

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:
Réception des soumissions - TPSGC / Bid
Receiving - PWGSC
1550, Avenue d'Estimauville
1550, D'Estimauville Avenue
Québec
Québec
G1J 0C7

**REQUEST FOR PROPOSAL
DEMANDE DE PROPOSITION**

**Proposal To: Public Works and Government
Services Canada**

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

**Proposition aux: Travaux Publics et Services
Gouvernementaux Canada**

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).

Comments - Commentaires

Title - Sujet Baie de Gaspé - eau et mollusques	
Solicitation No. - N° de l'invitation EE517-150463/A	Date 2014-08-26
Client Reference No. - N° de référence du client EE517-15-0463	
GETS Reference No. - N° de référence de SEAG PW-\$QCL-028-16054	
File No. - N° de dossier QCL-4-37096 (028)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2014-09-22	Time Zone Fuseau horaire Heure Avancée de l'Est HAE
F.O.B. - F.A.B. Plant-Usine: <input type="checkbox"/> Destination: <input checked="" type="checkbox"/> Other-Autre: <input type="checkbox"/>	
Address Enquiries to: - Adresser toutes questions à: Roy, Josée	Buyer Id - Id de l'acheteur qcl028
Telephone No. - N° de téléphone (418) 649-2932 ()	FAX No. - N° de FAX (418) 648-2209
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: TRAVAUX PUBLICS ET SERVICES GOUVERNEMENTAUX CANADA BAIE DE GASPÉ GASPÉ Québec Canada	

Instructions: See Herein

Instructions: Voir aux présentes

Vendor/Firm Name and Address

**Raison sociale et adresse du
fournisseur/de l'entrepreneur**

Delivery Required - Livraison exigée Voir Doc.	Delivery Offered - Livraison proposée
Vendor/Firm Name and Address Raison sociale et adresse du fournisseur/de l'entrepreneur	
Telephone No. - N° de téléphone Facsimile No. - N° de télécopieur	
Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)	
Signature	Date

Issuing Office - Bureau de distribution

TPSGC/PWGSC
601-1550, Avenue d'Estimauville
Québec
Québec
G1J 0C7

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PART 1 - GENERAL INFORMATION

1. Statement of Work

The Work to be performed is detailed under Annex A – Statement of Work.

3. Debriefings

Bidders may request a debriefing on the results of the bid solicitation process. Bidders should make the request to the Contracting Authority within 15 working days of receipt of the results of the bid solicitation process. The debriefing may be in writing, by telephone or in person.

3. Trade Agreements

The requirement is subject to the provisions of the World Trade Organization Agreement on Government Procurement (WTO-AGP), the North American Free Trade Agreement (NAFTA), and the Agreement on Internal Trade (AIT).

PART 2 - BIDDER INSTRUCTIONS

1. Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the bid solicitation by number, date and title are set out in the [Standard Acquisition Clauses and Conditions Manual](https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) (<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

Bidders who submit a bid agree to be bound by the instructions, clauses and conditions of the bid solicitation and accept the clauses and conditions of the resulting contract.

The **2003** (2014/06/26) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

2. Submission of Bids

Bids must be submitted only to Public Works and Government Services Canada (PWGSC) Bid Receiving Unit by the date and time indicated on page 1 of the bid solicitation at the following place:

Public Works and Government Services Canada

Bid Receiving Unit

1550, d'Estimauville Avenue

Quebec (QC), G1J 0C7

Bids transmitted by facsimile are accepted and must be sent to the following number:
418 648-2209.

NOTE : Bids submitted by email will not be accepted.

3. Former Public Servant - Competitive - Bid

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPS, bidders must provide the information required below before contract award. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the bid non-responsive.

Definitions

For the purposes of this clause, *"former public servant"* is any former member of a department as defined in the Financial Administration Act, R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

- a) an individual;
- b) an individual who has incorporated;
- c) a partnership made of former public servants; or
- d) a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of

various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means a pension or annual allowance paid under the Public Service Superannuation Act (PSSA), R.S., 1985, c.P-36, and any increases paid pursuant to the Supplementary Retirement Benefits Act, R.S., 1985, c.S-24 as it affects the PSSA. It does not include pensions payable pursuant to the Canadian Forces Superannuation Act, R.S., 1985, c.C-17, the Defence Services Pension Continuation Act, 1970, c.D-3, the Royal Canadian Mounted Police Pension Continuation Act, 1970, c.R-10, and the Royal Canadian Mounted Police Superannuation Act, R.S., 1985, c.R-11, the Members of Parliament Retiring Allowances Act, R.S., 1985, c.M-5, and that portion of pension payable to the Canada Pension Plan Act, R.S., 1985, c.C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension?

Yes ()

No ()

If so, the Bidder must provide the following information, for all FPS in receipt of a pension, as applicable:

- a) name of former public servant;
- b) date of termination of employment or retirement from the Public Service.

By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2012-2 and the Guidelines on the Proactive Disclosure of Contracts.

Work Force Adjustment Directive

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive?

Yes ()

No ()

If so, the Bidder must provide the following information:

- a) name of former public servant;
- b) conditions of the lump sum payment incentive;
- c) date of termination of employment;
- d) amount of lump sum payment;
- e) rate of pay on which lump sum payment is based;
- f) period of lump sum payment including start date, end date and number of weeks;
- g) number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is \$5,000, including Applicable Taxes

4. Enquiries - Bid Solicitation

All enquiries must be submitted in writing to the Contracting Authority preferably by e-mail at the following address: josee.roy@tpsgc-pwgsc.gc.ca, no later than **eight (8) calendar days** before the bid closing date. Enquiries received after that time may not be answered.

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Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked "proprietary" at each relevant item. Items identified as proprietary will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the questions or may request that the Bidder do so, so that the proprietary nature of the question(s) is eliminated, and the enquiry can be answered to all bidders. Enquiries not submitted in a form that can be distributed to all bidders may not be answered by Canada.

5. Applicable Laws

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in **Québec**.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the bidders.

PART 3 - BID PREPARATION INSTRUCTIONS

1. Bid Preparation Instructions

Canada requests that bidders provide their bid in separately bound sections as follows:

Section I: Technical Bid (4 hard copies) "and 1 soft copies on CD or DVD

Section II: Financial Bid (2 hard copies)

Section III: Certifications (1 hard copy)

If there is a discrepancy between the wording of the soft copy and the hard copy, the wording of the hard copy will have priority over the wording of the soft copy.

Prices must appear in the financial bid only. No prices must be indicated in any other section of the bid.

Canada requests that bidders follow the format instructions described below in the preparation of their bid:

- (a) use 8.5 x 11 inch (216 mm x 279 mm) paper;
- (b) use a numbering system that corresponds to the bid solicitation.

In April 2006, Canada issued a policy directing federal departments and agencies to take the necessary steps to incorporate environmental considerations into the procurement process [Policy on Green Procurement](http://www.tpsgc-pwgsc.gc.ca/ecologisation-greening/achats-procurement/politique-policy-eng.html) (<http://www.tpsgc-pwgsc.gc.ca/ecologisation-greening/achats-procurement/politique-policy-eng.html>). To assist Canada in reaching its objectives, bidders should:

- 1) use 8.5 x 11 inch (216 mm x 279 mm) paper containing fibre certified as originating from a sustainably-managed forest and containing minimum 30% recycled content; and
- 2) use an environmentally-preferable format including black and white printing instead of colour printing, printing double sided/duplex, using staples or clips instead of cerlox, duotangs or binders.

Section I: Technical Bid

- (a) In their technical bid, bidders should demonstrate their understanding of the requirements contained in the bid solicitation and explain how they will meet these requirements. Bidders should demonstrate their capability and describe their approach in a thorough, concise and clear manner for carrying out the work.

The technical bid should clearly address and in sufficient depth the points that are subject to the evaluation criteria against which the bid will be evaluated. Simply repeating the statement contained in the bid solicitation is not sufficient. In order to facilitate the evaluation of the bid, Canada requests that bidders address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, bidders may refer to different sections of their bids by identifying the specific paragraph and page number where the subject topic has already been addressed.

- (b) The technical bid consists of the following:

All the information required to demonstrate its conformity with the **Point Rated Technical Criteria** described in Attachment 1 - Point Rated Technical Criteria.

Section II: Financial Bid

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Bidders must submit their financial bid in accordance with the Basis of Payment. The total amount of Applicable Taxes must be shown separately.

Section III: Certifications

Bidders must submit the certifications required under Part 5.

Additional information precedent to Contract Award

Bidders must provide a list of names, or other related information as needed, pursuant to section 01 of Standard Instructions 2003.

For services requirements, Bidders in receipt of a pension or a lump sum payment must provide the required information as detailed in article 3 of Part 2 of the bid solicitation.

Canada requests that bidders provide the following information:

Administrative representative :

Name :

Telephone :

Facsimile :

Email :

Technical representative :

Name :

Telephone :

Facsimile :

Email :

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

1. Evaluation Procedures

- (a) Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical and financial evaluation criteria.
- (b) An evaluation team composed of representatives of Canada will evaluate the bids.

1.1 Technical Evaluation

Except where expressly provided otherwise, the experience described in the bid must be the experience of the Bidder itself (which includes the experience of any companies that formed the Bidder by way of a merger but does not include any experience acquired through a purchase of assets or an assignment of contract). The experience of the Bidder's affiliates (i.e. parent, subsidiary or sister corporations), subcontractors, or suppliers will not be considered.

1.1.1 Point Rated Technical Criteria

Refer to **Attachment 1**, Point Rated Technical Criteria.

1.2 Financial Evaluation

1.2.1 Mandatory Financial Criteria

Bidders must submit their financial bid in accordance with **1.2 Section II: Financial Bid of the Part 3** - Bid preparation instructions.

1.2.2 Evaluation of Price

The price of the bid will be evaluated in Canadian dollars, applicable taxes excluded, FOB destination, Canadian customs duties and excise taxes included.

The price of the bid will be the total estimated cost shown in Table 5 of the Basis of Payment in Annex B.

2. Basis of Selection - Highest Combined Rating of Technical Merit and Price

1. To be declared responsive, a bid must:
 - a. comply with all the requirements of the bid solicitation;
 - b. meet all mandatory criteria; and
 - c. obtain the required minimum of points overall for the technical evaluation criteria which are subject to point rating.

The rating is performed on a scale of 100 points.

2. Bids not meeting "(a) or (b) or (c)" will be declared non-responsive.
3. The selection will be based on the highest responsive combined rating of technical merit and price. The ratio will be 70% for the technical merit and 30% for the price.

4. To establish the technical merit score, the overall technical score for each responsive bid will be determined as follows: total number of points obtained / maximum number of points available multiplied by the ratio of 70 %.
5. To establish the pricing score, each responsive bid will be prorated against the lowest evaluated price and the ratio of 30%.
6. For each responsive bid, the technical merit score and the pricing score will be added to determine its combined rating.
7. Neither the responsive bid obtaining the highest technical score nor the one with the lowest evaluated price will necessarily be accepted. The responsive bid with the highest combined rating of technical merit and price will be recommended for award of a contract.

The table below illustrates an example where all three bids are responsive and the selection of the contractor is determined by a 70/30 ratio of technical merit and price, respectively. The total available points equals 100 and the lowest evaluated price is \$380 000.00.

Basis of Selection - Highest Combined Rating Technical Merit (70%) and Price (30%)

		Bidder 1	Bidder 2	Bidder 3
Overall Technical Score		80/100	65/100	85/100
Bid Evaluated Price		400 000,00 \$	380 000.00 \$	390 000.00 \$
Calculations	Technical Merit Score	$80 / 100 \times 70 = 56$	$65 / 100 \times 70 = 45.5$	$85 / 100 \times 70 = 59.5$
	Pricing Score	$380\,000 / 400\,000 \times 30 = 28.5$	$380\,000 / 380\,000 \times 30 = 30$	$380\,000 / 390\,000 \times 30 = 29.2$
Combined Rating		84.5	75.5	88.7
Overall Rating		2 ^e	3 ^e	1 ^{er}

PART 5 - CERTIFICATIONS

Bidders must provide the required certifications and associated information to be awarded a contract.

The certifications provided by bidders to Canada are subject to verification by Canada at all times. Canada will declare a bid non-responsive, or will declare a contractor in default in carrying out any of its obligations under the Contract, if any certification made by the Bidder is found to be untrue whether made knowingly or unknowingly, during the bid evaluation period or during the contract period.

The Contracting Authority will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply and to cooperate with any request or requirement imposed by the Contracting Authority may render the bid non-responsive or constitute a default under the Contract.

1. Certifications Required Precedent to Contract Award

1.1 Integrity Provisions - Associated Information

By submitting a bid, the Bidder certifies that the Bidder and its Affiliates are in compliance with the provisions as stated in Section 01 Integrity Provisions - Bid of Standard Instructions 2003. The associated information required within the Integrity Provisions will assist Canada in confirming that the certifications are true.

1.2 Federal Contractors Program for Employment Equity - Bid Certification

By submitting a bid, the Bidder certifies that the Bidder, and any of the Bidder's members if the Bidder is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list (http://www.labour.gc.ca/eng/standards_equity/eq/emp/fcp/list/inelig.shtml) available from [Employment and Social Development Canada \(ESDC\) - Labour's](#) website.

Canada will have the right to declare a bid non-responsive if the Bidder, or any member of the Bidder if the Bidder is a Joint Venture, appears on the "FCP Limited Eligibility to Bid" list at the time of contract award.

1.3 Status and Availability of Resources

The Bidder certifies that, should it be awarded a contract as a result of the bid solicitation, every individual proposed in its bid will be available to perform the Work as required by Canada's representatives and at the time specified in the bid solicitation or agreed to with Canada's representatives. If for reasons beyond its control, the Bidder is unable to provide the services of an individual named in its bid, the Bidder may propose a substitute with similar qualifications and experience. The Bidder must advise the Contracting Authority of the reason for the substitution and provide the name, qualifications and experience of the proposed replacement. For the purposes of this clause, only the following reasons will be considered as beyond the control of the Bidder: death, sickness, maternity and parental leave, retirement, resignation, dismissal for cause or termination of an agreement for default.

If the Bidder has proposed any individual who is not an employee of the Bidder, the Bidder certifies that it has the permission from that individual to propose his/her services in relation to the Work to be performed and to submit his/her résumé to Canada. **The Bidder must, upon request from the Contracting Authority, provide a written confirmation, signed by the individual, of the permission given to the Bidder and of his/her availability.** Failure to comply with the request may result in the bid being declared non-responsive.

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1.4 Education and Experience

The Bidder certifies that all the information provided in the résumés and supporting material submitted with its bid, particularly the information pertaining to education, achievements, experience and work history, has been verified by the Bidder to be true and accurate. Furthermore, the Bidder warrants that every individual proposed by the Bidder for the requirement is capable of performing the Work described in the resulting contract.

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PART 6 - FINANCIAL REQUIREMENTS

1. Financial Capability

SACC Manual clause A9033T (2012-07-16), Financial Capability

PART 7 - RESULTING CONTRACT CLAUSES

1 Statement of Work

The Contractor must perform the Work in accordance with the Statement of Work at Annex "A" and the Contractor's technical bid entitled _____, dated _____ **(to be completed at contract award)**.

2. Standard Clauses and Conditions

All clauses and conditions identified in the Contract by number, date and title are set out in the Standard Acquisition Clauses and Conditions Manual(<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

2.1 General Conditions

2010B (2014/06/26), General Conditions - Professional Services (Medium Complexity) apply to and form part of the Contract.

3. Term of Contract

3.1 Period of the Contract

The period of the Contract is from date of Contract to **March 31st, 2016 inclusive**.

3.1 Period of the Work (firm part)

The Work for the firm part (*validation of the protocol in the fall of 2014*) is to be performed from date of Contract to **24 weeks after the Contract award**.

3.3 Optional Services

The Contractor grants to Canada the irrevocable option to acquire the services described at Annex A – Statement of Work of the Contract under the same conditions and at the prices and/or rates stated in the Contract. The option may only be exercised by the Contracting Authority and will be evidenced, for administrative purposes only, through a contract amendment.

The Contracting Authority may exercise the option at any time before the expiry of the Contract by sending a written notice to the Contractor.

4. Authorities

4.1 Contracting Authority

The Contracting Authority for the Contract is:

Name: _____

Title: _____

Public Works and Government Services Canada

Acquisitions Branch

Directorate: _____

Address: _____

Telephone: _____

Facsimile: _____

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E-mail address: _____

The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

4.2 Project Authority (*will be completed at the Contract award*)

The Project Authority for the Contract is:

Name: _____

Title: _____

Organization: _____

Address: _____

Telephone : _____

Facsimile: _____

E-mail address: _____

The Project Authority is the representative of the department or agency for whom the Work is being carried out under the Contract and is responsible for all matters concerning the technical content of the Work under the Contract. Technical matters may be discussed with the Project Authority, however the Project Authority has no authority to authorize changes to the scope of the Work. Changes to the scope of the Work can only be made through a contract amendment issued by the Contracting Authority.

4.3 Contractor's Representative (*to be completed by the bidder*)

Name: _____

Title: _____

Organization: _____

Address: _____

Telephone : _____

Facsimile: _____

E-mail address: _____

5. Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a Public Service Superannuation Act (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with Contracting Policy Notice: 2012-2 of the Treasury Board Secretariat of Canada.

6. Payment

6.1 Basis of Payment for firm part for validation of the protocol in the fall of 2014

6.1.1 Basis of Payment – Firm Price (item 1 of the Annex B – Basis of Payment)

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price as specified in Annex B – Basis of Payment for a cost of \$ _____ (*the amount will be inserted at contract award*). Customs duties are *included* and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

6.1.2 Basis of Payment – Firm Unit Prices (item 2 of Annex B – Basis of Payment)

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid the firm unit prices as specified in Annex B – Basis of Payment. Customs duties are *included* and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

6.1.2.1 Limitation of Expenditure (item 2 of Annex B – Basis of Payment)

1. Canada's total liability to the Contractor under the Contract must not exceed \$ _____ (*the amount will be inserted at contract award*). Customs duties are included and Applicable Taxes are extra.

2. No increase in the total liability of Canada or in the price of the Work resulting from any design changes, modifications or interpretations of the Work, will be authorized or paid to the Contractor unless these design changes, modifications or interpretations have been approved, in writing, by the Contracting Authority before their incorporation into the Work. The Contractor must not perform any work or provide any service that would result in Canada's total liability being exceeded before obtaining the written approval of the Contracting Authority. The Contractor must notify the Contracting Authority in writing as to the adequacy of this sum:

- a. when it is 75 percent committed, or
- b. four (4) months before the contract expiry date, or
- c. as soon as the Contractor considers that the contract funds provided are inadequate for the completion of the Work,

whichever comes first.

3. If the notification is for inadequate contract funds, the Contractor must provide to the Contracting Authority a written estimate for the additional funds required. Provision of such information by the Contractor does not increase Canada's liability.

6.2 Basis of Payment for optional services for the monitoring of work in summer/fall 2015

6.2.1 Basis of Payment – Firm Price (item 3 of the Annex B – Basis of Payment)

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price as specified in Annex B – Basis of Payment for a cost of \$ _____ (*the amount will be inserted at contract award*). Customs duties are *included* and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

6.2.2 Basis of Payment – Firm Unit Prices (item 4 of Annex B – Basis of Payment)

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid the firm unit prices as specified in Annex B – Basis of Payment. Customs duties are *included* and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

6.2.2.1 Limitation of Expenditure (item 4 of Annex B – Basis of Payment)

1. Canada's total liability to the Contractor under the Contract must not exceed \$ _____ **(the amount will be inserted at contract award)**. Customs duties are included and Applicable Taxes are extra.

2. No increase in the total liability of Canada or in the price of the Work resulting from any design changes, modifications or interpretations of the Work, will be authorized or paid to the Contractor unless these design changes, modifications or interpretations have been approved, in writing, by the Contracting Authority before their incorporation into the Work. The Contractor must not perform any work or provide any service that would result in Canada's total liability being exceeded before obtaining the written approval of the Contracting Authority. The Contractor must notify the Contracting Authority in writing as to the adequacy of this sum:

. when it is 75 percent committed, or

a. four (4) months before the contract expiry date, or

b. as soon as the Contractor considers that the contract funds provided are inadequate for the completion of the Work,

whichever comes first.

3. If the notification is for inadequate contract funds, the Contractor must provide to the Contracting Authority a written estimate for the additional funds required. Provision of such information by the Contractor does not increase Canada's liability.

6.2 Method of Payment

6.2.1 Milestone Payments (items 1 and 3 (if the option is exercised by Canada) of the Annex B – Basis of Payment)

1. Canada will make milestone payments in accordance with the Schedule of Milestones detailed in the Contract and the payment provisions of the Contract, up to 90 percent of the amount claimed and approved by Canada if:

- a. an accurate and complete claim for payment, and any other document required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;
 - b. the total amount for all milestone payments paid by Canada does not exceed 90 percent of the total amount to be paid under the Contract;
 - c. all the certificates have been signed by the respective authorized representatives:
 - i. The Project Authority must certify that the Work complies with the required quality standards under the Contract and that the progress is in accordance with the Contract.
 - ii. The required certifications were signed by the Contractor.
 - d. all work associated with the milestone and as applicable any deliverable required have been completed and accepted by Canada.
0. The balance of the amount payable will be paid in accordance with the payment provisions of the Contract upon completion and delivery of all Work required under the Contract if the Work has been accepted by Canada and a final claim for the payment is submitted.

6.2.1.1 Schedule of milestones

The schedule of milestones for which payments will be made in accordance with the Contract is as follows:

Schedule of Milestones for protocol validation in Fall 2014

Milestone	Description or "Deliverable"	% of Firm Price	Due Date or "Delivery Date"
No. 1	Caging molluscs confirmation and on presentation of Analysis certificates of the first water sampling	15% of the firm price as described in item 1 of Annex B – Basis of Payment	30 days after the award of the contract
No. 2	Deliverable 2: Preliminary report as described in section 5.1.2 of Annex A – Statement of Work	35% of the firm price as described in item 1 of Annex B – Basis of Payment	No later than 12 weeks after the award of the contract
No. 3	Deliverable 3: Final report as described in section 5.1.3 of Annex A – Statement of Work	50% of the firm price as described in item 1 of Annex B – Basis of Payment	Within 10 days of the date of transmission of comments from the PWGSC project authority on the preliminary version, and no later than 20 weeks after the award of the contract

Schedule of Milestones for monitoring of work– Optional Services

Milestone	Description or "Deliverable"	% of Firm Price	Due Date or "Delivery Date"
No. 1	Deliverable 5: Progress report as described in section 5.2.2 of Annex A – Statement of Work	15% of the firm price as described in article 3 of Annex B – Basis of Payment	No later than 2 weeks after the beginning of the dredging activities in July 2015
No. 2	Deliverable 6: Technical reports after each field campaign as described in section 5.2.3 of Annex A – Statement of Work	15% of the firm price as described in article 3 of Annex B – Basis of Payment	No later than 8 weeks after the beginning of the dredging activities in July 2015
No. 3	Deliverable 7: Preliminary report as described in section 5.2.4 of Annex A – Statement of Work	20% of the firm price as described in article 3 of Annex B – Basis of Payment	No later than 15 days of receipt of all certificates of analysis and no later than November 10, 2015
No. 4	Deliverable 8: Final report as described in section 5.2.5 of Annex A – Statement of Work	50% of the firm price as described in article 3 of Annex B – Basis of Payment	Within 10 days of the date of transmission of comments from the PWGSC project authority on the preliminary version and no later than February 15, 2016

6.2.2 Multiple Payments (items 2 and 4 (if the option is exercised by Canada) of the Annex B – Basis of Payment)

Canada will pay the Contractor upon completion and delivery of units in accordance with the payment provisions of the Contract if:

- an accurate and complete invoice and any other documents required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;
- all such documents have been verified by Canada;
- the Work delivered has been accepted by Canada.

6.3 SACC Manual Clauses

A9117C (2007-11-30), T1204 - Direct Request by Customer Department

7. Invoicing Instructions

- The Contractor must submit invoices in accordance with the section entitled "Invoice Submission" of the general conditions. Invoices cannot be submitted until all work identified in the invoice is completed.

Each invoice must be supported by:

- a. a copy of the release document and any other documents as specified in the Contract;
- b. the description and value of the milestone claimed, if applicable;
- c. presentation of certificates of analysis, if applicable.

2. Invoices must be distributed as follows:

The original and one (1) copy must be forwarded to the address shown on page 1 of the Contract for certification and payment.

3. The Contractor must not submit claims until all work identified in the claim is completed.

9. Certifications

8.1 Compliance

The continuous compliance with the certifications provided by the Contractor in its bid and the ongoing cooperation in providing associated information are conditions of the Contract. Certifications are subject to verification by Canada during the entire period of the Contract. If the Contractor does not comply with any certification, fails to provide the associated information, or if it is determined that any certification made by the Contractor in its bid is untrue, whether made knowingly or unknowingly, Canada has the right, pursuant to the default provision of the Contract, to terminate the Contract for default.

9. Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Québec.

10. Priority of Documents

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

- (a) the Articles of Agreement;
- (b) the general conditions 2010B (2014/06/26), General Conditions - Professional Services (Medium Complexity);
- (c) Annex A, Statement of Work;
- (d) Annex B, Basis of Payment;
- (e) the Contractor's bid dated _____ (to be completed at contract award).

11. SACC Manual Clauses

SACC Manual clause A9068C (2010-01-11), Government Site Regulations

12. Insurance

SACC Manual clause G1005C (2008-05-12), Insurance

ATTACHMENT 1**POINT RATED TECHNICAL CRITERIA****SCORED TECHNICAL CRITERIA**

Criteria	Assessment grid	Max	Min
1-TECHNICAL PROPOSAL		30	15
1.1 Comprehension of the scope of services The Bidder should demonstrate in his own words his understanding of the scope of services requested.	The generic assessment Table (Table 1) will be used to detail the scoring of this criterion.	12	
1.2 Methodology The Bidder should offer an approach that will meet the requirements and ensure that the required quality criteria are met. He should explain how he plans to respect the constraint.	The generic assessment Table (Table 1) will be used to detail the scoring of this criterion.	12	
1.3 Resource allocation The Bidder should present the project team. He should indicate the tasks assigned to each proposed resources and present an organization chart with function title and name of resources, role, responsibility and hierarchic report (team of Bidder and sub- Bidder).	The generic assessment Table (Table 1) will be used to detail the scoring of this criterion.	6	
2- CONTRACTOR'S ACHIEVEMENTS		30	15
2.1 Contractor's achievements The Bidder should demonstrate that it has successfully completed, over the past five (5) years as principal contractor, the following projects: <ul style="list-style-type: none"> one (1) water quality monitoring project; and one (1) mollusc monitoring or inventory project. <u>Information that should be provided for each project</u> <ul style="list-style-type: none"> title and nature of project; scope of the services provided and objectives; Date of the project (Beginning and 	i. <u>The water quality monitoring project:</u> <ul style="list-style-type: none"> a) has been completed in marine environment (3 pts) b) required more than 3 sampling events (3 pts); or 2 sampling events (2 pts); or only one sampling event (1 pt) c) monitored more than three stations at least during one sampling event (3 pts); or 2 station (2 pts); or only one station (1 pt) 	15	

<p>ending with the Months)</p> <ul style="list-style-type: none"> Detailed description of the project to demonstrate the different elements in the assessment grid; 	<p>d) allowed to collect more than one sample (container for laboratory analysis) at least at one station (2 pts); or allowed to collect only one sample (container for laboratory analysis) per station (1 pt)</p> <p>e) Allowed to measure <i>in situ</i> chemical and physical parameters with a probe in station (2 pts)</p> <p>f) Allowed to collect water samples for laboratory analysis (ex.: metals, PAH, PCB, TSS and others) for two parameters (2pts); only one parameter (1pt).</p>		
	<p>ii. <u>The mollusc monitoring or inventory project:</u></p> <p>a) has been completed in marine environment (3 pts)</p> <p>b) required more than 3 sampling events (3 pts); or 2 sampling events (2 pts); or only one sampling events (1pt).</p> <p>c) included the dissection of organisms for sampling of soft tissues in prevision of chemical analysis (4 pts)</p> <p>d) included the dissection of organisms for physical and biological anomalies (3 pts)</p>	15	

	e) included individual morphometric measurements (2 pts)		
3. PROPOSED RESSOURCES		40	20
<p>Information that should be provide for each resource:</p> <ul style="list-style-type: none"> • Academic and professional training • Number of years of experience; • Key functions within the Contractor's <p>The Bidder should provide CVs.</p>			
<p>3.1 Project director</p> <p>The Bidder should provide one resources as Project director.</p> <p>The Project director is the person responsible to achieve a variety of projects in environment. He follows the progress of the project in terms of budget, ensures compliance with schedules filed, affects the necessary resources to different tasks, takes into account specificity, ensures quality control and manages conflict.</p> <p><u>Information that should be provided for each project</u></p> <ul style="list-style-type: none"> • title and nature of project; • scope of the services provided and objectives; • Date of the project (Beginning and ending with the Months) • Detailed description of the project to demonstrate the different elements in the assessment grid; 	<p>i. <u>Experience of the Project director:</u></p> <p>6 points :</p> <p>-has more than 48 months of experience as an environment Project director;</p> <p>4 points :</p> <p>-has more than 36 months of experience and less than 48 months as an environment Project director;</p> <p>2 points :</p> <p>-has more than 24 months of experience and less than 36 months as an environment Project director;</p> <p>0 points :</p> <p>-has less than 24 months as an environment Project director;</p>	6	

	<p>ii. <u>Project director marine environment achievements</u></p> <p>The Project director has:</p> <p>completed at least 5 projects (4pts); or</p> <p>3 or 4 projects (3pts); or</p> <p>2 projects (2pts)</p> <p>or only one project (1 pt);</p> <p></p> <p>To qualify, the project must have been completed over the past five (5) years in the marine environment and include sampling of water, sediment or benthic fauna.</p>	4	
<p>3.2 Project leader</p> <p>The Bidder should provide one resources as Project leader.</p> <p>The Project leader is the person responsible for the technical realization of various projects in environment and manage them smoothly in every detail. Under the direction of the Project Director, he coordinates efficiency a team of professionals, technicians and subcontractors for the time required the project under its responsibility.</p> <p><u>Information that should be provided for each project</u></p> <ul style="list-style-type: none"> • title and nature of project; • scope of the services provided and objectives; • Date of the project (Beginning and ending with the Months) • Detailed description of the project 	<p>i. <u>University Degree</u></p> <p>6 points :</p> <p>-has a bachelor in Biology</p>	6	
	<p>ii. <u>Experience of the Project leader:</u></p> <p>5 points :</p> <p>-has more than 48 months of experience as an environment Project leader;</p> <p>4 points :</p> <p>-has more than 36 months of experience and less than 48 months as an environment Project leader;</p>	5	

to demonstrate the different elements in the assessment grid;	<p>3 points :</p> <p><i>-has more than 24 months of experience and less than 36 months as an environment Project leader;</i></p> <p>1 points :</p> <p><i>-has more than 12 months of experience and less than 24 months as an environment Project leader;</i></p> <p>0 points :</p> <p><i>-has less than 12 months as an environment Project leader</i></p>		
	<p>iii. <u>Project leader marine environment achievements</u></p> <p><i>The Project leader has completed :</i></p> <p><i>at least 2 projects (2pts); or</i></p> <p><i>only one project (1 pt);</i></p> <p><i>To qualify, the project must have been completed over the past five (5) years in the marine environment and include sampling of water, sediment or benthic fauna.</i></p>	2	
	<p>iv. <u>Project leader mollusc inventory or monitoring project achievements</u></p> <p>4 points :</p> <p><i>-has taken part in at least 1 project including the dissection of organisms for sampling of soft</i></p>	7	

	<p>tissues for chemical analysis;</p> <p>2 points :</p> <p>-has taken part in at least 1 project including the measurement of molluscs;</p> <p>1 point :</p> <p>has taken part in at least 1 project including the dissection of organisms to identify physical and biological anomalies.</p>		
<p>3.3 Technician</p> <p>The Bidder should provide one resources as Technician.</p> <p>The Technician is a professional mastering one or more techniques in connection with the project. Under the supervision of Project Manager, it ensures to execute each tasks entrusted to complete the project.</p> <p><u>Information that should be provided for each project</u></p> <ul style="list-style-type: none"> • title and nature of project; • scope of the services provided and objectives; • Date of the project (Beginning and ending with the Months) • Detailed description of the project to demonstrate the different elements in the assessment grid; 	<p>i. <u>Experience of the Technician</u></p> <p>3 points :</p> <p>-has more than 24 months of experience as an environmental technician;</p> <p>2 points :</p> <p>-has more than 12 months of experience and less than 24 months of experience has an environmental technician;</p> <p>1 point :</p> <p>-has more than 6 months of experience and less than 12 months of experience has an environmental technician;</p> <p>0 points :</p> <p>-has less than 6 months of experience has an environmental technician</p>	3	
	<p>ii. <u>Technician marine environment achievements</u></p>	1	

	<p>The Technician has completed at least one project (1 pt);</p> <p>To qualify, the project must have been completed over the past five (5) years in the marine environment and include sampling of water, sediment or benthic fauna.</p>		
	<p>iii. <u>Technician mollusc inventory or monitoring project achievements</u></p> <p>3 points :</p> <p>-has taken part in at least 1 project including the dissection of organisms for sampling of soft tissues for chemical analysis;</p> <p>2 points :</p> <p>-has taken part in at least 1 project including the measurement of molluscs;</p> <p>1 point :</p> <p>-has taken part in at least 1 project including the dissection of organisms to identify physical and biological anomalies.</p>	6	
TOTAL		100	50

Table 1: Qualitative Criteria Evaluation Grid

Non-responsive	Extremely weak	Very weak	Weak	Acceptable	Average	Above average	Exceptional
0 points	1-2 points	3-4 points	5 points	6 points	7-8 points	9 points	10 points

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Did not submit information which could be evaluated	Does not meet requirements	Generally does not meet requirements	Lack of details	Just meets requirements	Meets requirements	Exceeds requirements	Far exceeds requirements
	Weaknesses cannot be corrected	Generally doubtful that weaknesses can be corrected	Weaknesses can be corrected	Weaknesses can be easily corrected	No significant weaknesses	No apparent weaknesses	No weaknesses
	Unacceptable	Extremely weak; insufficient to meet performance requirements	Little capability to meet performance requirements	Minimum acceptability; should meet minimum performance requirements	Average acceptability; should be adequate for effective results	Superior capability; should ensure effective results	Exceptional capability; should ensure extremely effective results

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ANNEX A

STATEMENT OF WORK

The document **Annex A - Statement of Work**, which is enclosed, is to be inserted at this point and forms part of this document.

ANNEX B BASIS OF PAYMENT

1. Firm price for the validation of the protocol in the fall of 2014

Item	DESCRIPTION	Firm All-Inclusive Price (excluding Applicable taxes) \$ CAN
1	Firm price for the performance of the work described in Annex A –Statement of Work. The firm price excludes the costs relating to the performance of work subject to a firm unit price and optional services (items 2, 3 and 4).	\$ _____ (total of the breakdown of firm price)

1.1 Breakdown of firm price

Breakdown

The bidder should provide, as a guide only, a table of breakdown of its bid price. At a minimum, it should include the information below. The total of the breakdown should be equal to the firm price specified at Item 1.

- Fee rate for each category of labour employed;
- Water sampling;
- CTD profile and *in situ* measurement;
- Molluscs harvest and caging;
- Molluscs sampling;
- Molluscs preparation and dissection;
- Cost for mobilization and demobilization of all equipment;
- Vessel/equipment rental;
- Transportation and living costs;
- Costs of preparing reports;
- Etc.

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2. Firm unit price for validation of the protocol in the fall of 2014

Items	Description	Unit	Estimated Quantity (Note 1) (A)	Firm Unit Price all included (Applicable taxes excluded) \$ CAN (B)	Total Estimated Cost (A X B)
2.1	Organochlorine pesticides in water	analysis	7	\$ _____	\$ _____
2.2	TSS in water (24 hrs)	analysis	21	\$ _____	\$ _____
2.3	Metals in molluscs (As, Cd, Cr, Cu, Sn, Mn, Hg, Ni, Pb, Zn) (24 hrs)	analysis	45	\$ _____	\$ _____
2.4	PAHs in molluscs (high resolution)	analysis	9	\$ _____	\$ _____
2.5	PAHs in molluscs (low resolution)	analysis	18	\$ _____	\$ _____
2.6	Organochlorine pesticides + PCBs in molluscs	analysis	9	\$ _____	\$ _____
Total estimated price – Limitation of Expenditure (Applicable taxes excluded) \$CAN					\$ _____

Note 1: Estimated quantity for purposes of bid. It will be adjusted on the basis of the actual analyses or events performed. The additional quantities must be approved in advance by the PWGSC project authority. Payment will be made for the actual quantities only.

3. Firm price for optional services for the monitoring of work in summer/fall 2015

Items	DESCRIPTION	Firm All-Inclusive Price (excluding Applicable Taxes) \$ CAN
3	Firm price for the performance of the optional work described in Annex A – Statement of Work. The firm price excludes the costs relating to the validation of the protocol (items 1 and 2) and the performance of work subject to a firm unit price (see item 4).	<div style="text-align: center;">\$ _____</div> <div style="text-align: center;"><i>(total of the breakdown of firm price)</i></div>

3.1 Breakdown of firm price

Breakdown

The bidder should provide, as a guide only, a table of breakdown of its bid price. At a minimum, it should include the information below. The total of the breakdown should be equal to the firm price specified at Item 3.

- Fee rate for each category of labour employed;
- Water sampling;
- CTD profile and *in situ* measurement;
- Molluscs harvest and caging;
- Molluscs sampling;
- Molluscs preparation and dissection;
- Cost for mobilization and demobilization of all equipment;
- Vessel/equipment rental;
- Transportation and living costs;
- Costs of preparing reports;
- Etc.

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4. Firm Unit Price for optional services for the monitoring of work in summer/fall 2015

Items	Description	Unit	Estimated Quantity (Note 1) (A)	Firm Unit Price all included (Applicable taxes excluded) \$ CAN (B)	Total Estimated Cost (A X B)
4.1	Organochlorine pesticides in water	analysis	28	\$ _____	\$ _____
4.2	TSS in water (24 hrs)	analysis	210	\$ _____	\$ _____
4.3	Metals in molluscs (As, Cd, Cr, Cu, Sn, Mn, Hg, Ni, Pb, Zn) (24 hrs)	analysis	150	\$ _____	\$ _____
4.4	PAHs in molluscs (high resolution)	analysis	44	\$ _____	\$ _____
4.5	PAHs in molluscs (low resolution)	analysis	88	\$ _____	\$ _____
4.6	Organochlorine pesticides + PCBs in molluscs	analysis	114	\$ _____	\$ _____
4.7	Additional sampling event for water only (Note 2)	sampling event	1	\$ _____	\$ _____
Total estimated price – Limitation of Expenditure (Applicable taxes excluded) \$CAN					\$ _____

Note 1: Estimated quantity for purposes of bid. It will be adjusted on the basis of the actual analyses or events performed. The additional quantities must be approved in advance by the PWGSC project authority. Payment will be made for the actual quantities only.

Note 2: The price for an additional sampling event includes all costs of mobilization/demobilization, water sampling at the six stations, *in situ* measurements and CTD profiles, etc. by the Contractor, equipment rental, transport and delivery of the samples to the laboratories, costs of preparing a technical report and integrating the data into the report, and fees.

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5. Estimated total price:

1	Firm price for validation of the protocol in Fall 2014 (item 1)	CAD\$_____
2	Firm unit price for validation of the protocol in Fall 2014 (item 2)	CAD\$_____
3	+ Firm price for additional services for monitoring of work in Summer/Fall 2015 (item 3)	CAD\$_____
4	Firm unit price for additional services for monitoring of work in Summer/Fall 2015 (item 4).	CAD\$_____
Estimated total price (Applicable taxes excluded)		CAD\$_____



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Government Services
Canada

Canada



STATEMENT OF WORK (Annex A)

Sediment Remediation Project at the Port of Gaspé—Sandy Beach
Water Monitoring and Biological Monitoring of Molluscs
Gaspé, Quebec

Requested by: **Environmental Services**
Public Works and Government Services Canada
Quebec Region

July 2014

1. Background

Transport Canada plans to conduct remediation of sediments contaminated with copper (Cu) and polycyclic aromatic hydrocarbons (PAHs) located directly south of the Gaspé—Sandy Beach commercial wharf. The remediation project will involve dredging 27,000 m³ of sediments over an area of roughly 50,000 m². One of the anticipated impacts of the project is the resuspension of contaminated sediments during the dredging operations and their transport to marine aquaculture sites northwest of Gaspé harbour. To assess the real impacts of the project, Transport Canada has undertaken to develop a monitoring program that would include an early warning system to track the movement of contaminated sediments in Gaspé harbour and to ensure that dredging activities in the sector of the Gaspé commercial wharf will have no measurable impacts on the mussel or scallop aquaculture sites in the northwestern part of the harbour.

Transport Canada has engaged Public Works and Government Services Canada (PWGSC) to validate the *Protocol for the Biological Monitoring of Molluscs* prepared by Dr. Émilien Pelletier, of ISMER, in the fall of 2014 and to conduct monitoring (optional services) during the dredging operations, which should begin in the summer of 2015. The services of a contractor are required to perform the work.

2. Mandate

The mandate includes two main activities:

- 1) validation of the protocol in the fall of 2014; and
- 2) monitoring during the dredging operations in the summer/fall of 2015 (optional services).

More specifically, during these activities, the Contractor will:

1. collect water samples and profiles of physical and chemical parameters through the entire water column of Gaspé harbour;
2. establish contact with marine aquaculture producers in Gaspé harbour to obtain the molluscs required to perform the work;
3. harvest and carry out the caging of molluscs;
4. carry out the sampling of mussels and scallops;
5. conduct morphometric analyses (length, width, weight, etc.);
6. prepare mussel and scallop samples for analysis;
7. have the analyses on water and mollusc samples performed by an accredited laboratory; and
8. present all results in the reports.

3. Detailed methodology for the monitoring of water and molluscs

The Contractor will perform the work in accordance with the *Protocol for the Biological Monitoring of Molluscs* prepared by Dr. Pelletier, of ISMER (see Appendix 3 for document, hereinafter referred to as the *Protocol*) and as further detailed in this document.

3.1 Water sampling for physicochemical analysis

The Contractor will collect water samples to determine:

- 1) the weight of total suspended solids (TSS) per volume of water;
- 2) turbidity (measured *in situ*);
- 3) concentration of particle-associated metals;
- 4) organic compounds in the water; and

- 5) concentration of dissolved metals in the water following filtration.

The Contractor must collect seven (7) water samples (including a duplicate) at six (6) stations during each sampling event. The locations of the sampling stations are shown in Figure 1. Table 1 summarizes the characteristics of each sampling station, their respective coordinates and the parameters to be measured. The Contractor will also be required to obtain profiles through the entire water column at each station using a probe that continuously measures depth, temperature, salinity, oxygen and fluorescence or chlorophyll (total algae) in order to identify the depths of the thermocline and pycnocline. Turbidity (*in situ*) will be measured just below the surface at 0.30 m and at the depth of the sample collected at each station. The portable turbidimeter and probes will be calibrated in accordance with the manufacturer's instructions prior to the work.

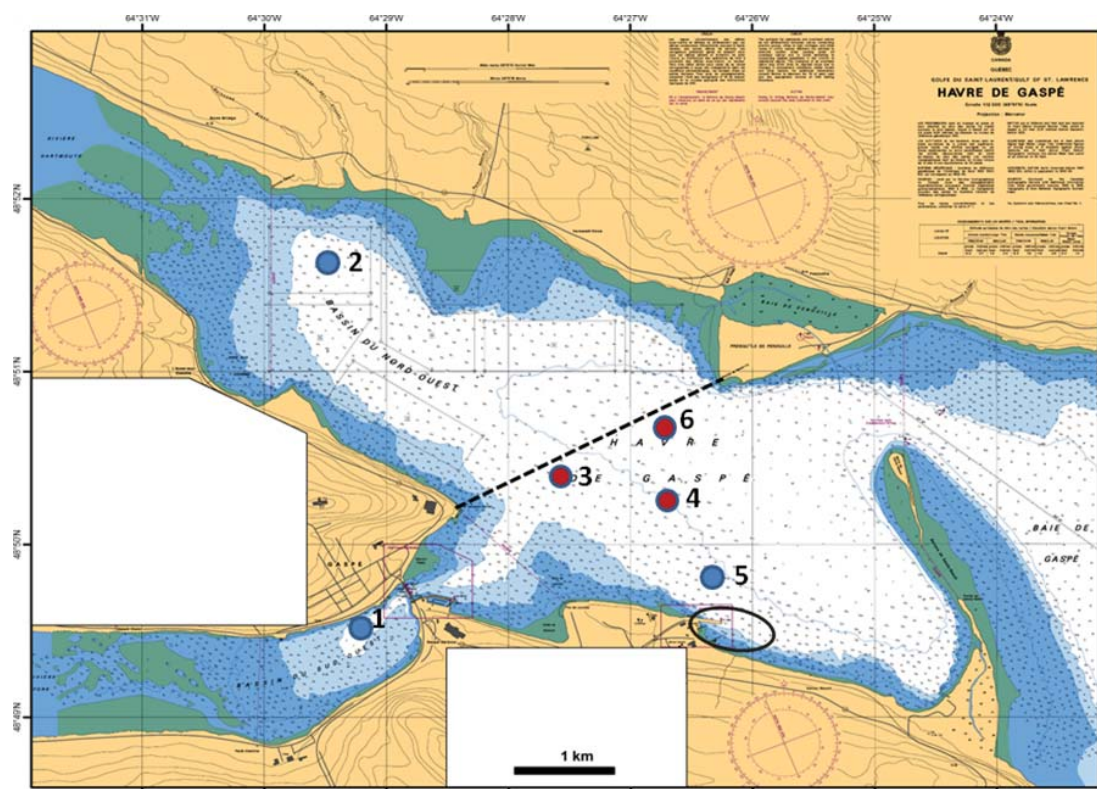


Figure 1: Locations of sampling stations

The water samples will be collected using a bottle sampler (e.g., Niskin, Van Dorn) that can be lowered into the water open and closed at the desired depth. The Contractor will check with the laboratory to determine the quantities of water required to perform all analyses. It may be necessary to collect multiple samples in order to have the quantity of water required to perform all of the analyses.

Table 1: Surface water sampling stations in Gaspé harbour

Station No.	Description	Measurements
1 Southwestern basin	<u>Coordinates</u> 48°49'28"N, 64°29'15"W Sample collected 5 m below the surface	- water depth - profile through the entire water column with probe for measuring depth, temperature, salinity, oxygen and fluorescence or chlorophyll - water sample at 5 m: dissolved and particle-associated metals, PAHs, organochlorine compounds - <i>in situ</i> turbidity at 0.3 m and 5 m
2 Northwestern basin	<u>Coordinates</u> 48°51'40"N, 64°29'30"W Sample collected 5 m below the surface	- water depth - profile through the entire water column with probe for measuring depth, temperature, salinity, oxygen and fluorescence or chlorophyll - water sample at 5 m: dissolved and particle-associated metals, PAHs, organochlorine compounds - <i>in situ</i> turbidity at 0.3 m and 5 m
3 Marine farm	<u>Coordinates</u> 48°50'24"N, 64°27'43"W Sample collected at mid-depth	- water depth - profile through the entire water column with probe for measuring depth, temperature, salinity, oxygen and fluorescence or chlorophyll - water sample at 5 m: dissolved and particle-associated metals, PAHs, organochlorine compounds - <i>in situ</i> turbidity at 0.3 m and at mid-depth
4 Middle of harbour	<u>Coordinates</u> 48°50'17"N, 64°26'30"W Sample collected at mid-depth	- water depth - profile through the entire water column with probe for measuring depth, temperature, salinity, oxygen and fluorescence or chlorophyll - water sample at 5 m: dissolved and particle-associated metals, PAHs, organochlorine compounds - <i>in situ</i> turbidity at 0.3 m and at mid-depth
5 Near wharf	<u>Coordinates</u> 48°49'48"N, 64°26'20"W Sample collected at mid-depth	- water depth - profile through the entire water column with probe for measuring depth, temperature, salinity, oxygen and fluorescence or chlorophyll - water sample at 5 m: dissolved and particle-associated metals, PAHs, organochlorine compounds - <i>in situ</i> turbidity at 0.3 m and at mid-depth
6 Marine farm	<u>Coordinates</u> 48°50'45"N, 64°26'33"W Sample collected at mid-depth	- water depth - profile through the entire water column with probe for measuring depth, temperature, salinity, oxygen and fluorescence or chlorophyll - water sample at 5 m: dissolved and particle-associated metals, PAHs, organochlorine compounds - <i>in situ</i> turbidity at 0.3 m and at mid-depth

3.2 Establishing contacts with marine aquaculture producers

In preparation for the work, the Contractor will contact preferably marine aquaculture producers in Gaspé harbour to obtain the necessary test farmed molluscs. The Contractor cannot collect the molluscs at the site without the authorization of the marine aquaculture producers. The organisms must be collected by a professional technician or biologist employed by the Contractor who must be on board the vessels of the marine aquaculture producers for each collection.

3.3 Harvest and carry out the caging of molluscs

Caging of mussels and scallops technique was chosen for the needs of the project. The Contractor will be required to obtain sufficient quantities of cultured mussels and scallops to ensure that there are enough cages for the duration of the protocol validation work. The specimens will have to be collected, cleaned and sorted in accordance with the Protocol. The Contractor will then be required to place the specimens in the cages in accordance with Table 2 and to ensure an additional supply of test organisms for future needs. During the protocol validation, only cages at stations 3 and 4 will be deployed. However, when monitoring the work (optional service), cages will be deployed at stations 3, 4 and 6.

The Contractor will be required to use the necessary means (line, anchor and buoys) to deploy the cages 6 to 8 m from the surface at each of the stations for the entire duration of the project. The cages used will have to be submitted for approval by the PWGSC project authority at the start-up meeting. The cages must be designed such that they do not hinder the growth of the molluscs or interfere with the chemical analyses.

Table 2: Allocation of specimens to cages and stations

Table 2.1	Protocol validation		
Mussels			
Stations	Number of cages	Number of individuals per cage	Total number of individuals
3	6	60	360
4	12	60	720
6	No cages deployed		
Reserve			100
Total	18		1,180
Scallops			
Stations	Number of cages	Number of individuals per cage	Total number of individuals
3	7	36	252
4	13	36	468
6	No cages deployed		
Reserve			100
Total	20		820

Table 2.2	Monitoring of work (optional services)		
Mussels			
Stations	Number of cages	Number of individuals per cage	Total number of individuals
3	20	60	1,200
4	20	60	1,200
6	20	60	1,200
Reserve			400
Total	60		4,000
Scallops			
Stations	Number of cages	Number of individuals per cage	Total number of individuals
3	24	36	864
4	24	36	864
6	24	36	864
Reserve			250
Total	72		2,842

Note for Tables 2.1 and 2.2: The numbers of individuals needed to perform the work are provided as a guideline. The number of cages and individuals is based on mussels measuring at least 50 mm and scallops measuring at least 50 to 70 mm. It could be necessary to increase the number of cages and/or individuals if the specimens are smaller in size or even to provide for a larger number of individuals to meet the laboratory requirements respecting the quantity of material needed to perform the analyses.

3.4 Carry out the sampling of mussels and scallops

The Contractor will collect water samples as well as mussel and scallop samples in cages and prepare the latter for analysis as required by the Protocol in accordance with the following schedule:

1) Validation of the protocol in 2014

Week	Approximate date	Activities
1	late September	<ul style="list-style-type: none"> • collection and preparation of mussels and scallops and deployment of cages at stations 3 and 4 • sampling 1 of mussels and scallops • water sampling
4	late October	<ul style="list-style-type: none"> • sampling 2 of mussels and scallops • water sampling
8	late November	<ul style="list-style-type: none"> • sampling 3 of mussels and scallops and recovery of cages • water sampling

2) Monitoring of work in 2015 (optional services)¹

Timeline	Approximate date	Activities
30 to 40 days prior to the work	June 1	<ul style="list-style-type: none"> collection and preparation of mussels and scallops and deployment of cages at stations 3, 4 and 6 water sampling
15 days prior to the work	June 15	<ul style="list-style-type: none"> water sampling
7 days prior to the work	June 23	<ul style="list-style-type: none"> sampling 1 (A) of mussels and scallops
At the start of the work	July 1	<ul style="list-style-type: none"> water sampling
Every 4 days during the work	From July 5 to the end of September (20 events)	<ul style="list-style-type: none"> sampling 2 and 3 (B and C) of mussels and scallops at 3 and 7 weeks after the start-up of the work water sampling
At the end of the work	early October	<ul style="list-style-type: none"> sampling 4 (D) of mussels and scallops water sampling
7 days after the end of the work	mid-October	<ul style="list-style-type: none"> water sampling
14 days after the end of the work	late October	<ul style="list-style-type: none"> water sampling
28 days after the end of the work	mid-November	<ul style="list-style-type: none"> last sampling 5 (X) of mussels and scallops and recovery of cages water sampling

¹ The schedule is based approximately on 12 weeks of dredging operations, representing 27 water sampling events. However, since the length of the work is not known, the firm price for the execution of the optional services in section 4 of the annex B must be based on 15 events. Additional events will be paid by unit price according the work actually done. Depending on the date the work started, the schedule may be adjusted to reflect the duration of the work and contingencies (work stoppage, bad weather, etc.).

3.4.1 Sampling and preparation of mussels

For the sampling of mussels, the Contractor will raise the cages, place them on the vessel and count the number of dead individuals as required by the Protocol. Where necessary, the Contractor will replace these individuals with individuals in reserve. The Contractor will then sample 20 individuals at random during protocol validation (13 during monitoring of work - optional services) in each cage. For each station, the Contractor will prepare: three samples consisting of 36 individuals each for the chemical analyses; five samples consisting of 20 individuals each for the biochemical analyses; and one sample consisting of 25 individuals for the condition index with the content of each cage, for either the validation or the monitoring. It may be necessary to collect more individuals to meet the laboratory requirements in terms of the quantities of material needed for the analyses. It is important to note the water depth at the time of sampling and the height of the cages relative to the bottom. For purposes of validation of the protocol, all analyses on mussels will be performed at station 4, and only metals and biochemical parameters will be analyzed at station 3. During monitoring of work (optional services) all analyses will be performed at three stations.

The Contractor will prepare the samples in accordance with the Protocol, i.e. clean and eliminate attached organisms, weigh and measure each specimen, etc. The chemical analyses on mussels will be performed on all soft tissues (3 samples per station) and the biochemical analyses will be performed on the hepatopancreas only (also 5 samples per station). In preparation for the biochemical analyses, the hepatopancreas will be removed immediately after the field work within one hour of the sampling work and 24 hours for chemical analysis in a suitable location in order to avoid any contamination.

To summarize, for each mussel sampling event (for either the validation or the monitoring) at each station, the Contractor will prepare:

- three (3) samples consisting of 36 individuals for chemical analysis;
- five (5) hepatopancreas samples from 20 individuals for biochemical analysis; and
- one (1) sample consisting of 25 individuals for the determination of condition index.

3.4.2 Sampling and preparation of scallops

For the sampling of scallops, the Contractor will raise the cages, place them on the vessel and count the number of dead individuals as required by the Protocol. The Contractor will then sample 12 individuals at random during protocol validation (7 during monitoring of work - optional services) in each of the cages. For each station, the Contractor will prepare three samples consisting of 24 individuals each for the chemical analyses and five samples consisting of 14 individuals each for the biochemical analyses with the content of each cage, for either the validation or the monitoring. For the determination of condition index, the Contractor will collect 25 individuals in each sampling event. It may be necessary to collect more individuals to meet the laboratory requirements in terms of the quantities of material needed for the analyses. It is important to note the water depth at the time of sampling and the height of the cages relative to the bottom. For purposes of validation of the protocol, all analyses on scallops will be performed at station 4, and only metals and biochemical parameters will be analyzed at station 3. During monitoring of work (optional services) all analyses will be performed at three stations.

The Contractor will prepare the samples in accordance with the *Protocol*, i.e. clean and eliminate attached organisms, weigh and measure each specimen, etc. The analyses on scallops will be performed on all of the organism's soft tissue, except the hepatopancreas, in accordance with the method outlined in the Protocol. Given that the hepatopancreas can contain much higher contaminant concentrations than the individual itself, it is very important at the time of dissection not to damage it or to leave part of it in the individual. The hepatopancreas of 72 individuals will be combined to form one sample for each of the sites. In preparation for the biochemical analyses, the hepatopancreas will have to be removed immediately following the field work within one hour of the sampling work and 24 hours for chemical analysis in a suitable location to avoid any contamination.

To summarize, for each scallop sampling event (for either the validation or the monitoring) at each station, the Contractor will prepare:

- three (3) samples consisting of 24 individuals (excluding hepatopancreas) for chemical analysis;
- one (1) sample of 72 hepatopancreas for chemical analysis;
- five (5) hepatopancreas samples from 14 individuals for biochemical analysis; and
- one (1) sample of 25 individuals for the determination of condition index.

3.4.3 Condition index

In addition to measuring and weighing all mussels and scallops submitted for chemical analysis to determine average growth in length and biomass, the Contractor will also calculate the condition index in accordance with Fisheries and Oceans Canada's method (http://publications.gc.ca/collections/collection_2012/mpo-dfo/Fs97-6-2944-eng.pdf) using mussel and scallop samples.

3.4.4 Physical or biological anomalies, diseases, parasites

Verify the visual quality of the soft tissue for the two species and make note of any anomalies observed, i.e. greenish colour along the edge and/or inner part of the mantle, presence of grey or black mini-pearls in the mantle or overly weak resistance to the opening of the shell. Take photos of any anomalies observed.

3.5 Chemical and biochemical laboratory analyses

All samples will be preserved in accordance with the Protocol until analyzed by the laboratory mandated by the Contractor. Table 3 presents the number of analyses to be performed on the water and mollusc samples. The analyses to be performed by a laboratory mandated by the Contractor include the following:

- metals (As, Cd, Cr, Cu, Sn, Mn, Hg, Ni, Pb, Zn);
- polycyclic aromatic hydrocarbons (PAHs), high and low resolution;
- principal organochlorine compounds, including polychlorinated biphenyls (PCBs), DDT and DDE, as well as hexachlorobenzene and total chlordane;
- TSS.

The chemical analyses will be performed by a laboratory accredited by Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC) in accordance with the specifications of Order in Council 464-2014 dated June 18, 2014, available on the website of the *Gazette officielle du Québec*.

The analyses (dissolved and particle-associated metals, PAHs and PCBs in water) are to be performed by Environment Canada laboratories in Montréal and Vancouver. The biochemical analyses (catalase (CAT) and superoxide dismutase (DAC) activity) will be performed by the INRS-ETE laboratory in Quebec City. The Contractor will not have to do those analyses and the results will be provided to the Contractor by the project manager of PWGSC.

The Contractor will be responsible for obtaining the conditioned containers for the water samples and dissections from the laboratories and for delivering the samples to the laboratory (including the laboratories mandated by PWGSC). The Contractor will have to personally communicate with the laboratory to obtain the containers and to advise them of the delivery of the samples to meet the sample holding times. The laboratory will have to have an internal quality control program and will have to perform the analysis in accordance with the method set out in the Protocol or use analytical methods of equivalent performance that make it possible to meet the detection limits in accordance with the requirements of Appendix 2 and in accordance with the conditions of Order in Council 464-2014. For the analyses performed by the Environment Canada laboratories, the quantities of water needed for each sample are as follows:

- dissolved and particle-associated metals in water (Montréal): 4-litre container
- PAHs + PCBs in water (Vancouver): 1-litre container

3.6 Reports on work performed

The Contractor must produce two types of report: a *report on work activities* and a *technical report* (only at the time of monitoring in the summer/fall of 2015, optional services). The reports on the work performed will include, but are not limited to, the following:

- executive summary;
- table of contents;

- description of the background and mandate;
- location of the study site and mollusc sampling sites in Gaspé harbour;
- description of the field work: sampling methods for water, mussels and scallops; vessels; coordinates (latitude and longitude); date and time; water and sample depth (bottle/cage/line); site, line or cage number; relevant information (marine aquaculture producers) on the provenance of the mussels and scallops, such as how long they have been in the water at that location and other relevant observations (presence of algae, etc.); weather conditions; wind speed and direction; sea conditions; waves; visibility in water; etc.;
- site plan of the water and mollusc sampling stations;
- presentation of the results in the form of tables and graphs (before analysis, number, length, weight, sex if possible, reproductive stage if possible, presence of anomalies, diseases, parasites, for each individual, group and site) and as compared against the various quality criteria;
- presentation of the results of the chemical and biochemical analyses for each sampling event, group and station as a function of the water and mollusc quality guidelines/criteria and condition indices; correlations between turbidity, TSS and chemical parameters;
- for each sampling event, a minimum of 12 photographs (to be appended) of the sites at the time of sampling, of the various sample handling steps, of groups and individuals having specific characteristics, of dissection, etc.;
- graphical and numerical representations of CTD profiles (Excel file) for all stations sampled, with elements such as thermocline identified on the graphs;
- certificates of analysis appended with quality control and a summary of the analytical methods used in the laboratories;
- field notes; and
- conclusions and recommendations.

Table 3: Breakdown of analyses conducted on water and mollusc samples

Table 3.1	Validation of the protocol		
	Number of samples	Number of sampling events	Total number of analyses
Analysis on water sample			
Particle-associated metals ¹	7	3	21
Dissolved metals ¹	7	3	21
TSS ⁴	7	3	21
PAHs + PCBs ²	7	3	21
Organochlorine pesticides ⁴	7	1	7
Analysis on mussel sample			
Metals ⁴	6	3	18
PAHs <i>high resolution</i> ⁴	1	3	3
PAHs <i>low resolution</i> ⁴	2	3	6
Organochlorine pesticides / PCBs ⁴	1	3	3
CAT/SOD ³ on hepato.	10	3	30
Analysis on scallop sample			
Metals ⁴	6	3	18
PAHs <i>high resolution</i> ⁴	1	3	3
PAHs <i>low resolution</i> ⁴	2	3	6
Organochlorine pesticides / PCBs ⁴	1	3	3
Analysis on hepatopancreas (scallop)			
Metals ⁴	3	3	9
PAHs <i>high resolution</i> ⁴	1	3	3
PAHs <i>low resolution</i> ⁴	2	3	6
Organochlorine pesticides / PCBs ⁴	1	3	3
CAT/SOD ³	10	3	30

¹Analyses performed by Environment Canada in Montreal

²Analyses performed by Environment Canada in Vancouver

³Analyses performed by INRS-ETE in Quebec City

⁴Analyses performed by a laboratory mandated by the Contractor

Table 3.2	Monitoring of the work (optional services)		
	Number of samples	Number of sampling events	Total number of analyses
Analysis on water sample			
Particle-associated metals ¹	7	27	189
Dissolved metals ¹	7	27	189
TSS ⁴	7	27	189
PAHs + PCBs ²	7	27	189
Organochlorine pesticides ⁴	7	3	21
Analysis on mussel sample			
Metals ⁴	9	5	45
PAHs <i>high resolution</i> ⁴	3	5	15
PAHs <i>low resolution</i> ⁴	6	5	30
Organochlorine pesticides /	9	5	45

PCBs⁴			
CAT/SOD³ on hepato.	15	5	75
Analysis on scallop sample			
Metals⁴	9	5	45
PAHs <i>high resolution</i>⁴	3	5	15
PAHs <i>low resolution</i>⁴	6	5	30
Organochlorine pesticides / PCBs⁴	9	5	45
Analysis on hepatopancreas (scallop)			
Metals⁴	5	15	15
PAHs <i>high resolution</i>⁴	1	5	5
PAHs <i>low resolution</i>⁴	2	5	10
Organochlorine pesticides /PCBs⁴	3	5	15
CAT/SOD³	15	5	75

¹Analyses performed by Environment Canada in Montreal

²Analyses performed by Environment Canada in Vancouver

³Analyses performed by INRS-ETE in Quebec City

⁴Analyses performed by a laboratory mandated by the Contractor

The technical reports (optional services) will include, but not be limited to, the following:

- description of the field work: coordinates (latitude and longitude); date and time; depth of water and sample (bottle/cage/line); site, line or cage number; other relevant observations (presence of algae, etc.); weather conditions; wind speed and direction; sea conditions; waves; visibility in water; etc.;
- presentation of the results in the form of tables and graphs (prior to analysis, number, length, weight, sex if possible, reproductive stage if possible, presence of anomalies, diseases, parasites, for each individual, group and site) and as compared against the various quality criteria;
- presentation of the chemical and biochemical analysis results for each group and station according to the quality criteria/guidelines for water and molluscs and condition indices; correlations between turbidity, TSS and chemical parameters, such as metals;
- for each sampling event, minimum of 12 photographs (to be appended) of the sites at the time of sampling, of the various sample handling steps, of groups and individuals having specific characteristics, of dissection, etc.
- graphical and numerical representations of CTD profiles (Excel file) for all stations sampled and elements such as thermocline will have to be identified on the graphs;
- certificates of analysis annexed with quality control and a summary of the analytical methods used in the laboratories;
- field notes; and
- summary of results (1 page) as measured against the project objectives.

The Contractor will also be responsible for maintaining, throughout the duration of the work, an Internet site (e.g., FTP) to provide all stakeholders access to all documents produced and all results (reports, Excel data compilation files, certificates of analysis, etc.) at all times as they become available according to the schedule presented in section 5. The Contractor could be asked to update the technical report more than once since the analysis certificates will not be delivered at the same time by the laboratories.

4. Transport and access to sites

The PWGSC project authority may accompany the Contractor on the vessel during the work.

The Contractor must provide the material and equipment needed to perform the work and will ensure that it is in good working order.

Commercial activities are carried out at the Transport Canada wharf at Gaspé–Sandy Beach. PWGSC is not responsible for standby periods during the field work if the work is temporarily interrupted. The Contractor will have to coordinate its work with the Transport Canada wharf operator/manager.

The Contractor will be responsible for obtaining permit for molluscs harvest to competent authority as Fisheries and Oceans Canada and approval of its facilities (approved buoys with lights and reflector, etc.) near by the Navigable Waters Protection of Transport Canada (Application for approval of works) and for publishing *Notices to Shipping*.

5. Deliverables and schedules

5.1 Validation of the protocol in the fall of 2014

5.1.1 Deliverable 1 – Work plan and health/safety program

At the start-up meeting, within five days after the award of the contract, the Contractor must submit a work plan for the field work and laboratory analyses, its occupational health and safety plan, its permit request for molluscs harvest and its request of approval to the Navigable Waters Protection.

5.1.2 Deliverable 2 – Preliminary report on the validation work

The preliminary report must be submitted within fifteen (15) days following the reception of all analysis certificates after the last sampling work, no later than twelve (12) weeks after the award of the contract to the PWGSC project authority for comment in one (1) electronic copy, including the complete version in pdf and Word formats. The report must contain all of the information specified in section 3.6.

5.1.3 Deliverable 3 – Final report on the validation work

In ten (10) days after all comments are received from the PWGSC project authority and no later than twenty (20) weeks after the award of the contract, the Contractor must provide five (5) double-sided copies and five (5) electronic versions of the final report, including the complete version in pdf format and all original formats (Word, Excel, JPEG, and AutoCAD for plans).

5.2 Monitoring of the work in the fall of 2015 (optional services)

5.2.1 Deliverable 4 – Work plan and health/safety program

No later than ten (10) days after the confirmation for the optional services by PWGSC, the Contractor must submit a work plan for the field work and laboratory analysis, its occupational health and safety plan, , its permit request for molluscs harvest and its request of approval to the Navigable Waters Protection.

5.2.2 Deliverable 5 – Progress report on the monitoring of the work

Two (2) weeks after the start of the dredging work in Summer 2015, the Contractor must prepare a progress report and submit one (1) electronic copy of the report, including the complete version in pdf and Word formats, to the PWGSC project authority for comment. The report must contain all of the information specified in section 3.6.

5.2.3 Deliverable 6 – Technical reports on the monitoring of the work

Within twenty-four (24) hours of receipt of the certificates of analysis, the Contractor must submit an electronic version of the technical report after each field water and/or mollusc sampling event. The report must contain all of the information specified in section 3.6.

5.2.4 Deliverable 7 – Preliminary report on the monitoring of the work

Within fifteen (15) days after receiving all certificates of analysis at the end of the work or no later than November 15, 2015, the Contractor must submit one (1) electronic copy of a preliminary report, including the complete version in pdf and Word format, to the PWGSC project authority for comment. The report must contain all information specified in section 3.6.

5.2.5 Deliverable 8 – Final report on the monitoring of the work

No later than ten (10) days after once comments are received from the PWGSC project authority and no later than February 15, 2016 or, the Contractor must submit five (5) double-sided copies and five (5) electronic copies of the final report, including the complete version in pdf format and all original formats (Word, Excel, JPEG, and AutoCAD for plans).

The Contractor will also be responsible for advising the PWGSC project authority before the start of each field campaign and for providing him or her with a report of the field campaign after its completion by email. All reports must be drafted in French, and the Contractor must sign all reports.

6. Health and safety plan

The Contractor must:

- comply at all times with the provisions of the *Act Respecting Occupational Health and Safety* and the *Safety Code for the Construction Industry*;
- comply with provisions associated with work involving risks of drowning and diving, as appropriate (Appendix 1);
- notify workers that they have the right to refuse any work that puts their health or safety at risk;
- have an effective means of communication in his or her possession in order to respond to emergency situations;
- ensure that all personnel present during the work has received the training and information they need to perform the work safely and that all tools and protective equipment required are available, are used and are in compliance with the applicable standards, acts and regulations;
- in the event of an unexpected incident, take all necessary measures, including work stoppage, to protect the health and safety of workers and the public (and immediately contact PWGSC).

The Contractor's obligations include providing the PWGSC technical authority with a plan to ensure that the work will be performed safely (health and safety plan). This plan must indicate the measures that will be taken on and in the vicinity of the work sites to protect the health and safety of its personnel and of the public. The health and safety plan must also include an emergency plan. The plan will have to be specific to the study site. A general health and safety plan outlining aspects that are irrelevant to the study site will be considered inadequate.

Appendix 1

HEALTH AND SAFETY REQUIREMENTS

The Contractor must:

- Comply at all times with the provisions of the following acts, regulations and standards:
 - *Act Respecting Occupational Health and Safety*;
 - *Regulation Respecting Occupational Health and Safety* (new Division XXVI.I, Underwater Work);
 - *Standard CAN/CSA-Z275.2-92 Occupational Safety Code for Diving Operations*; and
 - *Standard CAN/CSA-Z275.4-97 Competency Standard for Diving Operations*.

In the event of a conflict between the requirements of these documents, the most stringent will apply.

- Regardless of the number of workers assigned to the work, a work safety plan (prevention program) must be submitted to PWGSC listing the activities to be carried out under the contract, the risks and prevention measures that you undertake to apply to address these risks, in compliance with the applicable regulations. You must include the list of safety equipment on board the vessels, the procedures to be followed during sampling, the emergency procedures (e.g., diving accident, drowning), etc.
- Ensure that your workers, including divers and support personnel, have received the necessary training and information to perform the work safely.
- Provide a copy of the certification and first aid/CPR training certificate of each diver to the PWGSC project authority.
- Ensure that all necessary protection tools and equipment are available, are in compliance with the standards, acts and regulations, are inspected, and are used properly. Be able to provide proof of certification and inspection of such equipment on request.
- Inform your workers that they have the right to refuse any work that endangers their health or safety.
- In the event of an unexpected incident, take all necessary measures, including work stoppage, to protect the health and safety of workers and the public (and immediately contact PWGSC).

SPECIFIC CONDITIONS FOR WORK INVOLVING DROWNING HAZARDS

In addition to the above requirements, the following requirements will be met for all work involving drowning hazards:

- Comply with section 2.10.13 of the *Safety Code for the Construction Industry*.
- (a) Wear a life jacket or personal flotation device that keeps the person's head above water and allows the person to float without using the arms and that:
 - complies with Canadian General Standards Board standard CAN/CGSB-65.7-M88 *Lifejackets Inherently Buoyant Types*, published in 1988; or
 - with some exceptions, is approved by Transport Canada.
- (b) or be protected by a safety net or fall protection device.
- Obtain and send to the PWGSC project authority a letter of compliance issued by Transport Canada for approval of all vessels (transport, rescue, inspection or other) prior to the start of the work (reference: Transport Canada Marine Safety – 1-888-649-6292).
- Ensure (if needed) that a rescue vessel, moored and in the water, is available for each work area. Where the vessel is accessible by land, it may serve two or more work areas, provided the distance between any work area and the vessel is less than 100 m.
- Ensure that the vessel is equipped with a motor powerful enough to overcome the current.
- Ensure that the vessel has the necessary features to accommodate persons likely to take part in the rescue operation.
- Ensure that the rescue vessel is available to workers at all times in the event of an emergency.
- Ensure that a qualified person is available to operate the emergency equipment. That person must have a pleasure craft operator card for the length of vessel being used.
- Establish written emergency procedures containing the following information and ensure that all workers subject to those procedures have received the training and information needed to apply them:
 - a full description of the procedures, including the responsibilities of the persons who have access to the work site; and
 - the location of the emergency equipment.
- Where the work site is a pier, a basin, a jetty, a wharf or any similar structure, a ladder with at least two (2) rungs below the surface of the water will be installed on the front of the structure every 60 m. This measure will apply even if the project is a construction project, in which case a temporary (or portable) ladder may be used and removed when the work is complete if the owner does not own the basic facilities. However, the owner must be notified in writing that the site is not in compliance with the Canada Labour Code, Part II.

OHS CLAUSE RELATING SPECIFICALLY TO UNDERWATER WORK

By accepting this contract, the Contractor agrees to meet the following requirements:

- Compliance with all requirements of the *Regulation Respecting Occupational Health and Safety* (S-2.1, r. 13), more specifically Division XXVI.1 – Underwater Work, as well as with the most recent version of standards CAN/CSA Z275.2, *Occupational Safety Code for Diving Operations*, CAN/CSA Z275.1, *Hyperbaric Facilities*, and CAN/CSA Z275.4, *Competency Standard for Diving Operations*. In the event of a conflict between two provisions, the most stringent will apply.
- In addition to the above, compliance with the *Safety Code for the Construction Industry* (S-2.1, r. 6) in cases where construction work is involved.
- Before work begins, submit the following documents to the PWGSC project authority, as per the *Regulation Respecting Occupational Health and Safety*:
 - the professional diving training certificate of each member of the dive team or a document attesting to the competency of those persons in accordance with standard CAN/CSA Z275.4-02, *Competency Standard for Diving Operations*, as per section 312.8 of the Regulation;
 - the workplace first-aid training certificate of each member of the dive team;
 - the medical certificate of each member of the dive team;
 - for each dive included in this contract, a dive plan containing the following information, in addition to that required under the *Regulation Respecting Occupational Health and Safety*:
 - the thermal protection to be used;
 - the repetitive dive factor;
 - the no-decompression limit;
 - the circumstances in which the dive must be terminated;
 - the procedures to be followed to ensure that machinery, equipment or devices that could create a hazard have been locked out; and
 - the decompression schedule to be used, if required; and
 - notification confirming that a system for communicating with Emergency Medical Services for diving emergencies is available at the diving station at all times.
- The Contractor must take account of the following specific characteristics of the work site and adapt its dive plan accordingly:
 - Where the dive takes place at one of the following locations, provide the PWGSC project authority with confirmation that the authorities concerned have been notified:
 - upstream or downstream from a hydraulic structure or submerged water line;
 - in navigable waterways; and
 - at port facilities.
 - If the dive station is more than 2 m above the water, provide the PWGSC project authority with:
 - a drawing of the equipment used to lower the worker to an underwater work site if a device other than a stage is used for that purpose; and
 - a drawing of the device used to hoist the stage or other device, unless that device is a crane or boom truck.

- If the dive is carried out from a vessel, provide the PWGSC project authority with the following documents:
 - proof of qualification of the vessel operator; and
 - the vessel's certificate of compliance from Transport Canada.
- Before starting the work, carry out an underwater rescue simulation at the site, as required under section 312.31 of the *Regulation Respecting Occupational Health and Safety*.
- On a daily basis, complete and provide to the PWGSC project authority a checklist confirming the presence and condition of the equipment required at the dive site as per the dive plan.
- Ensure that all other documents required under section XXVI of the *Regulation Respecting Occupational Health and Safety* are available at the site at all times (dive log, diver's logbook, etc.).
- All persons assigned to this contract and who remain above water must comply with sections 355 to 357 of the *Regulation Respecting Occupational Health and Safety*.
- Where an emergency vessel is required in order to comply with section 357 of the *Regulation Respecting Occupational Health and Safety*, obtain the vessel's certificate of compliance issued by Transport Canada and provide it to the PWGSC project authority.

Appendix 2

REQUIREMENTS FOR THE ANALYTICAL DETECTION LIMITS

Mollusc tissue		
Metals	RDL (mg/kg)	
Arsenic (As)	0.5	
Cadmium (Cd)	0.2	
Chromium (Cr)	0.5	
Copper (Cu)	1	
Lead (Pb)	0.3	
Manganese (Mn)	1	
Mercury (Hg)	0.01	
Nickel (Ni)	0.5	
Tin (Sn)	2	
Zinc (Zn)	1	
PAH	GC-HRMS High resolution RDL (ng/g)	Low resolution RDL (mg/kg)
Acenaphthene	0.5	0.1
Acenaphthylene	0.5	0.1
Anthracene	0.5	0.1
Benzo(a)anthracene	0.5	0.1
Benzo(a)pyrene	0.5	0.1
Benzo(e)pyrene	0.5	0.1
Benzo(b)fluoranthene	0.5	0.1
Benzo(j)fluoranthene	0.5	0.1
Benzo(k)fluoranthene	0.5	0.1
Benzo(ghi)perylene	0.5	0.1
Chrysene	0.5	0.1
Dibenz(a,h)anthracene	0.5	0.1
Fluoranthene	0.5	0.1
Fluorene	0.5	0.1
Indeno(1,2,3-cd)pyrene	0.5	0.1
Naphthalene	0.5	0.1
Phenanthrene	0.5	0.1
Pyrene	0.5	0.1

ORGANOCHLORINE PESTICIDES + PCBs	GC-ECD RDL (ng/g)
Aroclor 1016	30
Aroclor 1221	30
Aroclor 1232	30
Aroclor 1242	30
Aroclor 1248	30
Aroclor 1254	30
Aroclor 1260	30
Total PCBs	30
α-Chlordane	20
γ-Chlordane	20
o,p-DDD	20
o,p-DDE	20
o,p-DDT	20
p,p-DDD	20
p,p-DDE	20
p,p-DDT	20
Hexachlorobenzene	20

Appendix 3

Protocol for the Biological Monitoring of Molluscs

Prepared by Émilien Pelletier of ISMER



**SEDIMENT REMEDIATION PROJECT
PORT OF GASPÉ, QUEBEC**

**PROTOCOL FOR THE BIOLOGICAL MONITORING OF
MOLLUSCS**

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December 2013

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Summary

The biological monitoring protocol could include several of the main elements that follow:

- Six sampling stations, placed at the mouth of the York and Dartmouth rivers and in the Gaspé harbour.
- Using caged mussels and scallops as bioindicators.
- Placing the cages in three strategic locations within the harbour.
- Sampling and analyzing water and suspended particulate matter (SPM) on a regular basis before, during and after the work to monitor the water quality parameters and the presence of contaminants in the SPM and water.
- Sampling the bioindicators before, during and once after the work is completed.
- Determining the condition index and mortality of the bioindicators over time.
- Conducting chemical analyses of the contaminants in the bioindicators' tissues to monitor bioaccumulation and the depuration of copper and PAH.
- Conducting biochemical analyses of the biological tissue to determine the level of stress experienced by the bioindicators during the dredging operations.
- Processing the chemical and biological data to determine the presence and extent of adverse effects on the bioindicators before and during the dredging operations.
- Testing the protocol in the spring and summer of 2014 to ensure its feasibility. Some elements could be adapted to the realities of the field work and the constraints of the chemical and biochemical analyses.

1 Introduction

1.1 *Reminder of the Mandate*

This mandate aims to provide a detailed methodology for a biological monitoring program implemented during the above-mentioned project, including:

- A description of the mollusc species used and the means of exposure;
- The plan for sampling the water, particles and organisms before, during and after the operations;
- The methods used to conduct chemical and biochemical analyses on the samples;
- The strategy for analyzing the results (data processing);
- The method used to quantify the impacts.

1.2 *Monitoring Context*

Transport Canada (TC) has plans to remediate sediment contaminated with copper (Cu) and polycyclic aromatic hydrocarbons (PAH) directly south of the commercial wharf in Gaspé – Sandy Beach. This remediation project will involve dredging 27 000 m³ of sediment (estimated non-bulked volume without overdredging) over a surface area of approximately 50 000 m². See the nautical chart for the Gaspé harbour in Figure 1. One of the project's expected impacts is that the contaminated sediment will be resuspended in the water column and carried toward the Gaspé harbour during the dredging activities. The LaSalle Consulting Group (LCG) numerically modelled the dispersion of the dredged sediment in October 2010. The dispersion simulations showed that the plume's maximum spread was limited to the immediate work area, over a maximum length of 1 km to the southeast. It is expected that sand and coarse silt, which make up over half of the dredged sediment, will quickly resettle at the work site. Finer sediment (fine silt and clay) is expected to remain suspended in the water column, but dilution should reduce the concentrations to acceptable values within a small radius around the work site. It is important to stress that the spread of the plume calculated via numerical modeling was based on a 2 mg/L concentration of SPM, which corresponds, depending on the degree of

contamination retained for the sediment, to a concentration of 4 µg/L of copper and 0.06 µg/L of total PAH (LaSalle Consulting Group, November 2010, Gaspé – Sandy Beach wharf, *Modélisation numérique de la dispersion des sédiments dragués*, report no. 1768, 67 p).

There are numerous aquaculture sites in the Gaspé harbour. In fact, there is a cluster of mussel and scallop farming sites approximately 2.5 km northwest of the planned work site. The aquaculturists who use these sites are worried about the potential effect the contaminated sediment's resuspension could have on their farms, since mussels and scallops are filter feeders. Given their concern, Transport Canada has committed to developing and implementing a program to monitor the flesh of molluscs for contamination by Cu (and other metals), organochlorine compounds and PAH, as well as various biological parameters (condition index and mortality) for scallops and mussels farmed in the Gaspé harbour.

1.3 Objectives

The objective is to develop a monitoring program that would, first, set up an early warning system by tracking the movements of the contaminated particles inside the Gaspé harbour and, second, ensure that the dredging activities planned in the Gaspé commercial wharf area will not have a measurable impact on mussel and scallop farms in the northwestern part of the harbour.

The proposed monitoring program should cover the following:

- Presence of the target contaminants and SPM in the water in the work area and throughout the Gaspé harbour.
- Presence of the target contaminants in the tissues of the bioindicator species, which will be positioned to detect the particles before they reach the aquaculture areas.
- Response of the selected biological parameters, to determine the adverse effects contamination could have on the general health of the bioindicator species.

- Processing the data using a statistical approach that enables the results to be interpreted as a whole based on the above-listed objectives and for maximum protection of the mollusc farming areas.

1.4 Target Contaminants

The various chemical analyses conducted on the sediment in the area targeted by the remediation work revealed the presence of copper and several polycyclic aromatic hydrocarbons (PAH). However, this does not exclude the presence of certain other contaminants, such as other metals and organochlorine compounds, in the sediment to be dredged. As a precaution, Transport Canada has decided to expand the range of contaminants considered in the biological monitoring protocol and to include 10 chemical elements considered to be the most toxic for aquatic organisms and humans (total arsenic, cadmium, chromium, copper, total tin, manganese, mercury, nickel, lead and zinc), the 16 priority PAHs (acenaphthene, acenaphthylene, anthracene, benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*e*]pyrene, benzo[*b*]fluoranthene, benzo[*ghi*]perylene, benzo[*j*]fluoranthene, benzo[*k*]fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, phenanthrene, pyrene) and the main organochlorine compounds, including total polychlorinated biphenyls (total PCBs), DDT, DDE, hexachlorobenzene and total chlordane.

Metals may be present both on the surface and inside the suspended particles as well as dissolved in the water. They will therefore be measured in the suspended particulate matter (SPM) and in the filtered water. Given that organic compounds (PAH and organochlorines) are highly water repellent and therefore not very water soluble, these compounds will be extracted from the water samples without prior filtration. Finally, it is to be noted that all of the chemicals (metals, PAH and organochlorines) determined in the bioindicator species will take into account the detection limits of the analytical methods used by the certified laboratories.

2 Methodology

2.1 Indicator Species

As explained in the previous section, dredging operation cause an environmental problem by resuspending variably-sized particulate matter with highly variable physicochemical properties. Mineral particles (metal sulphides, metal oxides and various minerals), both fine and coarser (silt and gravel) generally hold little risk for the aquatic environment, for three reasons: 1) these particles are dense and do not travel far from the resuspension point; 2) the metals that form the mineral structure are not very bioavailable because they generally have very low solubility; 3) the more or less crystalline surface of these particles has little capacity to adsorb ions or molecules dissolved in the water. However, very fine mineral particles (mainly clay that is $<1\ \mu\text{m}$) as well as organic particles in a wide variety of sizes (phytoplankton, debris from terrestrial plants and aquatic organisms, feces, bacterial floc, combustion residues and petroleum product residues) have the capacity to adsorb and carry toxic substances over long distances, both adsorbed metal ions and water-repellant organic molecules like hydrocarbons and organochlorines. This second category of particles is the main source of food for numerous invertebrates, mainly suspension and deposit feeders and benthic burrowers.

Numerous studies have demonstrated that metals and organic molecules adsorbed at the surface of fine clay particles and organic particles are bioavailable. This means that the ions and molecules are transferred in part to the tissues of the organisms that eat them and their respective toxicity can affect various biological functions, such as growth, reproduction and immune defence. What is more, significant bioaccumulation of the toxic compounds can render the organisms unfit for human consumption.

The blue mussel is widely used as an indicator species during dredging work in estuarine and coastal areas. Numerous recent dredging projects, published in international literature, mention this species (Bellas et al., 2007; Bergen et al., 2005; Bocchetti et al., 2008, among several others). The blue mussel (*Mytilus edulis*) is the first choice for this project because the species is present in the bay of Gaspé, is relatively tolerant to variations in salinity and is commercially farmed in the Gaspé harbour.

It is appropriate to use the scallop (*Platopecten magellanicus*) as a second indicator species in this project because it is naturally present in the bay and is also farmed in the harbour. It is a suspension filter feeder like the mussel and should therefore provide similar information regarding bioaccumulation. Toxic effects on the condition index or stress may differ, however, and comparing the data from both species should be of scientific interest.

The biological monitoring protocol therefore aims, on the one hand, to document the presence of suspended particulate matter contaminated by metals, PAH and organochlorines throughout the Gaspé harbour before, during and after the dredging work and. It also aims, on the other hand, to use the blue mussel and scallop as indicators of possible bioaccumulation of these substances in the biological tissue and determine the potential toxic effects.

2.2 Method of Exposure

Mussels and other species are often placed in cages for the purpose of monitoring contaminants (Mzoughi and Chouba, 2012; Turja et al., 2013). The caging method has many practical advantages, for sampling at predetermined periods and to ensure homogeneity of the samples throughout the study area and for data processing. Sampling directly on mussel socks and in scallop culture nets is problematic due to site accessibility and the heterogeneity of the samples, given that the mussels and scallops would not have been selected before the monitoring work. Morphometric data needs to be collected from the mussels and scallops before they are caged. The species used in this protocol would be taken, to the extent possible, from aquaculture farms in the northwestern part of the harbour. The farming areas themselves are not included in the biological monitoring protocol. The number of organisms required for the protocol will be determined based on a 12-week work period and a sufficient mass of flesh for chemical and biochemical analysis. This number could be adjusted as needed.

2.2.1 Mussel Caging

To keep the stress of caging and transplantation to a minimum, the adult mussels should be taken from a mussel farm located in the harbour. The process would be as follows:

- Collect, carefully clean and sort approximately 1 500 mussels, size 5.0 ± 0.1 cm. The average size may vary depending on availability from the local mussel farmer.
- Form 24 groups of 50 mussels each and place the groups in 24 identical hard plastic cages (approximately 30 x 30 x 30 cm, see example in Figure 2) with a mesh of no more than 0.5 cm, to permit water to flow freely while preventing predators from entering. Each monitoring station will have 8 cages containing 50 mussels each.
- An additional group of 10 mussels, precisely measured and identified, will be added to each cage for possible determination of the condition index.
- Keep an additional stock of 1 000 mussels of the same size for later use, if necessary.
- Place the cages in the water near the sampling area (station 3), at the same depth, for 5 to 7 days prior to their installation at the sampling stations, to allow the mussels to adapt and to reduce the stress of transplantation. Check for mortalities before transplanting and replace these mussels from the additional stock, if needed.
- The cages should be held in place with an anchor, nylon rope and a surface buoy. Suspend between 6 and 8 m from the surface and install in such a way to ensure that they do not touch the seabed at low tide. The final positioning of the cages, for secure installation and to permit sampling of the bioindicators, should be tested and approved in the summer of 2014.

2.2.2 Scallop Caging

A method similar to the one described for mussels would be used to select and prepare the scallops. Scallops 5 to 7 cm in length, according to availability from the local scallop farmer, should be selected and placed in cages similar to those used by Fisheries and Oceans Canada during a study on scallop growth in the Gulf of St. Lawrence (Sonier et al., 2011), containing 36 individual compartments (see example in Figure 3). The scallops will be carefully sorted and cleaned to obtain as narrow a size class as possible (example: 6.0 ± 0.2 cm). The scallops will be precisely measured before being placed in individual compartments in the cages. Each station will have 8 groups of 36 scallops each, for 864 scallops in total over the 3 stations. An additional stock of 500 scallops will be prepared and used as needed to replace mortalities. The scallop cages will be submerged at the same site as the mussel cages and for the same acclimation period.

2.3 *Positioning of the Stations and Sampling*

2.3.1 Sampling Sites

Based on the above-mentioned considerations and objectives, it is proposed that 6 water sampling stations be installed (Figure 1), 3 of which would also be used to sample bioindicators, as follows:

- No. 1: Southwestern basin (physicochemical)
- No. 2: Northwestern basin (physicochemical)
- No. 3: Marine farm (physicochemical + bioindicators) on the southwestern side of the aquacultural area
- No. 4: Middle of the harbour (physicochemical + bioindicators)
- No. 5: Near the work area (physicochemical)
- No. 6: Marine farm (physicochemical + bioindicators) on the northwestern side of the aquacultural area

Stations 1 and 2 will monitor water quality (salinity, temperature, SPM) at the mouth of the two rivers and determine the presence of contaminant-loaded particles originating

from the work or any other source. Stations 3 and 6 will be located near the farming sites (one to the south and the other to the north) and will monitor the possible arrival of contaminants in that sector. Station 4 will determine the presence of contaminants in the central part of the harbour before they can reach the aquaculture area. Station 5 will act like a forward position, used to trigger preventive (or corrective) action if the operations allow contaminated particles to escape.

2.3.2 Sampling for Physicochemical Analysis

The water sampling objective is to determine: 1) the mass of suspended particulate matter (SPM) by volume of water; 2) the concentration of metals and organic compounds in the SPM; and 3) metals dissolved in the water after filtration. To be able to understand and interpret this data and the data collected from the bioindicators, it will be necessary to combine it with data on temperature, salinity and fluorescence. Fluorescence provides an approximation of the abundance of phytoplankton and an indication of food availability for the two bioindicator species. An oxygen sensor could also be added. The four types of sensors (temperature, salinity, fluorescence, oxygen) are available on a multiparameter probe (CTD) currently used in oceanography. The volume of water to be sampled may be revised if deemed insufficient after the sampling plan is perfected in 2014.

The water samples are taken at a predetermined depth using a Niskin-type sampler (5 litres) that can be lowered in the open position and closed at the indicated depth.

The following steps must be taken before each sampling series:

- Prepare the CTD probe and check that it is working properly according to the manufacturer's instructions.
- For each station, prepare two high-density polypropylene (HDPP) bottles (2 L) by rinsing with a diluted hydrochloric acid solution (20 mL of HCl 0.1 M) to eliminate all traces of adsorbed metals, followed by two rinses (50 mL each) of distilled (or deionized) water to eliminate acid residues, followed by a final rinse

with 20 mL of dry ethanol (100%) to eliminate all organic residue. Air-dry for a few minutes and close tightly.

- For the bioindicators, bring Ziploc bags (large freezer bags) and a large cooler half filled with crushed ice.
- Take the samples during high tide slack water over a period that should not exceed 3 hours in total for all stations. If time is lacking or the weather is not conducive, sampling can be continued at next tide. At high tide, the SPM is held inside the harbour by seawater entering from the bay of Gaspé, which maximizes the chances of sampling contaminated SPM, especially at stations 1, 4 and 5.

2.3.3 Procedure for Physicochemical Sampling

For each of the 6 stations, the work method would be as follows:

- Determine the boat's exact position with a GPS and record in the logbook.
- Slowly lower the CTD probe to 2 m above the seabed and then slowly raise. The device must be able to store several series of measurements. If not, transfer the data to a laptop.
- Note the depth of the site, which can fluctuate depending on position and tide.
- Use the Niskin bottle to sample 5 litres of water at 5 m (stations 1 and 2) and at mid-depth for the other stations.
- Using gloves (for the person in charge of filling the 2 litre bottles), rinse the bottles twice with approximately 50 ml of water from the Niskin, then fill the bottles to the edge and close tightly.
- Label the samples and store out of direct light.

N.B. The samples for PAH, organochlorines and trace metals are easily contaminated with cigarette smoke and hydrocarbons on the boat. Great care must therefore be taken during sampling.

2.3.4 Procedure for Bioindicator Sampling

The procedure for the bioindicators would be as follows:

- Raise the mussel and scallop cages and place them in the boat;
- Open each cage and first take out any empty shells to determine the number of mortalities per cage for mussels and scallops. Keep the shells in a plastic Ziploc bag identified with the cage (or tray) number.
- Take 10 mussels at random from each of the 8 mussel cages. Immediately drop into 8 Ziploc bags and place in the cooler.
- For the condition index, take 10 mussels specifically identified for this purpose. Place in identified bags and preserve.
- Repeat the procedure by removing 6 pre-identified scallops from each of the 8 compartmentalized cages and place in 48 separate bags identified with the cage and compartment number.
- For the condition index, take 5 additional scallops for this purpose.
- Put the cages back into the water, at the same depth.

2.4 Procedure Upon Returning from At-Sea Sampling

The bottles of water must be kept out of direct light throughout the process. The bottles and biological samples must be kept on crushed ice and shipped to the analytical laboratory as soon as possible.

2.4.1 Receiving and Processing the Water Samples

- Since the water samples are taken in duplicate, only one of the two bottles will be filtered via a GFF 0.45 μm filter that has been pre-calcined and precision weighed beforehand.
- The maximum volume of water that can be filtered before the filter becomes clogged depends on the particle load and must be carefully noted for each sample.
- The filtration system must allow 500 mL of filtered water to be collected, to be analyzed for dissolved metals.

- The filters are dried for 24 hours at 100 °C and precision-weighted to determine the SPM mass by filtered volume.
- The second 2 L bottle must be stored out of direct light and in the refrigerator for PAH and organochlorine analysis as described below.

2.4.2 Receiving and Processing the Biological Samples

2.4.2.1 For the Condition Indexes

The condition index process would be as follows:

- For the 10 mussels and 6 scallops specifically identified for this purpose, the shells will be carefully cleaned and precision measured. The number and result will be recorded to calculate the shell's individual growth.
- The soft tissues from each organism will be sampled and placed in a small, pre-weighed, clearly identified glass jar. All of the jars will be frozen at -20 °C.
- After freezing, the jars will be freeze-dried for 48 h. Then, each jar will be precision measured to determine each organism's dry mass.
- The condition indexes will be calculated for all of the organisms.

2.4.2.2 For Chemical Analysis

The chemical analyses would be conducted as follows:

- Within 24 hours of sampling, the mussels and scallops would be cleaned, to remove any attached organisms, and prepared for analysis.
- For 4 of the 8 mussel groups (chosen at random) at a given station, take all of the soft tissues from the 10 mussels per group and form a pool for each group, using dissection instruments cleaned with 100% ethanol between each organism. 4 pools will be obtained per station.
- Finely homogenize the tissues in each of the 4 mussel pools with a commercial homogenizer and keep the homogenate in HDPP plastic jars (50 ml) previously rinsed with HCl (0.1 M), deionized water (3 x 20 mL) and ethanol (20 mL). All of the jars of homogenate are preserved by freezing at -20 °C. One jar of mussel homogenate per station is reserved in case of re-analysis.

- After freezing, freeze-dry 3 of the jars of homogenate (N=3) per station and finely grind the tissue. Store in a dry, dark place in pre-treated plastic jars as previously indicated. Results in 9 dry samples (3 x 3).
- Take 24 scallops (chosen at random from the 48 samples per station) and form 4 separate groups. Take all of the soft tissues from the 6 scallops per group and form a pool for each group, using dissection instruments cleaned with 100% ethanol between each organism. 4 pools will be obtained per station. Do the same for the two other stations to obtain 12 pools.
- Finely homogenize the tissues in each of the scallop pools, using the same procedure as for the mussels.
- After freezing, freeze-dry 3 jars of homogenate (N=3) per station and finely grind the tissue. Store in a dry, dark place in pre-treated plastic jars as previously indicated. Results in 9 dry samples.

2.4.2.3 For Biochemical Analysis

The biochemical analyses would be conducted as follows:

- For the 4 other groups of mussels from each station, open the mussels and take only the hepatopancreas (brownish-black mass). Form a pool for each group in pre-treated plastic jars as previously indicated. Do not homogenize at this stage.
- For the 24 remaining scallops, form 4 groups of 6. Open the scallops and take only the hepatopancreas (brownish-black mass). Form a pool for each group. Do not homogenize.
- Immediately freeze the pools of hepatopancreases at -78 °C for later analysis of the enzymatic activities. As before, the analyses will be conducted on 3 jars per species (N=3) and per station, keeping one jar in case of re-analysis.

2.5 Chemical Analyses

2.5.1 Analysis of the Chemical Elements

- All of the chemical analyses will be conducted by a certified laboratory, according to the methods in effect at that laboratory.

- The chemical elements in the SPM (dry filters) and dissolved in the water are analyzed by means of inductively-coupled plasma mass spectrometry (ICP-MS), according to the protocol in effect at the certified laboratory.
- The same applies to chemical elements in the biological tissues, which are analyzed by ICP-MS after the dry tissues have been completely digested by concentrated nitric acid according to the protocol in effect at the certified laboratory, in accordance with good analytical practices for analyzing trace metals in biological tissues (AOAC SMPR 2012.007).

2.5.2 Analysis of PAH and Organochlorine Compounds

- For water, a volume of 1 500 mL is taken from the sampling bottle (after shaking well) and transferred to a 2 L separatory funnel. A larger volume of water could be extracted if the preliminary analyses in 2014 deem that it is necessary.
- The volume of water is extracted with 3 x 20 ml of hexane:toluene (9:1). The extract is purified in a short silica column and the volume is reduced to 2 mL.
- The PAH and organochlorines in the extract will be analyzed and quantified by gas chromatography-mass spectrometry (GC-MS) according to the protocol in effect at the certified laboratory.
- For the dry biological tissue, the PAH and organochlorines will be extracted and quantified according to the protocols proposed by the certified laboratory and must comply with the methods described by official laboratories such as the CEAEQ and Environment Canada (see CEAEQ, 2013; EPA Method 1668B; AOAC Official Method 983.21)

All of the results will be recorded in dry µg/g for the SPM and biological tissues and in ng/litre for water.

2.6 Biochemical Analyses

To establish the state of health of the bioindicator organisms, it is necessary to determine the response of a few biochemical indicators used to measure general stress experienced by the organisms and their capacity to defend themselves from chemical attack. Many bioindicators are described in the literature, in particular for caged bivalves during biomonitoring work (Bellas et al., 2007; Bocchetti et al., 2008; Turja et al., 2013 and several others). Making a choice remains difficult, however, as biochemical responses are sometimes variable and hard to interpret. In spite of this, measuring catalase (CAT) and superoxide dismutase (SOD) activity generally produces results that are well-correlated with the organisms' level of exposure to toxic substances. The two tests are conducted either on tissue that is fresh or preserved at -78 °C. The analysis protocols are standardized and well described for marine species (Clairborne, 1985; Bocchetti, R. et al., 2008). The enzymatic tests are not specific to any contaminants in particular, but provide a global view of the organism's state of health.

3 Sampling Schedule

The sampling schedule should be as follows.

3.1 *Water Sampling, All Stations*

- Twice in the weeks leading up to the work: one water sample taken when placing the bioindicator cages and one taken during the first sampling of the bioindicators.
- Twice a week for the duration of the dredging operations.
- Once a week for several weeks after the work has been completed, at the same time as the bioindicators.
- One last time 4 to 6 months after the work (i.e., the next spring).

The sampling frequency at station 5 near the work area may be increased during the course of the work if the first chemical results indicate the presence of contaminants in the suspended particles or if resuspension of the fine particles is visible onsite.

3.2 *Mussel and Scallop Sampling*

The availability of 50 mussels per cage permits a theoretical maximum of 5 biological samplings by means of 10 mussels from each of the 8 cages. The same goes for the 32 scallops per cage (8 cages), with 5 x 6 scallops taken per cage with 2 extra. As previously indicated, 4 groups of mussels (or scallops) will be used for chemical analysis (triplicate analysis and one group in reserve) and the 4 other groups will be used as biomarkers (biochemical analysis in triplicate and one group in reserve). Even a significant loss (up to 20%) of the mussels and scallops at a given station would not threaten the sampling protocol, given the large number of replicas. Also, it would be possible to take fewer mussels or scallops per sampling without compromising the integrity of the samples. One (1) sample would therefore be taken before the work begins, three (3) others during the work and the last one (1) after the project is completed.

If the organisms at a given station are lost (due to a major incident such as the station being torn away by a ship or storm), a new station will be set up with the organisms kept in stock near station 3. The cages will be put in place 4 to 6 weeks before the start of the work. They will be checked for mortalities during each sampling and the organisms will be replaced only in the event of mass mortality (>50%).

Preliminary testing of the mussel and scallop caging, the cage installation method and determination of natural mortality due to the stress of transplantation should be carried out in the summer of 2014.

3.3 *Sampling Schedule*

3.3.1 For Water and SPM:

- Sampling before the work begins: 30 days before and then 15 days before the start of the dredging operations.
- Sampling T= zero: on the first day of the dredging operations.
- Sampling during the course of the work: every 3 to 4 days during the work, for a period of approximately 3 months.
- Final sampling after the work: once a week for several weeks after the work is completed, if the harbour is free of ice.

3.3.2 For the Bioindicators

- Sampling A: One week before work is set to begin (T = zero)
- Sampling B: 3 weeks after the work begins
- Sampling C: 7 weeks after the work begins
- Sampling D: 12 weeks after the work begins
- Sampling X: 4 weeks after the work ends

According to the information provided by the contractor on the duration of the work underway, the sampling frequency could be modified to maintain 3 samplings during the course of the work.

4 Data Processing Method and Impact Quantification

4.1 *List of Data Collected During the Monitoring Work*

The different at-sea measurements and analyses conducted on the water samples and bioindicators will provide the following data:

- Salinity, temperature, fluorescence and dissolved oxygen in the water for each sample;
- Particle load suspended in the water at every stage of the project;
- Metals (especially Cu) in and on the particles and dissolved in the water as well as bioaccumulated in the two bivalve species;
- PAH and organochlorine compounds, particulate and bioaccumulated in the bivalves;
- Mortality rate over time;
- Individual growth rate and condition indexes for the scallops and mussels sampled for this purpose;
- Biochemical data on the indicator enzymes.

4.2 *Data Processing and Use*

For the monitoring to be effective and useful, the data must be immediately available during the sampling process. As such, use of the most important raw data (metal, organochlorine and PAH content in the particles and organisms) requires the chemical analyses to be performed in a short timeframe (one week) after the samples are made available. This time limit requires a specific agreement with the analytical laboratory to obtain prompt results.

Metal (especially Cu), organochlorine and PAH content in the SPM and bioindicators should be used to assess the operations' impacts on the entire study area and for the entire operation period, including a pre-project and a post-project period.

The proposed approach was described by Bellas et al. (2007) during the monitoring of organic compounds and trace metals in a dredging project carried out in an estuary in Sweden, using caged mussels. The similarity between the Swedish project and

the Port of Gaspé project makes for very useful bridging. The data processing steps are as follows:

- Present the data in tables and graphs to illustrate changes over time.
- Compare the chemical data collected from the water with the chemical data collected from the organisms.
- Compare the biological responses of the two indicator species.
- Conduct repeated measures ANOVA and/or Tukey's tests to establish significant differences between the sites.
- Analyze correlation between the chemical and biological data (mortality and condition index).
- Use an appropriate statistical approach to classify the various sites based on their location and the sampling periods.

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Figure 1: Positioning of the Sampling Stations

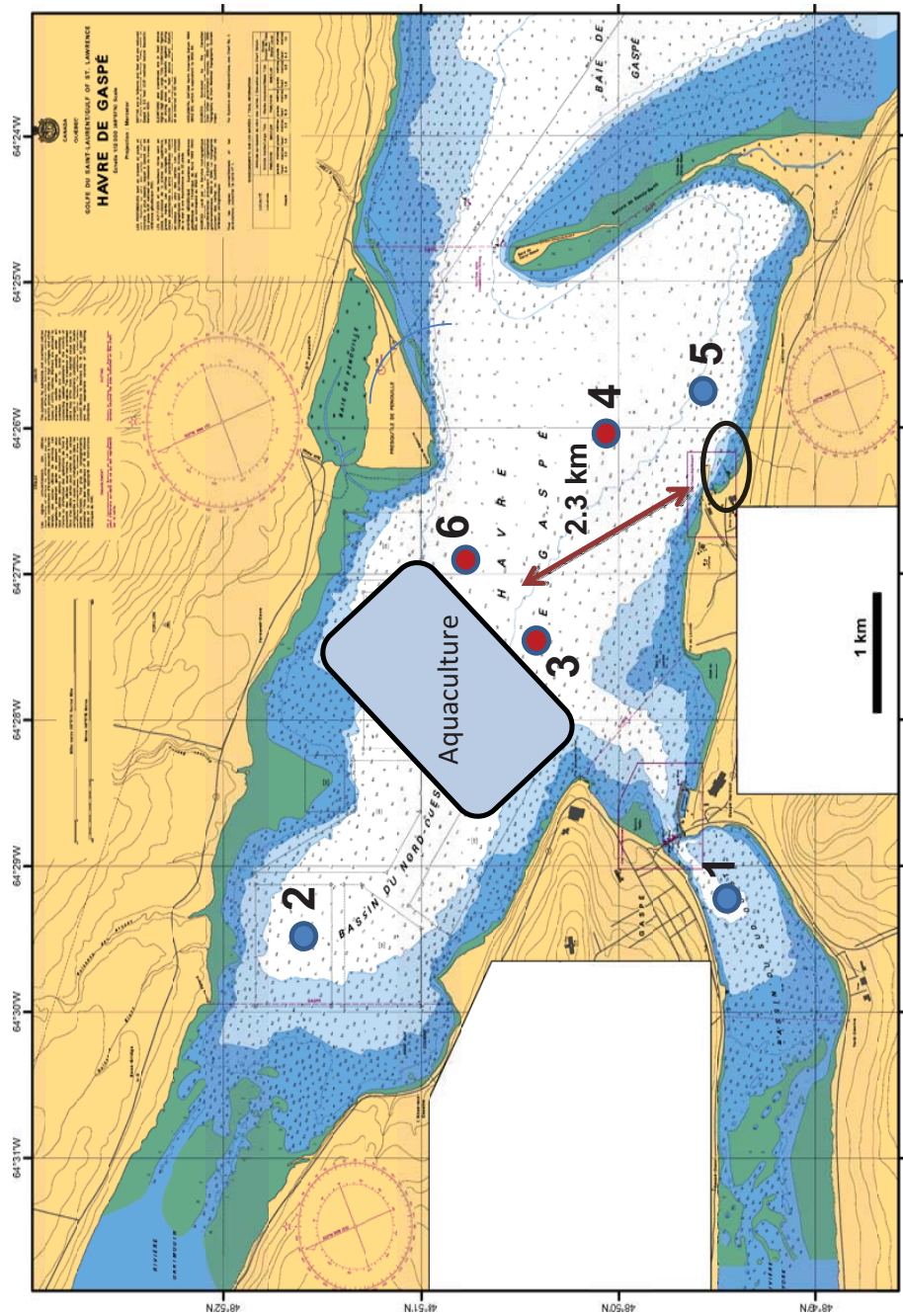


Figure 2. Suggested Types of Mussel Cages

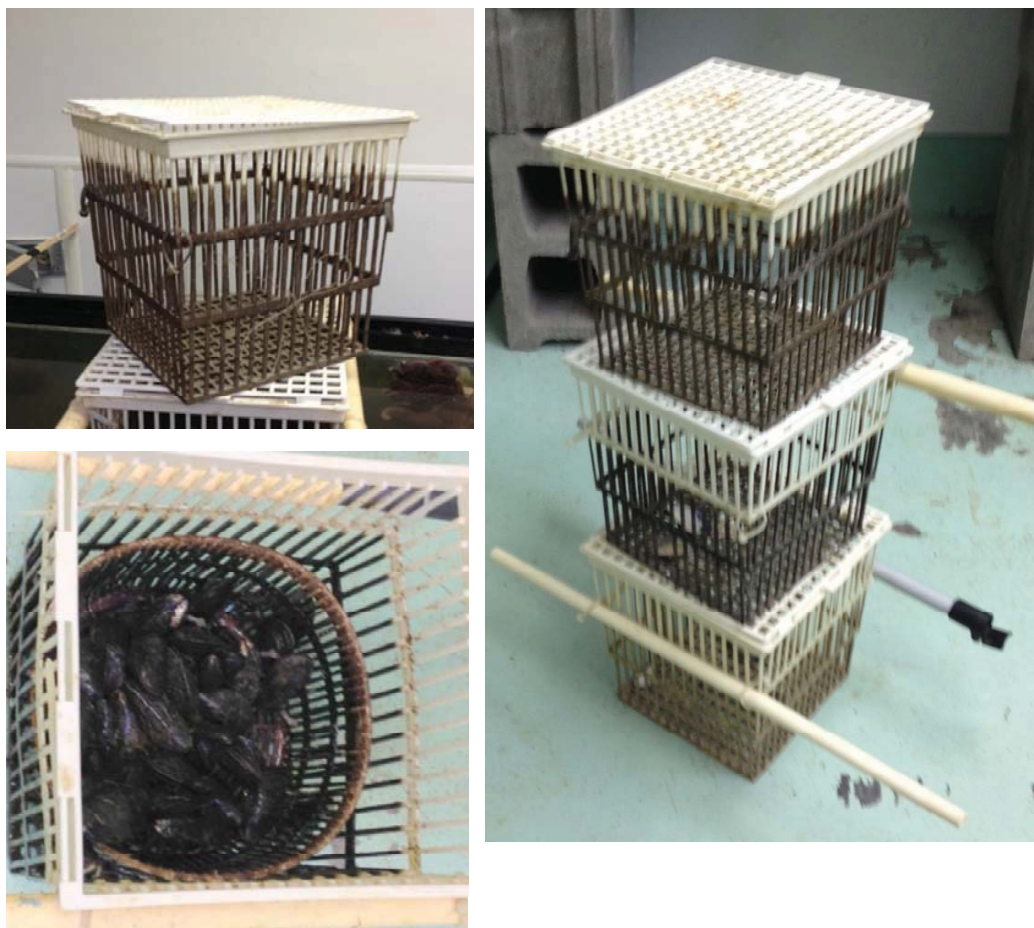


Figure 3. Suggested Types of Scallop Cages

(Image taken from Sonier et al., 2011, Figure 2)

