat d'autorisation

Demande d'autorisation en vertu de l'article 128.7 de la *Loi sur la conservation et la mise en valeur de la faune* (L.R.Q., c. C-61.1)	N° de dossier	N° de l'habitat
Demande de certificat d'autorisation en vertu de l'article 22 de la *Loi sur la qualité de l'environnement* (L.R.Q., c. Q-2, a. 22)		N° de dossier/NEQ

Nom du projet	Travaux géotechniques à Cacouna

1. Identification du requérant

1.1 Nom et coordonnées du requérant (personne, entreprise, organisme ou municipalité)

Nom: TransCanada Pipelines Limited			Ind. rég. N° téléphone (résidence):
Adresse (numéro, rue, appartement): 450 1 Street SW		Ind. rég.: 403	N° téléphone (bureau): 920-5915 / N° poste:
Ville: Calgary, Alberta	Code postal: T2P 5H	Ind. rég.	N° télécopieur:
Courriel (si disponible): Craig Schell: craig_schell@transcanada.com			
N° du Registre des entreprises du Québec (anciennement CIDREQ) **(Information obligatoire au traitement d'une demande provenant d'un organisme ou d'une entreprise.)**			N° NEQ: 1148486088

1.2 Adresse du siège social de la personne morale (si différente de 1.1)

Numéro, rue appartement		Ind. rég.	N° téléphone (bureau) / N° poste
Ville	Code postal	Ind. rég.	N° téléphone (autre) / N° poste

1.3 Le requérant est-il propriétaire du terrain où se situera l'activité? ☐ Oui ☒ Non

Si on répond oui et dans le cas d'une activité projetée dans un cours d'eau ou un lac, on doit être en mesure de fournir la preuve de la propriété du lit du cours d'eau ou du lac, là où est prévue l'activité faisant l'objet de la demande d'autorisation.
Si on répond non, indiquer le(s) nom(s) et coordonnées du (des) propriétaire(s) et joindre un accord écrit du (des) propriétaire(s) pour la réalisation des activités projetées.

Nom	Adresse (numéro, rue, appartement, ville, code postal)	Ind. rég.	N° téléphone / N° poste
Nom	Adresse (numéro, rue, appartement, ville, code postal)	Ind. rég.	N° téléphone / N° poste
Nom	Adresse (numéro, rue, appartement, ville, code postal)	Ind. rég.	N° téléphone / N° poste

1.4 Nom et coordonnées du représentant mandaté par le requérant

Joindre une copie certifiée d'une résolution émanant du conseil d'administration ou de ses associés ou de ses membres, qui autorise le signataire de la demande à la présenter. S'il s'agit d'une municipalité, joindre une copie certifiée d'une résolution du conseil municipal qui autorise le signataire de la demande à la présenter.

Nom du représentant	Fonction	Ind. rég.	N° téléphone (bureau) / N° poste
Adresse (numéro, rue appartement)		Ind. rég.	N° téléphone (autre) / N° poste
Ville et MRC			Code postal
Courriel (si disponible)			

1. Identification du requérant (suite)

1.5 Si différent de 1.4, indiquer les nom et coordonnées de l'entrepreneur ou du constructeur, du responsable de chantier ou de l'exécutant des travaux à contacter en cas de besoin.

Nom	Fonction	Ind. rég.	N° téléphone (bureau)	N° poste

Adresse (numéro, rue appartement)	Ind. rég.	N° téléphone (autre)	N° poste

Ville et MRC	Code postal

Courriel (si disponible)

2. Description de l'activité, des travaux et des ouvrages projetés[1]

Si l'espace est insuffisant pour décrire l'activité, joindre au formulaire une annexe.

2.1 Localisation des activités projetées

Préciser le lieu et le secteur où se dérouleront les activités. Joindre un plan à l'échelle localisant avec précision le secteur où sont projetées les activités.

a) Lieu d'intervention

Municipalité

Voir section 2 de l'annexe A

Adresse civique (numéro, rue, appartement, ville, code postal)

b) Désignation cadastrale

☐ Cadastre ou ☐ Canton — Rang

Lot(s) ou bloc(s) — Référence cartographique

c) Cadastre rénové (si disponible)

N° Voir section 2 de l'annexe A

d) Coordonnées géographiques (degrés, minutes, secondes ou degrés décimaux)

Longitude	Latitude	N. NAD

e) Zonage ou affectation municipale

Préciser l'affectation territoriale indiquée au schéma d'aménagement de la MRC ou de la communauté métropolitaine

2.2 Justification du projet

Préciser les besoins et les objectifs du projet.

La firme TransCanada PipeLines Limited («TransCanada») souhaite développer un projet d'oléoduc de quelque 4 400 kilomètres qui assurerait le transport de pétrole brut en provenance de l'Alberta et de la Saskatchewan vers des raffineries de l'Est du Canada. Ce projet, désigné Oléoduc Énergie Est, inclut la conversion d'environ 3 000 kilomètres de gazoduc en Saskatchewan, au Manitoba et en Ontario ainsi que la construction de nouvelles conduites sur une longueur d'environ 1 400 kilomètres en Alberta, en Ontario, au Québec et au Nouveau-Brunswick pour relier le pipeline converti. Au Québec, le Projet prévoit la construction de nouvelle canalisation destinée au transport du pétrole brut ainsi que la construction d'un terminal maritime et d'un parc de réservoirs de stockage à Cacouna.

Le Projet est sous la juridiction de l'Office nationale de l'énergie et, par conséquent, la présente demande est faite dans un esprit de collaboration et sans préjudice.

Des travaux préliminaires sont prévus dans les environs du site du terminal maritime projeté. Les travaux géotechniques permettront de définir la localisation la plus optimale pour la construction du nouveau terminal. Les informations recueillies permettront de définir les détails d'ingénierie de l'infrastructure à construire. La définition du design permettra de compléter la description du projet pour la préparation des demandes de permis ultérieures (ex: étude d'impact).

Voir section 3 de l'annexe A

[1] Les rubriques « Aide » ou « Lexique » vous aideront à remplir les sections 2.3, 2.4.

2. Description de l'activité, des travaux et des ouvrages projetés[1] (suite)

Si l'espace est insuffisant pour décrire l'activité, joindre au formulaire une annexe.

2.3 Nature des activités projetées[1]

a) Description technique

Décrire les activités envisagées ainsi que le secteur visé. Pour chacune des activités, indiquer si elle se déroulera en rive, dans une plaine inondable, sur le lit du cours d'eau ou du lac, dans un étang, un marais, un marécage et une tourbière, la superficie touchée ainsi que les méthodes de réalisation envisagées. Joindre des photographies du site, des photos aériennes, des cartes à une échelle appropriée, et, si approprié, des plans, des coupes et devis signés et datés, etc.

Les travgaux géotechniques se dérouleront dans le lit du fleuve St-Laurent à des profondeurs pouvant atteindre 30 m d'eau.

Le plan présenté à l'annexe 1 de l'annexe A, illustre la localisation des forages à effectuer.

b) Méthode de travail détaillée

Décrire les types de matériaux employés, les équipements et la machinerie qui seront utilisés. Présenter et décrire les différentes étapes de réalisation.

Voir section 4.1, 4.2, 4.3 et 4.4 de l'annexe A.

Il est à noter que la demande d'examen déposée en février 2014 prévoyait des forages à l'aide d'un équipement de forage seulement. Afin de compléter les forages le plus rapidement possible, deux équipements seront utilisés. L'analyse des effets du bruit généré dans l'eau pendant les travaux ont donc été revu dans le cadre de la préparation du programme de surveillance des mammifères marins. Une copie de ce programme est présentée à l'annexe B. m

2.4 Calendrier de réalisation[1]

Présenter le calendrier de réalisation (date de début des travaux, période prévue pour chacune des étapes du projet et, pour chacune, la durée estimée).

Voir section 3 de l'annexe A et section 3.1 de l'annexe B.

Veuillez noter la modification suivante à apporter à la section 3.1 quant à la date prévue du début des travaux. Les travaux géotechniques sont prévus débuter à l'été 2014.

[1] Les rubriques « Aide » ou « Lexique » vous aideront à remplir les sections 2.3, 2.4.

3. Description du milieu où se dérouleront les activités

Si l'espace est insuffisant pour décrire l'activité, joindre au formulaire une annexe.

3.1 Utilisation actuelle du milieu environnant

Indiquer la présence d'habitations, de prise d'eau, de route, de parc, d'un équipement récréatif ou touristique, d'une aire de conservation, de même que la référence au Plan directeur de l'eau si disponible, etc.

Le secteur des travaux est localisé au large du port de Gros Cacouna. Une partie des forages à effectuer est localisée dans une aire de concentration d'oiseaux aquatiques (ACOA) (voir carte de l'annexe C).

Les habitations les plus près sont localisées à environ 1.5 km des forages situés près du brise-lame du port de Gros Cacouna.

3.2 Description des milieux naturels ou du site visé par les activités[1]

Fournir un plan identifiant et localisant les milieux naturels ou des sites qui seront affectés par les activités. Caractériser les milieux naturels.

Voir section 5 de l'annexe A.

[1] Les rubriques « Aide » ou « Lexique » vous aideront à remplir la section 3.2.

4. Description des impacts, des activités projetées sur la faune, son habitat et l'environnement[1]

Si l'espace est insuffisant pour décrire l'activité, joindre au formulaire une annexe.

4.1 Décrire les impacts des activités projetées sur le milieu (eau, air, sol, habitats et espèces fauniques et floristiques, population, etc..), ceci pour chacune des phases de réalisation du projet.

Voir section 6 de l'annexe A et section 3.2 de l'annexe B.

4.2 Décrire la nature et le volume des matières, matériaux et contaminants (ex : déblais, remblais, débris ligneux, résidus de démolition, huiles, graisse, particules de terre, etc.) susceptibles d'être émis, rejetés, dégagés ou déposés ainsi que leurs points d'émission, de rejet, de dégagement et de dépôt dans l'environnement, le cours d'eau, le lac ou leur rive et leur plaine inondable ou dans un étang, un marais, un marécage ou une tourbière.

Les activités de forage sont susceptibles d'émettre des particules fines en suspension dans l'eau. Le volume de MES sera toutefois très faible.

4.3 Indiquer quel sera le mode et le lieu d'entreposage, de dépôt et d'élimination des contaminants (déchets solides, matières dangereuses, sédiments contaminés, sols contaminés, rebuts, débris de démolition, déblais, etc.).

Aucun entreposage ou élimination de contaminants n'est requis.

4.4 Décrire les mesures d'atténuation envisagées (méthodes de travail, période de réalisation, etc.) afin de réduire les effets dommageables sur le milieu pour chacun des impacts identifiés aux points 4.1 à 4.3.

Voir section 6.3.2 de l'annexe A et sections 4 et 5 de l'annexe B.

L'utilisation de deux équipements de forage permettra de réduire le temps d'intervention dans le milieu aquatique.

4.5 Indiquer si un programme de surveillance et de suivi des travaux a été prévu (moyens mis en place, calendrier avec étapes de contrôle et de suivi, rapports requis, etc.).

Voir section 6.3.2 de l'annexe A et sections 4 et 5 de l'annexe B.

[1] Les rubriques « Aide » ou « Lexique » vous aideront à remplir la section 4.

5. Aspects économiques

5.1 Décrire la nature et le montant de l'investissement projeté.

5.2 Pour la réalisation de votre projet, indiquer si vous avez reçu ou si vous espérez recevoir de l'aide financière d'un organisme gouvernemental?

☒ Non ☐ Oui *Si oui, préciser la nature, le montant et l'origine de l'aide financière reçue ou demandée.*

Coût du projet	$	**Emplois directs créés**		**Emplois indirects créés**	

6. Autres attestations, permis ou autorisations

Pour l'activité faisant l'objet d'une demande d'autorisation, détenez-vous les attestations, permis et autorisations des organismes suivants? Fournir, le cas échéant, une copie de ces attestations, permis et autorisations avec votre demande. De plus, assurez-vous d'obtenir tous autres attestations, permis et autorisations requis en vertu d'autres lois et règlements en vigueur.

	Requis	Obtenus	À venir	Non requis
Municipalité régionale de comté (MRC)	☐	☐	☐	☐
Municipalité concernée	☐	☐	☐	☐
Commission de protection du territoire agricole du Québec	☐	☐	☐	☐
Centre d'expertise hydrique du Québec	☐	☐	☐	☐
Autres : Avis de Pêches et Océans, permis de Transport Canada (Préciser)	☐	☒	☐	☐

7. Documents à joindre à la présente demande

*Sauf si expressément mentionné, tous les documents ou renseignements doivent être fournis **en deux exemplaires ou trois exemplaires**, si la demande concerne un ouvrage de retenue.*

☒ Des photographies du site actuel et un plan précisant le secteur où l'activité doit être réalisée;

☐ Des plans à l'échelle et devis dûment approuvés et datés;

☐ Dans le cas d'un cours d'eau ou d'un lac, fournir la preuve que le requérant est propriétaire du lit du cours d'eau ou du lac là où est prévue l'activité à être autorisée (un exemplaire);

☐ Si le requérant n'est pas le propriétaire des lieux où est prévue l'activité à être autorisée, fournir un accord écrit du (des) propriétaire(s) pour la réalisation des activités projetées;

☐ Le zonage ou l'affectation du territoire visé;

☐ Lorsque l'activité projetée concerne le territoire d'un parc régional ou un cours d'eau relevant de la compétence d'une municipalité régionale de comté (MRC), un certificat du secrétaire trésorier de la MRC concernée sur la conformité de la réalisation du projet avec la réglementation municipale régionale applicable;

☐ Un certificat du greffier ou du secrétaire trésorier d'une municipalité locale ou s'il s'agit d'un territoire non organisé, d'un certificat du secrétaire trésorier d'une municipalité régionale de comté, attestant que la réalisation du projet ne contrevient à aucun règlement municipal (un exemplaire);

☐ Si le requérant est une personne morale, une société ou une association, copies certifiées d'un document émanant du conseil d'administration ou de ses associés ou de ses membres, qui autorise le requérant de la demande à la présenter;

☐ S'il s'agit d'une personne morale, copies des lettres patentes;

☐ S'il s'agit d'une municipalité, copies certifiées d'une résolution du conseil qui autorise le signataire de la demande à la présenter;

☒ Tout autre document que vous jugez utile à l'étude du dossier (ex : photographies aériennes montrant les lieux où l'activité est projetée, études de faisabilité ou de rentabilité, etc.).

8. Information relative à la *Loi sur l'accès aux documents des organismes publics et sur la protection des renseignements personnels* (L.R.Q., c. A-2.1)

Conformément à la *Loi sur l'accès aux documents des organismes publics et sur la protection des renseignements personnels*, nous vous informons que les renseignements nominatifs contenus à ce formulaire, ainsi que ceux qui se joindront à votre dossier par la suite, ne seront communiqués qu'aux seules personnes autorisées à traiter votre demande d'autorisations.

Aucune activité requérant une autorisation en vertu de la *Loi sur la conservation et la mise en valeur de la faune* (L.R.Q., c. C-61.1) et un certificat d'autorisation en vertu de la *Loi sur la qualité de l'environnement* (L.R.Q., c. Q-2, a. 22) ne peut être réalisée sans avoir préalablement obtenu les deux autorisations requises.

9. Déclaration

Je, Elizabeth Swanson (nom en lettres moulées), en mon nom personnel ou en tant que représentant dûment mandaté certifie que les renseignements fournis et les documents annexés sont, à ma connaissance, complets et véridiques en tous points.

Toute fausse déclaration peut entraîner des sanctions en vertu de la *Loi sur la qualité de l'environnement* (L.R.Q., c. Q-2) ou de la *Loi sur la conservation et la mise en valeur de la faune* (L.R.Q., c. C-61.1).

Signature		Date	Année	Mois	Jour
			2014	05	22

Remplir, imprimer, signer et dater les deux exemplaires du formulaire et y joindre les copies des documents exigés. Dans le cas de demande concernant la construction d'ouvrage de retenue, trois exemplaires du formulaire sont exigés.

À votre convenance, les adresser à la direction régionale de l'analyse et de l'expertise régionales et au Centre de contrôle environnemental du Québec ou à la direction régionale de la faune concernées.

Les adresses des bureaux régionaux se retrouvent à l'adresse suivante : http://www.mddefp.gouv.qc.ca/ministere/rejoindr/repertoire.htm.

Elizabeth Swanson LL.B
Legal and Regulatory Affairs
Energy East Pipeline

TransCanada
In business to deliver

450 - 1st Street S.W.
Calgary, AB
Canada T2P 5H1

Tel: 403.920.6209
Fax: 403.920.2310
Cell: 403.835.1562

elizabeth_swanson@transcanada.com

Annexe A

Demande d'examen transmis

à Pêches et Océans Canada

CIMA
Partners in excellence

QUEBEC MARINE TERMINAL FEED

GEOTECHNICAL SURVEY

REQUEST FOR REVIEW
APPENDIX A

PRESENTED TO
FISHERIES AND OCEANS CANADA (DFO)

Prepared by :

Carolle Gosselin, B.Sc. Biology
Project Manager

Verified by :

Christian Gagnon, B.Sc. Biology
Director

February 12th 2014

1145 Lebourgneuf Blvd., Suite 300
Quebec QC G2K 2K8
CANADA

Phone : 418-623-3373
Fax : 418-623-3321
www.cima.ca

TABLE OF CONTENTS

Page

PHOTOS

FIGURES

TABLES

APPENDIX

1. CONTEXT

Energy East Pipelines Ltd. (Energy East), a subsidiary of TransCanada, proposes to construct and operate a 4,600 km oil pipeline system from Hardisty, Alberta to Saint John, New Brunswick. This national pipeline system will transport crude oil from Hardisty, Alberta and Moosomin, Saskatchewan (SK) to receipt points in Québec (QC) and New Brunswick (Energy East Project or the Project). The receipt points will include three existing refineries in Eastern Canada and two marine terminals that will allow for the export of crude oil to international markets.

Energy East intends to file with the National Energy Board (NEB) an application for the Project, including completion of a comprehensive Environment and Socio-Economic Assessment (ESA), in early summer of 2014. Prior to submitting its application for Energy East, TransCanada will be submitting a Project Description to the NEB for distribution to other federal agencies including Fisheries and Oceans Canada (DFO) as per the MOU between the NEB and DFO signed in December 2013.

Moffatt and Nichol and CIMA+ has been retained by TransCanada to support the FEED engineering assessment of the Energy East Project relating to the Marine facilities. This Request for Review to DFO by CIMA+ is to conduct geotechnical works in the area of the proposed Cacouna marine facility to assist Moffatt and Nichol and TransCanada with the preparation of the Energy East Application to the NEB.

2. STUDY AREA

The study area is located in the vicinity of the Port of Gros Cacouna, near the site retained for the implementation of a previously proposed LNG port terminal (Appendix 1, geotechnical survey plan).

Coordinates of the boreholes location are presented in Appendix 1. Each borehole will be carried out to cover about 1 m^2, for a total of approximately 20 m^2 for 16 boreholes.

The survey area would extend to about 900 m offshore in water depths up to 30 m.

Photos of the area under study are presented below.

Photo 1: Overview of the study area from the Cacouna cliff

Photo 2: Overview of the study area from the Cacouna cliff

3. OBJECTIVE OF THE GEOTECHNICAL SURVEY

Geotechnical surveys include drilling of borings into the subsurface to collect soil borings to assess geologic stability for potential placement of the marine terminal. Other *in situ* tests will be carried out as well such as standard penetration test, cone penetration test, vane shear test and dilatometer test in bedrock.

The gathered data will allow the engineers in charge of the conception to view and interpret large scale subsurface geologic structural features and will provide TransCanada a critical insight for the selection of the new terminal site. Information will be coupled to the geophysical data obtained within the same study area.

The geotechnical survey will be carried out during day time only. Shallow boreholes can be completed during one day. Deeper boreholes would require 3 to 4 days to complete.

The geotechnical survey will be carried out between the month of mid-April and the beginning of November 2014. Between 50 to 65 days are required to complete the survey. However, drilling activity will not be conducted continuously during a day since it will be interrupted by other preparation work. An average of four-five hours per day of drilling will be carried out.

4. SURVEY METHODOLOGY

Geotechnical survey will comprise borehole drilling down to the bedrock. A total of 16 boreholes will be drilled. During site investigations, boreholes are drilled to depths sufficient to characterize the soils within the zone of influence. The borings, samples, cores or field test data collected at the site will define the stratigraphy and geotechnical properties at that specific location. Details of the various tests to be conducted are presented hereafter.

4.1. Standard penetration test (SPT)

Offshore borehole drilling and coring is usually carried out using a drill rig mounted on skids and chained to the barge floor. The test uses a thick-walled sample tube that is driven into the ground at the bottom of a borehole by blows from a slide hammer falling through a certain distance. The test is standardized to use a 51 mm outside diameter split-spoon sampler, driven in the soil with a 63.5 kg weight having a free fall of 760 mm. The drilling operations are usually performed using an "HW" casing (112.7 mm outside diameter (O.D.)), as well as a "PW" casing (139.7 mm O.D.) used in the water for external protection during the drilling. Soil samples are obtained using a 50 mm O.D. split-spoon sampler in accordance with the Standard Penetration Test (SPT) (ASTM D1586-99) procedures.

Samples of the bedrock are obtained using an "NQ" size rock core barrel.

When possible, sampling of the cohesive material layers is carried out using a 76 mm O.D. thin-walled Shelby Tube sampler.

4.2. Cone penetration test (CPT) and dynamic Cone Penetration test (DCPT)

CPT is an investigation method that uses an instrumented cone (a rod with a conical tip) pushed through the soil at a constant rate via small rods, using the hydraulics of the drill head or sometimes using an independent hydraulic system. The instrumented cone measures tip resistance, sleeve friction and dynamic pore pressure. The cone is advanced vertically with the load applied in line with the cone probe. Data from the cone's channels are read by a field computer that displays the data in real-time.

DCPT can also be conducted using only a penetration cone driven through the soil by hammer blows. The length of penetration per blow is recorded and analysed in order to retrieve certain soil properties.

4.3. Vane Shear Test (VST)

The vane shear test (ASTM D2573) is an in-situ geotechnical testing methods used to estimate the undrained shear strength of fully saturated clays without disturbance. The test is relatively simple, quick, and provides a cost-effective way of estimating the soil shear strength; therefore, it is widely used in geotechnical investigations.

The vane equipment consists of a vane blade, a set of rods, and a torque measuring apparatus. The height of vane is usually twice its overall widths and is often equal to 10 cm or 15 cm. The test is conducted from the bottom of a borehole or a test pit. When conducted from the bottom of a borehole, the test area should be should be at the depth of least three times the borehole diameter lower that the borehole bottom in order to avoid the borehole disturbance effects.

The test starts by pushing the vane and the rod vertically into the soft soil. The vane is then rotated at a slow rate of 6° to 12° per minute. The torque is measured at regular time intervals and the test continues until a maximum torque is reached and the vane rotates rapidly for several revolutions. At this time, the soil fails in shear on a cylindrical surface around the vane. The rotation is usually continued after shearing and the torque is measured to estimate the remoulded shear strength.

4.4. Dilatometer test in bedrock (DMT)

This test covers the determination of the in situ deformability of rocks from measurements of the radial expansion of a borehole section under a known uniform radial pressure applied by means of a cylindrical dilatometer probe. The basis of the test consists of inserting a cylindrical probe, having an outer expandable flexible membrane, into a borehole, and measuring, at selected intervals or in a semi-continuous manner at closely spaced test locations, the radial displacement of the borehole while inflating the probe under a known radial pressure. This test is used mainly in hard rock formations to obtain profiles of deformability variations with depth and gives the deformability modulus.

5. BIOPHYSICAL CHARACTERISTICS OF THE SITE

The following sections describe briefly the main physical characteristics of the site as well as the main biological components susceptible to be affected by the geotechnical survey (fish and marine mammals). The main sources of information are the studies carried out in 2004 for the Cacouna LNG Terminal project as well as data collected by CIMA+ in 2007 regarding the dredging activities for the construction of the facilities (CIMA+, 2008).

5.1. Physical Characteristics of the Site

5.1.1. Water Level

The water level in the estuary is regulated by a semi-diurnal tidal regime which is two high tides and two low tides occurring per day. The mean sea level is 2.6 m and the mean tidal range is 3.7 m, while large mean tidal ranges can reach 5.3 m. The highest level ever recorded is 5.9 m. The maximum current speed varies between 3 and 4 knots (Table 1).

Table 1 : Tide Data and Current Speed

Locality			Gros-Cacouna
Reference port			Pointe-au-Père
Chart No.			1234, 1235
Type of tide			semi-diurnal
Range	Mean tide		3.7 m
	Large tide		5.3 m
Height	Highest high water	Mean tide	4.5 m
		Large tide	5.5 m
	Lowest low water	Mean tide	0.8 m
		Large tide	0.2 m
Extremes recorded	Extreme high water		5.9 m
	Extreme low water		- 0.8 m
Mean water level			2.6 m
Maximum speed of the currents	Flood		4.0 knots
	Ebb		4.0 knots

Source : Fisheries and Oceans Canada (Web Site)

5.1.2. Current and Waves

The current directions vary from the North-North-East to South-South-West. These directions are correlated to the directions of the tide. In the Cacouna area, the current direction is oriented parallel to the shore.

Waves in the area can reach more than 1 m in height and are from the South-West and North-East directions. The maximum registered in 2004 from an Acoustic Doppler Current Profiler is 3.04 m (ASL, 2004).

5.1.3. Ice

Ice in the area forms from mid-December to mid-March and recedes in April. Although, as a result of the estuary strong currents and tides, the ice is mobile and drifts in the form of floes. Consequently, the estuary and the berthing wharf area are not iced-up throughout the winter. Ice cover thickness in the estuary can reach up to 120 cm but ranges between 30 and 45 cm in March.

5.1.4. Geotechnical subsurface conditions

In 2007, geotechnical investigation was performed at the site proposed for the LNG marine terminal. At the time, the berthing facility was located approximately 150 meters from the shore. The geotechnical survey results are summarized hereafter. Bedrock appears to dip rapidly from shore to more than 80 m deep in a distance of less than 250 m. Cross section perpendicular to the shore is illustrated in Figure 1.

In general, as the distance from the shoreline increases, a fairly consistent geological sequence is obtained (Golder Associates Limited, 2008a):

- Sediments on top composed of a black silty sand/organics loose material The thickness of this recently deposited layer encountered ranged between 0.3 m and 2.0 m. A single Standard Penetration Testing (SPT) 'N' value measured within this surficial layer was 9 blows per 0.3 m of penetration, indicating a loose relative density.

- Followed by approximately 10 m of mostly granular materials with interbedded layers of silt, gravel and boulders. Along the shoreline, the upper granular deposit is predominantly covered with boulders and coarse materials. The sand to silty-sand layer appears to be very loose to relatively dense.

- A significant thickness of 0 to 50 m of primarily clayey-silt materials with occasional interbeds of granular materials. This thick deposit appears to be normally consolidated to slightly overconsolidated.

- Bedrock is encountered below the clayey-silt materials. A layer of sand was occasionally encountered just above the bedrock.

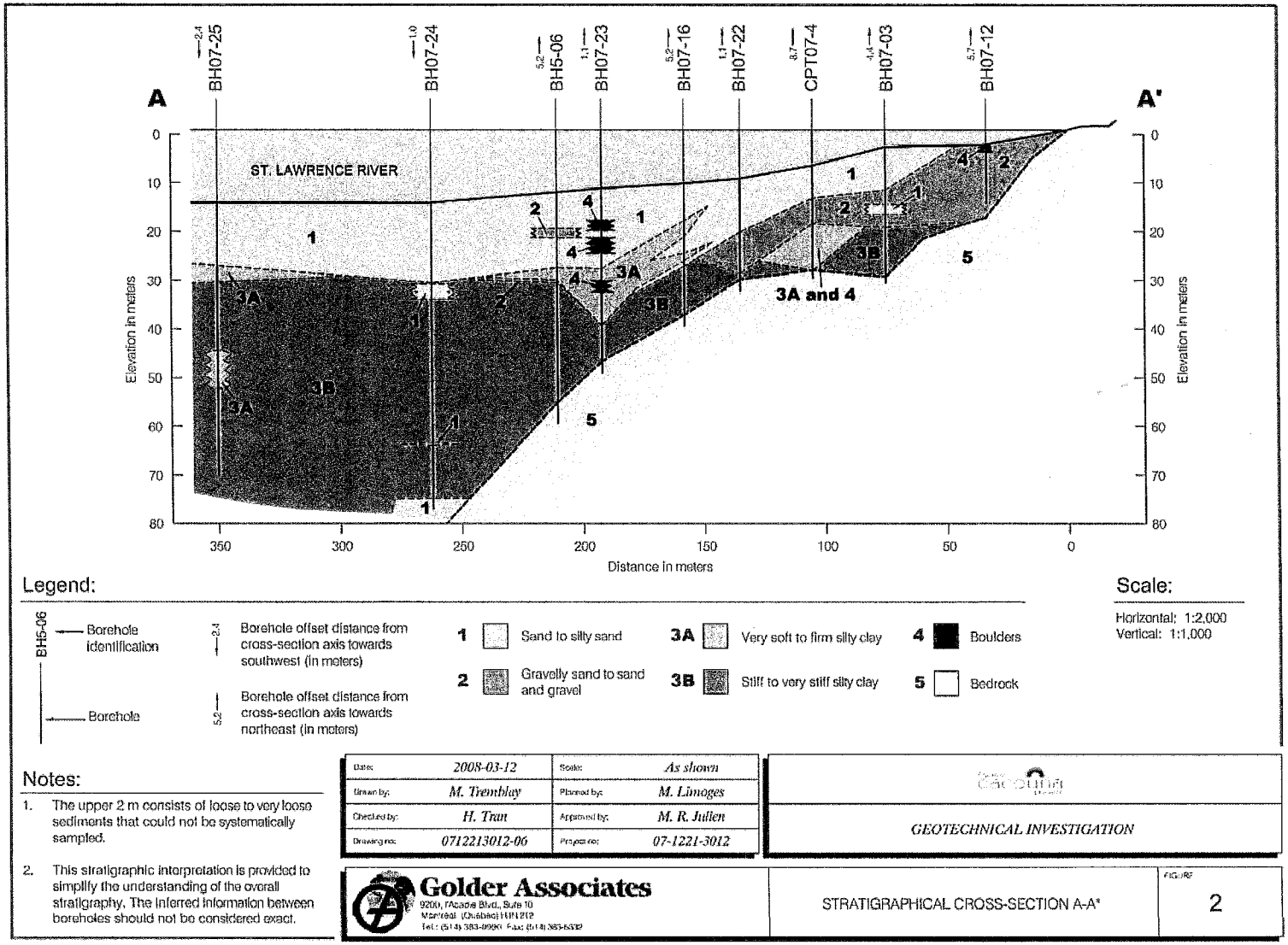


Figure 1: Stratigraphic Cross-Section

Source : Golder Associates Limited, 2008a

5.1.5. Nature and Sediment Quality

In 2007, physical and chemical analyses were done on sediments collected from different drilling cores in the area of the LNG terminal. Based on the information gathered, sediments are composed of sand in a proportion up to 66%. Gravel (38%) can also be found at different depth. Finally, silt and loam are present but in a lower proportion (CIMA+, 2008).

The quality of the sediments collected was assessed according to the *Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation* (Environment Canada and ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2007). Most of the parameters measured throughout the analysis of the 21 samples showed concentrations lower than the occasional effect level, including for the PCBs (CIMA+, 2008). Only one sample showed a copper concentration higher than the frequent effect level. Further investigation was then recommended.

Also, sediments samples were collected in 2004 to establish the baseline of the LNG project. Concentrations of all polycyclic aromatic hydrocarbons were lower than the detection limit and all the metal parameters analysed showed concentrations lower than the occasional effect. During that investigation, PCB's were not analysed.

5.2. Biological Components

5.2.1. Ichtyofauna

More than 61 species have been recorded in the St. Lawrence estuary (Mousseau et al., 1998). Table 3 shows fish species of interest that might be in the area. The study area is located in a migration corridor for the Atlantic herring, capelin, American shad, Atlantic salmon and American eel. Occasionally, some juvenile Atlantic sturgeons can be found in the deep section of the study area. Also, American shads can be found in the île Verte sector at about mid-May. These fish are travelling up the St. Lawrence estuary along the south shore in order to reach spawning areas in the Montreal region. Table 2 shows fish species of interest that might be in the area.

Among the species of fish inhabiting the area of Cacouna, two are designated vulnerable according to *An Act respecting threatened or vulnerable species of Quebec* (R.S.Q., chapter E-12.01). They are the Rainbow Smelt in the St. Lawrence estuary and the American Shad. As for the Atlantic sturgeon, it is a species that is likely to be designated threatened or vulnerable according to the Act.

Spawning activity for Rainbow Smelt was observed for the first time in 2002 at the mouth of the Rivière-du-Loup during the investigation carried out by CIMA+ and Roche (2009) for the reconstruction of the wharf of Rivière-du-Loup. This spawning site is one of the major reproductive habitats for this species on the estuary's south shore.

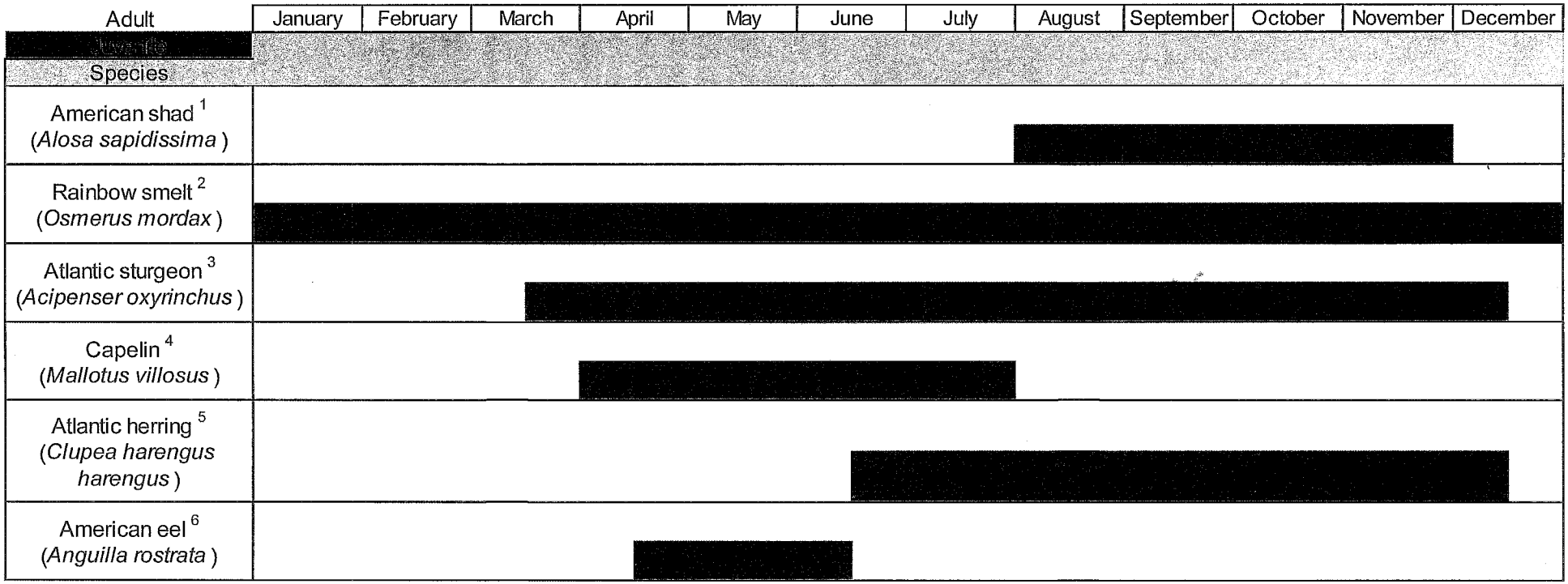
The Gros-Cacouna harbour, as well as the projected sites for the jetty and berthing wharf, has not been subjected to any sampling for larvae and juvenile specimens of smelt by the proponent or the Ministry of Natural Resources and Wildlife during the follow-ups done on this species. The habitat potential for larvae and juvenile of rainbow smelt for this sector is therefore unknown, although Rainbow Smelt larvae are often found in the intertidal zone located in the south of the estuary during the spring and summer seasons. Based on the information available, the area being used intensively by the juvenile is located upstream of the Rivière-du-Loup's Wharf (Figure 2) (Doucet et al., 2005).

Among the species of fish inhabiting the area of Cacouna, two are designated vulnerable according to *An Act respecting threatened or vulnerable species of Quebec* (R.S.Q., chapter E-12.01). They are the Rainbow Smelt in the St. Lawrence estuary and the American Shad. As for the Atlantic sturgeon, it is a species that is likely to be designated threatened or vulnerable according to the Act.

Regarding the Striped bass, the St. Lawrence Estuary population was designated extirpated in Canada in 2004, after having disappeared in the late sixties. However, a reintroduction program has been under way since 2002. The historical distribution of the species cover up to the region of Kamouraska, which is located 50 km upstream of the study area. However, since 2003, captures were recorded from Lac St-Pierre to Rimouski but the majority were reported between Quebec and Saint André de Kamouraska (Plan St-Laurent, 2008).

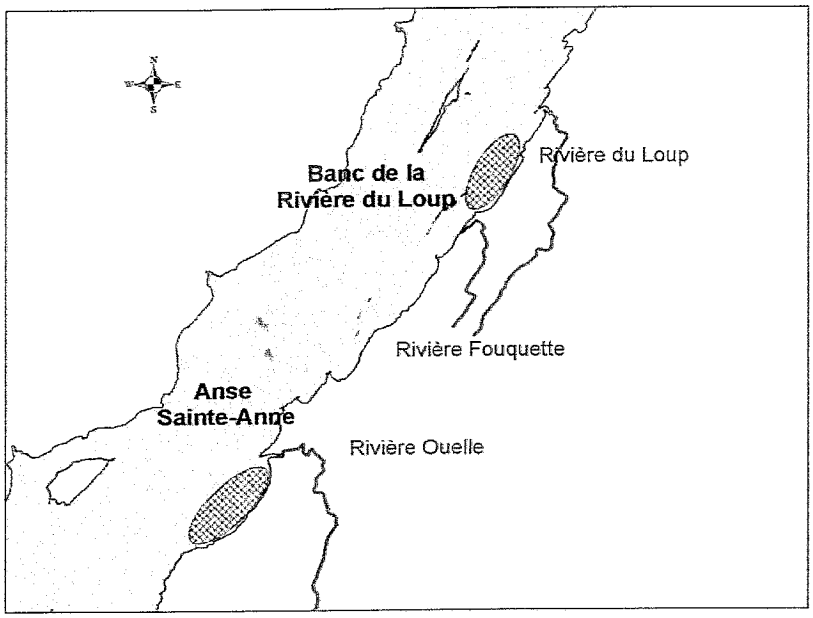
Knowledge about the quality of the habitat and its use by striped bass in the St. Lawrence River is still limited. In the recovery strategy, an area in Anse Sainte-Anne in La Pocatière has been identified as critical habitat between September 1 and October 31, due to a high concentration of juveniles reported during that period. Since then, the basin of Rivière du Sud in Montmagny, as well as a second spawning ground of striped bass in Rivière Ouelle, have been identified as breeding sites (Robitaille et al., 2011). These sites are located upstream of the study area.

Table 2: Fish Species of Interest in the Area of Cacouna



Source: CIMA+, 2009

1 MPO 1999.
2 Pettigrew P. 2002.
2 Robitaille et al. 1994
3 SIGHAP
4, 5, 6 Bérubé S., et J.-D. Lambert 1999
6 Scott et Scott, 1988
6 COSEPAC 2006
5 Munro et al 1998
5 Côté et al. 1980 CLS
5 Henri et al. 1985
5 Fortier et Gagné 1990



Source: Lepage-Ross et al., 2009

Figure 2: Location of Larvae Rainbow Smelt Retention Areas

5.2.2. Marine Mammals

The St. Lawrence estuary is a rich natural environment for marine wildlife and it is recognized as a major feeding area for numerous species of marine mammals because of the high concentration levels of prey found there, such as krill and Capelin. Many cetaceans migrate there every year, including many large whales, to feed and build up their energy reserves in preparation for the breeding season. Eight species of marine mammals can be found in the estuary, either permanently or temporarily during the year. Table 3 shows, for these species, the periods during which they can be observed in the St. Lawrence estuary.

Table 3: Presence of the Marine Mammals in the St. Lawrence Estuary

Species	Presence	Season
Toothed Whale		
Beluga	Frequently	Spring, summer, fall
Harbour Porpoise	Occasionally**	summer, fall
Atlantic White-sided Dolphin	Occasionall**	Spring, summer, fall
Baleen Whale		
Minke Whale	Occasionally**	Spring, summer, fall
Fin Whals	Occasionally	Spring, summer, fall
Pinnipeds		
Harbour Seal,	Frequently	All year round
Grey Seal	Frequently	Spring, summer, fall
Harp Seal	Frequently	Summer

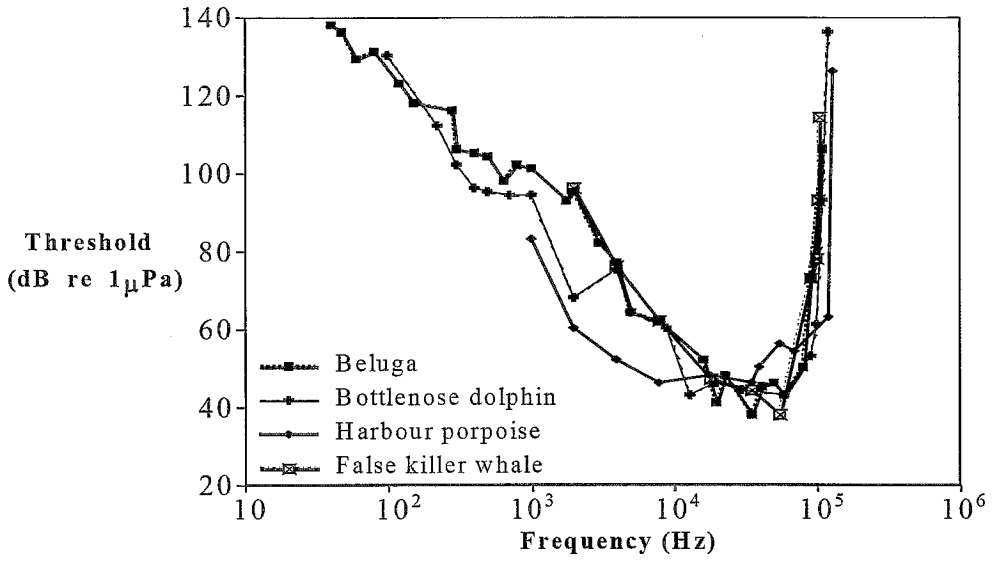
Source: Mousseau *et al.*, 1998

** Modified from Pesca Environnement, 2006

Hearing capabilities for each of these groups of marine mammals are presented hereafter.

Hearing Capabilities of Toothed Whales

The auditory sensitivities of the porpoises, dolphins and smaller toothed whales such as the beluga (*Delphinapterus leucas*) are greatest at very high frequencies, between 10 and 150 kHz (Figure 3). In this figure, sound frequencies associated with the lowest threshold levels – that can be observed at the bottom of each curve - correspond to the greatest sensitivities (Richardson *et al.*, 1991 *in* Tasker and Weir, 1998).



Source: Tasker and Weir, 1998

Figure 3: Audiograms of Selected Odontocetes (Toothed Whales)

Hearing Capabilities of Baleen Whales

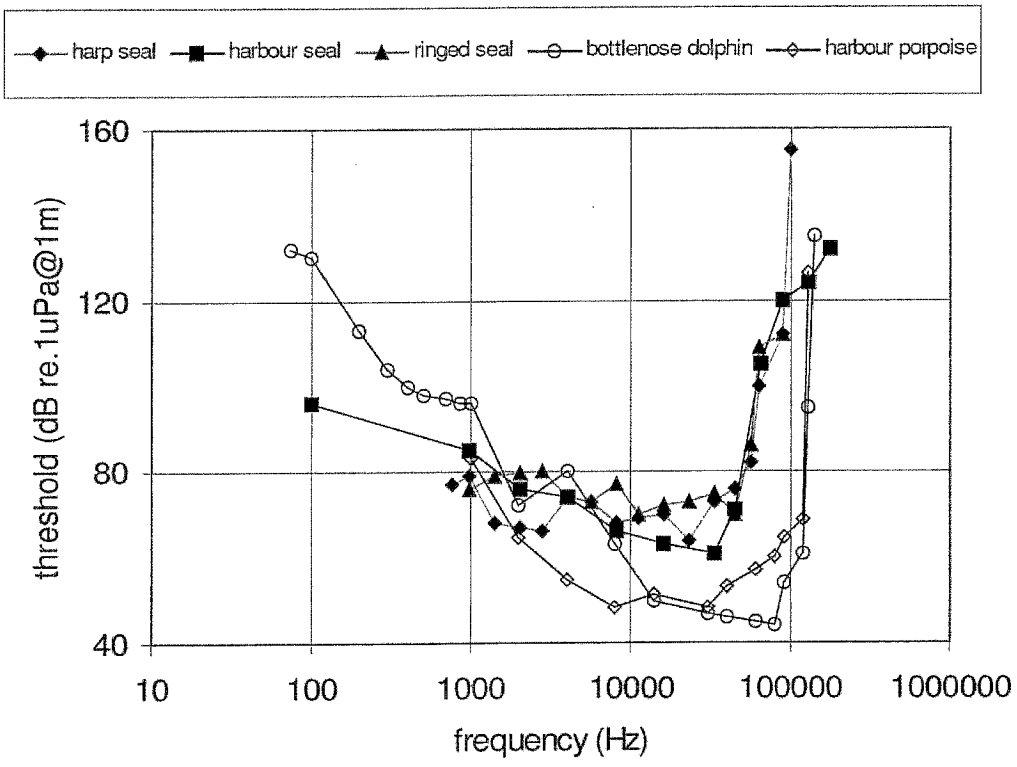
There is no direct information about the hearing capabilities of baleen whales. However, baleen whale calls are predominantly made at low frequencies, mainly below 1 kHz, and their hearing is presumably good at corresponding frequencies (Richardson *et al.*, 1995 *in:* LGL Limited, 2002).

Moore *et al.* (1984) and Dahlheim and Ljungblad (1990) (*in* Tasker and Weir, 1998) present tentative audiograms for the grey whale *(Eschrichtius robustus)* and bowhead whale *(Balæna mysticetus)*. They suggest that greatest hearing sensitivities occur between 100 Hz and 5 kHz, on the assumption that whales will hear approximately over the same frequency range as the sounds they produce.

Hearing Capabilities of Seals

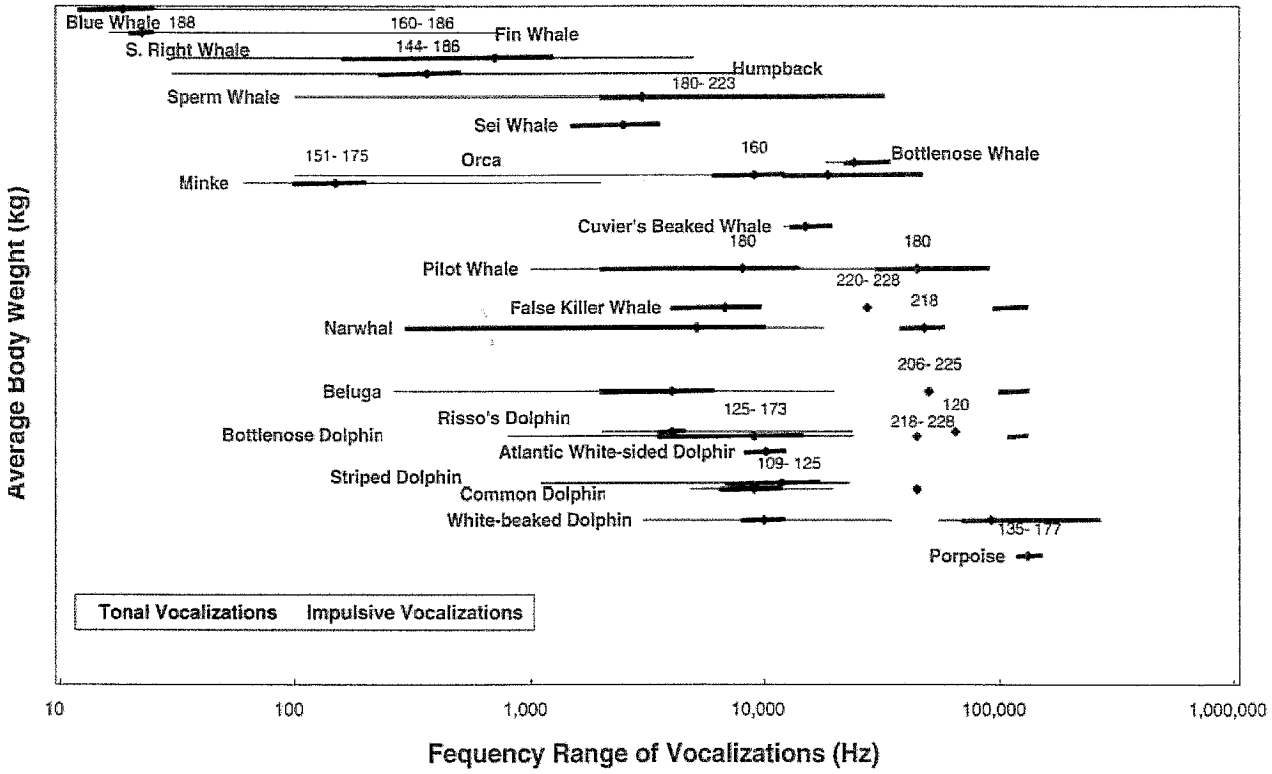
Behavioural audiograms have been published for four seal species, i.e. harbour seal, ringed seal *(Phoca hispida),* harp seal, and Hawaiian monk seal *(Monachus schauinslandi).* The audiograms of the four seal species are very similar (Figure 5). All show a fairly flat frequency response between 1 kHz and 40 to 50 kHz. Sensitivity rapidly decreases at frequencies above 50 kHz and the best frequency is between 10 and 30 kHz (Richardson *et al.*, 1995 *in:* Tasker and Weir, 1998).

The audiograms of the harbour porpoise and bottlenose dolphin are also shown in Figure 4 for comparison. Their hearing is more sensitive at high frequencies and they are more sensitive than phocids (seals) at all frequencies down to 7-8 kHz. Between 10 and 40 kHz, the small odontocetes thresholds are 15 to 20 dB lower than the phocids (Tasker and Weir, 1998).



Source: Tasker and Weir, 1998

Figure 4: Audiograms of Three Seal Species and Two Small Odontocete Whales



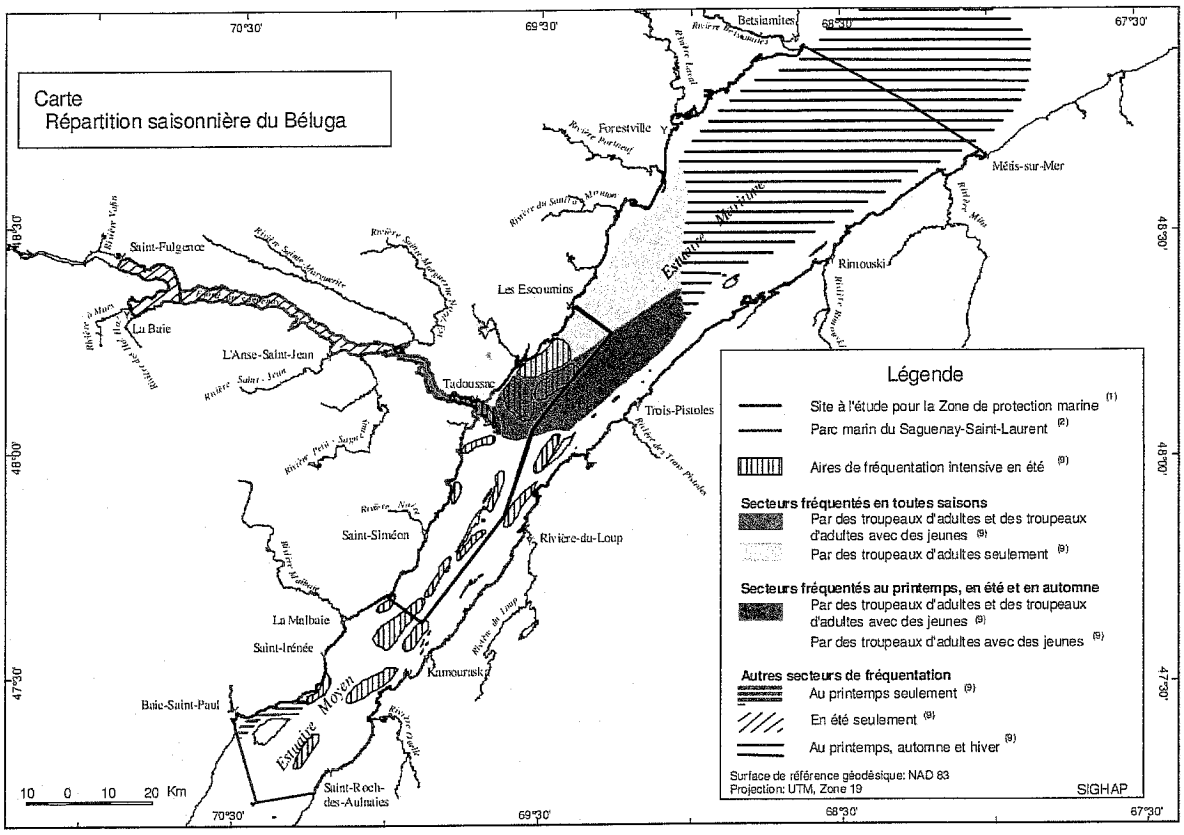
Source: National Research Council, 2003

Figure 5: Vocalizations of Marine Mammals by Average Adult Body Weight

5.2.3. Species at Risk : Beluga

The belugas of the St. Lawrence are considered to be a relic population that was separated from those in the Arctic, and appear to be isolated geographically. The St. Lawrence estuary population occupies the area centered around the Saguenay River mouth. Migrations of the populations occur from overwintering areas in the areas of open water to their spring and summer calving and feeding areas, which are usually river estuaries. The St. Lawrence population is estimated to about 1,000 individuals (COSEWIC, 2004). The population growth rate has been estimated, with a great deal of uncertainty, at 1 % (DFO, 2012).This population has also been designated in 2004 as "Threatened" under the *Species at Risk Act of Canada* and *An Act respecting threatened or vulnerable species* of Quebec.

The south shore of the St. Lawrence offers not only food resources, but also the conditions of birth and moulting more favorable than the other colder regions of the St. Lawrence. The seasonal distribution of the beluga within the estuary of the St. Lawrence River is shown in Figure 6. The study area is mainly used during the spring, summer and fall periods (from April to November or until the formation of an ice cover).



Source: SIGHAP, 2002 *in* CIMA+, 2008

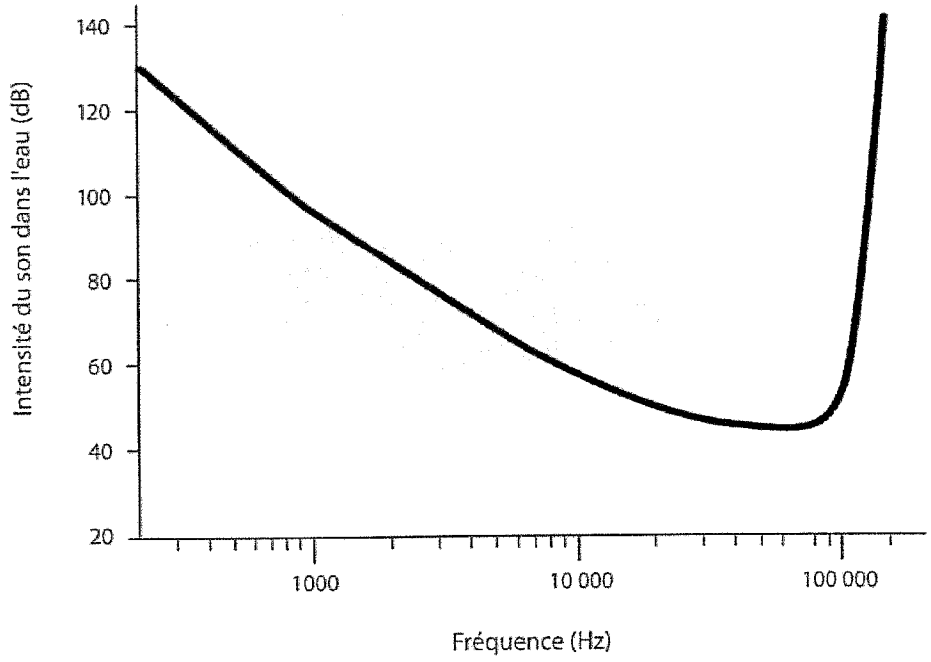
Figure 6: Seasonal Distribution of the Beluga

Among all the marine mammals observed during the inventory carried out by Pesca Environment, between December 2004 and December 2005, 68.9 % were belugas. In fact, the presence of beluga was recorded from April to November 2005 with a highest observation rate recorded in June 2005.

The beluga feed mainly on fish such as Atlantic Herring, Rainbow Smelt, American Eel and Capelin. According to Lesage and Kingsley (1995), during the summer, beluga movement in the area is directed by the spawning periods of their prey. In the St. Lawrence lower estuary, mating occurs between the month of April and June (Lesage et Kingsley, 1995 *in* CIMA+ et Roche, 2009) and calving happens between the month of June and September (COSEPAC, 2004 *in* CIMA+, 2009).

The beluga use more than 50 forms of vocalization (Corry-Crowe O, 2002 *in* CIMA+ et Roche, 2009). They generally emit sounds at higher frequencies. The dominant frequency ranges between 1 and 8 kHz for noisy vocalizations. The echolocation clicks range from 40 to 60 kHz and 100-120 kHz at a sound pressure of 206 to 225 dB re 1 m 1µPa.

Auditory sensitivity of the beluga is relatively low at low frequencies (Richardson et al., 1995 in CIMA + et Roche, 2009). Beluga hearing sensitivity is at 130 dB and 100 Hz. However, the frequency of better listening for the beluga is 40 kH (Richardson et al., (1995). At this frequency, the auditory threshold (the minimum intensity at which beluga perceives sound) is only 40 dB. Figure 7 shows the curve of audibility beluga.



Source : Parc Canada, 1998

Figure 7: Beluga Curve of Audibility

Today, the main threats identified regarding the beluga population of the St. Lawrence river are the following:

- Industrialization and pollution, which may be responsible for the high rates of chronic diseases such as cancer observed in stranded animals.
- The small population size and low genetic diversity, which may affect the reproductive rate.
- Habitat loss and disturbance, especially anthropogenic noise caused by marine navigation and whale watching activities.
- Competition for food resources with commercial fishermen and increasing populations of certain marine mammals, including some seal species.

Because of the reduced size of the population, even activities that affect only a few individual belugas can have serious repercussions on the entire population (DFO, 2012).

To achieve the population and distribution objectives of the recovery strategy, six recovery objectives have been identified by DFO:

- Reduce contaminants in belugas, their prey, and their habitat that could prevent population recovery;
- Reduce anthropogenic disturbances;
- Ensure adequate and accessible food supply;
- Mitigate the effects of other threats to population recovery;
- Protect beluga habitat throughout the entire distribution range;
- Ensure regular monitoring of the St. Lawrence Estuary beluga population.

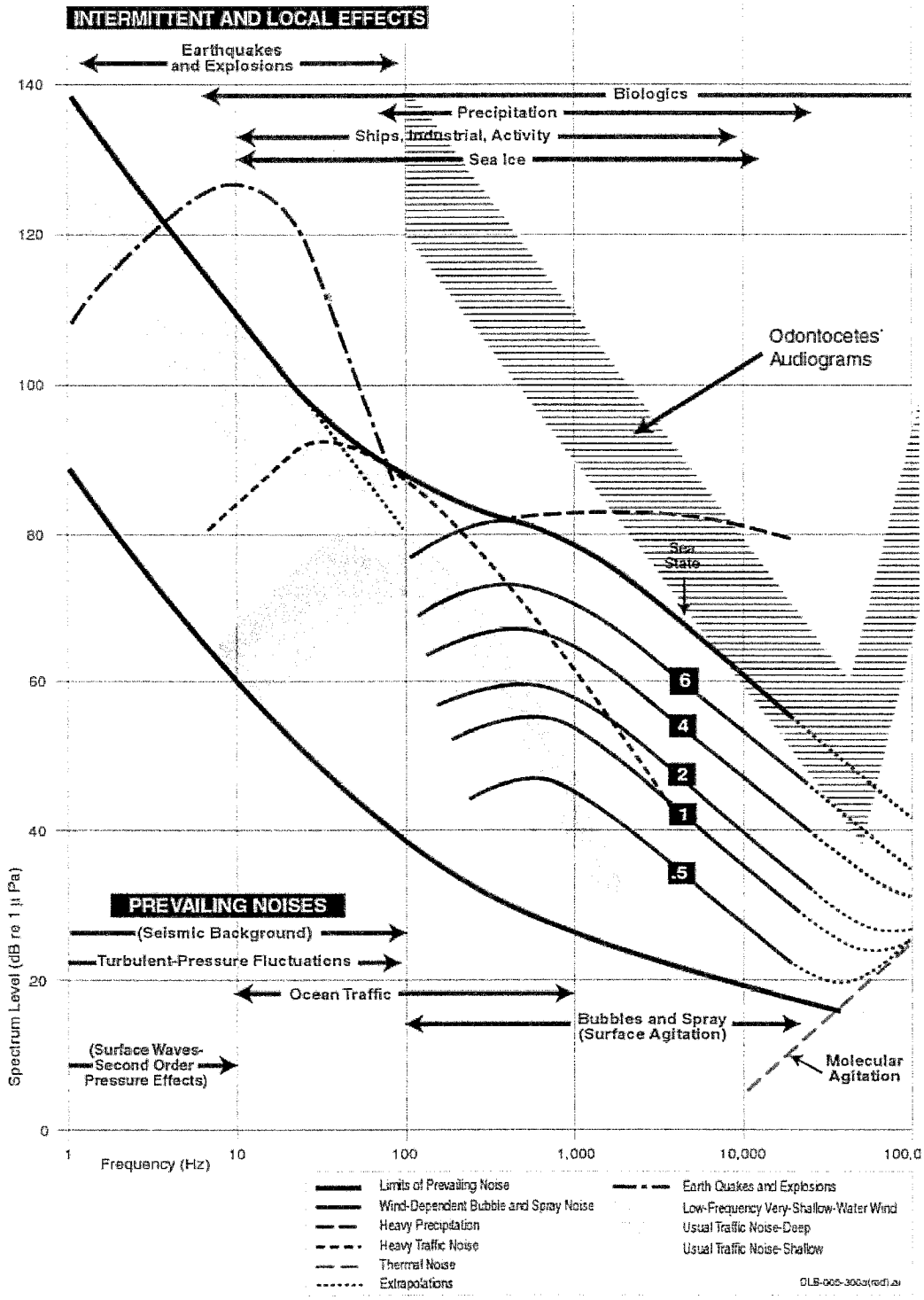
The study area is within the boundaries of the critical habitat, which is based on the summer distribution range of females and their calves. This habitat supports the function of calving and rearing of the young and thus juvenile survival.

6. IMPACT ASSESSMENT

The National Oceanic and Atmospheric Administration (NOAA) released in December 2013 (NOAA, 2013) new guidance for assessing the effects of anthropogenic sound on marine mammals. The new acoustic threshold levels are based on different metrics and cannot be compared to acoustic threshold levels presently in force in Canada. Since most of the literature regarding the measurement of anthropogenic noise and its effect on marine mammals is based on different references, the assessment of the geophysical survey effects on marine mammals is done using past acoustic threshold levels.

6.1. Marine Ambient Noise

Whether intentional or unintentional, any anthropogenic noise in the marine environment is an important component of ocean noise. Figure 8 summarize marine ambient noise from various sources.

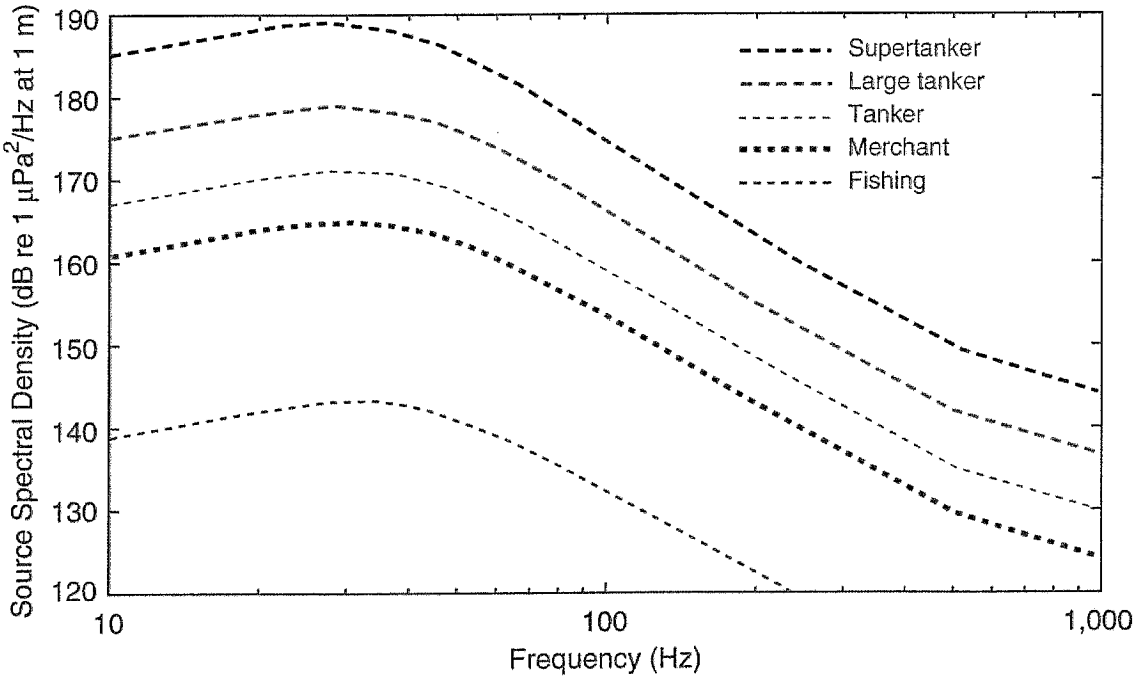


Source: National Research Council, 2003

Figure 8: Marine Ambient Noises from Various Sources

Sound is a widely used tool for a broad range of marine activities. In the search for new hydrocarbon reserves, the rock underlying the seafloor is usually characterized using air-guns. Marine researchers use sound waves to investigate the properties of seawater, both for local and global studies. Sonars used for civilian navigation and defense purposes use sound waves to locate objects under the sea surface. Unintentional contributions to marine noise arise from transiting ships, coastal and marine construction activity, mineral extraction, and aircraft overflights. These anthropogenic sound sources contribute to ocean noise over the complete 1 Hz to 200 kHz band.

In the lowest bands, 1-10 Hz, the contributors are ship propellers, explosives, seismic sources, and aircraft sonic booms. In the 10-100 Hz band, shipping, explosives, seismic surveying sources, aircraft sonic booms, construction and industrial activities, and naval surveillance sonars are the major contributors. For example, Figure 9 show ranges of band emitted in the ocean by various vessels.



Source: National Research Council, 2003

Figure 9: Modeled Surface Ship Source Spectral Densities for the Five Classes of Ships

In fact, commercial ships have been increasing in both number and size, and are producing a greater amount of underwater noise. Analysis of radiated sound from ships has revealed that they are the dominant source of underwater noise at frequencies below 300 Hz in many areas of the world (Wright, 2008). According to Simard et al. (2010), the daily merchant ship traffic on the lower St. Lawrence estuary is a main source to ambient noise. During a five months acoustic survey in 2005 in the lower St. Lawrence seaway, the maximum received level in the 20 Hz-09 kHz band reached 136 dB re 1 µPa rms. The median level of 112 dB re 1 µPa rms was exceeded 50% of the time due to transiting merchand ships. The relatively flat-bottom trench of the Laurentian channel allows significant propagation of the noise radiated by ships transiting on the seaway. Given the noise footprint of the ships and their succession rate along the seaway, there is very little time for low noise level without direct ship influence (Simard, 2010).

Various natural events can also contribute to increase the ocean ambient noise. Plunging surf can raise underwater noise levels by more than 20 dB a few hundred meters outside the surf zone across the band from 10 Hz to 10 kHz (Wilson et al., 1985 *in* National Research Council, 2003). Rain can increase the naturally occurring ambient noise levels by up to 35 dB across a broad range of frequencies and extending from several hundred hertz to greater than 20 kHz (National Research Council, 2003).

The levels of anthropogenic noise in the marine environment have increased substantially in the last century as human activities in coastal and oceanic waters have expanded and diversified. The main sources of anthropogenic sound in the marine environment and their acoustic properties are provided in Table 4.

Table 4: Main Sources of Anthropogenic Sound in the Marine Environment

Sound Source	Source Level (dB re 1 µPa-m)	Bandwidth (Hz)	Major amplitude (Hz)
Ship shock trials (10000 lb explosive)	304	0.5 - 50	-
Military sonar mid-frequency	223 – 235 Peak	2800 - 8200	3 500
Pile driving	228 peak / 243 – 257 P-to-P	20 - >20 000	100 - 500
Military sonar low-frequency	235 Peak	100 - 500	-
Echosounders	235 Peak	Variable	Variable 1500 – 36 000
Large vessels	180 – 190 rms	6 - > 30 000	> 200
Small boats and ships	160 – 180 rms	20 - > 1000	> 1000
Dredging	168 – 186 rms	30 - > 20 000	100 - 500
Drilling	145 – 190 rms	10 – 10 000	< 100

Source: UNEP, 2012

6.2. Noise from geotechnical equipment

The information regarding sound pressure level associated with geotechnical survey is limited. Most of the sounds levels quoted in the literature are in reference to well drilling operation for oil and gas exploration. Such operation generally produce moderate to high levels of continuous sound at low frequency (20 to 1000 Hz). Source sound pressure levels have generally been reported to lie within the 145-190 dB (Department of Art, Heritage and the Gaeltacht, 2012; UNEP, 2012). While sound exposure levels from such operations are thought to be below level to cause injury to a marine mammal, they have the potential to cause lower level disturbance (Department of Art, Heritage and the Gaeltacht, 2012).

Like drilling works, geotechnical investigation is executed using fixed or dynamically-positioned platforms and associated vessel. Those equipment are sources of anthropogenic noise. Although, sound pressure level from small boat or even larger vessel can be higher than drilling activities itself (figure 9 and table 4). Nevertheless, the underwater sound level may increase the potential for auditory masking, avoidance and other disturbance effects.

During the geotechnical survey of 2006 carried out for the LNG marine terminal, in addition to the marine mammals monitoring (photo 3), DFO requested to monitor the noise level during the survey. Measurements were collected with hydrophone (Reson TC4043 and TC4032) from the 10 to the 12 of July 2007. Results are presented in Table 5. Measurements were executed by Jasco Research. The following activities were monitored:

- Activities on barge without drilling (only the current generator was in operation);
- Drilling without hammering;
- Drilling with hammering;
- Use of tugs in different operating conditions, and;

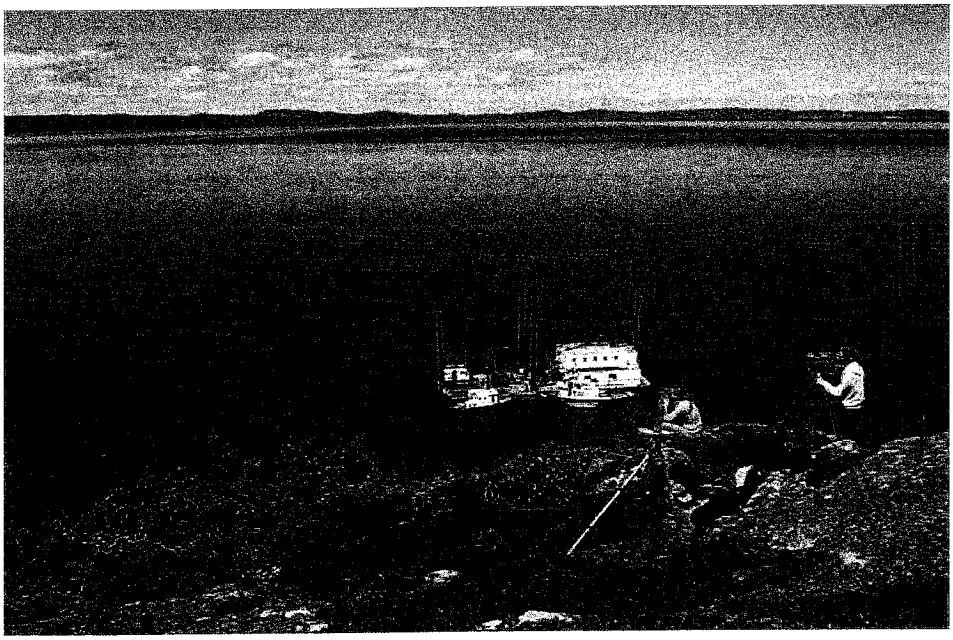


Photo 3: Marine Mammals Monitoring during the geotechnical Survey in 2007

Observations of whales approaching the 300 m protection zone were made in 2007 during the geotechnical survey. Work was stopped between one to three times per month because of these events. In some cases, following the interruption of equipment, some individual came as close as 100 m from the barge. Only the current generator was then in operation. Observations collected during the geotechnical survey are illustrated in Appendix 2.

In addition to obtaining sound levels for different types of equipment, sound level measured was used to confirm the radius of the marine mammals protected zone (300 m) applied during geophysical and geotechnical work in 2007.

Table 5: Sound Pressure Level Generated by Equipment Used during the Geotechnical Survey in 2007

Activity	Sound Pressure Level (dB re 1µ Pa@ 1m)	Distance to reach 120 dB* (m)	Distance to reach 160 dB** (m)
Main Current Generator (Perkins, 4 cylkinders, model N440)	120.9	1	-
Penetration Test (drill CME with hammering) (impulse sound)	164.0	-	2
Drilling Activity (drill CME wihtout hammering) (Non-pulse sound)	153.1	161	-
Pascal Tug - low speed (14,9 BRT, Cummins 6 cylinders NH series, 205 KW, 1600-1800 RPM max.)	142.3	31	-
Pascal Tug - high speed	143.2	35	-
Pascal Tug - backing up	146.3	57	-
Roxanne Tug, docked at the barge	138.6	17	-

* Threshold level for a non-impulsive sound over which behavioural effect can be observed
** Threshold level for an impulsive sound over which behavioural effect can be observed

Source: Golder, 2008b

Data collected in 2008, confirmed that the 300 m protection zone was more than adequate to protect the marine mammals inhabiting the area (Golder, 2008b).

6.3. Assessment

Anthropogenic noise can adversely influence the distribution, habitat use and behaviour of marine animals and even cause physical harm. The impact depends on the source level, sound radiation, characteristics of noise (pulsed, continuous), hearing abilities and motivation of the animal.

Investigating potential effects of noise on marine animals, often the radii, are assessed within which different acoustic effects are expected. Usually, four zones of noise impact are differentiated (Richardson *et al.*, 1995):

- zone of physical impairment through hearing loss or injury;
- zone of masking;
- zone of responsiveness and;
- zone of audibility.

The zones are usually illustrated as circles indicating the distance from the noise source.

However, little data is available so far in order to relate a certain strength and characteristic of a noise source with the extension of the zones concerned.

The current injury and harassment thresholds for pinnipeds, cetaceans, and fish are summarized in Table 6.

Table 6: Noise Threshold Levels for Marine Mammals and Fish

Species	Injury Threshold	Harassment
Pinnipeds	190 dB rms	180 dB rms
Cetaceans	180 dB rms	160 dB rms
Fish (2 grams or greater)	206 dB peak, 187 dB SEL (cumulative)	150 dB rms
Fish (less than 2 grams)	206 dB peak, 183 dB SEL (cumulative)	150 dB rms

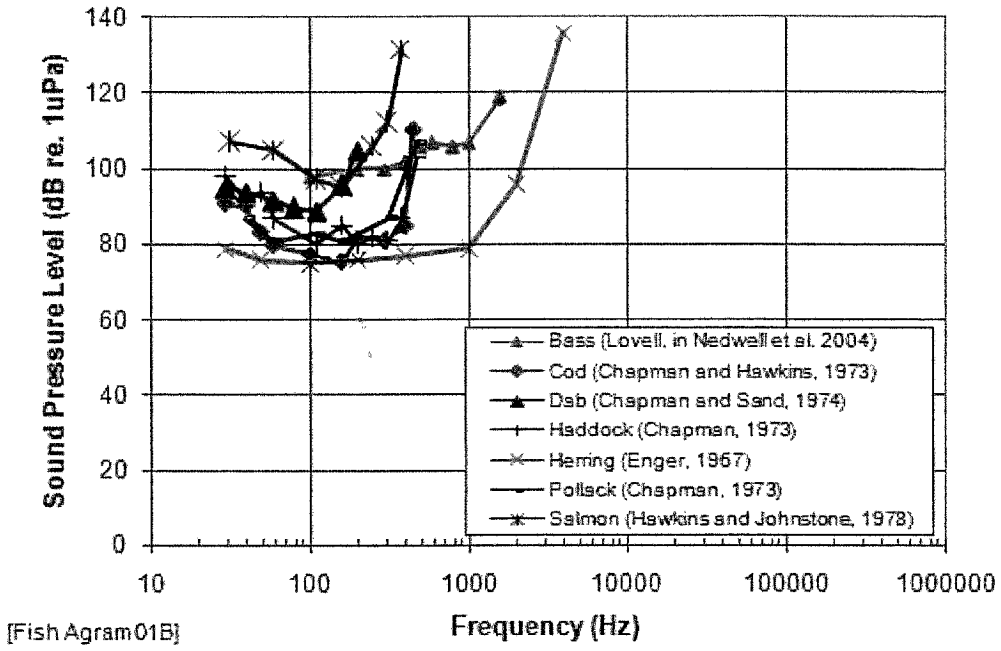
Source: CH2MHILL, 2008

Abbreviations:
- dB = decibel(s).
- rms = root mean square.
- SEL = sound exposure level.

6.3.1. Fish

There is a high diversity in hearing structures among fish, resulting in different auditory capabilities across species. Due to the higher compressibility of gas compared to water, the swim bladder responds to sound pressure fluctuations. Therefore, the perception of sound pressure is restricted to those fish species containing air-filled swim bladders. Fish without swim bladders are only sensitive to the particle motion component of the sound wave (Popper *et al.* 2008).

Fish utilize sound for navigation and selection of habitat, mating, predator avoidance and prey detection and communication. Impeding the ability of fish to hear biologically relevant sounds might interfere with these critical functions. Figure 10 shows the audiograms for a number of species of fish. The audiograms indicate that fish are sensitive to low frequency sound below 1000 Hz. The sound characteristic of drilling activities is also a low frequency (20 to 1000 Hz). Considering the fish hearing threshold (>80 dB) and the use of similar frequency, interference with their biological functions may be occurring. However, interference should not be greater than the one generated from small boat and vessel (Table 6).



Source: Nedwell et al., 2007

Figure 10: Hearing Threshold Data for Species of Fish

A wide range of effects of increased levels of sound on marine fauna have been documented both in laboratory and field conditions. The effects can range from mild behavioural responses to complete avoidance of the affected area, masking of important acoustic cues, and in some cases serious physical injury or death. Based on a non-exhaustive literature review, effect on marine fish species is summarized in Table 7. Fish present in the area during the geotechnical survey should avoid the area. Considering the injury threshold level for fish (206 dB to peak) and the higher sound pressure level recorded (164 dB re 1µ Pa@ 1m) during similar activities in the area in 2007, no physical injury is anticipated.

Table 7: Physical and Behavioural Effects on Marine Fish Species

Physical effects
Damage to the hearing system
Faster consumption of energy reserves
Physiological stress
Behavioural effects
Faster swimming and formation in tight groups
Startle responses: faster or more erratic swimming, jerking movements concurrent with an array activation, or flash expansion of schools
Displacement to deeper waters.

Source: McCauley et al., 2000

6.3.2. Marine Mammals

Marine mammals, especially cetaceans, are highly vocal and dependent on sound for almost all aspects of their lives, e.g. food-finding, reproduction, communication, detection of predators/hazards, and navigation. They are thus likely sensitive to anthropogenic noise. There can be great variation in the reaction of marine mammals to noise, depending on factors such as species, individual, age, sex, prior experience with noise, and behavioural state. Species with similar hearing capabilities can respond differently to the same noise.

The responses of cetaceans to noise sources are often dependent on the perceived motion of the sound source as well as the nature of the sound itself. Animals will only respond directly to sounds they can detect. The hearing sensitivities of only a few individuals in a select number of species are known. Even less is known about signal detection in the presence of ambient noise. Beluga whales can detect echolocation return signals when they are 1 dB above ambient noise levels (Turl et al., 1987 *in* National Research Council, 2003).

According to Watkins (1986 *in* National Research Council, 2003), for a given source level, fin and right whales are more likely to tolerate a stationary source than an approaching one. Humpback whales are more likely to respond at lower received levels to a stimulus with a sudden onset than to one that is continuously present. There are many documented cases of apparent tolerance of marine mammals to noise, which also demonstrate much variability. Although it is not known what the consequences of this apparent tolerance are: it may represent acclimation or habituation of some kind, but may also represent an unrelenting need, e.g. for feeding or reproduction, to remain in a particular location despite exposure to noise, that could result in increased impacts from masking, hearing loss, and other potential effects, such as stress (Weilgart, 2007).

The beluga is subject to various changes in marine noise level. These variations depend on the weather, bathymetry, tides, currents and topography. For example, beluga whales are more sensitive to ship noise when they are confined to open-water leads in the ice in the spring (Burns and Seaman 1985 *in* National Research Council, 2003). Baleen whales produce low frequency sounds at high intensity, allowing them to communicate over great distances using current open environments. This is not the case for the beluga confined to the St. Lawrence where the physical environment and the physiology of individuals do not allow such exchanges (Scheifele et al., 2005 *in* CIMA + et Roche, 2009). The only ways for the St. Lawrence beluga to counteract anthropogenic and natural sounds are either to change their communication frequencies, to increase the intensity of their calls or to leave the sites to quieter places. It has been observed that belugas increased their echolocation clicks to higher frequencies and to higher source levels in the presence of background noise (Scheifele *et al.*, 2005 *in* CIMA+ et Roche, 2009 and National Research Council, 2003.). Such response on a daily basis in summer time in the St. Lawrence, due to maritime traffic, is a significant impact on the ability of this species to communicate and probably affects their energy management (Scheifele et al., 2005 *in* CIMA + et Roche, 2009).

According to the literature, anthropogenic sound can have both physical and behavioural effects on marine mammals, as listed in Table 8. Those effects might affect a significant part of the population and thus endanger the long-term survival of the population or the species. In the specific case of endangered species, an effect at the individual level will have an effect on the long-term survival of the population or the species.

Table 8: Physical and Behavioural Effects on Marine Mammals

Physical effects
• Damage to the hearing system • Temporary threshold shift (reduction in auditory sensitivity with eventual recovery) • Permanent threshold shift
Behavioural effects
• Masking of biologically significant noises (communication signals, echolocation, and sounds associated with finding prey or avoiding predators or human threats such as shipping) • Avoidance of a particular area • Altered dive and respiratory patterns • Stress leading to reduced viability and disease

Physical damage occurs at a noise level greater than 180 dB. Richardson *et al.* (1995) report avoidance reactions of marine mammals exposed to continuous sounds above 120 dB and, conclude that marine mammals would avoid areas with continuous levels above 140 dB. A noise level greater than 120 dB from a non-impulsive sound and greater than 160 dB from an impulsive sound can generate modifications of their behaviour such as altered heading, fast swimming, change in dive and changes in vocalizations.

Behavioural responses of marine mammals to noise are highly variable and dependent on a suite of internal and external factors (National Research Council, 2003):

Internal factors include:

- Individual hearing sensitivity, activity pattern, and motivational and behavioural state at time of exposure;
- Past exposure of the animal to the noise, which may have led to habituation or sensitization;
- Individual noise tolerance; and
- Demographic factors such as age, sex, and presence of dependent offspring.

External factors include

- Non-acoustic characteristics of the sound source, such as whether it is stationary or moving;
- Environmental factors that influence sound transmission;

- Habitat characteristics, such as being in a confined location; and
- Location, such as proximity to a shoreline.

The observed reactions to noise in marine mammals could theoretically result in impacts such as decreased foraging efficiency, higher energetic demands, less group cohesion, decreased reproduction, and other effects, thus seriously impacting the population as well as the individual (Weilgart, 2007).

The potential effects depend on the intensity of the pulses received by the organisms, their physiology and their biological activity at the time of the surveys. Based on the sound pressure level recorded in July 2007 during geotechnical investigation (impulsive sound: 164 dB and non-impulsive sound: 153 dB), behavioural effects can be anticipated during the activity of drilling but not a continuous basis during the day. In fact, other activities will take place and will interrupt boreholes drilling. The nature of the sound generated from the geotechnical equipment is not likely to induce physical effect on marine mammals.

However, since the beluga is a species at risk and in order to contribute to the achievement of the recovery objective defined in the Recovery Strategy for the beluga (e.g.: reduce anthropogenic disturbances) (DFO, 2012), a marine mammals monitoring will be put in place.

The main elements of this program will be as follows:

- A protection zone of 300 m from the main sound source will be applied.
- Provide trained Marine Mammal Observers (MMO) to implement the program. MMO should have relevant experience and must have received formal and recognized training. The following information should be collected by the MMO:
  - Date and location of survey.
  - Number and types of vessels and equipment involved in the survey.
  - A record of the watches made for marine mammals, including details of any sightings during the watches.
  - A record of the behaviour of the marine mammals at the time of the observation.
  - Details of any problems encountered during the survey.
- All observations should be undertaken from a high platform with a clear unobstructed view of the horizon, and communication channels between the MMO and the crew.
- MMO should conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity should not commence until at least 30 minutes have elapsed with no marine mammal detections by the on-site MMO.
- Operations should not commence if marine mammals are detected within a 300 m radial distance of the intended sound source.
- Once begun, the activity will stop if weather conditions deteriorate or if marine mammals enter the 300 m protection zone.
- If there is a break in drilling activity for a period greater than 30 minutes then all pre-activity monitoring measures should recommence as for start-up.

7. REFERENCES

[1] ASL Environmental Sciences Inc. (ASL), 2004. Currents, Waves and Water Levels, October 2004 to October 2005, St. Lawrence River at Gros Cacouna. Prepared for: Mr. Ralph Seizer, Les Consultants LBCD Inc. ASL Project #80-534-F. 101 p.

[2] CH2MHILL, 2008. Oregon LNG Terminal and Oregon Pipeline Project – UnderwaterNoise Propagnation, Monitoring and Mitigation. Technical Memorandum. Appendix A. 13 p.

[3] CIMA+ et Roche, 2009. Étude d'impact sur l'environnement des travaux d'amélioration et de réparations majeures aux quais de Rivière-du-Loup - Rapport final. Société des traversiers du Québec, 257 p.

[4] CIMA+, 2008. Construction d'un port Méthanier : Activités de dragage. Examen Préalable. Rapport préparé pour le compte d'Énergie Cacouna. 166 p. + appendices.

[5] COSEWIC, 2004. COSEWIC assessment and update status report on the beluga whale *Delphinapterus leucas* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 70 pp.

[6] Department of Fisheries and Ocean Canada (DFO) 2012. Recovery Strategy for the beluga whale (*Delphinapterus leucas*) St. Lawrence Estuary population in Canada. *Species at Risk Act* Recovery Strategy Series. Fisheries andOceans Canada, Ottawa. 88 pp + X pp.

[7] Doucet J. et J. Pilote, 2005. Suivi des juvéniles d'éperlan arc-en-ciel (Osmerus mordax) anadrome du sud de l'estuaire en 2005. Ministère des Ressources naturelles et de la Faune de la région du Bas Saint-Laurent. 25 p.

[8] Department of art, heritage and the Gaeltacht, 2012. Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters. Draft. 48 p.

[9] Environment Canada and Ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2007. *Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation.*

[10] Fisheries and Oceans web site (http://www.marees.gc.ca/eng/station/info?sid=3250)

[11] Golder Associates Ltd, 2008a. The 2007 offshore geotechnical investigation Gros-Cacouna, Quebec, Canada. Submitted to TransCanada Pipelines (Energy Cacouna. 54 p.

[12] Golder Associates Ltd, 2008b. Report on the complementary actions of 2007 conducted as part of the marine mammal protection plan, Cacouna, Quebec. Report prepared for Cacouna Energy. 233 p.

[13] LGL Limited, 2002. Environmental assessment of a proposal 2D Seismic program in the southeastern gulf of St. Lawrence. Prepared by LGL LTd., Environmental research associates, Nova Scotia.

[14] Lepage-Ross, A. et R. Tardif, 2009. Suivi des juvéniles d'éperlan arc-en-ciel du sud de l'estuaire du Saint-Laurent en 2008. Ministère des Ressources naturelles et de la Faune, Direction générale du Bas-Saint-Laurent. Direction régionale de l'aménagement de la faune. 25 p.

[15] Mousseau, P., M. Gagnon, P. Bergeron, J. Leblanc et R. Siron, 1998. Synthèse des connaissances sur les communautés biologiques de l'estuaire moyen du Saint-Laurent. Ministère des Pêches et des Océans – Région laurentienne. Division de la gestion de l'habitat et des sciences de l'environnement, Institut Maurice-Lamontagne et Environnement Canada – Région Québec, Conservation de l'environnement, Centre Saint-Laurent. Rapport technique. Zone d'intervention prioritaire 15, 16 et 17. xxvi + 309 pages.

[16] National Research Council, 2003. Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals,. 204 p.

[17] Nedwell J R, Parvin S J, Edwards B, Workman R, Brooker A G and Kynoch J E, 2007. Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters. Subacoustech Report No. 544R0738 to COWRIE Ltd. ISBN: 978-0-9554279-5-4. 80 p.

[18] Parc Canada, 1998. Atelier de travail régional sur les activités d'observation en mer des mammifères marins. Document préparé par Peter M. Scheifele. P. 18-10.

[19] PESCA Environnement, 2006. Inventaire de mammifères marins dans le secteur de Gros Caouna. Rapport final. 34 p.

[20] Popper A.N. and M. C. Hastings, 2008. The effects of human-generated sound on fish. Integrative Zoology 2009. 4:43-52.

[21] Richardson, W. J., Green, C. R., Malme, C. I. & Thomson, D. H., 1995. Marine mammals and noise. Academic Press.

[22] Simard, Y, R. Lepage and C. Gervais, 2010. Anthropogenic sound exposure of marine mammals from seaways: Estimates for lower St. Lawrence seaway, eastern Canada. Applied Acoustics 71. 1093 – 1098 p.

[23] Tasker, M. L. and Weir, C., 1998. Proceeding of the Seismic and Marine Mammals Workshop, London 23-25, June 1998.

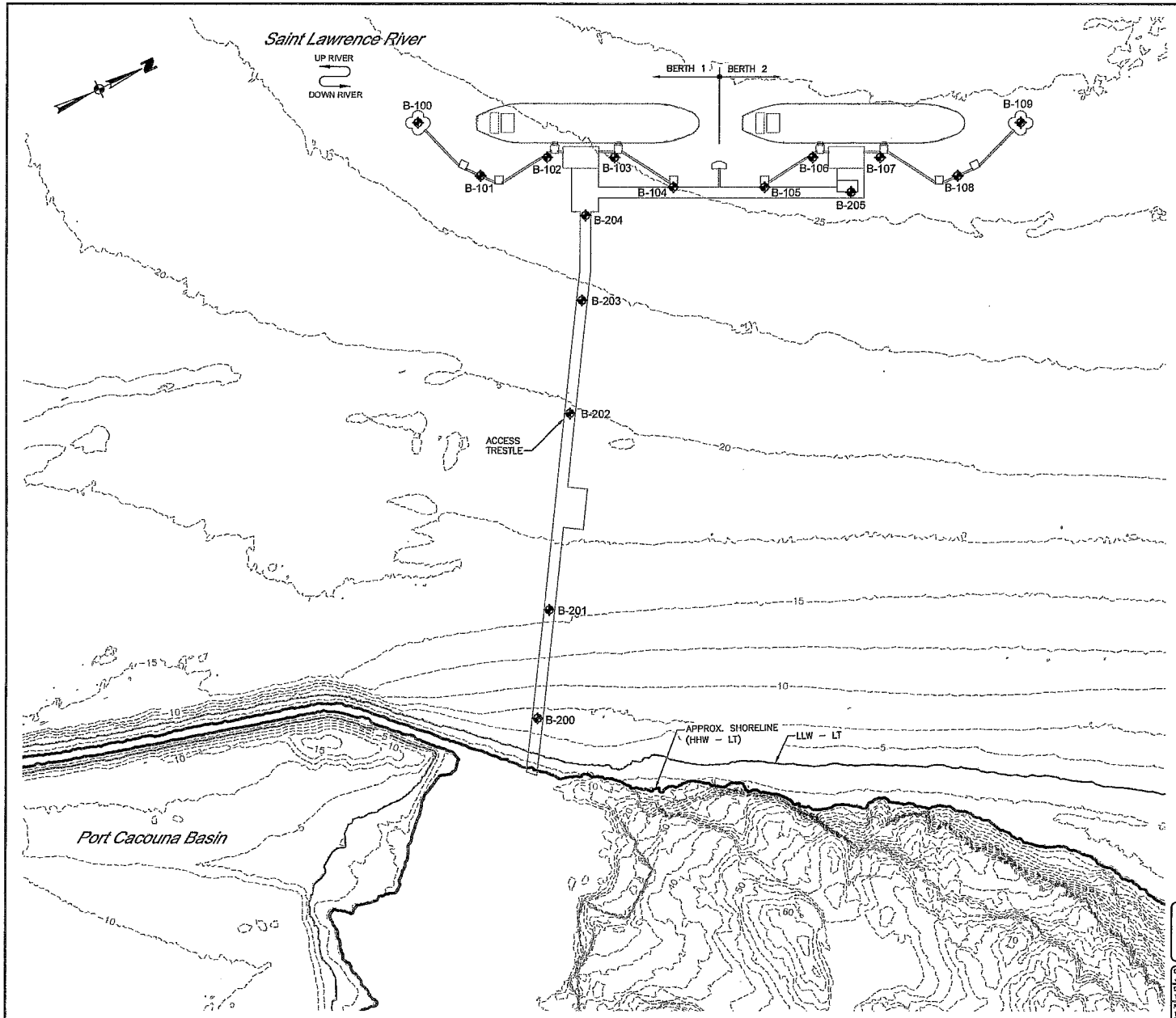
[24] UNEP, 2012. Convention on Biological Biodiversity. Scientific synthesis on the impacts of underwater noise and coastal biodiversity and habitats. Subsidiary body on scientific, technical and technological advice. UNEP/CBD/SBSTTA/16/INF/12. Sixteenth meeting. Montreal, 30 April-5 May 2012. 93 p.

[25] Weilgart L. S., 2007. A brief review of known effects of noise on marine Mammals. International journal of comparative psychology, 20. p 159-168.

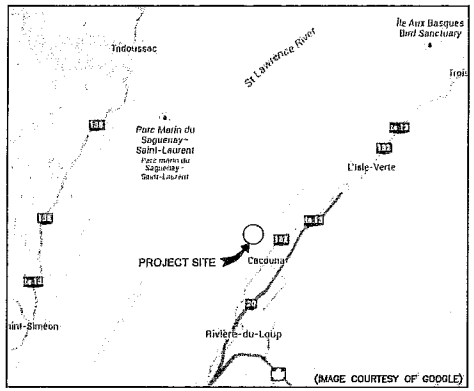
[26] Wright, A.J., 2008. International Workshop on Shipping Noise and Marine Mammals, Hamburg, Germany, 21st-24th April 2008. Okeanos - Foundation for the Sea, Auf der Marienhohe 15, D-64297Darmstadt. 33+v p. Available from http://www.sound-in-the-sea.org/download/ship2008_en.pdf

Appendix 1

Geotechnical Survey Plan



BOREHOLE LOCATION PLAN



LOCATION MAP

NOTES:

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. ELEVATION CONTOURS SHOWN ARE RELATIVE TO CGVD28 DATUM (2.580 METERS ABOVE CHART DATUM).
3. BOREHOLE COORDINATES ARE PROVIDED IN MODIFIED TRANSVERSE MERCATOR SYSTEM, ZONE 7 (MTM–7).

LEGEND:

◆ OFFSHORE BOREHOLE LOCATIONS

BORING COORDINATES (SEE NOTE 3)

BORING NO.	NORTHING	EASTING
B–100	5311548.385	377445.072
B–101	5311590.287	377539.618
B–102	5311675.909	377555.668
B–103	5311752.306	377592.930
B–104	5311802.738	377659.249
B–105	5311906.099	377709.662
B–106	5311977.005	377702.523
B–107	5312053.402	377739.784
B–108	5312131.011	377803.545
B–109	5312231.844	377777.873
B–200	5311354.128	376189.997
B–201	5311427.703	376072.248
B–202	5311559.360	377882.034
B–203	5311636.476	377738.141
B–204	5311687.352	377643.026
B–205	5312001.447	377763.229

1:5000 0 50 100 250m

FOR INFORMATION ONLY

CIMA Partners in excellence

MOFFATT & NICHOL
104 WEST 40TH ST., 14TH FLOOR
NEW YORK, NY 10018
212–768–7454

Designed by: AS	Date: JANUARY 2014	Rev. –
Dwn by: YC	Chkd by: WS	M&N Project No. 16385
Reviewed by: MTF		Drawing code:
Submitted by: MTF MOFFATT & NICHOL		Dwg Scale: AS NOTED Plot scale: 1:1

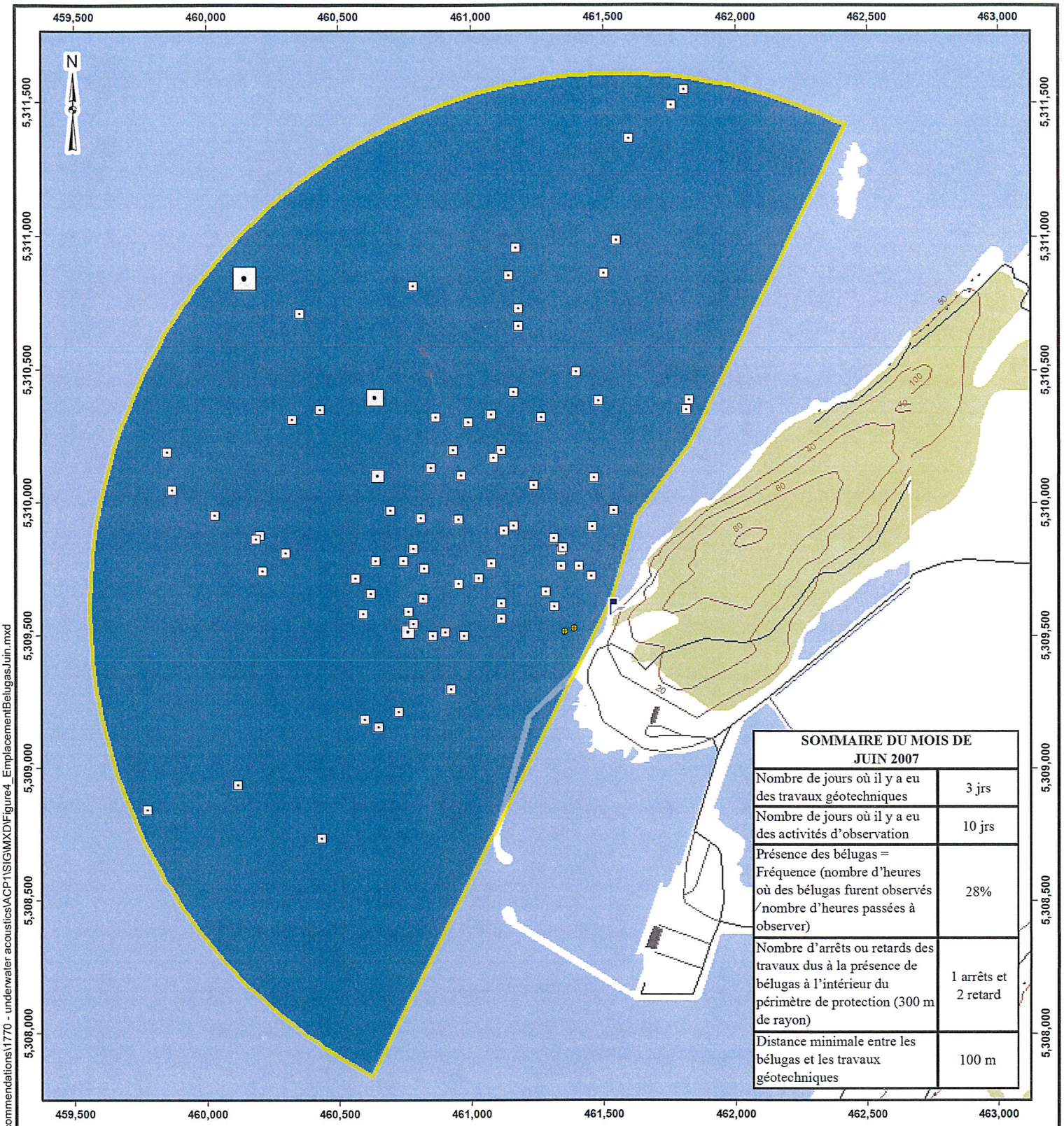
ENERGY EAST
CACOUNA MARINE TERMINAL

BOREHOLE LOCATION PLAN

Sheet Reference Number: APP 1

Appendix 2

Marine Mammals Monitoring Results
Geotechnical work in 2007



LÉGENDE

- Localisation des travaux géotechniques
- Emplacement des observateurs

Nb. de bélugas observés

- 1 à 5
- 6 à 15
- 16 à 30
- 30 +

- Courbe de niveau
- Route d'accès limité
- Route principale
- Zone d'étude (rayon de 2 km)
- Bâtiments
- Fleuve Saint-Laurent
- Végétation

RÉFÉRENCE

BDTQ 1:50 000 (22N13 et 22N14)
Référence/Datum: NAD 83 Projection: UTM Zone 19

PROJET

ÉNERGIE cacouna ENERGY

PROJET LNG

TITRE

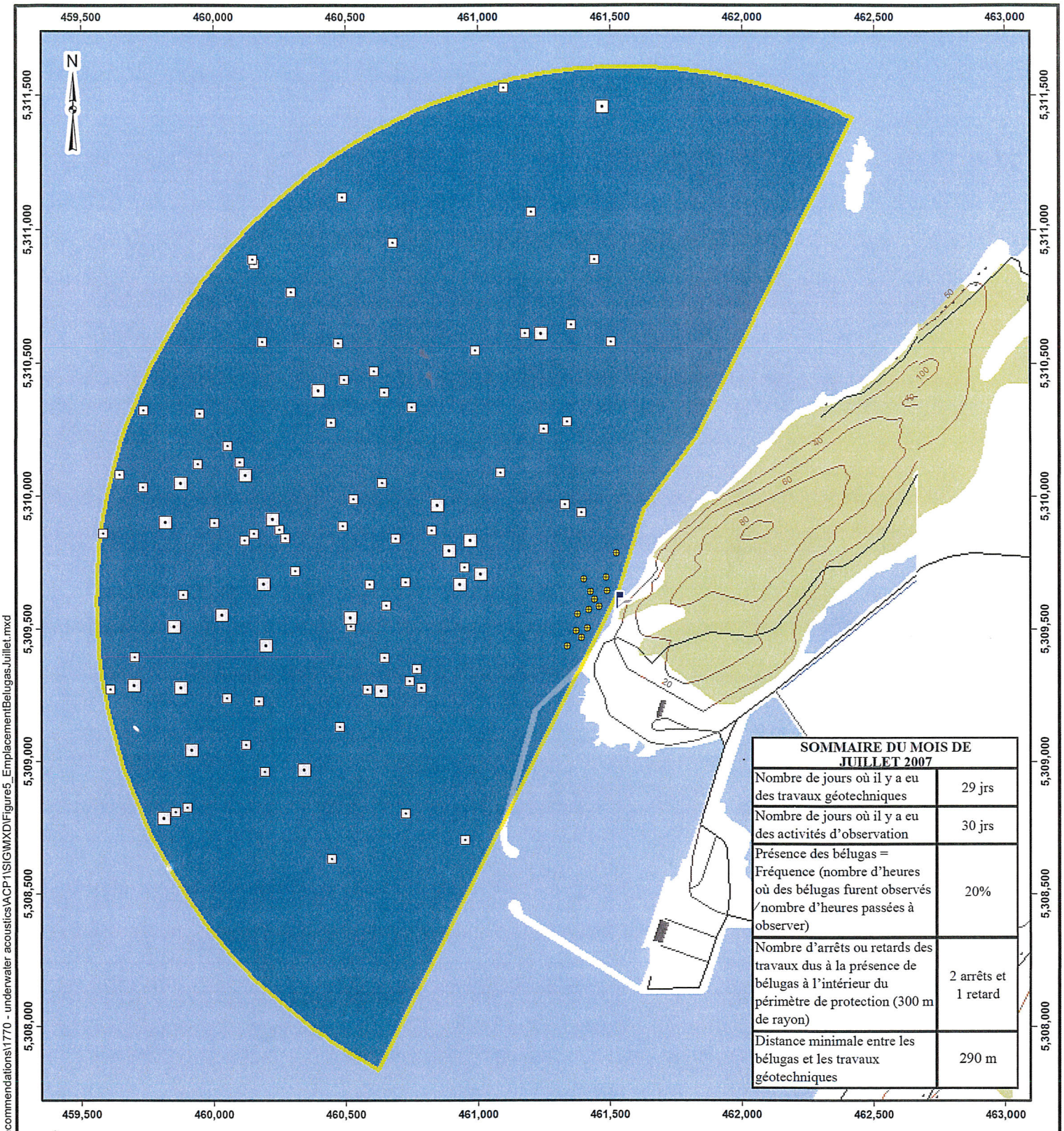
Emplacement des bélugas (*Delphinapterus leucas*) observés et des travaux géotechniques (Juin 2007)

Golder Associés

PROJET: 05-1222-302-9100-9101			ÉCHELLE TELLE QU'ILLUSTRÉE	REV. 2
PROJETÉ PAR	SJ	MARS 2008		
SIG	CG	AVRIL 2008		
VERIFÉ PAR	SM	AVRIL 2008		
APPROUVÉ PAR	MC	AVRIL 2008		

Figure 4

PROJET\ N:\Actif\2005\1222\05-1222-302\1700 - BAPE Recommendations\1770 - underwater acoustics\ACP1\SIG\MXD\Figure4_EmplacementBelugasJuin.mxd



RÉFÉRENCE

BDTQ 1:50 000 (22N13 et 22N14)
Référence/Datum: NAD 83 Projection: UTM Zone 19

PROJET

ÉNERGIE cacouna ENERGY

PROJET LNG

TITRE

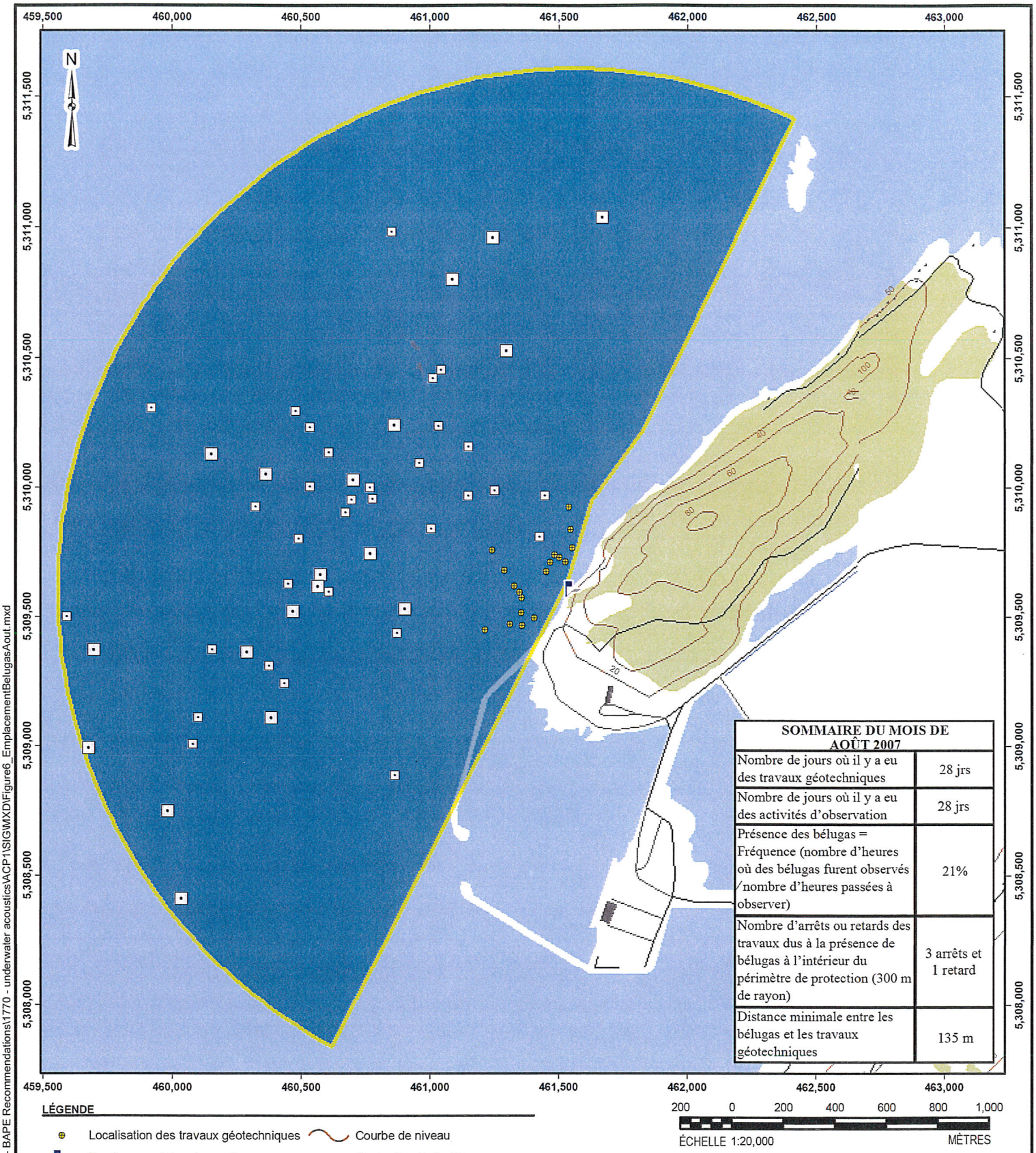
Emplacement des bélugas (*Delphinapterus leucas*) observés et des travaux géotechniques (Juillet 2007)

Golder Associés

PROJET 05-1222-302-9100-9101			ÉCHELLE TELLE QU'ILLUSTRÉE	REV. 2
PROJETÉ PAR	SJ	MARS 2008		
SIG	CG	AVRIL 2008		
VERIFÉ PAR	SM	AVRIL 2008		
APPROUVÉ PAR	MC	AVRIL 2008		

Figure 5

PROJET: N:\Actif\2005\1222\05-1222-302\1700 - BAPE Recommendations\1770 - underwater acoustics\ACP1\SIG\MXD\Figure5_EmplacementBelugasJuillet.mxd



RÉFÉRENCE

BDTQ 1:50 000 (22N13 et 22N14)
Référence/Datum: NAD 83 Projection: UTM Zone 19

PROJET

ÉNERGIE cacouna ENERGY

PROJET LNG

TITRE

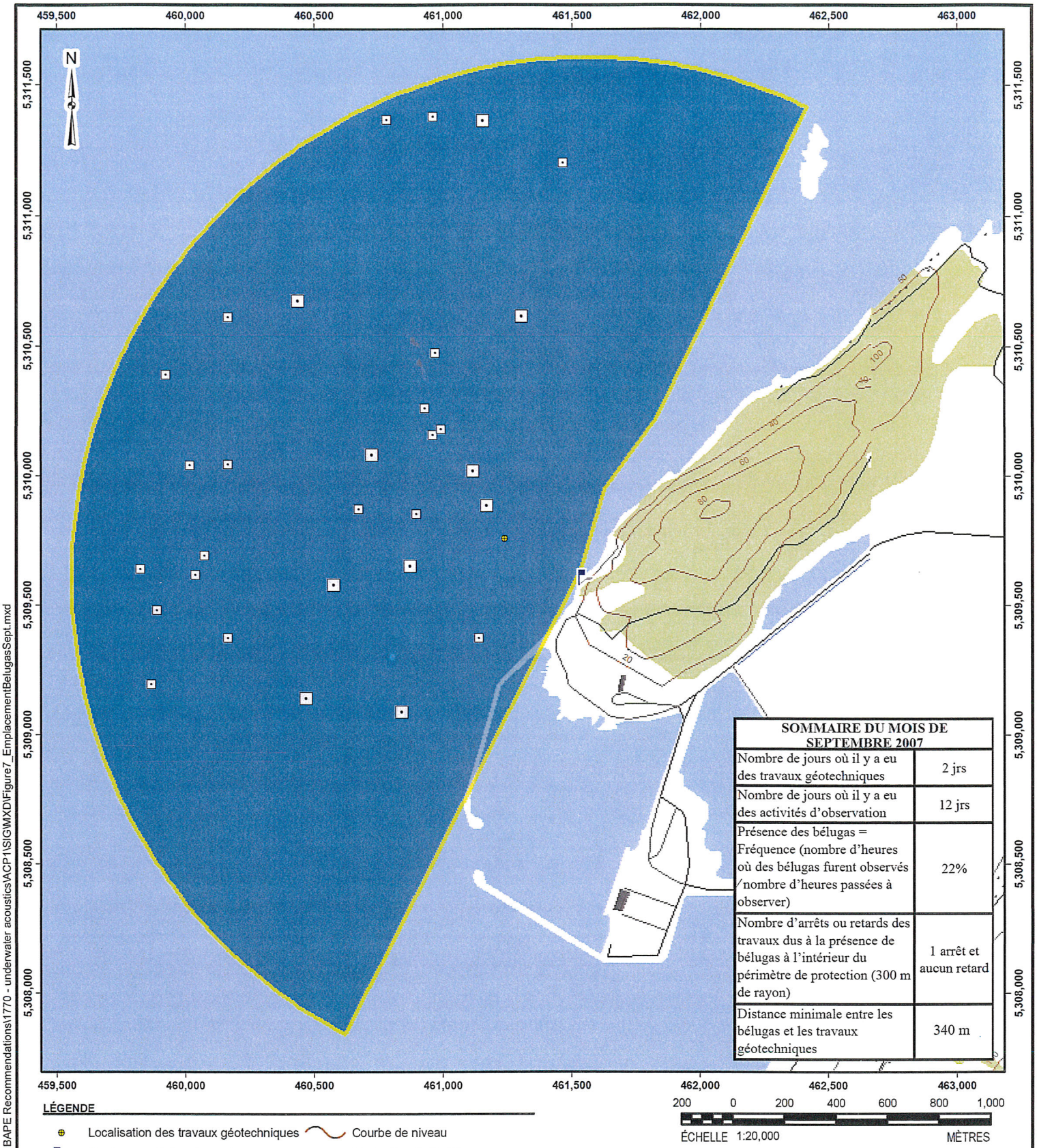
Emplacement des bélugas (*Delphinapterus leucas*) observés et des travaux géotechniques (Août 2007)

Golder Associés

PROJET: 05-1222-302-9100-9101			ÉCHELLE TELLE QUE ILLUSTRÉE	REV. 2
PROJETÉ PAR	SJ	MARS 2008		
SIG	CG	AVRIL 2008		
VERIFÉ PAR	SM	AVRIL 2008		
APPROUVÉ PAR	MC	AVRIL 2008		

Figure 6

PROJET: N:\Actif\2005\1222\05-1222-302\1700 - BAPE Recommendations\1770 - underwater acoustics\ACP1\SIG\MXD\Figure6_EmplacementBelugasAout.mxd



LÉGENDE

- Localisation des travaux géotechniques
- Emplacement des observateurs

No. de bélugas observés

- 1 à 5
- 6 à 15
- 16 à 30
- 30 +

- Courbe de niveau
- Route d'accès limité
- Route principale
- Zone d'étude (rayon de 2 km)
- Bâtiments
- Fleuve Saint-Laurent
- Végétation

RÉFÉRENCE

BDTQ 1:50 000 (22N13 et 22N14)
Référence/Datum: NAD 83 Projection: UTM Zone 19

PROJET

ÉNERGIE cacouna ENERGY

PROJET LNG

TITRE

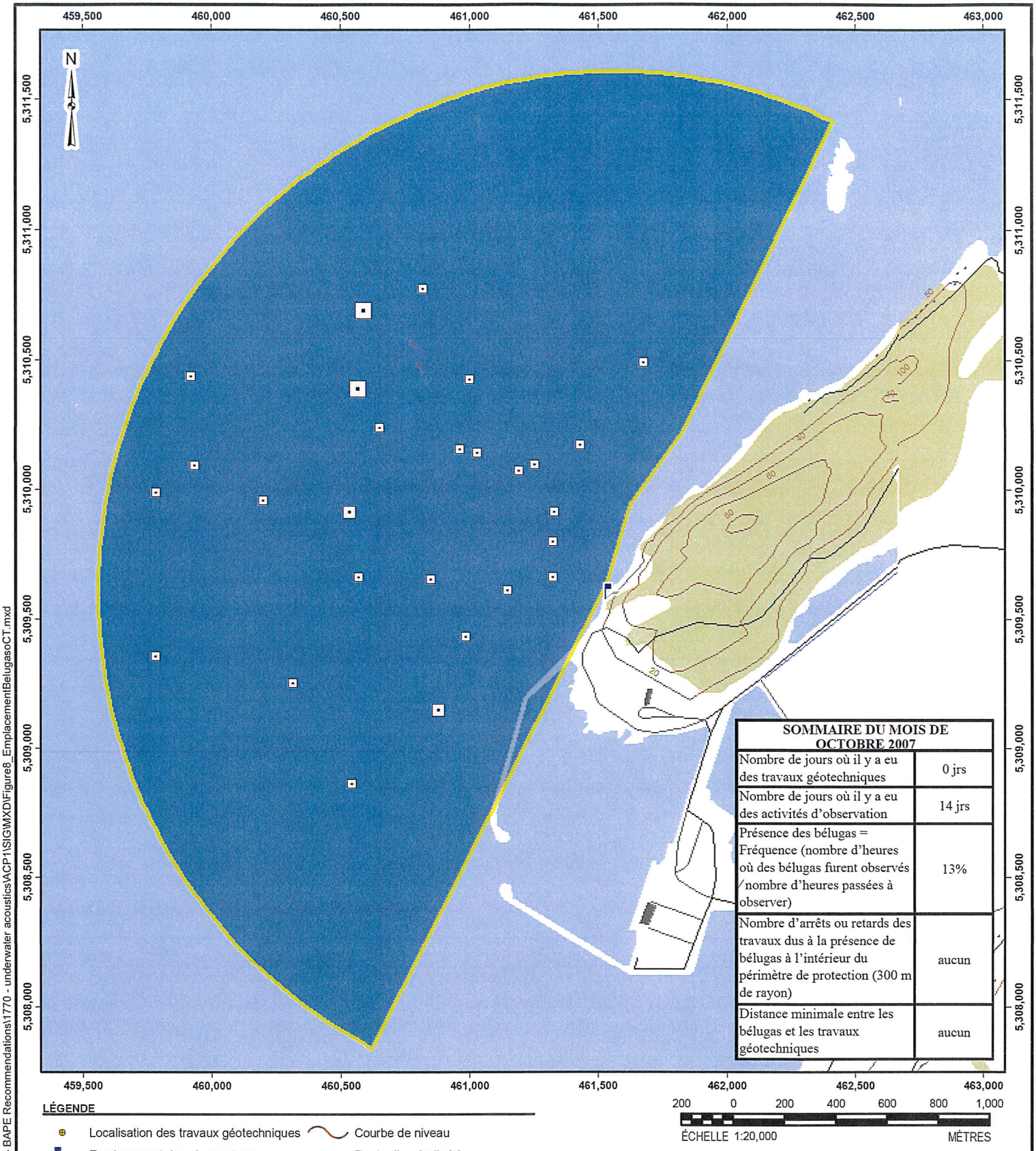
Emplacement des bélugas (*Delphinapterus leucas*) observés et des travaux géotechniques (Septembre 2007)

Golder Associés

PROJET: 05-1222-302-9100-9101			ÉCHELLE TELLE QU'ILLUSTRÉE	REV. 2
PROJETÉ PAR	SJ	MARS 2008		
SIG	CG	AVRIL 2008		
VERIFÉ PAR	SM	AVRIL 2008		
APPROUVÉ PAR	MC	AVRIL 2008		

Figure 7

PROJET: N:\Actif\2005\1222\05-1222-3021\1700 - BAPE Recommendations\1770 - underwater acoustics\ACP1\SIG\MXD\Figure7_EmplacementBelugasSept.mxd



LÉGENDE

- Localisation des travaux géotechniques
- Emplacement des observateurs

No. de bélugas observés

- 1 à 5
- 6 à 15
- 16 à 30
- 30 +

- Courbe de niveau
- Route d'accès limité
- Route principale
- Zone d'étude (rayon de 2 km)
- Bâtiments
- Fleuve Saint-Laurent
- Végétation

RÉFÉRENCE

BDTQ 1:50 000 (22N13 et 22N14)
Référence/Datum: NAD 83 Projection: UTM Zone 19

PROJET

ÉNERGIE cacouna ENERGY

PROJET LNG

TITRE

Emplacement des bélugas (*Delphinapterus leucas*) observés et des travaux géotechniques (Octobre 2007)

Golder Associés

PROJET: 05-1222-302-9100-9101			ÉCHELLE TELLE QU'ILLUSTRÉE	REV. 2
PROJETÉ PAR	SJ	MARS 2008		
SIG	CG	AVRIL 2008		
VERIFÉ PAR	SM	AVRIL 2008		
APPROUVÉ PAR	MC	AVRIL 2008		

Figure 8

PROJET: N:\Actif\2005\1222\05-1222-302\1700 - BAPE Recommendations\1770 - underwater acoustics\ACP1\SIG\MXD\Figure8_EmplacementBelugasoCT.mxd

Annexe B

Programme de surveillance des mammifères marins transmis à Pêches et Océans Canada

CIMA
Partners in excellence

CACOUNA ENERGY EAST MARINE TERMINAL

MARINE MAMMAL MONITORING PROGRAM FOR MARINE GEOTECHNICAL SURVEY IN CACOUNA

FINAL – Revision 1

Prepared by :

Carolle Gosselin, B.Sc. Biology
Project Leader, CIMA+

Isabelle Beaulac, Eng. M.Sc.
Project Engineer, CIMA+

Verified by :

Yannick Maltais, Eng. Ph.D.
Project Manager, CIMA+

May 13th 2014

1145, boul. Lebourgneuf, Suite 300
Québec, QC G2K 2K8
CANADA

Tél.: 418 623-3373
Fax: 418 623-3321
www.cima.ca

TABLE OF CONTENT

Page

APPENDIX

1. INTRODUCTION

Energy East Pipelines Ltd. (Energy East), a subsidiary of TransCanada, proposes to construct and operate a 4,600 km oil pipeline system from Hardisty, Alberta (AB) to Saint John, New Brunswick (NB). This national pipeline system will transport crude oil from Hardisty, Alberta and Moosomin, Saskatchewan (SK) to receipt points in Québec (QC) and New Brunswick (Energy East Project or the Project). The receipt points will include three existing refineries in Eastern Canada and two marine terminals that will allow for the export of crude oil to international markets.

Energy East intends to file with the National Energy Board (NEB) an application for the Project, including completion of a comprehensive Environment and Socio-Economic Assessment (ESA), in early summer of 2014. Prior to filing its application for Energy East, TransCanada has submitted a Project Description to the NEB for distribution to other federal agencies including Fisheries and Oceans Canada (DFO) as per the Memorandum of Understanding (MOU) between the NEB and DFO signed in December 2013.

In order to define the adequate location for the construction of the new marine terminal, a geotechnical survey is required. In fact, the information obtained from such survey is one key element of the site data collection that is required prior to initiating detailed engineering design pertaining to the construction of the marine terminal infrastructures. Obtaining this data will allow TransCanada to support their application to the National Energy Board (NEB). Following DFO's recommendations regarding mitigation measures received on April 9th 2014, TransCanada has prepared a Marine Mammal Monitoring Program to be put in place during the geotechnical survey to be carried out in the vicinity of the Port of Gros-Cacouna.

Moffatt and Nichol and CIMA+ have been retained by TransCanada to support the engineering assessment of the Energy East Project relating to the Québec marine facilities. The present Marine Mammal Monitoring Program, prepared by CIMA+, is describing the mitigation measures to be implemented in order to conduct the geotechnical survey in Cacouna. The data collected will support the preparation of the Energy East Applications to the ESA and NEB.

2. OBJECTIVE

As part of the site data collection effort required to proceed with the detailed design of the marine terminal facility, a geotechnical survey will be carried out in the marine environment located close to the Port of Gros-Cacouna (see Appendix 1).

As mentioned in the letter issued by DFO on April 9th 2014 *(ref. 14-HQUE-00022)* (see Appendix 2), DFO is of the view that the geotechnical survey will not result in serious harm to fish. DFO is also of the view that the geotechnical work will not contravene *sections 32, 33 or 58* of the *Species at Risk Act*. No formal approval is then required from DFO under the *Fisheries Act* or the *Species at Risk Act* in order to proceed with the work.

However, since the beluga is a species at risk and in order to contribute to the achievement of the recovery objective defined in the Recovery Strategy for the beluga (e.g.: reduce anthropogenic disturbances) (DFO, 2012), mitigation measures were proposed by TransCanada in their Request for Review submitted last February (see Appendix 3). To complement the proposed mitigation measures, DFO recommend, in their letter, to include additional mitigation measures.

The overall objective of the monitoring program is **to ensure that disturbance to marine mammal, especially the beluga, will be minimized**. The overall mitigation measures that will be put in place will be integrated in a terrestrial mammal monitoring program. However, pinnipeds will be excluded from the decision making process regarding the exclusion zone during the geotechnical survey.

It should be noted that Transcanada is working, in collaboration with Stantec, on a marine mammal assessment program, focusing on beluga, which will be implemented over the entire summer. During the execution of the proposed monitoring program, Stantec will also be in the area collecting data.

The following pages present the terrestrial monitoring program developed by CIMA+ on behalf of TransCanada.

3. GEOTECHNICAL SURVEY

The gathered data obtained from the geotechnical survey will allow the engineers in charge of the detailed design to view and interpret large scale subsurface geologic structural features and will provide TransCanada a critical insight for the selection of the new terminal site. Geotechnical data will be coupled to the geophysical data obtained this spring (April 2014) within the same study area. The results of both surveys will provide soil stratigraphy of the area and define the nature of the over-burden and depth of bedrock, thereby helping to determine the type of foundation requires for constructing the marine facility.

Geotechnical survey will comprise borehole drilling down to the bedrock. During the site investigation, boreholes will be drilled to depths sufficient to characterize the soils within the zone of influence. The borings, samples, cores or field test data collected at the site will define the stratigraphy and geotechnical properties at that specific location. The area under investigation is located in the vicinity of Port of Gros-Cacouna, near the site retained for the implementation of a previously proposed TransCanada LNG port terminal. The survey area will extend to about 900 m offshore in water depths up to 30 m. Sixteen (16) boreholes are to be drilled as part of this investigation to depths ranging between 50 m to 125 m below seabed with water columns ranging approximately between 10 m and 30 m. Each borehole will be carried out to cover about 1 m^2, for a total of approximately 20 m^2 for 16 boreholes. Coordinates of the boreholes location are presented in Appendix 1.

The geotechnical survey will include drilling of borings into the subsurface to collect core samples to assess geologic stability for potential placement of the marine terminal as well as other *in situ* tests:

- Standard Penetration Test (SPT);
- Cone Penetration Test (CPT);
- Dynamic Cone Penetration test (DCPT);
- Vane Shear Test (VST) and;
- Dilatometer Test in bedrock.

Details of the various tests to be conducted are described in Appendix A of Geotechnical Survey Request for Review (see Appendix 3).

3.1 Working Schedule

Originally, the impact assessment of the geotechnical survey was done considering only one (1) drilling barge (as mentioned in the Request for Review – Geotechnical Survey submitted to DFO last February). The use of two (2) barges will not directly result in dividing by half the time spent on-site since the duration of the geotechnical survey will vary depending on drilling depths. In fact, the drilling rates are directly proportional to the drilling borehole depth, i.e. the greater the borehole depth, the greater the time required to execute a borehole will take to travel a meter into the ground (e.g. considering the length of casing that needs to be put in place).

The geotechnical survey is expected to begin on May 21st and will end at the latest at the beginning of November 2014. The survey will take place during a period of approximately fourteen (14) weeks and is expected to take about 95 drilling days using two (2) barges, which include a safety margin to include time to move the barges (8 days), time related to other preparation work and downtime related to mechanical or operational breakdown (8 days). In consequence, seventy (70) days are thus expected to carry out the overall survey, which cover also other activities that are not inducing underwater noise. The overall survey activities are planned to be completed by August 23rd, 2014, assuming good weather conditions. Note that the 70-day duration was defined by the selected Contractor (Golder) in a context of request for proposals, which includes contingencies and safety margins for the overall duration of work.

The survey will be carried out during daytime only and over a period of twelve (12) hours per day (presence on water) seven (7) days a week, assuming good weather conditions. As there will be daily mobilization, calibration and demobilization activities, the actual drilling duration will be taking place during an average of ten (10) hours per day. However, sound-producing activities will not be conducted continuously during the day since it will be interrupted by other preparation work. An average of four-five (4-5) hours per day of sound-producing activities will be carried out.

3.2 Transmission Loss

The geotechnical work will induce two (2) types of noise to which different thresholds are set. One is the drilling activity itself (drilling without hammering) which is classified as a non-pulse sound and, the penetration test using a hammer (drilling with hammering) which is an impulsive sound. The thresholds for these two types of noise over which behavioural effect can be observed are:

- Non-pulse sound: 120 dB, and;
- Impulsive sound: 160 dB.

During the geotechnical survey carried out in 2007 for the LNG marine terminal, noise level was measured for these two (2) types of activities (Table 1).

Table 1: Noise level measured during the geotechnical survey executed in 2007

Activity	Sound Pressure Level (dB re 1µ Pa@ 1m)
Standard Penetration Test (SPT) (drill CME with hammering) (Impulse sound)	164.0
Drilling Activity (drill CME without hammering) (Non-pulse sound)	153.1

Based on the sound level measurement done by Jasco during the survey, it was estimated that the noise level generated in the water by the use of an extra drilling barge for either activities is 3 dB. Using Ian McQuinn's transmission loss factor for the area of Cacouna (DFO, 2014) the distance, to which both thresholds will be reached, are well under 300 m. Table 2 shows the results of the estimate:

Table 2: Estimation of the sound pressure level produced using two drilling barges and distance to reach the thresholds level

	One drilling barge	Two drilling barges	Transmission loss	
Activity	Sound Pressure Level (dB re 1µ Pa@ 1m)	Sound Pressure Level (dB re 1µ Pa@ 1m)	Distance to reach 120 dB* (m)	Distance to reach 160 dB** (m)
Standard Penetration Test (SPT) (drill CME with hammering) (Impulse sound)	164.0	167.0	-	2.5
Drilling Activity (drill CME without hammering) (Non-pulse sound)	153.1	156.1	124	-

* Threshold level for a non-pulse sound over which behavioural effect can be observed.

** Threshold level for an impulsive sound over which behavioural effect can be observed.

Carrying out the same activities at the same time will correspond to the maximum sound level anticipated in the water. Consequently, the exclusion zone of 300 meters will be adequate to mitigate the behavioural effect on marine mammals even with the use of two (2) barges.

The correspondence sent by CIMA+ to DFO can be consulted in Appendix 4.

4. MARINE MAMMAL OBSERVER QUALIFICATIONS AND TRAINING

The terrestrial monitoring program for marine mammals will be executed with certified Marine Mammal Observers (MMO's). A Marine Mammal Observer is an individual trained to identify and document the marine mammal species that are expected to be present in the area where the geotechnical survey will take place. MMO duties will include watching for and identifying marine mammals; recording their numbers, distances, direction and reactions to the survey operations.

The MMO's selected to do the monitoring work will have relevant marine mammal observation experience and have received formal and recognized training course from the Marine Mammal Observation Network (ROMM). This training is designed to familiarize individuals with monitoring and data collection procedures. Resumes for the selected MMO's will be presented upon request.

For the monitoring program to be implemented during the geotechnical survey, the MMO's will be provided by the ROMM and Ms. Stéphanie-Carole Pieddesaux will act as contact person for this group. She is certified to train MMO's and the Protected Species Observers (PSO) by the Bureau of Safety and Environmental Enforcement (BSEE) in the US and was formed by the Joint Nature Conservation Committee in the UK. It should also be noted that the Marine Mammal Observation Network (ROMM) is a recognized non-profit organization dedicated to the protection and conservation of cetaceans and pinnipeds that live in the waters of the St. Lawrence. It was originally created by the corporation Parc Bas-Saint-Laurent in 1998 and officially incorporated in March 2004. In addition, ROMM is the only organization providing official training of the MMO's in Québec

As part of this monitoring program, the MMO's will work under the supervision and coordination of CIMA+ who will have representatives on-site to supervise the work for its duration.

5. TERRESTRIAL MONITORING

5.1 Objective

The potential disturbance of marine mammals during survey operations will be minimized with the implementation of a 300-meter exclusion zone from the noise source (see section 5.2.1 for the definition of the exclusion zone). The main objective of the terrestrial monitoring covering the exclusion zone is to minimize the effects of the geotechnical survey on beluga and other marine mammals and to ensure that no marine mammal will be found within the exclusion zone.

As mentioned in our Request for Review, based on the sound pressure level recorded in July 2007 during the geotechnical investigation (impulsive sound: 164 dB and non-pulse sound: 153 dB), behavioural effects can be anticipated during the activity of drilling. Consequently, only tests perform with the use of a hammer will be monitored as well as the drilling activities itself. These tests are the Standard Penetration Test (SPT) and the Dynamic Cone Penetration Test (DCPT).

5.2 Monitoring Program Requirements

5.2.1 Exclusion Zone and Point of Observation

An exclusion zone of 300 meters will be established around the emitting source (i.e. around the barges carrying out the drilling) and will be continuously monitored to make sure no marine mammal is present within the exclusion zone (see Appendix 1). In consequence, the zones shown in Appendix 1 will move according to the barges position. An exclusion zone will be set to include both barges in order to obtain a 300-meter radius around the working area. Operations will be stopped immediately if any marine mammal is observed in this area.

The visual monitoring will be carried out from a site with a clear unobstructed view of the horizon located on the edge of Gros-Cacouna's cliff, which will cover the exclusion zone. The MMO's monitoring location is shown in Appendix 1. Precise location of the point of observation will be taken in order to calculate the marine mammal position.

The MMO's will use the following equipment to conduct their work: a marine 7X50 binocular (with an internal compass) and/or a telescope, a calliper to estimate the distance, a digital recorder to gather any observation information, a laptop computer and a digital camera.

5.2.2 Terrestrial Monitoring Methodology

The terrestrial monitoring program for marine mammals will be carried out throughout the geotechnical work period. It is important to underline that the survey will be performed during the hours of daylight when visual mitigation using Marine Mammal Observers (MMO's) is possible. The geotechnical work will begin at sunrise and will end at sunset but will not exceed twelve (12) hours of work per day. No geotechnical survey will be allowed during nighttime or when the observation conditions (sea state, rain, visibility) do not allow efficient marine mammal detection of the entire exclusion zone.

The terrestrial monitoring program will be done by Marine Mammal Observers (MMO's) that are assigned strictly to this work. Observation periods will not exceed two (2) consecutive hours in order to reduce potential eye strain and observers fatigue; one MMO will be on standby at all-time for replacement. A total of two (2) MMO's will be required to carry out the terrestrial monitoring.

Sighting information will be recorded with a digital recorder to keep the MMO's focused on the exclusion zone. For each sighting, the information found in Marine Mammal Recording Form (Appendix 5) will be recorded.

MMO's will record the numbers and species of marine mammals observed in the area and any observable reaction of marine mammals to the survey activities. Distance of marine mammal observation will be done using a range finding stick (calliper) to measure the vertical angle of the line of sight to the animal relative to the horizon. Direction of travel will be recorded based on the compass points and will be analyzed in relation to the vessel position and its operation.

Potential behaviour information to be recorded by the trained MMO's is the following:

- Feeding;
- Alteration of course;
- Breaching, jumping or somersaulting;
- Tail/flipper-slapping;
- Spy-hopping;
- Porpoising;
- Fast swimming;
- Slow swimming;
- Surfacing frequently;
- Surfacing infrequently;
- Diving;
- Logging/ "resting";
- Group geometry;
- Presence of juvenile.

A particular attention will be given on behaviour patterns of individual or herd within the monitoring area. Each herd or individual entering the area will be recorded with the position (angle from the true North and distance from the observer), the time of beginning of the sighting and the time of the end of the sighting. The time of the end of the sighting will be when the herd or the animal is out of the survey area, or when the herd is seen the last time and not visible anymore during a period of at least half an hour within the 300-meter monitoring area. The scan will mainly take into account the breathing and diving patterns. The time of the beginning and the end of surfacing, and the time of the beginning and the end of the diving will be recorded. In addition, the direction of the herd will be recorded according to the original position of the herd from the true North and the direction angle from the true North. This direction angle will be compared to the one of the drilling barge. If visible, the synchronicity of the breathing pattern of the group or a change in the synchronicity of the breathing pattern of the group will be noticed. Finally, the structure (geometry, number of juveniles, other) and size of the group will be recorded.

For each herd in focus, the size of the herd (number of individuals), the geometry of the herd (compact, distant, large, narrow), and the composition (juveniles, adults, males or females if visible) of the herd will be recorded. A herd is defined as at least two (2) individuals or more, separated from each other by a distance of less than a body length.

Each group or individual will be assigned a number. When only one (1) group or one (1) individual is present within the 300-meter zone for a fifteen-minute period of observation, monitoring will be focused on group #1 or individual #1. When several individuals or groups are present within the 300-meter zone, an individual or a group will be selected randomly to focus on. New groups arriving within the 300-meter zone will be identified based on the group characteristics.

Finally, the Southall et al., (2007) scale will be used to evaluate severity of changes by the visible behavioural changes, based on a short-term response (change of breathing pattern, behavioural demonstration like fluke slapping, bubble clouds, etc.) (see Table 3). This scale will permit to produce a tendency regarding the behavioural response of the belugas to the noise emission from the geotechnical operations, if the number of samples is important enough.

Table 3: Severity scale for ranking observed behavioural responses

Response score[1]	Corresponding behaviors (Free-ranging subjects)[2]	Corresponding behaviors (Laboratory subjects)[2]
0	- No observable response	- No observable response
1	- Brief orientation response (investigation/visual orientation)	- No observable response
2	- Moderate or multiple orientation behaviors - Brief or minor cessation/modification of vocal behavior - Brief or minor change in respiration rates	- No observable negative response; may approach sounds as a novel object
3	- Prolonged orientation behavior - Individual alert behavior - Minor changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source - Moderate change in respiration rate - Minor cessation or modification of vocal behavior (duration < duration of source operation), including the Lombard Effect	- Minor changes in response to trained behaviors (e.g., delay in stationing, extended inter-trial intervals)
4	- Moderate changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source - Brief, minor shift in group distribution - Moderate cessation or modification of vocal behavior (duration ≈ duration of source operation)	- Moderate changes in response to trained behaviors (e.g., reluctance to return to station, long inter-trial intervals)
5	- Extensive or prolonged changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source - Moderate shift in group distribution - Change in inter-animal distance and/or group size (aggregation or separation) - Prolonged cessation or modification of vocal behavior (duration > duration of source operation)	- Severe and sustained changes in trained behaviors (e.g., breaking away from station during experimental sessions)
6	- Minor or moderate individual and/or group avoidance of sound source - Brief or minor separation of females and dependent offspring - Aggressive behavior related to noise exposure (e.g., tail/flipper slapping, fluke display, jaw clapping/gnashing teeth, abrupt directed movement, bubble clouds) - Extended cessation or modification of vocal behavior - Visible startle response - Brief cessation of reproductive behavior	- Refusal to initiate trained tasks
7	- Extensive or prolonged aggressive behavior - Moderate separation of females and dependent offspring - Clear anti-predator response - Severe and/or sustained avoidance of sound source - Moderate cessation of reproductive behavior	- Avoidance of experimental situation or retreat to refuge area (≤ duration of experiment) - Threatening or attacking the sound source
8	- Obvious aversion and/or progressive sensitization - Prolonged or significant separation of females and dependent offspring with disruption of acoustic reunion mechanisms - Long-term avoidance of area (> source operation) - Prolonged cessation of reproductive behavior	- Avoidance of or sensitization to experimental situation or retreat to refuge area (> duration of experiment)
9	- Outright panic, flight, stampede, attack of conspecifics, or stranding events - Avoidance behavior related to predator detection	- Total avoidance of sound exposure area and refusal to perform trained behaviors for greater than a day

[1]Ordinal scores of behavioral response severity are not necessarily equivalent for free-ranging vs laboratory conditions.
[2]Any single response results in the corresponding score (i.e., all group members and behavioral responses need not be observed). If multiple responses are observed, the one with the highest score is used for analysis.

Reference: Southall et al., 2007

5.2.2.1 Pre-start-up monitoring

The pre-start-up monitoring of the exclusion zone will be conducted over a period of thirty (30) minutes before carrying out the sound-producing geotechnical activity. Sound-producing activity will not commence until at least thirty (30) minutes have elapsed with no marine mammal detections by the MMO's. Operations will not commence if a marine mammal is detected within a 300-meter radial distance of the intended sound source.

The entire exclusion zone must be visible during the 30-minute period leading to the commencement of the geotechnical work. If a marine mammal is sighted within the exclusion zone during the 30-minute watch prior the commencement of work, the sound-producing geotechnical activity will be delayed until the marine mammal is sighted outside of the exclusion zone or the marine mammal is not sighted for at least thirty (30) minutes.

5.2.2.2 Marine mammal detected within the exclusion zone

The MMO's will scan the area systematically, with the unaided eye, binoculars and/or a telescope, to confirm the absence of marine mammal in the vicinity of the exclusion zone. Photographs may also be taken to document the presence of marine mammals.

When a marine mammal is detected within the exclusion zone during the geotechnical activities, the MMO's will request to stop the activity in process in order to protect the marine mammal. In consequence, the geotechnical crew will be notified immediately by CIMA+ field representatives (one (1) will be located the edge of Gros-Cacouna's cliff and one (1) will be positioned on each barge) and survey will then be stopped. The MMO's will then maintain a watch to determine when the mammal(s) appear to be outside of the exclusion zone. The geotechnical work can be pursued only if no marine mammal is present in the exclusion zone for a period of 30 minutes.

If a marine mammal is observed within the exclusion zone, disturbing or harming the animals by urging them to leave the exclusion zone will not be allowed.

5.2.2.3 Communication system

A clear communication links and chain of command between CIMA+ field representatives, MMO's and the operators of the geotechnical equipment (Contractor) will be established in order to ensure quick, clear and well-implemented mitigation actions when marine mammal are observed. CIMA+ field representatives will have direct contact with MMO's and personnel operating geotechnical equipment, so that delays and shutdowns are executed immediately. The communication between CIMA+ field representatives located on each barge and the MMO's will be implemented with the use of marine radios.

5.2.3 Environmental factors

The effectiveness of MMO's to carry out the monitoring (observations) is influenced by a number of environmental factors, including amount of daylight, sea state, swell height and visibility (fog, rain, glare, snow).

The observation of marine mammals requires good weather conditions. When weather conditions do not allow the MMO's to ensure the absence of marine mammal within the exclusion zone, geotechnical survey will not be carried out.

6. REPORTING

6.1 Field data recording

The following information will be collected throughout the terrestrial monitoring program:

Survey procedure

- Date and location of survey;
- Weather conditions;
- Number and types of vessels and equipment involved in the survey;
- Borehole number;
- Date and time of the start of each borehole and date and time of the completion of each borehole (UTC);
- Number and duration of stops;
- Type of geotechnical work executed (e.g. drilling, SPT, DCPT).

Observation

- Species or species group that were observed;
- Range (distance) of animal from the MMO observation location (meter);
- Type and number of observed species or species group;
- Number of adults, juveniles and calves observed;
- A record of the photographs taken;
- A record of the behaviour of the marine mammals at the time of the observation;
- Direction of travel (relative to the working area);
- Time animals entered the exclusion zone and time animals left the exclusion zone (UTC);

- Closest distance of animals from each barge (meter);
- Occurrence of environmental factors (sea state, rain, visibility such as sun glare/fog) that stopped the terrestrial monitoring;
- Details of any problems encountered during the geotechnical survey.

The marine mammal recording form is presented in Appendix 5 and will be used for the terrestrial monitoring program. These datasheets will be completed daily by MMO's for each observation periods, even in the absence of marine mammals in the exclusion zone.

The datasheet being proposed is similar to the one used by the Joint Nature Conservation Committee (JNCC) to build a dataset utilized in the *Atlas of Cetacean Distribution in North-West European Waters*. The datasheet is designed to be user-friendly, efficient and to assure the uniformity in the data collection. All MMO's have been trained in the use of this proposed datasheet.

6.2 Final Report

6.2.1 Terrestrial Monitoring Report

A final report will be prepared and submitted to DFO two (2) months after the end of the field work to report data collected during the monitoring program. A final report (an electronic version (word) and a printed copy) will be submitted to DFO and will include the database (excel spreadsheet).

This report will be prepared based on data collected by the MMO's and other information available. This report will include minimally the following aspects:

- Summaries of monitoring effort throughout the monitoring program;
- Assessment of the effects of various factors influencing detectability of marine mammals including number of observers, sea state, rain and visibility (glare/fog);
- Species composition, occurrence, and distribution of marine mammal sightings including date, water depth, numbers and group sizes;
- Number and duration of stops;
- Details of any problems encountered during the geotechnical survey.

7. REFERENCES

CIMA+, GOSSELIN, C., *Programme de surveillance des mammifères marins – Quai de Rivière-du-Loup*, (2010), Société des traversiers du Québec, projet no. R00877A, 10 pages.

Department of Fisheries and Ocean Canada (DFO), *Recovery Strategy for the beluga whale (Delphinapterus leucas) St. Lawrence Estuary population in Canada*, (2012), Species at Risk Act Recovery Strategy Series, Fisheries and Oceans Canada, Ottawa. 88 pages.

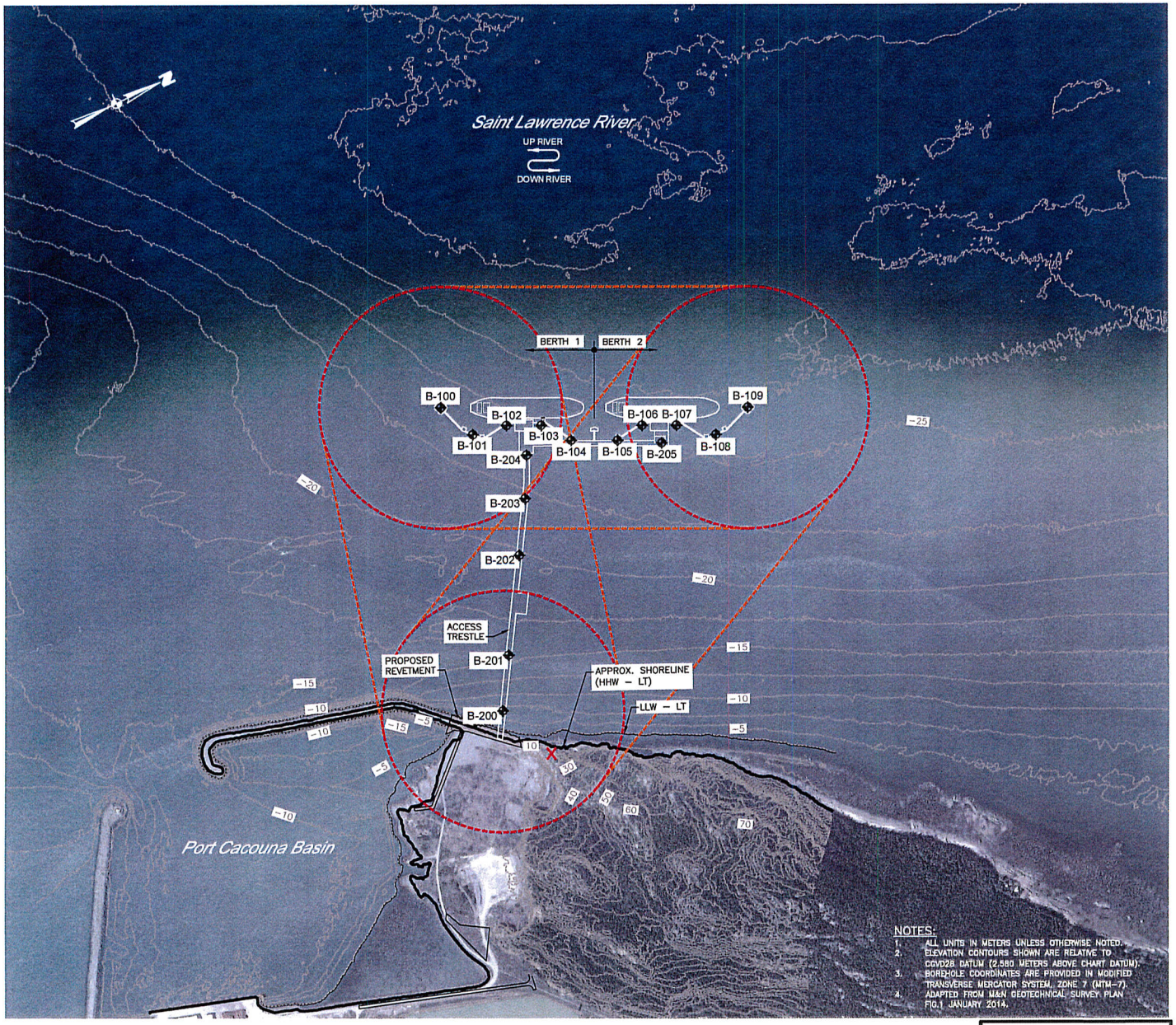
Department of Fisheries and Ocean Canada (DFO), *Exploration drilling, installation of a Marine Terminal – Implementation of Mitigation Measures to Avoid and Mitigate serious harm to Fish*, April 2014, Ecosystem Management, Quebec Region, ref. 14-HQUE-00022, 3 pages.

Department of Fisheries and Ocean Canada (DFO), *Impacts de levés géophysiques au port de Cacouna sur les bélugas du St-Laurent*, March 2014, Canadian Science Advisory Secretariat – Quebec region, Answer from Science, 2014/nnn 20 pages.

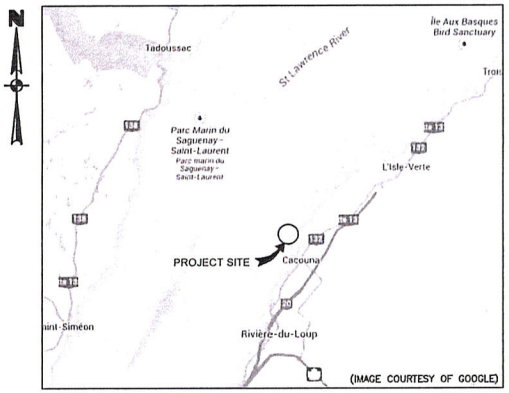
Golder Associates Ltd, *Report on the Complementary Actions of 2007 Conducted as part of the Marine Mammal protection plan, Cacouna, Quebec*, 2008b, Report prepared for Energy Cacouna, 233 pages.

APPENDIX 1

Terrestrial Monitoring Zone



OFFSHORE BOREHOLE LOCATION PLAN



LOCATION MAP

LEGEND:

- TOPOGRAPHIC/BATHYMETRIC CONTOUR
- SHORELINE HHW–LT LINE
- EXCLUSION ZONE OF 300m
- COMBINED EXCLUSION ZONE EXAMPLE
- POINT OF OBSERVATION
- OFFSHORE BOREHOLE LOCATIONS

BOREHOLE SCHEDULE*

BOREHOLE NO.	BORING DEPTH (m)		COORDINATES (SEE NOTE 3)	
	SOIL	ROCK	NORTHING	EASTING
B-100	85	–	5311548.385	377445.072
B-101	90	–	5311590.287	377539.818
B-102	75	–	5311675.909	377555.668
B-103	75	–	5311752.308	377592.930
B-104	125	–	5311802.738	377659.249
B-105	125	–	5311906.099	377709.662
B-106	75	–	5311977.005	377702.523
B-107	75	–	5312053.402	377739.784
B-108	90	–	5312131.011	377803.545
B-109	85	–	5312231.644	377777.873
B-200	25	25	5311354.126	378189.997
B-201	40	30	5311427.703	378072.248
B-202	100	–	5311559.360	377862.034
B-203	100	–	5311636.476	377738.141
B-204	100	–	5311687.352	377643.026
B-205	100	–	5312001.447	377763.229

1:10 000 100 200 500

NOTES:
1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. ELEVATION CONTOURS SHOWN ARE RELATIVE TO CGVD28 DATUM (2.880 METERS ABOVE CHART DATUM).
3. BOREHOLE COORDINATES ARE PROVIDED IN MODIFIED TRANSVERSE MERCATOR SYSTEM, ZONE 7 (MTM–7).
4. ADAPTED FROM M&N GEOTECHNICAL SURVEY PLAN FIG.1 JANUARY 2014.

FOR INFORMATION ONLY

CIMA Partners in excellence
MOFFATT & NICHOL
104 WEST 40TH ST., 14TH FLOOR
NEW YORK, NY 10018
212-768-7454

Designed by: JB	Date: MAY 2014	Rev. –
Dwn by: JB	Chd by: CG	
Reviewed by: YM	Drawing code:	
Submitted by: CG/JB/YM CIMA+	Dwg Scale: AS NOTED Plot scale: 1:1	

CACOUNA MARINE TERMINAL

TERRESTRIAL MONITORIN□ □ONE

Sheet Reference Number: 1

Sheet 1 of 1

APPENDIX 2

Letter issued by DFO for the Geotechnical Survey in Cacouna – April 2014

Katherine Langlois-Thibault

À: Katherine Langlois-Thibault
Objet: TR: Geotechnical survey - additionnal information

Importance: Haute

De : Carolle Gosselin
Envoyé : 6 mai 2014 11:38
À : Kemp, Alain
Cc : craig_schell@transcanada.com; robert_morin@transcanada.com; Larry Cunningham (Larry.Cunningham@ch2m.com); MFaeth@moffattnichol.com; rebekah_janzen@transcanada.com; gerry_vogt@transcanada.com
Objet : Geotechnical survey - additionnal information
Importance : Haute

Mr. Kemp,

Following last Friday telephone conversation, please find precisions on the formula used to estimate the noise level that will be generated in the water with the use of two drilling barges, the attenuation of the noise and the working schedule.

Formula

In fact, there's a mistake in the formula send by the INRS due to the limitations of the e-mail typo. The right formula is:

$$N_{sum} = 10 * log_{10}(10^{\frac{N1}{10}} + 10^{\frac{N2}{10}})$$

Attenuation

Geotechnical work will induce 2 types of noise to which different thresholds are set. One is the drilling activity itself (drilling without hammering) which is classified as a non-impulsive sound and, the penetration test using a hammer (drilling with hammering) which is an impulsive sound. The thresholds for these 2 types of noise over which behavioural effect can be observed are:

- Non impulsive sound: 120 dB and,
- impulsive sound, 160 dB.

During the geotechnical survey carried out in 2007 for the LNG marine terminal, noise level was measured for these 2 types of activities (see table below).

in a total noise of 167 dB@2m (the equation is: **10*log (10 N1/10 + 10 N2/10)** where N1 and N2 are the noise for each source).

2. Based on a "10*log" sound attenuation relationships, the noise will decrease by 3 dB each time the distance to the source is doubled. So, you'll get:
   167 dB@ 2m
   164 dB@ 4m
   161 dB@ 8m
   158 dB@ 16m
   155 dB@ 32m

Consequently, the noise level does change much by using one or two drilling rigs at the same time. However, the use of two drilling rigs will allow to reduce the duration of the geotechnical campaign. If possible, the rigs will be working close from each other. So, the 300 m exclusion area will be covering both rig and will be monitored by one team of MMO. If the position of the rig are two far from each other, every drilling rig will have its own 300 m exclusion area around it and we will be monitored by two teams of MMO.

As pointed out previously, our work plan/monitoring program based on the use of two barges will be sent to you shortly.

Best regards,

Carolle Gosselin
B.Sc. Biologie, Chargée de projet / B.Sc. in Biology, Project Leader
Environnement

CIMA+
Partenaire de génie
2030, Boul. de la Rive-Sud, bureau 201
St-Romuald QC G6W 2S6

Tél. bur. : 418 834-2273 poste 1406
Téléc. : 418 834-3356

APPENDIX 5

Marine Mammal Recording Form

MARINE MAMMAL RECORDING FORM - COVER PAGE

Regulatory reference number (e.g. DECC no., BOEM permit no., OCS lease no., etc.)	**Country**	**Location**	**Ship/ platform name**
Client	**Contractor**	**Survey type** ☐ SPT ☐ DCPT ☐ Drilling ☐ Other	
Start date	**End date**		

Visual monitoring equipment used (e.g. binoculars, big eyes, etc.)	**Magnification of optical equipment** (e.g. binoculars)	**Height of eye above water surface** (metres)	**How was distance of animals estimated?** ☐ by eye ☐ with laser rangefinder ☐ with rangefinder stick/ callipers ☐ with reticle binoculars ☐ by relating to object at known distance ☐ other
Number of dedicated MMOs	**Training of MMOs** ☐ JNCC approved MMO training course for UK waters ☐ PSO training course for the Gulf of Mexico ☐ MMO training course for Irish waters ☐ MMO training course for New Zealand waters ☐ other ☐ none		

MARINE MAMMAL RECORDING FORM - EFFORT

Regulatory reference number ..... **Ship/ platform name** .....
(e.g. DECC no., BOEM permit no., OCS lease no., etc.)

Record the following for all watches, even if no marine mammals are seen.
START A NEW LINE IF SOURCE ACTIVITY OR WEATHER CHANGES. ENTER DATA AT LEAST EVERY HOUR.

Date	**Visual watch or PAM** (v/ p)	**Observer's/ operator's name(s)**	**Time of start of section of watch** (UTC, 24hr clock)	**Time of end of section of watch** (UTC, 24hr clock)	**Source activity** (f/ s/ r/ n/ v)	**Start position** (latitude and longitude)	**Depth at start** (m)	**End position** (latitude and longitude)	**Depth at end** (m)	**Speed of vessel** (knots)	**Wind dir'n**	**Wind force** (B'fort scale)	**Sea state** (g/ s/ c/ r)	**Swell** (o/ m/ l)	**Vis.** (visual watch only) (p/ m/ g)	**Sun glare** (visual watch only) (n/ wf/ sf/ vf/ wb/ sb/ vb)	**Precip.** (n/ l/ m/ h/ s)

Visual watch or PAM: v = visual watch; p = PAM
Source activity: f = full power; s = soft start; r = reduced power (not soft start); n = not active; v = variable (e.g. tests)
Sea state: g = glassy (like mirror); s = slight (no/ few white caps); c = choppy (many white caps); r = rough (big waves, foam, spray)
Swell: o = low (< 2 m); m = medium (2-4 m); l = large (> 4 m)
Visibility: p = poor (< 1 km); m = moderate (1-5 km); g = good (> 5 km)
Sun glare: n = none; wf = weak forward; sf = strong forward; vf = variable forward; wb = weak behind; sb = strong behind; vb = variable behind
Precipitation: n = none; l = light rain; m = moderate rain; h = heavy rain; s = snow

MARINE MAMMAL RECORDING FORM - SIGHTINGS

Regulatory reference number (e.g. DECC no., BOEM permit no., OCS lease no., etc.)	**Ship/ platform name**	**Sighting number** (start at 1 for first sighting of survey)

Date	**Time at start of encounter** (UTC, 24hr clock)	**Time at end of encounter** (UTC, 24hr clock)

Were animals detected visually and/ or acoustically?	**How were the animals first detected?**
☐ visual ☐ acoustic ☐ both	☐ visually detected by observer keeping a continuous watch ☐ visually spotted incidentally by observer or someone else ☐ acoustically detected by PAM ☐ both visually and acoustically before operators/ observers informed each other

Observer's/ operator's name	**Position** (latitude and longitude)	**Water depth** (metres)

Species/ species group	**Description** (include features such as overall size; shape of head; colour and pattern; size, shape and position of dorsal fin; height, direction and shape of blow; characteristics of whistles/ clicks)
Bearing to animal (when first seen or heard) (bearing from true north)	**Range to animal** (when first seen or heard) (metres)

Total number	**Number of adults** (visual sightings only)	**Number of juveniles** (visual sightings only)	**Number of calves** (visual sightings only)	**Photograph taken** ☐ yes ☐ no

Behaviour (visual sightings only)

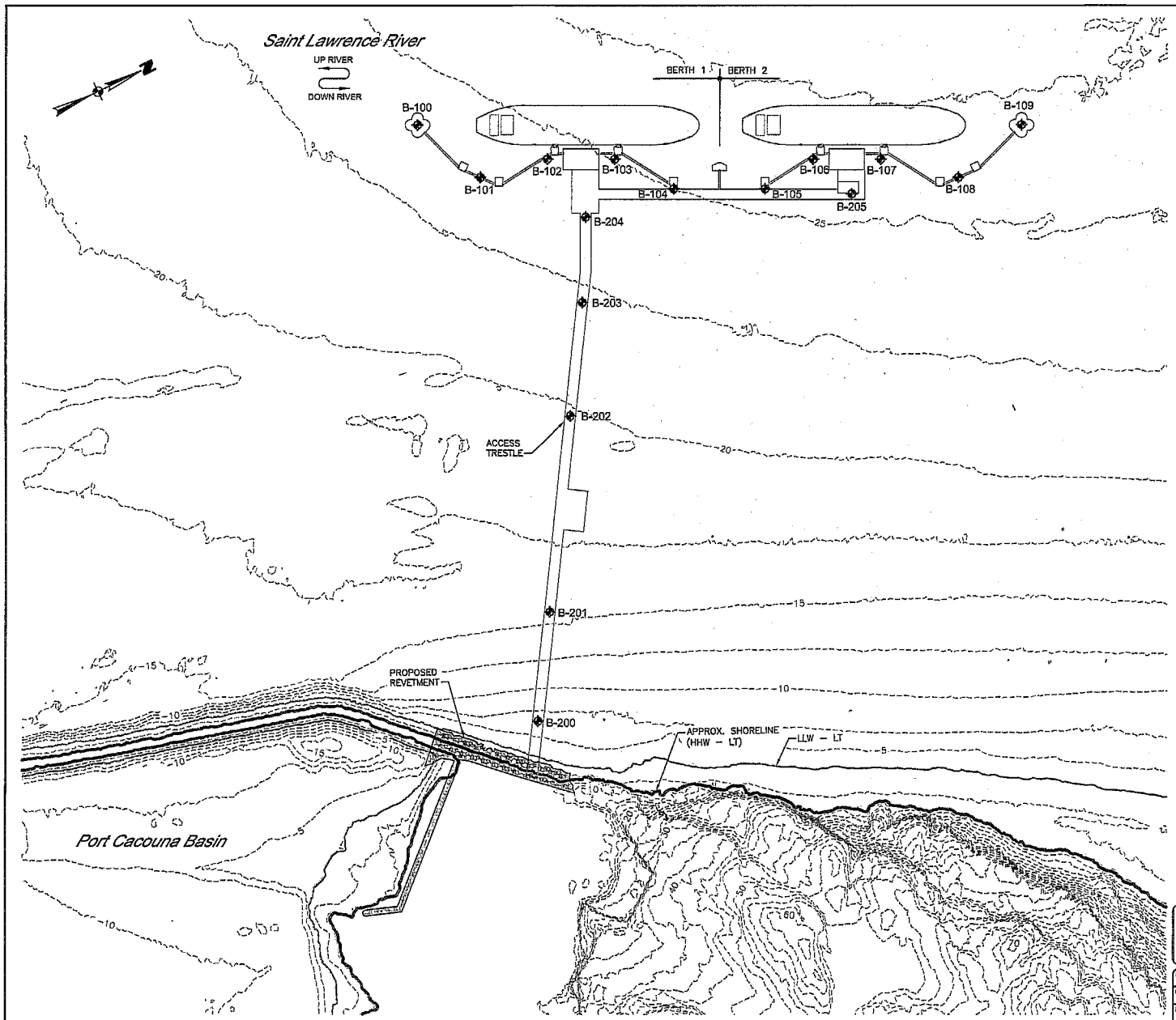
Direction of travel (relative to ship)		**Direction of travel** (compass points)	
☐ towards ship	☐ variable	☐ N	☐ W
☐ away from ship	☐ milling	☐ NE	☐ NW
☐ parallel to ship in same direction as ship	☐ stationary	☐ E	☐ variable
☐ parallel to opposite direction to ship	☐ other	☐ SE	☐ stationary
☐ crossing perpendicular ahead of ship	☐ unknown	☐ S	☐ unknown
		☐ SW	

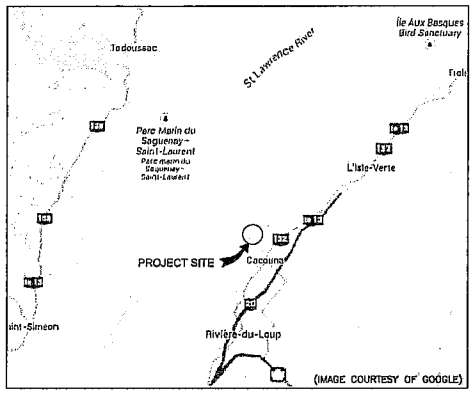
Geotechnical Test when animals first detected	**Airgun (or other source) activity when animals last detected**	**Time animals entered mitigation/ exclusion zone** (UTC, 24hr clock)	**Time animals left mitigation/ exclusion zone** (UTC, 24hr clock)
☐ SPT ☐ DCPT ☐ Drilling ☐ Other _____	☐ SPT ☐ DCPT ☐ Drilling ☐ Other _____	**Closest distance of animals from the noise source** (metres)	**Time of closest approach** (UTC, 24hr clock)

Annexe C

Carte de localisation des forages en

relation avec les limites de l'ACOA





LOCATION MAP

NOTES:

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. ELEVATION CONTOURS SHOWN ARE RELATIVE TO CGVD28 DATUM (2.580 METERS ABOVE CHART DATUM).
3. BOREHOLE COORDINATES ARE PROVIDED IN MODIFIED TRANSVERSE MERCATOR SYSTEM, ZONE 7 (MTM–7).

LEGEND:

- OFFSHORE BOREHOLE LOCATIONS
- RECOGNIZED WILDLIFE HABITAT

BOREHOLE SCHEDULE*

BOREHOLE NO.	BORING DEPTH (m)		COORDINATES (SEE NOTE 3)	
	SOIL	ROCK	NORTHING	EASTING
B–100	85	–	5311548.385	377445.072
B–101	90	–	5311590.287	377539.818
B–102	75	–	5311675.909	377555.668
B–103	75	–	5311752.306	377592.930
B–104	125	–	5311802.738	377658.249
B–105	125	–	5311906.099	377708.662
B–106	75	–	5311977.005	377702.523
B–107	75	–	5312053.402	377738.784
B–108	90	–	5312131.011	377803.545
B–109	85	–	5312231.644	377777.873
B–200	25	25	5311354.126	378169.997
B–201	40	30	5311427.703	378072.248
B–202	100	–	5311559.360	377862.034
B–203	100	–	5311636.476	377738.141
B–204	100	–	5311687.352	377643.026
B–205	100	–	5312001.447	377763.229

1:5000 0 50 100 250m

OFFSHORE BOREHOLE LOCATION PLAN

FOR INFORMATION ONLY

CIMA Partners in excellence

MOFFATT & NICHOL
104 WEST 40TH ST., 14TH FLOOR
NEW YORK, NY 10018
212–768–7454

Designed by: JS	Date: APRIL 28, 2014
Own. by: SO	Chd. by: CO
Reviewed by: YM	
Submitted by: YM CIMA+	Dwg. Scale: AS NOTED Plot scale: 1:1

ENERGY EAST
CACOUNA MARINE TERMINAL

RECOGNIZED WILDLIFE HABITAT IN REFERENCE TO THE PROPOSED BORING LOCATION

Sheet Reference Number: 1