citizens of the province and are protected and curated by the Nova Scotia Museum under the *Special Places Protection Act* (*R.S., c. 438, s.1.*).

Archeology and Heritage Resources are considered a VEC for this assessment because they provide a record of past use and occupation at the Project site and are important to regulators and the public. This VEC is also linked to the Land Use VEC (Section 6.6).

6.8.1 Environmental Assessment Boundaries

Spatial and Temporal

The archaeological assessment was designed to determine the potential for archaeological resources to be present within the boundaries of the study area which include the dredging channel, the confined disposal facility and the marine footprint for the new facility as well as the near shore area, and a secondary confined disposal facility on the east side of the Harbour at International Piers. These areas are collectively referred to as the Assessment Area for the assessment of Archaeological and Heritage Resources.

Project-related effects on archaeological resources are more likely to occur during the construction phase; however, environmental effects to such resources will be permanent and irreversible.

Administrative and Technical

Archaeological resource impact assessments (ARIA) are conducted under the Nova Scotia Special Places Protection Act and must be conducted under a Heritage Research Permit which is issued by the Provincial Minister of Tourism, Culture and Heritage. This ARIA was conducted under Heritage Research Permits A2008NS60 and A2008NS78.

The information used for this assessment was derived from historic research and consultation as well as archaeological reconnaissance and subsurface testing. The documentary resources used are limiting in that they are often incomplete, imprecise, and potentially inaccurate and have not been tested in the field.

6.8.2 Residual Environmental Effects Evaluation Criteria

Archaeological resources are evaluated according to their relative importance based on the cultural and physical integrity of the resources, existing documentation, and the expected effects on those resources. A significant adverse residual environmental effect is defined as any unmitigated Project-related disturbance to, or destruction of, archaeological or heritage resources considered by the affected First Nations, communities, or provincial heritage regulators to be of major importance due to factors such as rarity, condition, spiritual importance, or research importance.

It is important to informatively evaluate all archaeological sites that are threatened by development, either as a result of direct effects or as a cumulative or residual effect of development, as archaeological sites are non-renewable resources and adverse effects are permanent. The magnitude of potential residual adverse effects on an archaeological resource is directly tied to its archaeological importance.

6.8.3 Potential Interactions, Issues and Concerns

The potential interactions between Project-related activities during each phase of the Project and potential environmental effects to Archaeological and Heritage Resources are shown in Table 6.30.

TABLE 6.30 Potential Project Environmental Effects to Archaeological and Heritage Resources

Project Activities and Physical Works	Potential Environmental Effects Change in Archaeological and Heritage Resources
Construction and Commissioning	
Dredge and Dewatering	2
Vessel Transportation	0
Construction of confined disposal facility(s)	2
Site Preparation	2
Construction of land components	2
Operation	
Marine Vessel Traffic	0
Loading and Unloading Vessels/Trains	0
Site stormwater and wastewater Management	0
Equipment and Materials Storage	0
Maintenance/Repairs to Terminal	0

Note: Project-Environment Effects were ranked as follows:
0 No interaction. No substantive interaction contemplated.
1 Interaction will occur. However, based on past experience and professional judgment, the interaction would not result in a significant environmental effect, even without mitigation, or the interaction would clearly not be significant due to application of codified practices
2 Interaction may, even with codified mitigation, result in a potentially significant environmental effect and/or is important to regulatory and/or public interest. Potential environmental effects are considered further and in more detail in the EIA.

Ground disturbing activities associated with construction and operation of the Project could have significant adverse effects on archaeological and heritage resources. If unmitigated, activities such as dredging, grubbing, grading, and excavation could result in the permanent loss of irreplaceable archaeological and heritage resources and the knowledge that can be gained from them. Infilling of archaeological features without disturbance to the resource is deemed an insignificant effect, assuming that the location, extent, nature, and importance of the site have been recorded in detail prior to infilling. The frequency of impacts on archaeological resources is typically a result of a single activity.

Table 6.31 provides the measurable parameters that will be used for the environmental effects assessment, and the rationale for the selection of the measurable parameters.

TABLE 6.31 Measureable Parameters for Archaeological and Heritage Resources

Environmental Effects	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Archaeological and Heritage Resources	Number of known archaeological or heritage resource in study area.	The identification of specific sites will allow for a more complete measure of the potential effects of the Project on these resources.
	Potential to encounter undiscovered archaeological and heritage resource sites in study area.	It is important to identify sites within the study area that have a higher likelihood of containing important archaeological and heritage resource sites.

Construction and Commissioning

Activities related to construction and commissioning of the terminal and related infrastructure may result in environmental effects to archaeological resources. A wooden tugboat is known to exist in the Seaward Arm of Sydney Harbour near the proposed dredge channel. The dredge channel alignment has been shifted to avoid interactions with this archaeological resource.

Site preparation and construction of the terminal and confined disposal area at Keating Cove will affect three known archaeological resources including two earthen depressions near the coast and an unidentified feature (possible footing of a barn) further inland.

Construction of land components such as roads, rail, and buildings may also affect known archaeological features. Two stone and concrete foundations were encountered by archaeologists near an arm of Barachois Creek. An historic midden was also noted on the shoreline of the Creek.

Operation

Operation of the marine facility is not expected to affect archaeological resources; however, potential dragging of anchors by marine vessel traffic in the near shore area may cause disturbance to as yet unknown resources related to historic maritime activity (i.e. shipwrecks) as well as to precontact First Nations resources that may be submerged in the near shore area. Maintenance dredging is not anticipated, but would have the same effect on such resources.

6.8.4 Analysis, Mitigation and Residual Environmental Effects Prediction

6.8.4.1 Construction and Commissioning

The development area contains historic period archaeological resources which may be affected by ground disturbance activities. These resources are not limited to terrestrial areas. The potential exists for submerged First Nations archaeological resource in the near shore area as well as on land.

Avoidance is the preferred method of mitigation in all instances where archaeological resources are present; however, if avoidance is not possible, full-scale excavation of the two earthen features is recommended in order to further understand their function and significance. The two stone and concrete foundations have been determined be of low archaeological significance and therefore no further mitigation is recommended. The testing around the shoreline of Barachois Creek indicated that the potential for First Nations archaeological resources in the area is low. However, should any resources be encountered during development, the Manager of Special Places, Mr. Robert Ogilvie (902-424-6475) should be contacted immediately in order to determine a suitable method of mitigation. Finally, a plan for contacting the appropriate organizations should be developed should the potential for impact to submerged resources related to First Nations exist, including the Nova Scotia Department of Tourism, Culture and Heritage and First Nations.

6.8.4.2 Operation

Operation of the marine facility is not expected to result in adverse environmental effects to archaeological resources. Maintenance dredging is not anticipated, but could have the same effect on submerged resources as noted for Project construction and similar mitigation would apply.

6.8.5 Follow-up and Monitoring

Any changes or expansion to the Project development area should be followed up by an archaeological assessment of those areas not previously considered during this assessment in order to ensure that no archaeological resources are present which may be affected by ground disturbance. In the event that previously-unknown archaeological resources are encountered during construction, it is recommended that all activity cease and the Manager of Special Places, Mr. Robert Ogilvie (902-424-6475) be contacted immediately regarding a suitable method of mitigation.

6.8.6 Summary of Residual Environmental Effects Prediction

Project development will involve ground disturbance which may affect archaeological resources. Provided the mitigative measures laid out are followed (*i.e.,* that the development area be subjected to an archaeological survey with a focus on identified sites noted above that the necessary protocols and consultation measures are in place), it is anticipated that significant adverse environmental effects to archaeological resources can be avoided. A summary of potential effects and mitigative measures is provided in Table 6.32.

TABLE 6.32 Environmental Effects Assessment Matrix: Archeological and Heritage Resources

Project Activity	Potential Environmental Effect Positive (P) or Adverse (A)	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-economic Context	Prediction Confidence
CONSTRUCTION AND COMMISSIONING								
Dredge and Dewatering	▪ Damage to, or loss of, submerged archaeological or heritage resources (A)	▪ Avoidance ▪ Development of monitoring protocols	H	1	3/1	I	2	H
Construction of confined disposal facility	▪ Damage to, or loss of, submerged archaeological or heritage resources (A)	▪ Avoidance ▪ Where avoidance is not possible, full excavation of terrestrial features is recommended ▪ Development of monitoring protocols to address impact to potential submerged resources	L	1	3/1	I	1	M

TABLE 6.32 Environmental Effects Assessment Matrix: Archeological and Heritage Resources

Project Activity	Potential Environmental Effect Positive (P) or Adverse (A)	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-economic Context	Prediction Confidence
Site Preparation	▪ Damage to, or loss of, archaeological or heritage resources ((A)	▪ Avoidance ▪ Where avoidance is not possible, full excavation of terrestrial features is recommended ▪ Development of monitoring protocols to address impact to potential submerged resources	L	1	3/1	I	1	M
Construction of land components	▪ Damage to, or loss of, archaeological or heritage resources ((A)	▪ Avoidance ▪ Where avoidance is not possible, full excavation of terrestrial features is recommended	L	1	3/1	I	1	H

KEY

Magnitude:
L Low: Neither disturbance to, or destruction of, an Archaeological or Heritage resource.
M Moderate: Mitigated disturbance to, or removal of, an Archaeological or Heritage Resource
H High: Unmitigated disturbance to, or destruction of, an Archaeological or Heritage Resource considered to be of major importance.

Geographic Extent:
1 = Environmental effects restricted to Project footprint.
2 = Environmental effects extend beyond the Project footprint but remain with Assessment Area.
3 = Environmental effects extend beyond Assessment Area.

Duration:
1 = Short term: Effects are measurable for <1 year.
2 = Medium term: Effects are measurable for 1 to 5 years.
3 = Long term: Effects are measurable for >5 years.

Frequency:
1 = Occurs once.
2 = Occurs rarely and at sporadic intervals.
3 = Occurs on a regular basis and at regular intervals.
4 = Continuous.

Reversibility:
R = Reversible.
I = Irreversible.

Ecological/Socio-economic Context:
1 = Area is relatively pristine or not adversely affected by human activity.
2= Evidence of existing negative environmental effects (*e.g.,* existing stream crossings).

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation
L Low level of confidence
M Moderate level of confidence
H High level of confidence

6.9 Decommission and Abandonment

With proper operation and maintenance and equipment replacement, as needed, the lifespan of the Sydport Terminal Facility is considered indefinite as long as market forces support continued operation. As noted in Section 2.2, maintenance dredging is not expected for many years, if at all. Should decommissioning and abandonment of the terminal be required, it will be undertaken in accordance

with the regulatory requirements applicable at the time of such activities, which could include another environmental assessment. The effects of decommissioning and abandonment are expected to be similar to the construction and commissioning phases. However, the magnitude and duration of such effects are expected to be substantially less than Project construction because it is anticipated that most of the civil infrastructure (*e.g.,* jetty, roads) will be left in place with a few structures removed (*e.g.,* cranes, buildings). A Decommissioning and Abandonment Plan and a site restoration plan, will be developed and submitted to the relevant regulatory authorities for review prior to such activities taking place (refer to Section 2.3). The plan will focus on protecting health and safety, improving or eliminating environmental damage and liabilities, and reclamation of the land for future industrial use.

The following effects assessment is based on very limited information available at this time. It is anticipated that further assessment would be conducted in the future prior to decommissioning and abandonment.

Marine VECs

Marine VECs include Benthic Fish and Sediment Quality; Marine Fish and Water Quality; and Marine Mammals and Marine Related Birds. Decommissioning and abandoning activities will be similar to construction activities in some respects but of considerably less magnitude and duration, as there will be no requirements for dredging and/or pile driving and it is anticipated that marine-based construction (*e.g.,* wharf, berth, *etc.*) will remain intact. The effects on the Marine VECs from decommissioning will likely be limited to a potential increase in total suspended solids as a result of dismantling land based structures which may result in temporary soil exposure. The Decommissioning and Abandonment Plan will include mitigation that will prevent discharges to the marine environment not in compliance with applicable regulations of the day including procedures to control sediment run-off. The residual effects on the Marine VECs resulting from decommissioning and abandonment will not be significant.

Terrestrial Habitats and Wildlife

Changes in the quality of habitat for wildlife may occur during Project decommissioning and abandonment as a result of increased levels of noise which may result in avoidance by some species; however this disturbance will be short term and consistent with previous terminal operations. There will be no additional loss of terrestrial habitat during decommissioning; decommissioning and abandonment efforts will include site rehabilitation with possible revegetation of previously built areas which will improve terrestrial habitats. Any contaminated soils will be remediated to standards appropriate for future industrial development. The residual effects on Terrestrial Habitats and Wildlife resulting from decommissioning and abandonment should be positive.

Atmospheric Resources

The potential environmental effects to air quality (*e.g.,* dust) and the acoustic environment generated by decommissioning and abandoning activities will be similar to those that may occur during construction and commissioning although of less magnitude and duration (*e.g.,* no dredging or pile driving and less construction equipment). The Decommissioning and Abandonment Plan will include mitigation similar to that outlined for construction and commissioning (*e.g.,* dust control and compliance with noise limits) to minimize the environmental effects of decommissioning and abandonment. The residual environmental effects on atmospheric resources will not be significant.

Land Use

The property will be decommissioned and abandoned in such a way that is consistent with the CBRM Planning Strategy and SIP zoning and may include public consultation with respect to future use objectives; therefore residual environmental effects will not be significant.

Archaeological and Heritage Resources

Potential effects on archaeological and heritage resources resulting from decommissioning and abandonment are not anticipated; however the Decommissioning and Abandonment Plan will outline mitigation measures in the event of an artifact discovery. Therefore significant residual effects from Archaeological and Heritage Resources are assessed as not significant.

7.0 ASSESSMENT OF MALFUNCTIONS AND ACCIDENTS EVENTS

Accidents, malfunctions and unplanned events (referred to here as "accidental events") associated with the Project have the potential to result in environmental effects. These potential events have been scoped to include scenarios that have a reasonable chance of occurring (although may be highly unlikely) and could lead to adverse environmental effects. They include: fires; marine vessel accidents; and hazardous materials spills as presented in the Scoping Document (LEC 2008) for this assessment.

The VECs selected for effects assessment through the scoping process described in Section 5.0 are also considered appropriate and inclusive for the consideration of accidental events. The significance criteria and boundaries for these VECs is the same as those provided for the assessment of routine Project activities in Section 6.0.

In general, the Project will be designed, commissioned and operated to reduce the potential for accidental events in order to promote safe and efficient facility operations and to comply with all environmental and worker health and safety requirements. Many design features (including codes and standards) and management plans will be incorporated (see Section 2.12). While accidental events will be uncommon, particularly large scale events with severe consequences, they are possible. Contingency and emergency response plans will be developed to rapidly address and minimize adverse effects in their unlikely event.

7.1 Potential Effects and Proposed Mitigation

Accidental events have the potential to adversely affect a number of VECs in both the terrestrial and marine environments through changes in habitat quality and quantity and direct mortality as well as increased risk to marine transportation. These potential interactions with the scoped accident and malfunction scenarios are indicated in Table 7.1.

TABLE 7.1 Potential Interaction of Accidental Events with Valued Environmental Components

Accidents and Malfunction	VEC							
	Marine Fish and Water Quality	Benthic Habitat Communities and Sediment Quality	Marine Mammals and Marine Related Birds	Terrestrial Habitats and Wildlife	Atmospheric Resources	Archaeological and Heritage Resources	Commercial Fisheries	Land Use
Fires	X			X	X			X
Marine Vessel Traffic Accidents	X		X				X	
Hazardous Materials Spills	X	X	X	X	X		X	X

7.1.1 Fires

During Construction and Operation, activities such as equipment re-fueling, careless smoking and brush burning could result in a fire.

Fires could result in terrestrial habitat alteration including wetland habitat loss and direct mortality of rare plants and wildlife. Fire fighting chemicals and any spilled materials from the facility could enter sensitive terrestrial habitats (*e.g.,* wetlands) and marine environments which could adversely affect fish and fish habitat and marine water quality if allowed to disperse and persist. Fires have the potential for adverse effects on atmospheric resources and could pose risks to human health and safety.

An Emergency Response and Contingency Plan (see Section 2.12) will be developed for the Project and implemented in the unlikely event of fire in order to rapidly respond to the incident and restrict the dispersion of fire fighting chemicals and other spilled materials. The terminal facility will be designed to minimize the incidence and effects of a fire (*e.g.,* adherence to all building and fire codes). Specific mitigation includes: proper supervision of brush fires; compliance with conditions of burning permit(s); clearing and burning brush during the late fall, winter or early spring when forested habitats are less flammable; regular inspections of the work site; training of personnel in fire fighting techniques; provision of firefighting equipment; installation of specialized equipment to detect fires; and the installation of fire fighting systems in the facility. Any facility fires spreading to the surrounding vegetation would likely be rapidly controlled by trained first responders (*e.g.,* municipal fire departments and provincial forest fire fighting forces, if necessary).

The Project Emergency Response and Contingency Plan will have documented procedures applying to operation, maintenance and training, and will establish a documented emergency plan related to fires. Training will be provided to instruct all facility personnel with respect to carrying out the emergency procedures that relate to their duties. The Plan will consider the procedures for responding to emergencies, including the notification of personnel and the appropriate use of equipment. Procedures will be developed to address the unlikely event of an uncontrolled emergency including procedures to protect facility personnel and the public, and to provide prompt notification of the emergency to the appropriate local officials.

The Project will establish liaison with local authorities (*e.g,.* CBRM Fire Department and Police Department) to inform them of the emergency plans and establish clear roles in emergency situations. The Cape Breton Regional Fire Departments (including the Westmount Volunteer Fire Department) is available to respond during an emergency and assist plant personnel with any fires or spill events, should they occur. CBRM Police Department is available to provide security and access control during an emergency. Methods will be developed to advise the relevant fire and police department personnel of:

- the quantity and location of fire equipment;
- potential hazards at the facility; and
- communication and emergency control capabilities at the facility.

In consideration of the mitigation measures noted above, the effects of a fire are expected to be localized (*e.g.,* limited to the facility property), of short duration and reversible. Significant effects on terrestrial and marine VECs due to fires are not likely.

Significant adverse effects on atmospheric resources (*i.e.,* exceeding air quality regulatory limits) and human health and safety could result due to fires; however these accidents are unlikely to occur, and would be rapidly controlled by trained first responders (*e.g.,* trained on-site crews and municipal emergency response forces). Any such effects on atmospheric resources would be localized and temporary. Significant effects on atmospheric resources are therefore unlikely. Emergency response and contingency plans will minimize the threat to human health and safety.

7.1.2 Marine Vessels Traffic Accidents

Vessel accidents have the potential to interact with several VECs in this assessment. There is potential for impacts to Marine Fish and Marine Water Quality; Marine Mammals and Marine Related Birds; and damage to fisheries equipment. Of particular concern are Project related vessel collisions or groundings resulting in the release of oil or other deleterious substances which could impact Marine Fish and Water Quality, Marine Mammals and Marine Related Birds and Commercial Fisheries. Discharge of oily bilge or ballast water in Sydney Harbour will not be permitted (Section 4.11).

The approaches to Sydney Harbour are relatively free of hazards with wide channels and sea-room to swing off the berths. The channels to and from South and North West Arm converge in the vicinity of the Southeast Bar; marine traffic flow in the vicinity of Southeast Bar will be restricted due to limited sea-room. The land at Southeast bar extends into the waters of the harbour approximately 550 m, and is well marked with the Southeast Bar light and two buoys.

When approaching and departing the Sydport Container terminal, vessels will be under the jurisdiction of Canadian Coast Guard (CCG) and they will be subject to mandatory pilotage requirements. In addition, protection of the ship during navigation, berthing and unberthing, and while docked and unloading is a critical design consideration. The Terminal has been sited to take advantage of the relatively sheltered conditions at the Sydport location and generally favourable navigational features associated with the Sydney Harbour.

Container vessels carry up-to-date, anti-collision navigational systems. Crews on these vessels meet or exceed the standards of competence required by the International Convention, Standards of Training and Certification for Watchkeepers (STCW). The vessels and crews are monitored under the International Convention, Port State Control, with inspections carried out by the Marine Safety Inspectors in Canada, and the equivalent inspectors from other nations. Risk of incident for vessels in the approaches to, and the waters of, the Sydney Harbour are increased due to the proximity of other vessels and shallow waters; however a well-equipped, competently-crewed vessel is unlikely to be involved in an incident.

Transportation Canada Safety Board (TSB) maintains records of specific accidents and incidents occurring in Canadian waters. Their records indicate that within Sydney Harbour, there were 24 accidents and reportable incidents over the past 10 years, none of which resulted in a pollution incident (Table 7.2). The number of accidents and reportable incidents in Sydney Harbour after Project development is unlikely to increase.

TABLE 7.2 Types of Incidents or Accidents Within the Vicinity of Sydney Harbour between 1998 and 2007

Type	Number
Touching bottom	1
Grounding	2
Striking / Stuck in Ice	7
Taking in Water	1
Fire Aboard	2
Man Overboard	2
Gear Issue	4
Dangerous Goods Incident	3
Other	2
Total	24

(F Sidock, Transportation Safety Board)

In addition to the mitigation noted above, in the highly unlikely event of a vessel collision or grounding resulting in the release of oil or other deleterious substance the site-specific Spill Management Plan will be employed. It will limit the environmental effects of the incident by providing guidance on the appropriate clean up and containment strategies. Therefore vessel collisions are not likely to be significant.

7.1.3 Hazardous Materials Spills

A terrestrial or marine hazardous materials spill could occur during Construction or Operation. There is potential for accidental release of small volumes of other materials such as diesel fuel, hydraulic fluids, lubricants, oil and other deleterious substances.

Diesel fuel will be stored on site to run some equipment and emergency generators; the tanks will have secondary containment in accordance with provincial regulations. Diesel will also be available at the terminal to fuel marine vessels and construction machinery. Additional hazardous materials such as lubricating oils may be used. Localized minor spills could alter marine, terrestrial habitats and cause injury and mortality to birds, wildlife, rare plants, marine fish and marine mammals; commercial fisheries may also be affected.

Various factors would determine the degree to which ecosystems would be affected by spills, including the nature, location and quantity of material spilled. Spills could cause degradation of surface water quality and mortality of affected plants or wildlife.

To minimize, contain and control any potential releases of hazardous materials, a site-specific Spill Management Plan (see Section 2.12) will be developed. All staff will be appropriately trained in the handling, storage and disposal of hazardous materials (*e.g.,* WHMIS, TDG). Chemical storage and handling will be done in accordance with the manufacturers' recommendations and federal and provincial regulations.

Additional mitigation measures include:

- ensuring an adequate level of environmental awareness by contractors and workers;
- incorporating specific mitigative measures into contract specifications and providing strict on-site control and inspection;

- maintaining equipment and machinery in good working order and monitoring for leaks of fuel, lubricants and other hazardous substances;
- storing fuels, lubricants and other hazardous substances in designated areas (*e.g.,* with berms) outside of buffer zones established around surface water/wetlands;
- refuelling and maintenance activities should be undertaken on level terrain, at a suitable distance from environmentally sensitive areas including watercourses, and on a prepared impermeable surface with a collection system
- stockpiling potentially hazardous construction materials away from surface water/wetlands; and
- implementation of a Spill Management Plan to address response to accidental spills; this would include immediate clean-up of releases, containment and removal of impacted groundwater and removal and proper disposal of impacted soil.

In consideration of the safety measures and mitigation in place, any discharge to the environment would be minimal. Effects of localized, minor spills on the environment would be reversible and minimal, as any such spills would be rapidly cleaned up in accordance with the Spill Management Plan. Significant effects on Project VECs from a hazardous material spill are not likely.

7.1.4 Summary

With the implementation of design prevention, planning and mitigation measures detailed throughout this section and Section 2.12, environmental effects on the following VECs due to accidental events are not likely to be significant:

- Marine Fish and Water Quality;
- Benthic Habitat Communities and Sediment Quality;
- Marine Mammals and Marine Related Birds;
- Terrestrial Habitats and Wildlife;
- Atmospheric Environment; and
- Commercial Fisheries.

In the highly unlikely event of a Project related ship collision resulting in an oil spill, significant adverse effects are predicted for marine related birds and fisheries resources, however, this significant effect is not likely to occur. The Sydport Terminal will not be servicing bulk petroleum tankers.

Significant adverse effects on air quality (*i.e.,* exceeding regulatory limits) and human health and safety could result due to fires; however these accidents are unlikely to occur, and would be rapidly controlled by trained first responders (*e.g.,* trained on-site crews and municipal emergency response forces). Any such effects on air quality would be localized and temporary. Significant effects on air quality are therefore unlikely. Emergency response and contingency plans will minimize the threat to human health and safety. Significant effects on human health and safety in the surrounding communities, as a result of fires, are not predicted.

8.0 CUMULATIVE EFFECTS

Subsection 16(1) (a) of the *CEAA* requires that every screening of a project include an assessment of the "cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out." Methods for the assessment of cumulative environmental effects are described in Section 5.4.

In the early stages of the assessment, a cumulative effects scoping exercise was conducted to identify past, present, or likely (*i.e.,* approved) future projects that might interact cumulatively with the Project. These projects and activities were included in the draft Scoping Documents (LEC 2008) presented to the Responsible Authorities (LEC 2008) and Expert federal departments on March 25 and June 2, 2008 respectively.

Past and present/ongoing projects or activities potentially affecting VECs have been considered in the description of existing conditions (*i.e.,* as they influence background conditions) as applicable for each VEC (Section 4.0). These projects include:

- development in the Sydport Industrial Park;
- development on the Ports of Sydney Harbour (including marine terminals, and various industrial facilities);
- shoreline infilling/wharf development;
- marine transportation; and
- commercial fisheries.

The assessment of potential Project related environmental effects on VECs (Section 6.0) have therefore considered the cumulative of these past and present/ongoing projects and activities.

Likely future projects and activities were identified and included in the draft Scoping Document and include the following:

- **Muggah Creek Remediation Project.** Sydney Tar Ponds and Coke Ovens cleanup project at Muggah Creek has an extensive history that dates back to the 1980s. It is one of the most prominent remediation projects in Canada today. The Tar Ponds and Coke Ovens sites which are located in the centre of Sydney are the result of nearly a century of steelmaking. As part of the remediation plan, the Tar Ponds will be capped using a combination of geotextiles and clean fill. The primary objective of the remediation project is to stabilize or otherwise remediate contaminated sediments and groundwater onsite (including PAHs and PCBs) to prevent further erosion or leaching into Sydney Harbour where environmental impacts have long been noted. Remediation activities started in 2007 and are expected to be completed by 2014.
- **Other Port Terminal Development in Sydney Harbour.** Marine Atlantic Inc. (Marine Atlantic Ferry Terminal) is planning upgrades of the alternative dock in North Sydney. Upgrades at the Sydney Marine Terminal facility include the addition of a new dolphin with the capacity of 120 to 150 m, allowing enough room for two ships to berth at the same time.
- **Commercial Fishery.** The ongoing commercial fisheries include approximately 40 active fishers that routinely fish the waters of Sydney Harbour (excluding the fisheries closure area of the South Arm) for lobster, rock crab, *etc.* It is expected that the commercial fishery will continue at current levels into the future.

The VECs selected for effects assessment through the scoping process described in Section 5.0 are also considered appropriate and inclusive for the consideration of potential cumulative effects. Past and present/ongoing projects and activities to be assessed for potential cumulative effects are evaluated in the context of the Project effects assessment for the VECs in Section 6.0; the spatial and temporal boundaries for each VEC and significance criteria discussed in Section 6.0 are also considered appropriate for the assessment of cumulative environmental effects. For example, Sydney Harbour is considered appropriate as a cumulative effects assessment boundary to capture most, measurable residual cumulative environmental effects. The likely future projects to be assessed including potential cumulative interactions and relevant VECs are summarized in Table 8.1.

TABLE 8.1 Likely Future Projects and Potential Cumulative Interactions

Project/Activity	Status	Potential Cumulative Interaction	VECs Potentially Affected by Cumulative Effects
Muggah Creek Remediation Project	Planned and ongoing	Remediation activities at Muggah Creek include infilling several heavily contaminated ponds which may result in short term increases in turbidity in the marine environment. Long term effects are expected to include reductions in contaminants entering Sydney Harbour. Remediated lands may become available for future development.	▪ Benthic Habitat and Sediment Quality ▪ Marine Fish and Water Quality ▪ Commercial Fisheries ▪ Land Use
Other Port Terminal Development in Sydney Harbour	Planned and Reasonably foreseeable	Other Port Terminal Developments in Sydney Harbour (principally upgrades to Marine Atlantic and Sydney Marine terminals) may result in infilling which could result in potential cumulative effects on marine environment from erosion and siltation.	▪ Benthic Habitat and Sediment Quality ▪ Marine Fish and Water Quality ▪ Marine Mammals and Marine Related Birds ▪ Land Use ▪ Commercial Fisheries
Commercial Fisheries	Ongoing	Potential cumulative effects on fisheries (*i.e.,* pressures on fisheries resource from combination of directed fishing activity and other projects).	▪ Commercial Fisheries ▪ Benthic Habitats and Sediment Quality ▪ Marine Fish and Water Quality

The following sections evaluate potential cumulative environmental effects where temporal and spatial overlap occurs among residual environmental effects predicted for the Project and other likely projects and activities noted in Table 8.1.

8.1 Benthic Habitats and Sediment Quality; Marine Fish and Water Quality

The Project effects associated with the alteration and loss of benthic marine fish habitat and effects to sediment and water quality (Sections 4.7, 4.8, 6.1 and 6.2) could potentially interact cumulatively with the effects associated with the Muggah Creek Remediation Project, Other Port Terminal Development and Commercial Fisheries in Sydney Harbour. Potential cumulative interactions include changes to

benthic and fish habitat (temporary alteration from channel dredging and permanent loss from CDF infilling) as well as habitat degradation and effects on sediment and water quality due to movement of sediments and associated contaminants.

Spatial and temporal overlaps will occur between the Sydport Project and Muggah Creek Remediation Project with respect to benthic habitats and sediment quality, and marine fish and water quality. The spatial overlap will be is limited since the Muggah Creek Remediation Project is located approximately 2.5 km south of the Project site and discharges from the remediation project will be strictly managed through engineered siltation controls, regulatory limits and monitoring. The remediation project, which has been approved under the federal and provincial EA processes (including mitigation and regulatory conditions to ensure that environmental effects are not adversely significant) may result in short term increases in turbidity as the contaminated tar ponds are infilled with clean materials and capped thereby resulting in a cumulative contribution of suspended solids to Sydney Harbour. The extent of the cumulative effects will be controlled by both the Sydport and Muggah Creek projects as per mitigative and regulatory requirements and it is not expected that either project will cause significant adverse effects to the marine VECs either individually or cumulatively. In any case, it is not expected that suspended sediments in the water column will exceed natural conditions (*e.g.,* severe storm events) in Sydney Harbour (Section 4.6).

In the long term, the Muggah Creek Remediation Project is expected to have a net positive effect on benthic habitats and sediment quality, and marine fish and water quality since the heavily contaminated sediments will be capped, affectively preventing further leaching of heavy metals PAH and PCBs to Sydney Harbour.

Other Port Related Terminal Development in Sydney Harbour (principally upgrades to the Marine Atlantic and Sydney Marine terminals) will be located approximately 4 km north of the Sydport Terminal Project. The reasonably foreseeable projects have relatively small marine footprints (*e.g.,* piled jetty structure, berths) which will minimize the potential cumulative effects of these projects on benthic habitats and sediment quality, and marine fish and water quality. The cumulative effects will be a loss of benthic habitats from infilling in Sydney Harbour and short term increases in turbidity due to any dredging or marine construction.

There will be spatial and temporal overlap between the Project and commercial fisheries with respect to benthic habitats and sediment quality, and marine fish and water quality. Commercial fisheries will result in stock mortality (*e.g.,* loss of benthos and marine fish). The current dredge schedule for the Sydport Project will avoid direct interference with lobster fishing activities. The Project will include mitigation to reduce lobster and crab mortality which may include an intensive fishing and relocation program immediately prior to dredging subject to DFO approval. The Project will also provide fish habitat compensation (for HADD) as a condition of authorization under the *Fisheries Act.* The effects of the commercial fisheries (*i.e.,* sustainable catch) will continue be limited by regulated quotas set by regulatory agencies based on catch data.

Other mitigation measures specific to the Project includes the development and implementation of an EPP and Stormwater Management Plan, silt curtains and debris booms (where feasible and as required), adherence to applicable regulations, guidelines and conditions of permit. It is assumed that the other projects that could act cumulatively (*e.g.,* Muggah Creek Remediation Project and other

terminal development) will be held to similar environmental standards which may include fish habitat compensation, and adherence to applicable regulations, guidelines and conditions of permit. The overall residual cumulative effect of these projects and activities on marine benthic habitats and sediment quality, and marine fish and fish habitat is predicted to be not significant.

8.1.1 Marine Mammals and Marine Related Birds

The potential effects of terminal construction on marine mammals and marine related birds are potential collisions with vessels and exposure to hazardous material due to spills. Vessels used in terminal construction will likely not be an issue considering slow vessel speed and the high probability that marine mammals and marine related birds will avoid the general area during construction. Vessels calling on operating terminals will be subject to navigation controls including slow speeds and restrictions from discharging potentially harmful wastewaters. These controls will mitigate potential cumulative effects associated with vessel collisions or harmful discharges associated with increased shipping volumes. Small spills of hazardous materials (*e.g.,* fuel spills) could have an effect particularly on marine related birds. A Project-specific Spill Management Plan (Section 2.12 and 7.1.3) will be developed to minimize, contain and control any potential releases of hazardous materials therefore reducing the impact to marine mammals and marine related birds.

It is assumed that the other terminal projects that could interact cumulatively with the Sydport Project will be held to similar environmental standards which prohibit the release of hazardous materials to the marine environment and require project-specific Spill Management Plans to mitigate accidental releases.

The overall residual cumulative environmental effect of these projects and activities on marine mammals and marine related birds is predicted to be not significant.

8.1.2 Commercial Fisheries

There is potential for cumulative effects on commercial fisheries related to increases in turbidity in the marine environment during construction activities. Minimal, localized increases in turbidity are predicted during marine construction activities for all projects. Temporal overlap is predicted with the Muggah Creek Remediation Project. Since no schedule has been proposed for the Other Port Terminal Developments in Sydney Harbour temporal overlap is uncertain although such increases in turbidity are relatively short term. Spatial separation of the projects (approximately 4 km) reduces the likelihood of cumulative effects on commercial fisheries.

The cumulative effects on marine fish from commercial fisheries activities have the potential to interact both spatially and temporally with the Sydport Terminal Project. As noted above, the Sydport Project will provide mitigation for mortality of commercial species from the channel dredging operation and will provide HADD compensation for altered or lost habitat. Fish catch data will be monitored by DFO and catch quotas will be set based on analysis of the fish catch data for Sydney Harbour.

Other Terminal Port Development could have some minor effects on the fishery through removal of habitat (mitigated through HADD compensation) and fishing exclusion (if terminals located in area currently fished). The Sydport Project will not exclude fishers from areas they are currently fishing and

therefore cumulative effects from exclusion will not occur.

The overall residual cumulative effect of these projects and activities on commercial fisheries is predicted to be not significant.

8.1.3 Land Use

The Sydport Project is planned for development within lands specifically zoned to accommodate such industrial development. Likely other future terminal projects identified are also expected to be located in areas zoned for port industrial development. The cumulative effects of these projects are therefore predicted to have a positive effect on land use, as the development will "improve" the land in accordance with the CBRM Planning Strategy. Specifically the completion of Muggah Creek Remediation Project will have a positive effect on land use and community perception of the brownfield site. Both the Sydport Terminal Project and Other Port Terminal Developments are consistent with the Ports of Sydney Master Plan (TEC 2007), developed to increase the value of the harbor lands for Sydney Harbour. Regulatory requirements, EA commitments and permit conditions (*e.g.,* for dust and noise control) associated with the Sydport and other projects will reduce the potential for adverse cumulative effects on land use.

8.1.4 Summary

Potential cumulative affects arising from past, present and ongoing projects and activities and the Sydport Project are addressed in Section 6.0 of this EA report. Several likely future projects and activities could have cumulative environmental interactions with residual environmental effects from the Sydport Project and are discussed above. Spatial separation will generally limit the potential for adverse cumulative effects on the marine environment, and mitigation and regulatory requirements will further minimize opportunities for cumulative adverse environmental effects. Significant residual adverse cumulative environmental effects are considered not likely for all VECs. Cumulative environmental benefits are expected to occur with respect to enhanced industrial land use for port development in Sydney Harbour from the combination of the Sydport Project, Muggah Creek remediation and other terminal development consistent with the CBRM Planning Strategy and Ports of Sydney Master Plan.

9.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The definition of environmental effects under Section 2(1) of the *CEAA* includes "any change to the project that may be caused by the environment". Potential effects of the environment on the Project are described below.

9.1 Extreme Weather

Extreme weather events have the potential to damage the facility and container vessels calling on the terminal. Extreme wind can produce high waves, dense blowing sea foam, heavy tumbling of the sea and poor visibility. Throughout the year, the most probable wind direction is Southwest, while the strongest wind speeds are distributed over all directions. Southwest winds typically prevail during the summer, while winter months exhibit peaks predominantly from the West between November and January, and also with significant Northerly occurrences in late winter and spring. Further information on winds in Sydney Harbour, including extreme winds is presented in Appendix D.

Due to the situation of Harbour on the Northeastern shore of Cape Breton and the presence of the Cape Breton Highlands land mass to the West, all waves of significant height (greater than 2 m) off Sydney Harbour are from the Northeast quadrant over which they are about equally distributed. Waves under 2 m predominantly come from the North. Waves are under 0.5 m for 31% of the year, which includes the ice season. The ice season typically starts into the month of February and ends early April. It is reflected in the statistics for these months, with a low probability of occurrence for any wave height but a high chance of strong waves under unusual open water conditions. In the summer, waves off Sydney Harbour are generally small because the winds blow predominantly from the land. The strongest wave climate occurs in December and January, when the direction is strongly biased towards the North. Further information on waves including extreme wave values is presented in Appendix D.

High winds and heavy seas at reduced temperatures can cause freezing spray conditions. Freezing spray can occur between November and April however the potential for moderate or greater vessel icing from freezing spray is greatest in February. Safe work aboard a vessel can be impeded by freezing spray. The rate of ice build-up is strongly influenced by the vessel design, speed and direction of travel. Reduced visibility due to fog is likely to occur in late spring and early summer, with a peak fog potential in July. During winter poor visibility occurs less than 10% of the time and is often caused by snow.

The container facility and all related equipment will be fully weather proofed and designed for a full range of climatic conditions including severe rain, wind and waves. Equipment and structures will be designed to withstand the harshest recorded environment for the region including current engineering standards reflecting climate change predictions. Container vessels are designed to be seaworthy in all types of weather. Container vessels will not dock and, if docked, will undock and depart should the weather exceed the design criteria. The dredge vessel is anticipated to be a new, fully equipped TSHD (see Section 2.0) which is designed to operate in a range of weather conditions including those typical for northern Atlantic. There may however be extreme conditions (*e.g.,* winds, waves, ice) that may not be optimal for dredging operations and could result in temporary delays in dredging operations. Significant waves over three meters or heavy pack ice which can be encountered in late March or April have the potential to shut down the dredging operations.

High precipitation events (heavy rain or snow melt) can cause delays in onshore construction activities and increase the risk of erosion and sedimentation (*e.g.,* on fish habitat or wetlands) particularly when site soils are exposed and have not been fully stabilized. Most construction equipment that would typically be in use at the Project site is fully weather proofed and can operate in a range of conditions. However, heavy rains or snow can temporarily restrict construction activities and site construction normally ceases for a period during the winter. These delays could have short term implications for Project schedule, but are not expected to cause environmental effects. The Project Environmental Protection Plan (EPP) (Section 2.12) will typically include provision for wet weather shutdown as well as provision for weather monitoring and additional inspection of erosion and sedimentation control facilities before and after heavy precipitation as well as response and contingency measures to address any control failures. The risk from erosion and sedimentation during extreme weather will be greatly reduced once sites soils have been stabilized through revegetaton and/or through installation of stormwater management systems. Assuming these measures and procedures are in place, environmental effects related to extreme weather are not expected to be significant.

9.1.1 Sea Ice

Sea ice may accumulate between February and April at the entrance to Cabot Strait when water temperatures drop below the freezing point of salty or brackish water (*i.e.,* between -1 and -2.5 degrees centigrade). New ice is seldom thick but onshore winds can cause the development of pressure ridges. In March when the sea ice breaks up in the Gulf of St. Lawrence, it may accumulate at the entrance to Sydney Harbor and may result in pressure ridges. Ice accumulation is seldom long lived and causes little delays to vessels. Results of an ice study in Sydney Harbour (C Core 2007) indicate that the expected delay based on the last 10 years of ice data is less than seven days, once in approximately four years. Therefore it is unlikely that sea ice will have a significant effect on the Project. See Sections 2.2.1 and 4.11 for navigational response to sea ice in Sydney Harbour.

9.1.2 Climate Change and Sea Level Rise

Increasing concentrations of greenhouse gases in the atmosphere are believed to be causing global warming (IPCC 1990; IPCC 1995). Increased temperatures may contribute to an increase in ocean volume (*i.e.,* sea level rise). Other atmospheric changes relating to climate change may include increased storm intensity (Emanuel 1987) and other changes relevant to coastal stability such as surface winds, ocean waves storm surges and ice conditions (Forbes *et al.* 1997).

From 1970 to 2008 water levels in North Sydney have risen approximately 2.9 mm/year. The Intergovernmental Panel on Climate Change (IPCC, 2007) estimates that global sea levels will rise between 0.18 m and 0.59 m by 2099. These estimates exclude local crustal subsidence effects and possible rapid dynamical changes in ice flow, (*e.g.,* accelerated melting of polar ice caps). In their assessment of sea level rise impacts on PEI, MacCulloch *et al.* (2002) adopted a total projection of 0.7 m relative sea level rise to 2100 in the Charlottetown region (0.5 m for global sea level rise plus 0.2 m for crustal subsidence), with an uncertainty of ±0.4 m. It is reasonable to adopt the same value for Sydney, as trends in crustal subsidence and relative sea level rise are relatively similar between the two sites (Peltier 2002).

The design of the Project structures will incorporate an adequate factor of safety to deal with anticipated changes in weather severity during the lifetime of the Project, including storms and sea level rise associated with climate change. It is unlikely that climate change due to global warming will have a significant effect on the Project.

9.1.3 Summary

Project facilities will be designed based on the appropriate environmental design criteria to ensure the safety and integrity of these facilities during severe environmental conditions. All Project facilities will be designed and constructed with the most recent meteorological, climatological, oceanographic and geotechnical data available to the designers. The design will incorporate an adequate factor of safety to deal with anticipated changes in weather severity during the lifetime of the Project, including storms and sea level rise associated with climate change. Monitoring and/or contingency planning will also serve to minimize any adverse effects. Effects of the environment on the Project are therefore predicted to be not significant.