

**ENVIRONMENTAL SCREENING  
FOR  
HARBOUR DEVELOPMENT  
WATER, FLOATING DOCKS, DREDGING and S  
AT  
TIVERTON, DIGBY COUNTY, NOVA SCOT**



Screening Type 4  
CONSTRUCTION PROJECT  
(with dredging activities)

HRTS#

**ENVIRONMENTAL SCREENING  
FOR  
HARBOUR DEVELOPMENT  
(BREAKWATER, FLOATING DOCKS, DREDGING and SERVICE AREA)  
AT  
TIVERTON, DIGBY COUNTY, NOVA SCOTIA**

**DEPARTMENT OF FISHERIES AND OCEANS (DFO)**

**SMALL CRAFT HARBOURS (SCH) BRANCH**

**MARITIMES REGION**

Prepared for DFO-SCH  
by Public Works and Government Services Canada (PWGSC)  
Halifax, NS

SMALL CRAFT HARBOURS BRANCH ENVIRONMENTAL SCREENING  
FOR CONSTRUCTION PROJECTS WITH DREDGING

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**PART A                      DESCRIPTION OF THE PROPOSED PROJECT**

**a)      Project identification**

<b>Date:</b>	2004/05/17	<b>HRTS Number:</b>	
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<b>Harbour Code / Name:</b>	1323 / Tiverton		
<b>Harbour Site:</b>	Latitude : NAD 83 44° 23' 00" N	Longitude : NAD 83 66° 13' 30" W	
<b>Province :</b>	Digby County, Nova Scotia		
<b>Region :</b>	Maritimes		

<b>Screening Title :</b>	Harbour Development (Breakwater, Floating Docks, Dredging, and Service Area)		
<b>Proposal Description :</b>	<p>The proposed project involves the development of a new harbour adjacent to existing facilities in Tiverton, Digby County, Nova Scotia.</p> <p>The proposed harbour development project will be broken into three phases with construction scheduled over four years. Project components include:</p> <ul style="list-style-type: none"> <li>• (Phase I) - Construction of breakwater and installation of 7 floating docks;</li> <li>• (Phase II) - Dredging of the basin (including blasting of Class A material within the basin), installation of remaining floating docks and construction of service/parking area; and</li> <li>• (Phase III) - Construction of marginal wharf connected to the Provincial ferry wharf.</li> </ul> <p>As a component of this assessment, habitat compensation in the form of habitat enhancement/restoration will be conducted.</p>		
<b>Primary Undertaking:</b>	Yes	<b>Physical Activity:</b>	Yes

<b>Lead RA :</b>	Department of Fisheries and Oceans Canada (DFO) – Small Craft Harbours (SCH), Maritimes Region		
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<b>Assessor :</b>	Mr. Don Maynard, Public Works and Government Services Canada (PWGSC), Charlottetown, PEI (902) 566-7533.		
	Ms. Rosalia Galante, PWGSC, Halifax, NS (902) 496-3302		
<b>DFO Spokesperson:</b>	Mr. Gary Hubbard, Chief, Small Craft Harbours Branch Southwest Nova Scotia, 215 Main Street, Yarmouth, N.S. B5A 1C6 (902) 742-6452		
<b>Assessment Contact:</b>	Mr. Gary Hubbard, Chief, Small Craft Harbours Branch Southwest Nova Scotia, 215 Main Street, Yarmouth, N.S. B5A 1C6 (902) 742-6452		
<b>Public Registry Contact:</b>	Mr. Claude Burry, Regional Engineer, DFO-SCH, Moncton, NB (506) 851-6586		

<b>Trigger (Enter Y/N):</b>	Project proponent ..... Yes	Financial assistance ..... Yes
	Interest in land ..... Yes	Law List or Issuing a Permit.....No



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Other RAs:	Department of Fisheries and Oceans (DFO) <ul style="list-style-type: none"> <li>• Habitat Management Division (HMD) under <i>Fisheries Act</i> S.35(2)</li> <li>• Canadian Coast Guard under <i>Navigable Waters Protection Act</i></li> </ul>								
DFO - HMD Assessment Contact:	Ms. Tammy Rose, Habitat Assessment Biologist, Bedford Institute of Oceanography, Dartmouth, NS (902) 426-0379								
Public Registry Contact:	Mr. Claude Burry, Regional Engineer, DFO-SCH, Moncton, NB (506) 851-6586								
Trigger (Enter Y/N):	<table style="width: 100%; border: none;"> <tr> <td>Project proponent .....</td> <td>No</td> <td>Financial assistance .....</td> <td>No</td> </tr> <tr> <td>Interest in land .....</td> <td>Yes</td> <td>Law List .....</td> <td>Yes</td> </tr> </table> <p align="right"><i>(HADD authorization, Fisheries Act, Section 35(2))</i></p>	Project proponent .....	No	Financial assistance .....	No	Interest in land .....	Yes	Law List .....	Yes
Project proponent .....	No	Financial assistance .....	No						
Interest in land .....	Yes	Law List .....	Yes						

Type of assessment:	Screening ..... Yes	Class Screening ..... No
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**b) Project justification**

**Purpose of the project**

Issue A1: Outline the motivating factors and purpose of this proposal. Why is the undertaking of this project being considered (i.e. what purpose will it serve)?

Response: Tiverton Small Craft Harbour is home to a fleet of approximately 15 vessels. The proposed harbour development (breakwater, floating dock, dredging and services area) will provide improved access and facilities for local users. There are two nearby Harbour Authorities with wharves that are operationally inadequate and serve only as storage areas for traps. The development of a more operationally efficient harbour could lead to the eventual redeployment of these vessel fleets to Tiverton on a permanent basis.

**Alternative sites and options**

Issue A2: Were alternate activities or sites considered or evaluated? If so, briefly indicate scope of review and reasons why they were not chosen over the current proposal.

Response: The alternative to this project is to abandon the proposed harbour development project. If this is done, the existing facilities will continue to deteriorate and the local fishing fleet eventually will have to relocate to private wharves or discontinue operations at Tiverton.

**c) Description of the proposed project**

**Location**

Issue A3: Where will the project be carried out? Attach appropriate maps, SCH site plans and/or aerial photos. Describe location(s), as precise as possible, for every component of the project (construction sites, location of the facilities, storage sites, dredging and dumping sites, etc.).

Response: The proposed project at Tiverton Harbour, Digby County, Nova Scotia consists of the development of a new harbour to provide improved access and facilities for local users. Tiverton is located on Long Island on the west side of Petit Passage at latitude 44° 23' 00" N, and longitude 66° 13' 30" W (refer to **Figure 1** for topographic map 21B/08 indicating proposed project site, and **Figure 2** for aerial photo indicating proposed project site).

The proposed location of the new harbour is approximately 100 m north of the Tiverton Provincial Ferry wharf that is owned by the Provincial Department of Transportation and Public Works, and approximately 200 m north of the existing Fishermen's wharf (refer to **Figure 3** for topographic map indicating shellfish closure area, ferry route, and proposed project area).

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**Related projects**

Issue A4: Is this work proposal part of a larger development? Is there future potential for expansion or modification? If yes, describe related projects.

Note that only the impacts of the presently proposed project are to be assessed at this time, unless the SCH proponent feels it is important to include in this screening, the factors related to the future proposed works.

Response: In 2003, a separate CEAA Screening was conducted for wharf repairs at the existing Tiverton SCH facility. That work has been completed. This work proposal is not part of a larger development. The proposed harbour development will be a phased construction over five years. Project phases and corresponding components are described in Issue A5.

This project was considered in the context of past, present (breakwater, floating docks, dredging and service area), and future projects (private wharves) and no potential negative cumulative effects were predicted.

**Components of the project**

Issue A5: Describe the main components of the work proposal and related activities. Attach plans and drawings as may be required to fully describe the intended work. Some of the factors which should be considered include;

Construction / Demolition : Work areas;  
Construction/demolition methods;  
Materials;  
Transportation and disposal (material, equipment, etc.); and,  
Access roads.

Dredging/disposal: Volumes;  
Dredge characteristics;  
Dredge procedures;  
Disposal methods;  
Containment structures; and,  
Transportation of material.

Response: Construction Phase

The proposed harbour development project will be broken into three phases with construction scheduled over four years. Project components are listed below (refer to **Figure 4** for plan of proposed harbour development and **Figure 5** for cross-sections and details:

- (Phase 1) - Construction of breakwater and installation of 7 floating docks;
- (Phase II) - Dredging of the basin (including blasting of Class A material within the basin), installation of remaining floating docks and construction of service/parking area; and
- (Phase III) - Construction of marginal wharf connected to the Provincial ferry wharf.

The first phase of the proposed project is the construction of an armourstone breakwater and the installation of 7 floating docks. The breakwater will extend 149 m east and then 69 m southward. The length of the proposed breakwater is approximately 213 meters. The breakwater will be 5 meters wide at the crest and approximately 50 meters wide at the base, depending on water depth.



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The breakwater will be constructed of clean rock obtained from an approved quarry, and will consist of a 0.2 – 100 kg core stone surrounded by 2 layers of 200 - 800 kg filter stone, 1.5 meters thick. The north side (seaside and crest) will be protected with 2 layers of 8-10 tonne armourstone and a single layer of 6-8 tonne armourstone will protect the south side. Approximately 40,000 tonnes of armourstone, 25,000 tonnes of filter stone and 93,000 tonnes of core stone will be used in the construction of the breakwater. Seven floating docks will be installed, connected with an access ramp and secured to the breakwater with strong arms. Armourstone protection will extend along the shoreline for a length of approximately 120 meters to protect the neighbouring property (in agreement with the property owner). The rock will be placed above the high water mark. Depending on funding, dredging or blasting of Class A material (rock) within the new basin (proposed to be conducted in Phase II) may be started in this phase. If rock is blasted in Phase I, the rock will be used in construction of the breakwater.

The second phase of the proposed project is dredging of the basin (including blasting of Class A material within the basin), the installation of remaining floating docks, and the construction of the service/parking area. Dredging is required in the new basin to attain a depth of 2.0 meters below present Chart Datum. An excavator will be used in the proposed land-based dredging. The anticipated dredge volume is approximately 10,000 cubic meters. Approximately 6000 cubic meters of the total dredge volume is anticipated to be Class A material (or rock) and approximately 4000 cubic meters of the total dredge volume is anticipated to be Class B material. Dredging of the new basin will consist of blasting of bedrock bottom to attain desired dredge depth. The dredge material will be used to form the proposed service/parking area (also proposed to be constructed in Phase II).

The six remaining floating docks will be installed, attached with strong arms that will be secured to concrete anchors within the service/parking area and connected with an access ramp. The floating docks will allow for maximum berthing capacity of 32 vessels in the proposed basin. The proposed service/parking area will extend along the shoreline of the new basin (approximately 120 m). This infill (service/parking area) will be constructed of dredged material and rock fill and two layers of 500-1000 kg filter stone at a 1:25 to 1.0 slope. This service/parking area will provide parking space for up to 70 vehicles. Any remaining dredge material that cannot be utilized in the construction of the service/parking area will be disposed on land at a disposal site suggested by the Contractor, and approved by the Nova Scotia Department of Environment and Labour (NSDEL).

The final phase (Phase III) of the project involves the construction of a marginal wharf connected to the Provincial Ferry wharf. A marginal wharf will be constructed of timber piles tied into the existing Provincial Ferry wharf, and will serve as additional service area for loading and unloading. The marginal wharf will be finished with a concrete deck.

As a component of this assessment, habitat compensation in the form of habitat enhancement/restoration will be conducted.

### Operation Phase

The Environmental Management Plan (EMP) for the Harbour Authority of Tiverton covers operational aspects of environmental management and is the mitigation measure for the environmentally responsible aspects of harbour operation (fuelling, waste disposal, activities on the property and water).

### Decommissioning/Abandonment

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At the time of de-commissioning, DFO-SCH will develop a site specific re-use or reclamation plan that is appropriate for the applicable environmental legislation and DFO policies.

**Time frame**

**Issue A6:** When will the project be carried out? Include the work schedule. Are there possible conflicts with other activities, such as fishing seasons, recreational activities, etc. which impact on the proposed timing? It is important to note that times stated are those for which the final decision is rendered. Any future change in project timing will necessitate a further review by all agencies involved in the original screening.

**Response:** The proposed harbour development project will be a phased construction over four years and is broken down into three phases.

Phase I of the proposed project is the construction of the armourstone breakwater and installation of 7 floating docks. The tentative construction schedule for the armourstone breakwater is a start date of February 2004 and a completion date of August 2004.

Phase II of the proposed project is dredging of the basin (including blasting of Class A material within the basin, installation of remaining floating docks and construction of the service/parking area. This phase will begin during 2005 with completion by March 31, 2006. Dredging of the basin (including blasting of Class A material within the basin) will likely require 1.5 – 2 months to complete.

Phase III of the project involves the construction of a marginal wharf connected to the Provincial Ferry wharf. This phase of construction would begin within the 2006/07 fiscal year (between April 1, 2006 and March 31, 2007) and continue into the 2007/08 fiscal year (between April 1, 2007 and March 31, 2008) or be completed within either fiscal year alone. Construction would be scheduled to avoid sensitive periods within the environment.



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d) Description of the surrounding environment

Description of the natural area

Issue A7: Describe the surrounding environment, outlining environmental sensitive areas, such as special fish and wildlife habitats, as well as conservation areas or areas of special interest, etc. (attach maps or aerial photos if needed). Area Habitat coordinators and federal and provincial environmental officials should be contacted on this issue. Some of the factors which should be considered include:

Physical environment : soil characteristics  
groundwater  
water quality, etc.  
Biological environment : terrestrial vegetation  
aquatic and riparian vegetation  
wildlife  
fish fauna  
marine mammals  
wildlife refuges, conservation areas, etc.

Response: *Physical Environment:*

Information collected by AMEC Earth & Environmental Limited (AMEC) during an Underwater Benthic Habitat Survey and Sediment Sampling Program (refer to **Appendix B** for Final Report: *Underwater Benthic Habitat Survey and Sediment Sampling*, AMEC, August 2003) indicated that the dominant substrate type within the proposed project footprint was a combination of sand and rock, with some bedrock outcrops and larger boulders. The substrate size ranges from 6" to 8" for rocks and 3' to 6' for boulders.

A total of four (4) marine sediment samples were collected by AMEC Earth & Environmental Limited (AMEC) on March 21, 2003. All samples were analyzed by Seatech Limited (Halifax, N.S.) for metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides and grain size. The marine sediment samples collected were compared to the CCME Soil Quality Guidelines, NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments and the Atlantic PIRI Tier A Tables for petroleum hydrocarbons. All samples had metal concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments, with the exception of Boron and Selenium. The sample results of >11 mg/kg for Boron is higher than the CCME Soil Quality Guideline recommended value for 2 mg/kg for Agricultural areas. In addition the sample results of <3 mg/kg for Selenium is higher than the NSDOEL Schedule A recommended values of 0.6mg/kg and 2 mg/kg for Agricultural and Residential/Parkland areas, respectively, and the CCME Soil Quality Guideline recommended values of 1 mg/kg for both Agricultural and Residential/Parkland areas. Reanalysis of the Selenium was conducted at the proper detection limits, and all samples were found to be below the detection limit of 0.3 mg/kg (below all NSDOEL Schedule A and CCME Soil Quality Guidelines for all categories of land disposal). All samples had PAH concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had PCB concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had pesticide concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had petroleum hydrocarbon concentrations below the criteria for meeting Atlantic PIRI Tier 1 Criteria, CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments.



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The consistency of all marine sediment samples analysed is less than 1% gravel, 99% sand and less than 1% clay and silt.

*Biological Environment:*

Tiverton is located on Petit Passage at the eastern tip of Long Island and opposite East Ferry. Petit Passage, 400 to 800 meters wide, separates Long Island from the mainland. Tiverton is directly opposite East Ferry, which is on the western tip of Digby Neck. A ferry runs between the two villages to provide access to Long Island from the mainland.

The mean tidal range at Tiverton is 4.6 meters and the maximum tidal range is about 6.4 meters. The tides are semi-diurnal. Strong tidal currents of 7 knots or more flow through Petit Passage between the Bay of Fundy and Saint Mary's Bay. Petit Passage ranges in depth between about 20 and 59 meters in mid-channel. The bottom consists of a thin layer of fine materials overlying basaltic bedrock.

Tiverton is located within the Atlantic Coast Region, Basalt Peninsula unit theme region of Nova Scotia. The coastal habitat in this area is characterized by rocky shores. The low silt content of coastal waters provides a good substrate for seaweed, including well-developed *Laminaria* beds, and the economically important seaweeds dulce and Irish Moss. Vegetation includes dominant coastal spruce-fir forests, and hardwoods are not found in pure stands.

According to the Atlas of Breeding Birds of the Maritime Provinces (1992) there are between fifty-eight (58) and seventy (70) different bird species in the area.

Marine waters of Petit Passage and farther out into the Bay of Fundy support populations of herring (*Clupea harengus*), cod (*Gadus morhua*), flounder (*Pleuronectes americanus*), mackerel (*Scomber scombrus*), haddock (*Melanogrammus aeglefinus*), silver hake (*Merluccius bilinearis*), rock crab (*Cancer irroratus*) and lobster (*Homarus americanus*). Herring migrate to the Bay of Fundy in the spring where they feed during the summer before moving in the fall to the spawning grounds.

Rainbow smelt (*Osmerus mordax*) migrate to the rivers in April, and similarly, American shad (*Alosa sapidissima*) and Alewife or Gaspereau (*Alosa pseudoharengus*) are believed to migrate very near the coastline from mid May through June before migrating into rivers to spawn. Alewife or Gaspereau emigrate from the rivers by autumn to move offshore.

The results of the Underwater Benthic Habitat Survey (refer to Appendix B for Final Report: *Underwater Benthic Habitat Survey and Sediment Sampling*, AMEC, August 2003) indicated that flora within the proposed breakwater construction footprint include: kelp (*Laminaria digitata* and *Laminaria saccharina*), sea colander (*Agarum cribrosum*), sea lettuce (*Ulva lactuca*), filamentous brown and red macrophytes, patches of rockweed (*Fucus spp.*) and knotted wrack (*Ascophyllum nodosum*). It should be noted that over 10% of the transect areas that were surveyed contained no macrofloral species. The invertebrates encountered within the proposed breakwater footprint include: mussels (*Mytilus edulis*) and green urchins (*Strongylocentrotus droebachiensis*), sea stars (*Asterias spp.*), finger sponge (*Haliclona oculata*), Hermit Crab (*Pagurus spp.*), frilled anemone (*Metridium senile*), barnacles (*Balanus spp.*), and empty scallop shells. It should be noted that over 67% of the transect areas that were surveyed contained no macrofaunal species.

The Atlantic Canada Conservation Data Centre (ACCDC) was requested to provide biological data from a GIS scan of the specified study area. The GIS scan identified no special areas in the vicinity of the study area. Within a 5 kilometer buffer around the study area there were

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records of 9 rare vascular flora including Coast Pepper-Bush (*Clethra alnifolia*), Mountain Avens (*Geum pecki*), Skunk Cabbage (*Symplocarpus foetidus*), Capitata Spikerush (*Eleocharis olivacea*), Golden Crest (*Lophiola aurea*), Hooded Ladies'-Tresses (*Spiranthes romanzoffiana*), Small Bur-Reed (*Sparganium natans*), Cutleaf Grape-Fern (*Botrychium dissectum*), and Curly-Grass Fern (*Schizaea pusilla*), and no records of rare nonvascular flora. There is minimal potential for the proposed project to impact on these terrestrial species due to the limited spatial limits of the on-land portion of the proposed project site. Within a 5 kilometer buffer around the study area there were records of 2 vertebrate fauna including Wood Thrush (*Hylocichla mustelina*) and Rusty Blackbird (*Euphagus carolinus*). Also, with a 5 kilometer buffer around the study area there were records of 4 rare marine mammals including the Atlantic Right Whale (*Eubalaena glacialis*), Fin Whale (*Balaenoptera physalus*), Humpback Whale (*Megaptera novaeangliae*), and Atlantic white-sided dolphins (*Leucopleurus acutus*).

Species at Risk that may occur in the Tiverton area include Barrow's Goldeneye (*Bucephala islandica*) is a species of special concern, Harlequin Duck (*Histrionicus histrionicus*) is a species of special concern, Atlantic Salmon (*Salmo salar*) specifically the inner Bay of Fundy population is an endangered species, Atlantic Cod (*Gadus morhua*) specifically the Maritimes population is a species of special concern, Fin Whale (*Balaenoptera physalus*) is a species of special concern, Humpback Whale (*Megaptera novaeangliae*) is a species of special concern, Atlantic Right Whale (*Eubalaena glacialis*) is an endangered species, and Harbour Porpoise (*Phocoena phocoena*) is a threatened species (website: [www.sararegistry.gc.ca](http://www.sararegistry.gc.ca)).

Consultation with a local tour guide operator provided information on the time when marine mammals are present (pers. com., D. Norwood). Atlantic Right Whale appear in the Tiverton area at the earliest in July and stay until late Fall/early winter (until December 30 at the latest).

Humpback Whale and Fin Whale appear in the Tiverton area mostly during the summer, however they usually stay away from the shallow water. Atlantic Salmon migrate to the rivers in the spring (April) and emigrate by autumn to move offshore. Atlantic Cod are caught usually in deeper water. Harbour porpoises tend to stay in the Tiverton area year-round, however they are observed less frequently in the winter time.

References:

AMEC Earth & Environmental Limited (AMEC). *Final Report: Underwater Benthic Habitat Survey and Sediment Sampling – Tiverton, Digby County, NS.* August 2003.

Davis, Derek S. and Sue Browne (1997), *Natural History of Nova Scotia Vol 2, Theme Regions*, Nova Scotia Museum, <http://museum.gov.ns.ca/mnh/nature/nhns2/intronew.htm>.

Erskine, Anthony J. *Atlas of Breeding Birds of the Maritime Provinces*, 1992.

Gerriets, Stefen. *Atlantic Canada Conservation Data Centre (ACCDC) data*, March 2003

Norwood, Dan - Cetacean Boat Tours Limited, Tour Guide, 902-247-1976

Outhouse, Wayne - Harbour Authority of Tiverton, President, 902-839-2781

Species at Risk Public Act (SARA) Public Registry website: <http://www.sararegistry.gc.ca/>



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Description of the human environment

Issue A8: Describe human activities and facilities in and around the area under review. Some of the factors which should be considered include:

Land uses and planning	Heritage sites
Noise	Aesthetics
Hunting / fishing grounds and activities	Drinkable water
Recreational activities	Economic activities
Provincial/Municipal zoning	

Response: The existing harbour facilities at Tiverton include one public wharf. The harbour serves approximately 15 users, all of which are primarily commercial users. There is minimal recreational use at this harbour.

Commercial fisheries at Tiverton include:

- lobster which is trapped from the last Monday in November to the end of May;
- Groundfish are fished year round (3 vessels);
- herring are fished with the season opening in September (1 vessel);
- Sea Urchins are harvested during the winter months (2 vessels); and
- Rock crab are fished over the summer months (1 vessel).

Lobster is stored in lobster cars from the end of November up to the end of June at the existing Tiverton SCH facility (Fishermen's Wharf) with minimal lobster held past December. The four lobster cars are located south of the existing SCH wharf, approximately 350 meters from the project site (pers. com., W. Outhouse). There are no fish processing plants located at the harbour and no water intakes or water sources that could be affected by the project. There are no aquaculture sites at or near the facility. The closest site is located approximately 10 kilometers from the facility.

There are no other known human activities at the work site. Noise caused by this project is expected to be similar to noise levels when the wharf is operating at the peak of the commercial fishing season. Work is to be carried out during times acceptable to the local authorities who will mitigate any disturbance to harbour users and nearby residents. The harbour development project will not affect the aesthetics of the wharf area, however, it will provide safe navigational conditions within the harbour.

The potential disturbances associated with this project would be short-term in nature and create minimal disturbances to any nearby facilities with mitigative measures in place. Noise associated with this project is expected to cause minimal disruption due to the scheduled timing of the project. There are no heritage sites associated with the spatial scope of the project and no nearby hunting grounds.

References:

Outhouse, Wayne - Harbour Authority of Tiverton, President, 902-839-2781



## **PART B ENVIRONMENTAL ASSESSMENT OF THE PROJECT**

This environmental assessment considers the full range of project/environmental interactions and the environmental factors that could be affected by the project as defined above and the significance of related impacts with mitigation. Included in the considerations are land, air and water resources, the socio-economic environment, and the cumulative effects of the project in relation to existing or anticipated projects. Potential project/environment interactions are included in **Appendix C**. Upset conditions are also included.

For the purpose of this screening the spatial bounds of the project have been limited to the project site and the immediate surrounding area. The temporal bounds include the full life cycle of the project including construction, operation, decommissioning and abandonment.

### **a) Construction / Demolition**

#### **Drainage modifications**

Issue B1: Describe the source, nature, and duration of any drainage modifications (flooding, drying) which can be expected to occur. If applicable, describe the measures to be implemented to mitigate or compensate these modifications. Describe any long term changes to drainage patterns which might occur as a result of the completion of this project.

Response: No drainage modifications will result from this project.

#### **Erosion and sedimentation**

Issue B2: Determine the potential for an increase of soil erosion; describe the source, nature of material and expected quantity as well as duration of the disturbance. Describe changes in the sedimentation patterns and volumes to be expected during and after the completion of the project; state whether erosion and sedimentation control structures should be implemented.

Response: No disturbance of terrestrial soils or increase in soil erosion is expected. The proposed work does not involve any excavation or disturbance of soils.

#### **Disruption of terrestrial environment – vegetation**

Issue B3: Describe any impacts on terrestrial vegetation resulting from the project. Describe location, type, value and status of affected vegetation. Indicate if endangered or rare species could be affected. State if mitigation or revegetation is planned and describe the proposed program. If there are any long term effects resulting from the project, they should be outlined here.

Response: The proposed project to be carried out at the site will have minimal effects on the terrestrial vegetation due to the physical boundaries of the project area (i.e., limited terrestrial area) and the mitigation measures which will be in place.

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**Disruption of terrestrial environment – wildlife**

**Issue B4:** Describe any impacts on wildlife resulting from the disturbance of terrestrial habitats. Describe potential impacts, taking into account the habitats and their utilization (physical and biological characteristics, function, etc.), as well as the animal populations (status, numbers, etc.). Discuss any special characteristics: habitat rarity, presence of rare or endangered species, periods or areas of intensive use, migration patterns, etc. Describe the proposed impacts on these resources in the long term after the completion of the project and any measures which will be taken to minimize or eliminate the impact. Environment Canada officials should be contacted on this issue.

**Response:** If construction activities require contractor's employees to access the site by water, only main channels should be used. Concentrations of seabirds or waterfowl should not be approached when anchoring equipment, accessing wharves or ferrying supplies. All vessels and machinery should be well muffled. Proponents and contractors are to ensure that food scraps and garbage are not left at the site.

The proposed project to be carried out at the site will have minimal effects on the terrestrial wildlife due to the physical boundaries of the project area (i.e., limited terrestrial area) and the mitigation measures outlined in the site and project specific EPP (refer to **Appendix E**). **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

**Contaminated soils**

**Issue B5:** Indicate previous uses of the site for industrial or storage purposes which could have generated contaminated soils; describe the soils, and identify potential environmental impacts that could result during construction or demolition activities (for example, excavation of contaminated material). If applicable, describe the measures to be implemented to mitigate these impacts. Will there be any contaminated soils generated by the project or resulting from long term effects of the project? How will these be handled?

**Response:** No contaminated soil is expected on site due to no indication of past use that could contribute to the generation of contaminated soils. There are no construction activities proposed that could identify potential environmental impacts. There is no excavation or disturbance of soil planned or anticipated.

**Hazard lands**

**Issue B6:** If hazard lands (landslide for instance) are present, describe any relevant impact of the project or associated construction activity. Will any hazard lands be established as a result of the project?

**Response:** The work site (i.e., waterlot) is not considered hazard lands, nor is it near any hazard lands. In addition, no hazard lands are present nor will be established as a result of this project.



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**On-shore excavation and landfill**

Issue B7: Describe any excavation and landfill operations which would affect the on-shore area. If landfill is proposed, describe source, type and volume, area to be filled and confirm that fill source is free of toxic contaminants or floating debris. State whether the fill operations will encroach on wetland habitats or on fish habitats (spawning, nursery sites, etc.) and describe mitigation or compensation measures, if appropriate. What long term effects, if any, are anticipated which might impact the on-shore area? The Area Habitat Coordinator should be contacted on this issue.

Response: No excavation or landfill operations are planned at the site.

**Wetlands alteration**

Issue B8: If alteration of wetlands or drainage systems is expected, outline the area to be affected and describe how wetland will be altered. Describe the affected wetland environment (type, size and value), duration and location of the impact. Describe potential impacts on the wildlife in the affected area as well as mitigation or compensation measures to be implemented both during the project and in the long term after the completion of the work. The Area Habitat Coordinator should be contacted on this issue.

Response: There are no wetlands or drainage systems within the footprint of the project. Therefore no immediate or long-term effects are predicted for this project.

**Alteration of bottom substrate**

Issue B9: Indicate if pile driving or excavation activity (other than dredging, described in B25-42) may cause disruption of the ocean/harbour bottom substrate. Describe the area that will be disrupted. Describe expected turbidity and sedimentation and outline the extent of the affected area. Describe any sensitive areas (spawning site, nursery, staging, fishing areas, aquaculture, water intakes, etc.) which may be affected by these operations and describe potential impacts. The Area Habitat Coordinator should be contacted on this issue.

Response: The proposed harbour development project will result in the disruption of the ocean/harbour bottom substrate in the area of the proposed dredge area (total dredge area is 5213.8 m<sup>2</sup>), the construction of the breakwater structure (10,981.2 m<sup>2</sup>), and service/parking area (4250.0 m<sup>2</sup>).

Information collected by AMEC Earth & Environmental Limited (AMEC) during an Underwater Benthic Habitat Survey and Sediment Sampling Program (refer to **Appendix B** for Final Report: *Underwater Benthic Habitat Survey and Sediment Sampling*, AMEC, August 2003) describes the area to be disrupted. The results of the Benthic Habitat Survey indicated that flora within the proposed breakwater construction footprint include: kelp (*Laminaria digitata* and *Laminaria saccharina*), sea colander (*Agarum cribrosum*), sea lettuce (*Ulva lactuca*), filamentous brown and red macrophytes, patches of rockweed (*Fucus spp.*) and knotted wrack (*Ascophyllum nodosum*). It should be noted that over 10% of the transect areas that were surveyed contained no macrofloral species. The invertebrates encountered within the proposed breakwater footprint include: mussels (*Mytilus edulis*) and green urchins (*Strongylocentrotus droebachiensis*), sea stars (*Asterias spp.*), finger sponge (*Haliciona oculata*), Hermit Crab (*Pagurus spp.*), frilled anemone (*Metridium senile*), barnacles (*Balanus spp.*), and empty scallop shells. It should be noted that over 67% of the transect areas that were surveyed contained no macrofaunal species.



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DFO-HMD, Area Habitat Co-ordinator, Thomas Wheaton has determined that this project will result in a HADD to fish habitat requiring an Authorization under Section 35(2) of the Fisheries Act. To offset the reduction in production capacity of the watercourse lost as a consequence of the construction, compensation for the permanently lost habitat at a maximum 3:1 ratio will be required. A compensation plan is to be developed as stated in the Letter of Intent between DFO-Small Craft Harbours and DFO-Habitat Management Division. A copy of the Letter of Intent is provided in **Appendix F** as mitigation for this component.

**Disruption of aquatic environment - effects on aquatic vegetation**

Issue B10: Describe project impacts on aquatic vegetation (removal, burying, effects on sedimentation patterns, etc.). If appropriate, describe the mitigation or compensation measures to be implemented. Also describe any long term effects which might develop after the completion of the work. The Area Habitat Coordinator should be contacted on this issue.

Response: The proposed harbour development project will result in the disruption of the ocean/harbour bottom substrate in the area of the proposed dredge area (total dredge area is 5213.8 m<sup>2</sup>), the construction of the breakwater structure (10,981.2 m<sup>2</sup>), and service/parking area (4250.0 m<sup>2</sup>).

Information collected by AMEC Earth & Environmental Limited (AMEC) during an Underwater Benthic Habitat Survey and Sediment Sampling Program (refer to **Appendix B** for Final Report: *Underwater Benthic Habitat Survey and Sediment Sampling*, AMEC, August 2003) describes the area to be disrupted. The results of the Benthic Habitat Survey indicated that flora within the proposed breakwater construction footprint include: kelp (*Laminaria digitata* and *Laminaria saccharina*), sea colander (*Agarum cribrosum*), sea lettuce (*Ulva lactuca*), filamentous brown and red macrophytes, patches of rockweed (*Fucus spp.*) and knotted wrack (*Ascophyllum nodosum*). It should be noted that over 10% of the transect areas that were surveyed contained no macrofloral species.

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**Disruption of aquatic environment - effects on fauna**

Issue B11: Describe potential impacts of the project on fish populations and habitat, and on any other animal group (sea mammals, benthic fauna, etc.). Identify the causes and the extent of the impacts in both the short and long term after the completion of the work. If appropriate, describe the mitigation or compensation measures. The Area Habitat Coordinator should be contacted on this issue.

Response: The proposed harbour development project will result in the disruption of the ocean/harbour bottom substrate in the area of the proposed dredge area (total dredge area is 5213.8 m<sup>2</sup>), the construction of the breakwater structure (10,981.2 m<sup>2</sup>), and service/parking area (4250.0 m<sup>2</sup>).

Information collected by AMEC Earth & Environmental Limited (AMEC) during an Underwater Benthic Habitat Survey and Sediment Sampling Program (refer to **Appendix B** for Final Report:

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*Underwater Benthic Habitat Survey and Sediment Sampling*, AMEC, August 2003) describes the area to be disrupted. The invertebrates encountered within the proposed breakwater footprint include: mussels (*Mytilus edulis*) and green urchins (*Strongylocentrotus droebachiensis*), sea stars (*Asterias spp.*), finger sponge (*Haliclona oculata*), Hermit Crab (*Pagurus spp.*), frilled anemone (*Metridium senile*), barnacles (*Balanus spp.*), and empty scallop shells. It should be noted that over 67% of the transect areas that were surveyed contained no macrofaunal species.

DFO-HMD, Area Habitat Co-ordinator, Thomas Wheaton has determined that this project will result in a HADD to fish habitat requiring an Authorization under Section 35(2) of the Fisheries Act. To offset the reduction in production capacity of the watercourse lost as a consequence of the construction, compensation for the permanently lost habitat at a maximum 3:1 ratio will be required. A compensation plan is to be developed as stated in the Letter of Intent between DFO-Small Craft Harbours and DFO-Habitat Management Division. A copy of the Letter of Intent is provided in **Appendix F** as mitigation for this component.

The proposed harbour development (breakwater, floating dock construction and dredging) has the potential for causing disturbance in the aquatic environment (increased turbidity and sedimentation). Due to the nature of the material to be dredged (the consistency of all marine sediment samples analysed is less than 1% gravel, 99% sand and less than 1% clay and silt), visual monitoring of the turbidity in the vicinity of the work is sufficient. If excessive change occurs in the turbidity beyond 100 meters (m) of the dredge limits that differs from the existing conditions of the surrounding water bodies (i.e., distinct color difference) as a result of the dredging activities, the work will stop and Mr. Thomas Wheaton, DFO-HMD, will be contacted at (902) 527-5596 to determine if additional mitigation measures are required (these measures may include changes in production rates, or timing according to tidal cycle).

Potential impacts from increased water velocity on pelagic fish and/or larval stages is predicted to be minimal considering any change in water velocity is anticipated to result in negligible overall impact on Petit Passage (with the exception of localized eddying in the vicinity of the new harbour entrance).

A potential exists for leaks and spills of petroleum products from construction equipment during the harbour development project. Adherence to environmental practices for fuelling and equipment maintenance on the part of the contractor will be necessary to reduce the potential for impacts. Refueling must be done at least 30 m away from any water body. Equipment will be monitored for leaks on a regular basis.

Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** for additional information and mitigation measures for this component.

**Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.



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**Construction traffic**

Issue B12: Identify modes of transport for construction and waste material during construction (debris, excavation material, etc. except dredging spoil, described in B39). Indicate access roads and routes to be used. Describe potential impacts due to speed, spillage, traffic congestion. Will there be any long term changes to access routes developed as a result of the work, will there be an increase in traffic flow which could affect residential areas (noise, resident's safety, etc.). Describe the mitigation measures to be implemented.

Response: Materials and equipment will be brought to and from the site by barge. There will be no long-term effect on traffic after construction. Access routes will not be modified. No mitigation is planned. The proponent is to monitor the movement of material to the site, and ensure that proper signage and safety is maintained.

A site and project specific EPP is provided in **Appendix E** as mitigation for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

**Noise**

Issue B13: Describe sources of noise during construction. Indicate expected timing and duration of noise as well as details regarding the sources (such as excavator, truck, pile driver, blasting, drilling, etc.). Describe current noise environment, and whether it is likely to generate social concerns (residential areas) or impacts on wildlife (terrestrial or marine mammals, birds). Will there be any increased levels of noise to be expected after the completion of the project. If necessary, describe the mitigation measures to be implemented.

Response: The noise levels will be consistent with the normal operation of a commercial fishing harbour and therefore the effects on terrestrial/marine fauna will be minimal with the exception of proposed drilling and/or blasting in Phase II. If drilling and/or blasting are required, DFO-HMD must be contacted prior to commencing the work (i.e., Mr. Thomas Wheaton (902) 527-5596). With the contingency and mitigation measures in place minimal environmental effects are predicted with regard to noise levels as a result of the proposed project.

In addition, as a result of the proposed project there will be no increase in noise levels after the completion. The contingency and mitigations measures are outlined in the site and project specific EPP provided in **Appendix E** as mitigation for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

**Use of explosives**

Issue B14: Are there plans to use explosives for construction or demolition below the water level? Describe the extent and duration of any blasting activities and indicate if damage to aquatic organisms (fishes or sea mammals) is expected. Describe the mitigation measures to be implemented. The Area Habitat Coordinator must be contacted on this issue.

Response: Depending on funding, dredging or blasting of Class A material (rock) within the new basin (proposed to be conducted in Phase II) may be started in this phase. If rock is blasted in Phase I, the rock will be used in construction of the breakwater. Phase II of the proposed project is



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dredging of the basin (including blasting of Class A material within the basin), the installation of remaining floating docks and construction of the service/parking area. This phase will begin during 2005 with completion by March 31, 2006. Dredging of the basin (including blasting of Class A material within the basin) will likely require 1.5 – 2 months to complete. The anticipated dredge volume is approximately 10,000 cubic meters. Approximately 6000 cubic meters of the total dredge volume is anticipated to be Class A material (rock) and approximately 4000 cubic meters is anticipated to be Class B material. Dredging of the new basin will consist of blasting of bedrock bottom to attain desired dredge depth. The dredge material will be used to form the proposed service/parking area.

Blasting will not be permitted from July until late December when Atlantic Right Whale and other species at risk (identified in Issue A7) are present in the Tiverton area. Blasting will only be conducted from January through to the end of June.

Other requirements include:

- A predictive analysis of the proposed blast will be conducted to assess the zone of influence of blasting activities;
- Fish and mammals will be scared from the blasting area (i.e. by boat or pre-blasting caps);
- Shock wave padding (bubble curtain or air curtain) will be installed to minimize the transmission of the blast through the water;
- All temporary magazines for explosive storage will have a Temporary Magazine License;
- If explosives are to be stored on-site, explosives and blasting caps will be stored in separate magazines on-site; and
- Blasting activities will be done in a manner that ensures that the number and magnitude of explosions are limited to which is absolutely necessary.

DFO-HMD must be contacted prior to commencing blasting activities (i.e., Mr. Thomas Wheaton (902) 527-5596). All blasting activities will be conducted in accordance with the recommendations stated in the document "FACTSHEET Blasting- Fish and Fish Habitat Protection" and the blasting plan entitled Archibald Drilling and Blasting (1986) Ltd. submitted to and approved by DFO-HMD on February 3, 2004 (**Appendix G**). If changes to the blasting plan are required, they will be subject to a proper review by PWGSC and DFO-HMD. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

### **Solid waste disposal**

Issue B15: Indicate how the waste material (construction or demolition debris, material from temporary structures or roads, etc.) resulting from this work proposal will be disposed of. Will there be any long term changes to the present disposal of waste material after completion of the project? Describe impacts and proposed mitigation measures. (Note that disposal of dredged spoil should be described in B33-37 or B38-42, as required.)

Response: All waste material will be disposed of in a Provincially approved manner. There is no anticipated creosote timber waste as a result of this project. Any material lost as a result of wave or storm action is to be immediately recovered by the operator when safe to do so.

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**Wastewater disposal**

Issue B16: Identify any inflow of untreated wastewater to any natural body of water, resulting from construction or demolition activities. Will there be any long term effects after completion of the work? Describe impacts on water quality, aquatic habitats, fishery resources, human activities and facilities. Indicate if mitigation measures are planned. (Note that the assessment of the impact related to the discharge of wastewater into an existing sewage system is not required.

Response: There will be no inflow of untreated wastewater to any natural body of water resulting from the project.

**Toxic spill hazard**

Issue B17: Describe any potential hazard for spills of toxic materials which will be used or stored at the construction site or demolition site as well as any changes in the quantity or type of toxic materials which will be stored as a result of this project being completed. Identify the substances, where and how they will be used, stored and disposed of, as well as duration on site. Also state the safety measures and emergency plan to be implemented in case of a spill.

Response: Any equipment working in or over the marine environment is to be free from leaking hydrocarbon based fluids and/or lubricants harmful to the environment. Hoses and tanks are to be inspected on a regular basis to prevent fractures and breaks on or near the marine environment. Contractors involved in the dredging operations are to have an emergency response plan for fuel leaks and petroleum contamination, and are to have on hand for immediate deployment an emergency spill response kit, (i.e., synthetic sorbents including oleophilic and hydrophobic pads and containment booms) with the knowledge and ability to respond to any terrestrial and/or marine environmental spills.

Also, the Contractor is to have on hand the emergency phone numbers and contacts, so as to alert the proper authorities of possible contamination of the harbour should a spill occur. The contractor must report any degree of fuel spill or pollution of the marine or terrestrial environment immediately to the Canadian Coast Guard (CCG) at 1-800-565-1633.

Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** for additional information and mitigation measures for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

**Disturbance of harbour operations and navigation**

Issue B18: If the construction or demolition activities affect the navigable waters and/or navigation, describe the current use of these navigable waters (harbour activities, commercial navigation, fishery activities, aquaculture, lobster units, ships operations, etc.) and the expected impacts. Will there be any effects on the navigation of harbour users in the long term, resulting from this project? If applicable, describe the proposed mitigation measures. An application under NWPA will most likely be required.



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Response: The construction activity associated with the proposed harbour development (breakwater, floating dock construction and dredging) will not affect harbour operations since the proposed basin is a new area adjacent to a Provincial Ferry wharf. The proposed breakwater will be identified by the proper navigational aids as stated in the requested "Letter of Navigational Advice" which will be finalized in the *Navigable Waters Protection Act* approval. All work must follow *Canada Shipping Act Regulations*.

The Nova Scotia Department of Transportation ferry runs obliquely across the passage, and its trajectory takes it away from the proposed harbour entrance. Any eddying associated with the new breakwater is expected to be sufficiently localized so as not to impinge on the ferry path. In fact, currents in the vessel's approach to the existing Tiverton berth may lessen due to the added sheltering effect of the breakwater, and frictional losses due to its rough surface (pers. com., P. Davison).

The Contractor is to ensure that the Provincially subsidized ferry service has access to a portion of the wharf area at all times regardless of the construction activity. A Navigable Waters Protection Application (NWPA) has been filed with DFO-CCG. Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** for additional information and mitigation measures for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEEA screening.

#### Disturbance of recreational activities

Issue B19: If the construction or demolition activities interfere with recreational activities (boating, fishing from boat, wharf or shore, hunting, bird watching, whale watching, etc.), describe the expected impacts as well as the measures to be implemented to mitigate these impacts. Will there be any long term impacts on these activities as well? If so, what mitigation measures will be followed?

Response: There are minimal recreational users at Tiverton. It will be the responsibility of the contractor to coordinate with the Harbour Authority during the course of the project. There will be no immediate/long term effects for this project if mitigation measures outlined in the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** are followed. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEEA screening.

#### Heritage site or Native Lands disruption

Issue B20: Indicate whether the project proposal may impact on existing sites of historical significance such as heritage buildings, archeological sites, traditional hunting and fishing grounds or any important natural heritage areas in both the short and long term. Describe these sites and the contingency measures to be implemented whenever an archeological site is discovered. Contact with native groups which may be concerned with the proposal is strongly recommended.

Response: There are no known sites of historical importance such as heritage buildings, archaeological sites, traditional hunting and fishing grounds or any important natural heritage areas at the project site.



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**Disturbance of commercial Activities**

Issue B21: Indicate whether the project may directly or indirectly disrupt commercial activities such as fish buying on the wharf. Describe potential impacts in both the short and long term and mitigation measures, if appropriate.

Response: Commercial fisheries at Tiverton include:

- lobster which is trapped from the last Monday in November to the end of May;
- Groundfish are fished year round (3 vessels);
- herring are fished with the season opening in September (1 vessel);
- Sea Urchins are harvested during the winter months (2 vessels); and
- Rock crab are fished over the summer months (1 vessel).

Lobster is stored in lobster cars from the end of November up to the end of June at the existing Tiverton SCH facility (Fishermen's Wharf) with minimal lobster held past December. The four lobster cars are located south of the existing SCH wharf, approximately 350 meters from the proposed project site (pers. com., W. Outhouse). The proposed project is not expected to affect the storage of lobster considering the distance from the project site and the two existing structures (the Provincial Ferry wharf and the existing SCH facility) extending out into the waters of Petit Passage and acting as physical barriers between the project site and the stored lobster location. There are no fish processing plants located at the harbour and no water intakes or water sources that could be affected by the project. There are no aquaculture sites at or near the facility. The closest site is located approximately 10 kilometers from the facility.

The construction activity associated with the proposed harbour development will not affect harbour operations since the proposed basin is a new area adjacent to a Provincial Ferry wharf located between the existing Small Craft Harbour and the proposed project site.

Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** for additional information and mitigation measures for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEEA screening.

**Effects On Economic Growth**

Issue B22: Outline potential for increased business opportunities in the area which may result in tourist trade, servicing of boats, retail, etc. If there are any possible negative impacts on business opportunities, they should be mentioned here.

Response: There is potential for increase in business opportunities in the area, such as increased tourist trade, servicing of boats, retails, etc. Also, the improved infrastructure will make the harbour facilities more accessible, increase the overall safety of the harbour, and improve the berthing facilities.

### Local Aesthetics

Issue B23: Indicate whether the aesthetics of the area will be affected by the proposed project in either the short or long term and describe mitigation measures, if appropriate.

Response: No significant impacts on local aesthetics are expected. It is expected that during the construction operations that some aesthetic resources will be affected. It is imperative to acknowledge that these are short-term. Short-term impacts may include:

- dust (i.e., short to long-term impacts, mitigable with calcium chloride, dust screens, water spray on source, or by covering the source of dust with sandstone or hydro seed tack); and,
- spillage of fill on driving surfaces (i.e., temporary, and requires immediate clean up).

### Other Factors

Issue B24: Describe any other impact that may result from the proposed construction / demolition activities and the long term effects of the work after completion. Describe the proposed mitigation measures.

Response: According to Paul Davison (Senior Coastal Engineer, PWGSC) the maximum tidal current is in the most constricted part of Petit Passage, which is south of the proposed project site. The proposed work is located in relatively shallow water in the wider portion of the strait. The *Petit Passage Tide and Current Survey* by Seibert and Reddy (1966) indicates that the main flood and ebb flows are confined to the deeper portions of the channel, and do not extend all the way in to the shorelines. Instead, there are two shear lines on either side of the flow jet, varying from 10m to 200 m offshore. The water on the shoreward side of the shear lines actually flows counter to the main flow in a series of eddies. The proposed harbour is located in the part of Petit Passage where this reverse flow zone is at its widest. The new breakwater will not extend sufficiently far from shore to disrupt this flow pattern. The overall impact on Petit Passage will be negligible because the main flow is not being constricted any more than it is now. There will be localized eddying in the vicinity of the new harbour entrance around the times of mid-tide, not exceeding 3 knots (as per data for gauge location 4 in Seibert and Reddy, 1966). This is already occurring at the ends of existing wharves in the Passage, and the harbour users are prepared to deal with them (pers. com., P. Davison).

There are no other predicted effects that may result from the proposed construction activities. The Contractor will be responsible for acquiring the appropriate Provincial permits prior to the commencement of work.

## b) Dredging (capital dredging and maintenance)

### Past dredging activities

Issue B25: Describe past dredging activities at the site : periodicity, volumes, material characteristics, past test results, environmental features, etc

Response: The proposed dredge area includes new capital dredging only since the area to be dredged is the site of a new harbour. The material to be dredged is predominantly of sand composition (all marine sediment samples analysed had composition of less than 1% gravel, 99% sand and less than 1% clay and silt).



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Characteristics of the material

Issue B26: Describe the characteristics of the sediment and the contamination level (heavy metals, PCB's, PAH's, pesticides, etc.). Indicate the methods used for sediment quality assessment (location, sampling design, sample number, etc.).

Response: Information collected by AMEC Earth & Environmental Limited (AMEC) during an Underwater Benthic Habitat Survey and Sediment Sampling Program (refer to **Appendix B** for Final Report: *Underwater Benthic Habitat Survey and Sediment Sampling*, AMEC, August 2003) indicated that the dominant substrate type within the proposed project footprint was a combination of sand and rock, with some bedrock outcrops and larger boulders. The substrate size ranges from 6" to 8" for rocks and 3' to 6' for boulders.

A total of four (4) marine sediment samples were collected by AMEC Earth & Environmental Limited (AMEC) on March 21, 2003. All samples were analyzed by Seatech Limited (Halifax, N.S.) for metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides and grain size. The marine sediment samples collected were compared to the CCME Soil Quality Guidelines, NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments and the Atlantic PIRI Tier A Tables for petroleum hydrocarbons. All samples had metal concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments, with the exception of Boron and Selenium. The sample results of >11 mg/kg for Boron is higher than the CCME Soil Quality Guideline recommended value for 2 mg/kg for Agricultural areas. In addition the sample results of <3 mg/kg for Selenium is higher than the NSDOEL Schedule A recommended values of 0.6mg/kg and 2 mg/kg for Agricultural and Residential/Parkland areas, respectively, and the CCME Soil Quality Guideline recommended values of 1 mg/kg for both Agricultural and Residential/Parkland areas. Reanalysis of the Selenium was conducted at the proper detection limits, and all samples were found to be below the detection limit of 0.3 mg/kg (below all NSDOEL Schedule A and CCME Soil Quality Guidelines for all categories of land disposal). All samples had PAH concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had PCB concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had pesticide concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had petroleum hydrocarbon concentrations below the criteria for meeting Atlantic PIRI Tier 1 Criteria, CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments.

The consistency of all marine sediment samples analysed is less than 1% gravel, 99% sand and less than 1% clay and silt.



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Turbidity and sedimentation

Issue B27: Describe expected turbidity and sedimentation both during and after completion of the work and outline the extent of affected area.

Response: The proposed harbour development (breakwater, floating dock, dredging and service area) has the potential for causing disturbance in the aquatic environment (increased turbidity and sedimentation). Due to the nature of the material to be dredged (the consistency of all marine sediment samples analysed is less than 1% gravel, 99% sand and less than 1% clay and silt), visual monitoring of the turbidity in the vicinity of the work is sufficient. If excessive change occurs in the turbidity beyond 100 meters (m) of the dredge limits that differs from the existing conditions of the surrounding water bodies (i.e., distinct color difference) as a result of the dredging activities, the work will stop and Mr. Thomas Wheaton, DFO-HMD, will be contacted at (902) 527-5596 to determine if additional mitigation measures are required (these measures may include changes in production rates, or timing according to tidal cycle).

There are minimal predicted negative effects from turbidity and sedimentation during this project if all environmental mitigative measures, identified above and outlined in the site and project specific EPP provided in **Appendix E**, are put in place. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

Toxic element release

Issue B28: Indicate whether unusually high levels of contaminants such as heavy metals, PCB's, PAH's etc. will be released in the water column and in which form (dissolved, adsorbed on particulate matter) as a result of the bottom disruption. How does this compare with the levels usually observed in the area ?

Response: Information collected by AMEC Earth & Environmental Limited (AMEC) during an Underwater Benthic Habitat Survey and Sediment Sampling Program (refer to **Appendix B** for Final Report: *Underwater Benthic Habitat Survey and Sediment Sampling*, AMEC, August 2003) indicated that the dominant substrate type within the proposed project footprint was a combination of sand and rock, with some bedrock outcrops and larger boulders. The substrate size ranges from 6" to 8" for rocks and 3' to 6' for boulders.

A total of four (4) marine sediment samples were collected by AMEC Earth & Environmental Limited (AMEC) on March 21, 2003. All samples were analyzed by Seatech Limited (Halifax, N.S.) for metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides and grain size. The marine sediment samples collected were compared to the CCME Soil Quality Guidelines, NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments and the Atlantic PIRI Tier A Tables for petroleum hydrocarbons. All samples had metal concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments, with the exception of Boron and Selenium. The sample results of >11 mg/kg for Boron is higher than the CCME Soil Quality Guideline recommended value for 2 mg/kg for Agricultural areas. In addition the sample results of <3 mg/kg for Selenium is higher than the NSDOEL Schedule A recommended values of 0.6mg/kg and 2 mg/kg for Agricultural and Residential/Parkland areas, respectively, and the CCME Soil Quality Guideline recommended values of 1 mg/kg for both Agricultural and Residential/Parkland areas. Reanalysis of the Selenium was conducted at the proper detection limits, and all samples were found to be below the detection limit of 0.3 mg/kg (below all NSDOEL Schedule A and CCME Soil Quality Guidelines for all categories of land

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disposal). All samples had PAH concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had PCB concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had pesticide concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments. All samples had petroleum hydrocarbon concentrations below the criteria for meeting Atlantic PIRI Tier 1 Criteria, CCME Interim Soil Quality Guidelines and NSDOEL Schedule A Guidelines for Land Based Disposal of Marine Sediments.

**Biological impacts**

Issue B29: Describe any sensitive area or animal population (spawning site, nursery, rearing sites, marine mammals) which may be affected by the dredging operations and describe potential impacts and proposed mitigation measures (seasonal restrictions, alternative dredging procedures, etc).

Response: The proposed harbour development (breakwater, floating dock, dredging and service area) has the potential for causing disturbance in the aquatic environment (increased turbidity and sedimentation). Due to the nature of the material to be dredged (the consistency of all marine sediment samples analysed is less than 1% gravel, 99% sand and less than 1% clay and silt), visual monitoring of the turbidity in the vicinity of the work is sufficient. If excessive change occurs in the turbidity beyond 100 meters (m) of the dredge limits that differs from the existing conditions of the surrounding water bodies (i.e., distinct color difference) as a result of the dredging activities, the work will stop and Mr. Thomas Wheaton, DFO-HMD, will be contacted at (902) 527-5596 to determine if additional mitigation measures are required (these measures may include changes in production rates, or timing according to tidal cycle).

In addition, non-native and invasive species may be unintentionally introduced into a marine environment via various marine construction and improvement projects. The non-native and invasive species have the potential to alter the native ecosystems and have negative impacts on the commercial fishing and aquaculture industries. Some of the potential pathways for spreading these species are, but not limited to the following:

- Species or their water borne larvae travel in bilge and ballast water of various marine construction equipment (i.e. barges, scows, etc.);
- Marine sediments remaining in excavation equipment, barges or trucks; and,
- Species could be attached or be carried in the bottom/hull of various boats or barges.

To mitigate against non-native and invasive species the following environmental protection procedures will be followed:

- All dredging equipment including excavators/cranes, floating plant, scows, barges and work boats are to be free of all marine growth prior to mobilization to the site;
- The Contractor will make all equipment available for inspection by PWGSC and any growth identified is to be completely removed from the equipment in an environmentally acceptable manner;
- The Contractor is to coordinate removal and cleaning operations to ensure they abide by all requirements of the Federal Dept of Environment and the DFO-HMD; and,

The Contractor is to make all necessary enquiries during the preparation of the tender in order to ensure that all costs associated with the above requirements are included in the bid price.



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Note: Mr. Thomas Wheaton, DFO-HMD, (902) 527-5596 must be contacted at least 48 hours prior to the commencement of dredging for the proposed project.

Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** for additional information and mitigation measures for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

**Impacts on human activities and facilities**

Issue B30: Describe any sensitive area and activity (aquaculture, water intake, lobster holding units, ship operations, protected areas for scientific or conservation purposes, etc.) which may be affected by the dredging activities in either the short or long term and describe potential impacts. Indicate whether mitigation measures are planned (schedule to ensure resident quietness, seasonal restrictions, etc.).

Response: Lobster is stored in lobster cars from the end of November up to the end of June at the existing Tiverton SCH facility. Both individual fishermen and fishermen's groups (such as co-ops and unions) store lobsters in this manner. There are no fish processing plants located at the harbour and no water intakes or water sources that could be affected by the project. There are no aquaculture sites at or near the facility. The closest site is located approximately 10 kilometers from the facility.

Human activities near the dredging area are mostly related to the commercial fishery with minimal recreational activities. There are minimal predicted potential negative effects due to this project with the mitigation measures outlined in the site and project specific EPP provided in **Appendix E**. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

**Future dredging**

Issue B31: If possible, predict future maintenance dredging activities.

Response: The proposed project is mainly a capital project to allow for the construction of a new harbour development. Future maintenance dredging is anticipated to be minimal considering the strong currents and deep water in the Tiverton area. No short-term future (within 4 years) or long-term future (beyond 4 years) dredging is planned beyond the now proposed area.

**Other**

Issue B32: Describe any other impact that may occur or any other mitigation measure with regards to dredging activities.

Response: Accidental fuel leaks from dredging equipment working and construction equipment have the potential to cause fuel spills in the water and within the harbour. Also, hydraulic hose fractures can spill significant quantities of fluids in a short period of time. Refuelling of vessels on or near the water has the potential to cause spills.

Any equipment working in or over the marine environment is to be free from leaking petroleum fluids or lubricants harmful to the environment. Hoses and tanks are to be inspected on a

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regular basis to prevent fractures and breaks on or near the marine environment. Refueling must be done at least 30 m away from any water body. Basic petroleum spill clean-up equipment, including a 250 L oil spill cleanup kit, must be on site during the entire length of the project. All spills or leaks should be promptly contained, cleaned up and reported to the 24-hour environmental emergencies reporting system (1-800-565-1633). The contractor will monitor all equipment on-site to ensure all hydraulic hoses, oil and fuel lines are in good condition with no leaks.

Contractors involved in the dredging operations are to have an emergency response plan for fuel leaks and petroleum contamination, and are to have on hand for immediate deployment an emergency spill response kit, (i.e. synthetic sorbents including oleophilic and hydrophobic pads and containment booms) with the knowledge and ability to respond to any spill on land and in the marine environment.

Also, the Contractor is to have on hand the emergency phone numbers and contacts, so as to alert the proper authorities of possible contamination of the harbour should a spill occur. The Contractor, must report any degree of fuel spill or pollution of the marine or terrestrial environment immediately to the Canadian Coast Guard at 1-800-565-1633.

Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** for additional information and mitigation measures for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEEA screening.

**c) Disposal of dredged material offshore and ocean dumping**

*Note: The dredge material will not be disposed offshore nor ocean-dumped (therefore, questions B33 through B37 are not applicable for this project).*

**d) Disposal of dredged material on land**

**On-land disposal site characteristics**

Issue B38: Describe the natural characteristics of the disposal site : slopes, drainage, physical characteristics, surface and underground water, sensitive areas, etc. Describe potential impacts of the presence of the material both in the short and long term.

Response: The anticipated dredge volume is approximately 10,000 cubic meters. Approximately 6000 cubic meters of the total dredge volume is anticipated to be Class A material (or rock) and approximately 4000 cubic meters of the total dredge volume is anticipated to be Class B material. The dredge material will be used to form the proposed service/parking area. Any remaining dredge material that cannot be utilized in the construction of the service/parking area will be disposed on land at a disposal site suggested by the Contractor, and approved by the Nova Scotia Department of Environment and Labour (NSDEL). It will be the Contractor's responsibility to select the on-land disposal site, obtain permission from the property owner, acquire the necessary permit from NSDOEL, and comply with all requirements of that agency. The remaining dredge material will be transported by tandem dump trucks equipped with watertight boxes via local public roads to the selected Provincially approved on-land disposal site.



### Dredged spoil transportation

Issue B39: Describe transportation methods and procedures for handling of dredged material including access routes. Describe potential impacts due to speed, noise, spillage, traffic and describe mitigation measures to be implemented.

Response: The anticipated dredge volume is approximately 10,000 cubic meters. Approximately 6000 cubic meters of the total dredge volume is anticipated to be Class A material (or rock) and approximately 4000 cubic meters of the total dredge volume is anticipated to be Class B material. The dredge material will be used to form the proposed service/parking area. Any remaining dredge material that cannot be utilized in the construction of the service/parking area will be disposed on land at a disposal site suggested by the Contractor, and approved by the Nova Scotia Department of Environment and Labour (NSDEL). It will be the Contractor's responsibility to select the on-land disposal site, obtain permission from the property owner, acquire the necessary permit from NSDOEL, and comply with all requirements of that agency. The remaining dredge material will be transported by tandem dump trucks equipped with watertight boxes via local public roads to the selected Provincially approved on-land disposal site.

The sample analysis of the dredge area indicated that the dredge material meets the applicable guidelines for land based disposal, except for Boron which had results higher than the CCME Soil Quality Guidelines recommended value for Agricultural areas, and Selenium which had results higher than the CCME Soil Quality Guidelines recommended value for Residential/Parkland areas. Reanalysis of the Selenium was conducted at the proper detection limits, and all samples were found to be below the detection limit of 0.3 mg/kg (below all NSDOEL Schedule A and CCME Soil Quality Guidelines for all categories of land disposal).

Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix F** for additional information and mitigation measures for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.

### Biological impacts

Issue B40: Outline potential impacts on terrestrial habitats and resources as well as on adjacent aquatic habitats and resources (leaching from the site or other mechanisms) in both the short and long term. List, if applicable, mitigation measures to be implemented.

Response: The approved on-land disposal site may require the construction of berms or other control structures (i.e., sedimentation ponds) to mitigate for potential erosion from the site. Requirements for the approved on-land disposal site would be outlined in the permit obtained by the Contractor from NSDOEL. The Contractor must comply with all requirements outlined in the permit from NSDOEL.

### Impacts on human activities and facilities

Issue B41: Describe potential impacts on human activities and facilities : fresh water supplies (contamination of underground or surface water), landscape aesthetics, recreational activities, etc. List mitigation measures to be implemented, if necessary in either the short or long term.

Response: Human activities near the dredging area are mostly related to the commercial fishery operations. No potential impacts on human activities or facilities are expected. Approval and conditions contained in the NSDOEL permit are expected to resolve any potential impacts on

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human activities and facilities, fresh water supplies, landscape aesthetics, recreational activities etc. associated with the disposal site.

Other

Issue B42: Describe any other impact that may occur and any other mitigation measure with regards to the disposal of dredged material on land.

Response: Human safety is paramount; therefore, it will be necessary to restrict access to the project area of the harbour during the dredging period.

In addition, to further mitigate the concerns of increased traffic, noise and the possibility of accidents while transporting materials to and from the site, the following practices should be used, which include the following:

- Trucks used to haul material must be roadworthy;
- Trucks will operate within posted speed limits;
- Trucks will reduce speed and proceed with caution when traffic (vehicle and pedestrian) is present and during low light periods in the dusk and dawn; and,
- Trucks will follow the designated trucking route.

A site and project specific EPP is provided in **Appendix E** as mitigation for this component. **Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEAA screening.



## PART C PUBLIC CONCERNS

### Public opinion

Issue C1: Indicate any public concerns or local/regional opposition which have been expressed on the environmental or human activity issues related to this project. Include measures which will be implemented to mitigate these concerns.

Response: There are no known public concerns or opposition to the project. The proposed harbour development (breakwater, floating dock, dredging and service area) will provide improved access and facilities for local users. Most residents in the area would not be negatively affected by the harbour development project and therefore would likely support this necessary work.

### Public information

Issue C2: Describe the public meetings, media announcements and coverage, and any other public communication which may have been held in regards to the project.

Response: The Honourable Robert Thibault, then Minister of Fisheries and Oceans, announced this project in Tiverton, Nova Scotia on June 25, 2003.

The local Harbour Authority, representing the local users of the facility is aware of the project, and is in support of the project.

### Local Planning

Issue C3: Describe how the project fits with local, municipal, district and provincial development plans.

Response: The project fits with local, municipal, district and provincial development plans. The harbour development is required to provide improved access and facilities for local users.

### Mitigation and Compensation Measures

Issue C4: Describe the measures which will be implemented to mitigate anticipated environmental impacts with respect to public concerns.

Response: These items are addressed in Part D "Impacts of the project and mitigating measures" and in Tables 1 – 5 (of Appendix D).

### Native Concerns

Issue C5: Describe how the project may affect any Native fisheries or concerns.

Response: It is not expected that the proposed project will affect any Native fisheries or concerns (the Harbour Authority has indicated there are no First Nations using the Tiverton SCH facilities). There are no known sites of traditional hunting and fishing grounds or any important natural heritage areas at the project site.

## **PART D SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES - FOLLOW-UP PROGRAM**

### Impacts of the project and mitigation measures

Issue D1: Summarize the impacts of the project and the main public concerns previously expressed. Indicate the measures to be implemented to mitigate or compensate for the environmental impacts of the project.

Response: The project is not predicted to have a negative environmental effect with the following mitigation measures:

- The Contractor will be required to coordinate dredging and construction activities with the Harbour Authority for the duration of the project in order to minimize conflict with harbour activities.
- If construction activities require Contractor's employees to access the site by water, only main channels should be used. Concentrations of seabirds or waterfowl should not be approached when anchoring equipment, accessing wharves or ferrying supplies. All vessels and machinery should be well muffled. Proponents and contractors should ensure that food scraps and garbage are not left at the site.
- Visual monitoring of the turbidity will be required in the vicinity of the work to ensure that the turbidity is limited. If excessive change occurs in the turbidity beyond 100 meters (m) of the dredge limits that differs from the existing conditions of the surrounding water bodies (i.e., distinct color difference) as a result of the dredging activities, the work will stop and Mr. Thomas Wheaton, DFO-HMD, will be contacted at (902) 527-5596 to determine if additional mitigation measures are required (these measures may include changes in production rates, or timing according to tidal cycle).
- Blasting will not be permitted from July until late December when Atlantic Right Whale and other species at risk (identified in Issue A7) are present in the Tiverton area. Blasting will only be conducted from January through to the end of June. Other requirements include: blast caps will be detonated to scare fish and mammals away from the area; and shock wave padding (bubble curtain or air curtain) will be installed to minimize the transmission of the blast through the water.
- The Contractor will be required to select the on-land disposal site, obtain permission from the property owner, acquire the necessary permit from NSDOEL, and comply with all requirements of that agency. The Contractor will be required to transport the dredge material by tandem dump trucks equipped with watertight boxes via local public roads to the selected Provincially approved on-land disposal site.
- A potential exists for leaks and spills of petroleum products from construction equipment during the harbour development project. Adherence to environmental practices for fuelling and equipment maintenance on the part of the contractor will be necessary to reduce the potential for impacts. Refueling must be done at least 30 m away from any water body. Equipment will be monitored for leaks on a regular basis. Refer to the site and project specific Environmental Protection Plan (EPP) provided in **Appendix E** for additional information and mitigation measures for this component.  
**Note:** The EPP included in **Appendix E** is for the proposed Phase I project work only. Separate EPPs will be prepared for Phase II and Phase III and will reflect the mitigation measures identified in this final CEEA screening.
- Trucks are to be in good condition and well muffled and caution is to be taken to avoid overloading trucks. Materials being transported should be secured to ensure no loss during transit and speeds should be reduced or traveling on rural roads should be avoided during periods of heavy traffic.
- Construction will be carried out during daylight hours to avoid disturbances to the residences in the area.



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- All waste material will be disposed of in a Provincially approved manner, and no anticipated creosote timber waste is anticipated. Any material lost as a result of wave or storm action is to be immediately recovered by the operator when safe to do so.
- Any equipment working in or over the marine environment is to be free from hydrocarbon based fluids and/or lubricants harmful to the environment. Hoses and tanks are to be inspected on a regular basis to prevent fractures and breaks on or near the marine environment. Contractors involved in the dredging operations are to have an emergency response plan for fuel leaks and petroleum contamination, and are to have on hand for immediate deployment an emergency spill response kit, (i.e., synthetic sorbents including oleophilic and hydrophobic pads and containment booms) with the knowledge and ability to respond to any terrestrial and/or marine environmental spills. Refueling must be done at least 30 m away from any water body. Also, the Contractor is to have on hand the emergency phone numbers and contacts, so as to alert the proper authorities of possible contamination of the harbour should a spill occur. The contractor must report any degree of fuel spill or pollution of the marine or terrestrial environment immediately to the Canadian Coast Guard (CCG) at 1-800-565-1633.
- Any equipment that has been in the marine environment (i.e., boat hulls, anchors, excavators, piping, etc.) will be cleaned of any sediments, plants or animals and washed with freshwater and/or sprayed with undiluted vinegar prior to being mobilized to the project site. Refer to Environmental Protection Plan (EPP) developed for this project, included in **Appendix E**.
- The Contractor will be required to coordinate dredging and construction activities with the Harbour Authority within the proposed basin area for the duration of the project.
- The Canadian Coast Guard (CCG) has been consulted regarding the application of the Navigable Waters Protection Act.

#### Residual impacts

Issue D2: Summarize any residual environmental impacts of the project, i.e. impacts remaining after the implementation of the mitigation measures.

Response: There are no projected residual environmental effects. This assessment considered the potential negative environmental effects resulting from the proposed project. The potential effects were considered in context of spatial and temporal boundaries (i.e., an area surrounding the harbour and the upland area) and for significance criteria (i.e., population and natural variation based) that are appropriate for this project. With the mitigation measures described below in Issue D5, there are no predicted negative environmental effects related to this project.

#### Cumulative Impacts

Issue D3: Indicate whether there are other activities in the surrounding area that could generate similar impacts to those described above (e.g. activities that may affect water quality, fish habitats, fishing activities, etc.). Describe potential cumulative impacts from all these sources.

Response: No significant cumulative effects (i.e., past present and likely future projects) are predicted to impact water quality, fish habitats and fishing activities in the long term as a result of this project.

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Follow-up program

Issue D4: Describe briefly any proposed follow-up monitoring program, if appropriate. If such a program is not required, explain why.

Response: A site inspector will monitor this project during the dredging and construction activity. DFO-SCH representatives will also carry out a site inspection after the harbour improvements project has been completed and a CEAA follow-up by PWGSC will be conducted. The Harbour Authority will also monitor the project on behalf of DFO-SCH.

**PART E SIGNATURES, CONTACTS AND RECOMMENDATIONS**

Issue E1: References - persons contacted and reports referred to during the screening process

*NOTE FOR PROJECTS UNDERTAKEN IN NOVA SCOTIA: To meet federal coordination regulations, a signed agreement is in place within the province of Nova Scotia, between SCH and Habitat Management, whereby all projects which could impact on water quality or the marine environment will be reviewed by Habitat Management and an authorization may be required.*

Response: Persons consulted:

- Birch, Angela - Nova Scotia Department of Environment and Labour, 902-424-2387
- Davison, Paul - Public Works Government Services Canada, Senior Coastal Engineer, 902-496-5125
- Gerriets, Stefan. *Atlantic Canada Conservation Data Centre (ACCDC)*, March 2003
- Norwood, Dan - Cetacean Boat Tours Limited, Tour Guide, 902-247-1976
- Outhouse, Wayne - Harbour Authority of Tiverton, President, 902-839-2781
- Petrie, Bob - Nova Scotia Department of Environment and Labour (NSDEL), Yarmouth, 902-742-8985
- Saywood, Mark - Nova Scotia Department of Natural Resources, Digby, 902-245-2164
- Smith, Oz - Fisheries and Oceans Canada - Canadian Coast Guard, Navigable Waters Protection Program, Navigable Waters Protection Officer, 902-426-3798
- Stewart, Andrew - Fisheries and Oceans Canada, Habitat Management Division (902) 426-3576
- Wheaton, Thomas - A/Area Habitat Coordinator, Fisheries and Oceans Canada - Habitat Management Division, 902-527-5596
- Zwicker, Stephen - Environment Canada, Environmental Assessment Section, Reviewer, 902-426-0092



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Publications consulted:

AMEC Earth & Environmental Limited (AMEC). Underwater Benthic Habitat Survey and Sediment Sampling – Tiverton, Digby County, NS. August 2003.

Davis, Derek S. and Sue Browne (1997), Natural History of Nova Scotia Vol 2, Theme Regions, Nova Scotia Museum, pp. 194-195.

Erskine, Anthony J. *Atlas of Breeding Birds of the Maritime Provinces*, 1992.

Seibert, G.H. and M.P.M Reddy. *Petit Passage Tide and Current Survey*, 1966.

Small Craft Harbours Branch, Maritimes Region, CEAA Screening for Wharf Repairs at Tiverton, Digby County, Nova Scotia, Project 307381, dated January 27, 2003.

Species at Risk Public Act (SARA) Public Registry website: <http://www.sararegistry.gc.ca/>

Issue E2: Permits / Authorizations / Approvals (see above comments)

Response: The following table provides a summary of permits, approvals and authorizations:

REQUIRED PERMITS	ISSUING DEPARTMENT	PERSON TO OBTAIN PERMIT
Nova Scotia Department of Environment and Labour (NSDEL)	NSDEL Contact: Mr. Bob Petrie (902) 742-8985	PWGSC has advised NSDEL of the project on behalf of DFO-SCH. The successful Contractor will be required to apply for and obtain all applicable permits.
Nova Scotia Department of Natural Resources (NSDNR) - Inland and Coastal Waters Permit (pursuant to the <i>Beaches and Crown Lands Act</i> )	NSDNR Contact: Mr. Mark Saywood (902) 245-2164	PWGSC has applied for the permit on behalf of DFO-SCH.
Navigable Waters Protection Act (NWPA) – Navigable Waters Protection Application	NWP Contact: Mr. Oz Smith (902) 426-3798	PWGSC has applied for the permit on behalf of DFO-SCH.
Fisheries and Oceans Canada (Habitat Management Division) – <i>Fisheries Act</i> S. 35 (2) Authorization (HADD)	DFO-HMD Contact: Ms. Tammy Rose (902) 426-0379	The project is being reviewed by DFO-HMD and PWGSC has applied for an authorization under <i>Fisheries Act</i> S.35 (2) on behalf of DFO-SCH.

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**Recommendations**

This screening form:

Was completed by :  
(Print name)

*[Signature]*  
Dori Maynard  
May 20/2004  
Senior Environmental Specialist - PWGSC

Recommended rating : 1

Date :

Position/role :

Comments :

Was reviewed by :

(Print name)

*[Signature]*  
(Lead RA representative)  
Tammy Rose  
June 4, 04  
Habitat Assessment Biologist

Recommended rating : 1

Date :

Position/role :

Comments :

Was reviewed by :

(Print name)

*[Signature]*  
(RA representative)  
Marci Penney  
Surety Section Head, Habitat Management Division

Recommended rating : *A. Z. Potter*  
*Ahila Z. Potter*

Date :

Position/role :

Comments :

Was reviewed by :

(Print name)

*[Signature]*  
(RA representative)  
Paul Rowe  
10/06/04  
Project Mgr.

Recommended rating :

Date :

Position/role :

Comments :

RATING DESCRIPTIONS :

- Significant adverse environmental effects unlikely, taking into account mitigation measures; project may proceed, ensure implementation of measures..... 1
- Significant adverse environmental effects likely and not justified in the circumstances; project as presented cannot proceed..... 2
- Uncertain adverse environmental effects, taking into account mitigation measures; refer the project to the Minister of the Environment for a referral to a mediator or review panel ..... 3
- Significant adverse environmental effects, but that can be justified in the circumstances; refer the project to the Minister of the Environment for a referral to a mediator or a panel review ..... 4
- Public concerns warrant a reference to the Minister of the Environment for a referral to a mediator or a panel review ..... 5



**PART F FINAL DECISION FOR HARBOUR DEVELOPMENT  
(BREAKWATER, FLOATING DOCK, DREDGING AND SERVICE AREA) AT  
TIVERTON, DIGBY COUNTY, NOVA SCOTIA**

**Final Recommendation**

This section must be completed by the SMALL CRAFT HARBOURS REGIONAL DIRECTOR, the REGIONAL ENGINEER, or the SMALL CRAFT HARBOURS REPRESENTATIVE WITH SIGNING AUTHORITY for the specific project under assessment.

Decision rating :   1   (see previous page for rating descriptions)

**SCH REPRESENTATIVE, PLEASE CHECK (✓) ONLY ONE :**

Project as presented can proceed :

- adverse environmental effects are unlikely or mitigable

Project as presented must be abandoned :

- adverse environmental effects are likely and cannot be justified in the circumstances

Project must be referred to the Minister of the Environment for referral to a mediator or a panel review:

- adverse environmental effects are uncertain

- adverse environmental effects are likely but justified in the circumstances

- public concerns warrant a reference to a mediator or a panel review

Approved by :

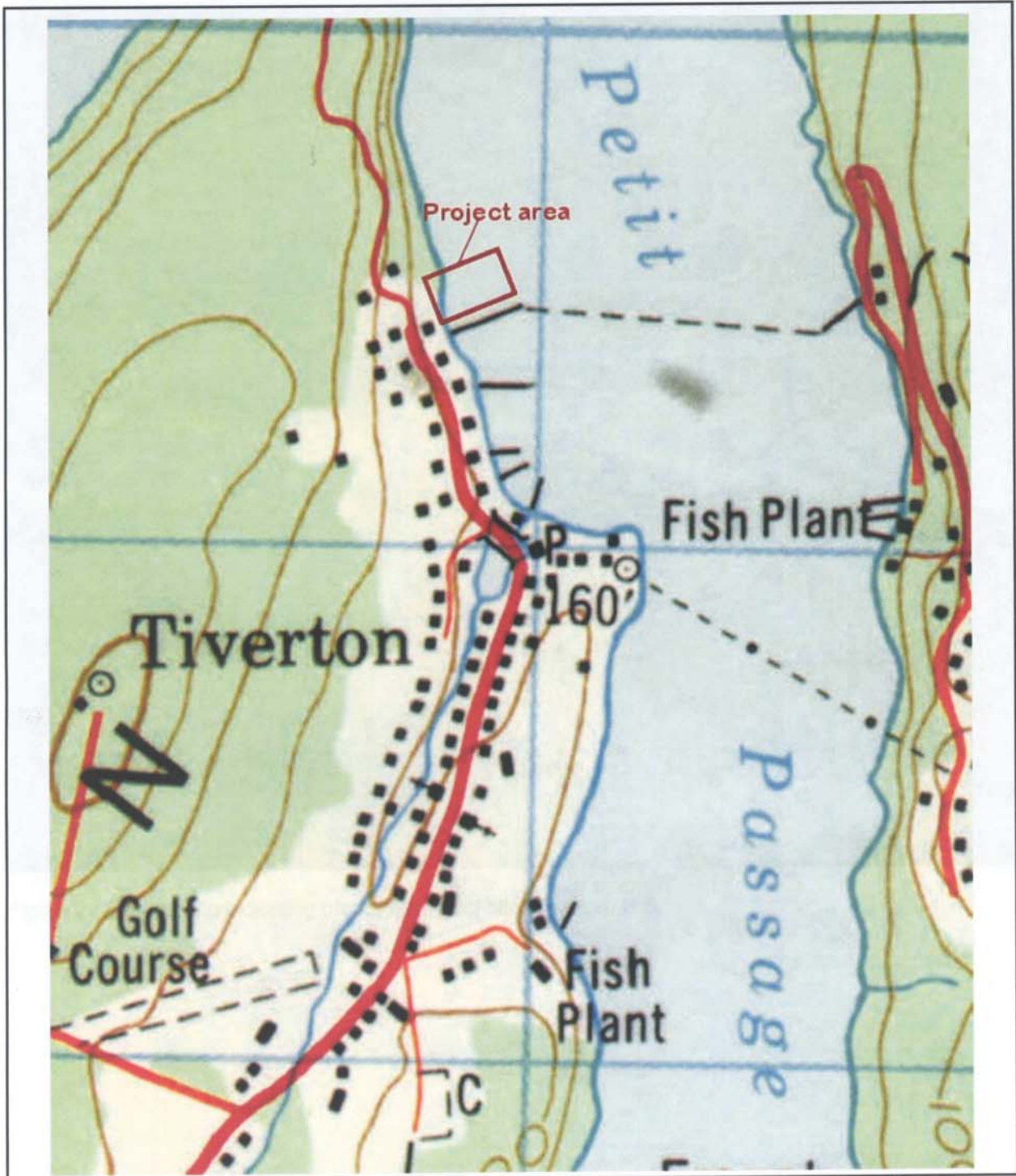
  
Chief - SWNS

Date : June 8 / 2004

Title :

**APPENDIX A**  
**Figures 1 – 5**





**Figure 1**

Topographic map of Tiverton (21B/08) showing the proposed site. Each square represents 1 km<sup>2</sup> (above).



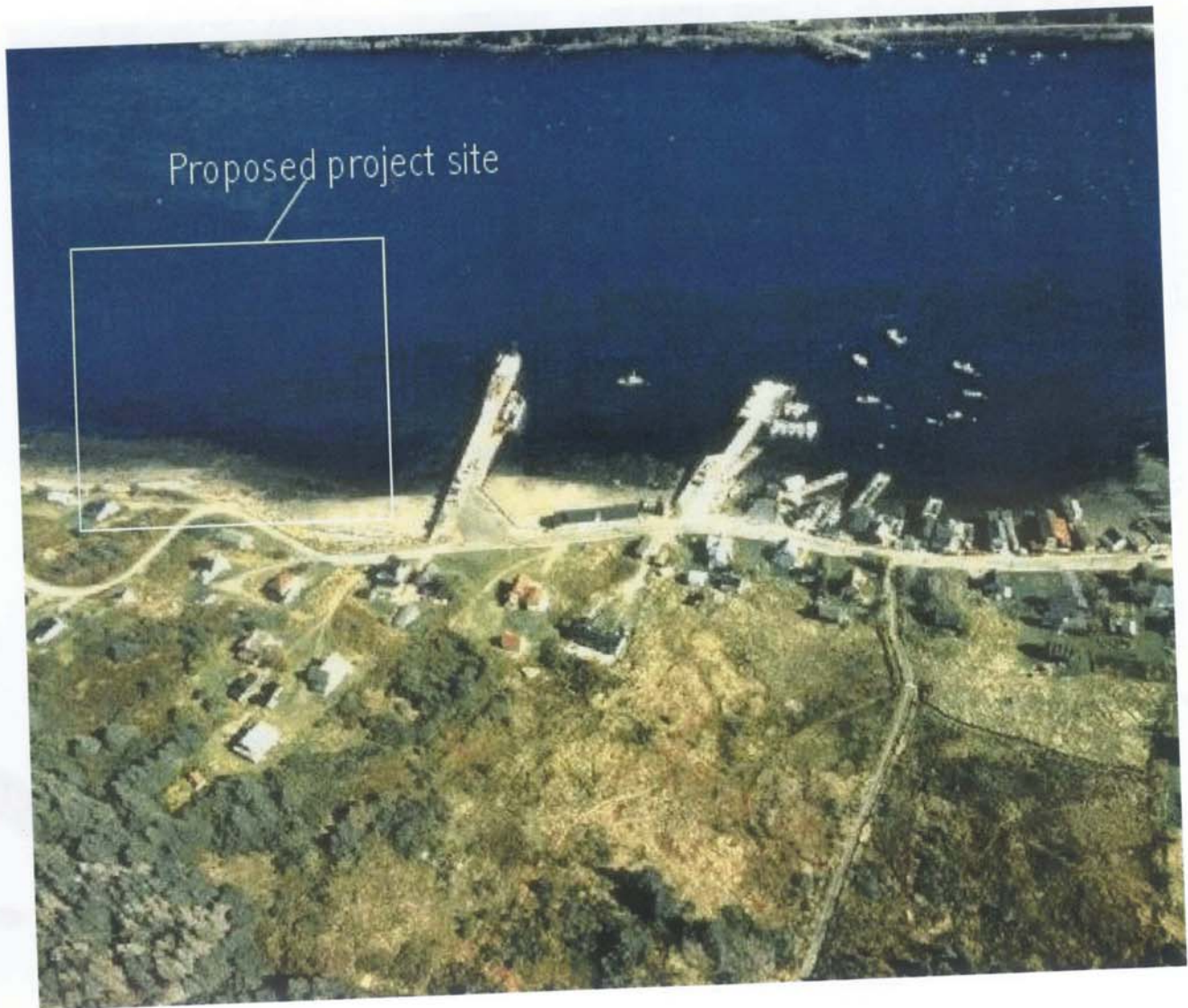


Figure 2. Aerial photo indicating proposed project site, Tiverton, N.S.



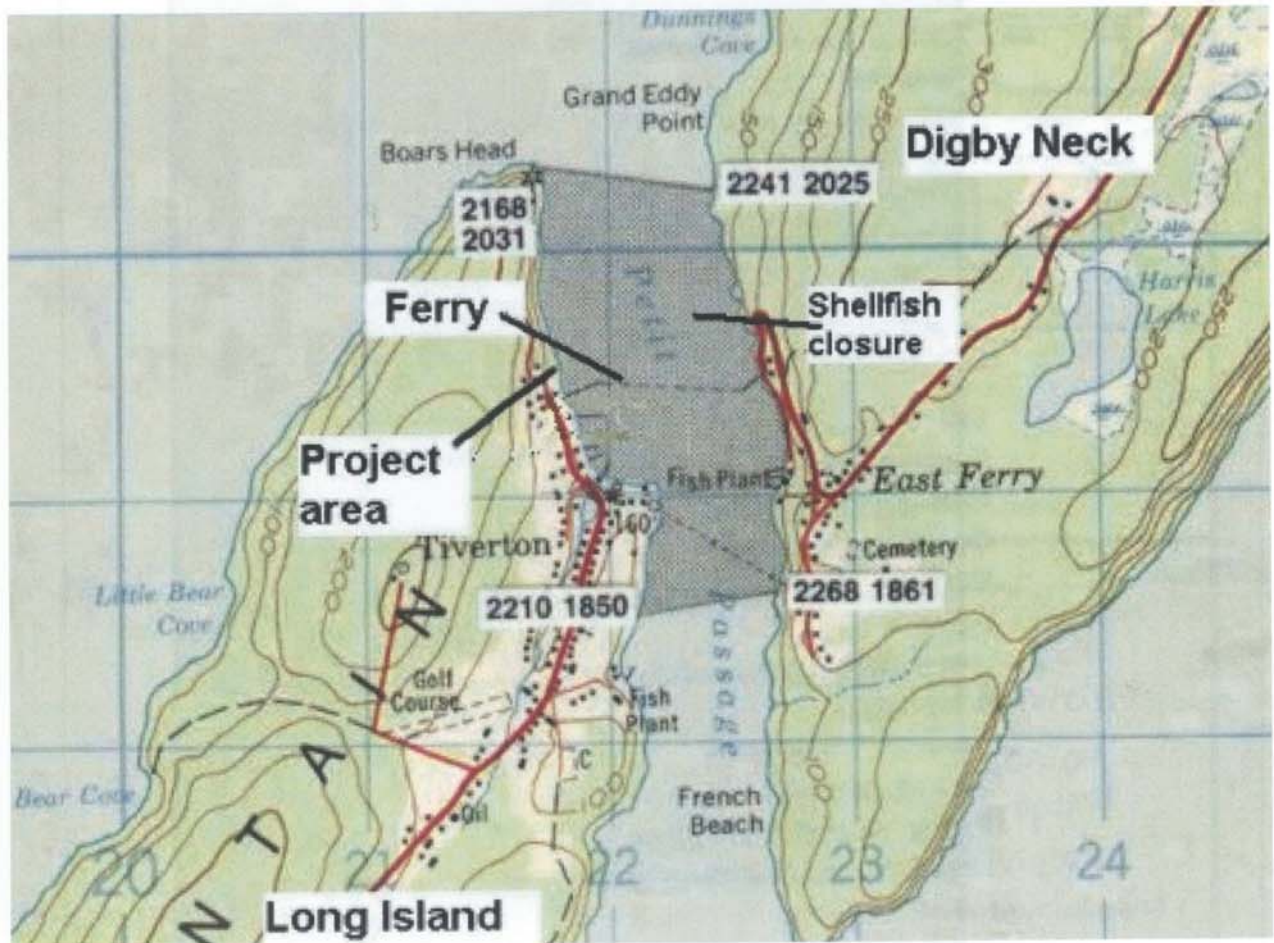


Figure 3. Map indicating shellfish closure area, ferry route, and proposed project area, Tiverton, N.S. Each square represent 1 square kilometer.









**APPENDIX B**  
**Final Report: *Underwater Benthic Habitat Survey and Sediment Sampling,***  
**AMEC, August 2003**



**Underwater Benthic Habitat Survey & Marine  
Sediment Sampling  
Tiverton, Digby County, Nova Scotia**

**FINAL REPORT**

Submitted to:

**Public Works and Government Services Canada  
Environmental Services  
Real Property Services, Atlantic Region  
3<sup>rd</sup> Floor, Bedford Row, Halifax, NS  
B3J 3C9**

Submitted by:

**AMEC Earth & Environmental Limited  
32 Troop Avenue  
Dartmouth, Nova Scotia  
B3B 1Z1**

**August 2003**

**TV23121**

## EXECUTIVE SUMMARY

AMEC Earth & Environmental Limited was commissioned by Public Works and Government Services Canada to conduct an underwater video survey of benthic habitat over a specified area at the marine terminal in Tiverton, Digby County, Nova Scotia. The purpose of the project was to characterize the seabed footprint of proposed breakwater construction site.

In total, 710 m of underwater video surveillance was required at the marine terminal at Tiverton. The distance was divided into two main transect lines of 218 m and 210 m, and two tie-lines of 140 m which intersected the 218 m and 210 m lengths.

Characterizations of the substrate along the transects at the marine terminal at Tiverton, NS were made using a combination of visual field observations and underwater video survey techniques. The dominant substrate type within the proposed wharf footprint at Tiverton was a combination of sand and rock, with some bedrock outcrops and larger boulders.

The invertebrates encountered within the proposed breakwater extension footprint include: mussels (*Mytilus edulis*) and green urchins (*Strongylocentrotus droebachiensis*), sea stars (*Asterias spp.*), finger sponge (*Haliclona oculata*), Hermit Crab (*Pagurus spp.*), frilled anemone (*Metridium senile*), barnacles (*balanus spp.*), and empty scallop shells. It should be noted that over 67% of the transect areas that were surveyed contained no macrofaunal species.

The macrofloral species present within the proposed breakwater construction footprint include: kelp (*Laminaria digitata* and *Laminaria saccharina.*), sea colander (*Agarum cribrosum*), sea lettuce (*Ulva lactuca*), filamentous brown and red macrophytes, patches of rockweed (*Fucus spp.*) and knotted wrack (*Ascophyllum nodosum*). It should be noted that over 10% of the transect areas that were surveyed contained no macrofloral species.

Marine sediment sampling was conducted to confirm the presence or absence of contamination in the Tiverton Harbour related to ferry terminal and other harbour activities. The following summarizes the relevant analytical results of the intrusive investigation:

- With the possible exception of two metal constituents, the sediment samples were all below guideline levels recommended by CCME, NSDOEL, and Atlantic PIRI – Tier 1 for a land disposal option for marine sediments.
- The sample results of <11 mg/kg for Boron in all samples is higher than the CCME Soil Quality Guideline recommended value of 2 mg/kg for Agricultural areas. In addition the sample results of <3 mg/kg in all samples for Selenium is higher than the NSDOEL Schedule "A" recommended values of 0.6 mg/kg and 2 mg/kg for Agricultural and Residential/Parkland areas, respectively, and the CCME Soil Quality Guideline recommended values of 1 mg/kg for both Agricultural and Residential/Parkland areas. It should again be noted that due to the limits of the laboratory detection levels, it might be possible that the actual values for these two contaminants may be below these guideline values.



## 1.0 INTRODUCTION

At the request of Ms. Rosalia Galante of Public Works and Government Services Canada (PWGSC), AMEC Earth & Environmental Limited (AMEC) conducted an underwater video survey of benthic habitat over a specified area at the marine terminal in Tiverton, Digby County, Nova Scotia (NS). The purpose of the project was to characterize the seabed footprint of a proposed breakwater construction at the marine terminal.

Qualitative and quantitative underwater video surveys were conducted along transects in the proposed breakwater extension areas to map substrate type and document macrofaunal and macrofloral species present.

Sediment sampling was conducted to confirm the presence or absence of contamination in the Tiverton Harbour and proposed dredge area.

### 1.1 Scope and Methodology

On 21 March 2003, a video habitat survey was conducted at the Tiverton marine terminal, in the proposed breakwater extension area. Connors Diving Services Ltd. was contracted to perform the diving and video services.

The two main transect lines 218 m (T1) and 210 m (T2) in length were laid approximately 30 m apart in a northerly direction parallel to the existing ferry terminal wharf and originating from the highwater mark of the existing shoreline. T1 takes an approximate 60° turn at a distance of 210 m eastward running perpendicular to the existing ferry terminal wharf. The transect lines consisted of a lead line marked in 10 m increments (Figure 1.1).

There were also two tie-lines, 140 m (T3) and 140 m (T4) which were laid perpendicular to the two main transect lines (Figure 1.1).

The main transect lines and tie-line locations were determined visually in the field with the use of a site drawing provided by PWGSC. The coordinates of the transects are provided in Table 1.1.

To investigate potential environmental concerns related to the activities of the Tiverton ferry terminal and other harbour related activities, four marine sediment samples were collected at predetermined locations specified by PWGSC. The samples were collected to a depth of approximately 15 cm (6 inches). Two of the four sediment samples were to be tested for TPH/BTEX and it was requested by PWGSC that core samples be taken to a depth of 0.50 m. However, due to the shallow sediment cover, approximately 15 cm (6 inches), coring was limited. Therefore, the sediment samples were collected in pre-cleaned mason jars and labeled accordingly. The coordinates of the sediment samples are provided in Table 1.2.

**Table 1.1** *Coordinates of the Main Transect Line Locations,  
 Tiverton, Digby County, NS*

Transect Number	Location on Transect	Latitude	Longitude
Main Transect Line (T1)		From highwater mark of existing shoreline	
	0	44°23'49.6"	66°12'52.5"
	210	44°23'51.1"	66°12'45.6"
	210	44°23'51.1"	66°12'45.6"
	218	44°23'48.4"	66°12'44.2"
Main Transect Line (T2)		From highwater mark of existing shoreline	
	0	44°23'47.2"	66°12'52.6"
	210	44°23'49.7"	66°12'43.4"
Tie-Line (T3)		Running west 140 m from existing wharf. 60m north of existing shore line.	
	0	44°23'46.4"	66°12'46.6"
	140	44°23'51.3"	66°12'48.9"
Tie-Line (T4)		Running west 140 m from existing wharf	
	0	44°23'45.7"	66°12'49.9"
	140	44°23'50.5"	66°12'51.3"

\*Main transect lines ran in a northeasterly direction from the existing shoreline (refer to Figure 1.1). The tie-lines were laid in a southeasterly direction over the main transect lines, intersecting the main transect lines at a distance of 25 m and 60 m from the existing wharf.

\*Note: Coordinates are given in NAD83.

The underwater surveillance of the main transects and intersecting tie lines required the use of an underwater video camera operated by a CSA certified diver using surface fed communication and breathing apparatus. As much as was practical, the underwater video surveillance encompassed a span of approximately 1 m on either side of the main transects and tie-lines. Benthic habitat characterization involved input from the on-site diver, the on-site biologist, field observations, and a review of the video surveillance.



## 2.0 RESULTS AND DISCUSSION

The following subsection provides a summary of the qualitative and quantitative transect observations obtained at the proposed project footprint at Tiverton, NS.

### 2.1 Underwater Video Surveillance

The results of the transect surveys of the proposed breakwater construction footprint are presented in Appendix A (Table A.1), including the following information for each 10 m increment of transect line:

- visual determination of substrate type (in order of dominance);
- macrofaunal species identification and abundance; and,
- macrofloral species identification and percent coverage.

A summary of the information provided in Table A.1 is provided in the following paragraphs.

#### • Substrate

The substrate observed within the proposed breakwater construction footprint consisted primarily of sand and rock, with some bedrock outcrops and larger boulders. The substrate size ranges from 6" to 8" for rocks and 3' to 6' for boulders. Refer to the Tables in Appendix A for a more detailed observation of each individual transect or tie-line.

#### • Macrofauna

The invertebrates encountered within the proposed breakwater extension footprint include: mussels (*Mytilus edulis*) and green urchins (*Strongylocentrotus droebachiensis*), sea stars (*Asterias spp.*), finger sponge (*Haliclona oculata*), Hermit Crab (*Pagurus spp.*), frilled anemone (*Metridium senile*), barnacles (*balanus spp.*), and empty scallop shells. It should be noted that over 67% of the transect areas that were surveyed contained no macrofaunal species. Refer to Appendix A for a more detailed observation of each individual transect or tie-line.

#### • Macroflora

The macrofloral species present within the proposed breakwater construction footprint include: kelp (*Laminaria digitata* and *Laminaria saccharina.*), sea colander (*Agarum cribrosum*), sea lettuce (*Ulva lactuca*), filamentous brown and red macrophytes, patches of rockweed (*Fucus spp.*) and knotted wrack (*Ascophyllum nodosum*). It should be noted that over 10% of the transect areas that were surveyed contained no macrofloral species. Refer to Appendix A for a more detailed observation of each individual transect or tie-line.

- All samples had pesticide concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments. The results are summarized in Table 2.4.

#### Petroleum Hydrocarbons

- All samples had petroleum hydrocarbon concentrations below the criteria for meeting Atlantic PIRI Tier 1 Criteria, CCME Interim Soil Quality Guidelines and NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments. The results are summarized in Table 2.5.

#### Sieve Analysis

- The consistency of all marine sediment samples analyzed is less than 1 % gravel, 99 % sand and less than 1 % clay and silt. The results are summarized in Appendix C.

### **2.3 Quality Assurance/Quality Control**

The field crew was comprised of a field supervisor (Ms. Robyn Parsons, BSc. Geo.Eng., EIT) who is experienced in sample and data collection. This person was responsible for the supervision of the data collection and the overall data quality, had authority to make decisions in the field regarding the implementation of the program, and was responsible for ensuring that all standard operating procedures were followed and that adequate health and safety measures were taken.

As per AMEC's internal review policy, a project reviewer (Mr. Shawn Duncan, BSc.) was established at the outset of the project. This individual was kept apprised of the project's progress and has reviewed this report prior to the release.



Public Works and Government Services Canada  
 Underwater Benthic Habitat Survey & Marine Sediment Sampling -- Final Report  
 Tiverton, Digby County, Nova Scotia  
 August 2003

Parameters	Units	Sample Identification							NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		1	3	5	7	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial				
Tellurium (Te)	mg/kg	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	
Thallium (Tl)	mg/kg	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	1	1	1	1	
Thorium (Th)	mg/kg	<3	<3	<3	<3	-	-	-	-	-	-	-	-	-	-	
Th (Sn)	mg/kg	<1	<1	<1	<1	-	-	-	-	-	-	5	50	300	300	
Titanium (Ti)	mg/kg	118.0	106.0	111.0	103.0	-	-	-	-	-	-	-	-	-	-	
Tungsten (W)	mg/kg	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	
Uranium (U)	mg/kg	0.2	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	
Vanadium (V)	mg/kg	8.2	6.1	6.0	6.7	100	200	200	200	130	130	130	130	130	130	
Zinc (Zn)	mg/kg	12.5	10.3	12.6	20.8	300	500	500	200	200	200	360	360	360	360	

Table 2.2 PAH Concentrations in the Four Marine Sediment Samples at Tiverton, NS

Parameters	Units	Sample Identification							NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		1	3	5	7	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial				
Naphthalene	µg/kg	<5	<5	<5	<5	-	-	-	-	-	-	100	1000	10000	10000	
Chrysene	µg/kg	<10	<10	<10	<10	-	-	-	-	-	-	-	-	-	-	
Benzo(b)fluoranthene	µg/kg	<10	<10	<10	<10	-	-	-	-	-	-	100	1000	10000	10000	
Benzo(k)fluoranthene	µg/kg	<10	<10	<10	<10	-	-	-	-	-	-	100	1000	10000	10000	
Benzo(a)pyrene	µg/kg	<5	<5	<5	<5	-	-	-	-	-	-	100	700	700	700	
Acenaphthylene	µg/kg	<5	<5	<5	<5	-	-	-	-	-	-	-	-	-	-	
Indeno(1,2,3-cd)pyrene	µg/kg	<20	<20	<20	<20	-	-	-	-	-	-	100	1000	10000	10000	
Dibenzo(a,h)anthracene	µg/kg	<20	<20	<20	<20	-	-	-	-	-	-	100	1000	10000	10000	
Benzo(g,h,i)perylene	µg/kg	<20	<20	<20	<20	-	-	-	-	-	-	-	-	-	-	
Acenaphthene	µg/kg	<10	<10	<10	<10	-	-	-	-	-	-	-	-	-	-	
Fluorene	µg/kg	<5	<5	<5	<5	-	-	-	-	-	-	-	-	-	-	
Benzo(a)anthracene	µg/kg	<10	<10	<10	<10	-	-	-	-	-	-	100	1000	10000	10000	

Public Works and Government Services Canada  
 Underwater Benthic Habitat Survey & Marine Sediment Sampling – Final Report  
 Tiverton, Digby County, Nova Scotia  
 August 2003

Parameters	Units	Sample Identification							NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		1	3	5	7	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial				
Heptachlor	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-	-	-	-	-	-	-				
Heptachlor Epoxide	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-	-	-	-	-	-	-				
Lindane	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-	-	-	-	0.01	-	-				
Methoxychlor	mg/kg	< 0.008	< 0.008	< 0.008	< 0.008	-	-	-	-	-	-	-				
Mirex	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-	-	-	-	-	-	-				
p,p'-DDD + p,p'-DDD	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-	-	-	-	-	-	-				
p,p'-DDE + p,p'-DDE	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-	-	-	-	-	-	-				
p,p'-DDT + p,p'-DDT	mg/kg	< 0.002	< 0.002	< 0.002	< 0.002	-	-	-	-	0.7	0.7	12				
Total Pesticides	mg/kg	< 0.008	< 0.008	< 0.008	< 0.008	0.05	0.5	1	-	-	-	-				

Table 2.5 Petroleum Hydrocarbon Concentrations in the Four Marine Sediment Samples at Tiverton, NS

Parameters	Units	Sample Identification			Atlantic PIRI Tier 1*			NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		5	7	7	Residential	Commercial	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial		
Benzene	mg/kg	< 0.005	< 0.005	0.005	0.005	0.005	-	-	-	0.05	0.5	5			
Toluene	mg/kg	< 0.006	< 0.006	0.06	0.06	0.06	-	-	-	0.1	0.8	0.8			
Ethylbenzene	mg/kg	< 0.005	< 0.005	0.015	0.015	0.015	-	-	-	0.1	1.2	20			
Xylenes	mg/kg	< 0.014	< 0.014	1.8	1.8	1.8	-	-	-	0.1	1	20			
C <sub>9</sub> -C <sub>10</sub>	mg/kg	< 0.1	< 0.1	-	-	-	-	-	-	130**	30**	180**			
>C <sub>10</sub> -C <sub>21</sub>	mg/kg	< 5	< 5	-	-	-	-	-	-	150**	150**	150**			
>C <sub>21</sub> - <C <sub>24</sub>	mg/kg	< 19	< 19	-	-	-	-	-	-	400**	400**	1700**			
Modified TPH (Tier 1)	mg/kg	< 19	< 19	45	45	60	-	-	-	-	-	-			
Total TPH	mg/kg	< 19	< 19	-	-	-	25	50	50	-	-	-			

\* Values used correspond to the most stringent criteria for potable water supplies in clay soils.

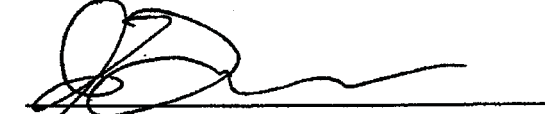
\*\* Values adapted from the most stringent values in the Canada Wide Standard for Petroleum Hydrocarbons in Soils (2001)

## **CLOSURE**

This report has been prepared for the exclusive use of PWGSC for specific application to the Tiverton, Digby County, NS site. No other warranty, expressed or implied, is made. The limitations of this report are specified in Appendix B.

Respectfully submitted,

**AMEC Earth & Environmental Limited**



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**Shawn Duncan, B. Sc.**  
Head Environmental Science and Planning



**APPENDIX A**  
**Qualitative and Quantitative Transect Observations**

Transect 1: Leg 1 Longshore Leg

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
50 - 55	Sand and 20-30% Rock	Occasional Mussels and Urchins	<i>Laminaria</i> sp. Devils Apron Kelp Filamentous Brown and Red
55 - 60	6'-6' Rock	Sponge	Same
60 - 65	Same		Same
65 - 70	Same		Same
70 - 75	Same		Same
75 - 80	Same		Same
80 - 85	20-60% Rock		Same
85 - 90	Same		Same

Transect 1: Leg 2, Perpendicular Leg

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
0 - 5	Sand and 50-70% Rock	Sporadic Mussels and Urchins	<i>Laminaria sp.</i> Both Mature and Immature Devils Apron, Filamen. Brown
5 - 10	Sand and Rocks 6" to 8'	Same	Same
10 - 15	Same	Same	Same
15 - 20	Same	Same	Same
20 - 25	Same	Same	Same
25 - 30	Same	Same	Same
30 - 35	Same	Same	Same
35 - 40	Same	Same	Same
40 - 45	Same	Same	Same
45 - 50	Same	Same	Same



Transect 2: Below Water Line

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
0 - 5 Depth 31'	Sand and 5-10% Rock	Sporadic Mussels and Urchins	<i>Laminaria sp.</i> Both Mature and Immature Devils Apron, Filamen. Brown
5 - 10	Sand and Rocks 6" to 8'	Same	Both <i>L. sacharina</i> and <i>digitata</i>
10 - 15	Same	<i>Asterias sp.</i>	Same
15 - 20	20% Rock	Same	Same
20 - 25	Same	Same	Same
25 - 30	Same	Same	Same
30 - 35	Same	Same	Same
35 - 40	60% Rock	<i>Asterias sp.</i>	Filamentous Red
40 - 45	Same	Same	Same
45 - 50	50% Sand and 50% Rock	Same	Same

Transect 2: Below Water Line

Transect Distance from Shore (m)	Substrate	Invertebrates and Fish	Plant Species
100 - 105 11 <u>Depth</u>	10-30% Rock and Sand		<i>Laminaria sp.</i> , Devils Apron Sea Lettuce, Filamentous Brown and Red Macrophytes
105 - 110 11	Patches of Gravel		Same
110 - 115 11	Boulders and Sand	Sea Anemone	Same
115 - 120 11	3'-6' Boulders		Same
120 - 125 11	Same		Same
125 - 130 11	Same		Same
130 - 135 11	Bedrock		Same
135 - 140 10	Bedrock and Boulders		Same
140-145 10	Same		Same
145-150 5	Same		Same

### Transect 3 - Longshore

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
0 - 5	Gravel	Sporadic Mussels and Urchins	<i>Laminaria sp.</i> Both Mature and Immature Devils Apron, Filamen. Brown
5 - 10	Sand	Many Empty Scallop Shells	Sea Lettuce
10 - 15	Same		Both <i>L. sacharina</i> and <i>digitata</i>
15 - 20	80% Sand, large rock		Same
20 - 25	Same		Same
25 - 30	Same		Same
30 - 35	Same		Same
35 - 40	Sand and Larger Rock 10% Rock		Devils Apron and laminaria
40 - 45	Same	Occasional Large Mussels	Same
45 - 50	Same 6 - 10" boulders	Occasional Large Mussels	local patches of <i>Ascophyllum</i>



### Transect 3

Transect Distance from Shore (m)	Substrate	Invertebrates and Fish	Plant Species
100 - 105 14' <u>Depth</u>	80% Rock and 20% Sand		<i>Laminaria sp.</i> , Devils Apron Sea Lettuce, Filamentous Brown and Red Macrophytes
105 - 110 14'	Same		Same
110 - 115 14'	Same		Same
115 - 120 14'	2" - 3' Boulders		Same
120 - 125 14'	Same		Same
125 - 130 14'	80% Rock 10% Gravel and Sand		Same
130 - 135 14'	Same		Same
135 - 140 14'	2% Sand, 98% rock		Filamentous Red Macrophytes

Transect 4

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
50 - 55 0'	Large Cobble and Rock		Brown Macrophytes <i>Fucus, Ascophyllum</i>
55 - 60 0'	Same		Same
60 - 65 0'	Same		Patches to 60% coverage
65 - 70 0'	Same		Same
70 - 75 0'	Same		Same
75 - 80 0'	Same		Same
80 - 85 0'	Boulders and Cobble		80%-90% coverage
85 - 90 0'	Same		Same
90 - 95 0'	Same		Same
95 - 100 0'	Same		Same

Transect 4

Transect Distance from Shore (m)	Substrate	Invertebrates and Fish	Plant Species
100 - 105 0' <i>Depth</i>	Large Rock, Gravel		Nearly complete coverage by <i>Ascophyllum</i> .
105 - 110 0'	Same		Same
110 - 115 0'	Same		Same
115 - 120 0'	Bedrock and Boulders		Same
120 - 125 0'	Same		Same
125 - 130 0'	Same		Same
130 - 135 0'	Same		Same
135 - 140 0'	Bedrock		Complete Coverage <i>Ascophyllum</i>



Transect 4

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
0 - 5	Gravel and Cobble		<i>Laminaria</i> sp. Patches of <i>Fucus</i> and <i>Ascophyllum</i>
5 - 10	Same		Same
10 - 15	Same		Same
15 - 20	Sand, Large Rock Cobble		Sea Lettuce, <i>Fucus</i> , detritus
20 - 25	Same		Same
25 - 30	Same		Red Macrophytes
30 - 35	Same		Same
35 - 40	Large Rock and Cobble		Kelps, <i>Ascophyllum</i>
40 - 45	Same		Same
45 - 50	Same		local patches of <i>Ascophyllum, fucus</i>

Transect 3

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
50 - 55 <u>Depth</u> 14'	Sand and 50-70% Rock	Occasional Mussels and Urchins	<i>Laminaria</i> sp. Devils Apron Kelp Filamentous Brown and Red
55 - 60 14'	6" Rock		Same
60 - 65 14'	Same		Same
65 - 70 14'	Same		Same
70 - 75 14'	Same		Same
75 - 80 14'	Same		Same
80 - 85 14'	60%-90% Rock		Same
85 - 90 13'	Same		Same
90-95 13'	Same		Same
95-100 13'	Same		Same

Transect 2: Above Water Line

Transect Distance from Shore (m)	Substrate	Invertebrates and Fish	Plant Species
0 - 5 Depth 0'	Gravel and Boulders		Sea Lettuce, <i>Laminaria sp.</i> <i>Fucus sp.</i> , <i>Ascophyllum sp.</i> Red and Green macrophytes
5 - 10 0'	1'-3' Rocks		<i>Ascophyllum</i> , 40% coverage <i>Fucus spp.</i> , sea lettuce
10 - 15 0'	Same		Same
15 - 20 0'	Gravel and Large Cobble		<i>Ascophyllum</i> and <i>Fucus</i> on the Rocks
20 - 25 0'	Same	Barnacles	Same
25 - 30 0'	Sand mixed with gravel cobble and bedrock	Same	Same
30 - 35 0'	Bedrock	Same	Scattered Patches



Transect 2: Below Water Line

Transect Distance from Start (m)	Depth	Substrate	Invertebrates and Fish	Plant Species
50 - 55	17	60% Rock and 40% Sand		<i>Laminaria sp.</i> Devils Apron Kelp Filamentous Brown and Red
55 - 60	15	6"-6' Rock	Occasional Scallop Shells	Same
60 - 65	13	Same		Same
65 - 70	13	Same	Sea Anemone and Star Fish	Same
70 - 75	13	Same		Same
75 - 80	14	Same	Sea Anemone	Same
80 - 85	14	Same		Same
85 - 90	14	Same	Hermit Crab	Same
90-95	14	10% Rock		Brown Filamentous
95-100	12	Same		Same

Transect 1: Leg 2, Perpendicular Leg

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
50 - 55	Rock and 10% Sand	Occasional Mussels and Urchins	<i>Laminaria</i> sp. Devils Apron Kelp Filamentous Brown and Red
55 - 60	6"-6' Rock	Occasional Scallop Shells	Patches of <i>Ascarina</i>
60 - 65	Same		Same
65 - 70	Same		Same
70 - 75	Same	Hemit Crab	Same
75 - 80	Same		Same
80 - 85	Some Gravel		Same
85 - 90	Same		Same

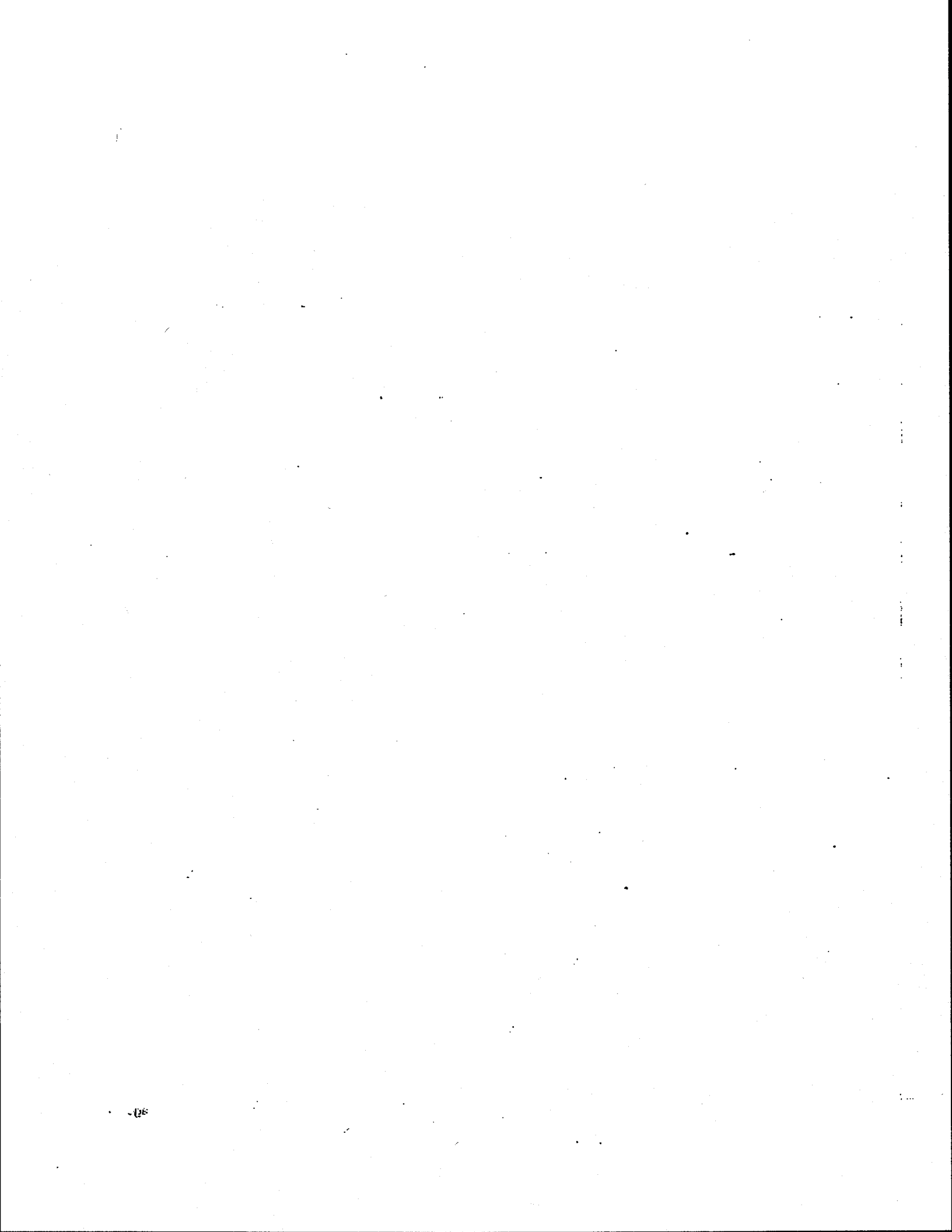
Transect 1: Leg 2, Above Water

Transect Distance from Shore (m)	Substrate	Invertebrates and Fish	Plant Species
0 - 5 Depth 0'	Bedrock, Boulders, and Large Cobbles		Sea Lettuce, <i>Laminaria sp.</i> <i>Fucus sp.</i> , <i>Ascophyllum sp.</i>
5 - 10 0'	Same		<i>Ascophyllum</i> , 100% coverage
10 - 15 0'	Same		Same
15 - 20 0'	Same		Same
20 - 25 0'	Same		Same
25 - 30 0'	Same		Same
30 - 35			End of Littoral Zone



Transect 1: Leg 1, Longshore Leg

Transect Distance from Start (m)	Substrate	Invertebrates and Fish	Plant Species
0-5	Sand and 5-10% Rock	Sporadic Mussels and Urchins	<i>Laminaria sp.</i> Both Mature and Immature Devils Apron, Filamen. Brown
5-10	Sand and Rocks 6" to 8"	Same	Some <i>Ascophyllum sp.</i>
10-15	Same	Same	Both <i>L. sacharina</i> and <i>digitata</i>
15-20	Same	Same	Same
20-25	Same	Same	Same
25-30	Same	Same	Same
30-35	Same	Same	Same
35-40	Sand and Larger Rock Rocks 6" - 6'	<i>Asterias</i> , Urchins, Mussels	Same
40-45	Same	Occasional Large Mussels	Same
45-50	Same	Triton Snail	Same



### 3.0 CONCLUSIONS

Characterizations of the substrate along the transects at the marine terminal at Tiverton, NS, were made using a combination of visual field observations and underwater video survey techniques. The dominant substrate type within the proposed breakwater construction footprint at Tiverton was a combination of sand and rock, with some bedrock outcrops and larger boulders. The substrate size ranges from 6" to 8" for rocks and 3' to 6' for boulders.

The macrofauna encountered within the Tiverton footprint included: mussels (*Mytilus edulis*) and green urchins (*Strongylocentrotus droebachiensis*), Triton Snail, scallop shells, sea stars (*Asterias spp.*), finger sponge (*Haliclona oculata*), Sea Anemone, Star Fish, Hermit Crab (*Pagurus spp.*), frilled anemone (*Metridium senile*), barnacles (*Balanus spp.*), and empty scallop shells. It should be noted that over 67% of the transect areas that were surveyed contained no macrofaunal species.

The macrofloral species present within the proposed breakwater construction footprint include: kelp (*Laminaria digitata* and *Laminaria saccharina*), sea colander (*Agarum cribrosum*), sea lettuce (*Ulva lactuca*), filamentous brown and red macrophytes, patches of rockweed (*Fucus spp.*) and knotted wrack (*Ascophyllum nodosum*). It should be noted that over 10% of the transect areas that were surveyed contained no macrofloral species.

Marine sediment sampling was conducted to confirm the presence or absence of contamination in the Tiverton Harbour related to ferry terminal and other harbour activities. The following summarizes the relevant analytical results of the intrusive investigation:

- With the possible exception of two metal constituents, the sediment samples were all below guideline levels recommended by CCME, NSDOEL, and Atlantic PIRI for a land disposal option for marine sediments.
- The sample results of <11 mg/kg for Boron in all samples is higher than the CCME Soil Quality Guideline recommended value of 2 mg/kg for Agricultural areas. In addition the sample results of <3 mg/kg in all samples for Selenium is higher than the NSDOEL Schedule "A" recommended values of 0.6 mg/kg and 2 mg/kg for Agricultural and Residential/Parkland areas, respectively, and the CCME Soil Quality Guideline recommended values of 1 mg/kg for both Agricultural and Residential/Parkland areas. It should again be noted that due to the limits of the laboratory detection levels, it might be possible that the actual values for these two contaminants may be below these guideline values.



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 August 2003

Parameters	Units	Sample Identification							NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		1	3	5	7	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial				
Phenanthrene	µg/kg	<5	<5	<5	<5	-	-	-	100	5000	50000	50000				
Anthracene	µg/kg	<5	<5	<5	<5	-	-	-	-	-	-	-				
Fluoranthene	µg/kg	<5	<5	<5	7	-	-	-	-	-	-	-				
Pyrene	µg/kg	<5	<5	<5	6	-	-	-	100	10000	100000	100000				
Total PAH	µg/kg	<20	<20	<20	13	500	100	100000	-	-	-	-				

Table 2.3 PCB Concentrations in the Four Marine Sediment Samples at Tiverton, NS

Parameters	Units	Sample Identification							NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		1	3	5	7	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial				
Total PCB (Aroclor 1016+1221+1232+1242+1248+1254+1260 isomers)	mg/kg	<0.015	<0.015	<0.015	<0.015	0.05	0.5	1	0.5	1.3	33	33				

Table 2.4 Pesticide Concentrations in the Four Marine Sediment Samples at Tiverton, NS

Parameters	Units	Sample Identification							NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		1	3	5	7	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial				
Endosulfan I	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
Endosulfan II	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
a-BHC	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
g-Chlordane	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
Aldrin	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
b-BHC	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
g-BHC	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
Dieldrin	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
Endosulfan Sulphate	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
Endrin	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				
g-Chlordane	mg/kg	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-				

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Table 2.1 Metal Concentrations in the Four Marine Sediment Samples at Tiverton, NS

Parameters	Units	Sample Identification							NSDOEL Schedule 'A' Guidelines for Land Based Disposal of Marine Sediments				CCME Soil Quality Guidelines, 2002			
		1	3	5	7	Agriculture	Residential/ Parkland	Commercial/ Industrial	Agriculture	Residential/ Parkland	Commercial	Industrial				
Aluminum (Al)	mg/kg	1630	1660	1730	1710	-	-	-	-	-	-	-	-	-	-	
Antimony (Sb)	mg/kg	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	20	20	40	
Arsenic (As)	mg/kg	1.1	1.2	1	1.1	8	20	30	12	12	12	12	500	2000	2000	
Barium (Ba)	mg/kg	4	7	4	8	-	-	-	-	-	-	-	4	8	8	
Beryllium (Be)	mg/kg	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	
Bismuth (Bi)	mg/kg	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	
Boron (B)	mg/kg	<11	<11	<11	<11	-	-	-	-	-	-	-	-	-	-	
Cadmium (Cd)	mg/kg	<0.6	<0.6	<0.6	<0.6	2	3	10	1.4	10	22	22	-	-	-	
Calcium (Ca)	mg/kg	2420	1320	1960	2220	-	-	-	-	-	-	-	-	-	-	
Chromium (Cr)	mg/kg	5	5	4	5	25	250	400	64	64	87	87	64	300	300	
Cobalt (Co)	mg/kg	1.7	1.6	1.7	1.7	-	-	-	40	50	87	87	50	91	91	
Copper (Cu)	mg/kg	5.9	5.4	5.2	6.5	500	100	150	63	63	91	91	-	-	-	
Iron (Fe)	mg/kg	3740	3440	3470	3500	-	-	-	-	-	-	-	-	-	-	
Iron (Fe)	%	0.374	0.344	0.347	0.35	1	4	10	-	-	-	-	-	-	-	
Lead (Pb)	mg/kg	4.0	3.0	4.0	3.0	75	150	2500	70	140	260	260	70	600	600	
Lithium (Li)	mg/kg	6	5	5	5	-	-	-	-	-	-	-	-	-	-	
Magnesium (Mg)	mg/kg	1340	1310	1390	1450	-	-	-	-	-	-	-	-	-	-	
Manganese (Mn)	mg/kg	50.8	44.9	46.6	44.1	-	-	-	-	-	-	-	-	-	-	
Mercury (Hg)	mg/kg	<0.5	<0.5	<0.5	<0.5	0.8	0.8	2.0	6.6	6.6	24	24	6.6	50	50	
Molybdenum (Mo)	mg/kg	<0.2	<0.2	<0.2	<0.2	-	-	-	5	10	40	40	5	40	40	
Nickel (Ni)	mg/kg	3.7	3.6	3.3	3.5	25	100	200	50	50	50	50	50	50	50	
Potassium (K)	mg/kg	244.0	254.0	257.0	260.0	-	-	-	-	-	-	-	-	-	-	
Selenium (Se)	mg/kg	<3	<3	<3	<3	-	-	10	-	-	3.9	3.9	-	-	-	
Silicon (Si)	mg/kg	<250	<250	<250	<250	-	-	-	-	-	-	-	-	-	-	
Silver (Ag)	mg/kg	<1	<1	<1	<1	-	-	-	20	20	40	40	-	-	-	
Sodium (Na)	mg/kg	1780.0	1770.0	1820.0	1960.0	-	-	-	-	-	-	-	-	-	-	
Strontium (Sr)	mg/kg	12.6	10.0	13.3	11.1	-	-	-	-	-	-	-	-	-	-	

## 2.2 Marine Sediment Sampling

Four marine sediment samples were collected from the Tiverton Harbour in the proposed area of the PWGSC new breakwater construction. All samples were analyzed for metals, PAHs, PCBs, pesticides and a grain size sieve analysis was also performed on the samples. It should be noted that based on the proposed land based disposal option, the marine sediment samples collected were compared to the CCME Soil Quality Guidelines, NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments and the Atlantic PIRI Tier 1 Tables for petroleum hydrocarbons. The sediment analysis results are summarized in the following subsections and their corresponding tables.

The laboratory certificates of the marine sediment analysis of the proposed breakwater construction footprint are presented in Appendix C.

### Metal Concentrations

- All samples had metal concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments, with the exception of Boron and Selenium. The sample results of <11 mg/kg for Boron is higher than the CCME Soil Quality Guideline recommended value of 2 mg/kg for Agricultural areas. In addition the sample results of <3 mg/kg for Selenium is higher than the NSDOEL Schedule "A" recommended values of 0.6 mg/kg and 2 mg/kg for Agricultural and Residential/Parkland areas, respectively, and the CCME Soil Quality Guideline recommended values of 1 mg/kg for both Agricultural and Residential/Parkland areas. It should be noted that due to the limits of the detection limits, it might be possible that the actual values for these two contaminants may be below these guideline values. The results are summarized in Table 2.1.

### PAH Concentrations

- All samples had PAH concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments. The results are summarized in Table 2.2.

### PCB Concentrations

- All samples had PCB concentrations below the criteria for meeting CCME Interim Soil Quality Guidelines and NSDOEL Schedule "A" Guidelines for Land Based Disposal of Marine Sediments. The results are summarized in Table 2.3.

### Pesticides

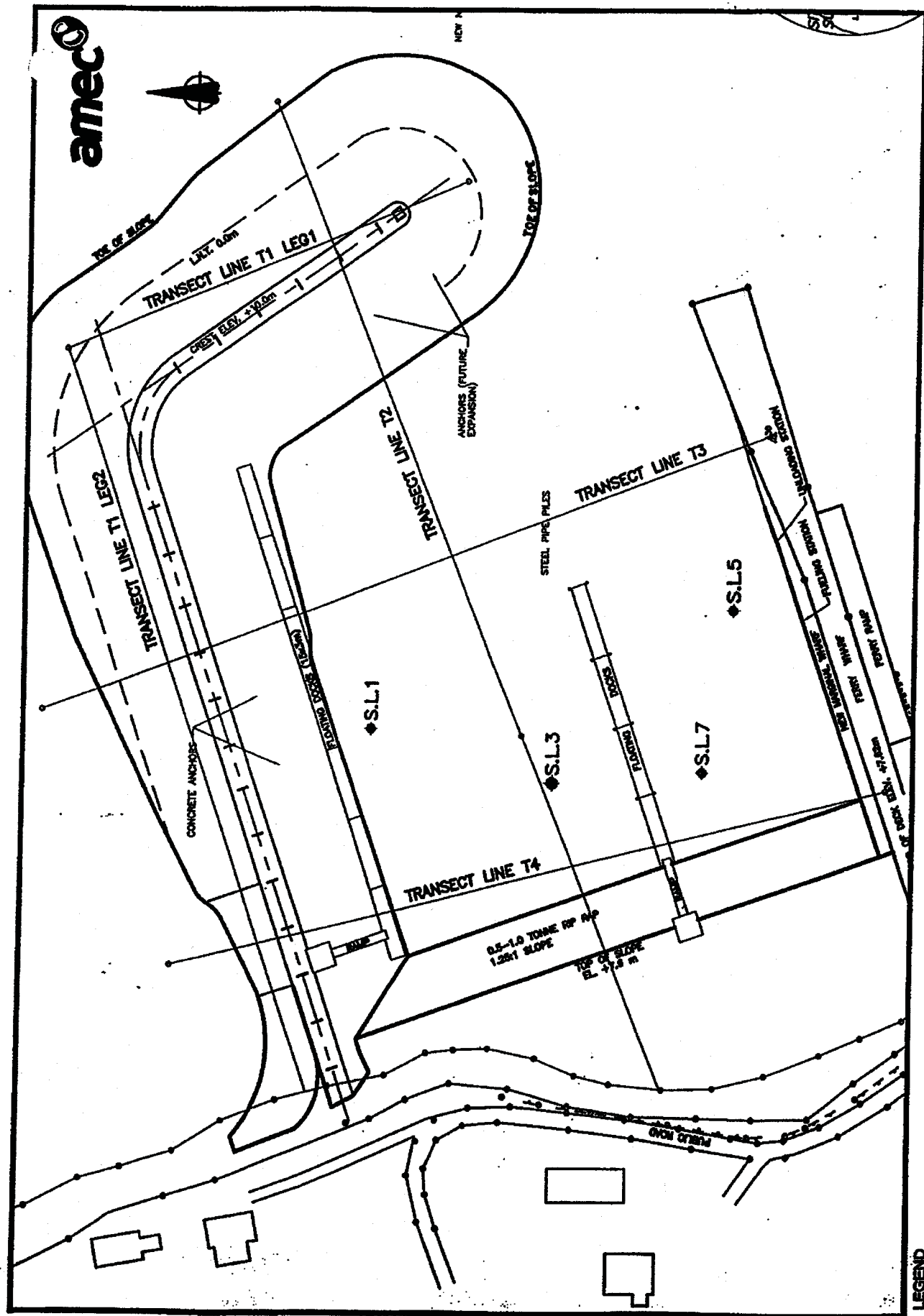


**Table 1.2** *Coordinates of Marine Sediment Samples, Tiverton, Digby County, NS*

Sample Number	Latitude	Longitude
MS#1	90 m North of Existing Shore Line	
	44° 23'47.3" N	66°12'49.2" W
MS#3	70 m North of Existing Shore Line	
	44°23'47.4" N	66°12'47.7" W
MS#5	15 m north of Existing Ferry Terminal	
	44°23'47.9" N	66°12'48.7" W
MS#7	13 m north of Existing Ferry Terminal	
	44°23'47.5" N	66°12'46.8" W

\*Note: Coordinates are given in NAD83.

Deviations in the coordinates and the actual sample location can be attributed to the instability of the boat as a result of tidal influences.



**FIGURE 1.1**  
**UNDERWATER BENTHIC HABITAT SURVEY AND MARINE SEDIMENT SAMPLING**  
**TRANSECT LINES AND SAMPLE LOCATIONS**

**◆ S.L.2** MARINE SEDIMENT SAMPLE LOCATION

**LEGEND**

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