VOLUME VI
CHAPTERS 9.1 & 9.2

WHITES POINT QUARRY & MARINE TERMINAL

ENVIRONMENTAL IMPACT STATEMENT

BILCON OF NOVA SCOTIA

March 31, 2006

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9.0 ENVIRONMENTS AND IMPACT ANALYSIS

Introduction

An ecosystem approach has been taken during the preparation of this environmental impact statement. This approach involves determining not only the direct impact of an activity on an ecosystem component, but also how this impact may indirectly affect other ecosystem components. Assessment of the interactions between and within physical, biological, and human environmental ecosystem components is presented to the extent possible realizing that the boundaries of what is considered an "ecosystem" is arbitrary since all ecosystems interact with each other.

An ecosystem can be viewed as a "dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit" (Convention on Biological Diversity 2001-2005, Ref. 232). These organisms depend upon and are influenced by the habitat in which they live. It is this interaction of the living (biotic) and nonliving (abiotic) components that create an ecosystem. A typical ecosystem consists of four structural components (Smith 1966, Ref. 168): the abiotic component consisting of elements such as soil, water, and minerals; the autotrophic component consisting of producers such as green plants and chemosynthic microrganisms; the heterotrophic component consisting of the larger consumers which feed on plants and other organisms; and the decomposers consisting of bacteria and fungi which break down complex compounds of dead organic matter. The spatial area in which these organisms live is their 'habitat'. Habitats vary in scale and, as previously mentioned, for the purpose of this environmental impact statement have been placed in a hierarchy of local, regional, provincial, and national/international.

9.1 Physical Environment and Impact Analysis

Introduction

The regional setting for the proposed Whites Point quarry and Marine Terminal is the Digby Neck peninsula between the Bay of Fundy and Saint Mary's Bay. The climate is humid temperate with an annual mean precipitation of approximately 1300 mm and an average temperature range of approximately 18° C in summer to -3° C in winter.

Topography along Digby Neck ranges in relief from over 100 m along the ridge to sea level. Regional bedrock geology is shown on **Map 5.** The Digby Neck area is comprised of the North Mountain Formation. The North Mountain Formation is underlain by the Blomidon Formation. Four faults are shown in this regional area of Digby Neck, Long Island and Brier Island at Rossway, Sandy Cove, East Ferry, and Freeport.

Regional surficial geology is shown on **Map 8.** The Digby Neck area is characterized as a stony till plain with occasional alluvial, glaciofluvial, and colluvial deposits. The soils on Digby Neck in the area of the proposed Whites Point quarry are shown on **Map 9.** Rossway soils dominate the Digby Neck area. Surficial geology in the Bay of Fundy is shown on **Map 10.**

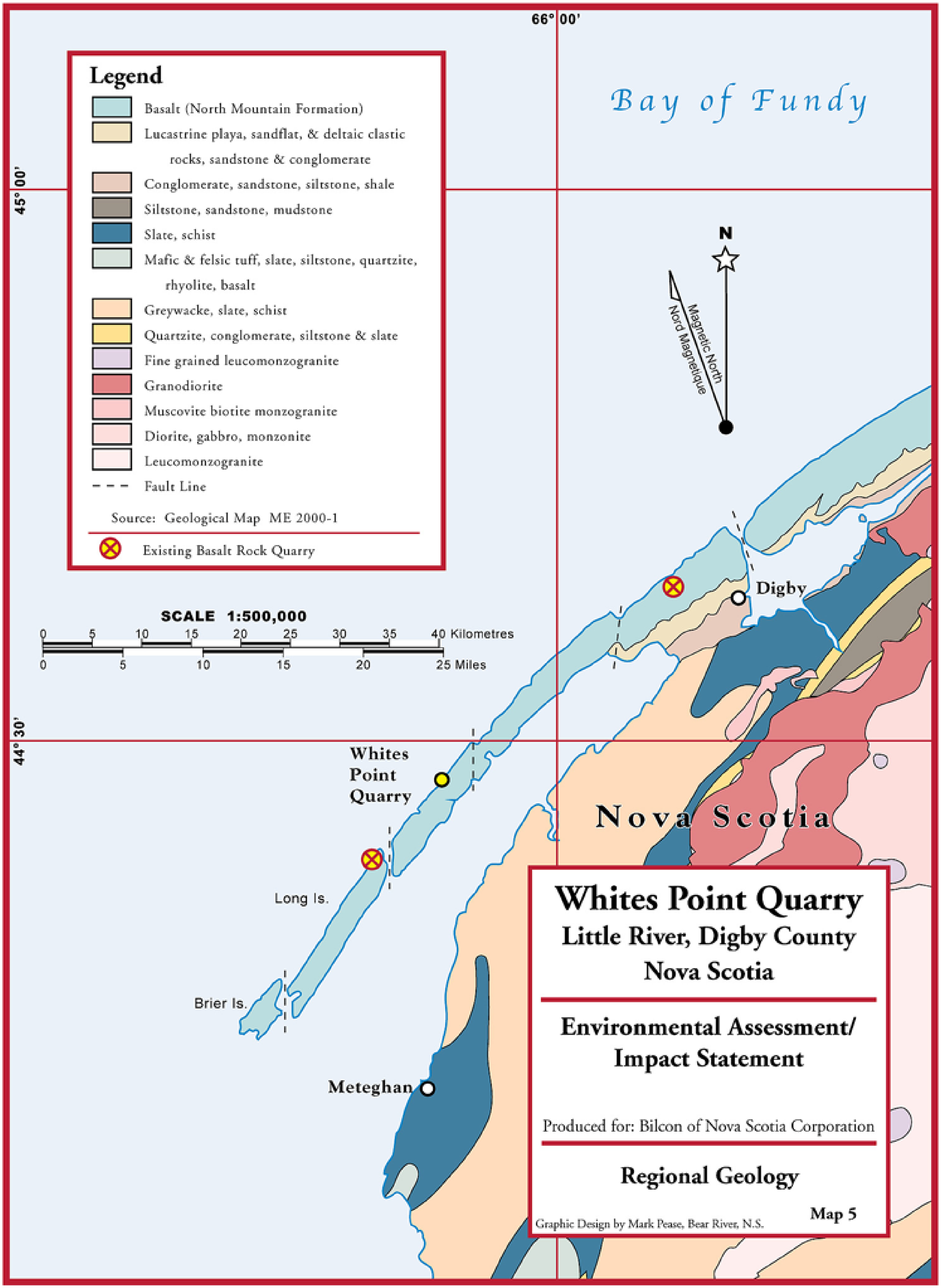
The Whites Point Quarry site is composed of the Jurassic North Mountain Basalt. North Mountain Basalt is present along the Bay of Fundy from Brier Island to Cape Blomidon, a distance of over 200 km. The Quaternary aged glacial deposit overburden on the quarry site is mapped as the Basalt Till Facies of the Beaver River Till Unit. This till is generally thin and mantled over the bedrock and may overlie older till deposits in some areas. Rossway soils cover the entire quarry site and are generally stony and well drained. These soils are chiefly forested in Digby County and on the site.

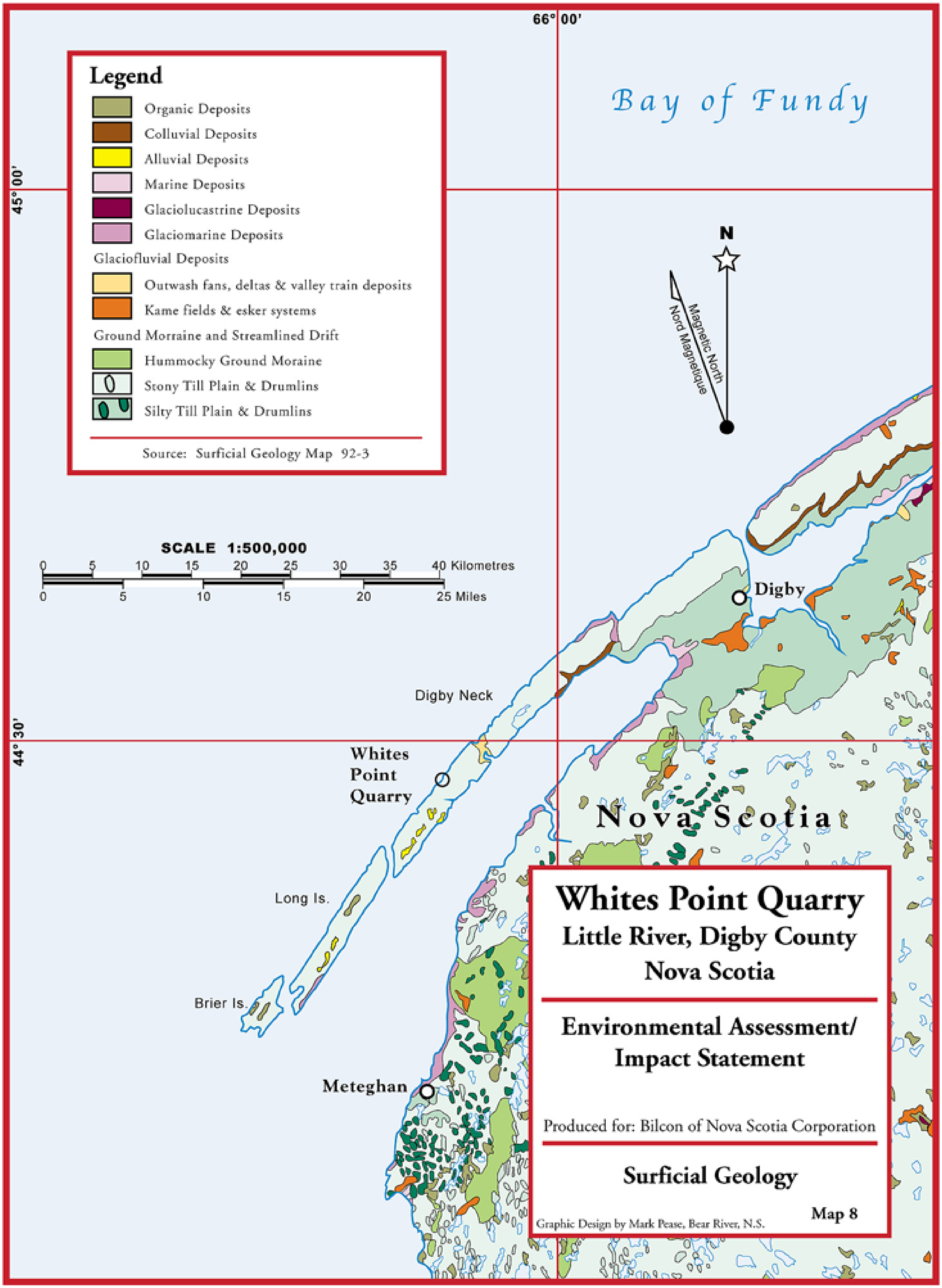
The existing topography of the proposed quarry site is steeply sloping toward the Bay of Fundy. Relief at the highest point is over 90 m. Extreme gradients range up to 50% slope with more common slopes in the 10% to 25% range, - see **Map 11** for slope analysis and aspect. Several areas such as those along the shoreline, the abandoned pit, and the southeast ridge of the site are relatively flat.

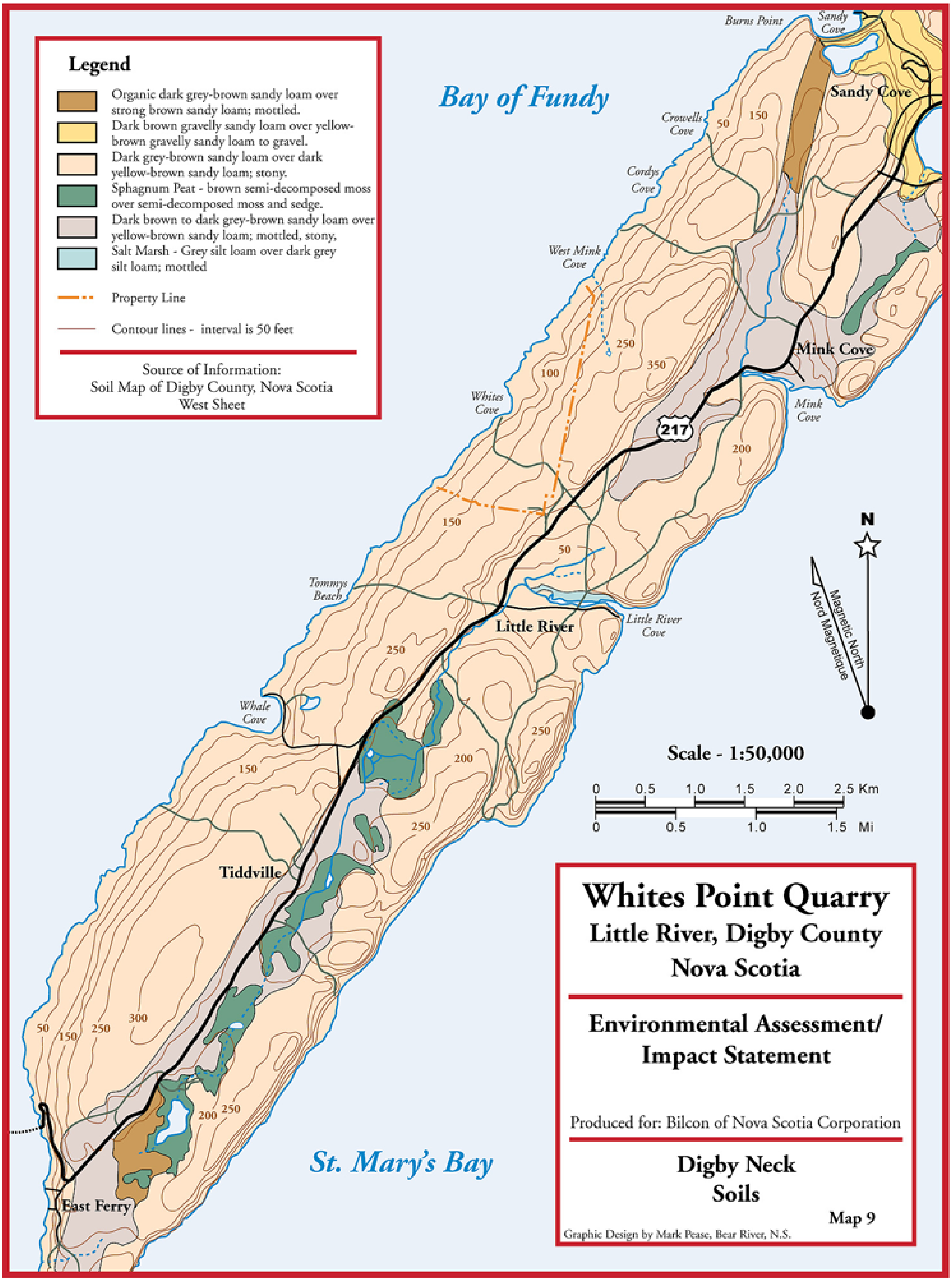
The ridge line and watershed divide are shown on **Map 12.** Surface water runoff from the majority of the site flows toward the Bay of Fundy except for an approximate 21 acre area at the southeast corner which drains toward Saint Mary's Bay. Several, small, intermittent, irregularly defined water courses, typical of the North Mountain, are evident flowing down the mountain side and dispersing into the Bay of Fundy.

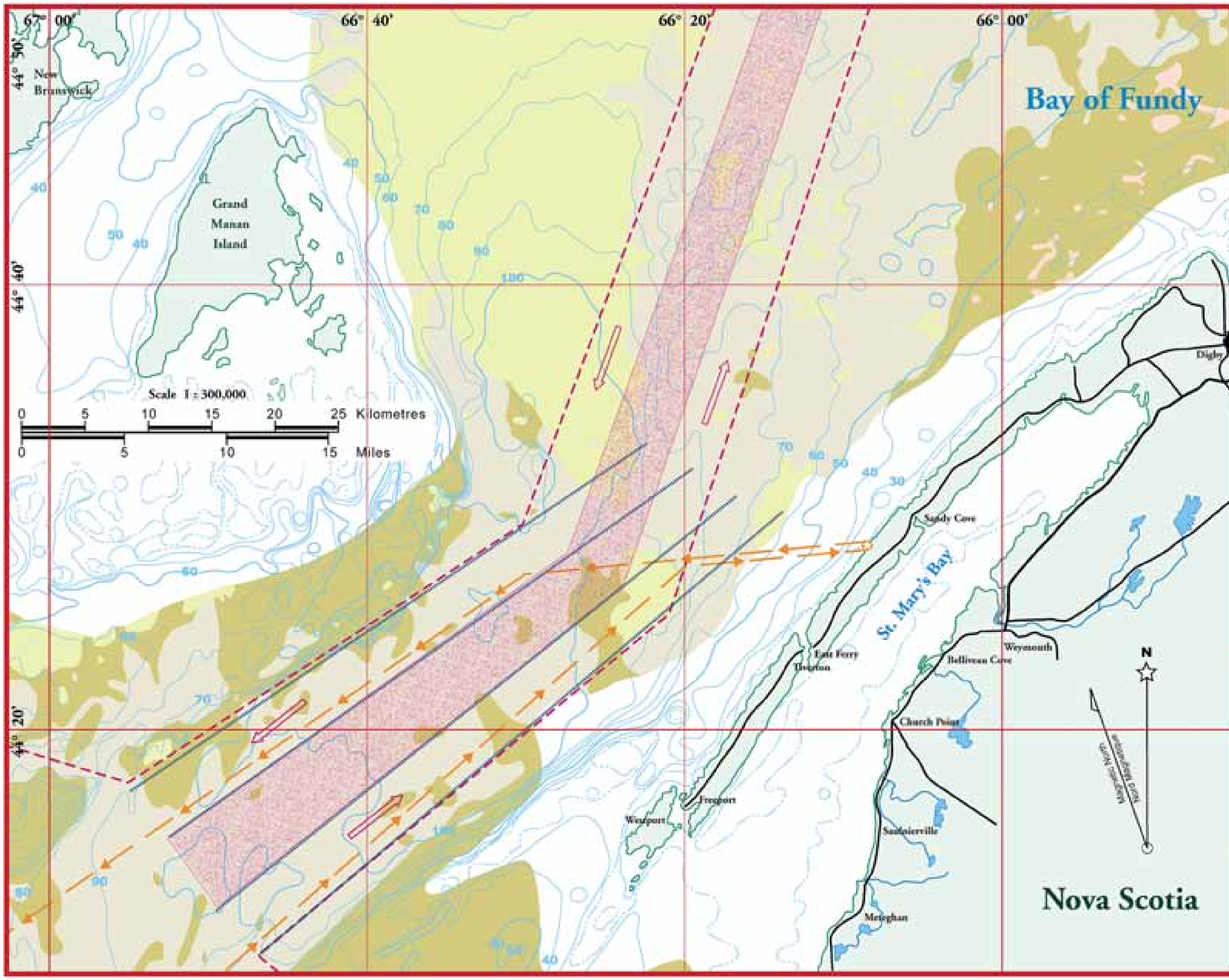
The quarry site and nearshore waters are strongly influenced by the Bay of Fundy. An extreme tidal range occurs in this area of the outer Bay of Fundy with nearshore tidal currents ranging from 0 to 2.5 knots along the immediate coast depending on the state of the tide. The onshore basalt bedrock continues seaward into the Bay with areas of sand overlying the rock. Wind speed and direction vary seasonally in this area of the Bay.

Air quality on Digby Neck is good due to the combination of maritime climate, relatively small population, and few industrial bases. These climatic conditions provide good dispersion of air contaminants. The ambient air quality also benefits from the infusion of relatively clear polar and artic air masses. Occasionally, long-range transport of air masses from central Canada or the eastern seaboard of the Unites States may bring contaminants into the area.


66° 00'
45° 00'
44° 30'
Legend
Basalt (North Mountain Formation)
Lucastrine playa, sandflat, & deltaic clastic rocks, sandstone & conglomerate
Conglomerate, sandstone, siltstone, shale
Siltstone, sandstone, mudstone
Slate, schist
Mafic & felsic tuff, slate, siltstone, quartzite, rhyolite, basalt
Greywacke, slate, schist
Quartzite, conglomerate, siltstone & slate
Fine grained leucomonzogranite
Granodiorite
Muscovite biotite monzogranite
Diorite, gabbro, monzonite
Leucomonzogranite
Fault Line
Source: Geological Map ME 2000-1
Existing Basalt Rock Quarry
Bay of Fundy
N
Magnetic North
Nord Magnetique
SCALE 1:500,000
0 5 10 15 20 25 30 35 40 Kilometres
0 5 10 15 20 25 Miles
Digby
Whites Point Quarry
Long Is.
Brier Is.
Meteghan
Nova Scotia
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/ Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Regional Geology
Map 5
Graphic Design by Mark Pease, Bear River, N.S.


66° 00'
45° 00'
44° 30'
Bay of Fundy
Legend
Organic Deposits
Colluvial Deposits
Alluvial Deposits
Marine Deposits
Glaciolucastrine Deposits
Glaciomarine Deposits
Glaciofluvial Deposits
Outwash fans, deltas & valley train deposits
Kame fields & esker systems
Ground Morraine and Streamlined Drift
Hummocky Ground Moraine
Stony Till Plain & Drumlins
Silty Till Plain & Drumlins
Source: Surficial Geology Map 92-3
N
Magnetic North
Nord Magnetique
SCALE 1:500,000
0 5 10 15 20 25 30 35 40 Kilometres
0 5 10 15 20 25 Miles
Digby
Digby Neck
Whites Point Quarry
Nova Scotia
Long Is.
Brier Is.
Meteghan
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/ Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Surficial Geology
Map 8
Graphic Design by Mark Pease, Bear River, N.S.


Legend
Organic dark grey-brown sandy loam over strong brown sandy loam; mottled.
Dark brown gravelly sandy loam over yellow-brown gravelly sandy loam to gravel.
Dark grey-brown sandy loam over dark yellow-brown sandy loam; stony.
Sphagnum Peat - brown semi-decomposed moss over semi-decomposed moss and sedge.
Dark brown to dark grey-brown sandy loam over yellow-brown sandy loam; mottled, stony,
Salt Marsh - Grey silt loam over dark grey silt loam; mottled
Property Line
Contour lines - interval is 50 feet
Source of Information:
Soil Map of Digby County, Nova Scotia
West Sheet
Bay of Fundy
St. Mary's Bay
Burns Point
Sandy Cove
Sandy Cove
Crowells Cove
Cordys Cove
West Mink Cove
Whites Cove
Mink Cove
Mink Cove
217
Tommys Beach
Little River
Little River Cove
Whale Cove
Tiddville
East Ferry
50
150
250
350
100
200
300
N
Magnetic North
Nord Magnetique
Scale - 1:50,000
0 0.5 1.0 1.5 2.0 2.5 Km
0 0.5 1.0 1.5 Mi
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Digby Neck
Soils
Map 9
Graphic Design by Mark Pease, Bear River, N.S.



Whites Point Quarry
Little River, Digby County
Nova Scotia

Environmental Assessment/ Impact Statement

Legend

- Proposed Whites Point Marine Terminal
- Proposed Shipping Route
- Existing Shipping Lanes
- New Shipping Lanes (2003)
- Traffic Separation Zone
- **La Have Clay**: silty clay/clayey silt: silty, sandy clay/clayey, sandy silt - grading locally to silty calyey sand (more than 20% sand).
- **Scotian Shelf Drift:** glacial till; includes some stratified drift.
- Subsurface deposits of La Have Clay underlying uppermost Sambro Sand. Occurs only in the Bay of Fundy.
- **Sambro Sand:** Mainly silty and clayey sand with less than 10% gravel

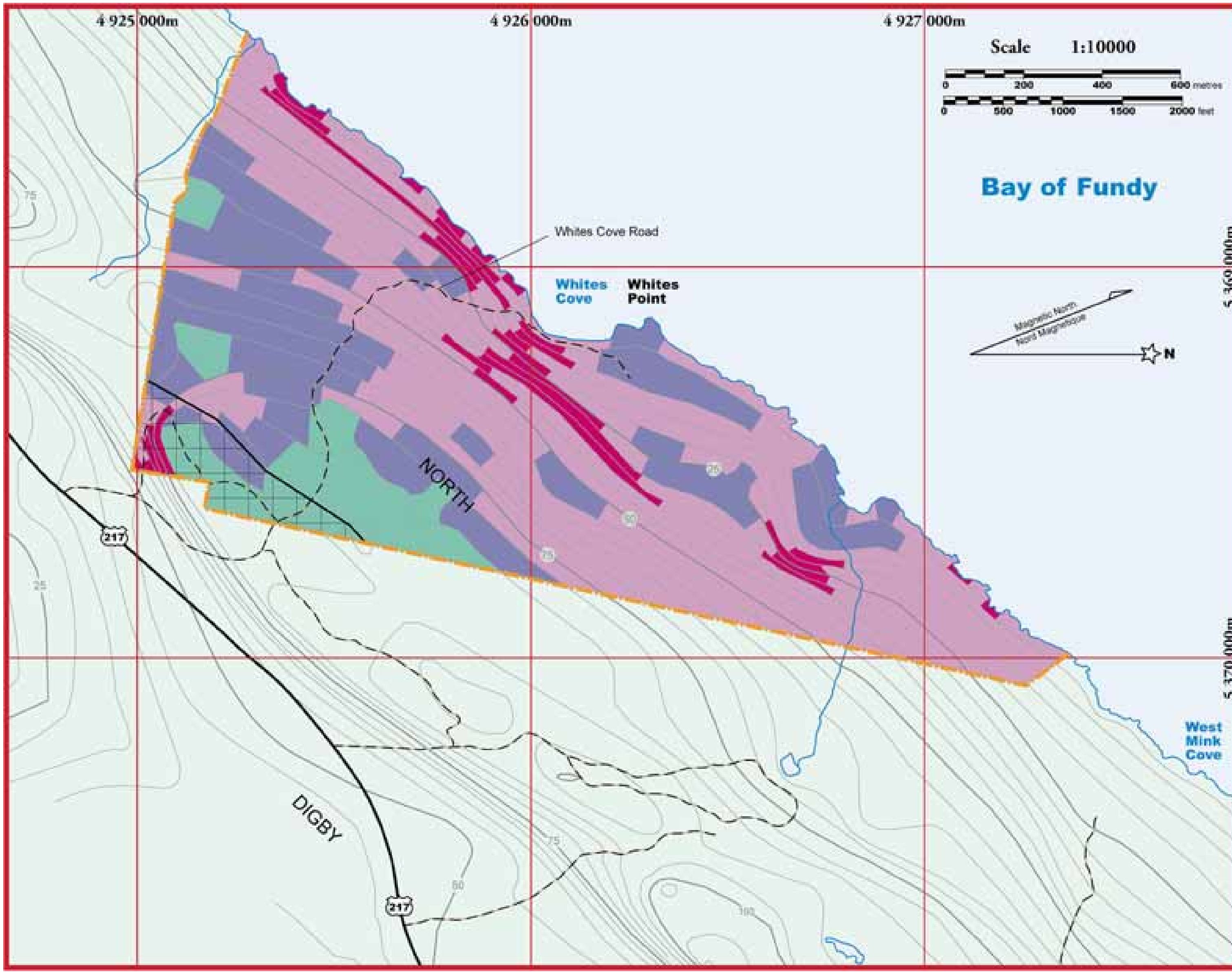
Source of Information:
Canadian Steamship Lines International Inc. 2002 & 2003

Map Source:
Surficial Geology 4011-G
Eastern Gulf of Maine & Bay of Fundy

Produced for: Bilcon of Nova Scotia Corporation

Surficial Geology: Bay of Fundy
Map 10

Graphic Design by Mark Pease, Bear River, N.S.



Whites Point Quarry
Little River, Digby County
Nova Scotia

Environmental Assessment/ Impact Statement

Legend

Highway 217
Gravel Road
Property Line

Slope

O - 5%
5 - 10%
10 - 25%
25 - 50%

Aspect

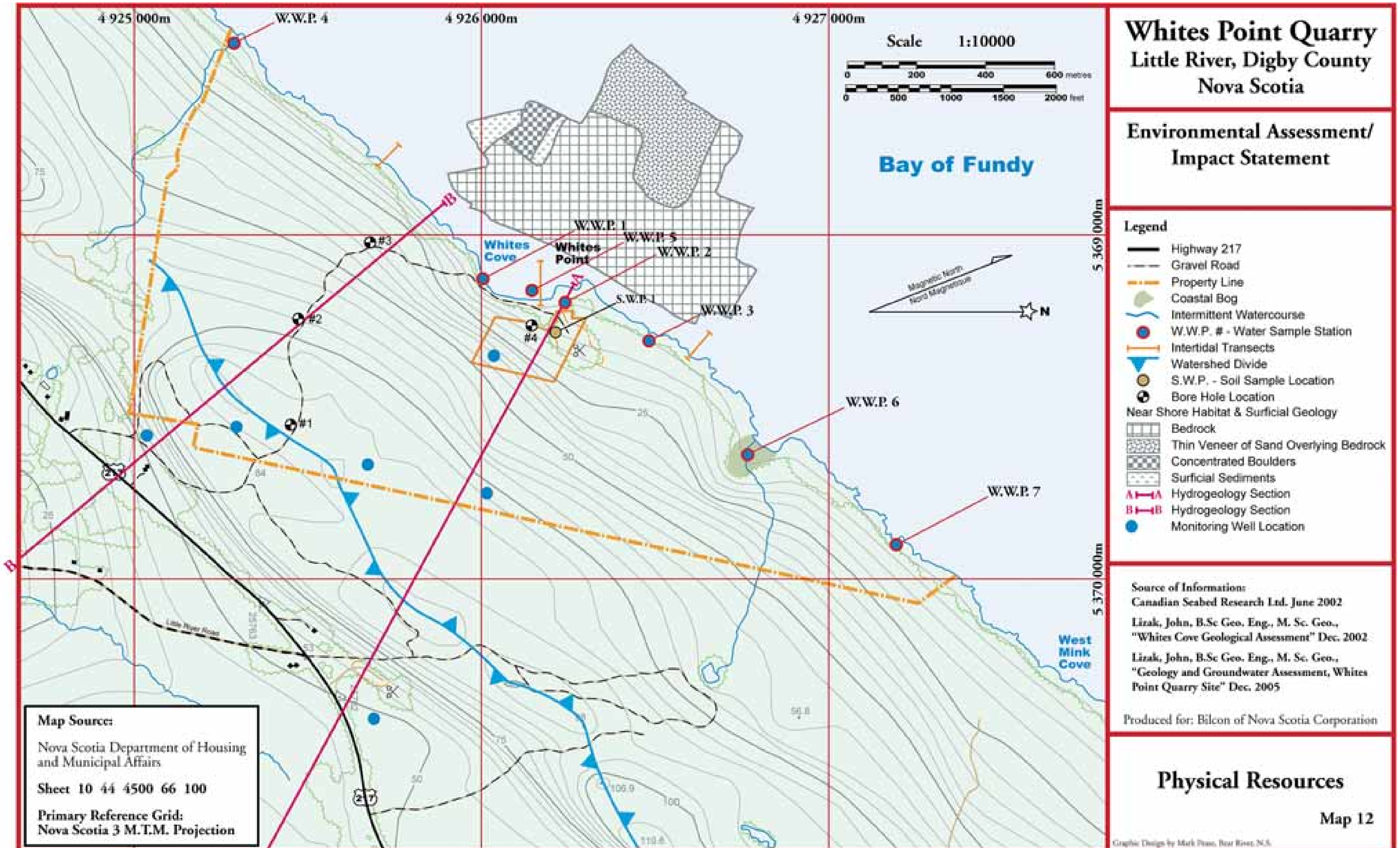
Southeast
Northwest

Produced for: Bilcon of Nova Scotia Corporation

Terrain
Slope/Aspect

Map 11

Graphic Design by Mark Pease, Bear River, N.S.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Highway 217
Gravel Road
Property Line
Coastal Bog
Intermittent Watercourse
W.W.P. # - Water Sample Station
Intertidal Transects
Watershed Divide
S.W.P. - Soil Sample Location
Bore Hole Location
Near Shore Habitat & Surficial Geology
Bedrock
Thin Veneer of Sand Overlying Bedrock
Concentrated Boulders
Surficial Sediments
A—A Hydrogeology Section
B—B Hydrogeology Section
Monitoring Well Location
Source of Information:
Canadian Seabed Research Ltd. June 2002
Lizak, John, B.Sc Geo. Eng., M. Sc. Geo., "Whites Cove Geological Assessment" Dec. 2002
Lizak, John, B.Sc Geo. Eng., M. Sc. Geo., "Geology and Groundwater Assessment, Whites Point Quarry Site" Dec. 2005
Produced for: Bilcon of Nova Scotia Corporation
Physical Resources
Map 12
Scale 1:10000
Bay of Fundy
Magnetic North
Nord Magnétique
N
4 925 000m
4 926 000m
4 927 000m
5 369 000m
5 370 000m
W.W.P. 1
W.W.P. 2
W.W.P. 3
W.W.P. 4
W.W.P. 5
W.W.P. 6
W.W.P. 7
S.W.P. 1
Whites Cove
Whites Point
West Mink Cove
Little River Road
Map Source:
Nova Scotia Department of Housing and Municipal Affairs
Sheet 10 44 4500 66 100
Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

9.1.1 Climate

9.1.1.1 Research

Precipitation and Temperature

Climatic data from two recording stations located on the Bay of Fundy was researched to establish regional baseline climate conditions. The Prim Point station in Digby County (44° 41' – N, 65° 47' – W) with records from 1965 to 1985 and the Meteghan River station in Digby County (44° 16' – N, 66° 08' – W) with records from 1937 to 1986 were used. Climatic conditions with seasonal variations for temperature and precipitation including rainfall and snowfall are presented in Appendix 14 .

Extreme daily rainfall and snowfall for the 1965 - 1985 period at Prim Point was 106.9 mm in June and 35.8 cm in January respectively. Extreme daily rainfall and snowfall for the 1937 - 1986 period at Meteghan River was 120.7 mm in July and 26.4 cm in February respectively. Highest total precipitation of 154 mm at Prim Point occurred in December and 138.2 mm at Meteghan river in December.

Extreme maximum temperature for the 1965 - 1985 period at Prim Point was 30 ° C in June and 30.6° C in August at Meteghan River. Extreme minimum temperature for the 1937 - 1986 period at Prim Point was – 22.2° C in January and –21.7° C in February at Meteghan River. The highest daily maximum temperatures occurring in August at Prim Point and Meteghan River were 21.2° C and 19.8° C respectively. The lowest daily minimum temperatures occurred in January at Prim Point and February at Meteghan River – 6.9° C and –6.8° C respectively.

Visibility

Canadian climate normals for the 30 year period (1971 – 2000) presents monthly averages for hours with visibility for distances less than 1 km., 1 to 9 km, and greater than 9 km. This data is from the Yarmouth station.

Hours with Visibility

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
<1 km	41.4	30.2	40.2	38.2	74.8	106.6	153.3	139.5	70.0	40.3	27.0	29.4	791.1
1 to 9 km	158.63	133.7	117.0	101.8	101.1	121.9	133.4	127.6	100.6	81.8	82.0	136.7	1396.1
>9 km	543.9-6	514.8	586.7	580.0	568.1	491.5	457.3	477.0	549.4	621.9	611.0	577.9	6579.5

The greatest number of hours (over 100) with less than 1 km of visibility occurs in the months of June, July, and August. The months with the greatest number of hours (over 600) with over 9 km of visibility occur in the months of October and November.

Greenhouse Gas

Some greenhouse gases (GHGs) occur naturally in the atmosphere, while others result from human activities. Natural GHGs include water vapour, carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Other GHGs that are not naturally occurring in the atmosphere include hydrofluorocarbons (HFCs), perfluorocarbons (PECs), and sulphur hexafluoride (SF6) which are generated by a variety of industrial processes. These latter gases will not be used or produced at the Whites Point quarry. Based on the nature of the operations taking place at this quarry, carbon dioxide emissions will be the primary focus.

In Nova Scotia, more than 80% of greenhouse gas (GHG) emissions are caused by fuel consumption (Environment Canada 2002, Ref. 111). In the year 2000, GHG emissions by fuel consumption indicated that mining, next to the construction industry, contributed the least amount of all sources of GHGs. Following is the percent by use of GHG emissions from fuel consumption for Nova Scotia in 2000.

- Electricity and Heat Generation 45.5%
- Transport 30.4%
- Residential 9.3%
- Fossil Fuel Industries 5.1%
- Commercial and Institutional 4.7%
- Mining 0.3%
- Construction 0.1%
- Other 1.2%

9.1.1.2 Analysis

The Whites Point quarry and Marine Terminal will contribute to greenhouse gas emissions. Energy and fuel consumption will primarily consist of electrical energy for operation of the plant (crushing, conveying, screening, washing, loading) and fuel consumption for the mobile equipment. In this regard, the engine power of the equipment was used to determine the fuel consumption. Engine fuel consumption typically yields approximately 86 percent carbon which is directly related to the production of CO2. For the purpose of typical fuel consumption, the equipment was assumed to operate at 85 percent of its maximum power. Also, it was assumed that the equipment will be operational for 85 percent of the time under working conditions. The CO2 production at various stages of the operation and the overall tonnes/year of CO2 produced is presented in **Table GHG – 1.**

Table GHG – 1

Carbon Dioxide Production during Quarry Operations at Various Stages
Whites Point Quarry

Stage	Carbon Dioxide Produced (tonnes/year)
Primary	4119
Secondary	14,052
Fine Crushing	20,088
Washing Plant	32,863
Load Out	9,647
Heavy Diesel Vehicles x 3	997
Total	**81,766**

Source: Jacques Whitford 2005

9.1.1.3 Mitigation

The burning of brush during clearing activities for construction and over the life of the project is a common practice. In order not to contribute to emissions of gases such as carbon dioxide, methane, and nitrous oxide from burning, Bilcon of Nova Scotia Corporation proposes to chip and compost wood fibre resulting from land clearing. Chipping is a more costly process than burning, however, the environmental benefits from recycling the composted material as part of the land reclamation process will produce a more productive soil on the quarry site.

The first step in the utilization of carbon dioxide by living organisms is photosynthesis by green plants. In simple terms, green plants take-up carbon dioxide and, through photosynthesis, give off oxygen, and produce carbohydrates. Forests therefore contribute to the reduction of carbon dioxide through carbon dioxide uptake. In this regard, the Whites Point quarry will be developed in increments thereby conserving forest resources until required for quarry expansion. Reclamation will also be conducted incrementally and land will be reforested soon after the rock is extracted. Approximately 20 percent of the quarry site will be conserved in a preservation zone. Also, Bilcon of Nova Scotia Corporation intends to manage over 300 acres of buffer land adjacent to the quarry property as forest resource. This method of land management will greatly mitigate the production of GHGs from the quarry operation.

9.1.1.4 Monitoring

None proposed.

9.1.1.5 Impact Statement

Greenhouse Gas

Considering the inherent relative low production of greenhouse gas from quarry operations as compared to other sources, the amount of land to remain as forest resource over the life of the project, and the proposed reclamation procedures on the quarry site the result will be a ***long term, insignificant negative effect, of regional scale.***

9.1.2 Geology

9.1.2.1 Research

Much of the information on the regional geology has been excerpted from NSDNR Report of Activities 2001 published by D.J. Kontak titled "Internal Stratigraphy of the Jurassic North Mountain Basalt, Southern Nova Scotia". The North Mountain Basalt, typical of the site, has been subdivided into three units based on the nature of the basalt flows. The units are called the lower, middle, and upper flow units. The thickness of the upper flow unit reportedly varies from 0 to 154 m deep and has been subdivided into the columnar jointed lower part and the upper part which is more massive and often contains a honeycomb network of quartz veins. The middle flow unit is amygdaloidal, vesicular and zeolite rich in marked contrast to the massive, and generally vesicle-free, lower and upper flow units. The thickness of the middle flow ranges from 9 to 165 m and it contains 4 to 15 flows. The lower flow unit varies from 40 to 185 m and consists of one flow. The unit is a uniform textured, massive, holocrystalline basalt with well developed columnar jointing. The regional dip of the North Mountain Basalt is 3 to 8 degrees to the northwest and is offset at several locations by northeast trending right lateral faults.

Site geology was initially investigated and evaluated by Mineral Valuation & Capital Inc. – see Lizak, John, "Geological Assessment of the Whites Cove Site" December 2002 (Lizak 2002, **Ref. Vol. V, Tab 29**). The initial geologic assessment was primarily based upon the drilling program and field investigation that was conducted in the spring of 2002. Four core holes were drilled on-site in April and May of 2002 – see **Map 12.** All four holes were continuously cored to a depth from 35.0 to 74.5 m. All but one of the holes was drilled to a depth below sea level.

Field investigations were conducted with Dan Kontak, Ph.D., Regional Geologist with the NSDNR, Minerals and Energy Branch, the recognized expert on the North Mountain Basalt, in December 2004 and May 2005 to supplement the geologic information obtained from the drill holes. Dr. Kontak also examined, described, sampled, and tested the drill core. The primary objectives of the fieldwork were to delineate the structure and the stratigraphy of the upper and middle basalt flows and the contact between the units, and to further describe the physical, chemical, and hydrogeologic characteristics of the upper and middle basalt unit. Thirteen quarry operations in Nova Scotia and New Brunswick were also analyzed and/or inspected with NSDNR and NBDNR geology and quarry experts as part of the field investigation.

Six additional holes were drilled in September of 2005 and completed as monitoring wells – see Mineral Valuation & Capital Inc. "Geology and Groundwater Assessment – Whites Point Quarry Site". December 2005. **Ref. Vol. V, Tab 29.** The monitoring wells were drilled to depths ranging from 36.0 to 79.0 m.

Basalt bedrock samples from core #1 were laboratory analyzed by PSC Analytical Services for potential acid rock drainage. Three rock samples from depths of 5 m, 33 m, and 61 m were analyzed. Following are the analytical test results for acid rock drainage.

			SAMPLE		
Analyte	**Units**	**EQL**	**RWP-01-5**	**RWP-01-33**	**RWP-01-61**
Sulphate Sulphur	%(w)	0.001	0.001	0.003	0.001
Sulphide Sulphur	%(w)	0.03	nd	nd	nd
Max. Potential Acidity	ppt	1.0	nd	nd	nd
Neutralization Potential	ppt	1.	26	25	24
Net Neut. Potential	ppt	1.	26	25	24
Fizz Rating		-	None	Moderate	None
Leach, Aqueous Prep		0.01	5:1	5:1	5:1
PH Paste		-	9:3	9.8	9.3
Sulphur Sub	%(w)	0.020	0.020	nd	0.020

- The units for Maximum Potential Acidity, Neutralization potential and Net Neutralization Potential are : tonne $CaCO_3$ /1000 tonne.
- EQL = Estimated Quantitation Limit is the minimum concentration that can be reliably reported. It is not a regulatory limit.

  nd = Not Detected, instruments did not detect anything above standard EQL.

Basalt bedrock samples from core #1 were laboratory analyzed by PSC Analytical Services for baseline metals. Three rock samples from depths of 5 m, 33 m, and 61 m were analyzed – see Appendix 4 for analytical test results for metals in the bedrock.

The Digby Neck region is located within the Northern Appalachian Seismic Zone (NAN). Maps of seismic risk in the 1995 National Building Code of Canada by the Geological Survey of Canada show the area occurs within Zone 1 and is considered to have a low earthquake risk. Historically, earthquakes in the Digby Neck Region have been infrequent and of small magnitude. The nearest zone of earthquake activity is across the Bay of Fundy in the Passamaquoddy Bay region. The Oak Bay Fault is considered to be the site of the activity for that region. Two small earthquake epicenters have been reported to the northeast of Digby. Further, an assessment of the proposed quarry site was requested from the Geological Survey of Canada for evaluation against the 1995 National Building Code of Canada. Results of this assessment are contained in (Atlantic Marine Geological Consulting Ltd. 2005, **(Ref. Vol. 3, Tab 18**).

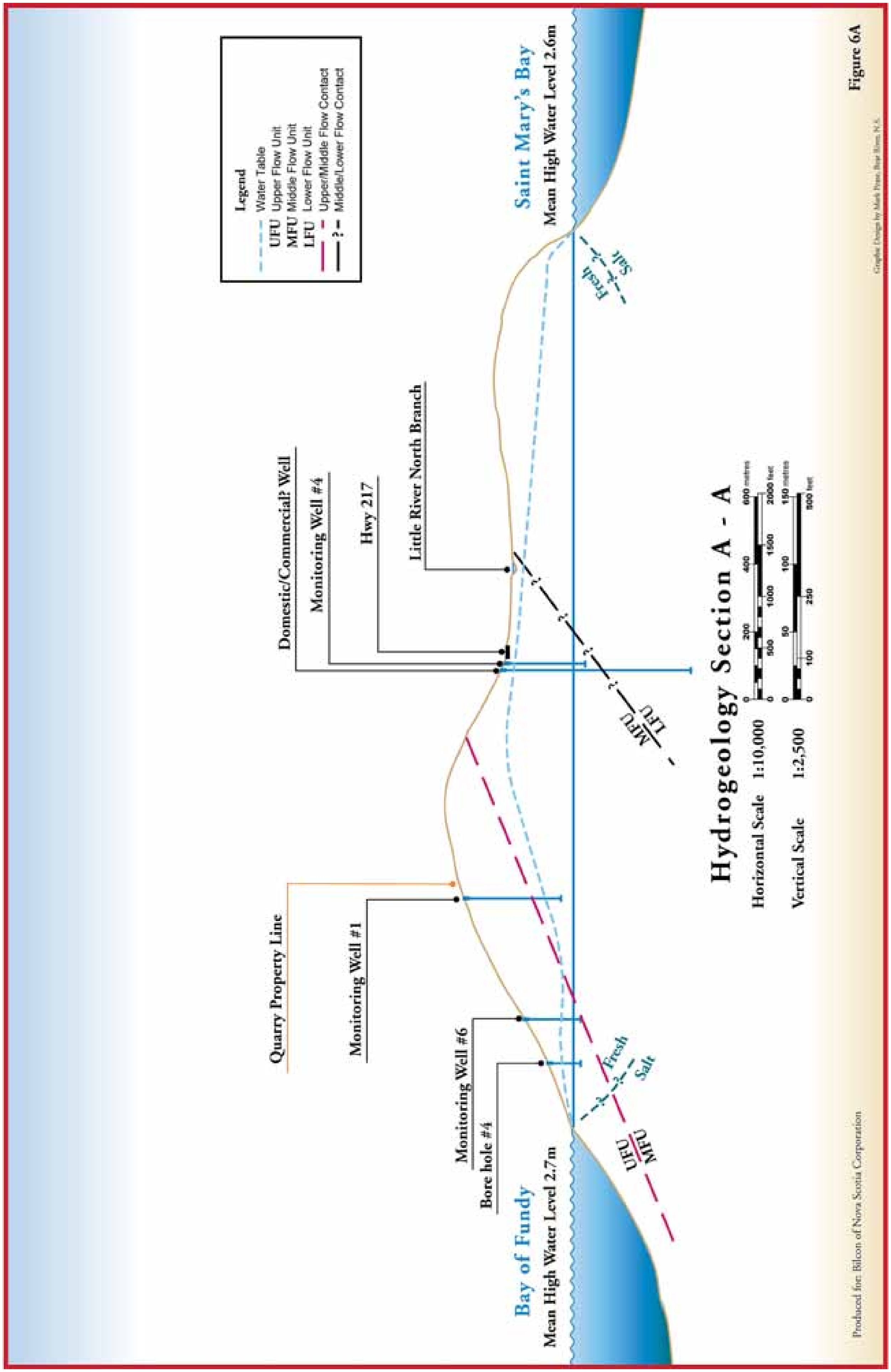
9.1.2.2 Analyses

The drill data and the fieldwork confirm that the bedrock and the quarry at Whites Point will be comprised exclusively of the upper flow unit of the North Mountain Basalt. The upper flow unit (UFU) is a uniform, hard, massive, vesicle free, medium dark gray to black basalt. The unit attains a maximum thickness of approximately 76 m on the quarry site. It is virtually unweathered with vertical quartz veins observed in the upper third portion of the unit. Some of these veins showed red iron oxidation and some contained calcite. Minor vertical joints were occasionally observed in the basal portion of the upper flow unit, which may indicate the presence of a narrow, possibly lenticular band of columnar jointing. There is, however, virtually no communication between the joints due to the paucity of horizontal fractures and/or the sealing of the original fractures with secondary mineralization. The orientation, spacing, and sealing of the limited fractures in the basalt appear to be random and hence unpredictable.

The top portion of the middle flow unit (MFU) was penetrated by core hole #1 and #2 and monitoring wells #1, #2, and #3. In the southern part of the project area, the top part of the MFU consists of a medium dark gray to dark gray, vesicular, amygdaloidal, zeolite rich basalt with rust colored bands. The contact between the UFU and MFU is virtually indistinguishable on the northern part of the property because the vesicular, amygdaloidal zone is absent or isolated. Unlike the massive UFU, the vesicular, amygdaloidal, zeolite rich upper part of the MFU is not suitable for the production of construction aggregate.

The outcrop of the contact between the UFU and MFU is located along, or near, the southeast flank of the North Mountain (see **Figures 6A and 6B**). Consequently, the bedrock in the valley along Highway #217 is composed of the middle and lower flow units of the North Mountain Basalt. Unconsolidated, Quaternary aged glacial deposits and colluvium that range in thickness from 1m to over 50m purportedly overlie the bedrock in the valley along Highway #217.

On-site, the North Mountain Basalt dips approximately 6 degrees to the northwest and strikes northeast-southwest. Regional faulting is indicated on **Map 5 .** No evidence of unique geological features or faulting was observed on, or near, the Whites Point Quarry site.



Legend
Water Table
UFU Upper Flow Unit
MFU Middle Flow Unit
LFU Lower Flow Unit
Upper/Middle Flow Contact
Middle/Lower Flow Contact
Saint Mary's Bay
Mean High Water Level 2.6m
Domestic/Commercial? Well
Monitoring Well #4
Hwy 217
Little River North Branch
Quarry Property Line
Monitoring Well #1
Monitoring Well #6
Bore hole #4
Bay of Fundy
Mean High Water Level 2.7m
Fresh
Salt
UFU
MFU
MFU
LFU
Fresh
Salt
Hydrogeology Section A - A
Horizontal Scale 1:10,000
Vertical Scale 1:2,500
Figure 6A
Produced for: Bilcon of Nova Scotia Corporation

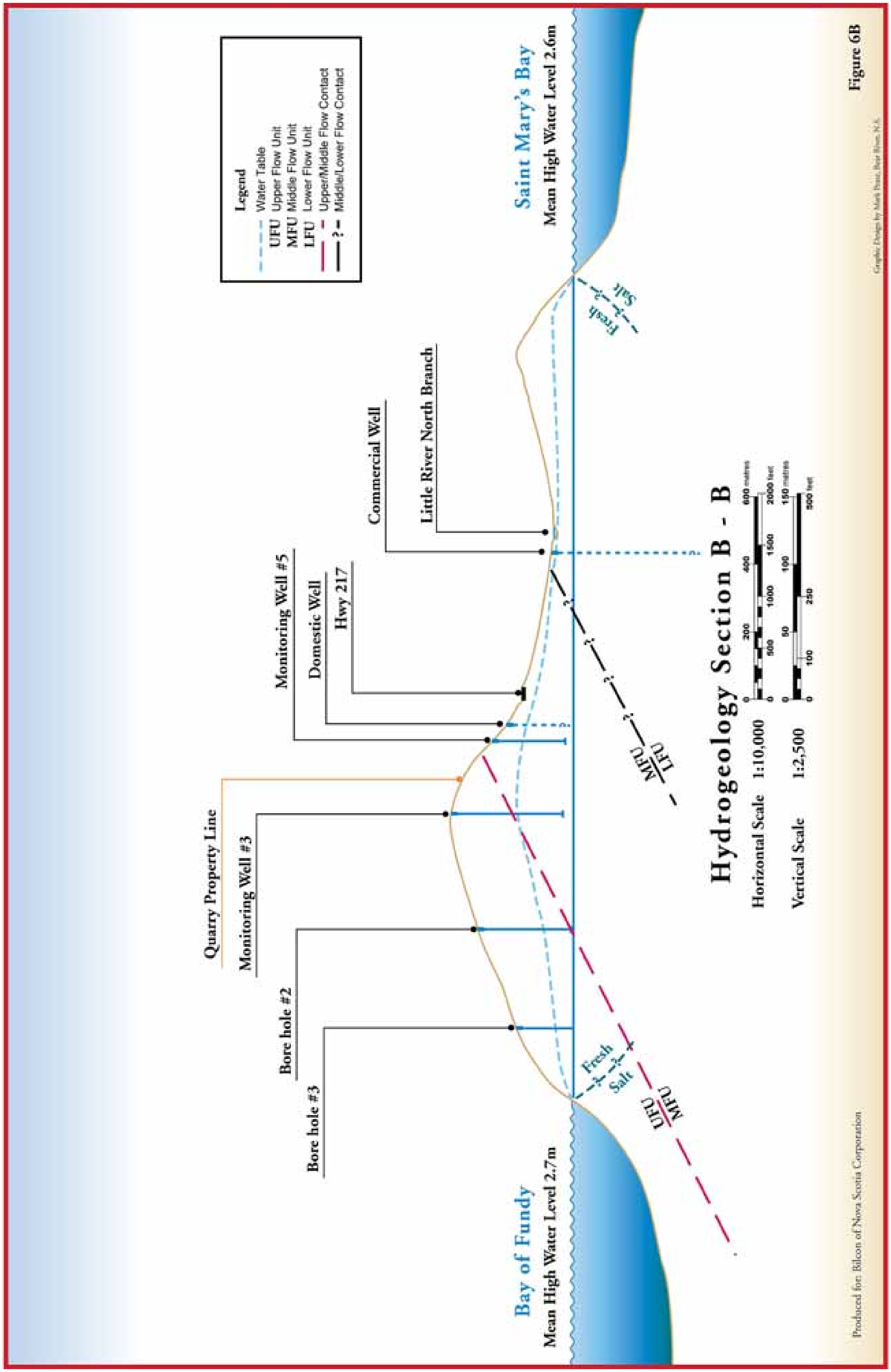

Legend
Water Table
UFU Upper Flow Unit
MFU Middle Flow Unit
LFU Lower Flow Unit
Upper/Middle Flow Contact
Middle/Lower Flow Contact
Saint Mary's Bay
Mean High Water Level 2.6m
Bay of Fundy
Mean High Water Level 2.7m
Bore hole #3
Bore hole #2
Monitoring Well #3
Quarry Property Line
Monitoring Well #5
Domestic Well
Hwy 217
Commercial Well
Little River North Branch
Fresh
Salt
UFU
MFU
MFU
LFU
Hydrogeology Section B - B
Horizontal Scale 1:10,000
Vertical Scale 1:2,500
Produced for: Bilcon of Nova Scotia Corporation

Figure 6B

In referring to the extensive outcrop of the upper flow unit of the North Mountain Basalt at Whale Cove, approximately 4 km from the proposed quarry at Whites Point, the statement was made " The exceptionally massive and fresh nature of the UFU here and its location on high-tide water level makes this an excellent location for aggregate production and the Whites Cove area just to the north of here is being examined for such purpose (as of spring 2005)" (Kontak et al 2005 Ref. 129, Page 112).

Additionally, physical and chemical laboratory tests indicate the proposed quarry site at Whites Point contains a large reserve of high quality construction aggregate material. The site contains in excess of 100 million tons of in-place stone which is ideally suited for quarrying and processing for the construction industry.

Sulphide sulphur was not detected at EQL 0.03 at various depths in core sample #1 nor was maximum potential acidity detected in the samples analyzed. Further, net neutralization potential at EQL 1. ranged from 24 – 26 ppt in the samples. Acid slates are not known to exist on the quarry property. Based on this data and research conducted by NSDNR, acid production will not occur on the site during, or after, quarrying of basalt rock.

As expected, the basalt parent material is rich in iron and aluminum as indicated by the 14,000 – 24,000 mg/kg of aluminum and the 20,000 to 23,000 mg/kg of iron in the rock samples – see Appendix 4 . Iron and aluminum in combination with organic matter have certain beneficial effects on soil structure and cation-exchange capacity (Hilchey 1969, Ref. 121). Thus, it is likely that the release of the iron and aluminum during the rock processing could benefit overall soil productivity when sediments are mixed with stripped, stockpiled, and composted organic material and spread during the reclamation process of the quarry site.

Quarrying of the upper flow unit and the related activities will not adversely impact the bedrock stability, the thermal regime, or the infrastructure within and near the Whites Point site. The evidence to support this conclusion comes from the investigation of local and Provincial quarries, assessments of local infrastructure and construction projects and the physical and chemical characterization of the surficial material and bedrock.

The upper flow unit is a uniform, hard, massive, stable basalt with an extremely high compressive strength, which is one of the reasons it is an advantaged source of construction aggregate. Bedding is absent and fracturing is absent or, at most, moderately developed and typically filled with secondary mineralization. As a result, the porosity and permeability are secondary and low. The unit is also resistant to weathering, is stable, has good cut slope stability, and is able to stand in steep cuts. The upper flow unit makes a good quality foundation for heavy structures. Blasting will not reduce the stability of the bedrock beyond the quarry face.

Quarrying and the related activities will not adversely impact the local infrastructure. The quarrying activities will be limited to the Whites Point site and, unlike other County projects, there will be no increased use of the land based infrastructure. Because there will be no quarry pumping or offsite discharge, the proposed activities will not contribute to frost heaving. Overall, quarrying will have less of an impact on the local infrastructure than the residential, non-residential building (schools, factories, hospitals, etc.) and non-building activities (roads, bridges, etc.) occurring in the area.

Concern about impacts on the thermal regime is typically limited to permafrost regions. The permafrost table may shift upward or downward, sometimes with undesirable consequences, when the thermal regime is upset by natural factors or human activities. However, because there is no permafrost, ground ice, or unusual geothermal activity (geothermal hotspots, underground mine fires, etc.) in the area, quarrying will not impact a permafrost zone or the thermal regime.

9.1.2.3 Mitigation

Quarrying will result in the removal of approximately 100 million tons of naturally occurring basalt rock over the 50 year life of the project, which will then be processed into a high quality, value added construction industry product. This natural geologic resource will be irretrievably lost from the site. Site clearing or opening of new areas within the quarry will proceed in a northerly and southerly direction from the Whites Cove Road. Approximately six acres will be cleared each year with reclamation beginning within five years of operation. This procedure will maintain existing habitat until required for quarrying and begin the reclamation of quarried areas concurrently with quarrying and before exhaustion of the rock resources. Details of the reclamation procedure are contained in **paragraph 7.10** .

No excavation is planned to be carried out below sea level. The floor of the quarry will not extend below the contact of the upper and middle flow units due to the marginal quality of the rock in the middle flow unit. Upon completion of quarry operations, the site will be totally reclaimed to enhance biological productivity and diversity as well as site graded for future development. During quarrying, the floor of the quarry will be sloped toward the working face. Surface water will be retained in this area, and be channeled to the sediment retention ponds.

9.1.2.4 Monitoring

Monitoring of surface water discharges, water quality in receiving marine waters, noise and vibration from blasting, general noise, ground water levels and quality, air borne particulates, and selected biological parameters is proposed by Bilcon of Nova Scotia Corporation. Details of specific monitoring procedures are presented in subsequent environmental component sections of this document.

9.1.2.5 Impact Statement

Basalt Rock

Quarrying will produce a site specific irretrievable loss of approximately 100 million tons of naturally occurring basalt rock and would result in a ***long term, insignificant negative effect, of local scale.***

9.1.3 Hydrogeology

9.1.3.1 Research

Non-intrusive hydrogeological investigations including literature research of the region and of the site and immediate area were conducted during September 5 – 10, 2002 by Jacques Whitford Environment Ltd. – see Hogg, Dwayne, M.Sc. P.Eng. and MacFarlane, David M.Sc. P. Geo. "Preliminary Hydrogeological Assessment, Proposed Quarry, Whites Cove, Digby Neck, Nova Scotia" December 2002 (**Ref. Vol V, Tab28**). The North Mountain Basalt is a groundwater aquifer on Digby Neck and the following research focuses on the hydraulic properties of the aquifer, ground water quantity, and ground water quality.

Regional hydraulic properties of the aquifer are based on hydraulic testing data from the Nova Scotia Department of Environment and Labour pumping test inventory for the Digby area. Based on ten pumping tests in basalt between Halls Harbour and Digby Neck, the basalt aquifer has an apparent transmissivity of 0.27 to 78.8 m^2/d, with a geometric mean of 5.75 m^2/d. Hydraulic testing suggests a safe sustainable well yield of 1.3 imperial gallons per minute (igpm) to 94 ipgm with a geometric mean of 14.4 ipgm for wells ranging in depth from 22.9m to 141.7m for a mean depth of 71.6m.

Review of 32 available well logs, primarily for domestic demand and excluding deep wells (greater than 120m) for fish plants in the Mink Cove and Little River area indicates a poor correlation between well depth and yield (R=0.11). In this area the higher yield wells are between depths of 25m to 30m and 50m to 55m with a mean well yield of 37 L/min (8.2gpm). Also, review of 72 well logs over a larger area from Lake Midway to Tiddville indicates a similar poor correlation (R=0.24). Again the higher yield wells occur between depths of 25m to 30m and 50m to 55m. Yields increase significantly at depths exceeding 107m upon penetration of the underlying Blomidon Shale Unit.

More specifically, the Nova Scotia Department of Environment and Labour well records for drilled water wells located within and between the communities of Little River and Mink Cove were reviewed. Information on 47 drilled water wells is recorded for this area. Well depths range from 18 to 277 m with a median depth of 55 m. Well yield ranged from 0.2 igpm to 65 igpm with a median yield of 7 igpm. It should be noted that these are not all inclusive of residential water sources for this area and many shallow wells or unrecorded drilled wells probably exist.

On-site water samples and water measurements were attempted in the four existing bore holes – see **Map 12.** Three of the four bore holes apparently had been vandalized and obstructions prevented access to the full depth of the holes. Only bore hole #1 could be made accessible to measure the depth to the existing water table. The measured depth to water in bore hole #1 was 53.0 m, inferring an existing ground water elevation of 35.9 m.

Water samples were taken from bore hole #1. Samples were collected in laboratory furnished bottles and analyzed for general chemistry and trace metals by PSC Analytical Services Ltd. Analytical results are contained in Appendix 45.

Subsequent to the initial preliminary hydrogeological investigations (Jacques Whitford Environmental Ltd. 2002, **Ref. Vol V, Tab 28**), comprehensive field investigations of the local geology and hydrogeology of the Whites Point site were conducted – see Mineral Valuation & Capital Inc. "Geology and Groundwater Assessment – Whites Point Quarry Site". December 2005 **Ref. Vol V, Tab 29.** This investigation included:

- The drilling and analysis of six groundwater monitoring wells
- Surveying the location of domestic and industrial well locations adjacent to the quarry property
- Consultation with provincial mining and hydrogeology experts
- Inspection and/or analysis of thirteen quarry operations in Nova Scotia and New Brunswick

Six monitoring wells were drilled in September 2005 – see **Map 12.** The wells were drilled to determine if the quarry operation will affect groundwater quantity or quality and to acquire additional data on groundwater chemistry, the water table, local aquifer characteristics, etc. Two monitoring wells were drilled in the midst of the neighbouring residential wells to directly monitor any effect of the quarry or other adjacent industrial water use on the local groundwater supply. Step down "air blow" tests and recharge tests were conducted to estimate the yield of the hydrostratigraphic units, the aquifer characteristics, etc. A program to routinely measure and record water levels and precipitation was implemented.

In anticipation of conducting a pre-blast survey as required by the Nova Scotia Department of Environment and Labour's "Procedure for Conducting a Pre-Blast Survey", November 1993, domestic and industrial wells adjacent to the quarry property were located. Horizontal coordinates and vertical elevations for 24 active wells were recorded.

Prior to this survey, Bilcon of Nova Scotia Corporation sent a letter to adjacent property owners requesting permission to do this work. All but one property owner agreed to the survey. The survey was conducted by a licensed Nova Scotia land surveyor and the wells were located with the help of the property owners. Twenty-four wells were located, 17 drilled wells and 7 dug wells.

9.1.3.2 Analyses

Using the above research data and relevant data contained in the previous Geology section, some comments can be made concerning potential influences the proposed quarry may have on surrounding residential water supplies. As previously stated, a local ground water source occurs in the basalt aquifer continuously along Digby Neck. However as previously stated, a poor correlation exists between recorded well depths and yield in the immediate area. Most of the original fracture permeability of the basalt has been lost due to secondary mineralization. Groundwater flow occurs primarily along horizontal discontinuities between lava flows with very limited flow along vertical discontinuities. The columnar joints transmit minimal, if any, amounts of groundwater. As a result, the massive upper and lower flow units are relatively tight. Groundwater flows mainly through the horizontal to sub-horizontal fractures located along contacts between flows in the middle unit. In general, the highest well yields are expected from the middle flow zone and poor well yields are expected in the upper and lower flow units.

Water table data was obtained from the existing core holes, the six monitoring wells and neighbouring wells. The ground water regime and the hydrostratigraphic units are shown on **Figures 6A** and **6B**. The two cross-sections - **see Map 12** - depict a "snapshot" of the water table, the hydraulic gradient etc. in the fall of 2005. The data show that the local water table mimics the topography and it is at or near the surface in the valley along Highway #217 and deep below the surface under the North Mountain.

The seventeen drilled wells in the surrounding area of the proposed quarry are completed in different hydrostratigraphic units than the quarry – see **Map 2.** Quarrying will occur in the upper flow unit of the North Mountain Basalt, whereas the neighbouring drilled wells are constructed in the middle or lower flow units of the North Mountain Basalt, or in the deeper Blomidon Formation. Five (Nos. 1, 8, 13, 16, and 19) of the seventeen drilled wells in this area have records. Yields from these wells ranged from 1.2 to 10 gpm. Since only five of the wells have records, other residences are expected to be served with either pre-1965 drilled wells, non-registered wells, dug wells, or springs.

It was concluded that "The Whites Point quarry will not adversely impact the quantity or quality of the groundwater supply or the local wells" (Mineral Valuation & Capital Inc. 2005). This conclusion is based on analysis of the local geology, the local hydrogeology, the monitoring well data, the quarry's operating parameters and relevant case studies and quarry investigations. The salient evidence is as follows:

- Quarrying and local water production will occur in different geologic horizons or hydrostratigraphic units. Quarrying will take place in the upper unit of the North Mountain Basalt, whereas the neighbouring drilled wells are completed in the middle unit of the North Mountain Basalt, the lower unit of the North Mountain Basalt, and the Blomidon Formation. The neighbouring dug wells appear to be completed in unconsolidated glacial and colluvial deposits.

- The neighbouring domestic and industrial wells are located hydraulically down-gradient of the quarry and/or on opposite sides of the groundwater divide that is near the crest of the North Mountain. The recharge and discharge areas for the quarry and the neighbouring wells are also located in different watersheds on opposite sides of the divide. The recharge area for the neighbouring wells is in the valley not the quarry area. Consequently, the quarry will not adversely impact the relevant recharge regime.

- Quarrying will be carried out above the natural water table. Consequently, mine dewatering and pumping will not be needed and there will be no groundwater withdrawal or drawdown. Bilcon will essentially be dry mining. Quarrying will be a non-consumptive use because none of the water that enters the relevant watershed will leave the watershed as a result of the proposed activity.

- Blasting will not impact the groundwater supply. Agencies such as the U.S. Bureau of Mines, the Montana Bureau of Mines & Geology, etc. have done studies to evaluate the effects of blasting on groundwater supplies and wells. These studies have investigated, among other things, the issues of blasting residue and groundwater chemistry, water well stability and turbidity, yield, etc. No change in groundwater quality or quantity was observed in these studies as a result of blasting in comparable mines.

- Analysis of core hole No. 1 – see Appendix 43 and groundwater samples indicates that the chemistry of the basalt, the groundwater, and the surface water is excellent. The basalt will provide an electrochemically neutral, naturally soft, low total dissolved solids, calcium-magnesium bicarbonate groundwater of very good chemical quality. All parameters except occasional manganese can be expected to meet the "Guidelines for Canadian Drinking Water Quality" (2001).

- Construction aggregate operations have been used to enhance recharge via artificial surface recharge. Quarrying at Whites Point may enhance the local groundwater regime by increasing stormwater retention and aquifer recharge.

- The quarry will not cause saltwater intrusion. Quarrying will occur well above sea level and the freshwater-saltwater interface. No quarry pumping will take place. Construction aggregate mines have been used in coastal areas to prevent saltwater intrusion. The quarry could be part of a long term, comprehensive strategy to protect the local water supply from the seawater intrusion that could result from the unregulated pumping from the deep industrial wells in the area.

9.1.3.3 Mitigation

Due to the lack of water well data for residential wells in the immediate area of the quarry, a pre-quarrying survey of water quality of neighbouring properties is proposed by Bilcon of Nova Scotia Corporation. The survey would be done in consultation with the Nova Scotia Department of Environment and Labour according to their guidelines "Procedure for Conducting a Pre-Blast Survey" November 1993, to establish baseline water quality data. This would include analysis of bacteriology, general chemistry, and trace metals. Six new ground water wells have been drilled – see **Map 12**, and these together with the four existing bore holes will be used to monitor water table levels as quarrying proceeds. In any event, Bilcon of Nova Scotia Corporation will replace, at their expense, any existing water supply, identified as lost or damaged as a result of their quarrying operation.

9.1.3.4 Monitoring

An on-site groundwater monitoring program was selected based on the following rationale:

- On-site and adjacent property groundwater data is essential for establishment of reliable, pre-project baseline conditions of groundwater quantity and quality.

- On-site and off-site monitoring will ensure and further demonstrate that there will be no diminution in groundwater quantity or quality.

A comprehensive groundwater monitoring program was initiated in the fall of 2005 in accordance with the recommendations of Provincial experts. The design and construction of six monitoring wells will allow implementation of a multi-level monitoring program from discreet depths and geologic horizons. The objectives of the monitoring program are to:

- Demonstrate that the quarry project will not diminish the quality or quantity of the neighbouring groundwater supply.

- Acquire additional data on groundwater chemistry, the water table, the local aquifer characteristics etc.

- Address the groundwater issues raised by the neighbours and educate the public about the nature of the local groundwater supply, well design, well maintenance etc.

- Provide a failsafe, early detection system should groundwater issues arise that are not related to Bilcon's quarrying activities.

Precipitation measurements are being recorded concurrently with water level measurements.

Pump or aquifer testing is not proposed as part of the monitoring program since quarrying will be limited to the upper flow unit. This flow unit is tight and it is deemed impractical and unnecessary to pump test a unit that yields less than 1 imperial gallon per day. As well, Bilcon will be "dry mining" above the natural water table. Pump tests could be conducted at wells drilled into the middle flow unit. However, quarrying will not occur in, or impact, this unit.

Water quality monitoring will be performed by Bilcon of Nova Scotia Corporation on an annual basis for bacteriology, general chemistry, and trace metals. Summary reports of groundwater levels and water quality will be provided to the Nova Scotia Department of Environment and Labour monthly during operation of the quarry.

Public participation is proposed to continue during quarry construction and operation. Bilcon of Nova Scotia Corporation intends to re-establish the Community Liaison Committee (CLC) that was established as a result of the permitting of the 4 hectare quarry at the Whites Point site in 2002. In this regard, two neighbours with wells, adjacent to the quarry property will be invited to participate on this committee and be involved with the water well monitoring program.

9.1.3.5 Impact Statements

Residential Water Well Quantity and Quality

Well water quantity and quality in neighbouring, existing wells will not be affected since the location of the wells occur in different geologic horizons or hydrostatigraphic units than those being quarried; the existing wells are located hydraulically down gradient of the quarry and/or on opposite sides of the groundwater divide; quarrying will be carried out above the natural water table with no groundwater withdrawal or drawdown; and blasting at comparable quarries indicates no change in groundwater quantity or quality; thus resulting in a ***long term, neutral (no) effect, of local scale.***

9.1.4 Surficial Geology and Soils

9.1.4.1 Research

The surficial geology of Digby Neck is shown on **Map 8.** The glacial deposit overburden along Digby Neck is mapped as the Basalt Till Facies of the Beaver River Till Unit (Stea 1992, Ref. 169). The Basalt Till Facies consists of yellowish grey, loose, sandy tills with many boulders, sand rims around clasts and inclusion of older tills. The Beaver River Till is generally thin (1 – 10 m thick) and mantled over bedrock topography.

Geochemistry of the Beaver River Till–Basalt Till Facies is contained in Table SG–1. The closest samples 341A and 342A are located near West Mink Cove and Whale Cove respectively. Chemical analysis of these samples are contained in Table SG – 2.

Table SG - 1

Glacial Geology – Geochemical Summary Statistics
Beaver River Till – Basalt Till Facies
N = 5

Element	**Mean** Standard Deriviation	Range **(95th percentile)**
Cd	**.16** .09	.10 - .30 **.30**
Ag	**.31** .26	.05 - .70 **.72**
Cu	**131** 54	80 - 218 **218**
Pb	**10** 4	4 - 15 **22**
Zn	**53** 11	40 - 70 **71**
Ni	**24** 8	17 - 37 **37**
Co	**22** 8	14 - 36 **37**
Mo	**3** 7	2 - 4 **5**
U	**2.3** .7	1.6 - 3.1 **3.6**
Sn	**10** 7	1 - 20 **24**
W	**5** 8	1 - 20 **22**
As	**10** 5	3 - 16 **47**

Source:Province of Nova Scotia - Department of Mines and Energy, 1982

Note: N = number of samples
All values in ppm

Table SG - 2

Glacial Geology – Geochemical Analysis
Beaver River Till – Basalt Till Facies

Element	Sample No. 341A	Sample No. 342A
Cd	.10	<2.0
Ag	.70	.40
Cu	80	107
Ni	20	37
Pb	15	4
Zn	52	70
Co	19	36
Fe%	3.75	5.50
Mn	1000	1000
Ca	3800	12800
Mg	14800	40000
Mo	3	2
U	2.80	1.60
As	16	3
Sn	10	20
W	<2	<2
Depth (m)	1.0	1.0

Source: Province of Nova Scotia – Department of Mines and Energy, 1982

Note: All values in ppm except Fe%

The entire 380 acre quarry site is comprised of the Rossway Series of soils-see **Map 9.** Rossway soils occupy 36,474 acres in Digby County which is 5.4% of the total area of Digby County. The parent material of these soils is a yellowish brown cobbly sandy loam till derived from basalt that is thin and stony. The subsoil is a dark yellowish brown sandy loam and the surface soil is dark grayish brown sandy loam. The soils are stony and well drained with internal drainage medium to rapid. Limiting factors from an agriculture standpoint include extreme stoniness, rock outcrops, and a generally shallow soil occurring on 16% to 30% slopes. Rossway soils in Digby County are chiefly forested and where the soils are thin, as on the site under study, vegetation is stunted.

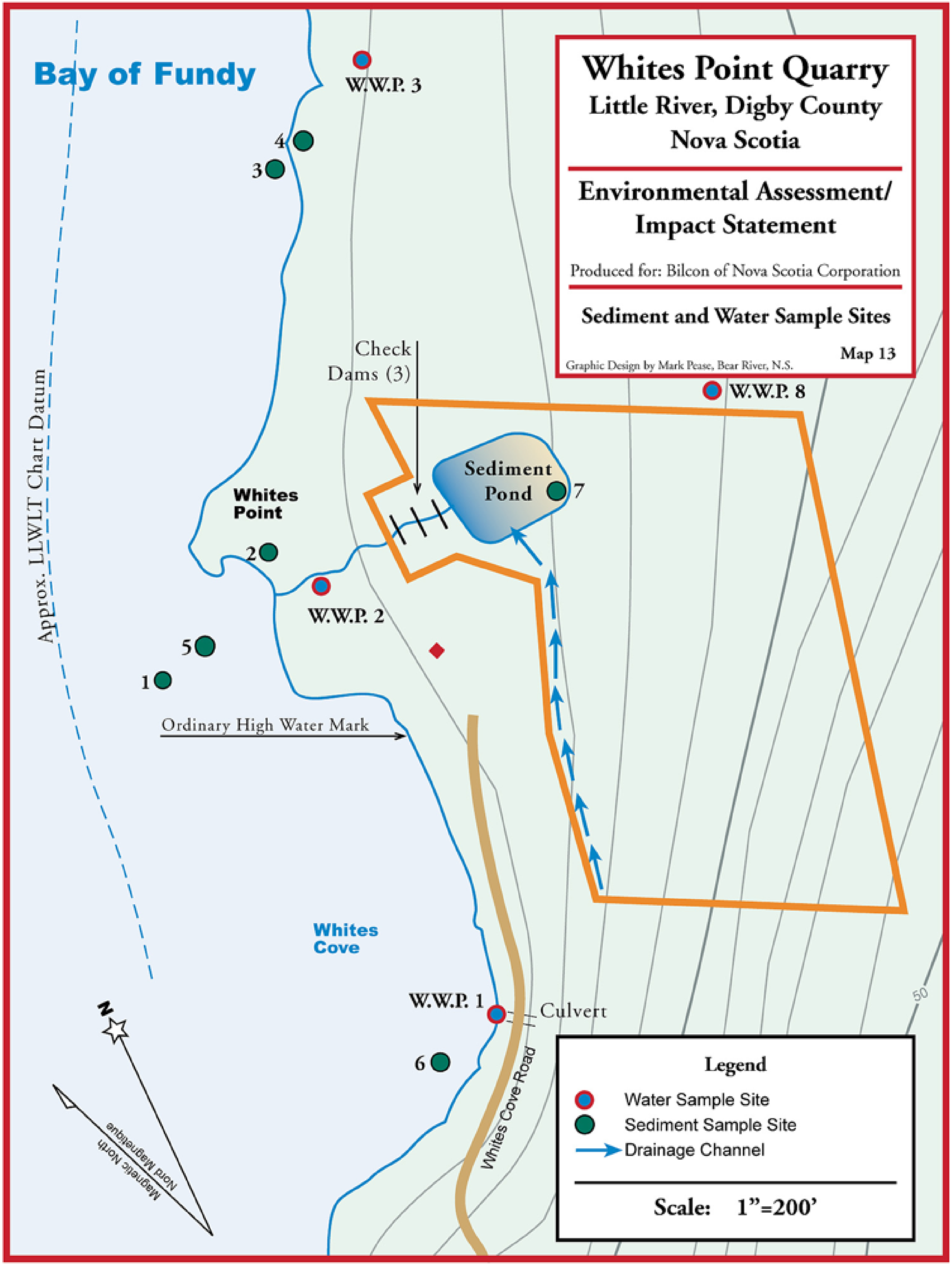
Site specific soil samples were taken on May 22, 2002 for analysis regarding site reclamation requirements and again on June 4, 2002 for analysis regarding available metals and BTEX/TPH MUST – Hydrocarbons for baseline data. The sampling site location (S.W.P. 1) is shown on **Map 12** and analytical data contained in Appendix 38 .

In the spring of 2003, a sediment retention pond was constructed to collect surface water runoff and sediments from a four hectare quarry site. Part of the four hectare quarry site was subsequently cleared of vegetation and grubbed. On July 14, 2005 a sediment sample was taken by Michael Brylinsky, PhD at sediment sample site 7 as shown on **Map 13**. The objective of this particular sample was to document any sediment contamination levels, sediment carbon content, and sediment particle size from the land disturbance caused by the grubbing of the four hectare quarry site.

9.1.4.2 Analyses

On-site soil analysis was conducted to determine baseline pH, nutrient levels, and minerals available in relation to site reclamation requirements. Prior to quarrying, the usable organic and soil layers will be removed and stockpiled for future reclamation use. Also, sediment accumulation from the on-site sediment retention ponds and from the high rate thickener will be recycled as part of the reclamation process. Dyked, stockpile areas are proposed for organic material and sediment disposal. Each area is approximately 30 acres, and is located on recently clear cut portions of the quarry site – see **Plan OP-1** Dykes will contain the wet sediment materials until dry enough to be mixed with the organic material for site reclamation. Likewise, the organic disposal area will be dyked to contain any runoff from this disposal area. Spreading and grading of these soil sources over the quarry floor and benches will be carried out and lime and fertilizer incorporated into the soil, based on the soil test results.

The soil tests taken indicate low pH levels (5.5), relatively high organic matter (18%), very low phosphorus, medium potassium, very low calcium, and high magnesium. After incorporation of the required soil amendments, hydro-seeding and selected planting/ reforestation will be conducted. Due to the thin mantle of till overlying bedrock on the site, the occurrence of land slides, slumping, creep, mudflows, or debris flow is highly unlikely.


Bay of Fundy
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Sediment and Water Sample Sites
Map 13
Graphic Design by Mark Pease, Bear River, N.S.
W.W.P. 3
4
3
Check
Dams (3)
W.W.P. 8
Sediment
Pond
7
Whites
Point
2
W.W.P. 2
5
1
Approx. LLWLT Chart Datum
Ordinary High Water Mark
Whites
Cove
W.W.P. 1
Culvert
6
Whites Cove Road
N
Magnetic North
Nord Magnetique
50
Legend
Water Sample Site
Sediment Sample Site
Drainage Channel
Scale: 1"=200'

The sediment sample taken from the existing sediment retention pond on the four hectare quarry site was analyzed by Maxxam Analytics Inc. – see Appendix 36**.**

Particle size composition for this sample was documented as 50% sand, 36% silt, 14% clay, and 0% gravel. Polychlorinated biphenyl (PCBs), polyaromatic hydrocarbons (PAHs) and organochlorinated pesticides were not detected at 0.01 concentration, detection level. Also, this sample was analyzed for levels of metals (cadmium, copper, lead, mercury and zinc). Levels of metals were compared to the Canadian Council of Ministers of the Environment (CCME) 1999 interim freshwater sediment quality guidelines.

All metals except copper were below the interim sediment quality guidelines (ISQG) and the probable effects level (PEL). Copper levels were 52 mg/kg which is greater than the ISQG level of 35.7 mg/kg^{-1} but less than the PEL of 197 mg/kg^{-1}. This level of copper is typical for this area and similar to the background geochemical analysis of the Beaver River Till (see Table SG-2) which ranges from 80 to 107 mg/kg at sample sites at nearby Whale Cove and West Mink Cove.

Also, copper levels taken at various depths in the bedrock indicated background levels ranging from 27 to 170 mg/kg at the estimated quantitation limit (EQL) of 2 mg/kg.

In summary, PCBs, PAHs, and organochlorinated pesticides were not detected in the sediment pond sample. The only metal to exceed the ISQG was copper which has high naturally high levels in this region (Province of Nova Scotia – Department of Mines and Energy, 1982 Ref. 157).

The "Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health – 1999 (Ref. 41), presents guidelines specifically for protection of the ecological receptors in the environment and for the protection of human health associated with identified land uses. These guideline levels are intended to provide a healthy, functioning ecosystem capable of sustaining the current and likely future uses of the site by ecological receptors that sustain normal activities on four categories of land uses (agriculture, residential/parkland, commercial, and industrial). Soil quality, relative to human health, will be presented in a subsequent section of this document.

9.1.4.3 Mitigation

The incremental reclamation procedure planned for the quarry operation will minimize the exposed land susceptible to erosion. Much of the site will remain undisturbed for many years. By beginning reclamation after only approximately five years of operation, the land area susceptible to erosion will be reduced. Also, recycling of soils for use in the site's reclamation process, incrementally, as the quarry operation proceeds, will use the existing resource. The addition of organic compost and other amendments will produce a healthier soil regime than previously existed and in turn support healthier vegetation.

9.1.4.4 Monitoring

Soil tests indicate additives are needed for a healthy soil regime. After spreading and grading of existing soil resources, soil tests will again be taken on the specific soils to be reclaimed. Amendments will be added to meet soil pH and fertility requirements and to ensure soil quality guidelines for the protection of environmental and human health for the particular land use are met.

9.1.4.5 Impact Statement

Soil Resource

Recycling of the existing soil resource and adding required soil nutrients necessary for a healthy soil regime will result in a ***long term, insignificant positive effect, of local scale.***

9.1.5 Little River Watershed

9.1.5.1 Research

The Whites Point Quarry property is located primarily within the Bay of Fundy watershed which stretches from East Ferry to beyond Sandy Cove. Twenty-one acres of the proposed 380 acre quarry, located in the southeast corner of the property, lie in the Little River watershed. The Little River watershed has two main branches – one to the south of the Little River estuary and one to the north of the Little River estuary. The south branch watershed comprises approximately 2,600 acres from Harris Lake to the head of the Little river estuary and the north branch watershed comprises approximately 415 acres from the head of the Little River estuary to the watershed divide. The Little River watershed comprises approximately 3,015 acres.

Land use in the Little River watershed is mainly residential. The highest density of residential development is in the community of Little River (but there are other resource industry land uses such as agriculture, forestry, and the fishery). The Little River watershed is interspersed with lakes and wetlands as shown on **Map 14.** Several “important freshwater wetlands” are designated by the Nova Scotia Department of Natural resources in their Wetlands Atlas in the south portion of the Little River watershed as shown on **Map 15.** These freshwater wetlands provide important habitat for wildlife, act as flood controls, protect subsurface water resources, remove water pollutants, control erosion and provide recreational, educational and scientific opportunities. The wetlands in the Little River watershed are scored from 65 – 79.5, out of a scoring range of 37 – 108, as to their value to wildlife by the Nova Scotia Department of Natural Resources.

Records of endangered plant species, (personal comm. R. Newell), exist for the south portion of the Little River watershed.

Guem peckii – Eastern Mountain Avens is a disjunct plant species found at only six sites in Digby Neck and Brier Island. It is listed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and as endangered in 2000 as a wildlife species protected under the Endangered Species Act in Nova Scotia. One of the six records is from the Harris Lake area, all other records are from Brier Island. *Lophiola aurea* – Golden Crest is listed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in May 2000. This plant is found in the Little River watershed in the Tiddville area at a former mine site.

Both plants are wetland plants and both are recorded from the southern portion of the Little River watershed before it flows into the Little River estuary and then into Saint Mary’s Bay.

9.1.5.2 Analysis

Land use proposed in the twenty-one acre parcel of quarry land lying in the Little River watershed includes the quarry compound area (5 acres) and environmental preservation lands (16 acres). The quarry compound area will contain an office, shop, fuel storage, equipment parking, roads, domestic water supply, on-site sewage disposal, and landscaped areas. Surface water drainage from the compound area will be directed toward the active quarry area and away from the Little River watershed. This runoff will be channeled into the sediment ponds and constructed wetlands before ultimately entering the Bay of Fundy. Thus, the only surface runoff contributed from this area will be from the forested, environmental preservation lands. Further, this contribution of surface runoff will be to the north branch of the Little River, avoiding the more sensitive south branch wetlands with endangered and threatened plant species. A typical section of this area through the Bay of Fundy, Little River and Saint Marys Bay watersheds is shown on **Figure 7.**

Small, isolated wetlands exist in the environmental preservation lands proposed adjacent to the compound area. These wetlands have been created in depressions in the surface of the basalt bedrock and due to the massive, vesicle free make-up of the basalt, minimal infiltration of surface water into the ground water regime is evident. Also, since the contact zone of the upper North Mountain Basalt flow and the middle flow will not be penetrated during quarrying, loss of ground water to the north branch of the Little River through this contact zone is unlikely.

9.1.5.3 Mitigation

A minimum 30 m wide environmental preservation zone is proposed around the perimeter of the quarry property. As a mitigation measure, this preservation zone has been expanded to include all quarry lands contributing surface water runoff to the adjacent Little River watershed. The remaining lands presently within the Little River watershed proposed for the compound area, will be graded to drain toward the quarry property. Consequently, only surface water runoff from forested and wetlands will flow toward the north branch of the Little River.

Due to the massive, vesicle free make-up of the upper flow unit of the basalt bedrock, no transmission of ground water was evident upon examination of the cores (personnel comm. J. Lizak). Thus no transmission or loss of ground water from the Little River watershed is expected during quarrying and no further mitigation is proposed.

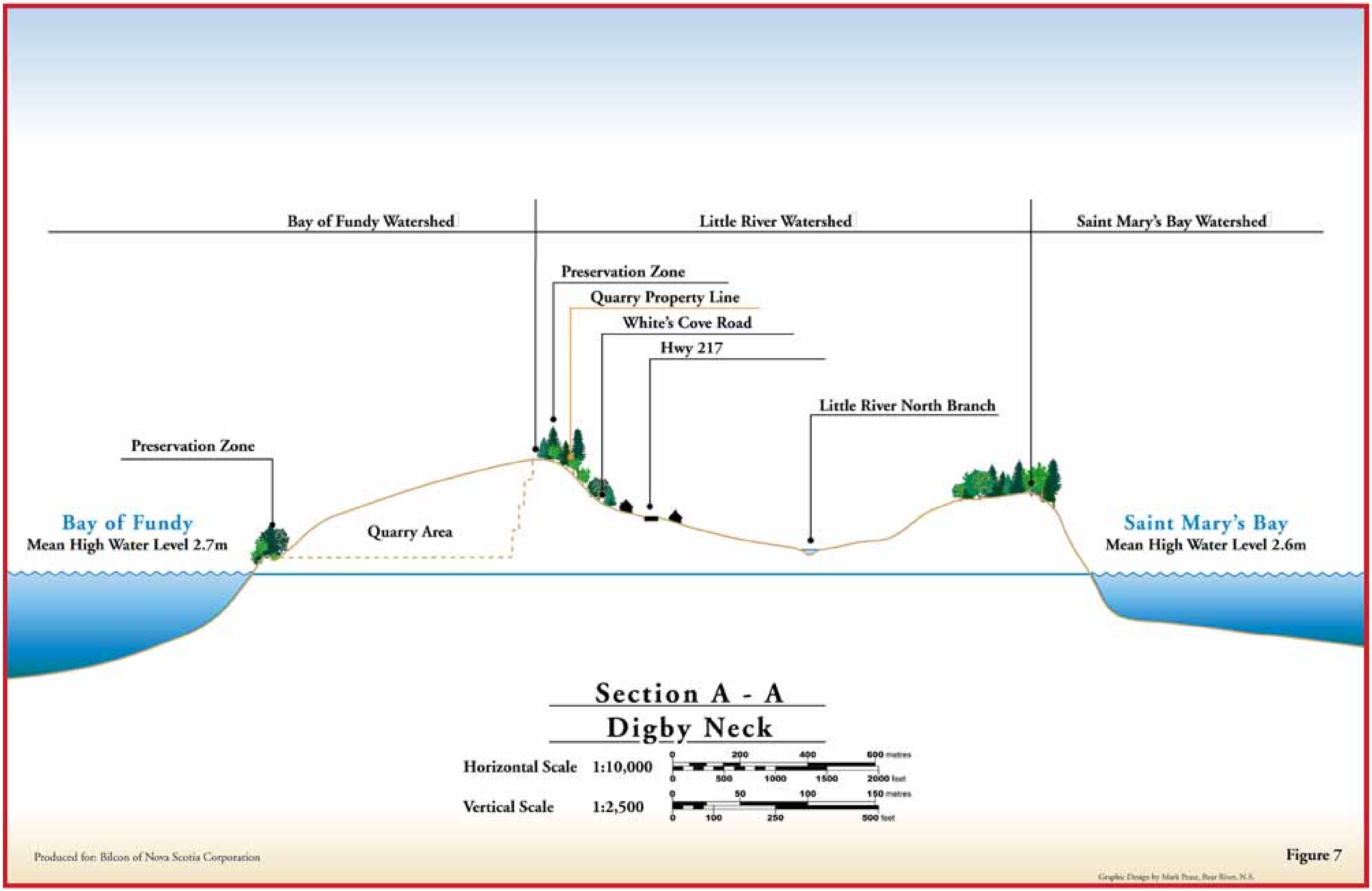

Bay of Fundy Watershed
Little River Watershed
Saint Mary's Bay Watershed
Preservation Zone
Quarry Property Line
White's Cove Road
Hwy 217
Little River North Branch
Preservation Zone
Bay of Fundy
Mean High Water Level 2.7m
Quarry Area
Saint Mary's Bay
Mean High Water Level 2.6m
Section A - A
Digby Neck
Horizontal Scale 1:10,000
Vertical Scale 1:2,500
Produced for: Bilcon of Nova Scotia Corporation

Figure 7

9.1.5.4 Monitoring

Periodic inspection and maintenance of grading and drainage structures in the compound area by Bilcon of Nova Scotia Corporation will be carried out to ensure that surface water flow from the compound area is toward the quarry property and the environmental control structures (constructed wetlands and sediment ponds). Monitoring of surface water flow from the environmental preservation zone proposed for quarry lands in the Little River watershed is not proposed.

Wells were drilled in October 2005 for ground water quality and quantity monitoring along the east property line of the quarry and east of the groundwater divide. These monitoring wells will provide data on the ground water resource near the ground water divide of the quarry lands and the Little River watershed.

9.1.5.5 Impact Statement

Little River Watershed

Since only surface water runoff from 16 acres of forested and wetlands from the quarry property will enter the north portion of the Little River watershed and sensitive wetlands and endangered/threatened plant species are not reported to be present in the north portion of the Little River watershed, and no loss of ground water from the Little River watershed in the direction of the quarry is expected, this would result in a ***long term, neutral (no) effect, of regional scale.***

9.1.6 On-site Surface Water Drainage

9.1.6.1 Research

Surface water drainage flows are intermittent on the Whites Point quarry site. On-site observations by David W. Kern, B.Sc., indicated several of the watercourses or drainage ways had no flow of water evident during the latter part of August 2002. This was especially evident in the drainage ways entering the coastal bog. Other water courses near the north and south property lines were barely flowing at this time in August. During periods of heavier rainfall, such as in the spring and fall, moderate flows were observed in the more defined watercourses.

Subsequent to the 2002 investigations, on-site review of the two watercourses entering the coastal bog was conducted by David W. Kern, BSc and Michael Brylinsky, PhD on July 14, 2005. The flow in these watercourses was not adequate for flow measurements. Barely a trickle of water flow was evident in both water courses.

Water quality background samples were taken at six locations by David W. Kern, B.Sc. during spring and early summer of 2002 in areas where surface water runoff enters the intertidal zone of the Bay of Fundy. The location of the water sample sites are shown on **Map 12** and a summary of water data analysis is in Appendix 45.

In accordance with the terms and conditions of the four hectare quarry permit, weekly water quality monitoring was conducted for Total Suspended Solids (TSS) and pH in the spring of 2003. Sample station WWP-2 was used to monitor surface water discharges from the quarry operation into the Bay of Fundy. Background water samples were also taken in the watershed up slope from the four hectare quarry at station WWP-8, see **Map 13.** Water data analysis for 2003 is contained in Appendix 45.

View of the 4 Hectare Quarry - Photo by David W. Kern

Sedimentation Pond Looking Toward the Bay of Fundy - Photo by David W. Kern

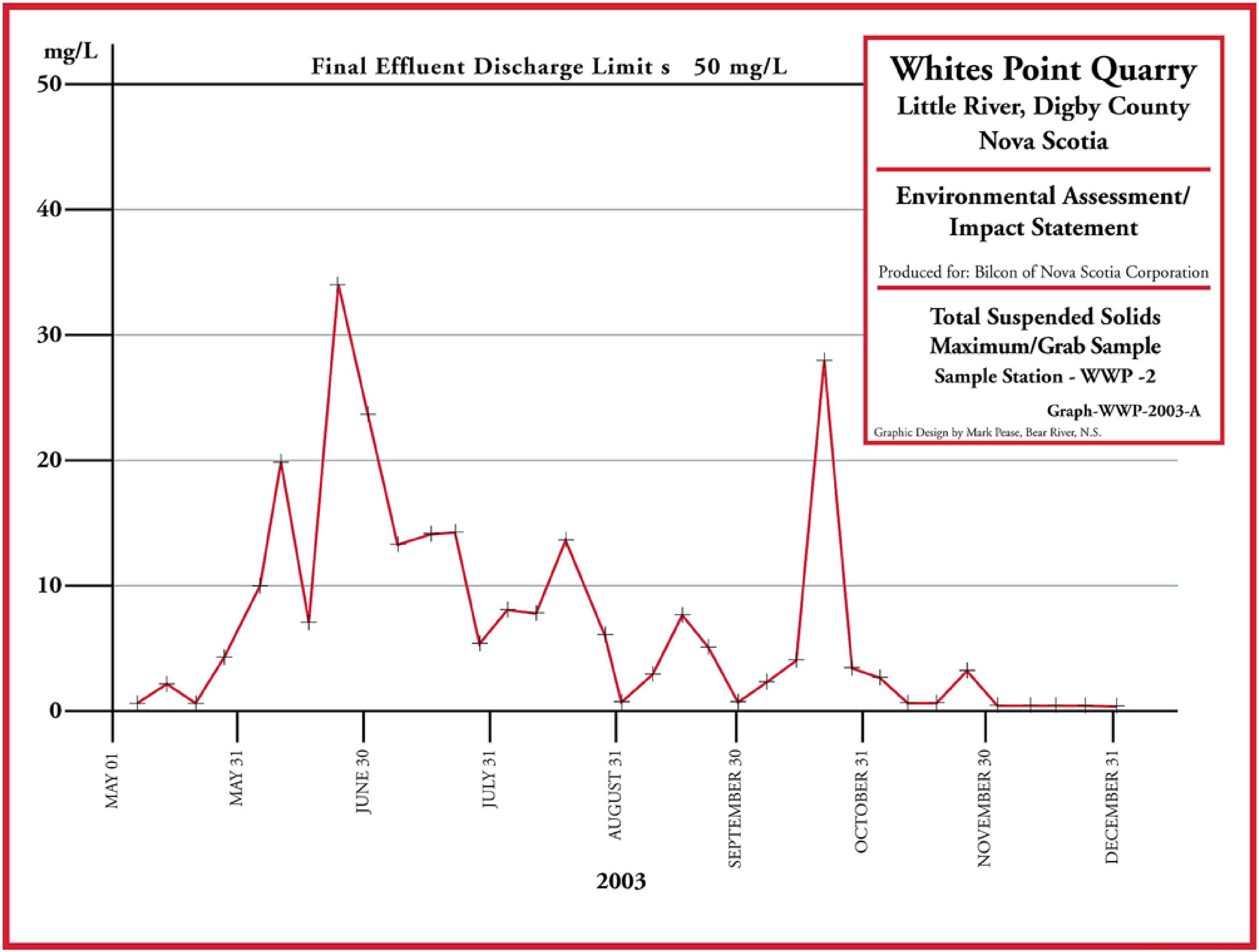
9.1.6.2 Analysis

Since former sea levels on the site were as high as the 45 m land elevation, fine grained silts and clays have already been removed from the site during regression and transgression associated with past sea level changes. Large areas of the site have a thin overburden and bedrock exposure resulting in minimal amounts of surficial materials having to be removed and redistributed. Also, those materials requiring excavation are mostly well-sorted clean sands and gravels without a fine- grained silt and clay component. This overburden characteristic considerably reduces the potential quantity of fine-grained particulates that could be produced during construction and operation.

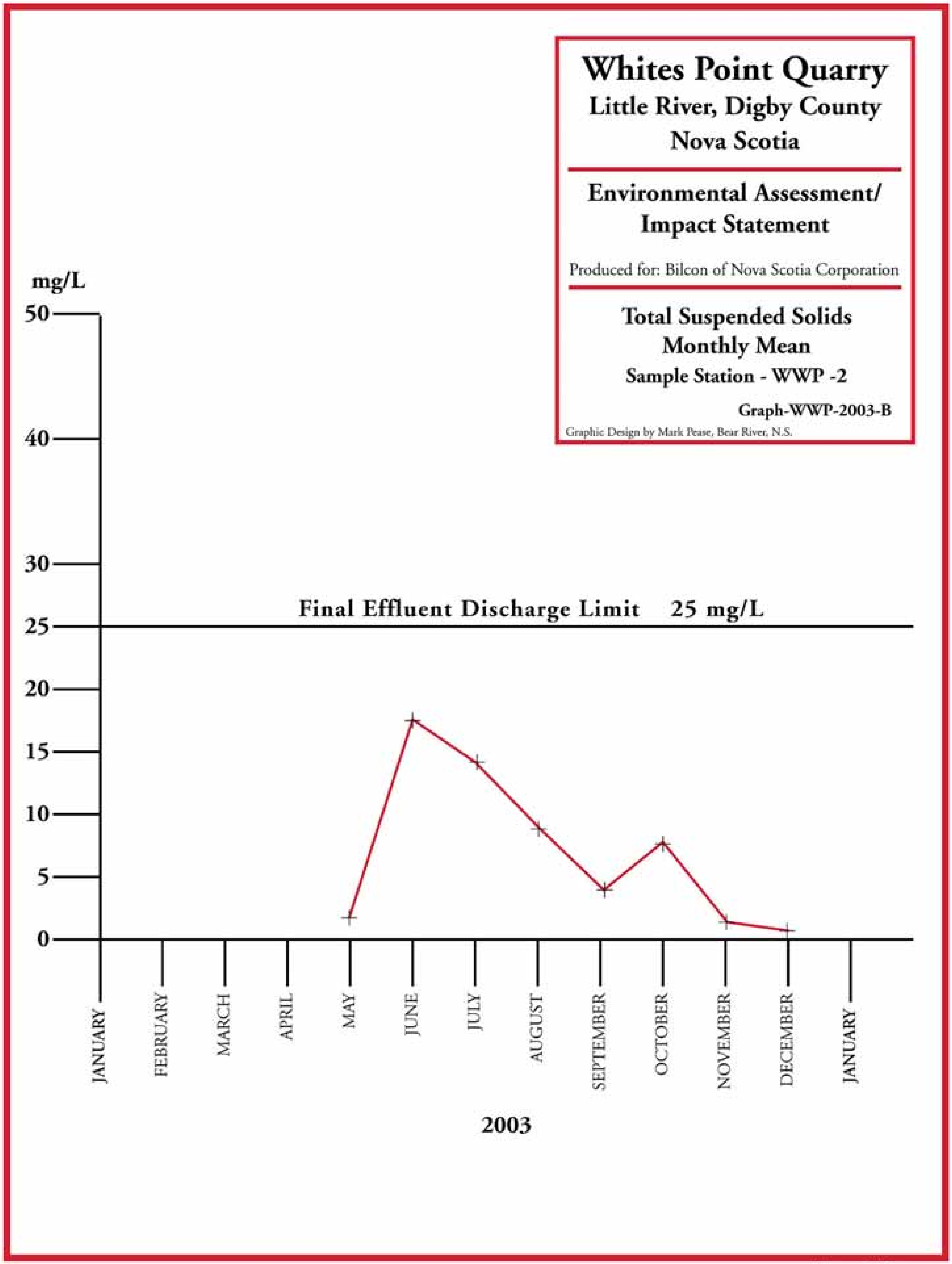
One of the most critical physical water quality parameters in fresh water and marine environments is the presence of Total Suspended Solids (TSS). Unacceptable levels of TSS in the water can cause adverse effects on fish, marine mammals, and general fish habitat. Analysis of water samples taken in 2002 from the watercourses/drainage ways entering the Bay of Fundy indicated background levels of TSS in a range of none detected to 4.0 mg/l. Low levels of sediment transport such as these are common from thin soiled, predominately rocky slopes with the underlying bedrock characteristic of this site.

Monitoring of water quality from the clearing and grubbing operation on the four hectare quarry site located within the proposed Whites Point Quarry was conducted. Work commenced on the four hectare quarry in the spring of 2003. Monitoring, as required in the approval document, was conducted on a weekly frequency at station WWP – 2 for Total Suspended Solids (TSS) and pH, - See Appendix 45 . All TSS and pH data are well within the limits set forth in the four hectare quarry approval document. It should be noted that the samples taken during the spring of 2003 were taken during construction of the sediment retention pond, associated dykes, and clearing and grubbing of the four hectare site. Heavy rain events also occurred during this time period.

The permit for construction and operation of the four hectare quarry required that TSS not exceed 50 mg/L per grab sample or a monthly mean of 25 mg/L. **Graph WWP-2003-A and Graph WWP-2003-B** display the maximum TSS recorded per grab sample (50mg/L) and maximum monthly mean (25mg/L) respectively.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Total Suspended Solids
Maximum/Grab Sample
Sample Station - WWP -2
Graph-WWP-2003-A
Graphic Design by Mark Pease, Bear River, N.S.
Final Effluent Discharge Limit s 50 mg/L
mg/L
50
40
30
20
10
0
MAY 01
MAY 31
JUNE 30
JULY 31
AUGUST 31
SEPTEMBER 30
OCTOBER 31
NOVEMBER 30
DECEMBER 31
2003

Buxton & Kern



Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Total Suspended Solids
Monthly Mean
Sample Station - WWP -2
Graph-WWP-2003-B
Graphic Design by Mark Pease, Bear River, N.S.
mg/L
50
40
30
25
20
15
10
5
0
Final Effluent Discharge Limit 25 mg/L
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY
2003

Buxton & Kern

Comparison of TSS at WWP-2 (quarry discharge point into the Bay of Fundy) and WWP-8 (background watershed) are presented below.

	WWP-2	WWP-8
July 23, 2003	14.2 mg/L	27.5 mg/L
August 14, 2003	7.5 mg/L	not detected @EQL 0.5
October 29, 2003	3.5 mg/L	5.5 mg/L
November 26, 2003	not detected @EQL 0.5	3.2 mg/L
December 24, 2003	not detected @EQL 0.5	not detected @EQL 0.5

These results indicate that in all but one instance, TSS was equal to or less than background, at the point of discharge from the four hectare site. Also, TSS and pH were well within the limits set forth in the terms and conditions of the permit.

Sediment samples were taken from the bottom of tide pools within a potential area of influence of the four hectare quarry and from tide pools remote from the quarry operation for comparison – see **Map 13.** Six tide pools, above and below ordinary high tide, indicate no appreciable difference in organic and inorganic composition of bottom sediments. This monitoring of tide pool sediments indicates that there has been little, if any, export of sediments into tide pools in proximity to the four hectare quarry, - see Brylinsky, Michael. "Results of a Suspended Solids Survey at the Whites Point Quarry, Little River, Digby County, Nova Scotia". June 2003. (**Ref. Vol II, Tab 12**). A similar erosion/sediment control plan, as successfully implemented for the four hectare quarry, is proposed for the Whites Point Quarry operation.

9.1.6.3 Mitigation

The quarrying of basalt rock will alter the existing topography of the site and its drainage patterns. A schematic section of the resultant quarry is shown on **Figure 5** contained in the Reclamation Section. The quarry floor during quarry operation, will be back sloped toward the working face to direct surface runoff away from the receiving waters of the Bay of Fundy. Natural surface runoff from the mountain side will be interrupted near the quarry face and diverted at this point into controlled drainage ways and into the environmental control areas such as sediment retention ponds and constructed wetlands, before entering the receiving waters of the Bay. As the quarry operations proceed in a northerly direction, appropriate flows into the coastal bog will be maintained from the diverted water courses. Even though no rare plants or animal species at risk were identified in the bog itself, it was identified as an area of diverse habitat within the site, unusual on a local basis, and it is part of the proposed environmental preservation zone. In this regard, it is proposed to maintain its existing natural habitat requirements such as an intermittent surface water flow through the bog.

Maintaining the appropriate surface water flow into the coastal bog preservation area will be accomplished by diverting runoff from the quarry floor to the sediment retention ponds, through a constructed wetland, and then to the head of the bog. This bog has functioned as a natural filter for upland surface water runoff for years. Thus, the objective is to maintain this natural filtering system for runoff before entering the marine environments of the Bay. All water from the working area of the quarry will enter the sediment retention ponds before flowing into the bog area or being discharged into the constructed wetland and then into the Bay. This will maximize the retention time of any suspended solids before entering marine waters. It should be noted that the background TSS in the marine waters ranged from 9.6 mg/l to 19.2 mg/l – See Appendix 43.

9.1.6.4 Monitoring

Water quality monitoring of all outflows from sediment retention ponds will be conducted weekly for Total Suspended Solids (TSS) and pH and monthly for general chemistry. TSS will be maintained at less than 50 mg/l per grab sample or 25 mg/l monthly arithmetic mean while pH will be maintained within a range of 5 – 9 per grab sample or 6 – 9 monthly arithmetic mean at the sediment pond outlet. These TSS and pH limits correspond with those contained in the permit for the four hectare quarry on this site. The frequency of monitoring will be weekly for TSS and pH and a monthly summary of results will be prepared by Bilcon of Nova Scotia Corporation and be available to regulatory agencies.

9.1.6.5 Impact Statements

Wetlands

Given the inclusion of the coastal bog in the environmental preservation zone and the maintenance of surface water flows to the coastal bog during quarry operations, the effect on this natural wetland would result in a ***long term, neutral (no) effect, of local scale.***

Surface Water Quality

By constructing controlled drainage ways, sediment retention ponds, constructed wetlands, and maintaining a perimeter environmental preservation zone, the effect on receiving marine waters of the Bay of Fundy and adjacent watersheds from quarry runoff would result in a ***long term, neutral (no) effect, of local scale.***

9.1.7 Physical Oceanography

9.1.7.1 Research

Bathymetry

General bathymetry of the outer Bay of Fundy is shown on Nautical Chart 4011 – Approaches to Bay of Fundy. Water depths range from over 100 m in parts of the inbound/ outbound shipping lanes to 16 m below chart datum at the proposed marine terminal. Regional bathymetry in the area extending southwest from Sandy Cove was mapped by the Geological Survey of Canada (Atlantic) using multibeam bathymetry imagery.

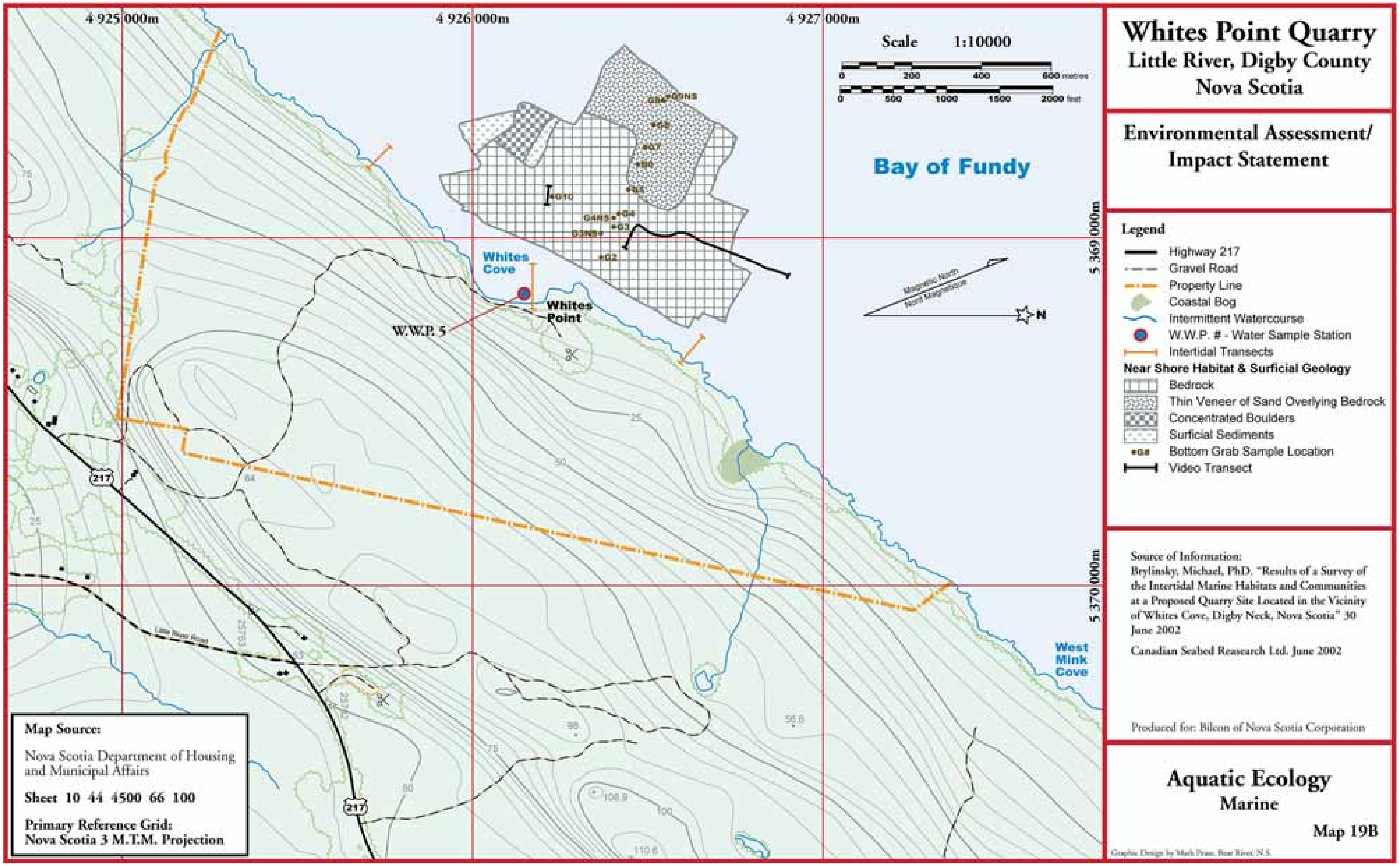
Local bathymetry in the area of the proposed marine terminal was mapped in 2002 (Canadian Seabed Research Ltd. 2002, Appendix 23) when an area 800 m along the coast at Whites Cove/Whites Point by 500 m seaward was mapped. Soundings were recorded continuously along survey lines using a Knudsen 320M (200kHz) echosounder. Bathymetric contours were then plotted at one m intervals. The regional multibeam bathymetry and local bathymetry were georeferenced in 2005 (XY GeoInformatics Services 2005, **Ref. Vol. V, Tab 26**). The general bathymetry of the Bay is shown on **Map 4** and the detailed bathymetry of the marine terminal area is shown on **Figure 2.**

The shoreline of the proposed Whites Point quarry is dominated by exposed basalt rock which extends into the intertidal and sublittoral zones of the Bay of Fundy. Surficial geology of the nearshore at Whites Point is shown on **Map 19B**. Transects in the intertidal zone were conducted in 2002 (Brylinsky 2002, **Ref. Vol. II, Tab 10**).

The 30 – year (1971 – 2000) frequency of presence of sea ice in the Bay of Fundy is 0% (Environment Canada 2004, Ref. 59). However, sea ice in the Bay of Fundy area has not been reported consistently in the period 1971 – 2000. Consequently, data from this reference document is not reliable in that area. Traditional knowledge indicates floating ice has been observed in the Bay off Whites Point, presumably from ice break-up in the inner Bay of Fundy and the Annapolis Basin.

Marine Sediments

Research on seabed sediments, sediment transport, and suspended sediments have been ongoing throughout the Bay of Fundy system (Atlantic Marine Geological Consulting Ltd. 2005, **Ref. Vol. III, Tab 19**). The following research will focus on the regional and local dynamics within the outer Bay of Fundy and the local area that could be influenced by the proposed Whites Point Quarry and Marine Terminal. Fine-grained material (silt and clay) is introduced into the Bay by both natural and anthropogenic sources including ocean dumping activities, river barrier construction, seabed fishing activities and natural erosion of the seabed and adjacent land.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Highway 217
Gravel Road
Property Line
Coastal Bog
Intermittent Watercourse
W.W.P. # - Water Sample Station
Intertidal Transects
Near Shore Habitat & Surficial Geology
Bedrock
Thin Veneer of Sand Overlying Bedrock
Concentrated Boulders
Surficial Sediments
Bottom Grab Sample Location
Video Transect
Source of Information:
Brylinsky, Michael, PhD. "Results of a Survey of the Intertidal Marine Habitats and Communities at a Proposed Quarry Site Located in the Vicinity of Whites Cove, Digby Neck, Nova Scotia" 30 June 2002
Canadian Seabed Reasearch Ltd. June 2002
Produced for: Bilcon of Nova Scotia Corporation
Aquatic Ecology
Marine
Map 19B
Scale 1:10000
Bay of Fundy
Magnetic North
Nord Magnétique
N
4 925 000m
4 926 000m
4 927 000m
5 369 000m
5 370 000m
Whites Cove
Whites Point
W.W.P. 5
West Mink Cove
217
Little River Road
Map Source:
Nova Scotia Department of Housing and Municipal Affairs
Sheet 10 44 4500 66 100
Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

The first comprehensive Bay of Fundy wide assessment of suspended sediment was conducted by Miller in 1966. Water samples were taken during mid-flood and mid-ebb from 43 stations, at the bottom, 1 m from the bottom, 10 m from the bottom and at the surface. The average concentration was 6.6 mg/l. An analysis by Miller indicates high turbidity water during the ebb moves south and west toward the Gulf of Maine and high turbidity water enters the Bay from the southwest side of Saint John Harbour. Concentration of suspended sediments would be higher during maximum flood and ebb flows. Examination of the suspended sediment found sand, silt, clay, phytoplankton, and other organic debris. Silt and organic debris were the major components. Selected vertical turbidity profiles located off Digby Neck showed near bottom suspended sediment increased on the ebb tide, indicating a source from the northeast and not local erosion of the seabed.

Important to the understanding of sediment deposition, erosion, and transport in the Bay of Fundy is the distribution of sediments at the seabed of the outer Bay in geologic and recent history. Large areas of the seabed of the outer Bay consist of gravel that occurs as a thin layer of till that was deposited directly by glaciers. Surficial geology map 4011 – G depicts the seabed off Digby Neck as consisting largely of till in water depths greater than 90 m. Little has happened to these gravels since they were deposited. As such, they are not in dynamic equilibrium with present conditions of erosion and deposition. These areas of till are non-depositional zones where fine-grained sediments are not deposited on the seabed. As a result, these sediments are not sources for fine-grained material to be eroded and transported throughout the Fundy system.

Sediment transport and deposition in the Bay of Fundy is unique and does not fit the typical model of a continental shelf coastal environment where sediment deposition and transport is controlled by water depth, abundant source material and low velocity currents. In the Bay of Fundy, the strong tidal currents dominate seabed processes and have an effect in all water depths. Additionally, a complex sea-level history of rise and fall has developed sediment textures, distribution and surfaces of high energy that are relict from past environments.

The Marine Terminal will be located on an area of exposed bedrock at the seabed. The only local sediments at the terminal site are small patches of coarse sand and gravel that occur in crevices and ledges on the bedrock surface. Seaward of the Marine Terminal location, is an area of continuous and thin coarse sand that overlies the bedrock surface. The sand is generally less than one metre in thickness and many boulders protrude from beneath the sand. This distribution of bedrock and sand is the direct result of relict processes resulting from sea-level change that occurred over the past 9,000 years. The sea both regressed and transgressed all surfaces in the region from a maximum depth of approximately 60 m to the present shoreline. This effectively eroded previously deposited glacial sediments and produced the present conditions of exposed bedrock in the nearshore.

Multibeam bathymetry collected from the area of the Marine Terminal continuing to the north and sidescan sonar data at the Marine terminal location show that the nearshore off Digby Neck is dominated by a bedrock exposed platform that extends to a water depth of approximately 50 m. At that depth, the seabed steepens and dips rapidly to 70 m water depth where it is dominated by glacial coarse-grained gravelly sediments and glacial unmodified features such as drumlins and flute-shaped gravel ridges. Both the side scan imagery and multibeam bathymetry show no bedforms such as sand waves and mega ripples in this region.

The surficial geology of the nearshore at Whites Point is described and shown on **Map 19B.** This area which was investigated in detail (Canadian Seabed Research Ltd. 2002, Appendix 23) is comprised mainly of massive basalt bedrock outcrops and boulders. In some areas the bedrock is overlain with a thin veneer of sand, and in other areas surficial sediments consisting mainly of coarse to very coarse sand and shell fragments occur. Based on sediment transport modeling, the lack of bedforms in coarse sand indicates that the currents at the seabed are less than 45 cm/s. Small ripples can form in coarse sand at between 35 and 25 cm/s. No sediment bedforms were visible on the sidescan sonar and photographic data indicating little current movement close to the bottom.

A more detailed analysis of bottom sediments and lack of sediments is contained in **Table GS – 2002, see paragraph 9.2.4.1.** Due to the minimal thickness of sediments covering the bedrock in the area of the Marine Terminal, no vertical profiles were taken. Since proposed construction techniques for the marine terminal do not include dredging or dredge spoil disposal, those sections of the Canadian Environmental Protection Act, 1999, and its Disposal at Sea Regulations are not applicable in this case.

In summary, the nearshore of Digby Neck can be described as a starved sediment platform of exposed bedrock formed by relict erosional processes of sea level rise and fall from former low stands to high stands. Sediments are sparse and do not appear to be in transport within the Marine Terminal area and adjacent areas.

Contaminants

On a regional scale, the general distribution of heavy metal concentrations in sea-floor sediments in the outer Bay of Fundy along Digby Neck is low (Bay of Fundy Ecosystem Partnership 2003, Ref. 99). This is relative to the high concentrations on the New Brunswick side northeast of Grand Manan Island, south of Saint John, and along the shores of Annapolis and Kings Counties. Generally, metal concentrations are lower in the coarser, sandier sediments of the central and eastern parts of the Bay and higher in the finer sediments around the Passamaquoddy Bay region of southwestern New Brunswick. The abundance of metals in different areas was also related to the presence of bedrock of differing geologic origins in coastal formations around the Bay. Elevated concentrations of chromium, vanadium, and nickel in the sediments along the Nova Scotia coast and near Grand Manan Island probably result from weathering of volcanic rocks with high metal content (Bay of Fundy Ecosystem Partnership 2004, Ref. 99).

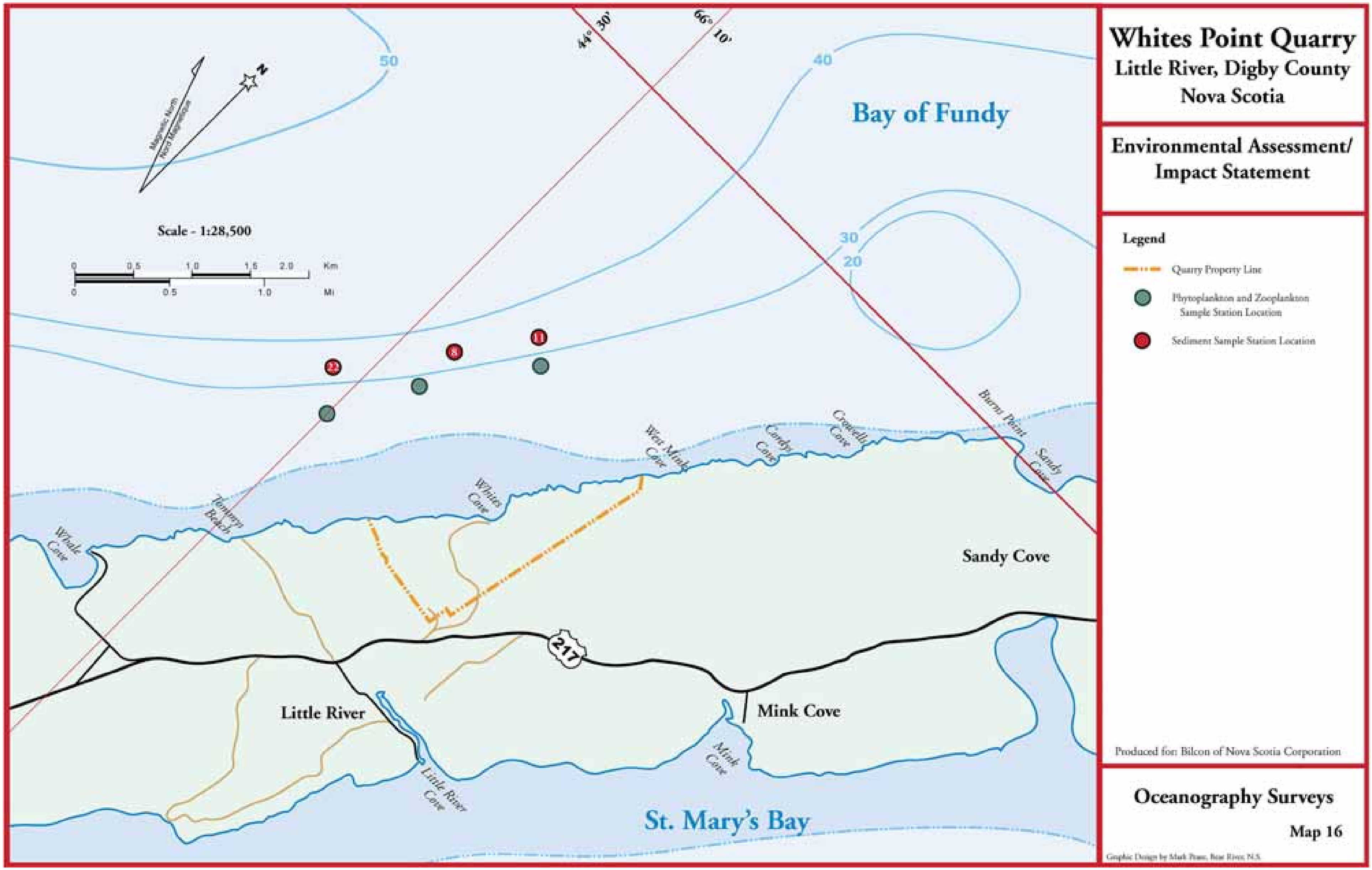
Sediment samples in the nearshore waters off the Whites Point quarry site were taken on July 14, 2005 – see Brylinsky, Michael. "Results of a Sediment Survey in the Near Offshore Waters of the Proposed Quarry Site in the Vicinity of Whites Cove, Digby Neck, Nova Scotia". September 2005. (**Ref. Vol. II, Tab 9**). The objective of the survey was to document sediment contaminant levels, sediment carbon content and sediment particle size. Sediment samples were collected with a 10.4 liter Van Veen Grab fitted with weights, and a total of 30 stations were sampled along three transects perpendicular to the shoreline. Ten sites were sampled along each transect extending from approximately 0.3 to 3 km offshore in water depths ranging from 1.8 to 43.9 m relative to chart datum. Of the 30 grab samples taken, only nine contained sediments.

A sediment sample from each of the three transects, station 8, 11, and 22 – see **Map 16**, was selected for laboratory analysis. Laboratory analysis was performed by Maxxam Analytics Inc. – see Appendix 45 .

Particle size composition varied little among samples and was dominated by sands and gravels. Sands ranged from 34% to 54% depending on sample location while gravels ranged from 29% to 43%. Clays ranged from 2.6% to 15% depending on sample location while silts ranged from 1.1% to 15%. Sediment organic carbon content was very low (less than one percent). The predominant bedrock bottom had a low organic carbon content and a paucity of fine sediments indicating an environment unsuitable for the development of a significant infauna community in these nearshore waters.

Sediment contaminant levels for metals (cadmium, copper, lead, mercury and zinc), polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs) and organochlorinated pesticides were analyzed. These data were compared to the Canadian Council of Ministers of the Environment (CCME) 1999 interim guidelines for marine sediment quality. In all cases, the sediment contaminant levels were below the interim sediment quality guideline (ISQG) and the probable effects level (PEL) for metals, total PAHs and total PCBs. Pesticides were not detected at the detection limit of 0.01.

In summary "The results of the sediment survey indicate that the nearshore waters off of the proposed quarry site are characterized by relatively pristine conditions. In most cases contaminant levels are well below current CCME guidelines" and "together with the lack of fine sediments, especially clays, makes it unlikely to be an area where pollutants would be entrained" (Brylinsky 2005 **Ref Vol. II, Tab 9**). Only copper with a contaminant level of 17 mg/kg at station number 8 approached the ISOG guideline of 18.7 mg/kg. This is most likely due to the inherently high background levels of copper in this region.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Quarry Property Line
Phytoplankton and Zooplankton Sample Station Location
Sediment Sample Station Location
Produced for: Bilcon of Nova Scotia Corporation
Oceanography Surveys
Map 16
Bay of Fundy
St. Mary's Bay
Sandy Cove
Mink Cove
Little River
Scale - 1:28,500
44° 30'
66° 10'
Burns Point
Sandy Cove
Crowells Cove
Candys Cove
West Mink Cove
Whites Cove
Tommys Beach
Whale Cove
Little River Cove
Mink Cove
217
50
40
30
20
22
8
11

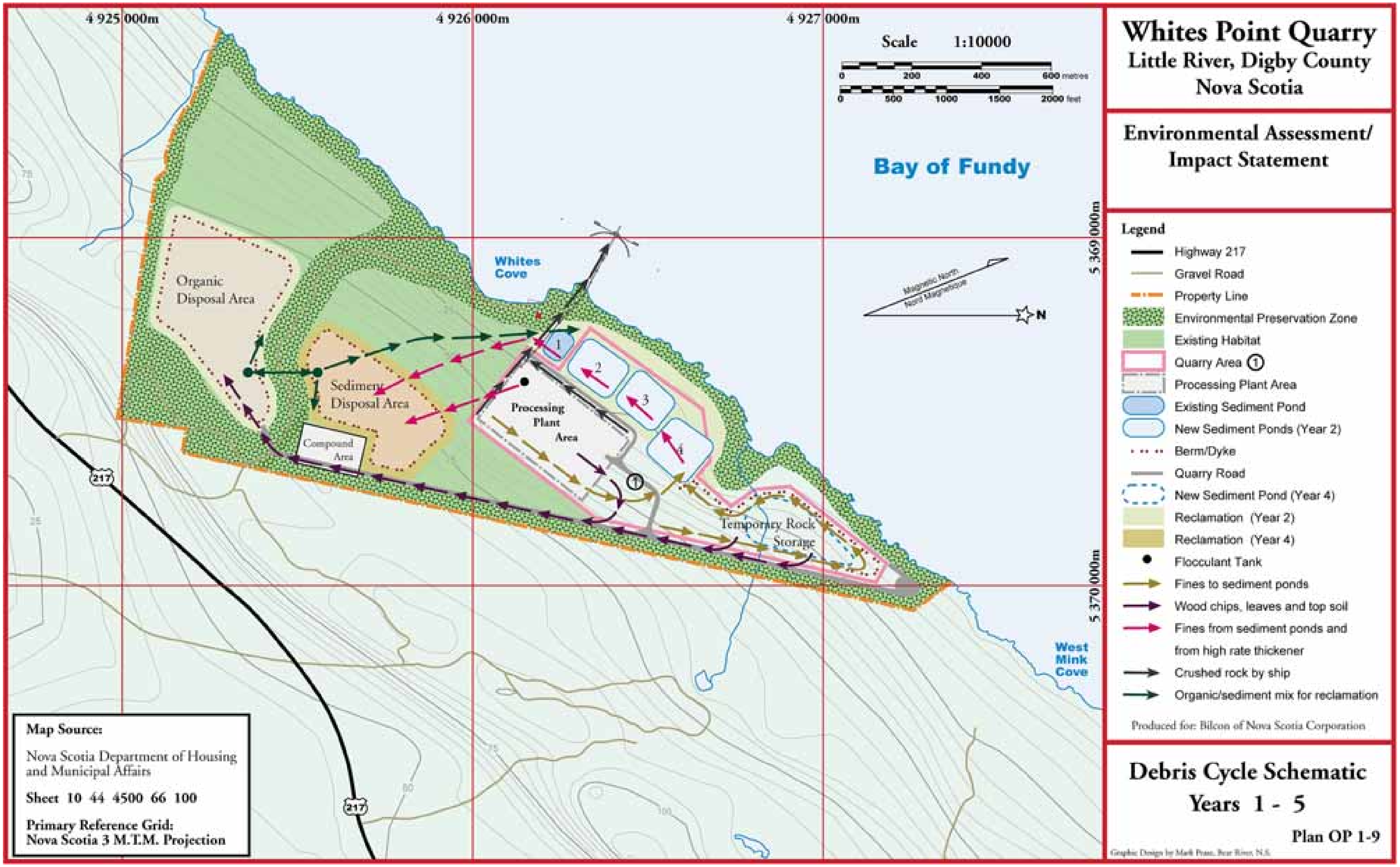
Debris Cycle

The debris remaining from the crushing process will initially be stored in designated areas and subsequently used in the reclamation process. **Plan OP1-9** – Debris Cycle Schematic shows the track of debris for the initial 1-5 years of the quarry operation. Subsequent five-year periods are similar.

Topsoil and chips from the clearing and grubbing process will be transported to the organic disposal area in the southeast corner of the site for temporary storage. This area will be bermed to prevent material washing further down the slope.

Fines from the exposed operations area will be collected in the settling ponds which will be periodically emptied and the fines transported to the sediment disposal area in the easterly area of the site for temporary storage. Fines from the washing operation will be directed to the high rate thickener where, following dewatering, they will be pumped to the sediment disposal area for temporary storage. The sediment disposal area will be bermed to prevent migration of the fines further downslope.

As material is required for reclamation, the organic material and the fine sediment will be mixed and spread for replanting following the addition of soil amendments. Crushed rock and grits will be loaded via the loading tunnel and the shiploader on a period basis for trans-shipment to New Jersey. No debris will be transported off-site since it will all be employed in the reclamation process which will be carried out incrementally throughout the life of the project.



Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Highway 217
Gravel Road
Property Line
Environmental Preservation Zone
Existing Habitat
Quarry Area 1
Processing Plant Area
Existing Sediment Pond
New Sediment Ponds (Year 2)
Berm/Dyke
Quarry Road
New Sediment Pond (Year 4)
Reclamation (Year 2)
Reclamation (Year 4)
Flocculant Tank
Fines to sediment ponds
Wood chips, leaves and top soil
Fines from sediment ponds and from high rate thickener
Crushed rock by ship
Organic/sediment mix for reclamation
Produced for: Bilcon of Nova Scotia Corporation
Debris Cycle Schematic
Years 1 - 5
Plan OP 1-9
Scale 1:10000
0 200 400 600 metres
0 500 1000 1500 2000 feet
Bay of Fundy
Magnetic North
N
4 925 000m
4 926 000m
4 927 000m
5 369 000m
5 370 000m
Whites Cove
West Mink Cove
Organic Disposal Area
Sediment Disposal Area
Compound Area
Processing Plant Area
Temporary Rock Storage
1
2
3
4
217
Map Source:
Nova Scotia Department of Housing and Municipal Affairs
Sheet 10 44 4500 66 100
Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

Ocean Tides and Currents

The tidal regime of the Bay of Fundy is essentially of a lunar semi-diurnal nature (two complete tidal oscillations daily). The tidal range recorded for Sandy Cove (44°30'N Latitude and 66°06'W Longitude) and Tiverton, at Boars Head (44°24'N Latitude and 66°13'W Longitude) is as follows.

	Mean Tide (feet)	Large Tide (feet)
Sandy Cove	18.4	25.7
Tiverton, Boars Head	17.0	23.1

The location of the proposed marine terminal at Whites Point is 44°28'N Latitude and 66°08'W Longitude. Mean water level, above Chart Datum, at Whites Point is approximately 11.5 feet.

Major tidal current patterns in the main portion of the Bay of Fundy indicating the hourly rate and direction are shown in Appendix 40. The currents shown are those to be expected for the average tidal range at Saint John, New Brunswick of 20.0 feet. Currents in this portion of the Bay in the vicinity of the bulk carriers route from the inbound/outbound shipping lanes to the marine terminal at Whites point ranges from 0 – 2.5 knots. It should be noted that these currents are for normal weather conditions. Strong winds and abnormal barometric pressures may modify the rates and directions shown on these charts by causing currents of a non-periodic nature.

Wind

The Whites Point Quarry and Marine Terminal site is located in the Bay of Fundy sub-area 1 of the East Coast of Canada as described in Volume I of the Wind and Wave Climate Atlas – see **Figure 8** for spatial definition. Wind speed and direction vary seasonally in this area of the Bay. Monthly wind statistics (frequency of wind speed by direction) for East Coast Area 1 – Bay of Fundy is contained in Appendix 48. Monthly data statistics indicate December has the highest mean wind speed (21.6 knots) from the northwest. The lowest mean wind speed (13.3 knots) from the southwest occurs in August. Maximum wind speed varies from 49.0 knots in August to 69.0 knots in October. These statistics are based on over 4,000 observations per month.

Wave

Volume I of the Wind and Wave Climate Atlas – see **Figure 8** for spatial location, indicates wave height and direction vary seasonally in this area of the Bay. Monthly wave statistics (frequency of significant wave height by direction) for East Coast Area 1 – Bay of Fundy is contained in **Appendix 46.** Monthly wave statistics indicate December and January have mean wave height of 1.1 m. These statistics are based on over 800 observations per month. The highest percentage frequency of wave occurrence is from the southwest.

Water Quality

Water column characteristics, including temperature, salinity, and water transparency were taken at three locations in nearshore waters – see **Map 16 -** during spring, summer, and fall of 2004 (Brylinsky 2004, **Ref. Vol II, Tab 11**). Water quality sampling in the intertidal zone was conducted by David W. Kern, B.Sc. in 2002 – see **Map 12.** Parameters analyzed included coliform and e-coli, general chemistry and trace metals. Laboratory analysis was conducted by Comeau Lab (coliform and e-coli) and PSC Analytical Services (general chemistry and trace metals) – see Appendix 45.

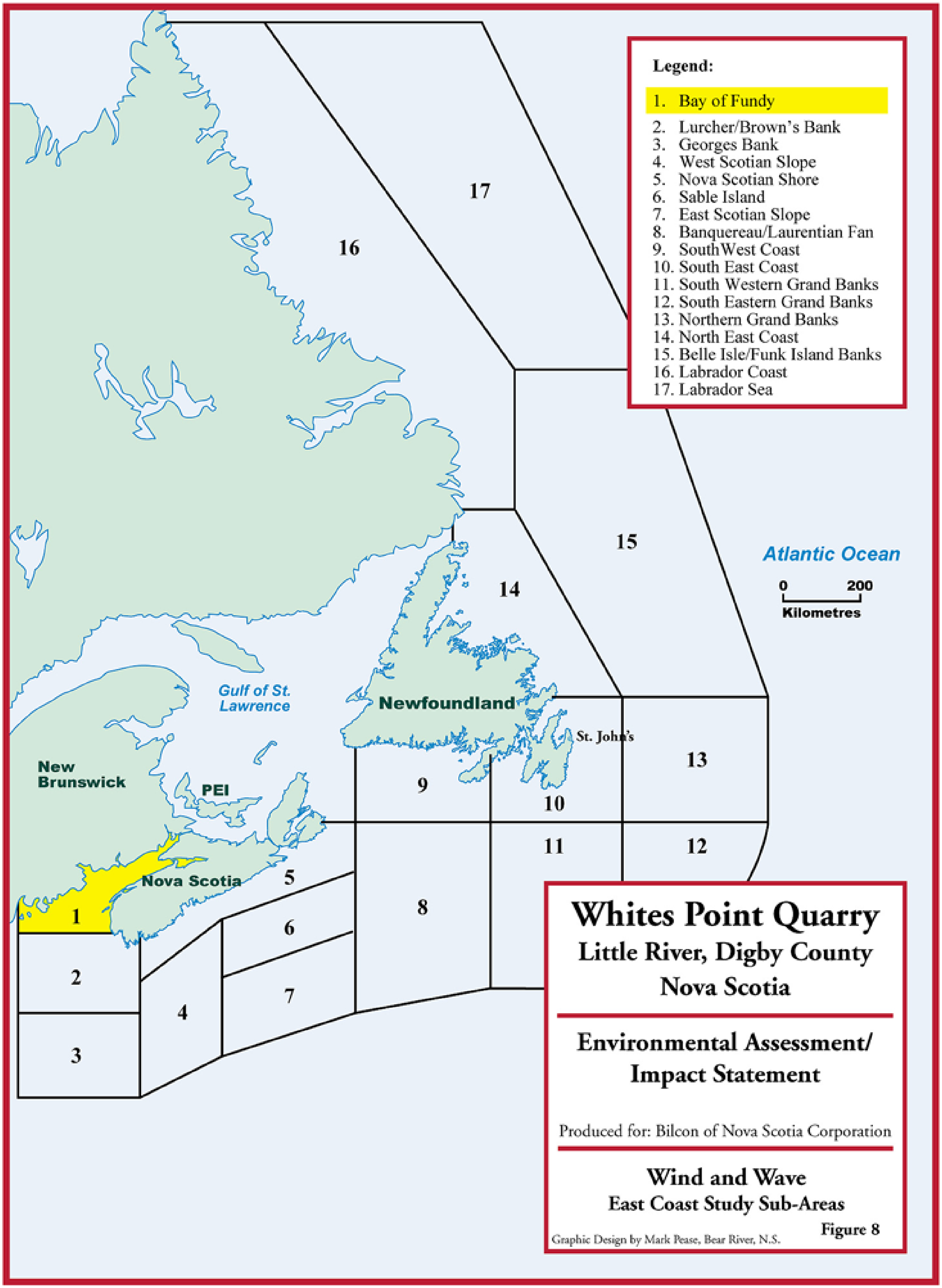
Physical characteristics were surveyed in temporal context during April, July, and October, 2004. Measurements of water column stratification (based on temperature and salinity profiles), water transparency (as Secchi Disk depth) were taken using a Yellow Springs Instrument Salinity – Conductivity – Temperature Meter and a standard 20 cm diameter Secchi Disk. Results of this survey data are contained in (Brylinsky, 2004 **Ref. Vol II, Tab 11,Table 4.2**). There was no indication of water column stratification at any of the sampling stations or during any of the sampling periods. Salinity varied little (30.0-32.3 ppt) and Secchi Disk depth varied little (7.0 – 7.3 m) indicating relatively clear water.

Sea Level Change

Historically, in the Bay of Fundy and particularly along Digby Neck, a former sea level as high as the present land elevation of 45 m occurred at the end of the last glaciation. This was followed by falling relative sea levels to a maximum of 60 m in the Bay of Fundy. During this process, fine-grained sediments were removed and transported to deeper water. Due in part to global melting of glaciers, the resulting sea level rose to the present shoreline elevation. Presently, sea level change is slowing but still rising at rates of between 20 and 30 cm/century (Atlantic Marine Geological Consulting Ltd. 2005, **Ref. Vol. III, Tab 17**).

The sensitivity of coastal areas to a potential global rise in sea level (such as might be caused by global warming) was addressed by a "coastal vulnerability index" (Shaw et al 1998, Ref. 167). Seven variables including relief and vertical land movements, lithology and coastal landform, rates of erosion, wave energy, and tidal range were considered. For example, a coast with a high sensitivity index would be a region with low relief and unconsolidated sediments, with barrier islands, high tidal range, high wave energy levels and where relative sea level is already rapidly rising. This is characteristic of much of the south shore of Nova Scotia along the Atlantic coast. The south shore area has a sensitivity index between 5.0 and greater or equal to 15.0.

A coast with a low sensitivity index would have high relief, a rocky shore with resistant, non-eroding bedrock, falling sea level, low tidal range and low wave energy. This type of coastline, typical of the Bay of Fundy at Digby Neck, is not subject to significant retreat under current conditions and would remain stable even if the sea level rises at the predicted rates. The sensitivity index along Digby Neck coast at Whites Point is low (0 -4.9) indicating a relatively stable shoreline at the Whites Point quarry and Marine Terminal site.



Legend:
1. Bay of Fundy
2. Lurcher/Brown's Bank
3. Georges Bank
4. West Scotian Slope
5. Nova Scotian Shore
6. Sable Island
7. East Scotian Slope
8. Banquereau/Laurentian Fan
9. SouthWest Coast
10. South East Coast
11. South Western Grand Banks
12. South Eastern Grand Banks
13. Northern Grand Banks
14. North East Coast
15. Belle Isle/Funk Island Banks
16. Labrador Coast
17. Labrador Sea
Atlantic Ocean
0 200
Kilometres
Gulf of St. Lawrence
Newfoundland
St. John's
New Brunswick
PEI
Nova Scotia
1
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17
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Wind and Wave
East Coast Study Sub-Areas
Figure 8
Graphic Design by Mark Pease, Bear River, N.S.

9.1.7.2 Analysis

The bathymetry of the Bay of Fundy in the region of the proposed marine terminal affords adequate, unobstructed water depth for bulk carrier navigation and transport of aggregate materials. Water depths in the proposed ship route from the inbound/outbound shipping lanes ranges from over 100 m to 16 m at the terminal. Location of the terminal near the entrance to the Bay requires no deep penetration of the Bay by shipping and has the closest deep water route to the adjacent Gulf of Maine from the Bay of Fundy. Surficial sediments, including sand and/or muddy sediments are minimal in this region of the Bay.

The marine terminal site consists of a stable and hard bedrock seabed and occurs along a typical Bay of Fundy coastal segment without anomalous bathymetric, bedrock, or sedimentological characteristics. No in water blasting, dredging or dredge spoil disposal are proposed during construction of the marine terminal. Pipe piles are proposed to support the marine terminal infrastructure. Erosion at the base of the piles is extremely unlikely due to the absence of sediments in this area.

Minimal disturbance to the morphology of the seabed in the sublittoral, intertidal, and shoreline zones will result from construction of the marine terminal. The proposed construction method using pipe piles will produce minimal effects on bottom morphology. Analysis of existing bottom current speed and patterns indicate erosion at the base of the pipe piles will not occur. The location of the marine terminal is on exposed bedrock. No armour rock protection at the base of the piles will be required thereby confining the area of direct effect to the pile footprint. The majority of the sublittoral, intertidal and shoreline zones will be spanned – see **Figures 2** and **3,** and produce no direct effect on the bottom in the area of the spanned construction.

The location of the quarry and marine terminal on the Bay of Fundy coastline presents the possibility of potential adverse natural forces affecting the project. Climatic events such as storm surges, tides, and meteorological conditions individually and in combination will present the most probable effect on components of the marine terminal (mooring dolphins, ship loader, and conveyor system). The all time extreme wind event, recorded for this period at the Yarmouth weather station occurred on February 2, 1976. This storm event commonly called the "groundhog day storm" had recorded maximum hourly wind speed of 108.0 km and maximum gust speed of 163.0 km from the southwest.

Detailed engineering design will ensure that the structural systems chosen will be capable of withstanding these natural forces. Necessary studies including wave height and duration, wind speed, and potential sea level rise of 30 cm/century will be conducted during detailed engineering design to ensure adequate infrastructure over the 50 year life of the project.

Terrestrial surface disturbance during construction and operation phases of the quarry including aggregate washing operations will be contained on-site. A system of drainage channels, sediment retention ponds, constructed wetlands, and an environmental preservation zone will minimize runoff into marine waters. Surface water discharge levels will meet the thresholds established by the Nova Scotia Department of Environment and Labour "Pit and Quarry Guidelines – 1999". Aggregate washing operations will be arranged in a closed circuit and make-up water for the washing will be supplied from surface water runoff. Uncontrolled releases of solids from the closed circuit wash water system are highly unlikely and would be contained by the environmental control structures.

Marine sediment redistribution during construction is extremely unlikely since pilings for the marine terminal are located on exposed bedrock. The design of the marine terminal infrastructure on pipe piles allows for practically unobstructed current and tidal flows when compared to other marine construction techniques (sheet piling and infill or rock fill). This construction technique will produce minimal effects on temperature, salinity, and nutrient concentrations during construction and operational phases. Since currents and tides are practically unobstructed by construction of the marine terminal, effects on nearshore navigation, marine ecology, and harvesting of sea life will be minimal. Also, minimal turbidity will result from drilling of the bedrock to anchor the pile driving templates and pile anchors. If turbidity exceeds the "Canadian Water Quality Guidelines for the Protection of Aquatic Life – Total Particulate Matter". (Ref.45), mitigation measures such as silt curtains will be implemented.

It is highly unlikely that water quality in the marine environment will be affected by the proposed marine terminal construction and operation. Laboratory analysis of marine bottom sediments indicates that metals, PCBs, PAHs, and organochlorinated pesticides were either not detected or are within the CCME interim marine sediment quality guidelines. No provisions for ship refueling are proposed at the marine terminal. Also, uncontrolled releases of fuel oils or nutrients from land infrastructure, operational procedures and mobile equipment will be contained by the environmental control structures. Heavy metals, PCBs, PAHs, and organochlorines substances will not be used or produced during construction and operation. Seasonal water column investigations indicate a non-stratified water column exists in the nearshore marine waters in the vicinity of the quarry property. Since there is no stratification of the water column or seasonal mixing, and, no uncontrolled releases from aggregate washing and no releases of fuel oils, heavy metals, organochlorines or nutrients, there would be no effects on water quality.

In conclusion, based on a marine geological, structural, sedimentological and bathymetric understanding of the Bay of Fundy, the location of the proposed marine terminal offshore Digby Neck is the most optimum location for such a facility within the entire Bay of Fundy " In my opinion, based on a marine geological, structural, sedimentological and bathymetric understanding of the Bay of Fundy, the location of the marine terminal offshore Digby Neck is the most optimum location for such a facility within the entire Bay by shipping and has the closest deep water route to the adjacent Gulf of Maine from the Bay of Fundy. It occurs over a stable and hard bedrock seabed with no surficial sediments including sand and /or muddy sediments. It occurs along a typical Bay of Fundy coastal segment without anomalous bathymetric, bedrock, or sedimentological characteristics. The area has no active faults within the bedrock and is considered to have a low seismic risk”(G. Fader, Atlantic Marine Geological Consulting Ltd. - personal communication). Additionally, the sensitivity index for sea level change in this area is low, and the proposed site will not require dredging or dredge spoil disposal during the construction and operational phases of the project.

9.1.7.3 Mitigation

Site selection for the marine terminal at Whites Point constitutes a significant mitigating factor from a physical oceanography standpoint. The site is located to provide a natural, unobstructed deep water port. Its location avoids the potentially archaeologically sensitive underwater ridge extending from Sandy Cove. It is located in an area of the Bay with little sediment in the nearshore area. It provides a sound geological bedrock support for the terminal construction and is in an area of practically non-existent seismic activity. Penetration of shipping activity into the outer Bay is minimal and the distance from established shipping lanes to the marine terminal is short and direct. The above factors all contribute to mitigate effects on the regional ecosystem.

Selection of the alternate means of construction – pipe pile supports – for marine terminal infrastructure minimizes effects in the local marine environment. This mitigation measure contributes positively to sustainable development objectives when compared to other marine construction such as withinin water blasting and dredge operations and infill. The marine terminal extends offshore into adequate existing water depth and eliminates the need for blasting and dredging to achieve the necessary water depth. Turbidity within the water column is also greatly reduced with piling construction compared to placing rock infill within the intertidal and sublittoral marine zone. Again, to the extent possible, impact avoidance has been considered.

The primary direct effects on the physical oceanography will be during the construction phase of the marine terminal. Construction affecting the bottom of the intertidal and sublittoral zones will be scheduled during periods of low biological activity. Construction within the sublittoral zone will be carried out from floating platforms to further minimize effects on the pelagic and benthic communities. Construction within the intertidal zone will be done from shore and to the extent possible at low tide. During installation of the pipe pile support structures, if turbidity exceeds prescribed thresholds, silt curtains, a well established and proven mitigation measure (Vagle 2003,Ref. 90), will be installed. Pipe pile construction was selected to minimize effects on nearshore currents and tides. The pilings will provide a stable substrate for long term habitat colonization in the water column.

Secondary effects on marine waters could result from quarry operations. However, runoff from land sources during quarry operations will be routed through sediment retention ponds and constructed wetlands before entering marine waters. This system of sediment control of Total Suspended Solids (TSS) proved successful in meeting the thresholds established by the Nova Scotia Department of Environment and Labour during construction operations at the 3.9 hectare quarry on the Whites Point site.

9.1.7.4 Monitoring

Monitoring potential effects on the physical oceanography will focus on the direct influences during the construction phase of the marine terminal. Minimal turbidity in the marine water column is anticipated when pipe pile templates and pilings are installed within the intertidal and sublittoral bottom. Turbidity monitoring will be conducted during this construction process. If turbidity exceeds the "Canadian Water Quality Guidelines for the Protection of Aquatic Life – Total Particulate Matter". (Ref. 45), silt curtains will be implemented. Liquid effluent discharge levels from land sources will meet the thresholds established by the Nova Scotia Department of Environment and Labour "Pit and Quarry Guidelines – 1999". (Ref.77).

9.1.7.5 Impact Statements

Physical Oceanography – Construction

Since the only direct construction within intertidal and sublittoral marine waters consists of installation of pipe piles in areas of bedrock, turbidity will be minimal and result in a ***short term, insignificant negative effect, of local scale.***

Physical Oceanography – Life of Project

Placement of pipe piles within the intertidal and sublittoral marine waters will produce minimal alteration and obstruction to nearshore currents and tides and result in a ***long term, insignificant negative effect, of local scale.***

9.1.8 Air Quality

9.1.8.1 Research

On-site investigations indicate no development presently exists on the Whites Point Quarry property and no commercial or industrial land uses are adjacent to the property. The nearest industrial activities are two fish processing plants in the village of Little River over 1km away. Vehicle traffic on Highway #217 is generally light with some increase during the summer tourist season and only minimal internal combustion engine emissions are evident. Emissions from diesel powered fishing boats along the nearshore are also minimal. Vehicular traffic on Whites Cove Road, due to the unimproved condition is practically limited to four wheel drive vehicles and all terrain vehicles which frequent the site. A portion of the site was recently clear cut with logging trucks hauling out along Whites Cove Road generating greater than normal emissions and dust.

Total suspended particulate (TSP) has been the air quality parameter of most concern for quarry operations in Nova Scotia in regard to potential effects on human health and the environment. In June 2000, the Canadian Council of Ministers of the Environment (CCME) “Canada-Wide Standards for Particulate Matter (PM) and Ozone” see – CCME 2000. Ref.46 **.** was endorsed. Further, “Regulations Related to Health and Air Quality” were published by Health Canada (Health Canada 2003, Ref.63). This latter document sets forth National Ambient Air Quality Objectives & Guidelines in Canada and establishes the following for Total Suspended Particulate (TSP):

Maximum Desirable Level	(annual) 60 µg/m³	(24 hour)
Maximum Acceptable Level	(annual) 70 µg/m³	(24 hour) 120 µg/m³
Maximum Tolerable Level	(annual)	(24 hour) 400 µg/m³

Further, as indicated in Appendix D of the NSDEL Pit and Quarry Guidelines (NSDEL 1999, Ref.77) paragraph VI establishes the following limits for suspended particulate levels at or beyond the property boundary.

Suspended Particulate Matter

Maximum Limit	60 – 70 µg/m³ 120 µg/m³ ave.	annual geometric mean concentration over a 24 hr period

Ambient air quality is monitored in Nova Scotia with a network of 28 sites and generally meets federal ambient air quality criteria for S02, TRS1, H2S, CO, NO, and O3. An exception may be when long-range, trans-boundary events occur (Jacques Whitford 2005, **Ref. Vol V, Tab 31**).

9.1.8.2 Analysis

Particulates such as dust, generated by quarry operations will not exceed the criteria established by the NSDEL at or beyond the property boundaries of 70 $\mu g/m^3$ annual geometric mean or 120 $\mu g/m^3$ daily average (24 hour). Dust generated from on-site haul roads will be controlled with water spray or other approved methods. Dust from rock processing will also be controlled by water sprays from recycled water from the sediment retention ponds.

Quarrying will require heavy mobile equipment, primarily diesel powered, for land operations. Arrival and departure of the bulk carrier once a week will briefly involve diesel powered emissions. Some increase in vehicle traffic, primarily private vehicles, will be generated by the quarry workforce and commercial vehicles delivering equipment and materials during quarry operations. All heavy mobile equipment including quarry trucks and loaders, will have approved emission controls meeting U.S. Environmental Protection Agency Tier 3 emissions regulations. This equipment will be maintained in prescribed mechanical operating condition.

Electrical power will be used for land operations such as the conveyor systems, stationary equipment, and ship loading systems. As a result, emissions are not expected to affect adjacent residences, especially since no stationary machinery activities such as crushing and screening will take place within 800 m of the adjacent residences.

9.1.8.3 Mitigation

Since quarry products will be shipped by water to markets, no heavy trucks hauling rock will generate dust in adjacent residential areas. Also, access to the Whites Point quarry is presently being investigated. A paved access road from Highway #217 to the quarry property is planned. Paving the access road will practically eliminate dust generated from employee and delivery vehicles. The physical plant area where crushing and screening will take place has been located approximately 1000 m from the nearest residence to further reduce any effects of air borne particulates on residential life. As a further precautionary measure, processing equipment will be enclosed whenever practical and hooded conveyor systems used to reduce fugitive dust. Dust control at the source with water sprays, horizontal and vertical separation, maintaining existing forest cover, and an approximate five year revegetation program will collectively eliminate any adverse effect of dust on adjacent residences.

Heavy operational (quarry trucks and loader) mobile equipment will be equipped with diesel engines meeting the U.S. Environmental Protection Agency Tier 3 emission standards and maintained in prescribed mechanical operating condition. This will further ensure emissions of particulate matter, hydrocarbons, nitrous oxide and carbon monoxide are within regulatory standards. Smaller maintenance equipment used on an infrequent basis may not be equipped to Tier 3 emission standards.

The burning of brush and associated wood fibre from land clearing activities causes emissions of gases such as carbon dioxide, methane, and nitrous oxide into the air. This practice is presently common in Nova Scotia with appropriate burning permits. Construction and the opening of new quarry areas over the life of the project will require land clearing. To eliminate the resultant emissions from open burning of brush, Bilcon of Nova Scotia Corporation intends to chip the remaining wood fibre after merchantable timber has been harvested. Wood chips will then be placed in the organic disposal area on-site to be composted and used during land reclamation. The chipping and composting process constitutes a mitigation measure that will increase the costs associated with land clearing.

9.1.8.4 Monitoring

Particulate emissions (dust) will be monitored by Bilcon of Nova Scotia Corporation if requested by the Nova Scotia Department of Environment and Labour. The location of monitoring stations will be established by the Nova Scotia Department of Environment and Labour. If requested, particulates will be measured by the high volume method as described in report No. E.P.S. 1 – AP – 73 –2.

9.1.8.5 Impact Statement

Particulate Emissions

Fugitive dust from quarry operations will be controlled on-site and will not exceed 120 µg/m³ daily average or 60 – 70 µg/m³ annual geometric mean at the property line as established by the Nova Scotia Department of Environment and Labour's Pit and Quarry Guidelines resulting in a ***long term, neutral (no) effect, of local scale.***

9.1.9 Noise and Vibration - Blasting

9.1.9.1 Research

The Nova Scotia Department of Environment and Labour's terms and conditions for operation of the four-hectare quarry located on the Whites Point Quarry site includes the following:

1 No blasting within 30 m of the boundary of a public or common highway

2 No blasting within 30 m of the bank of any watercourse or ordinary high water mark

3 No blasting within 800 m of the foundation or base of a structure located off site

4 No blasting within 15 m of the property boundary when a structure on the abutting property is not involved.

Further to the above, no blasting will be permitted if there is a thermal atmospheric inversion or a low cloud cover or fog conditions. No blasting shall occur on Sunday, on a statutory holiday prescribed by the Province of Nova Scotia, or on any day between 1800 and 0800 hours.

9.1.9.2 Analysis

The above terms and conditions will be adhered to during blasting operations at the proposed Whites Point Quarry. Also, a technical blast design will be prepared by a qualified person (a blaster with a minimum Class 2 certification for the province of Nova Scotia). The blast design will ensure air concussion does not exceed 128 dBA within 7 m of the nearest structure not located on the site and that ground vibration of 12.5 mm/sec peak particle velocity will not be exceeded below grade or less than 1 m above grade in any part of the nearest structure not located on the site. No blasting is proposed within 800 m of a structure not located on the site, without written permission of the structure owner.

Blast monitoring data at other rock quarries in Nova Scotia indicates concussion below 128 dBA and ground vibration below 12.5 mm/sec as required by the Nova Scotia Department of Environment and Labour can be routinely achieved. For example, data from a rock blast using a four-inch hole loaded at 214 kg of explosive per delay with an average collar of 7 feet produced 88 dBA at 1460 m and 122.4 dBA at 420 m (personal communication, P. Caza, Dyno Nobel North America). A prediction of ground vibration using the Holmberg Equation and a K factor of 400 (based on actual blast results in a basalt rock quarry), an explosive weight of 45 kg per delay, would result in 1mm/sec ground vibration at a structure 1120 m from the blast site and 7 mm/sec at 150 m. The above circumstances indicate values well within the criteria established by the Nova Scotia Department of Environment and Labour.

The frequency of blasting during quarry start-up is planned to be once per week and once every two weeks during normal operations. Blasting is proposed throughout the year and each blast design will likely be different in regard to number and size of holes, weight of explosives per detonation, and location. However, all blasting will be designed to meet the 128 dBA and 12.5 mm/sec criteria.

9.1.9.3 Mitigation

A minimum 30-m environmental preservation zone is proposed around the perimeter of the quarry and Whites Cove Road. The 30-m zone along the landward property line, between the quarry and residential dwellings, will remain in a forested condition. This forested "buffer" will absorb and deflect sound waves generated by blasting activities. Also, the proposed restoration schedule provides for re-vegetation of quarried areas approximately every five years. The revegetation will provide greater absorption of sound generated by blasting. Further, as a mitigative measure, no blasting is proposed within 800 m of residential structures not located on the quarry property without written permission.

9.1.9.4 Monitoring

Three land monitoring stations are proposed as shown on **Map 2 .** Each blast will be monitored for concussion and ground vibration. Additionally, all blasts will be video taped to record blast efficiency. Monthly reports summarizing the results of blasting activities will be submitted to the Nova Scotia Department of Environment and Labour.

9.1.9.5 Impact Statement

Blasting

Concussion and ground vibration from blasting activities will meet the criteria established by the Nova Scotia Department of Environment and Labour and not exceed 128 dBA and 12.5 mm/sec respectively and result in a ***long term, neutral (no) effect, of local scale.***

9.1.10 Noise and Vibration - Plant

9.1.10.1 Research

Sound levels in rural areas are generally in the range of a minimum of 30 decibels (dB) to a maximum of 75 decibels. The transmission of noise is primarily influenced by climatic conditions, distance from the source, and attenuation resulting from elements or barriers between the sound source and the receiver.

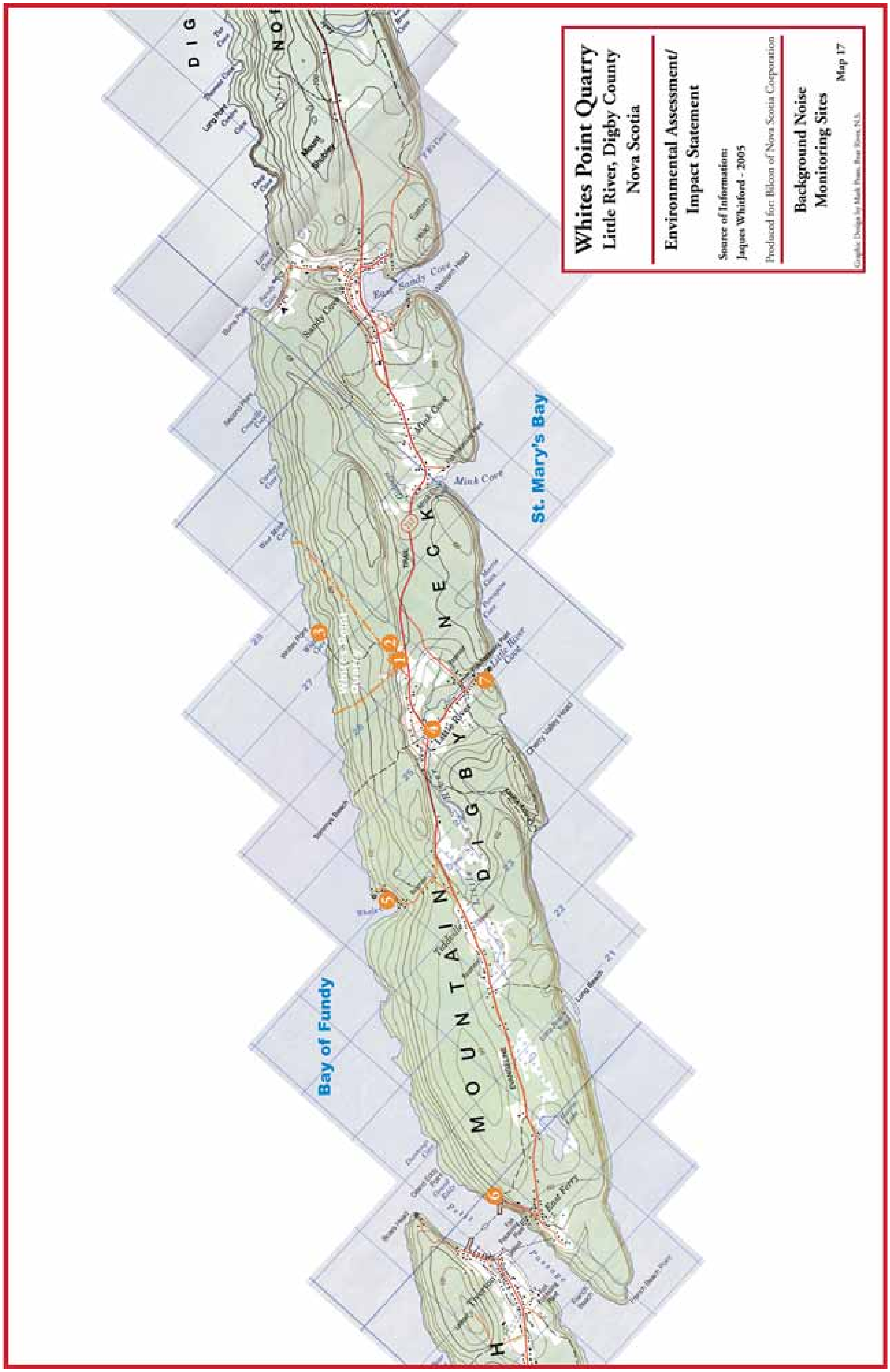
Baseline noise levels of existing conditions were determined by on-site measurements at the Whites Point quarry site and surrounding areas. Measurements were taken during May and June 2005, (Jacques Whitford 2005, **Ref. Vol V, Tab 31**). Sound levels were taken using a Larson Davis Model 824 and Quest Model 2900 Type 2 integrating sound level meters. Eight sites - see **Map 17** - including two on the quarry site, one at the nearest receptor, and five at various locations were measured to compare background sound levels of everyday activities in nearby communities.

Following is the list of sites monitored and the range of sound levels recorded. For details see (Jacques Whitford 2005 **Ref. Vol. V, Tab 31**).

Site Number	Location	Sound Level Range (dBA)
1	Residence Hwy #217	32.9 – 48.1
2	Quarry Property Boundary	35.3 – 57.6
3	Whites Cove Shore	32.8 – 51.9
4	Little River Intersection	52.8 – 65.4
5	Whale Cove Harbour	32.8 – 51.9
6	East Ferry	30.5 – 70.7
7	Little River Fish Plant	37.4 – 66.9
8	Highway #303 Conway	54.7 – 59.8

The frequency of data collection for sites 1 and 2 was at one minute intervals, then averaged for hourly Leq values. Measurements were taken during portions of three daily periods (day 0700 – 1900, evening 1900 – 2300, and night 2300 – 0700) corresponding with provincial guidelines. Sites 3 – 8 used twenty minute recordings to calculate the one minute Leq values.

Sound monitoring was also conducted by David W. Kern B.Sc. in a rural area in Annapolis County, Nova Scotia using a Martel 325 Sound Level Meter with the following results. Rural highway traffic produced a maximum of 75 dB sound level at a distance of 30 m



Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Source of Information:
Jaques Whitford - 2005
Produced for: Bilcon of Nova Scotia Corporation
Background Noise
Monitoring Sites
Map 17
St. Mary's Bay
Bay of Fundy
DIGBY NECK
MOUNTAIN
Whites Point Quarry
Little River
East Ferry
Mink Cove
East Sandy Cove
Sandy Cove
Little River Cove

from the highway. Comparatively, a person operating a chain saw experienced 88 dB while a person 30 m away experienced a 68 dB noise level. Also, a person operating a diesel powered farm tractor experienced 75 dB to 83 dB while a person 30 m away experienced 60 dB to 65 dB. Studies generally indicate there is a 20 dB reduction in sound level due to distance from a point source at 30 m. Further reductions per 30 m ranging from 1 dB to 5 dB or greater may be achieved by attenuation. A 1 dB reduction per 30 m may be achieved from absorption by a rough grass cover while a 5 dB or greater reduction per 30 m may be achieved from absorption and the scattering of sound waves by vegetative tree cover (Robinette 1972 Ref. 163).

As indicated in Appendix D of the NSDEL Pit and Quarry Guidelines, paragraph VII establishes the following guidelines for sound level limits at the property boundaries of the quarry.

Leq. Sound Level Limits

Night	23:00 – 07:00 & all day Sunday and statutory holidays	55dBA
Evening	19:00 – 23:00	60dBA
Day	07:00 – 19:00 hours	65dBA

9.1.10.2 Analysis

Background noise levels at sites 1 and 2 (residence Highway #217 and the quarry property boundary) did not exceed the guideline sound levels during the twenty-four hour monitoring periods. Background noise level at sites 4, 6, and 7, in surrounding communities, very infrequently exceeded the guideline sound levels during the twenty minute monitoring period. The highest average sound levels recorded were 70.0 – 70.7 dBA at East Ferry, influenced by the arrival and departure of ferry traffic and a transport truck idling near the sound level meter. It should be noted that peak noise levels at sites 5 (Whale Cove) and 7 (Little River Fish Plant) reached 80dBA as a result of harbour activity including boats, trucks, and general traffic.

General noise levels from operations at the Whites Point quarry at the source are expected to be in the range of 65 dB to 85 dB. The primary sources of noise will be from drilling, blasting, hauling, and crushing basalt rock. Sound pressure levels measured at 15 m for operating off-road equipment varied from 82 – 84 dBA. The largest mobile equipment to be used during quarry operations are off-highway trucks (Caterpiller 773E) and a quarry face wheeled loader (Caterpiller 990 Series II). The 773 off-highway truck has a 15 m sound pressure level of 84dBA for the mode of operation that gives the highest level. The 990 wheel loader at 15 m in mid-gear moving operations has a sound pressure level of 82dBA. Other operating equipment such as excavators and bulldozers have similar sound pressure levels. Specific considerations regarding blasting will be discussed in a subsequent section of this report.

The location of the physical plant, which includes the crushers, screens, and conveyor systems, is shown on **Figure 1.** The distance to the nearest residence is approximately 1000 m horizontally and over 60 m below the ridge line separating the quarry and adjacent residences. In addition to the reduction of noise by attenuation over the 1000-m horizontal distance, sound waves will be deflected upwards and dissipated due to the vertical change in topography. As mentioned previously and considering a maximum 85 dB sound level at the physical plant site, the horizontal and vertical separation in conjunction with attenuation by vegetative cover should adequately reduce noise levels at the quarry property line to well below the 65 dBA daytime level and 55 dBA night time level required by the Nova Scotia Department of Environment and Labour.

Noise generated during construction of the quarry access road from Highway #217 to the quarry property would have the potential of affecting nearby residents. Depending on the type of equipment used, and combination of equipment, sound level pressures are not expected to be greater than any other rural road construction. Access road location to the quarry is presently being planned to provide the greatest separation distance feasible from adjacent residences.

9.1.10.3 Mitigation

The primary mitigation measure will be to minimize noise generated at the source from construction and operational activities. For example, during construction of the marine terminal, the installation of steel pipe piles into bedrock will be required. To minimize noise during this construction process, it is proposed to drill sockets in the bedrock for seating the piles rather than a continuous pile driving process.

Equipment design, as a mitigation measure, is also proposed. Processing equipment will be enclosed whenever practical to reduce noise levels at the source. Additionally, noise generated during loading rock into quarry trucks will be reduced by the use of rubber lined truck beds. Rubberized screens will also be used to reduce noise during the aggregate screening process.

A minimum 30 metre environmental preservation zone is proposed around the perimeter of the quarry property and Whites Cove Road. This preservation zone will also act as a noise buffer zone and will remain in a forested condition between the quarry and adjacent residences and public roads. Also, the proposed reclamation schedule provides for re-vegetation of quarried areas approximately every five years. The re-vegetation will provide greater absorption of sound and further reduce noise levels generated by the physical plant operation and associated activities.

9.1.10.4 Monitoring

Monitoring of sound levels will be conducted to ensure the thresholds at the property line is not exceeded. The following equivalent sound levels (Leq) will be met.

Leq	65 dBA 60 dBA 55 dBA	0700 – 1900 hours (days) 1900 – 2300 hours (evenings) 2300 – 0700 hours (nights and all day Sunday and statutory holidays)

Sound level monitoring stations will be located in consultation with the Nova Scotia Department of Environment and Labour. Monthly summary reports of sound level data will be provided to the Nova Scotia Department of Environment and Labour.

9.1.10.5 Impact Statement

Noise – Plant

Sound levels from quarry plant operations are not expected to exceed typical noise experienced in rural residential environments and will not exceed the decibel levels at the quarry property line as required by the Nova Scotia Department of Environment and Labour resulting in a ***long term, neutral (no) effect, of local scale.***

9.1.11 Noise and Vibration – Ship Loading

Questions regarding noise levels during ship loading were raised during the public consultation process. To address these concerns, Bilcon of Nova Scotia Corporation contracted with Jacques Whitford to conduct background noise investigations in the area of the proposed Whites Point Quarry and Marine Terminal – see **Map 17 .**

9.1.11.1 Research

Background sound levels were taken onshore at the Whites Point marine terminal location on May 3 and 4, 2005 (Jacques Whitford 2005 **Vol. V, Tab 31)**. At this time, fishing boats were operating in the nearshore waters and wind conditions varied from calm to brisk with waves hitting the shore. The averaged background sound levels ranged from 32.8 dBA to 51.9 dBA. The higher noise levels were recorded on May 3, 2005 with continuous peaks of over 55 dBA. These higher recordings were presumably due to the wind and wave conditions on that day. Average background noise levels on May 3, 2005 were 50.6 dBA, while on May 4, 2005, average background noise levels were 34.5 dBA.

9.1.11.2 Analysis

Prediction of noise levels at the proposed marine terminal at Whites Point during ship loading are presented from research conducted at a similar loading facility at Sechelt, British Columbia in April 2004 (Klohn Crippen Consultants Ltd. 2004, Ref. 69).

Background noise levels were taken at Sechelt when no loading or shipping activities were taking place. Weather conditions varied from calm to windy, similar to background weather conditions at Whites Point during background noise monitoring. Average background noise levels at the Sechelt facility ranged from 45 dBA to 53 dBA. During ship loading with conveyors running, radial arm ship loader in operation and the loading of holds in the vessel, the following sound levels were recorded and compared to everyday sound levels.

20 m from source – 70 dBA (equivalent to a vacuum cleaner at 3 m)
500 m from source – 60 dBA (equivalent to conversational speech)
1000 m from source – 58 dBA (equivalent to normal conversation)

It should be noted that these sound levels were recorded over open water with no intervening attenuation features.

The proposed ship loading facility at Whites Point is located approximately 1000 m from the quarry property line and 1500 m from the nearest residential receptor. Using the comparable data from Sechelt of noise levels of 58 dBA at 1000 m over open water and considering further attenuation provided by land mass, forested buffer zones and horizontal and vertical separation, night time noise levels would be considerably less than 55 dBA at the property line. Further reduction by attenuation would be realized by the 1500 m distance to the nearest residential receptor. This is verified based on data recorded at Sechelt, where without any land or forest attenuation, the maximum distance for sound levels to attenuate to 45 dBA was 1480 m. In association with attenuation, this would be comparable with background noise levels recorded at the nearest receptor to the Whites Point quarry.

The Nova Scotia Department of Environment and Labour's Pit and Quarry Guidelines indicate noise levels at the quarry property line should not exceed 55 dBA between 2300 and 0700 hours. In this regard, night time noise levels from ship loading would be less than the noise levels specified in the Pit and Quarry Guidelines. Therefore, ship loading at night will not exceed the provincial guidelines.

9.1.11.3 Mitigation

The proposed environmental preservation zones along the coast line and property lines of the quarry between the ship loading activities and human receptors will further reduce sound levels by attenuation. These buffer zones and horizontal separation will attenuate noise levels and the vertical separation between the source and human receptors will disperse sound waves upward contributing to dissipation of the noise.

9.1.11.4 Monitoring

Monitoring of sound levels will be conducted to ensure thresholds established in the Pit and Quarry Guidelines are not exceeded. - see **paragraph 9.1.10.4** for monitoring details.

9.1.11.5 Impact Statement

Noise – Ship Loading

Sound levels from ship loading operations are not expected to exceed typical noise experienced in rural residential environments and to not exceed the decibel levels at the quarry property line as required by the Nova Scotia Department of Environment and Labour's Pit and Quarry Guidelines resulting in a ***long term, neutral (no) effect, of local scale.***

9.1.12 Light

9.1.12.1 Research

Anthropogenic light at the proposed Whites Point Quarry and Marine Terminal site is presently non-existent. Existing ambient light levels at the project site consist of natural light. Investigations regarding potential effects of light from project development were conducted – see Jacques Whitford. "Noise and Air Quality Study at Whites Point Quarry"" November 2005. Light can be defined as visible radiation (about 0.4 to 0.7 microns in wavelength) considered in terms of its luminous efficiency.

9.1.12.2 Analysis

The proposed daily operating schedule of the quarry is from 0600 – 2200 hours. This schedule will require artificial lighting in several general areas of the quarry site including the working face, the physical plant, the compound area, and the shiploader and mooring facilities. The level of lighting and timing will vary according to basic safety and operational requirements. Operational lighting will be kept to a minimum and synchronized with needs to reduce energy consumption at the quarry.

The working face of the quarry will require minimal lighting during short daylight days in the spring and fall. Mobile flood lighting directed toward the ground at the base of the face would be mounted on elevated stands, angled downward, and shielded to reduce light spill into the night sky. The vertical face will also act to block light flow horizontally toward adjacent residences. The flood lighting will be directed away from nearshore waters. However, during these times of the year (spring and fall), some "glow" in the night sky may be evident during early evening hours.

Lighting at the physical plant and compound area is in most cases within structures. Security lighting at the compound area would be pole mounted with illumination directed downward. All security lighting would be equipped with dusk to dawn controls for energy efficiency. It should be noted that neither of these buildings and areas would be visible from adjacent residences due to vertical elevation change and forested buffer zones. Some night sky "glow" will result from the security lighting. However, this is expected to be comparable to other adjacent community lighting.

The marine terminal would have navigational lighting as required by Transport Canada. Operation of the shiploader is scheduled once per week. Shiploading is expected to take approximately twelve hours and could occur at night. Lighting of the shiploader and conveyor systems will be required for night time shiploading. Conveyor system lighting will be shielded and directed onto the conveyor belts. The elevated shiploader will be equipped with lighting directed downward to the holds of the ship. Minimal light spill is expected into the marine waters and into the night sky. Whenever feasible, ship loading would be conducted in daylight hours to avoid night light that could attract fish or birds. More detailed discussion of possible light effects on wildlife are contained in subsequent sections on fish and migratory birds. Again, if ship loading is conducted during early evening, it could contribute to the night sky glow. Considering the horizontal separation distances, vertical change in elevation, and forested buffer zones, minimal light annoyance is anticipated at adjacent residences. No known commercial fishery or whale and seabird cruises or recreational boating are presently conducted at night in the nearshore waters. The only recreational uses observed in the evening were on land by OHV's using the Whites Cove Road. These vehicles are equipped with their own lights.

9.1.12.3 Mitigation

Mitigation measures to reduce the effects of artificial illumination at the quarry site include the timing and frequency of activities, and the location of the light source. All lighting will be designed specifically for the intended use, to reduce light spill, and for overall energy efficiency. Much of the lighting will be enclosed within structures. Outdoor lighting will be shielded to illuminate specific areas or operating elements. The overall objective of the mitigation will be to manage the lightscape to avoid effects on the human and biological environments.

9.1.12.4 Monitoring

Re-establishment of the Community Liaison Committee will provide an opportunity for Bilcon of Nova Scotia Corporation to invite a neighbour to participate on the Committee. This person could communicate any concerns neighbours of the quarry may have about night lighting at the quarry and discuss resolutions.

9.1.12.5 Impact Statement

Light

Considering the duration, frequency and location of proposed night lighting at the quarry and marine terminal site, no direct light is expected to be viewed by neighbouring residences. However, minimal night sky glow may occasionally be experienced resulting in a ***long term, insignificant negative effect, of local scale.***

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9.2 Biological Environment and Impact Analysis

9.2.0 Introduction

9.2.0.1 Species at Risk

Four priority lists of wild species were consulted in the preparation of species at risk lists for this EIS. These priority lists and the species status designations incorporated in this species at risk list are;

1 Species listed under the Federal Species at Risk Act (SARA 2003) as Endangered, Threatened or of Special Concern

2 Species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered, Threatened or of Special Concern

3 Species listed under the Nova Scotia Endangered Species Act (NS ESA 1999) as Endangered, Threatened or Vulnerable

4 Species designated under the Nova Scotia General Status Ranks of Wild Species (NS GSR) as status red or yellow.

As specified in the Guidelines (9.2.1 Species at Risk), while all of the species appropriately designated in the four priority lists indicated above are considered to be at risk, only those identified on the SARA and COSEWIC priority lists are treated individually as Valued Environmental Components (VEC's).

Using these priority lists, a Province of Nova Scotia species at risk list was compiled for the following taxonomic groups (see Appendix 39):

- Vascular plants, mosses and lichens
- Land mammals, amphibians, and reptiles
- Birds (land, water)
- Marine mammals and reptiles, fish, and mollusks
- Butterflies, damselflies, and dragonflies.

By applying information concerning distribution and habitat use obtained from the scientific literature, databases maintained by the Atlantic Canada Conservation Data Centre (ACCDC), the Nova Scotia Museum of Natural History, and NSDNR (Significant Species and Habitat database), and consultation with scientists and naturalists, to the list derived for the Province of Nova Scotia, species at risk that might be found on or adjacent the Whites Point property were identified (see Appendix 39**)** for qualitative probabilities of

Nova Scotia species at risk occurring on or adjacent the Whites Point property). Ranges, occurrences, and habitat requirements for the priority species identified are described in greater detail in the Terrestrial Ecology and Aquatic Ecology sections of this Environmental Impact Statement.

It should be noted that a number of the field investigations commissioned by Bilcon of Nova Scotia Corporation were completed prior to the establishment of standards and guidelines by NSDNR (November 2004) or the Review Panel (March 2005). Some species at risk lists used in these investigations were derived in whole or in part from the sub-national (Nova Scotia) rankings assigned in ACCDC's priority list. Species considered at risk were those that were classified under this system as S1 (extremely rare), S2 (rare) or S3 (uncommon). The ACCDC rankings tend to identify more species as being at risk than the four priority lists referred to above. While ACCDC rankings are referred to in the supporting documentation, and even on some occasions within this document, the identification of species at risk in this EIS is based on the four priority lists indicated above.

Definitions for the various risk categories for each of these four priority lists used in this document for identifying species at risk can be found in Appendix 39. Definitions for the risk categories for the ACCDC rankings can be found in attached reports (see Alliston 2004a ad Newell 2002).

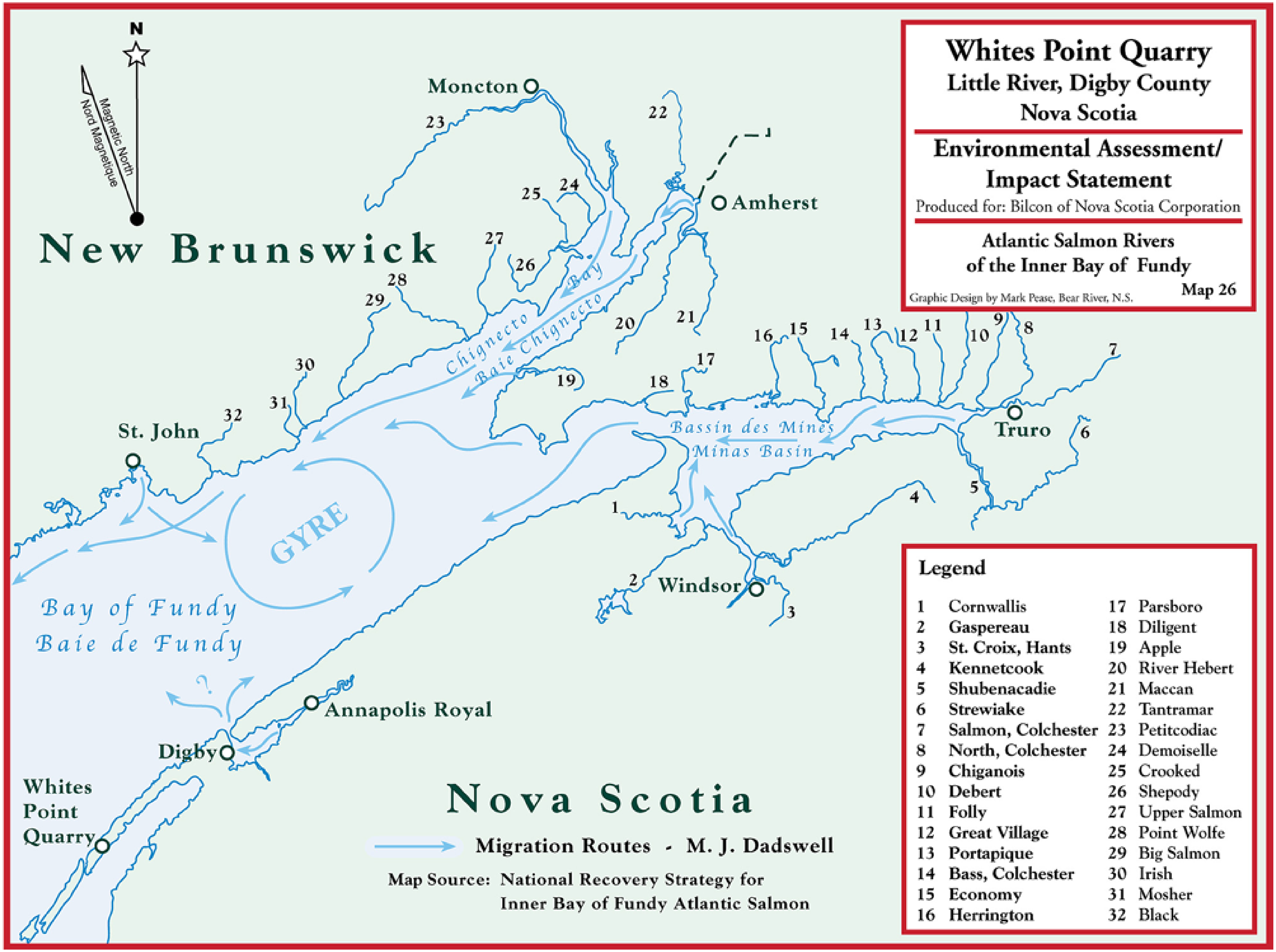
Critical habitat has been identified whenever possible for priority species at risk such as the North Atlantic right whale (*Eubalaena glacialis*) – see **Map 24** , inner Bay of Fundy salmon (*Salmo salar*) – see **Map 26** , eastern mountain avens (*Geum peckii*) and golden crest (*Lophiola aurea*) – see **Map 15** glaucous rattlesnake-root (*Prenanthes racemosa*) – see **Map 18A**, occurring at or adjacent to the Whites Point Quarry and Marine Terminal site. More detailed information is contained in specific sections of this EIS and the accompanying reference documents.

Sites of ecological significance in the vicinity of the project on Digby Neck include the south portion of the Little River watershed -–see **Map 15** A provincial picnic park is located at Lake Midway – see **Map 6A**. No federal, provincial, or municipal protected/ conservation areas (national migratory bird sanctuaries, wildlife management areas, provincial wilderness areas), or municipal water supply areas are known to exist in the vicinity of the project on Digby Neck.

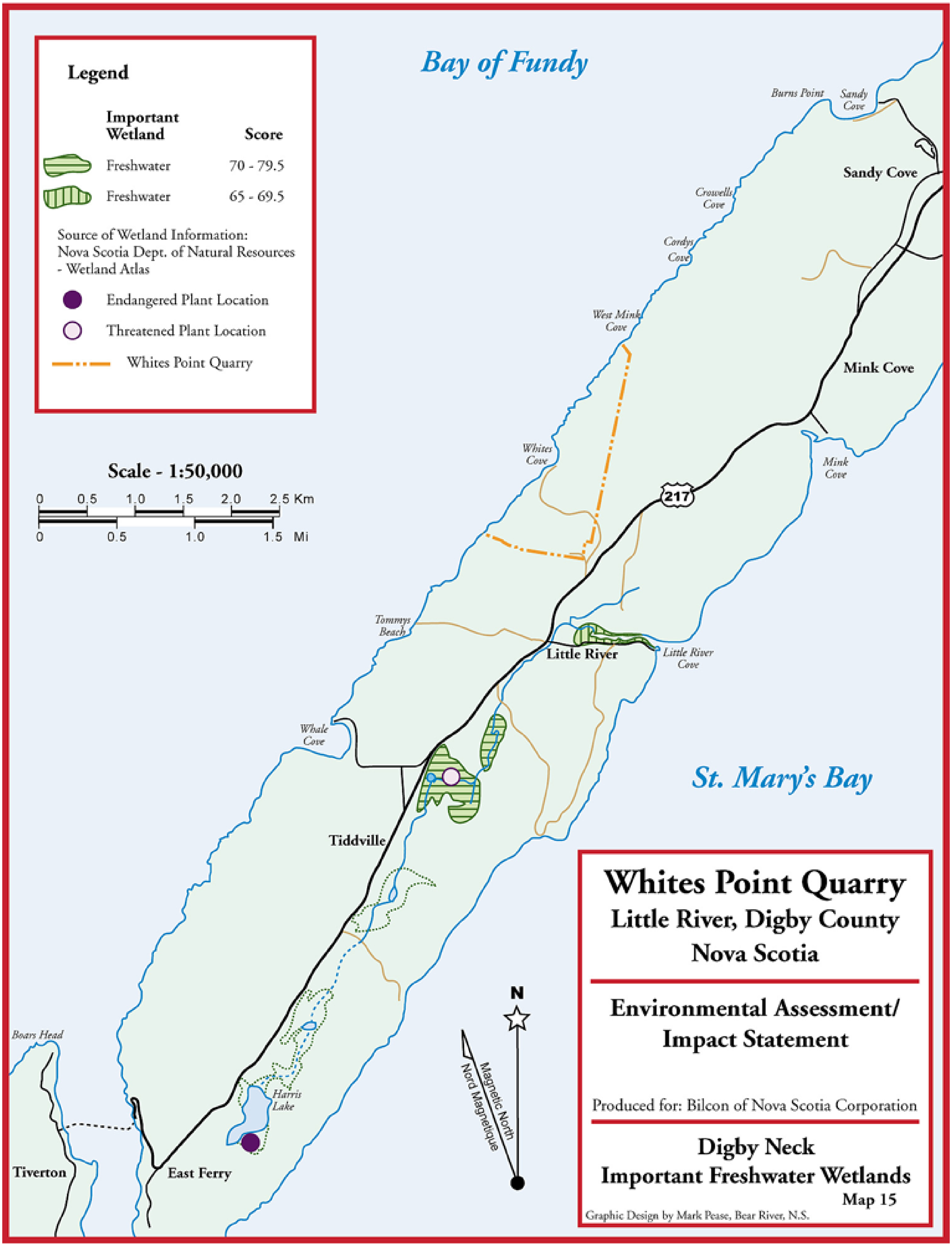
9.2.0.2 Invasive Species

The introduction and spread of invasive alien species (IAS) has and continues to affect the economy, environment, and society, including human health. Alien invasive species can be defined as "species of plants, animals, and micro-organisms introduced by human

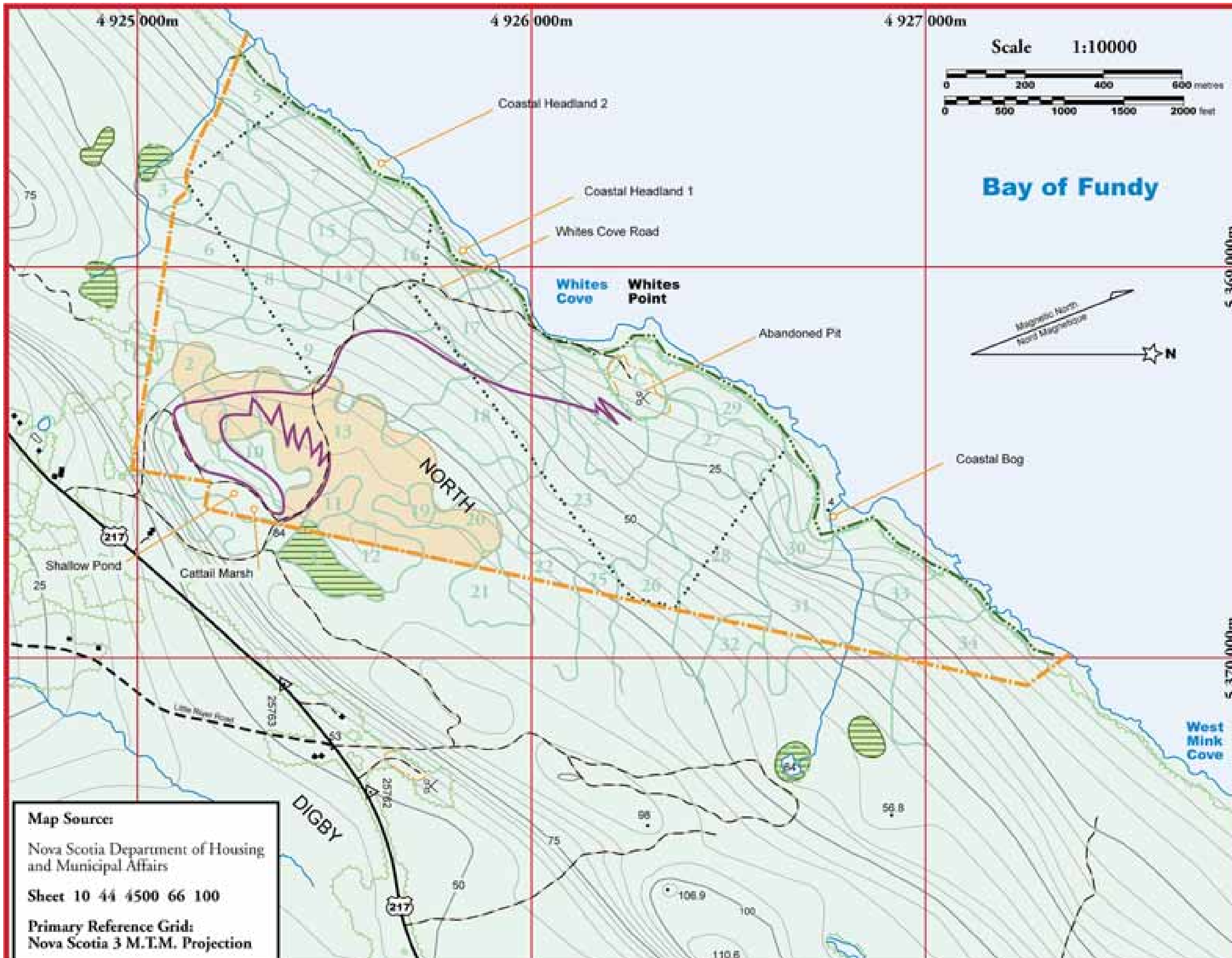

New Brunswick
Bay of Fundy Conservation Area
St John, N.B.
Nova Scotia
Portland, ME
Boston, MA
Roseway Basin Conservation Area
New York City, N.Y.
Great South Channel Critical Habitat
Cape Cod Bay Critical Habitat
Baltimore, MD
Atlantic Ocean
Wilmington, NC
Charleston, SC
South East Critical Habitat
N
Magnetic North
Nord Magnetique
SCALE
0 50 100 150 200 250 300 350 400 Kilometres
0 50 100 150 200 250 Miles
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Conservation Area
Critical Habitat
Source: J. Beaudin Ring, April 2000
Produced for: Bilcon of Nova Scotia Corporation
North Atlantic Right Whale
Critical Habitats/Conservation Areas
Map 24
Graphic Design by Mark Pease, Bear River, N.S.



Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Atlantic Salmon Rivers
of the Inner Bay of Fundy
Map 26
Graphic Design by Mark Pease, Bear River, N.S.
N
Magnetic North
Nord Magnetique
New Brunswick
Nova Scotia
Moncton
Amherst
St. John
Truro
Windsor
Annapolis Royal
Digby
Whites
Point
Quarry
Chignecto Bay
Baie Chignecto
Bassin des Mines
Minas Basin
GYRE
Bay of Fundy
Baie de Fundy
?
Migration Routes - M. J. Dadswell
Map Source: National Recovery Strategy for
Inner Bay of Fundy Atlantic Salmon
Legend
1 Cornwallis
2 Gaspereau
3 St. Croix, Hants
4 Kennetcook
5 Shubenacadie
6 Strewiake
7 Salmon, Colchester
8 North, Colchester
9 Chiganois
10 Debert
11 Folly
12 Great Village
13 Portapique
14 Bass, Colchester
15 Economy
16 Herrington
17 Parsboro
18 Diligent
19 Apple
20 River Hebert
21 Maccan
22 Tantramar
23 Petitcodiac
24 Demoiselle
25 Crooked
26 Shepody
27 Upper Salmon
28 Point Wolfe
29 Big Salmon
30 Irish
31 Mosher
32 Black



Legend
Important Wetland
Score
Freshwater
70 - 79.5
Freshwater
65 - 69.5
Source of Wetland Information:
Nova Scotia Dept. of Natural Resources
- Wetland Atlas
Endangered Plant Location
Threatened Plant Location
Whites Point Quarry
Scale - 1:50,000
0 0.5 1.0 1.5 2.0 2.5 Km
0 0.5 1.0 1.5 Mi
Bay of Fundy
St. Mary's Bay
Burns Point
Sandy Cove
Sandy Cove
Crowells Cove
Cordys Cove
West Mink Cove
Mink Cove
Mink Cove
Whites Cove
217
Tommys Beach
Little River
Little River Cove
Whale Cove
Tiddville
Harris Lake
Boars Head
Tiverton
East Ferry
N
Magnetic North
Nord Magnetique
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Digby Neck
Important Freshwater Wetlands
Map 15
Graphic Design by Mark Pease, Bear River, N.S.



Map Source:

Nova Scotia Department of Housing and Municipal Affairs

Sheet 10 44 4500 66 100

Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

Whites Point Quarry
Little River, Digby County
Nova Scotia

Environmental Assessment/ Impact Statement

Legend

- Highway 217
- Gravel Road
- Property Line
- Stand Number
- Clear Cut
- Woodland Plant Transects - 2002
- Coastal Plant Transects - 2002
- Bog wetland
- Rock Outcrop Plant Transects - 2005

Source of Information:

Newell, Ruth E. B.Sc., M.Sc. "Plant Survey at Whites Cove Property, Digby Neck, Digby County, Nova Scotia" July 2002

Department of Natural Resources - Forest Cover Type map May 1993

Beylinsky & Kern - On-site investigations July 14, 2005

Department of Natural Resources - Wetlands Data Base 2005

Proulx, Gini - On-site investigations November 9, 2005

Produced for: Bilcon of Nova Scotia Corporation

Terrestrial Ecology
Vegetative Cover & Plant Surveys

Map 18A

Graphic Design by Mark Pease, Bear River, N.S.

action outside their natural past, and present distribution" (MacNeil 2004 Ref.139). Next to loss of habitat, invasive species pose the greatest threat to biodiversity. Many pathways for introduction have been identified for terrestrial and aquatic systems including ballast water, recreational boating, the aquarium trade, animal traffic and various other import items to name a few. Environment Canada is the lead agency for the development of a national plan to address IAS threats. This plan will use a hierarchy approach that prioritizes prevention of new species invasions, early detection of new invaders, rapid response and management of established and spreading IAS through containment, eradication, and control.

A significant aspect of Bilcon of Nova Scotia Corporation's baseline data collection was to identify any existing invasive species on or adjacent to the Whites Point quarry site. Invasive species lists such as the "Global Invasive Species Database" for Canada (Ref. 233), the "Canadian Botanical Conservation Network" (Ref.234), "Invasivespecies.gov" (Ref. 235) and the "Marine Invader Database" (Ref. 236) were consulted. Several invasive species already exist at the Whites Point site in both terrestrial and aquatic ecosystems. As a precautionary measure, phytoplankton and zooplankton samples and marine sediment samples have been taken and undergone laboratory analysis. This includes identification of organisms within the marine environment. These background data samples are in a permanent archival collection. Baseline data regarding invasive species in terrestrial and aquatic environments at Whites Point will be discussed in the relevant environmental component sections of this EIS.

Bilcon of Nova Scotia Corporation intends to work with Environment Canada in addressing IAS threats at the Whites Point Quarry and Marine Terminal site. This will include the implementation of a monitoring program for the early detection of invasive species in terrestrial and aquatic environments.

9.2.1 Terrestrial Ecology

Photo by Ruth Newell

Introduction

The Whites Point Quarry property lies within the North Mountain Basalt Ridge Natural Landscape, one of 80 landscape types found in Nova Scotia as defined by the Nova Scotia Department of Environment and Labour (NSDEL). This landscape extends for approximately 250 km along the Bay of Fundy from Cape Split in the east to Brier Island in the west. The underlying geology and soils of this area have been described in a previous section of this document.

Unlike the domed basalt ridge that forms the North Mountain north of Gullivers Cove, along Digby Neck lava flows have formed twin ridges with a central valley. Within the central valley are freshwater wetlands and long streams connecting lakes and ponds. Coastal wetlands are rare.

The narrow Digby Neck peninsula is more exposed to marine influences than other portions of this landscape. As a result, coastal spruce-fir forests dominate, even in the somewhat protected central valley. Unlike the more northerly portions of this landscape, there are no pure hardwood stands found on Digby Neck.

The 154 ha (380 acre) parcel of land for the proposed Whites Point quarry is located on Digby Neck in Digby County just north of the community of Little River The western boundary of the property extends approximately 3.1 km (1.9 mi.) along the Bay of Fundy shoreline.

Forests and the habitats they provide are typical of the area and of coastal forests of the North Mountain Basalt Ridge Natural Landscape. The property is almost entirely forested, dominated by coniferous species, with the exception of two coastal barrens south of Whites Cove and a boggy marsh north of the Cove – see **Map 18A .**

A significant proportion of the coniferous species, (particularly white spruce (*Picea glauca*), is diseased, dead or dying. Approximately sixty, (60) acres of forest on the site was recently clear - cut, primarily on top of the ridge along the east property line. Infestation of spruce, primarily white spruce, by the spruce beetle (*Dendroctonus rufipennis*) has prompted clear cutting of significant acreage of softwoods on nearby areas of Digby Neck. Low quality round wood harvested from the property was observed piled along Whites Cove Road in the spring of 2002, indicating the unhealthy condition of the forest resource.

9.2.1.1 Research

9.2.1.1.1 Terrestrial Habitats

As indicated on **Map 18A** and described in the accompanying table, the vegetative cover is predominately softwood. The majority of the site slopes to the Bay of Fundy and is exposed to the north - west winds from the Bay. Thus, much of the vegetation exhibits the textbook "Krumholtz" effect. Data for the thirty-four stands of tree cover identified indicates the predominance of a softwood overstory. Specific stand composition is presented in **Table TE – 1.** It should be noted that the stand composition and age is based on 1993 data and areas designated as cleared are now in a stage of early succession. This is typical of the abandoned 2.4 ha (6 acre) pit just east of Whites Cove, and areas on top of the ridge along the east property line, which historically has been used as a dump.

Table TE - 1 - Vegetative Cover

Stand #	Species and composition	Age (1993)
1.	S-40%, IH-30%, TL-20%, OS-10%	7
2.	WS-100%	999
3.	WS-40%, S-30%, IH-20%, OS-10%	43
4.	WS-90%, OS-10%	39
5.	WS-80%, OS-10%, OH-10%	35
6.	WS-100%	39
7.	WS-80%, OS-10%, OH-10%	35
8.	WS-80%, OS-10%, OH-10%	35
9.	WS-100%	999
10.	S-80%, OS-20%	12
11.	WS-90%, OS-10%	20
12.	WS-90%, OS-10%	39
13.	WS-80%, OS-10%, OH-10%	43
14.	WS-80%, OS-10%, OH-10%	999
15.	WS-90%, OS-10%	39
16.	WS-80%, OS-10%, OH-10%	45
17.	WS-90%, OS-10%	39
18.	WS-40%, F-20%, IH-20%, TH-20%	39
19.	WS-60%, OH-20%, OS-20%	999
20.	WS-90%, OS-10%	20
21.	WS-40%, F-30%, IH-20%, OH-10%	35
22.	S-40%, F-40%, OS-10%, OH-10%	35
23.	IH-40%, WS-40%, F-20%	43
24.	WS-80%, OS-10%, OH-10%	48
25.	WS-50%, F-30%, OH-20%	999
26.	WS-40%, S-40%, OH-20%	35
27.	S-60%, OS-20%, IH-20%	16
28.	WS-60%, OS-20%, OH-20%	48
29.	WS-80%, OS-10%, OH-10%	35
30.	WS-40%, IH-30%, OS-20%, OH-10%	999
31.	WS-70%, F-10%, OS-10%, IH-10%	43
32.	WS-60%, S-20%, F-10%, OH-10%	48
33.	S-40%, TL-20%, F-20%, OH-20%	43
34.	WS-70%, F-10%, OS-10%, IH-10%	31
C.	Cleared Land	

Legend

WS – White Spruce
S - Red and Black Spruce
OS – Other Softwood
F - Fir

TL - Larch
TH – Tolerant Hardwood (Sugar Maple, Yellow Birch, Beech, Oak)
IH – Intolerant Hardwood (Red Maple, White Birch)
OH – Other Hardwood

9.2.1.1.2 Wetlands

Natural Resources Canada's "Atlas of Canada – Wetlands" maps wetland regions on a national scale based on the percentage of wetland area occurring across Canada. The North Mountain Basalt Ridge, from Brier Island to Blomidon, all falls within the lowest category of less than 5% of this land area considered wetlands.

Review of the Department of Natural Resources Restricted and Limited Use Land Database Themes revealed the Whites Point site did not fall in any of the theme categories.

Review of the Nova Scotia Department of Natural Resources 1991 Wetlands Atlas – Map 21B – 08 indicates no unique or especially important freshwater wetlands and coastal wildlife habitats are located in or near the Whites Point site. More specifically, no freshwater or marine wetlands, migratory bird habitats, piping plover nesting habitats or bald eagle habitat are indicated within or near the site. Also, no hemispheric shorebird reserve, Nova Scotia Wildlife Sanctuary, Nova Scotia Wildlife Management Area or barrier beach ponds or marshes are found within or near the Whites Point site.

Further review of the Nova Scotia Department of Natural Resources – Wetlands Data Base around the quarry site, identified terrestrial wetlands – see **Map 18B** . These wetlands are classified as bogs. One bog wetland (80% treed, 20% shrub) borders the east property line of the quarry site. A portion of this bog, approximately 0.1 ha (0.3 acres), lies within the quarry property.

On-site investigations identified additional wetlands to those mentioned above. An approximately 1.5 ha (3.7 acres) freshwater wetland is located on the coast approximately 0.6 km (0.4 mi.) northeast of Whites Cove. This area is described by Newell (2002) as a "cinnamon fern/shrub/red maple wetland with a mix of both bog and marsh plant species". The wetland contains only a few small areas with shallow standing water.

Also, on-site review of two potential wetland areas noted as Odonata Survey location - 2005, located in the southeast corner of the quarry property – **see Map 18B** was conducted by David W. Kern B.Sc. and Michael Brylinsky Ph.D. on July 14, 2005. Based on 2001 aerial photo review, both of these wetland areas were open water. On-site investigation in July 2005 revealed a lush growth of cattails (*Typha sp.*) growing in the northerly portion. This area of cattails comprises approximately 0.06 ha (0.15 acres). The southerly portion, approximately 0.07 ha (0.17 acres) remains shallow (less than 30 cm (1 ft.) deep over a hard substrate) open water. Both of these wetland areas appear to be a result of excavations carried out to construct a nearby roadway and may thus be remnant borrow pits.

9.2.1.1.3 Flora and Fauna

Review of databases maintained by the Nova Scotia Museum, the Atlantic Canada Conservation Data Centre (ACCDC) and the Nova Scotia Department of Natural Resources (Significant Species and Habitat database) and historic records from the literature, provided little information from the Whites Point site but did provide some information concerning species at risk in similar adjacent areas. To fill in these information gaps, beginning in 2002, Bilcon of Nova Scotia Corporation contracted a series of site specific flora and fauna investigations.

During the spring/summer of 2002, a botanical survey and a vertebrate faunal analysis of the site were conducted by Ruth E. Newell, B.Sc. (Hons.), M. Sc. and by W. George Alliston, Ph.D., respectively. In the summer of 2004, a replication of the breeding bird survey portion of the 2002 study was conducted by Dr. Alliston. In the summer of 2005, site surveys were conducted for species at risk from two Orders of insects; the Odonates (damselflies and dragonflies) and Lepidoptera (butterflies and moths). Mr. Paul M. Brunelle conducted the Odonate survey and Dr. Kenneth A. Neil the Lepidoptera survey. The following reports, which are included in this submission, provide the detailed findings of these investigations:

Flora:

Newell, Ruth E., "Plant Survey at White's Cove Property, Digby Neck, Digby County, Nova Scotia", July, 2002 (**Ref. Vol. I, Tab 6**).

Fauna: Vertebrates

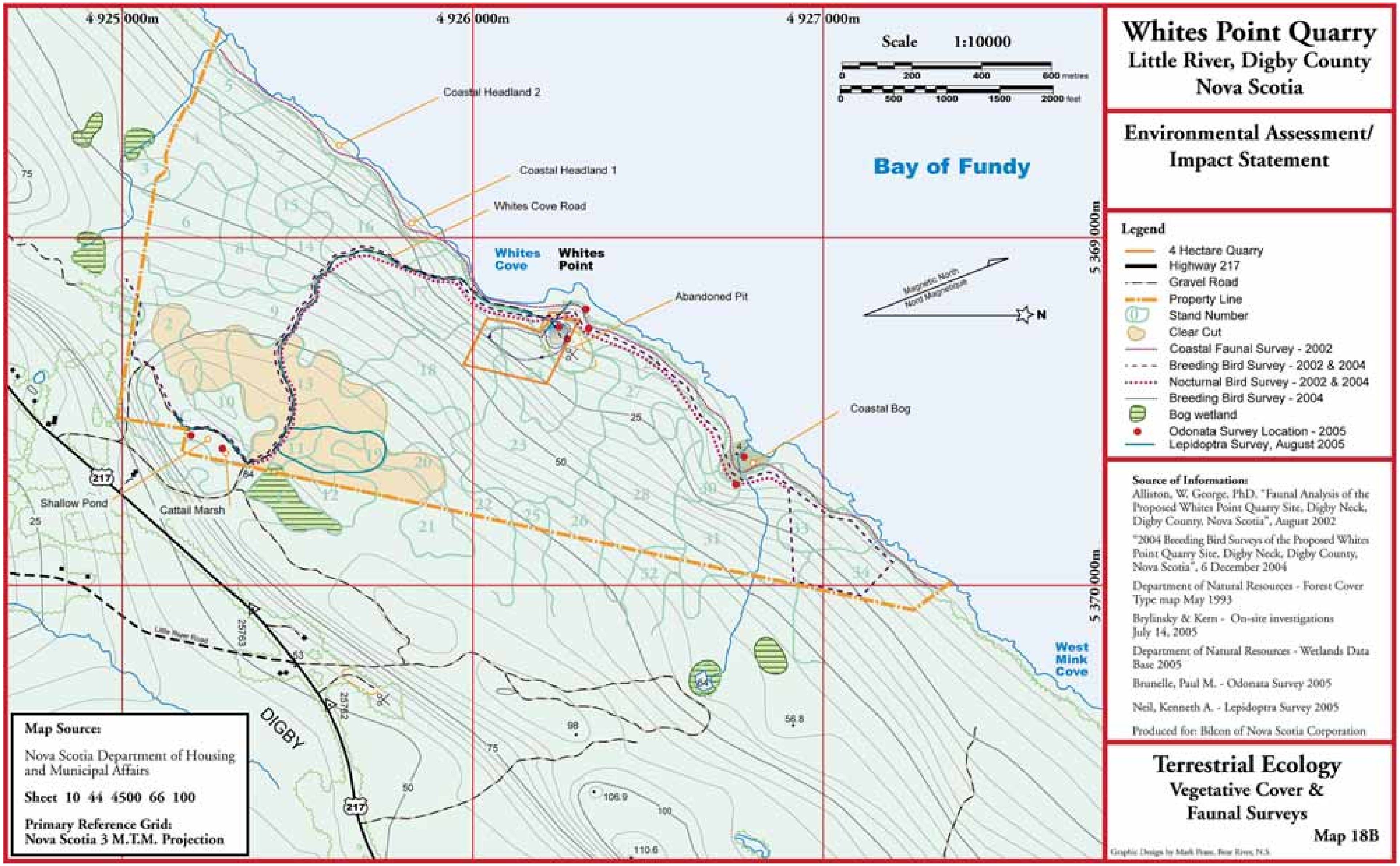
Alliston, W. George, "Faunal Analysis of the Proposed White's Point Quarry Site Digby Neck, Digby County, Nova Scotia," January 2004 **(Ref. Vol. I, Tab 1)**

Alliston, W. George ,"2004 Breeding Bird Surveys of the Proposed Whites Point Quarry Site, Digby Neck, Digby County, Nova Scotia; A Supplemental Report", December 2004 **(Ref. Vol. I, Tab 1)**

Fauna: Invertebrates (Insects)

Brunelle, Paul M., "Odonata Survey 2005: (Damselflies and Dragonflies) Whites Point Property, Digby County, Nova Scotia" August 2005 **(Ref. Vol. I, Tab 4)**

Neil, Kenneth A., "Adult Butterfly Habitat and Larval Host Plant Survey of Whites Point, Digby Co., N.S.", August 2005 **(Ref. Vol. I, Tab 5)**


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
4 Hectare Quarry
Highway 217
Gravel Road
Property Line
Stand Number
Clear Cut
Coastal Faunal Survey - 2002
Breeding Bird Survey - 2002 & 2004
Nocturnal Bird Survey - 2002 & 2004
Breeding Bird Survey - 2004
Bog wetland
Odonata Survey Location - 2005
Lepidoptra Survey, August 2005
Source of Information:
Alliston, W. George, PhD. "Faunal Analysis of the Proposed Whites Point Quarry Site, Digby Neck, Digby County, Nova Scotia", August 2002
"2004 Breeding Bird Surveys of the Proposed Whites Point Quarry Site, Digby Neck, Digby County, Nova Scotia", 6 December 2004
Department of Natural Resources - Forest Cover Type map May 1993
Brylinsky & Kern - On-site investigations July 14, 2005
Department of Natural Resources - Wetlands Data Base 2005
Brunelle, Paul M. - Odonata Survey 2005
Neil, Kenneth A. - Lepidoptra Survey 2005
Produced for: Bilcon of Nova Scotia Corporation
Terrestrial Ecology
Vegetative Cover &
Faunal Surveys
Map 18B
Scale 1:10000
0 200 400 600 metres
0 500 1000 1500 2000 feet
Bay of Fundy
Magnetic North
Nord Magnetique
N
4 925 000m
4 926 000m
4 927 000m
5 369 000m
5 370 000m
Coastal Headland 2
Coastal Headland 1
Whites Cove Road
Whites Cove
Whites Point
Abandoned Pit
Coastal Bog
West Mink Cove
Shallow Pond
Cattail Marsh
Little River Road
DIGBY
217
25763
25762
Map Source:
Nova Scotia Department of Housing and Municipal Affairs
Sheet 10 44 4500 66 100
Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

Flora

The botanical survey of the Whites Point property was initially conducted over three days, (July 2, 3 and 7, 2002), with two days spent surveying coastal habitats, (headlands, coastal wetlands, rocky shoreline and mountain streams), and one day on forested areas. Nine habitats were investigated: headland at Whites Cove, headlands northeast of Whites Cove, headlands southwest of Whites Cove, coastal marshes/open seepage slopes, rock crevices along lower shoreline, inland boulders and outcrops, coastal "boggy" marsh northeast of Whites Cove, streams, and wooded areas. Plant lists were recorded for each habitat type. Transects in the upland and coastal areas are shown on **Map 18A .**

Floral Species at Risk

The botanical survey documented the occurrence of three species of vascular plants that are at at risk. These species have status "blue" or "yellow" under the NS GSR but are not recognized in the three other priority lists used in this document to identify species at risk. These species and their NS GSR colour rankings are:

1 Glaucous rattlesnake–root *(Prenanthes racemosa)* – blue
2 Mountain sandwort (*Arenaria groenlandica*) – yellow
3 Hemlock parsley (*Conioselinum chinensis*) – yellow

All the above species were in coastal habitats. Bilcon of Nova Scotia Corporation, as recommended by Ruth E. Newell, requested confirmation of glaucous rattlesnake-root during August when this plant normally is in flower. On August 18, 2002, the site was revisited by Ms. Newell who observed and photographed flowering specimens, and confirmed the presence of this plant. In addition to the original clump of 15 plants observed on the upper portion of a rocky shoreline in July, another group of 100 – 200 plants was discovered on the lower portion of a nearby headland south of Whites Cove. It is noteworthy that, prior to this discovery, glaucous rattlesnake-root had not been recorded for more than 50 years and was believed to be extirpated in the Province of Nova Scotia.

Glaucous Rattlesnake-root - Photo by Ruth Newell

Small numbers of hemlock parsley plants were also found scattered along the upper portions of the rocky shoreline and the headlands southwest of Whites Cove. About 15 small clumps of mountain sandwort were found high on the shoreline, at the edge of flat terraced basalt outcrops to the northeast of Whites Point.

Two more plant species were recorded which are not designated as being at risk on the priority lists used in the preparation of this document, but are identified on the ACCDC Nova Scotia priority list. These species are bird's-eye primrose (*Primula laurentiana*) and skunk cabbage (*Symplocarpus foetidus*). About 300 bird's-eye primrose were observed at about 10 locations along the coast southwest of Whites Cove in sheltered areas where rocky shoreline and headlands meet. A single specimen of skunk cabbage was found in woodland habitat.

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At the November 1, 2005 Open House in Sandy Cove, the possibility of rock spike-moss (*Selaginella rupestris*) occurring on the upland of the Whites Point quarry site was raised. This plant had not been recorded in Nova Scotia for over 50 years (NS GSR - blue) until recently when a population was discovered at Centreville, Digby Neck. Since the Whites Point quarry property contains rock outcrops similar to the site at Centreville where rock spike-moss was found, it was decided to carry out a specific on-site investigation for this species. In this regard, Bilcon of Nova Scotia Corporation contracted Gini Proulx, a local naturalist who discovered this species at Centreville, to do the necessary on-site investigation.

The on-site investigation was conducted by Gini Proulx - see (Proulx, Gini A Report on a Botanical Survey, Bilcon Property, Whites Cove, Little River, Digby County, Nova Scotia, November 2005 **Ref. Vol. I, Tab 7**) specifically for the occurrence of rock spike-moss. The survey routes are shown on **Map 18A.** This intensive one-day site investigation of potential rock outcrop habitats resulted in no findings of rock spike-moss or any additional plant species at risk (personal communication – Gini Proulx).

For a complete listing of floral species at risk in Nova Scotia and probability of occurrence on the Whites Point quarry site – see Appendix 39.

Invasive Flora

Plant lists were compiled for various habitats existing on the Whites Point quarry site (Newell 2002 **Ref. Vol. I, Tab 6**). Review of tree, shrub, vine and herbaceous invasive species lists compiled by the Canadian Botanical Conservation Network indicates invasive plant species presently exist on the site. Two habitats, influenced by past and present anthropogenic activities, contain invasive species. The headland at Whites Cove where past fishing activities, human habitation, sand and gravel extraction and present off highway vehicle (OHV) use is evident, has two invasive species –common St. John's-wort (*Hypericum perforatum*) and Kentucky bluegrass (*Poa pratensis*). North of Whites Cove along an existing OHV trail two other invasive species – Canada bluegrass (*Poa compressa*) and rugosa rose (*Rosa rugosa*) are present. No invasive species were found in other habitats during the botanical survey of 2002. However, it is likely that invasive species exist as a result of human activity along the Whites Cove Road and could be considered a pathway for introduction. Also, the area along the southeast property line that has been used as a dump could provide habitat for invasive plant species.

Faunal Surveys – Vertebrates

Two faunal surveys for vertebrate species were conducted on the Whites Point site, one in June 2002 and another in June 2004. The first survey in June 2002 was conducted over four days (June 4, 15, 22, 23) and focused on the entire coastline and selected woodland habitats to gather information on herptile, breeding bird, and mammal species present. Survey work included a general reconnaissance of the property, a late evening and night census of nocturnal birds, mammals, and amphibians and an early morning census of diurnal breeding birds using the property. The June 2004 survey was a replication of the breeding bird surveys conducted in 2002 plus a new transect through the four hectare (10 acre) approved quarry site which had the vegetation and overburden removed and a sediment retention pond constructed in 2003. The 2004 survey was conducted over two days (June 21 & 22). During these surveys, Dr. Alliston was assisted by Bernard Forsythe, a well recognized amateur ornithologist and naturalist. Transect locations through representative habitats are shown on **Map 18B** .

The on-site vertebrate faunal analysis recorded five amphibian and two reptilian species, 45 bird species were observed using terrestrial habitats and may have nested on the site including a pair of barred owls which responded to calls during the nocturnal survey, and nine terrestrial mammal species confirmed by either observation or by sign (Alliston, 2004a and 2004b **Ref. Vol. I, Tab 1**).

Reptiles, Amphibians, and Mammals Species at Risk

For a complete listing of faunal species at risk in Nova Scotia and probability of occurrence on or adjacent to the Whites Point site – see Appendix 39, Table TE-2.

Field studies during 2002 and 2004 did not identify any species of terrestrial reptile, amphibian, mammal or breeding bird currently considered at risk in Nova Scotia using the Whites Point property. These studies did recognize that, although none was observed during the nocturnal surveys of 2002 and 2004, two bat species at risk (NS GNR - yellow), the little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*) might possibly forage on the Whites Point property. Critical habitats for these two species are those required for maternity colonies and hibernation. Maternity colonies are mainly associated with buildings and sometimes with hollow, preferably hardwood, trees. Caves are used for hibernation. There are neither buildings nor caves on the property and the likelihood of mature, hollow hardwood trees appropriate for maternity colonies in the young, conifer dominated forests on this property, is low. It was also recognized that, although no observations were made during the 2002 and 2004 surveys, the Whites Point property could be part of the home range of breeding northern goshawks (*Accipiter gentilis*), a species at risk (COSEWIC – not at risk; NS GNR – yellow), whose home ranges can exceed 2000 ha (5000 acres). Critical habitat for northern goshawks is associated with the nest site which is normally located in a large tract of mature forest having an open understory. Such habitat does not exist on the Whites Point property. Very marginal habitat for nesting Nelson's sharp-tailed sparrow (*Ammodramus nelsoni*) (COSEWIC – not at risk; NS GSR – yellow) exists in a small coastal "boggy marsh" on the Whites Point property to the north of Whites Cove, although this species was not observed during two years of surveys.

During each of the breeding bird surveys of 2002 and 2004, small numbers of boreal chickadees (*Poecile hudsonica*) were recorded using terrestrial habitats on the proposed quarry site and were believed to nest there. This species is not listed as being at risk in the four priority lists consulted for the preparation of this document. However, the ACCDC ranking for the boreal chickadee is "S3S4" which indicates that under their system it is considered marginally at risk. Nova Scotia is the only province where this species is considered potentially at risk by ACCDC. The boreal chickadee was the only terrestrial vertebrate species on a rather long list that the ACCDC consider at risk, that was found on this property.

Smooth Green Snake - Photo by George Alliston

A smooth green snake (*Liochlorophis vernalis*) was observed at Whites Cove in 2002. This species is not considered at risk in Nova Scotia (status "green"), however, it is on the current (August 4, 2005) COSEWIC candidate list (mid-priority candidate).

A comprehensive list of the birds of nearby Brier Island has been compiled from many years of observations and research (Laviolette 2005, **ref 132**). This list provides information on both the status (year round resident, confirmed or unconfirmed breeder, spring and/or fall migrant, winters, or visitor/vagrant) and relative abundance (common, uncommon, irruptive, rare or exceptional) of the 339 species recorded. This information is presented in Appendix 8.

Species known to breed on Brier Island could be expected at the Whites Point Quarry and Marine Terminal site if suitable habitat exists. A total of 62 species of land birds, including four "rare" and four "exceptional" species have been confirmed as breeding on Brier Island, and another eight species may nest there but nesting has not been confirmed. An additional four seabird species are confirmed breeders on Brier Island and another is suspected but unconfirmed. Of the species of land birds for which nesting has been confirmed, there are only two species at risk; eastern bluebird (*Sialia sialis*) and northern goshawk. A third species at risk, Nelson's sharp-tailed sparrow, is believed to nest on Brier Island but this has not been confirmed.

The status of the northern goshawk and Nelson's sharp-tailed sparrow on the Whites Point property have been discussed above. Until the clear cutting of about 60 acres of woodland in 2002 there was no open habitat on the property for eastern bluebirds (COSEWIC – not at risk; NS GSR – yellow) and the clear cut would have produced at best, marginal habitat. No eastern bluebirds were recorded during the 2002 and 2004 surveys of the property. During the period from 1986 to 1990, when research was being conducted for the Atlas of Breeding Birds of the Maritime Provinces (Erskine, 1992), the closest confirmed nesting of eastern bluebirds to that recorded on Brier Island was in the Annapolis Valley some 120 km away.

Migratory Birds

In the 1970's Brier Island was identified as Proposed Ecological Site 59 by the International Biological Program. This identification was due in part to its recognized importance to migrating and wintering birds. Subsequently Brier Island has been designated by Bird Studies Canada as an Important Bird Area and the Island and its surrounding waters are considered Globally Significant for its concentrations of migratory land birds and shorebirds as well as its coastal waters being a year round feeding area for seabirds. Migratory bird research has been ongoing for over 25 years at the Brier Island Bird Migration Research Station. The banding of migratory land birds constitutes a major portion of the work of the Research Station and to date more than 40,000 birds have been banded. These studies indicate that bird species attain their peak numbers at Brier Island during migration (Laviolette 2003Appendix 8). Spring migration is typically April and May, while fall migration is from August to the end of October although this varies considerably by species. Duration of migration for a given species is usually four to six weeks. The orientation of the Digby Neck peninsula, Long Island, and Brier Island is similar to other land bird concentration points in the U.S. and Canada where the numbers of birds found at the tip (Brier Island) are consistent with those at the base (Digby Neck). In this regard, migration data from Brier Island should be applicable to the Whites Point Quarry site located approximately midway on the Digby Neck peninsula. The use of Digby Neck and Long and Brier Islands by migrating land birds is a very important biological feature in southwest Nova Scotia.

While the numbers of spring migrants are small (Lance Laviolette - personal communication), the fall migration is large with daytime counts of passerines (warblers, sparrows, thrushes, et al.) at Brier Island reaching over 1.4 million per month during September and October. A similar situation is found with raptorial birds; whereas small numbers of raptors are observed during spring migration, their numbers can reach over 10,000 per month during September. The most common raptors are sharp-shinned (*Accipiter striatus*) and broad-winged (*Buteo platypterus*) hawks with American kestrels (*Falco sparverius*), merlins (*Falco columbarius*), and red-tailed hawks (*Buteo jamaicensis*) also occurring in substantial numbers. Least common are ospreys (*Pandion haliaetus*) peaking at 15 per day during late September and early October, northern goshawk at 12 per day in late September and peregrine falcon (*Falco peregrinus*) at 5 to 10 per day in late September and early October. The turkey vulture (*Cathartes aura*) has become more common and peak numbers of 50 per day have occurred in October and continuing at 10 to 20 through the winter. It should be noted that radar studies have shown that many more migrant passerines move at night than in the day so the numbers quoted above are underestimates of total migrants (Ref.132).

A total of 226 species of birds, including 154 species of "land birds", 22 species of waterfowl, 26 species of shorebirds and 25 species of seabirds, have been recorded as "common", "uncommon" or "rare" migrants using Brier Island and its surrounding waters (Ref.132).

Fundy Shorebirds - Photo by Glen Parsons

Migratory Land Bird Species at Risk

A total of 36 migrant bird species at risk have been documented at and around Brier Island. Twenty-three of these are "land bird" species (waders are included in this group) and 13 use marine habitats more or less exclusively during migration and are included in sections dealing with nearshore marine areas (below). The "land bird" species at risk that have been documented as migrants or vagrants on Brier Island, their relative abundance and the timing of their peak migration periods are presented in Table **AA**.

Table AA. Migratory Status and Timing of Land Bird Species at Risk at Brier Island, Digby County, Nova Scotia ø

	Migratory Status	Main Migration Period Spring	Fall	Comments
Least Bittern**	Exceptional (1)	?	Sept.	
Snowy Egret	Rare	Apr. - May *	Sept. - Nov.*	
Black-crowned Night Heron	Uncommon	Apr.*	Sept. - Oct.*	
Northern Goshawk	Uncommon	Feb. - Mar.*	Sept. - Oct.	peak in late Sept. at 12/day
Red-shouldered Hawk**	Uncommon		Sept. - Dec.	daily peaks of 5 to 10 in Oct.
Peregrine Falcon**	Common	May	Sept. - Oct.	daily peaks of 5 to 10 in late Sept. - Oct.
Long-eared Owl	Uncommon	?	Oct. - Nov.*	
Short-eared Owl**	Uncommon	Mar. - May	Sept. through winter	daily peaks of 1 to 2
Acadian Flycatcher**	Exceptional (3)	May *	Oct.*	
Loggerhead Shrike**	Exceptional (5)	Apr. - June *	Aug. - Nov.*	
Purple Martin	Rare	Apr. - May *	Aug. - Sept.*	
Eastern Bluebird	Uncommon	Mar. - Apr.*	Sept. - Oct.*	
Bicknell's Thrush**	Exceptional (1)	-	Sept.	
Cerulean Warbler**	Exceptional (2)	May	Sept.	single birds
Prothonotary Warbler**	Exceptional (2)	Apr. - May	Aug.	very rare migrant
Louisiana Waterthrush**	Exceptional (2)	-	Aug. - Sept.	single birds
Hooded Warbler**	Exceptional (4)	Apr. - May	Aug. - Sept.	single birds
Yellow-breasted Chat**	Irruptive	-	Sept. - Oct.	daily peaks of 5 to 10 birds
Vesper Sparrow	Uncommon	Apr. - May *	Sept. - Oct.*	
Ipswich Savannah Sparrow**	Rare	Apr. - May	Nov.	singles and pairs
Nelson's Sharp-tailed Sparrow	Exceptional	June *	Sept. - Oct.*	
Bobolink	Common	May *	Sept. - Oct.*	
Eastern Meadowlark	Uncommon	April *	Oct.*	

Common	observed every year, usually in good numbers
Uncommon	observed almost every year, usually in low numbers
Irruptive	observed some years, sometimes in good numbers
Rare	observed some years, usually in low numbers
Exceptional ( )	exceptionally rare vagrant or migrant; number of sightings in ( )
**	considered at risk by SARA/COSEWIC
*	main migration period determined from observations at locations within Nova Scotia other than Brier Island (Tufts, 1986)
ø	derived from information compiled by Lance Laviolette (2003 and Nov. 2005)

From Table **AA** we can see that eight of these species at risk are considered "exceptional" and occur only as vagrants or as very rare migrants, having been recorded on only five or fewer occasions during many years of study. Only two species at risk are considered to be common migrants; peregrine falcon, and bobolink (*Dolichonyx oryzivorus*).

While most land birds that use Brier Island during migration will also pass along Digby Neck, the manner in which they use these two areas is very different. Brier Island would be first landfall for comparatively small numbers of spring migrant land birds. These birds would probably use Brier Island as a staging area where they replenish the energy reserves used in their flight across the Gulf of Maine before continuing their migration along Digby Neck. For the much more numerous fall migrants, Brier Island is where they congregate waiting for weather conditions that are favourable for their crossing of the Gulf of Maine. Migrant birds passing along Digby Neck may briefly forage in favoured habitats along the way but their passage through the area would be quite rapid. For any given location it is more likely that most migrants would fly over the area than forage there, however briefly.

As a general rule, small birds migrate at night and larger birds migrate during the day. Night migrants, particularly those migrating in foggy or inclement conditions, can be attracted to lights; particularly white lights that remain on continuously. Most migratory movements occur at altitudes below 1000 m and most small birds migrate at altitudes of from 150 to 300 m (Lincoln et al., 1998).

Migratory Mammals

It has been suggested that migratory mammals, specifically migratory bat species, might use the Digby Neck, Long Island, Brier Island migration route in much the same manner as birds (Davis and Brown, 1997, Ref.214). A study of spring and fall bat migration was conducted on Bon Portage Island, Yarmouth County, and Brier Island, in 2001 (Broders et al., 2003). Of the three migratory bat species that might breed in Nova Scotia; (silver-haired bat – *Lasionycteris noctivagans*; red bat – *Lasiurus borealis*; hoary bat – *Lasiurus cinereus*) only two echolocation sequences of the hoary bat were recorded at Brier Island in September and the other two species were not recorded. Broders et al. (2003) concluded that "no significant bat migration occurred in Nova Scotia in 2001, and unless distributional range has changed in recent years, we suggest that previous records of these species in Nova Scotia are extralimital." Based on this study, we would expect no movement of migratory bat species through the Whites Point property.

Insects

Investigations of two Orders of insects, Odonata (damselflies and dragonflies) and Lepidoptera (butterflies), were conducted for possible occurrence of species at risk on the Whites Point site. For a complete listing of butterfly, damselfly, and dragonfly species at risk and their probability of occurrence on or adjacent to the Whites Point site – see Appendix 39, Table TE-4.

Odonata

An initial screening of databases maintained by the Nova Scotia Museum, the Atlantic Canada Conservation Data Centre (ACCDC) and NSDNR revealed no records of Odonata species at risk at or near the quarry site. Further to these database searches, Bilcon of Nova Scotia Corporation contracted a survey of Odonata on the Whites Point site. This survey was conducted by Paul M. Brunelle on August 6 &7 2005; see Brunelle, Paul M. "Odonata Survey 2005: (Damselflies and Dragonflies) Whites Point Property, Digby County Nova Scotia". (Brunelle 2005, **Ref. Vol. I, Tab 4)**. This survey sampled damselflies and dragonflies in freshwater habitats as shown on **Map 18B**. A total of eight habitats were investigated including three natural sites (two intermittent streams and a coastal "boggy marsh") and five which are apparently man-made or man-influenced. Fifty-one records of twenty-one species were documented. All records and sites were documented according to the Atlantic Dragonfly Inventory Program (ADIP) protocols. No exuivae or larvae were encountered. The principal Odonata diversity observed was associated with the five man-made and man-influenced habitats.

Of the 13 Odonate species considered at risk in Nova Scotia, none was recorded during this survey. However, the timing of the survey was not appropriate for all species and potential habitat for five species at risk was identified on the Whites Point property. Mr. Brunelle has indicated that one species identified during this survey, sweetflag spreadwing (*Lestes forcipatus*), which is not currently considered at risk, may be of some conservation concern due to past confusion of this species with the morphologically similar and common northern spreadwing (*Lestes disjunctus*). A sweetflag spreadwing was found at a man-made pond ("Chara Pond") near the southeastern boundary of the property (see **Map 18B**). One species, that is not identified as being at risk on the priority lists used for the preparation of this document, the Canada darner (*Aeshna canadensis*), is presently ranked S3 by the ACCDC and was recorded on the site.

In his report, Paul Brunelle has assigned colour rankings of "red" and "yellow" to an additional ten species whose status is currently considered as "Undetermined" by NSDNR. Aquatic habitats appropriate to three of these ten species have been identified on the Whites Point property.

Lepidoptera

Initial screening of the Heritage Division of the Nova Scotia Museum, the ACCDC and the NSDNR databases identified two at risk Lepidoptera species reported from habitats near the Whites Point quarry site. These species are the monarch butterfly (*Danaus plexippus*) and the satyr comma (anglewing) (*Polygonia satyrus*). Both species are listed as "yellow" in the NS GSR. It should be noted that the monarch is also listed by COSEWIC as of "Special Concern".

Further to this screening, Bilcon of Nova Scotia Corporation contracted a survey of Lepidoptera on the Whites Point site. This survey was conducted by entomologist Dr. Kenneth Neil, B.Sc., PhD on August 22, 2005 – see Neil, Kenneth A. "Adult Butterfly Habitat and Larval Host Plant Survey of Whites Point, Digby Co., N.S." August 2005. (**Ref.Vol. I, Tab 5)**. Selected habitats were investigated and adult butterfly specimens were collected, identified, and released. Eight species of butterflies were observed and all species are considered common to Nova Scotia. The area of investigation is shown on **Map 18B .**

Nine species of butterflies were identified as being at risk in Nova Scotia and for three of these; monarch butterfly, satyr comma and hoary comma (*Polygonia gracilis*), there are appropriate habitats in western Nova Scotia. Of these three species the monarch butterfly is migratory, wintering in large aggregations in the highlands of north-central Mexico and breeding throughout temperate North America, north to southern Canada. In Nova Scotia, monarch butterflies are irruptive and one or two years of relative abundance can be followed by several years when they are quite rare. The satyr and hoary commas are resident species that overwinter as adults.

The 2005 study was preliminary and the status at the Whites Point property of these three butterfly species was not established. It was established that gooseberry (*Ribes hirtellum*), the larval host plant for the hoary comma, was present, however, larval host plants were not present for either the monarch (milkweed – *Asclepias sp.*) or satyr comma (nettles – *Urtica sp.*). Woodland areas on the property could support adult satyr and hoary commas. Asters (*Aster sp.*) and goldenrod (*Solidago sp.*), used as a food source by fall migrant monarch butterflies, were present on the Whites Point property. The recently clear cut area along the ridge of the property could provide potential staging habitat for arriving spring migrant monarch butterflies.

Potential habitat for the mustard white (*Pieris oleracea*) was identified on the Whites Point property. The distribution of this once abundant species is now thought to be limited to only a few locations within Nova Scotia. This species is not currently considered at risk on any of the four priority lists used to identify species at risk for this document. However, Bilcon of Nova Scotia Corporation, at the recommendation of Dr. Neil, will be investigating the possible presence of this species on the Whites Point property

The possible use of the Whites Point site by the five species of Odonates and three species of Lepidoptera considered at risk, for which potential habitat is available, will be further investigated during the preconstruction planning phase of the project. During these studies, at the recommendation of the species specialists conducting these studies, information will also be collected on at least one additional damselfly species (sweetflag spreadwing) and one butterfly species (mustard white), neither of which are currently listed as being at risk on any of the four priority lists used in the compilation of species at risk lists for this document.

Invasive Species

During the terrestrial fauna analysis, various habitats were investigated for mammals, amphibians, reptiles, breeding birds, damselflies, dragonflies, and butterflies at the Whites Point quarry site (Alliston 2004a and 2004b, Brunelle 2005, and Neil 2005). Additionally, research conducted at Brier Island provided a list of birds that includes those that are resident to Brier Island and migrant through the Digby Neck peninsula. Review of the Global Invasive Species Database for Canada indicates only one terrestrial invasive species was recorded during on-site faunal surveys; the cabbage white (*Pieris rapae*) butterfly. The introduction of this highly competitive European species into North America in the 1860's is believed to be partly responsible for the apparent decline in the closely related North American species, the mustard white.

While not observed at the site, introduced bird species such as the European starling (*Sternus vulgaris*), now probably one of the most numerous bird species of its size in the Maritimes, house sparrow (*Passer domesticus*) and rock pigeon (*Columba livia*) and introduced mammal species such as the Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*) are well established in the region. All of these species tend to be closely associated with human habitation. Another more recently introduced bird species, the house finch (*Carpodacus mexicanus*), a species native to western North America, was released in New York City in 1940. Breeding in the Maritimes was first confirmed in 1987 and has been reported on Digby Neck and Brier Island in very small numbers. Like the other invasive bird and mammal species mentioned above, the house finch tends to be associated with human habitation.

9.2.1.2 Analyses

A major focus of the environmental impact assessment process has been the evaluation of the potential for impact of the Whites Point Project on species at risk. On site investigations of terrestrial habitats have identified three plant species at risk, one of which (glaucous rattlesnake-root) was considered extirpated in Nova Scotia until discovered during these investigations. All three of these species are found in coastal habitats; rocky shoreline and headlands.

Investigations of vertebrate species, conducted over two summers, identified no amphibian, reptile, mammal or breeding bird species at risk using the property. It was recognized that while two mammal species at risk, little brown bat and northern long-eared bat might visit the property during their nocturnal foraging, critical habitats used for hibernation (caves) and maternity colonies (buildings; mature, hollow hardwood trees) are not present on the property. It is possible that all or part of the Whites Point property could be included in the very large home ranges of another species at risk, the northern goshawk, however, critical nesting habitat for this species, which consists of large areas of mature forest with an open understory, does not exist on the property.

While summer resident vertebrate species using the property consisted of common species, characteristic of the North Mountain Basalt Ridge Natural Landscape, Digby Neck is an important thoroughfare for many species of migrating land birds, mainly during the fall migration period. Annual studies conducted at Brier Island for more than a quarter of a century provide excellent information on the species, timing and relative abundance of fall migrants that follow a route through Digby Neck and Long Island to congregate on Brier Island prior to their flight across the Gulf of Maine. A total of 154 migrant land bird species, including 23 species at risk (13 recognized by SARA/COSEWIC), have been recorded at Brier Island over the years and while eight of these species at risk have been recorded on five or less occasions, and most are considered "rare" or "uncommon", most of these birds would have migrated along the Digby Neck. Most migrant land birds would simply fly over the Whites Point property, however, some would land and forage in favoured habitats for short periods while en route. The greatest potential for migrant birds, including species at risk, to interact with the project is with night migrants that, particularly in foggy or inclement weather can be attracted to lighted structures, particularly towers (Evans-Ogden,1996). Death or injury could result from collision with these structures or the birds could become exhausted from circling these structures (Larkin and Frase, 1988).

Preliminary studies of species at risk from two Orders of Insects, the Odonates (damselflies and dragonflies) and Lepidoptera (butterflies and moths) have not identified any species at risk on the Whites Point property. Potential habitat for five Odonate species at risk has been identified. Larval host plants for one butterfly species at risk, the hoary comma, is present on the property, however, the larval host plants for two other butterfly species at risk (monarch butterfly and satyr comma) that might be found on the property, are not present. Adult forms of all three species might be found on the property including migrating monarch butterflies. Further investigations of Odonate and Lepidopteran species at risk will be conducted during the preconstruction planning stage of the project.

Industrial activities such as the proposed quarry operation will have short and long term effects on the site's terrestrial ecology. The quarrying of rock will permanently alter the existing site's topography, and in the short term, remove habitat and displace wildlife from active areas of the quarry and the lands immediately adjacent to the active areas. In the long term, however, with the successful implementation of a reclamation program in the disturbed areas, the protection of the rarest species and habitats currently found on the site, and the introduction of new habitats, the biological diversity of the site could be enhanced.

Existing forest resources on-site are generally in serious decline. Forests in this area have been harvested since European settlement and these conifer dominated woodlands have recently experienced an epidemic infestation of spruce beetle. Forests in this area tend to be somewhat lacking in diversity.

The proposed land reclamation will increase habitat diversity with the creation of additional coastal wetlands, a habitat that is rare in the North Mountain Basalt Ridge Natural Landscape, and fields. In addition, the existing, more unique and diverse habitats on the site, are to be part of an environmental preservation zone that will be protected throughout the life of the project. These areas include the majority of the coastline, wetlands, and the two prominent headlands which, together, support one uncommon and all three plant species at risk found on the property including glaucous rattlesnake-root that, prior to Bilcon of Nova Scotia Corporation's botanical site survey, was believed to be extirpated within Nova Scotia. The preservation zone also includes some potential marginal nesting habitat for one bird species at risk, Nelson's sharp-tailed sparrow, and potential nesting habitat for the rusty blackbird (*Euphagus carolinus*), a species considered at risk by ACCDC, although neither species has been recorded using this habitat. The reforestation of parts of the property with native tree species, the control of invasive plant species, along with natural regeneration and succession should, over time, return those areas that have not been converted to wetlands, to the conifer dominated forests preferred by such species as the boreal chickadee. Even the rock faces resulting from quarrying may offer habitat for certain species not presently found on the site.

Abandoned Quarry With Natural Regeneration - Photo by David W. Kern

The proposed operating procedure of incremental reclamation of quarried portions of the site will enhance stabilization and initiate habitat reclamation during the life of the project, rather than waiting until quarrying is completed. Also, the operating procedure will preserve portions of the site in its existing natural condition for many years. For example, the land area lying in the Little River watershed will be preserved for the 50 year life of the project.

The land containing the quarry infrastructure is approximately 11 ha (27 acres). Buildings, crushers, work area, load out facilities, stockpile areas, sedimentation ponds and roads will permanently alter the terrestrial ecology of this portion of the 154 ha (380 acre) site. However, much of this infrastructure/work area will be constructed on the previously disturbed pit area or within the 4 ha (10 acre) quarry area. With the active working area of the quarry expected to be 2.4 ha (6 acres) per year, there will be a relatively short term period, approximately five years, before reclamation efforts begin. Land clearing, noise from drilling and blasting, rock crushing and the working face of the quarry will affect local wildlife populations.

Within the boundaries of the property, each year approximately 2.4 ha (6 acres) will be cleared. Any merchantable trees will be harvested, the overburden will be removed, stored, and allowed to decompose naturally for later use in reclamation. In the short term, this process will essentially eliminate wildlife habitat within these areas. Furthermore, noise from the extraction, transportation, and crushing activities could exclude some of the more sensitive species from adjacent, undisturbed habitats and possibly reduce the reproductive success of those that do remain.

The reclamation process will begin after about 12 ha (30 acres) of the quarry has been exhausted (approximately 5 years). Reclamation will involve mixing the decomposed overburden, and sediment from the sediment storage area, spreading this mix over the rock substrate, incorporating lime and fertilizer, and replanting these areas. Native tree species will be planted, primarily along the coast and on the horizontal “steps” of the quarry’s working face, but also in other select areas. Most of the reclaimed areas will be planted in grasses and legumes. The drainage channels and sediment retention ponds will remain, resulting in an increase in the wetland habitat on the property.

Successful reclamation efforts will produce fields and small wetlands which could increase the biodiversity by attracting wildlife species that prefer these habitats; habitats that were previously either scarce or nonexistent on the property. Species that could be attracted to these areas could include species at risk such as the bobolink and possibly the vesper sparrow. Extensive fields could support high mouse populations which could attract predatory birds and mammals; possibly even species at risk such as the long-eared owl.

Assuming this reclamation procedure is successful, and the reclaimed areas are left undisturbed over a long period of time, through normal succession processes, the coastal boreal forest and the wildlife species that inhabit it should become reestablished throughout the reclaimed area.

There is a potential for noise from quarrying operations to affect wildlife in areas adjacent to, but not on, the quarry property. Proposed regulations require that noise from ongoing operations not exceed 65 dBA during the day and 55 dBA at night at the property line. Adjacent properties are forested and, given local topography and the relative low level of noise permitted, noise from operations should rapidly dissipate within the forest and not constitute a significant stressor for most wildlife species using these areas. The 55 dBA permit requirement at night would further minimize the potential effects of noise on nocturnal species using adjacent areas.

Blasting is part of the proposed quarry's operations. Noise from blasting can, by regulations, reach levels of 128 dBA at the property boundary. Noise from blasting would carry for considerable distances into surrounding habitats. Blasting will, however, consist only of a single blast with a duration of less than one second, conducted on a weekly basis during the earliest phase of the project, diminishing to biweekly during later phases. Blasting will take place near midday and generally on clear days. While blasting will elicit startle behaviour in wildlife using habitats adjacent to the quarry property, the infrequent occurrence of such blasts should not be a significant stressor for wildlife using these areas.

The Whites Point property is located within the migration path of large numbers of land birds including as many as 23 species at risk. The Whites Point property contains no natural features that would make it particularly attractive to migrating birds. Although some migrant birds would likely stop and forage briefly on the property, most of those that do encounter the property during migration would simply fly over it. Habitat loss to migrant birds by quarrying activities should not be of any consequence. The major potential for interaction between migrating birds and quarry development would be associated with potential hazards presented by the project, generally in the form of high, night lighted structures.

Large land bird species, including raptor species such as the peregrine falcon, migrate by day and would have no trouble avoiding structures, although guy-lines anchoring tall structures could present a hazard. However, most of the smaller bird species migrate by night and particularly under foggy, or otherwise inclement weather conditions, can be attracted to lighted tall structures. Collision with these structures or supporting guy wires can ensue, resulting in death or injury to the birds, and sometimes birds circle these structures to the point of exhaustion.

The tallest structure proposed for the Whites Point Quarry and Marine Terminal is the ship loader, which extends to a maximum height of 30 m (100 ft.) above the ordinary high water line. This loader is located at the base of a steep incline that raises to a height of close to 90 m (300 ft.) near the eastern boundary of the property. Most night migrant land birds would be flying at heights of 150 m (500 ft.) to 300 m (1000 ft.) above the land (Lincoln et al., 1998 so are unlikely to be in close proximity to the ship loader. The compound area is situated near the highest point on the property, however, no tall communication towers, wind turbines, or tall, continuously night lighted structures are planned for the compound area or indeed any other location on the site. Lighting on the ship loader would only be used when loading a ship at night and will be shaded so that light is directed downward. At most, loading would occur once a week. When not being used, the ship loader would not be lighted thereby greatly reducing the possible collision hazard for night migrating land birds. No structures on the quarry site will require stabilization through the use of guy-wires.

The construction of buildings on the site could attract some vertebrate invasive species. While sanitary conditions at the site will be such that species that are mainly attracted by refuse (e.g. Norway rat) would not be attracted to the area, other species that might find buildings and cleared areas attractive (European starling, house sparrow, rock pigeon) might be attracted to the site. The European starling is a predator of other birds eggs and nestlings and will compete with other hole nesting bird species (e.g. northern flicker) for nest sites. House sparrows also compete with other hole-nesting birds (e.g. chickadees, swallows) for nest sites.

The construction of buildings could attract more than invasive exotic species. Two mammal species at risk which are likely to occur in the area, little brown bat and northern long-eared bat, are attracted to buildings for roosting and for a critical part of their life history, the rearing of young, which is done in maternity colonies located, by preference, within buildings.

In reality, many “non-industrial” development projects do not require permits or are not required to undergo the formal environmental assessment process. Some may have adverse impacts on the terrestrial ecology, especially plants. Examples of such projects occurring provincially and on Digby Neck include:

- Land clearing for agricultural purposes
- Forestry operations including clear cutting
- Recreation/tourism development projects including campgrounds and golf courses
- Waterfront housing/cottage development
- The indiscriminate recreational use of all terrain vehicles

The use of off highway vehicles (OHV's) on the site presently poses a problem for a clump of Mountain Sandwort which was found on an OHV trail. Also, extensive clear cutting of large tracts has recently altered the terrestrial ecology on Digby Neck. Land development for housing with preferred waterfront locations result in potential destruction of rare plant habitat, especially the preferred habitat of coastal rare plants as found on the quarry site. Subdivision of land is spreading along Digby Neck as evidenced in Culloden, and nearby Crowells Cove and Whale Cove. This development is occurring in areas of potential rare plant habitat and without the requirements of environmental assessment.

9.2.1.3 Mitigation

The terrestrial environmental assessment for the Whites Point quarry has verified the existence of three species of plants that are considered at risk, on the property, including one species that, until these studies, was thought to have been extirpated in Nova Scotia. All three of these species are found in coastal habitats. Without the quarry project, the possibility of a "non-industrial" development for this waterfront land could happen in the future. Thus, the quarry project offers the opportunity to protect the coastal habitat that supports these species at risk as part of the quarry's proposed environmental preservation zone along the coastline of this section of the Bay of Fundy.

Bilcon of Nova Scotia Corporation proposes a minimum 30m (100 ft.) environmental preservation zone, extending from the mean high water mark, inland along the 3 km (1.9 mi.) coastline of the property, (except in the area of the marine terminal), to protect the coastal rare plants identified. The extent of the preservation zone generally extends from the ordinary high water mark inland to the defined inland edge of tree cover. This proposed environmental preservation zone will include approximately 9 ha (22 acres) of general coastline and be expanded inland to encompass an additional 1.2 ha (2.9 acres) at the first headland south of Whites Cove, an additional 0.7 ha (1.8 acres) inland at the second headland south of Whites Cove and an additional 1.8 ha (4.5 acres) inland at the "boggy marsh" north of Whites Cove. This amounts to a minimum of 12.7 ha (31.2 acres) of coastal habitats included in the environmental preservation zone. Also, a 30m (100 ft.) upland buffer zone including the portion of the upland bog, is proposed around the perimeter of the property line for wildlife, noise attenuation and as a visual screen. An additional 8.5 ha (21 acres) at the southeastern corner of the property, which is part of the Little River watershed, will be included in the upland buffer zone. The total upland buffer zone will amount to 19.3 ha (47.7 acres) of upland habitat. Together the coastal and upland environmental preservation zones total 32 ha (78.9 acres) – 20% of the total site area.

The coastal preservation zone will include all habitats where the three plant species at risk identified on this property occur. These species are mountain sandwort, hemlock parsley and glaucous rattlesnake-root; the latter species was thought to be extirpated in Nova Scotia prior to its discovery at this site. In addition, the coastal preservation zone will include all habitats on the property where bird's-eye primrose, a species identified as being at risk by ACCDC, occur. Preservation of the coastal "boggy marsh" area will protect not only a rare habitat within the North Mountain Basalt Ridge Natural Landscape but potential nesting habitat for rusty blackbird (a species considered at risk by ACCDC), and marginal potential nesting habitat for Nelson's sharp-tailed sparrow (NS GSR – yellow).

The Little River watershed portion of the upland environmental preservation zone contains the habitat where a damselfly (sweetflag spreadwing) that may be of conservation concern, was found. A single specimen of skunk cabbage, a species considered at risk by ACCDC, is not within any environmental preservation zone and would be destroyed by quarrying operations.

The 1917 *Migratory Birds Convention Act* refers to the protection of nesting birds and their habitat. In this regard, Bilcon of Nova Scotia Corporation will take the following steps to mitigate impacts on birds and meet its obligation under the Migratory Birds Convention Act. The scheduling of any habitat alteration – e.g. clearing of forest cover and overburden for quarry expansion – will be done to minimize direct impacts on all bird species. Clearing activities for quarry expansion will generally take place during late fall through winter to avoid spring and fall migrations on Digby Neck and to avoid the most sensitive spring and summer nesting period for resident species.

As a precautionary measure, minimal night lighting is proposed to reduce the possible collision hazard for night migrating birds. Night lighting would be used for navigational safety requirements, operations, and security. Outdoor operation and security lighting would be shielded whenever possible to direct light downward. To the extent practicable, ship loading would be conducted during daylight hours to reduce the necessity for lighting the ship loader at night.

Small numbers of boreal chickadees (identified as a species at risk by the ACCDC but not by the four priority lists used in this document), were observed using terrestrial habitats on the proposed quarry site in 2002 and 2004. Incremental clearing of approximately 2.4 ha (6 acres)of forest cover per year is planned during the life of the project. This procedure, in conjunction with the proposed environmental preservation zones, should provide some nesting habitat for on-site breeding populations of the boreal chickadee. Also, properties surrounding the quarry site are relatively undeveloped and consist primarily of coniferous (spruce/fir) forest, preferred habitat of the boreal chickadee.

Also, the wetlands (cattail marsh and shallow pond) located in the southeast corner of the quarry site and the treed bog north of the Whites Cove Road identified in the NSDNR Wetlands Data Base will be included in the environmental preservation zone. In addition to the existing sediment pond, a series of five new sediment ponds are proposed – see **Plan OP - 1.** This series of ponds, comprising approximately 8 ha (20 acres) of surface water, will overflow into a constructed wetland. The constructed wetlands will be designed to attract avian wildlife, especially resident waterfowl and migratory species who may use them for both nesting and staging sites. This additional wetland development will create aquatic habitat and add to the natural habitats already existing on the site thereby providing potential habitat for some Odonata species at risk and other wildlife species.

Incremental reclamation, including reforestation with native species and natural regeneration, is proposed to begin within five years of the beginning of quarry operations. This will result in varied successional stages of forest growth thereby potentially supporting a greater species diversity of breeding birds on the site. The sediment retention pond – constructed in 2003 has already provided habitat diversity and a resting area for waterfowl.

Early vegetation successional stages could also provide staging and resting areas for migrating monarch butterflies. It is proposed to allow native plants such as goldenrod and aster to become permanently established on the dykes around the sediment retention ponds. Since no farmland exists adjacent to the quarry site, these weed species, and even the introduction of milkweed, should not cause conflicts with adjacent land uses. Selective management of the dyke land will enhance both migratory habitat and possible breeding habitat for the monarch butterfly, a species identified by COSEWIC as being of special concern.

Known nesting areas of birds that are sometimes attracted to quarry areas such as killdeer (*Charadrius vociferus*), common nighthawk (*Chordeiles minor*), or spotted sandpiper (*Actitis macularia*) will be avoided, where possible, if found within active quarry areas until the young have left the nest.

Any toxic substances used during quarry operations (diesel fuel, gasoline, hydraulic fluids, antifreeze, etc) will be stored appropriately and not be accessible to birds or other wildlife. Any accidental spills will be dealt with as outlined in other sections of this document.

All segments of the environmental preservation zone would be environmentally managed and monitored by Bilcon of Nova Scotia Corporation. Access to the preservation zone would be controlled and if necessary restricted by Bilcon of Nova Scotia Corporation to ensure public access does not impact rare plant or other sensitive species.

9.2.1.4 Monitoring

Monitoring of plant populations that are considered at risk would be conducted by Bilcon of Nova Scotia Corporation, for as long as they operate the quarry. Professionals, contracted by Bilcon of Nova Scotia Corporation, would conduct inspections at the appropriate times to document the condition of the rare plant populations and their habitats. Appropriate monitoring procedures would be developed depending on the characteristics of each plant population. This monitoring procedure would involve checking each of the known locations where these plants are found, photographing and recording the total numbers, numbers that are flowering, the general condition of the plants and the condition of the surrounding vegetation. The frequency of monitoring would vary depending on the vulnerability of the species. The glaucous rattlesnake-root is vulnerable due to its concentration in one small area and will be monitored annually during the first five years of the project. Mountain sandwort, whose populations are expected to be somewhat dynamic and are in close proximity to project activities during its early phases, will also be monitored annually during the first five years of the project. Hemlock parsley, which is widely scattered and removed from the area where early project development will occur will initially be monitored once every five years. A written report of findings would be submitted to the Nova Scotia Department of Environment and Labour upon completion of each of these inspections.

Also, monitoring of invasive plant species would be included in the monitoring program. An overall long term objective of site reclamation is to encourage native species through planting and natural succession. Invasive plant species often initially become established in disturbed areas where there is ample available open habitat. Once established in these areas of disturbance, they may spread into adjacent undisturbed habitat and displace native plant species. Therefore, early detection is important and if located, removal would be carried out. The incidence of invasive species and proposed control methods would be included in a written report that would be submitted to the Nova Scotia Department of Environment and Labour. The proposed frequency of monitoring would be every five years.

Although no species at risk were documented during the vertebrate faunal studies, the boreal chickadee, identified as a species at risk by the ACCDC, was observed on the proposed quarry site. In this regard, Bilcon of Nova Scotia Corporation proposes to conduct vertebrate faunal monitoring surveys. Professionals, contracted by Bilcon of Nova Scotia Corporation would conduct a breeding bird survey every five years to determine any change in species composition, including the boreal chickadee, as a result of quarry operations. A written report of findings would be submitted to the Nova Scotia Department of Environment and Labour upon completion of each survey.

To document the potential effects of preserving existing wetlands and increasing wetland habitat with constructed wetlands, Bilcon of Nova Scotia Corporation will conduct general wetland and Odonata surveys. Professionals contracted by Bilcon will conduct wetland and Odonata surveys every five years. The objective of these surveys will be to document any changes in species composition and diversity. A written report will be prepared upon completion of the surveys.

Finally, the effectiveness of reclamation procedures will be monitored over the life of the quarry. Management and monitoring of the environmental preservation zone and reclaimed areas is part of the overall reclamation program. Included in this program will be the management of the sediment retention pond dyke lands as monarch butterfly habitat. Professionals contracted by Bilcon of Nova Scotia Corporation will conduct a Lepidoptera survey every five years. The objective of this survey will be to document any changes in Lepidoptera populations on-site with particular emphasis on the monarch butterfly. A written report will be prepared upon completion of each survey.

9.2.1.5 Impact Statement

Terrestrial Habitat - Alteration

Loss of habitat will result from construction of quarry infrastructure and noise will exclude sensitive fauna from habitats immediately adjacent operations activities, however, considering environmental preservation zones, phased quarry operations and incremental reclamation, effects on the site's terrestrial habitat would result in a ***long term, insignificant negative effect, of local scale.***

Terrestrial Habitat - Diversity

After quarry closure, and considering completion of on-site reclamation with the resultant habitat diversification, effects on the site's terrestrial habitat would result in a ***long term, insignificant positive effect, of local scale.***

Floral Species at Risk

Assuming acceptance of the previously stated environmental preservation zone and buffer areas, reclamation, mitigation, and monitoring plans, effects on floral species at risk would result in a ***long term, significant positive effect, of provincial scale.***

Vertebrate Species at Risk

Since no terrestrial vertebrate species at risk were identified during on-site field studies and critical habitat is marginal for vertebrate species at risk that could possibility use the site, effects on terrestrial vertebrate species at risk would result in a ***long term, insignificant negative effect, of local scale.***

Odonata Species at Risk

While on-site censuses of Odonata species at risk are not complete, none was identified during 2005 studies and considering that all aquatic habitats where Odonates have been observed will be preserved and new wetland habitat will be created, effects on Odonata species at risk would result in a ***long term, insignificant positive effect, of local scale.***

Lepidoptera Species at Risk

Since no Lepidoptera species at risk were identified during on-site field studies and on-site habitat is marginal, and considering habitat reclamation and creation, effects on Lepidoptera species at risk would result in a ***long term, insignificant negative effect, of local scale.***

Wetlands

Inclusion of the coastal bog, treed bog, cattail marsh, and shallow pond in the environmental preservation zone, proposed pond and wetlands construction, and maintenance of surface water flows to the coastal bog during quarry operations, will result in a net increase in wetland habitat resulting in a ***long term, insignificant positive effect, of local scale.***

Migratory Land Birds

Considering there will be no communication towers, wind turbines or any tall night lighted structures and land clearing will be scheduled to avoid nesting periods and migration seasons, effects on migrating land birds would result in a ***long term, insignificant negative effect, of local scale.***

9.2.2 Aquatic Ecology – On-site Freshwater

Introduction

The proposed 380 acre Whites Point Quarry property lies between the Bay of Fundy and the Little River watershed on Digby Neck. The quarry property extends approximately 3.1 km (1.9) miles along the Bay of Fundy shoreline with several intermittent water courses flowing through the property toward the Bay of Fundy.

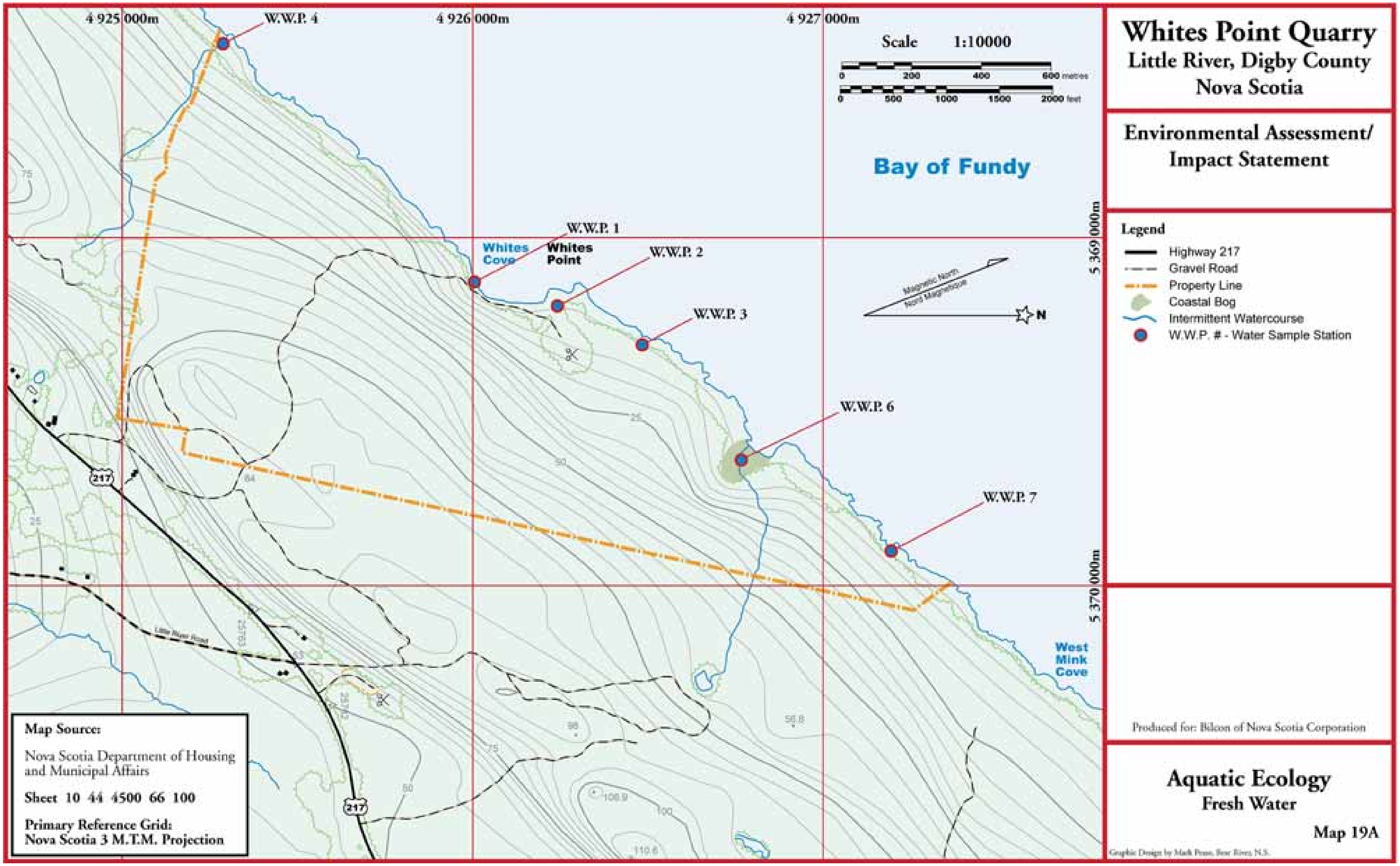
Direct, land based development, including the quarry operation, will be discussed in relation to the Little River watershed, the on-site freshwater Bay of Fundy watershed, and any influences that may occur on the receiving waters of the Bay of Fundy. Direct, marine based development including the ship loader, conveyor system, and marine terminal will be discussed in relation to the intertidal zone and the coastal-nearshore marine habitats in subsequent sections. Indirect, induced influences of quarry operations and construction – e.g., possible offshore whale/ship interactions and noise/marine mammals will be discussed in other sections of the Environmental Impact Statement document.

Watersheds in the vicinity of the proposed Whites Point Quarry on Digby Neck, as mapped by the Nova Scotia Department of Natural Resources – Wildlife Division are shown on **Map 14.** The Whites Point Quarry property watershed is bordered mainly by two small streams located to the north and south and the mountain ridge to the east. The Gidneys Brook watershed is located to the northeast of the quarry property and the Little River watershed to the southeast of the quarry property.

9.2.2.1 Research

During the spring and summer of 2002, on-site field reconnaissance and water sampling was conducted in freshwater habitats by David W. Kern, B.Sc. Several intermittent water courses and surface water drainage ways flow from the site into the Bay of Fundy. The most defined water courses are located near the north and south property lines and in the coastal bog area – see **Map 18B.** On-site observations during the spring and fall indicated moderate flows in these water courses, however, in late August of 2002, no flow was observed in the water course entering the bog area and only a slight trickle in the north and south water courses. These three water courses as well as three additional drainage ways were sampled for water quality (bacteriological, general chemistry, and trace metals) by David W. Kern, B.Sc. during the spring and summer of 2002 – see **Map 19A.**

Also, during late spring (June 13 and 14, 2002) on-site field reconnaissance of the three water courses was conducted by Dr. Michael Brylinsky, – see Brylinsky, M. “Results of a Survey of the Intertidal Marine Habitats and Communities at a proposed Quarry Site Located in the Vicinity of Whites Cove, Digby Neck, Nova Scotia”, 30 June 2002 (**Ref. Vol. II, Tab 10**). The following descriptions of the three freshwater water courses are excerpted from his report.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Highway 217
Gravel Road
Property Line
Coastal Bog
Intermittent Watercourse
W.W.P. # - Water Sample Station
Produced for: Bilcon of Nova Scotia Corporation
Aquatic Ecology
Fresh Water
Map 19A
Scale 1:10000
0 200 400 600 metres
0 500 1000 1500 2000 feet
Bay of Fundy
N
4 925 000m
4 926 000m
4 927 000m
5 369 000m
5 370 000m
W.W.P. 4
W.W.P. 1
W.W.P. 2
W.W.P. 3
W.W.P. 6
W.W.P. 7
Whites Cove
Whites Point
West Mink Cove
217
Map Source:
Nova Scotia Department of Housing and Municipal Affairs
Sheet 10 44 4500 66 100
Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

The lower portion of the north water course at water sampling station WWP-7 (**Map 19A**) is about 0.7 – 1.0 m in width and, at the time of survey, had a moderate flow of water. Water depths averaged about 0.2m, but in some places there were small pools, generally less than one metre in diameter and 0.5 m in depth. The streambed of the water course was mainly bedrock with a few small areas that contained cobbles. There was little evidence of any sandy or gravelly areas. Two Surber samples, taken in an area containing a cobble substrate, contained only a few caddis fly larvae, and visual examination of the undersides of submerged rocks failed to reveal the presence of any other types of aquatic invertebrates.

This north water course does not appear on the Nova Scotia 1:10 000 Topographic Series Sheet 10 44 4500 66 100 mapping with 5m contours, or on the more detailed mapping with 2.5m contours specifically flown for the quarry project. The inability to locate this water course is due primarily to poorly defined contour signatures. Water courses such as this are cut into the surface of the basalt rock formations and are common along the Bay of Fundy watershed. In this case, this precludes definitive water course or watershed delineation.

The south water course at water sampling station WWP – 4 (**Map 19A**) is only about 0.2 – 0.5 m in width at its lower end and flows at approximately a 12% gradient. This water course contains a number of small water falls at its lower end before entering the Bay. Water depths were only 5 – 10 centimetres at the time of the survey. Due to its small size, no Surber samples were taken.

This south water course provides a more defined contour signature and appears on the Nova Scotia 1:10 000 Topographic Series Sheet 10 44 4500 66 100. The majority of this stream flows outside the quarry property and enters the quarry property where it then empties into the Bay of Fundy – see **Map 19A.** The watershed comprises approximately 34 ha (85 acres) and is primarily forested with a lowland area near the head of the watershed. Approximately 10% of this total watershed lies within the quarry property and all of this eight plus acres is proposed to be within the environmental preservation zone around the perimeter of the quarry property.

The water course at water sampling station WWP – 6 (**Map 19A**) flowing through the bog located just above the shoreline forms a small, less than 3 m diameter, shallow, less than 0.2 m deep pool. At the time of the survey, the surface of the pool was covered with a green filamentous algae, and most of the bottom was covered with a brown bacterial mat (probably a sulphur bacteria). This pool had a strong hydrogen sulphide odour which is indicative of anoxic conditions.

Invasive Species

Freshwater habitats on the Whites Point quarry site are limited to intermittent water courses and small wetlands. Review of the Global Invasive Species Database for Canada and Invasivespecies.gov, list no invasive fish species or aquatic plant species presently exist on the Whites Point site, especially fish and molluscs. One aquatic plant which could possibly exist in on-site wetlands is Purple Loosestrife (*Lythrum salicaria*) which was recorded in a botanical survey at nearby Sandy Cove (Newell 2002). However, Purple Loosestrife was not identified on-site during the botanical survey for Whites Cove (Newell 2002).

9.2.2.2 Analyses

Water samples were taken at six locations to establish background water quality data for the fresh water entering the intertidal zone of the Bay of Fundy by David W. Kern, B.Sc. The locations of the sample sites are shown on **Map 12 .** Samples were taken in laboratory furnished bottles. Laboratory analyses for total coliform and total e-coli was conducted by Comeau Lab and for general chemistry and trace metals by PSC Analytical Services. A summary of these analyses is contained in Appendix 46 . With the exception of one parameter – aluminium – the analyses showed that all other parameters were within the "Canadian Water Quality Guidelines for the Protection of Aquatic Life" (1999, Ref. 43).

Aluminium exceeded the Canadian Council of Ministers of the Environment (CCME) 5 – 100 *ug*/L at all freshwater water sampling stations. Values for aluminium ranged from 110 *ug*/L at pH 7.2 to 320 *ug*/L at pH 5.7. It should be noted that the maximum concentration of aluminium allowable in freshwater by the U.S. Environmental Protection Agency is 750 *ug*/L at ph 6.5 to 9.0. These values in the fresh water runoff at the Whites Point Quarry site indicate background levels of aluminium presently exceed the CCME guidelines.

Regarding suitability of the water courses for fish habitat, it is concluded in Brylinsky's report that the two small brooks examined near the north and south property lines at WWP–7 and WWP - 4 do not appear to be particularly good salmonid habitat due to their small size, steep gradient, and lack of substrate suitable for spawning (Brylinsky 2002, **Ref.Vol. II, Tab 10**). Also, due to the anoxic conditions encountered at the bog water course WWP–6, it was determined that this stream is not suitable as fish habitat and was not examined in detail.

Subsequent to Dr. Brylinsky's spring reconnaissance, representatives of the Department of Fisheries and Oceans, Habitat Management Division, examined the full length of the water course at WWP - 6 flowing into the bog to its source. In their September 18, 2002 letter DFO concluded that "this watercourse cannot be categorized as "Fish Habitat", therefore the *Fisheries Act* does not apply", - see Appendix 18 .

The 3 plus hectares (8 acres) of surface acres of the south water course watershed within the quarry property will be protected within the proposed environmental preservation zone. The remaining 90% of the surface of this watershed is outside the quarry property and subject to prevailing local land uses. Quarrying in the area of the south water course will be in the upper flow unit, a uniform, hard, massive, vesicle free medium dark gray to black basalt. Quarrying below the contact of the upper flow unit and the middle flow unit, will not be carried out, and no loss of groundwater through this fractured zone to the south water course is expected.

9.2.2.3 Mitigation

As previously addressed in the component entitled “On-site Surface Water Drainage”, surface water flow to the coastal bog will be maintained during quarry operations. Also, this existing wetland habitat is included in the proposed environmental protection zone. The water courses near the north and south property lines will also be included in the minimum 30 m buffer zone proposed around the perimeter of the property. The proposed 30 m buffer zone actually exceeds by one third the requirements of the Nova Scotia Natural Resources, Wildlife Habitat and Watercourses Protection Regulations which became law on January 14, 2002. A “Special Management Zone” (SMZ) of at least 20 m is required for watercourses 50 centimetres or more in width during forest harvesting under these regulations. By including these water courses in the preservation zone and/or buffer zones, the quality of surface water flowing into the intertidal zone of the Bay will be maintained. Further, all surface runoff from disturbed land, before restoration is complete, will flow through a series of sediment retention ponds and then into a constructed wetland. Discharges from the wetland will meet the criteria established by the Nova Scotia Department of Environment and Labour for Total Suspended Solids (TSS) and pH.

Based on the results of the monitoring program, if the criteria established by the Nova Scotia Department of Environment and Labour (NSDEL) is exceeded, increased sediment pond capacity and/or retention time will be developed to maintain acceptable levels of TSS at the discharge point. PH will also be monitored. If the criteria established by the NSDEL exceed the acceptable range for pH, adjustments to the pH levels will be made with the addition of lime.

9.2.2.4 Monitoring

As previously stated in the component entitled “On-site Surface Water Drainage”, a water quality and flow monitoring program will be implemented by Bilcon of Nova Scotia Corporation. This program will include monitoring of all outflows from sediment retention ponds for Total Suspended Solids (TSS), pH, and total water flow. The frequency of monitoring will be weekly and a monthly report of results will be prepared by Bilcon of Nova Scotia Corporation and be available to regulatory agencies.

9.2.2.5 Impact Statement

Freshwater Fish Habitat

Since on-site studies and reconnaissance by the Department of Fisheries and Oceans, Habitat Management Division, have concluded that the only watercourse within the active quarry area is not suitable as fish habitat, this would result in a ***long term, neutral (no) effect, of local scale.***

Adjacent Watersheds

The watersheds of the north and south watercourses are within the environmental preservation zone and would not be altered by quarry operations resulting in a ***long term, neutral (no) effect, of local scale.***

9.2.3 Aquatic Ecology - Marine Intertidal Zone

Marine Intertidal Zone – Bay of Fundy, Whites Point- Photo by David W. Kern

9.2.3.1 Research

During the spring and summer of 2002, on-site field reconnaissance and water sampling was conducted within the intertidal habitats. One water sampling station in Whites Cove and three intertidal transects were established – see **Map 19B.** The intertidal zone was sampled for background water quality including bacteriological, general chemistry and trace metals including total suspended solids and mercury, see Appendix 44. Three intertidal transects were established by Dr. Michael Brylinsky – see Brylinsky, Michael, "Results of a Survey of the Intertidal Marine Habitats and Communities at a Proposed Quarry Site Located in the Vicinity of Whites Cove, Digby Neck, Nova Scotia" 30 June 2002 (**Ref. Vol. II, Tab 10**). The following descriptions of the three transects are excerpted from the above report.

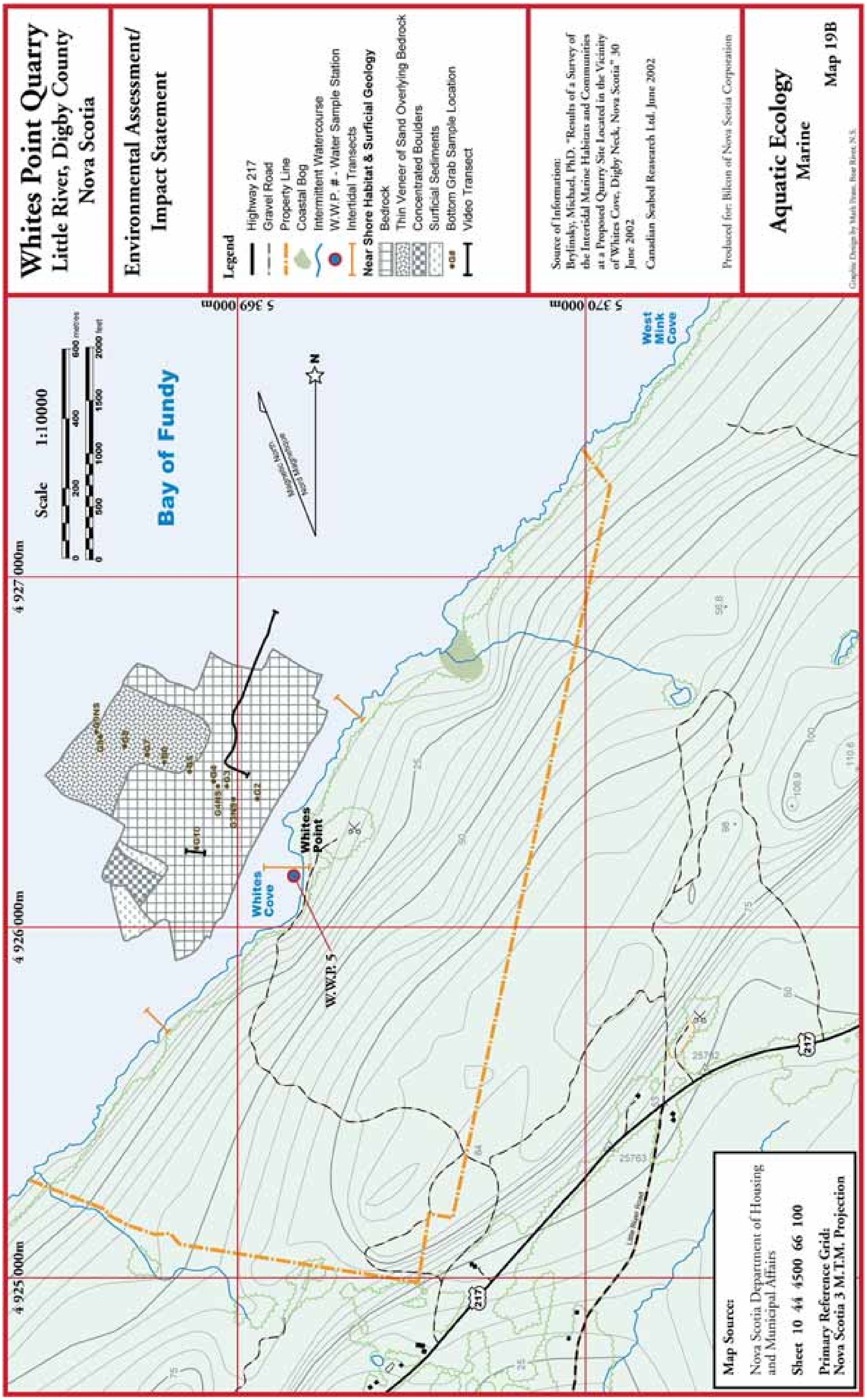
The Whites Cove transect, because of its more general relief (less than 4% gradient), exhibits the most distinct intertidal zonation pattern. The upper shore consists largely of sparsely scattered mats of rockweeds (*Fucus vesiculosus* and *Ascophyllum nodosum)* and patches of barnacles (*Balanus balanoides*). The intertidal community is poorly developed in this area as a result of the "mobile" cobble substrate. This area also lacked a distinct barnacle zone as barnacles were only present on some of the larger, more immobile boulders. The substrate of the mid and lower shore is more stable being composed mainly of bedrock which is overlain with a thick mat of rockweeds. Other algae observed included sea lettuce (*Ulva lactuca*), dulse (*Palmaria palmata*), Irish moss (*Chondrus crispus*), and deadman's fingers (*Briareum asbestinum*). Periwinkles (*Littorina spp.*) are abundant in this area, especially in the tide pools and rock crevices. Other marine animals observed included blue mussels (*Mytilus edulis*), horse mussels (*Modiolus modiolus*), hermit crabs (*Pagurus spp.*), dog whelk (*Thais lapillus*), and European green crabs (*Carcinus maenas*). It should be noted that the European green crab was introduced to the Bay of Fundy over 20 years ago and has since spread throughout the Bay.

The north and south transects are quite similar to each other with pronounced relief of a stable bedrock substrate and abundant tide pools. Yellow patches of lichens are prevalent on the bedrock of the upper zone in contrast to blue green algae which imparts the dark green colour to the rock surfaces. Tide pools are scattered throughout the mid and lower shore zones. A diversity of marine organisms inhabits this zone including periwinkles, amphipods, red coralline algae, and limpets with some occurrence of brown algae. The dominant macroalgae in all three transects was *Fucus* and *Ascophyllum*.

Coastal vegetation communities including the coastline, intertidal, and sublittoral are shown on **Figure 9.** These communities were identified using aerial photography interpretation, on-site flora surveys, on-site intertidal transects, near shore bottom sampling, and underwater video.

Invasive Species

Investigations of the marine intertidal zone were conducted at three transects along the Whites Point property coastline (Brylinsky 2002). Review of the Global Invasive Species Database for Canada and Invasivespecies.gov indicate invasive marine species presently exist in the intertidal zone at Whites Point. The European green crab and the common periwinkle (*Littorina littorea*) were identified during intertidal investigations. It should be noted that the common periwinkle is presently commercially harvested along the Whites Point shoreline.

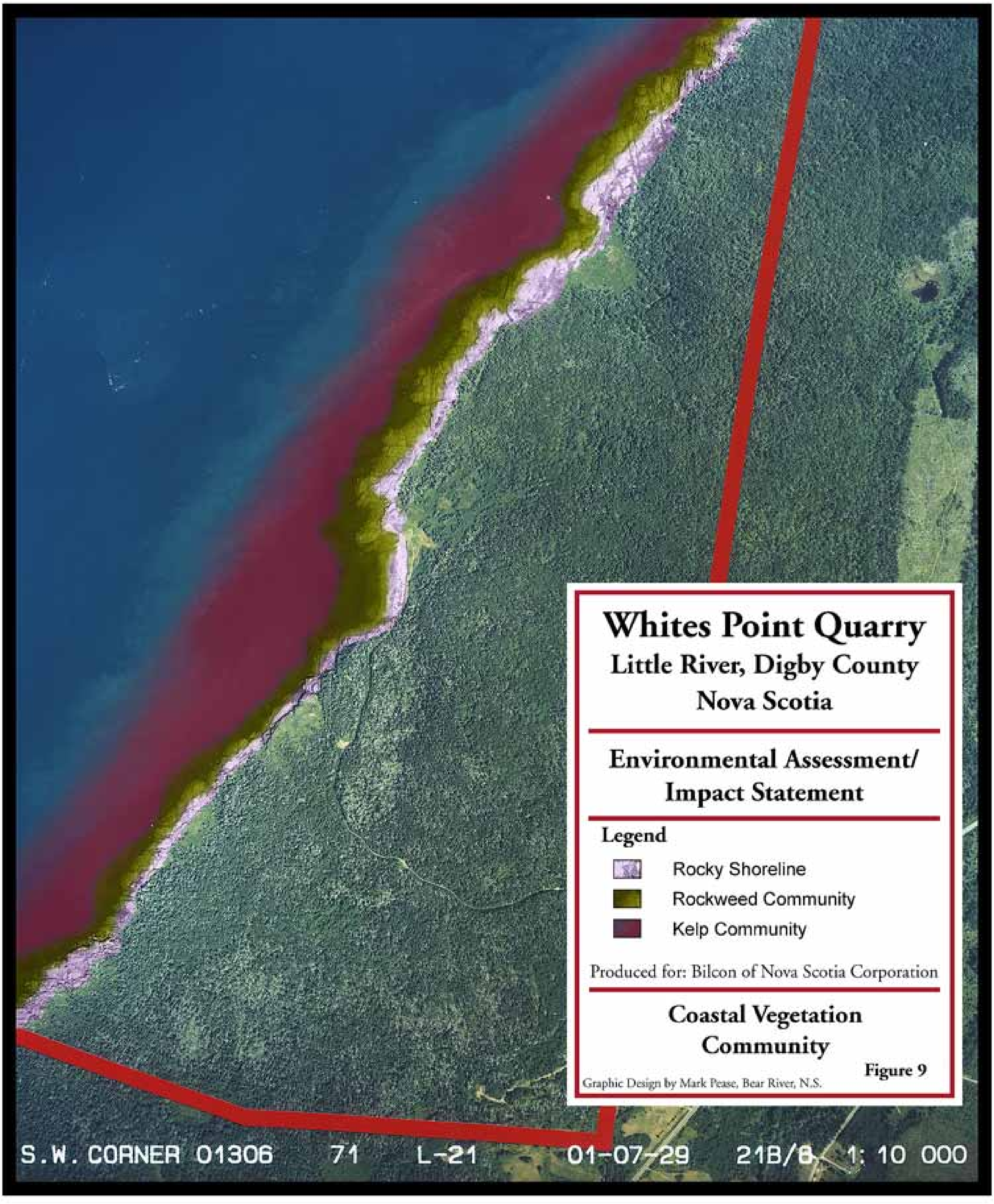

Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Highway 217
Gravel Road
Property Line
Coastal Bog
Intermittent Watercourse
W.W.P. # - Water Sample Station
Intertidal Transects
Near Shore Habitat & Surficial Geology
Bedrock
Thin Veneer of Sand Overlying Bedrock
Concentrated Boulders
Surficial Sediments
Bottom Grab Sample Location
Video Transect
Source of Information:
Brylinsky, Michael, PhD. "Results of a Survey of the Intertidal Marine Habitats and Communities at a Proposed Quarry Site Located in the Vicinity of Whites Cove, Digby Neck, Nova Scotia" 30 June 2002
Canadian Seabed Reasearch Ltd. June 2002
Produced for: Bilcon of Nova Scotia Corporation
Aquatic Ecology
Marine
Map 19B
Scale 1:10000
Bay of Fundy
Magnetic North
Nord Magnétique
N
Whites Cove
Whites Point
W.W.P. 5
West Mink Cove
4 925 000m
4 926 000m
4 927 000m
5 369 000m
5 370 000m
Little River Road
217
Map Source:
Nova Scotia Department of Housing and Municipal Affairs
Sheet 10 44 4500 66 100
Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

9.2.3.2 Analyses

A water sampling station was established in Whites Cove to establish water quality data in the intertidal marine environment. The location of the sampling station is shown on **Map 19B .** Samples were taken in laboratory furnished bottles and laboratory analysis for coliform and e-coli was conducted by Comeau Lab and for general chemistry and trace metals by PSC Analytical Services. A summary of the analyses is contained in **Appendix 45.** Few guidelines for parameters in marine waters are available in the "Canadian Water Quality Guidelines for the Protection of Aquatic Life" (1999) however, all parameters indicated in the Guidelines for marine environments were within acceptable limits.

The intertidal zone along the Bay of Fundy shore bordering the property is approximately 3.1 km (1.9 mi.) long and consists of a predominately rocky shoreline dominated by basaltic bedrock. Fine sediments are scarce resulting in a lack of sandy beaches and mudflats. An exception to this is the beach at Whites Cove which varies from small boulders at low tide to cobbles along the high tide mark. The lack of sediment and the presence of hard substrate provides ideal conditions for the establishment of macroalgal communities which are very well developed along the entire shoreline of the property. Results of the survey transects indicate that the intertidal marine communities and habitats present along the shoreline of the property are typical of the rocky shoreline areas of the Lower Bay of Fundy. The dominant rockweed community of *Fucus* and *Ascophyllum* is well developed and appears to be in a healthy, prolific condition. No unique or extraordinary characteristics associated with this shoreline were observed.

These rocky intertidal macroalgal communities play a number of important ecological roles as part of the larger marine environment. They are major primary producers, and although macroalgae are grazed on directly by some animals such as sea urchins, much of this material is eventually exported to the open waters of the Bay of Fundy where it becomes part of the detrital food web. Rafts of floating, detached macroalgae also play an important role as a feeding area for seabirds, marine mammals, and fish. Macroalgae are an important energy source and provide foraging and refuge habitat for many species of marine organisms. Estimates indicate as many as 31 species of fish use the rockweed habitat typical of that at Whites Point during the summer and about 17 species are present as juveniles (Rangley, R.W. 1998, Ref. 159), suggesting it is an important nursery habitat. Lobsters also rely on macroalgal habitat during various stages of their life cycle and ducks forage for amphipods and periwinkles living in the rockweed community. No disturbance of the rockweed community resulting from commercial harvesting by licensed seaplant harvesters was apparent along this section of shoreline.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Rocky Shoreline
Rockweed Community
Kelp Community
Produced for: Bilcon of Nova Scotia Corporation
Coastal Vegetation
Community
Figure 9
Graphic Design by Mark Pease, Bear River, N.S.
S.W. CORNER 01306 71 L-21 01-07-29 21B/6 1: 10 000

9.2.3.3 Mitigation

Since the intertidal zone is important to the overall marine environment from a habitat, primary production and species diversity standpoint, the proposed method of construction for the conveyor system to the ship loader – see **Figures 2 and 3** - was chosen to span the intertidal zone. No filling such as a rock causeway or infilled crib work or sheet piling within the intertidal zone is proposed. Approximately three conveyor supports on pipe piles, anchored into the bedrock, will be located within the intertidal zone. Construction within the intertidal zone will require drilling sockets and anchor holes for the conveyor support pipe piles. The proposed pipe piles, pending detailed design, are a maximum thirty-six inch diameter resulting in a permanent displacement of intertidal bottom habitat of 5.9 m^2 (63 ft^2) or 0.0006 ha (0.001 acres).

This harmful alteration, disruption or destruction (HADD) of fish habitat will require a *Fisheries Act Subsection 35(2) Authorization.* A "Fish Habitat Compensation Plan" – see Appendix 17 - to balance this habitat loss has been approved in principle by the Department of Fisheries and Oceans – Habitat Management Division.

Construction within the intertidal zone will be done from the land during low tide periods. Socket drilling will produce aggregate size material with little or no fines. Anchor drilling will be done within the pile casing thus confining any fines. Since construction will be done from and in basalt bedrock, and no bottom sediments are present, water quality in the intertidal zone should experience negligible alteration with this construction process. Importantly, the use of this construction technique will maintain unobstructed shoreline currents.

Although more expensive than other construction techniques, the loss of habitat is very small and will be compensated for, as noted above. The intertidal zone extends approximately 35 m (115 ft.) seaward from the ordinary high water line. Thus vertical habitat surface within the tidal water column on the piles will result, especially for organisms such as barnacles. No other disturbances are proposed within the intertidal zone along the shoreline of the property.

9.2.3.4 Monitoring

A water quality monitoring program within the intertidal zone in Whites Cove will be implemented by Bilcon of Nova Scotia Corporation during construction of the conveyor supports. This program will include monitoring of Total Suspended Solids (TSS) within the intertidal marine environment. The frequency of monitoring will be monthly with a monthly report of results prepared for Bilcon of Nova Scotia Corporation which will be available to regulatory agencies. Since no disturbance within the intertidal zone is anticipated after the construction is complete, monitoring of TSS within the intertidal marine environment will be discontinued. As indicated in previous sections, the marine conveyor will have spill containment. In the event of a conveyor malfunction requiring off loading, the aggregate will be off loaded into a barge moored on-site.

9.2.3.5 Impact Statement

Intertidal Habitat – Construction

Since construction within the intertidal zone for three conveyor supports is expected to take less than one year and will be conducted during periods of low biological activity, this would result in a ***short term, insignificant negative effect, of local scale.***

Intertidal Habitat – Life of Project

Since the only disturbance within the intertidal zone along the entire shoreline of the property is the construction of three conveyor supports, no net loss of habitat is anticipated after compensation resulting in a ***long term, neutral (no) effect, of local scale.***

9.2.4 Aquatic Ecology - Coastal / Nearshore Marine Habitat

Coastal / Nearshore Waters, Bay of Fundy, Whites Point - Photo by David W. Kern

9.2.4.0 Introduction

The site of the proposed Whites Point Quarry and Marine Terminal is located along the western shoreline of Digby Neck, Nova Scotia and on the northwestern shoreline of the outer Bay of Fundy. In broader context, it lies within the Gulf of Maine/Bay of Fundy system, an area considered to be one of the world's richest marine ecosystems (Tyrell 2005, Ref. 89).

This introduction presents an overview of the marine ecosystem with some selected examples of life and interactions. In preparing the Environmental Impact Statement for the Whites Point project, an ecosystem approach has been taken, emphasizing the complexities of interactions within and among ecosystems and communities.

9.2.4.0.1 Benthic Habitats and Communities

The major benthic marine habitats and communities present in the immediate area of the quarry site include a rocky intertidal area colonized extensively by a diversity of marine macrophytes, and a subtidal area that is largely erosional due to the presence of strong currents. There are also numerous tide pools present within depressions that have formed within the intertidal area that serve as habitat for some animals and plants.

Rocky intertidal macroalgal communities play a number of important ecological roles. They are major primary producers and, although macroalgae are grazed on directly by some animals, especially sea urchins, much of this material is eventually exported to the open waters of the Bay where it becomes part of the detrital food web (Bradford 1989; Mann 1992). Rafts of floating, detached macroalgae are also thought to play an important role as a feeding area for seabirds, marine mammals and fish (Rangley 1994).

Intertidal macroalgae are not only important as an energy source but, because of their large size and structural characteristics, are also important in providing foraging and refuge habitat for various species of marine organisms (Mann 1992: Percy, 1996). Rangley (1998) estimates that as many as thirty-one species of fish use rockweed habitat during summer, and about seventeen species are present as juveniles suggesting it is an important nursery habitat. American black ducks (*Anas rubripes*) and common eiders (*Somateria mollissima*) are known to forage for amphipods and periwinkles living in the rockweed community. Macroalgae that is ripped from its substrate by storms and eventually deposited along beaches as wrack becomes colonized by various crustaceans that use it for food and shelter and which in turn become food for various species of shorebirds.

Rockweed is also a valuable commercial commodity that is harvested and processed for use in food and agricultural products, livestock feed and as an emulsifier in numerous products such as paints, cosmetics and foods. Species currently being harvested in the Bay of Fundy region include dulse, Irish moss, kelps (*Laminaria spp.*) and rockweeds (*Ascophyllum nodosum).*

The subtidal community consists of attached macrophytes, mainly kelps, and numerous species of epifauna, such as sea anemones and mussels that are adapted to living attached to hard substrates. There are virtually no deposits of fine sediments in this area and, as a result, no infaunal communities are present. Scattered boulders along the seafloor provide important hiding and living spaces for swimming organisms and others that live on the bay bottom.

Commercially important species that may frequent or live in the nearshore benthic subtidal habitats include some demersal fish species such as Atlantic cod (*Gadus morhua*), cunner (*Tautogolabrus adspersus*) and redfish (*Sebastes marinus*), as well as numerous invertebrates such as American lobster (*Homarus americanus*), sea scallops (*Placopecten magellanicus*), rock crabs (*Cancer spp.*), sea cucumbers and sea urchins.

9.2.4.0.2 Pelagic Habitats and Communities

The pelagic zone or water column extends from the sea surface to the bottom substrate. In many areas of the Bay, the water column is often stratified and consists of distinct layers that form different habitats. The upper water mass is composed of less dense warmer water, and the bottom water layer consists of more dense colder water. If there is a source of fresh water input nearby, the upper layer may also have a lower salinity than the bottom layer. Because of the differences in salinity and temperature, these water masses represent different habitats. In addition to the habitat differences created by stratification of the water column, there are also habitat differences created by the attenuation of solar radiation through the water column. The upper water layer to a depth where there is sufficient light for photosynthesis to occur is called the euphotic zone and is the habitat where phytoplankton grow and reproduce. The area below the euphotic zone, where there is insufficient light for photosynthesis, is referred to as the aphotic zone. Organisms living in this zone receive their food from materials that either sink from the upper euphotic zone or are resuspended from the bottom substrate.

There is tremendous diversity in the kinds of pelagic, or open-water, organisms that live within the water column in terms of both size and life style. Pelagic organisms can be characterized as planktonic or nektonic.

9.2.4.0.3 Plankton Community

This community consists of small organisms that have limited ability to swim against ocean currents and, although many planktonic organisms can migrate vertically within the water column, their movements and distribution are dictated largely by the factors that control the circulation of oceanic water masses.

The phytoplankton community is composed of microscopic plants that have the ability to photosynthesize. These organisms are in turn fed upon by the zooplankton, the small microscopic animals that inhabit the water column. The zooplankton community consists of small crustaceans, such as copepods, as well as the larval stages of fish and numerous bottom dwelling organisms such as shellfish, sea anemones, crabs and American lobsters. The zooplankton community is an important food source for the younger stages of many fish species as well as for large marine mammals such as baleen whales that have the ability to strain these organisms out of the water column as they swim through it.

In addition to the phyto- and zooplankton communities, there exists a pelagic community that consists of very small organisms such as bacteria and protozoans. This community forms the microbial food chain which is considered by some to be important in making dissolved organic material available to larger organisms.

9.2.4.0.4 Nekton Community

Larger organisms that have the ability to swim independently against water currents form the nekton community. This community is typically dominated by chordates, or vertebrate or cartilaginous fish, marine mammals and reptiles. The nekton community is typically comprised of pelagic fish, whales, sharks, turtles, and seals; arthropods, such as shrimp; and some molluscs, such as squid and octopus.

Nektonic organisms can be considered as top predators and are mainly carnivores preying on smaller fish, but some are planktivores or omnivores. This means that they rely on a healthy food chain for survival. With the exception of anadromous and catadromous species, nektonic organisms live and breed in marine waters. Many pelagic fish live in schools that facilitate reproductive activities and increase swimming efficiency and reduce predation.

There is a significant economic reliance on nektonic species in the Bay of Fundy. Commercial fisheries rely on pelagic species such as herring and Atlantic mackerel (*Scomber scombrus*). Ecotourism depends on various species of whales and seals.

It is difficult to generalize about the ecology of nektonic organisms; however, herring is used as an example because of their ecological role as a "middle predator/prey". Herring typically spawn in shallow waters in spring, but summer and fall spawners prefer to spawn offshore. They eat plankton and their main food source is crustaceans such as copepods and euphaniids. They are preyed on by most of the larger fish species such as cod, tuna (*Thunnus spp*.), and Atlantic salmon (*Salmo salar*), and by seals, whales and sea birds. Herring form the basic food supply for many marine species. Commercially, they are harvested by gill nets, weirs, and seines.

The pelagic community offshore of Whites Point lies in an area that is considered to be very productive. Unlike the central Gulf of Maine, the water column remains unstratified due to the shallow depths and strong tidal mixing. This mixing also brings nutrients into the area from deeper offshore water and results in high levels of primary production by both phytoplankton and macroalgae (Townsend 1991; Durbin 1996).

9.2.4.0.5 Benthic-Pelagic Interactions

There are strong connections between pelagic and benthic communities, particularly in environments where water column stratification is absent. Exchange between the two communities is important for both food and nutrient supplies. Nutrients and food particles, both living and dead, that either sink or are transported by water circulation, are the primary source of nourishment for benthic plants and animals. In turn, decomposition of organic matter and resuspension of nutrients and organic matter from the benthos into the water column can be an important source of nourishment for phytoplankton and zooplankton.

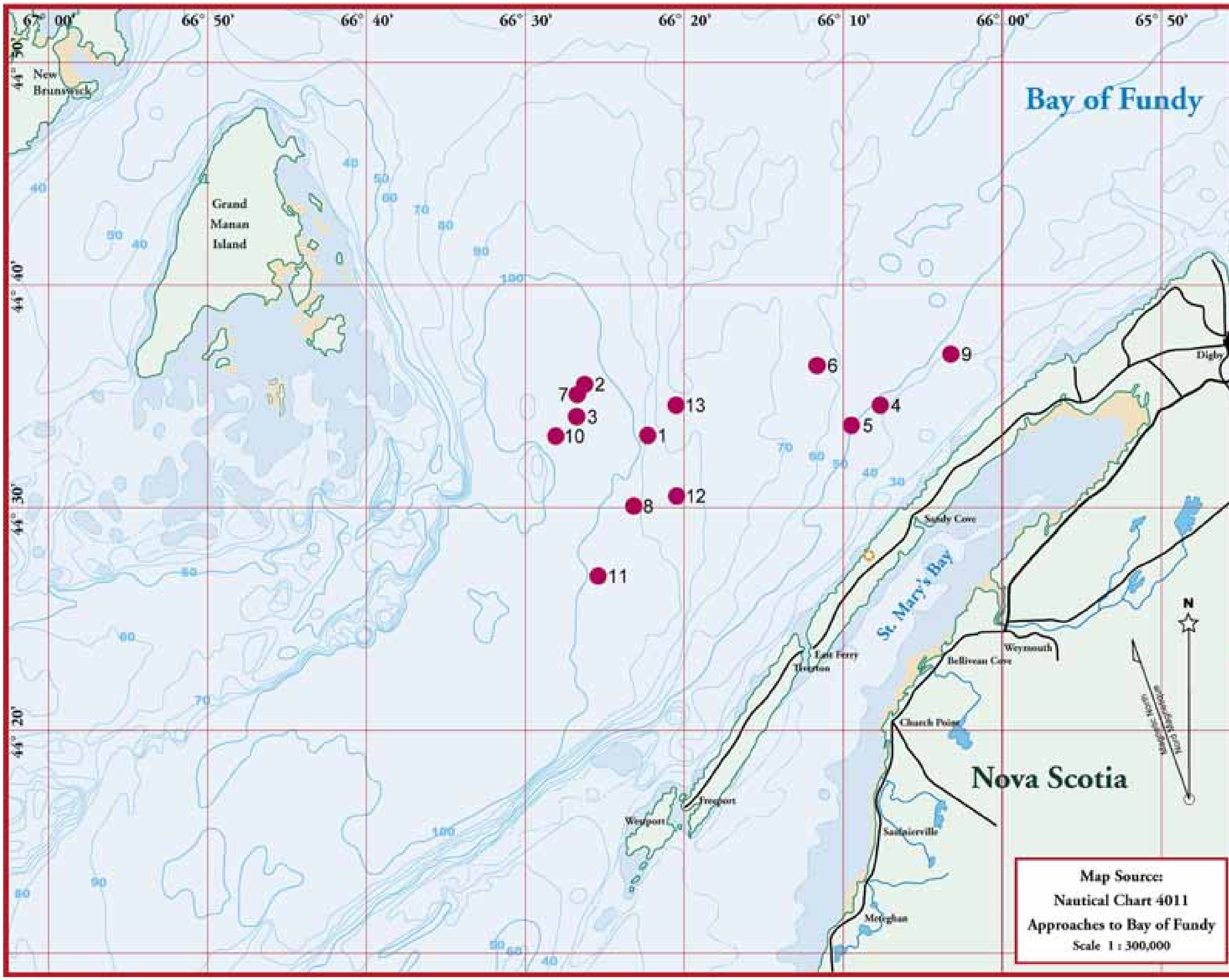
In conclusion, the Bay of Fundy is a diverse and complex ecosystem. Its importance was substantiated during the community consultation meetings, meetings with regulatory agencies, panel scoping sessions and public commentary in the Public Registry. Areas of concern were raised regarding possible project interactions with components of the nearshore marine environment. Those concerns ranged from the destruction of fish habitat to direct and indirect influences of the project on specific species such as the American lobster, North Atlantic right whale, inner Bay of Fundy salmon, harlequin duck (*Histrionicus histrionicus*), and the leatherback turtle (*Dermochelys coriacea*). In particular, concerns were raised regarding specific project activities such as the proposed on-land blasting. Therefore, this section of the Environmental Impact Statement addresses possible nearshore marine ecosystem effects and effects on particular species that may be resident, seasonal, or migratory in this marine ecosystem.

9.2.4.1 Research

The coastal – nearshore waters off Digby Neck have been investigated historically, and most recently, as a result of the proposed Whites Point Quarry and Marine Terminal. Historic data includes nutrient and phytoplankton biomass from the BioChem data base maintained by the Department of Fisheries and Oceans (http://www.meds-sdmm.dfo-mpo.gc/biochem/Biochem e.htm, Ref 237)). This data spans a time period between 1979 and 2003. Chemical and nutrient data from a survey carried out between 1977 and 1980 by the Marine Ecology Laboratory of the Bedford Institute of Oceanography is also available. Also, limited data on phytoplankton primary production and macroalgal production is available from the early 1980s as a result of studies by Prouse (1983 and 1984). More recently, Bilcon of Nova Scotia Corporation had research conducted in the nearshore waters off the quarry site – see Canadian Seabed Research Ltd 2002 (Appendix 23) and Brylinsky 2004 (**Ref. Vol. II, Tab 11**).

9.2.4.1.1 Nutrients

Nutrient data from 13 sites in the Bay of Fundy off shore of the quarry site – seven representing single values typically from samples taken in the near surface layer, and six representing profiles consisting of three or less values from sample depths ranging between 5 and 50 m (16.5 and 165 ft.) in depth are shown on **Map 20** and contained in **Table NS – 1.**



Whites Point Quarry
Little River, Digby County
Nova Scotia

Environmental Assessment/ Impact Statement

Legend

- Proposed Whites Point Quarry
- Sample Sites

Source of Information:
Department of Fisheries and Oceans BioChem database

Produced for: Bilcon of Nova Scotia Corporation

Bay of Fundy
Nutrient Sample Sites

Map 20

Graphic Design by Mark Pease, Bear River, N.S.

Table NS-1 Nutrient concentration data obtained from the Department of Fisheries and Oceans BioChem database

Site*	Latitude	Longitude	Date	Depth (m)	Phosphate (ug/L)	Nitrate (mg/L)
1	44.58	66.37	10/24/79	8	1.035	9.95
1	44.58	66.37	12/1085	4	1.020	8.96
1	44.58	66.37	4/16/81	5	1.130	9.39
1	44.58	66.37	4/13/83	0	1.015	7.61
1	44.58	66.37	7/14/84	1	0.305	0.25
1	44.58	66.37	10/17/93	1	0.806	3.87
2	44.63	66.46	4/16/81	5	1.175	10.07
2	44.63	66.46	10/24/79	5	0.980	8.94
2	44.63	66.46	4/13/83	0	0.920	6.68
3	44.60	66.47	7/12/99	5	0.355	0.08
4	44.61	66.04	7/10/00	5	0.642	4.12
5	44.59	66.08	7/11/01	5	0.744	1.30
6	44.65	66.13	7/11/01	5	0.707	1.10
7	44.62	66.47	7/12/01	5	0.715	0.91
8	44.51	66.39	7/10/02	5	0.439	2.62
8	44.51	66.39	7/10/02	25	0.626	5.21
8	44.51	66.39	7/10/02	50	0.820	8.61

Table NS-1 Nutrient concentration data obtained from the Department of Fisheries and Oceans BioChem database

Site*	Latitude	Longitude	Date	Depth (m)	Phosphate (ug/L)	Nitrate (mg/L)
9	44.66	65.94	7/10/02	5	0.616	4.30
9	44.66	65.94	7/10/02	25	0.615	4.32
9	44.66	65.94	7/10/02	50	0.592	4.14
10	44.58	66.50	7/11/02	5	0.230	0.17
10	44.58	66.50	7/11/02	25	0.692	6.64
10	44.58	66.50	7/11/02	50	0.889	10.78
11	44.44	66.44	7/6/03	5	0.372	1.19
11	44.44	66.44	7/6/03	25	0.556	4.37
12	44.52	66.33	7/6/03	5	0.397	2.20
12	44.52	66.33	7/6/03	25	0.509	3.16
12	44.52	66.33	7/6/03	50	0.635	4.85
13	44.61	66.33	7/6/03	5	0.268	0.79
13	44.61	66.33	7/6/03	25	0.645	5.70
13	44.61	66.33	7/6/03	50	0.799	7.72

Chemical and nutrient data collected at stations approximately 15 km offshore of Digby Neck are contained in **Table NS – 2.**

Table NS – 2
Average concentration of chemical parameters in surface samples collected in August between 1977 and 1979 at three stations located approximately 15 km offshore of Digby Neck (from Keizer et al. 1980) are as follows:

Salinity (ppt)	32.3
Ammonia (mg/L)	0.009
Nitrite (mg/L)	0.005
Nitrate (mg/L)	2.41
Phosphate (mg/L)	0.11
Silicate (mg/L)	1.47
Dissolved Organic Carbon (mg/L)	1.72
Particulate Organic Carbon (mg/L)	0.282
Particulate Nitrogen (mg/L)	0.032

9.2.4.1.2 Phytoplankton Production

Phytoplankton primary production within the Bay of Fundy was studied by Prouse (1983). One of the sites at which primary production was measured was located approximately 15 – 20 km (9 – 12 mi.) offshore of the central portion of Digby Neck. The results are contained in **Table NS – 3.** Prouse et al. (1984) estimated the annual production in the outer Bay of Fundy to be 133gC/m^{-2} yr^{-1}. Also, this report indicates that phytoplankton production is highest in the summer and lowest in the fall, and that it does not appear to be nutrient limited.

Table NS – 3

Results of primary production measurements carried out by Prouse (1983) in the area of Digby Neck

Station	Date	Phytoplankton Production mgC/m^{-2}day^{-1}
BF 1	29 Mar 1979	114.1
BF 1	11 Aug 1979	955.4
BF 1	16 Feb 1980	64.8

Phytoplankton biomass is typically measured and expressed as phytoplankton chlorophyll *a* concentration.

The BioChem data base contains a number of chlorophyll *a* values for the Digby Neck area as contained in **Table NS-4.** Since most of the data was collected in early September, it is not possible to determine if there are any seasonal trends in chlorophyll *a* concentration. However, it is obvious that surface waters contained much higher levels than deeper waters.

Table NS – 4 Phytoplankton chlorophyll a values obtained from the BioChem database maintained by Fisheries and Oceans.

Latitude	Longitude	Date	Depth (m)	CHL *a* (ug/L)
44.60	66.47	7/12/1999	5	1.29
44.61	66.04	7/10/2000	5	5.04
44.59	66.08	7/11/2001	5	3.48
44.65	66.13	7/11/2001	5	3.96
44.62	66.47	7/12/2001	5	4.08
44.51	66.39	7/10/2002	5	1.39
44.51	66.39	7/10/2002	25	1.37
44.51	66.39	7/10/2002	50	0.42
44.66	65.94	7/10/2002	5	1.60
44.66	65.94	7/10/2002	25	1.66
44.66	65.94	7/10/2002	50	1.46
44.58	66.50	7/11/2002	5	2.09
44.58	66.50	7/11/2002	25	0.87
44.58	66.50	7/11/2002	50	0.18
44.44	66.44	7/6/2003	5	5.46
44.52	66.33	7/6/2003	5	6.65
44.52	66.33	7/6/2003	25	3.69
44.52	66.33	7/6/2003	50	0.32
44.61	66.33	7/6/2003	5	4.63
44.61	66.33	7/6/2003	25	2.60
44.61	66.33	7/6/2003	50	0.65

9.2.4.1.3 Macroalgal Production

Although no direct studies have been undertaken in the area off Whites Point, estimates of macroalgal production by Prouse et al. (1984) have been made within the Bay of Fundy. In this regard it was noted by Prouse that the Digby area contains significant stands of macroalgae with biomass of up to 20 kg/m^{-2} wet weight and estimated seaweed net production along the shorelines of the Outer Bay of Fundy to be about 845 gCm^{-2}yr^{-1}.

More recently, the coastal–nearshore surficial geology–see **Map 10 -** and bathymetry off Whites Cove and Whites Point was investigated for Bilcon in June 2002. Canadian Seabed Research Ltd. (Appendix 23) conducted the investigations which included side scan sonar, underwater video transects, and bottom samples. Following are descriptions of the bottom characteristics as shown on **Map 12** . The majority of the area is comprised of bedrock, an extension of the land and intertidal basalt. The bedrock is a massive, irregular type with occasional joints and fractures. Boulders are also common throughout this area. A second area of bedrock is overlain with a thin veneer of sand which also has outcrops of bedrock and boulders evident. The third area of surficial sediments consists mainly of coarse to very coarse grained sand. Bottom samples taken in this area contained sand and 15% shell fragments and is characterized by a high abundance of boulders ranging in size from less than one m to 5 m (16 ft.) in diameter. No sediment bedforms (current marks) were visible indicating little current movement close to the bottom. Water depths below Chart Datum (LLWLT) in the area of investigation range to over 30 m (100 ft.).

9.2.4.1.4 Benthic Community

Bottom grab samples were taken on June 28 and 29, 2002 in nearshore waters off Whites Point by Canadian Seabed Research Ltd. The location of the grab samples are shown on **Map 13.** A Van Veen Grab Sampler was used in water depths ranging from 9.5 to 41.5 m (31 to 136 ft.). A total of twelve grab samples were attempted. Seven of the grabs resulted in no samples due primarily to rocky bottom conditions and the absence of bottom sediments. Samples G2, G5, G6, G9, and G10 produced some bottom materials. **Table GS - 2002** provides a summary of the grab sample field notes.

Laboratory analysis of the grab samples and review of the video transects were performed by Dr. Michael Brylinsky – see Brylinsky, Michael., "Interpretation of a Sublittoral Benthic Survey Along the Shoreline of Whites Point, Digby Neck, Nova Scotia". 28 February 2004. (**Ref. Vol. II, Tab 8**). Based on these samples and video records, the subtidal substrate is composed mainly of coarse sands, gravels and mollusc shell fragments overlain in many areas by small to medium size boulders. These boulders are heavily colonized by a community consisting of epiflora and epifauna (plants and animals that live on the sediment surface). The major types of epiflora present are attached macroscopic algae with kelps and Irish moss most prominent. In some cases, small boulders are colonized by encrusting coralline red algae. The epifauna consists mainly of sessile attached anthozoans, hydroid polyps and sponges and motile starfish and crabs.

Nearshore Bottom Marine Life - Photos by Canadian Seabed Research Ltd.

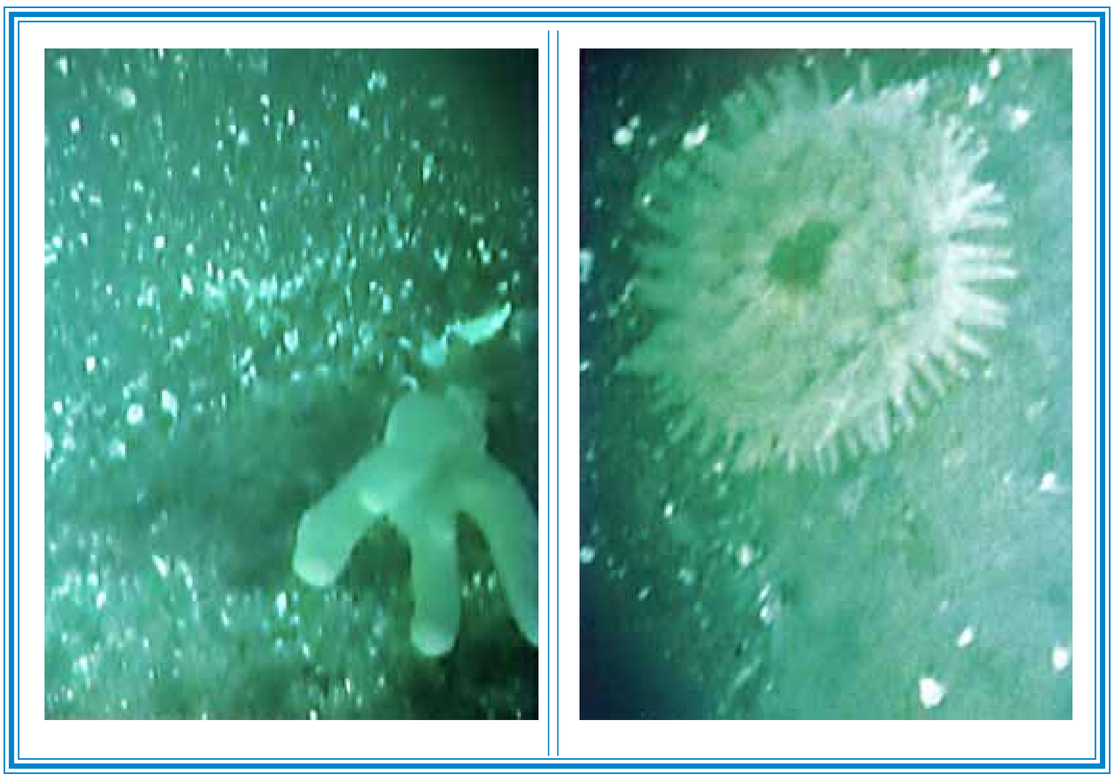


Table GS – 2002
Geophysical Survey – Whites Point, Nova Scotia
Grab Sample Field Notes

Sample ID # *28-Jun-02*	Easting/Northing	Time(local)	WaterDepth (m)	Description
G2	727057.95E 4927539.29N	16:37	9.5	Biological-kelp, various seaweed,approx 250g
G3NS	726986.09N 4927542.80E	16:40		No sample
G3	726982.19N 4927576.93E	16:43	22.5	Muddy water, no sample to bag after 2 attempts
G4	726933.73N 7927576.93E	16:48	28.0	No sample
G9	726620.98N 4927689.47E	16:55	41.5	Biological-Sea Cucumber brown approx 15cmx10cm Shell fragments (80%) and dark coloured sand mixture (20%)approx 500g
G9NS	726622.00N 4927692.47E	17:01		No sample
G8	726657.40N 4927655.95E	17:05	39.0	Biological-insignificant, nothing bagged
G7	726739.37N 4927643.91E	17:10	38.5	No sample
G6	726782.66N 4927631.11E	17:14	37.0	Shell fragments, approx 500g Single cobble, approx 5cm
G5	726859.22E 4927613.17N	17:20	33.5	Shell fragments (80%) andsand/fines (20%) approx 2kgSmall percentage of biomass-worms
G4NS	726938.25N 4927570.96E	17:30		No sample
29-Jun-02 G10	726887.79E 4927369.62N	11:37	24.0	Shell fragments (30%), very coarse sand (65%) and subrounded pebbles (5%) Approx 2kg no odour

* "NS" is an identifier for a duplicate grab sample performed at the same location as the original sample ID#
Source: Canadian Seabed Research Ltd.

Further to the nearshore benthic community research conducted in June 2002, bottom grab samples were taken in July 2005 by Dr. Michael Brylinsky. These bottom samples were taken as part of the sediment survey – see Brylinsky, Michael. "Results of a Sediment Survey in the Near Offshore Waters of the Proposed Quarry Site in the Vicinity of whites Cove, Digby Neck, Nova Scotia". September 2005 (**Ref. Vol. II, Tab 9**). The biological analysis of these samples for macrofauna and macroflora are contained in **Table GS – 2005.**

Table GS - 2005 Macrofauna and Macroflora

Sample Number	Location		Depth** (m)	Physical Characteristics	Biological Characteristics
	Northing	Easting			
2	4927601	726878	30.0	No sediments	1 *Asterias vulgaris*
4	4927727	726854	29.2	Mainly cobble and shell fragments	1 *Astarte undata;* 1 *Ophiopholis aculeata; 2 Nereis* sp.
6	4927512	726922	12.4	No sediments	1 kelp stipe
8	4927717	726653	36.0	Coarse sediments and shell fragments	No living organisms
10	4927985	726378	43.9	coarse sediments, 2-3 cm cobble	*Balanus* shells attached to cobbles; 1 *Astarte undata*
11	4928259	727143	34.7	Coarse sediments and shell fragments	No living organisms
12	4928447	727225	34.7	Coarse sediments	No living organisms
13	4928601	727402	34.7	Coarse sediments and shell fragments	No living organisms
14	4928174	727563	1.8	No sediments	1 kelp and 1 brittle star
17	4928279	727560	1.8	No sediments	1 kelp w/ attached red algae
19	4928792	726983	40.2	Coarse sediments and cobble	*Balanus* shells attached to cobbles 1 *Astarte undata*
20	4928697	727021	34.7	Coarse sediments, 2 cm cobble	*Balanus* shells attached to cobbles

Sample Number	Location		Depth** (m)	Physical Characteristics	Biological Characteristics
	Northing	Easting			
21	4926886	726126	38.4	Coarse sediments, 2 cm cobble	*Balanus* shells attached to cobbles
22	4926804	726104	38.4	Coarse sediments and shell fragments	*Balanus* shells attached to cobbles
27	4926589	726204	7.3	No sediments	1 *Agarum cribrosum*
30	4926497	726558	7.3	No sediments	1 *Laminaria longicruris*

Common Names of Organisms:

Agarum cribosum - sea colander (a kelp)
Astarte undata - wavy astarte
Asterias vulgaris - purple starfish
Balanus sp. - barnacle
Laminaria lonicruris - hollow-stemmed kelp
Nereis sp. - sandworm
Ophiopholis aculeata - brittle star

Source: Michael Brylinsky, September 2005

9.2.4.1.5 Phytoplankton and Zooplankton Community

A seasonal survey of the plankton community offshore of Whites Point was conducted by Dr. Michael Brylinsky – see Brylinsky, Michael. "Results of a Survey of the Plankton Communities Located Offshore of a Proposed Quarry Site at Whites Cove, Digby Neck, Nova Scotia". April 2005 (**Ref. Vol. II, Tab 11**). The objective of the survey was to document the phytoplankton and zooplankton communities present in terms of species composition and abundance – see Appendix 44. Further, this baseline collection was archived as a permanent reference of phytoplankton and zooplankton in the nearshore waters off the Whites Point Quarry and Marine Terminal. The location of the nearshore sample stations are shown on **Map 16.**

The phytoplankton community was dominated by diatoms (51 species). Dinoflagellates (10 species) were also present as well as other species including silicoflagellates and euglenoids. Concentrations of phytoplankton chlorophyll *a* were also measured at each station. Protozoa species were also observed in the phytoplankton samples.

The results of this survey are contained in **Table NS – 5.** The phytoplankton chlorophyll *a* values obtained were for composite samples collected within the upper 30 m (100 ft.) of the water column. These results indicate concentrations during the spring are generally within the range for upper waters obtained from the previously mentioned BioChem data base. Concentrations during summer and fall, however, are much lower and reflect a distinct seasonal trend that suggests a strong spring phytoplankton bloom.

Table NS – 5

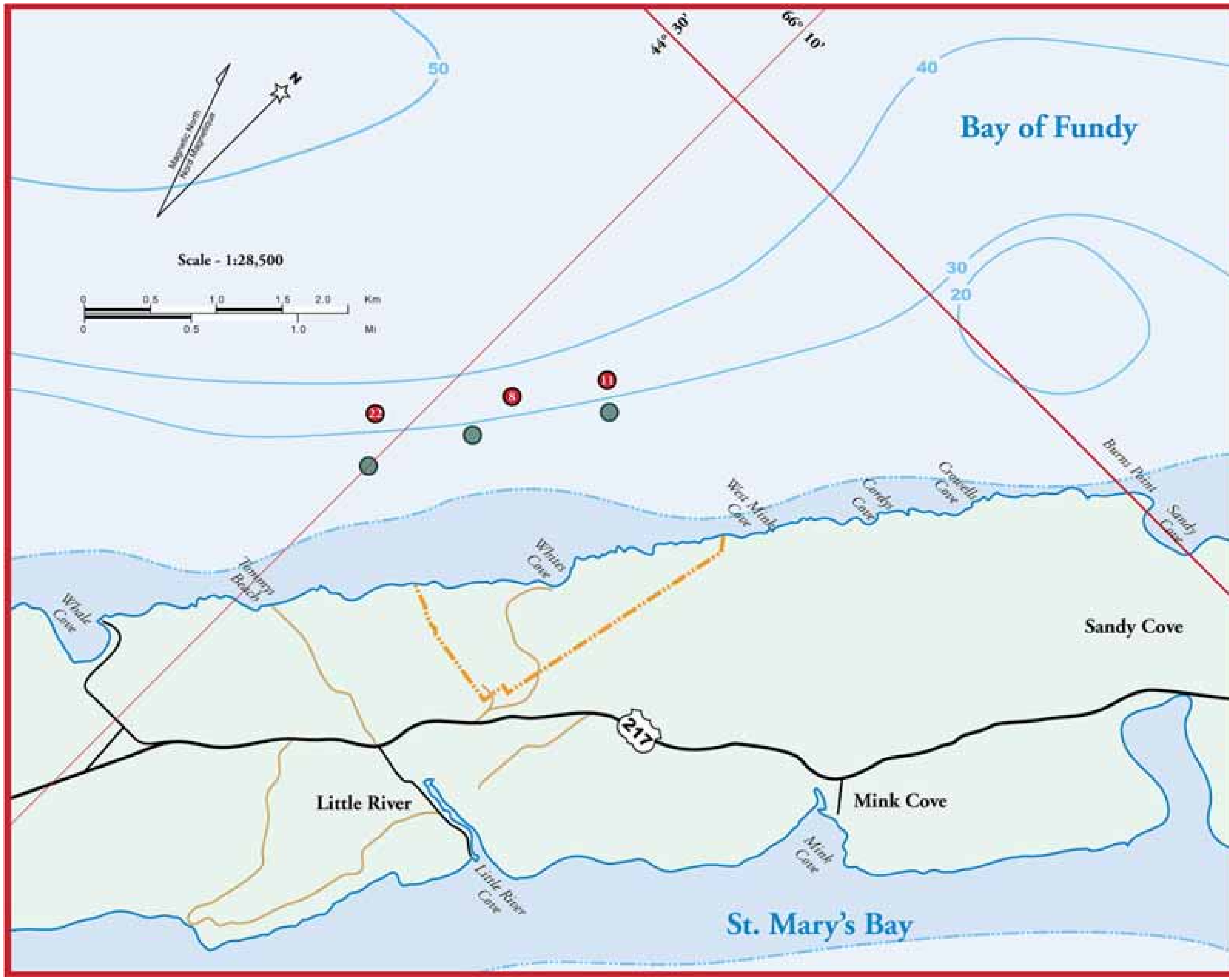
Phytoplankton chlorophyll *a* concentrations measured at each station (Brylinsky 2004).

Station	Date	Chlorophyll *a* (ug/L)
South	04 April 2004	3.6
	28 July 2004	0.8
	21 Oct 2004	0.1
Central	04 April 2004	3.7
	28 July 2004	1.0
	21 Oct 2004	0.3
North	04 April 2004	3.4
	28 July 2004	0.6
	21 Oct 2004	0.1

Whites Point Quarry

Little River, Digby County
Nova Scotia

Environmental Assessment/ Impact Statement



Legend

- Quarry Property Line
- Phytoplankton and Zooplankton Sample Station Location
- Sediment Sample Station Location

Produced for: Bilcon of Nova Scotia Corporation

Oceanography Surveys

Map 16

Graphic Design by Mark Pease, Bear River, N.S.

Zooplankton species were dominated by calanoid copepods with a total of nine species observed. Two species of cladocerans were also present as well as a pteropod, a tunicate and a number of larvae of which *Balanus nauplii* (a barnacle) were the most common and abundant.

9.2.4.1.6 Fish

Potential freshwater fish habitat was investigated on and adjacent to the Whites Point quarry site. One intermittent watercourse flows through the proposed active quarry area. Two intermittent watercourses flow adjacent to the active quarry area at the north and south boundaries of the quarry property. These three watercourses were investigated (Brylinsky 2002) and it was determined that they are unlikely to contain suitable salmonid habitat. Subsequently, the Department of Fisheries and Oceans – Habitat Management Division investigated the watercourse which flows through the active quarry area and found it to be not suitable fish habitat – see Appendix 18. It should be noted that the north and south watercourses are included in the perimeter environmental preservation zone.

The intertidal and nearshore waters along the coast of the proposed quarry provide habitat for various species of fish. Demersal and pelagic finfish, shellfish and crustaceans inhabit these marine waters. Shellfish and crustaceans such as scallop and American lobster live within the benthic (bottom) community. Demersal fish such as flounder, cod, redfish etc. inhabit the lower portion of the water column and are closely associated with the benthic community. Pelagic fish such as herring, mackerel, salmon, shark etc. inhabit the middle and upper water column. Some species such as salmon are anadromous depending upon fresh and marine waters during their life cycle stages. Many of these species are commercially important and are discussed further in **paragraph 9.3.13**.

Sensitive species of marine fish at some level of risk as identified by COSEWIC and NSDNR, such as striped bass (*Morone saxatilis*) (Bay of Fundy population), Atlantic sturgeon (*Acipenser oxyrhynchus*), Atlantic cod (Maritimes population), and gaspereau (*Alosa pseudoharengus*), may possibly be present in offshore waters. A complete list of federal and provincial species at risk and the probability of their occurrence at or adjacent to the quarry and marine terminal are contained in **Table AE – 1,** Appendix 39. The inner Bay of Fundy salmon is designated as "endangered" by COSEWIC and SARA, the striped bass as "threatened" by COSEWIC; and the Atlantic cod as "special concern" by COSEWIC. Accordingly, these species will be treated as VECs and discussed in detail in **paragraph 9.2.5.6 .**

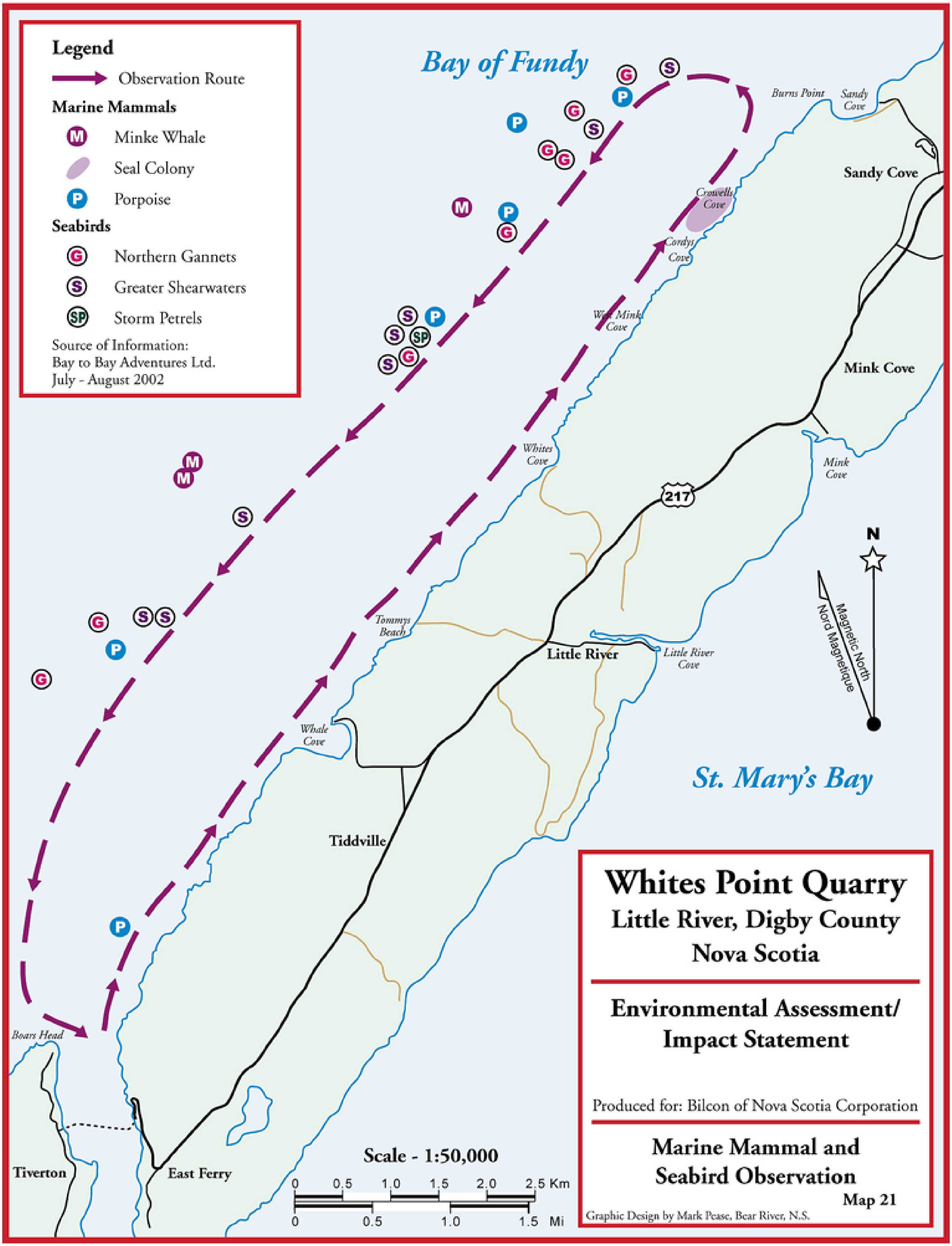
Contaminants in harvested marine organisms are discussed in **paragraph 9.3.19.**

9.2.4.1.7 Marine Mammals

Sixteen species of marine mammals (whales, dolphins, porpoises, and seals) are likely to be found in the Bay of Fundy (Beatty 1989, Ref. 100 . These include the endangered North Atlantic right whale and the blue whale (*Balaenoptera musculus*). Most whales are found in the lower Bay of Fundy, however, harbour porpoises (*Phocoena phocoena*) and seals are found in the uppermost reaches of the Bay. Generally, whales begin arriving in the Bay in late May and leave in October, with some staying into the winter. Harbour seals (*Phoca vitulina concolor*) and gray seals (*Halichoerus grypus*) are resident throughout the year. Following are the documented species of marine mammals and their occurrence in the Bay of Fundy (Beatty 1989).

Fin whale (*Balaenoptera physalus*)	Abundant (June – October)
Minke whale (*Balaenoptera acutorostrata*)	Common (June – October)
Humpback whale (*Megaptera novaeangliae*)	Common (June – October)
North Atlantic right whale	Abundant Locally (June – Sept.)
Harbour porpoise	Common
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Common (June – October)
Pilot whale (*Globicephala melaena*)	Occasional
White-beaked dolphin (*Lagenorhynchus albirostris*)	Occasional
Harbour seal	Common (Resident)
Grey seal	Occasional
Blue whale	Extremely Rare
Sperm whale (*Physeter macrocephalus*)	Rare
Beluga whale (*Delphinapterus leucas)*	Extremely Rare
Killer whale (*Orcinus orca*)	Rare
Blue nose dolphin (*Tursiops truncates*)	Rare
Common dolphin (*Delphinus delphis*	Rare

Since there was little available information concerning the distribution of marine mammals and the summer distribution of waterbirds in the vicinity of the Whites Point Quarry, boat reconnaissances for these taxa were conducted during July and August of 2002 by Bay to Bay Adventures Ltd., an experienced, local whale and seabird tour business operating out of East Ferry, under contract to Bilcon of Nova Scotia Corporation. Weekly trips were made along the coast from Petite Passage to Sandy Cove, approximately 150 m (500 ft.) from shore, and a return trip approximately 1.9 km (1.2 mi.) from shore. Duration of the trips was approximately two hours depending on the weather and sea conditions. The observation route is shown on **Map 21.** From May to October 2003, weekly observations of the nearshore waters off Whites Point were made by David W. Kern, B.Sc. Some casual observations of marine mammals using coastal waters adjacent the Whites Point property were made during investigations of the terrestrial fauna in June


Legend
Observation Route
Marine Mammals
Minke Whale
Seal Colony
Porpoise
Seabirds
Northern Gannets
Greater Shearwaters
Storm Petrels
Source of Information:
Bay to Bay Adventures Ltd.
July - August 2002
Bay of Fundy
Burns Point
Sandy Cove
Sandy Cove
Crowells Cove
Cordys Cove
West Minks Cove
Mink Cove
Whites Cove
Mink Cove
217
N
Magnetic North
Nord Magnetique
Tommys Beach
Little River
Little River Cove
Whale Cove
St. Mary's Bay
Tiddville
Boars Head
Tiverton
East Ferry
Scale - 1:50,000
0 0.5 1.0 1.5 2.0 2.5 Km
0 0.5 1.0 1.5 Mi
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Marine Mammal and
Seabird Observation
Map 21
Graphic Design by Mark Pease, Bear River, N.S.

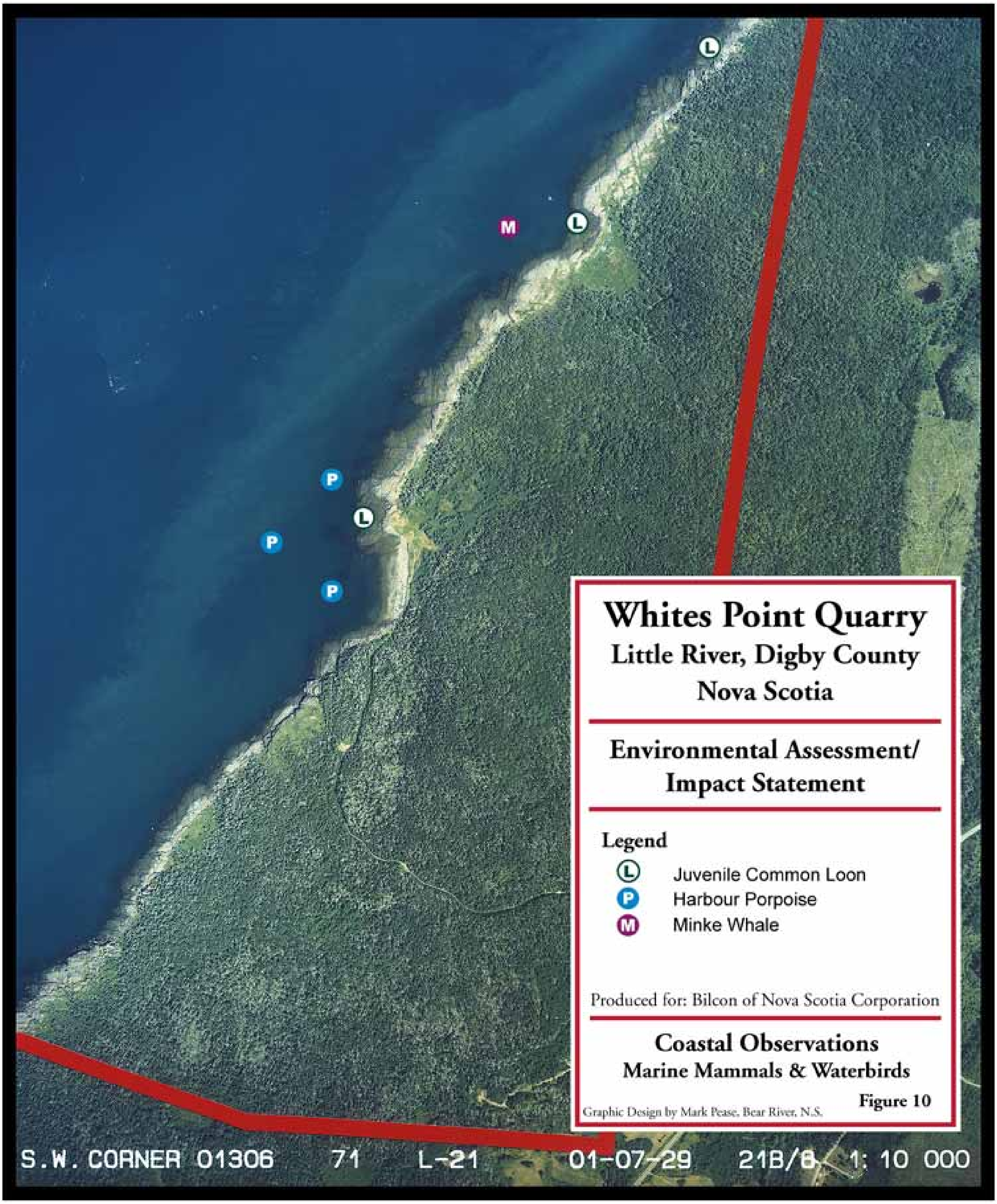
2002 and 2004 (see Alliston, 2004A; Alliston, 2004B). Following is a compilation of the species observed.

The locations where observations of marine mammals including whales, porpoises, and seals were recorded during the boat trips. Three minke whales were the only whales observed on the boat trips – one on July 6, and two on August 1. These whales were observed along the route 1.9 km (1.2 mi.) from shore. A single minke whale was observed approximately 250 m (800 ft.) from shore on June 21 2004 during terrestrial breeding bird surveys (Alliston, 2004b). No whales were observed by Mr. Kern during his weekly observations at Whites Point in 2003. The location of the sightings are shown on **Map 21.**

Groups of four to ten and an occasional lone harbour porpoise were observed during four of the nine boat trips. Occurrence of porpoises were generally along the route 1.9 km (1.2 mi.) off- shore in the area of Whale Cove and from West Mink Cove to Burns Point. A small group (2+) of harbour porpoises was observed just off Whites Point on June 22, 2002 during surveys of terrestrial fauna (Alliston, 2004a). Mr. Kern observed a single harbour porpoise feeding in Whites Cove on June 24 2003. A single harbour porpoise was observed off Whites Cove during harlequin duck surveys on February 9, 2005 (George Alliston- personal communication) The location of the sightings are shown on Figure 10. Lone and small groups of harbour seals and a colony of forty to sixty individuals were observed during every boat trip. Occurrence of seals was continuous along the immediate coast throughout the month of August and at the colony in the area of Crowells Cove. The location of the seal colony is shown on **Map 21.** It should be noted that no marine reptiles were observed during these trips.

Subsequent to the above observations, in a letter dated February 10, 2006 (Appendix 22), the Department of Fisheries and Oceans Environmental Assessment and Major Projects Division furnished comments on Bilcon of Nova Scotia Corporation's Whites Point Quarry and Marine Terminal Blasting Protocol. This letter included results from the Maritimes DFO sightings database for North Atlantic right, finback, humpback, and minke whales as well as harbour porpoises in the vicinity of Digby Neck (see Figure 3 of February 10, 2006 letter). Although not an accurate reflection of the relative density of whales and porpoises in this region, the patterns of occurrence generally reflect other research and whale watching effort in this area of the Bay of Fundy.

Sensitive species of marine mammals at some level of risk, as identified by SARA/ COSEWIC, such as the North Atlantic right whale, blue whale and fin whale, may possibly be present in nearshore waters and we know the harbour porpoise occurs there. A complete list of federal and provincial species at risk and the probability of their occurrence at or adjacent to the quarry and marine terminal are contained in **Table AE-1,** Appendix 39. The North Atlantic right whale and blue whale are designated as "endangered" by SARA/COSEWIC and the fin whale and harbour porpoise are designated as "special concern" by COSEWIC. Accordingly, these species of marine mammals will be treated as VECs and discussed in detail in **paragraphs 9.2.11 and 9.2.13.**



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Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Juvenile Common Loon
Harbour Porpoise
Minke Whale
Produced for: Bilcon of Nova Scotia Corporation
Coastal Observations
Marine Mammals & Waterbirds
Figure 10
Graphic Design by Mark Pease, Bear River, N.S.
S.W. CORNER 01306 71 L-21 01-07-29 21B/6 1: 10 000

9.2.4.1.8 Waterbirds – Summer

Double-crested cormorants (*Phalacrocorax auritus*) were the most abundant bird observed during every boat trip conducted in the summer of 2002. Common eiders were observed during the July 11 trip, while black (*Melanitta nigra*) and white-winged (*Melanitta fusca*) scoters were observed during all of the August trips. Occurrence of these birds was continuous along the inshore transect with the exception of the cormorants which were also sighted on the “offshore” transect. Great blue herons (*Ardea herodius*) were also observed along the coast line during the majority of the trips. Northern gannets (*Morus bassanus*) and greater shearwaters (*Puffinus gravis*) were observed during most trips in July and early August along the “offshore” transect. Small groups of immature northern gannets were also recorded flying over and feeding in waters adjacent to the Whites Point property during terrestrial fauna surveys carried out in late June of 2002 and 2004.

Groups of five to fifteen greater shearwaters were observed actively feeding during the early August boat trips. A group of ten to fifteen were observed off Tommys Beach during the August 8 trip. Northern gannets were also observed diving during the early July trips and one large group of storm petrels was observed feeding off West Mink Cove during the August 8 trip. The location of the sightings of greater shearwaters, northern gannets and storm petrels are shown on **Map 21.**

A single immature (non-breeding) common loon (*Gavia immer*) was observed swimming and diving in the coastal waters adjacent the Whites Point property during terrestrial breeding bird surveys on 23 June 2002. Two immature common loons were observed during similar surveys conducted on 22 June 2004. The locations of these sightings are shown on Figure 10.

No waterbird nesting colonies were observed during the coastal boat surveys or during the terrestrial breeding bird surveys.

Of the waterbird species observed using coastal waters during summer, only the common loon is considered at risk by NS GSR (yellow). However, COSEWIC considers this species to be not at risk.

9.2.4.1.9 Waterbirds - Winter

On behalf of Bilcon of Nova Scotia Corporation, winter use of coastal waters by waterbirds in the Digby Neck area was investigated by W. George Alliston Ph.D. – see Alliston, W. George, “Use by Wintering Waterbirds of Digby Neck and Adjacent Coastal Waters of Southwestern Nova Scotia” 7 June 2005 (**Ref. Vol. I, Tab 3**). This study is based on a literature search, recent surveys conducted by NSDNR and CWS, and field observations.

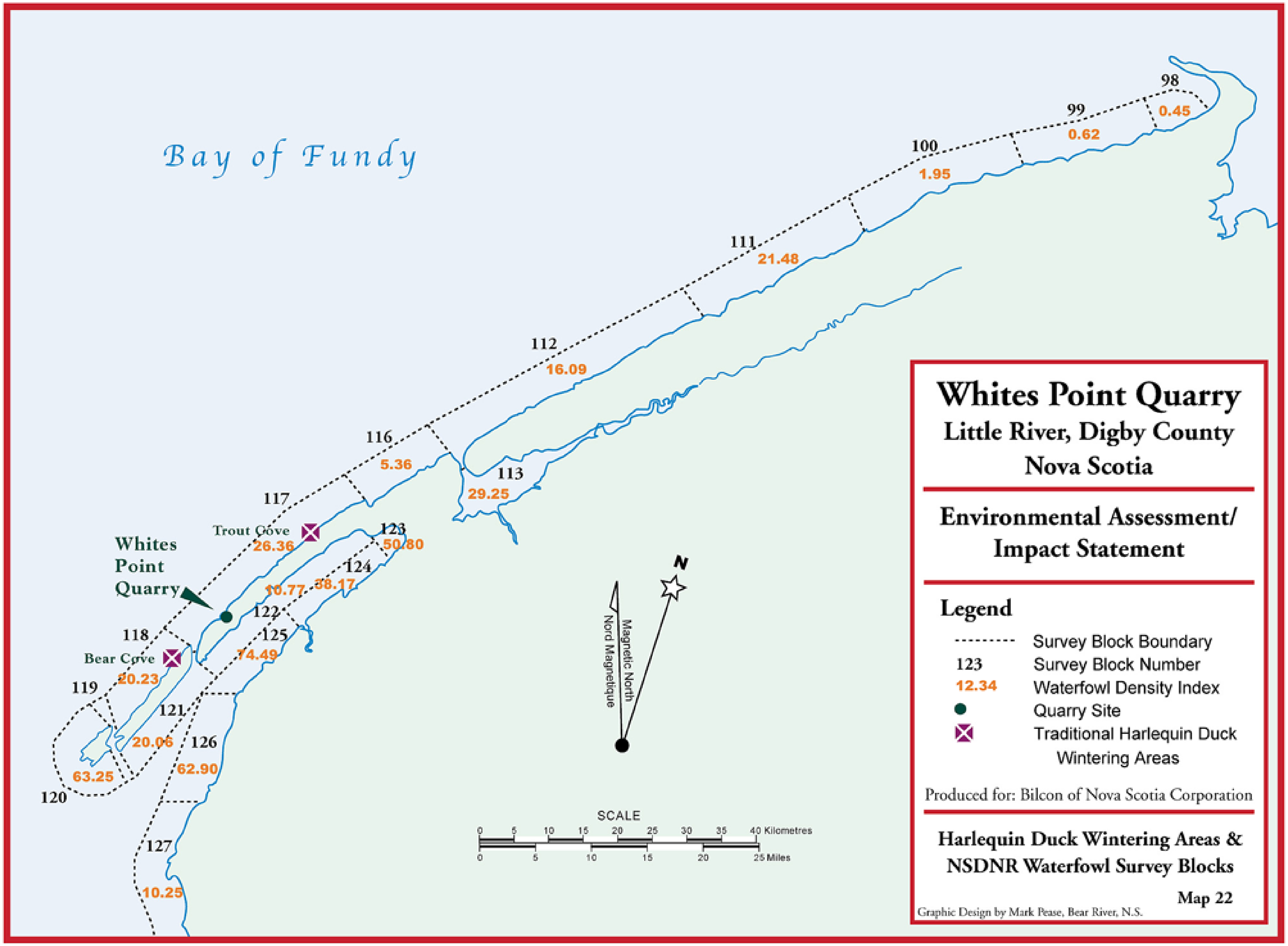
NSDNR helicopter surveys for wintering waterfowl were conducted annually, between mid January and mid February, from 1992 through 2000, along the entire coastline of Nova Scotia. Additional opportunistic surveys were conducted from fixed-wing aircraft. The surveys were broken up into blocks of varying lengths that adhered to a system previously established by CWS.

The block which contained the Whites Point property was designated as block 117 and extends a distance of 36 km (22 mi.) from Boars Head light, at the northern tip of Long Island, through the northern half of Petite Passage to Gullivers Head on Digby Neck, of which about 3 km (1.9 mi.) is the coastline of the Whites Point property. These surveys showed a great deal of variation year by year in the numbers of waterfowl using this block; from a high of 1853 in 1992 to a low of 123 in 1999 with an average of 606. Similar year by year variations were observed in other survey blocks. Although 9 species, and two species groups (scaups – *Aythya spp*. and goldeneyes – *Bucephala spp*.), were identified in block 117, by far the majority of waterfowl observed (84%) were common eiders. Moderate numbers of black ducks (4%), long-tailed ducks (*Clangula hyemalis*) (3%) and goldeneye species (3%) were recorded in this block.

By dividing the numbers of waterfowl observed in each survey block by the length of the block a "density index" (# waterfowl/km) can be obtained which permits a direct comparison among blocks of their use by waterfowl. The location and numbering system of these blocks, and the average waterfowl density index for the period 1992 to 2000, as obtained from the annual helicopter surveys, are shown for the southern Bay of Fundy – St Marys Bay areas on **Map 22.** The average density index for block 117 was 16.8 waterfowl/km (27.0 waterfowl/mi.). Other survey block density indices in the southern Bay of Fundy and Saint Marys Bay range from a low of 0.3 waterfowl/km (0.5 waterfowl/mi.) in the Scots Bay area to a high of 44.2 waterfowl/km (74.8 waterfowl/mi.) in block 125 which includes the coast of Saint Marys Bay between Weymouth Harbour and Church Point .

While aerial surveys are effective in censusing most waterfowl species, they are not particularly effective in censusing harlequin ducks, a species at risk. In 2000, CWS began an annual census of known harlequin duck wintering sites in the Maritimes, using both land based observations and observations made from boats. CWS surveys have identified harlequin duck wintering areas in the Bay of Fundy including portions of the coastline of Digby Neck, Long Island and Brier Island. Of the wintering areas that have been identified in this area, only in the areas surrounding Trout Cove, Digby Neck and Bear Cove, Long Island have harlequin ducks been found consistently and in good numbers. These two wintering areas are located approximately 12 km (7.5 mi.) north and south of the Whites Point property (see **Map 22**). Harlequins have also been observed in Deep Cove/Sandy Cove, Tommy's Beach and Whale Cove on Digby Neck, and at Peajack Cove and Western Light, Brier Island. Only small numbers have been observed at these latter sites and these sites are apparently not used consistently.

In the Digby Neck – Long Island area, known harlequin duck wintering areas were censused from land in 2000 and 2001. However, from 2002 onward, surveys were conducted by boat and extended from the Bear Cove area on Long Island to the Trout Cove area on Digby Neck thus including the coastline of the Whites Point property. In 2004 (February 24) and 2005 (February 9), George Alliston and Bernard Forsythe, on behalf of Bilcon of Nova Scotia Corporation, were guests of CWS biologist Andrew Boyne, on his winter boat surveys of this area.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Survey Block Boundary
123 Survey Block Number
12.34 Waterfowl Density Index
Quarry Site
Traditional Harlequin Duck Wintering Areas
Produced for: Bilcon of Nova Scotia Corporation
Harlequin Duck Wintering Areas &
NSDNR Waterfowl Survey Blocks
Map 22
Graphic Design by Mark Pease, Bear River, N.S.
Bay of Fundy
Whites Point Quarry
Trout Cove
Bear Cove
98
0.45
99
0.62
100
1.95
111
21.48
112
16.09
113
29.25
116
5.36
117
26.36
118
20.23
119
120
63.25
121
20.06
122
10.77
123
50.80
124
38.17
125
74.49
126
62.90
127
10.25
N
Magnetic North
Nord Magnetique
SCALE
0 5 10 15 20 25 30 35 40 Kilometres
0 5 10 15 20 25 Miles

The populations of harlequin ducks wintering in the Maritimes appears to be increasing in recent years and this appears to hold true for that portion of the population wintering in the Digby Neck area. The highest number recorded during CWS surveys was in 2005 when 118 birds were recorded. The previous high count was 86 birds in 2003.

Harlequin ducks using the Digby Neck – Long Island areas are concentrated around their traditional wintering areas centered around Trout Cove, Digby Neck and Bear Cove, Brier Island. During four years of winter boat surveys, no harlequin ducks have been observed using the coastal waters adjacent the Whites Point property. Dr. Alliston and Bernard Forsythe conducted a land based survey of the coastal waters of the Whites Point property from Whites Cove to the north boundary of the property on February 7, 2005 and found no harlequin ducks.

Concerns were expressed by government agencies regarding the possible interaction of harlequin ducks with the Whites Point project if they moved between traditional wintering areas located approximately 12 km (7.5 mi.) on either side of Whites Point. In response to this concern, Bilcon of Nova Scotia Corporation contracted Dr. George Alliston to determine if there were frequent movements of harlequins between these two wintering areas. This study was carried out in the winter of 2005 (see Alliston, W. George, "Wintering Harlequin Ducks in the Digby Neck – Long Island Area, Digby County, Nova Scotia – 2005" 20 May 2005 **Ref. Vol I, Tab 2**). While this study was preliminary and relied on indirect methods, it strongly suggested that, after settling on their wintering grounds, there were no frequent movements of harlequins between these two traditional wintering areas. Indeed some of the information collected suggests that little exchange of birds occurred between these two sites over the entire winter.

During aerial surveys, common goldeneye (*Bucephala clangula*) (not at risk) and Barrow's goldeneye (*Bucephala icelandica*) (a species at risk) cannot be distinguished. These two species can generally be distinguished during boat surveys. Goldeneye species were commonly observed in moderate numbers during winter aerial surveys of block 117. The annual winter boat surveys for harlequin ducks cover more than 75% of block 117 and during the four surveys conducted between 2002 and 2005, no Barrow's goldeneye have been recorded (Andrew Boyne - personal communication). No Barrow's goldeneye were observed during a land based survey of the coastline of the Whites Point property from Whites Cove to the north boundary of the property on February 7, 2005.

Winter aerial surveys were designed to obtain information on waterfowl and provided little information on the distributions of other species of waterbirds (loons, grebes, alcids), so, unlike waterfowl, information to compare use of coastal waters by these species within the region, is not available. Participation in the CWS boat surveys of 2004 and 2005 provided an opportunity to collect information at the local level on the distribution of these species. During these boat surveys, in addition to 10 species of waterfowl, 7 other waterbird species were recorded (see **Table BB**).

Table BB. Waterbird[1] species recorded during CWS boat surveys of portions of Digby Neck and Long Island, Nova Scotia: 24 February 2004[2] and 9 February 2005[3].

DIGBY NECK

	Petite Passage [4]		Long Island		Grand Eddy Point to Whites Point Property		Whites Point Property		NE of Whites Point		Total Digby Neck		TOTAL	
Species	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**
Common Loon	0	0	0	3	0	0	0	9	1	26	1	35	1	38
Red-necked Grebe	0	0	2	1	0	23	0	2	3	36	3	61	5	62
Great Cormorant	6	2	1	1	0	3	1	2	11	8	12	13	19	16
American Black Duck	0	0	0	2	0	10	0	0	2	2	2	12	2	14
Mallard	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Common Eider	700	623	0	12	7	418	1	46	8	83	16	547	716	1,182
Harlequin Duck	0	0	48	49	0	2	0	0	17	67	17	69	65	118
Long-tailed Duck	0	0	21	5	12	73	0	24	39	141	51	238	72	243
Surf Scoter	0	0	0	0	0	0		4	30	40	30	44	30	44
White-winged Scoter	0	0	0	0	0	0	0	0	1	7	1	7	1	7
Common Goldeneye	0	0	0	12	0	51	2	12	0	0	2	63	2	75
Bufflehead	0	0	0	0	0	1	0	0	1	0	1	1	1	1
Red-breasted Merganser	0	2	2	0	0	17	0	0	3	26	3	43	5	45
Duck *sp.*	0	0	0	0	0	0	0	0	5	0	5	0	5	0
Purple Sandpiper	0	0	0	15	0	0	0	0	0	5	0	5	0	20
Common Murre	0	0	0	1	0	0	0	0	0	1	0	1	0	2
Murre *sp.*	0	2	0	0	0	2	0	1	1	6	1	9	1	11
Black Guillemot	0	0	6	5	0	7	0	2	1	23	1	32	7	37
Atlantic Puffin	0	0	0	0	0	0	0	1	0	1	0	2	0	2
Total	**706**	**629**	**80**	**107**	**19**	**607**	**4**	**103**	**123**	**472**	**146**	**1,182**	**932**	**1,918**
Length of coastline surveyed (km)			3.8	6.1	8.2	8.2	2.8	2.8	14.0	16.3	25.0	27.3		

[1] gulls not counted [2] sea state = Beaufort 4+ [3] sea state = Beaufort 0 [4] includes land-based observations

Unlike wintering waterfowl that tend to be found in flocks, some of which can be quite large, other waterbird species found in these coastal waters tend to occur as individuals or in very small, loose groups. The only exception that was observed was red-necked grebes (*Podiceps grisegena*) which, when they were resting/sleeping, were sometimes found in tight flocks of up to 57 birds. These resting flocks were observed on several occasions but were only seen in the shelter of Sandy Cove and Whale Cove. Feeding red-necked grebes were distributed in a similar fashion to other non-waterfowl species. For only one of these waterbird species was a higher density recorded in the coastal waters off the Whites Point property than in other locations covered by the boat survey. That species was the common loon, a species at risk. During the February 9, 2005 boat survey, densities of common loons in the coastal waters of Digby Neck to the south of the Whites Point property were 0.0/km and to the north 1.6/km but at the property were 3.2/km.

A February 7, 2005 land based survey of the coastal waters of the Whites Point property from Whites Cove to the northern property boundary resulted in 13 species of waterbirds being identified and a total count of 672 waterbirds, 601 (89.4%) of which were waterfowl, and of these waterfowl, 467 (69.5%) were common eiders (see **Table CC**). In addition to waterfowl, significant numbers of common loons, red-necked grebes and black guillemots (*Cepphus grille*) were found using these coastal waters. Although not observed during the land-based survey, two days later, during the CWS boat survey, a single Atlantic puffin (*Fratercula arctica*) was recorded in the waters off the northern boundary of the Whites Point property.

Table CC: Numbers* of Waterbirds Observed During a Land Based Survey of the Coastal Waters of the Whites Point Property (from Whites Cove to NE Boundary on 7 February, 2005

Species	Numbers
Common Loon	14
Red-necked Grebe	32
Great Cormorant	6
American Black Duck	12
Common Eider	467
Long-tailed Duck	68
Black Scoter	4
Surf Scoter	23
White-winged Scoter	20
Bufflehead	4
Red-breasted Merganser	3
Thick-billed Murre	1
Black Guillemot	18
TOTAL	**672**

* These numbers include only birds observed swimming/diving in coastal waters. Birds observed flying past but not landing are not included. Gulls were not counted.

9.2.4.1.10 Waterbird Migration

The shores of the inner Bay of Fundy, particularly Shepody Bay, New Brunswick and Southern Bight, Minas Basin, Nova Scotia are vital staging areas for migrating shorebirds. Most notably, this area is used in autumn by between 40 and 75% of the world population (estimated wintering population of 2 to 2.5 million) of semipalmated sandpipers (*Calidris pusilla*) (Hicklin, 1987). These birds arrive in the Bay of Fundy from their arctic breeding grounds starting in mid-July. Here they feed, often doubling their weight during their two to three week stay. These fat reserves are required for their >3200 km (>2000 mi.) non-stop flight from the Bay of Fundy to South America. Flocks of as large as 350,000 birds have been recorded in Shepody Bay. Based on the fact that these areas support the largest numbers of mixed species shorebirds during fall migration in all of North America, they have been designated a Western Hemisphere Shorebird Reserve.

In the southern portion of the outer Bay of Fundy, Brier Island and the marine areas surrounding the island are staging areas for several waterbird species. Part of the coast of Brier Island provides a staging area for shorebirds (mainly semipalmated sandpipers) with peak daily numbers reaching 2000 to 3000 birds in July and August and 1000 birds in September. Atlantic brant (*Branta bernicla*) are also known to stage at Brier Island with daily numbers peaking at 4000 in March (Laviolette, 2003, Ref 132). From late July through September red phalaropes (*Phalaropus fulicaria*) and red-necked phalaropes (*Phalaropus lobatus*) gather in the waters surrounding Brier Island to feed on the copepod *Calanus finmarchicus* prior to dispersing to their wintering grounds in the offshore waters off Africa. Daily peaks of as many as 100,000 birds have been recorded (Laviolette, 2003).

Between 1994 to 2000, NSDNR conducted several opportunistic fixed-wing aircraft surveys for waterfowl in the coastal waters of Nova Scotia, including the Bay of Fundy and Saint Marys Bay, during the period between late March and late May; an interval that covers the peak spring migration period for most waterfowl (see Alliston 2005a). Six surveys of block 117, a 36 km (22 mi.) section of the coast which includes the 3 km (1.9 mi.) shoreline of the Whites Point property, were flown. The only waterfowl species recorded in block 117 was the common eider. During these surveys 30 birds were recorded on two surveys, 3 birds on one survey and no birds were recorded on three surveys.

The only location on the southern Bay of Fundy coast where significant numbers of waterfowl were recorded during spring aerial surveys was on block 100 which extends from Margaretsville to Black Rock. During a survey on May 16, 2000, 1186 scoters (1120 of which were black scoters) and 1151 common eiders were recorded in this block. Moderate numbers of common eiders (max. 173 on March 24, 1994) and Atlantic brant (max. 550 on April 26, 1994) were regularly recorded in the coastal waters of Brier Island.

Relatively little is known of the actual routes taken by waterbirds migrating through the outer Bay of Fundy. Routes could be coastal or offshore. For those birds using coastal routes to travel to and from their southern wintering grounds, it would seem more likely thatmost would travel along the north coast of the Bay, via the coasts of Maine and New Brunswick. Falardeau et al. (1998, Ref. 216) reports "thousands" of spring migrant surf scoters (*Melanitta perspicillata*) following this route. While this appears to also be the case for much of that portion of the Atlantic brant population that uses the coastal migration route (Erskine, 1988), those birds that stage at Brier Island may follow coastal migration routes along the southern Bay of Fundy. It seems likely that some other waterfowl species, as well as loons and grebes might also use such routes.

Common loons are diurnal migrants that follow migration paths that sometimes are just offshore following coastlines although they also follow offshore and overland routes. When migrating over water common loons fly at heights of e"15 m (50 ft.) (Sibley, 1993, Ref. 224).

Red-necked grebes are known to have extensive diurnal migratory movements along coastlines but overland movements are strictly nocturnal. During over water migratory flights observed at the Whitefish Bird Observatory, MI, most red-necked grebes flew at heights of from 0.5 to 50 m (1.5 to 165 ft.) above water and generally remained at least 750 m (0.5 mi.) offshore (Stout and Nuechterlein, 1999, Ref. 225).

In Alaska, migrant black scoters fly low (<100 m – 330 ft.) over marine waters and usually > 1 km (0.6 mi.) from shore (Herter et al. 1999, Ref. 218).

Barrow's goldeneye pairs, on the other hand, are believed to migrate alone and at night in a somewhat direct line from wintering to breeding areas (Savard, 1985, Ref. 223. Harlequin ducks are believed to take direct routes between wintering and breeding areas but may stage in coastal areas (Robertson and Goudie, 1999, Ref. 221).

9.2.4.1.11 Waterbird Species at Risk

Sensitive species of waterfowl at some level of risk such as the Atlantic brant, harlequin duck and Barrow's goldeneye are known to be present as regular, seasonal visitors in the region of the Whites Point property. Another waterbird species at risk, the common loon, is known to use the nearshore waters adjacent to the Whites Point property. A single sighting of another bird species at risk, the Atlantic puffin, was made in the waters off the Whites Point property. A complete list of federal and provincial waterbird species at risk and the probability of their occurrence at or adjacent to the quarry and marine terminal are contained in Table AE-1, Appendix 39.

The eastern population of the harlequin duck is designated as of "special concern" by SARA/COSEWIC, as "endangered" under NSESA and "red" under the NS GSR. The eastern population of Barrow's goldeneye is designated of "special concern" by SARA/ COSEWIC and "yellow" under the NS GSR. Accordingly, these two species will be treated as VECs and discussed in detail in **paragraph 9.2.7**. The Atlantic puffin, common loon and Atlantic brant are designated as colour rank "yellow" under the NS GSR but are not designated as being at risk by SARA/COSEWIC. These latter species are discussed below.

Atlantic Brant

The Atlantic brant nests in the Canadian low arctic near Foxe Basin and winters along the Atlantic coast from Massachusetts to North Carolina (Reed *et al*, 1998). The spring and autumn migrations take many of these birds through the Bay of Fundy (Lincoln *et al*., 1998; Erskine, 1988). Although most of these birds follow the north coast of the Bay of Fundy, some make regular stopovers at Brier Island during their migrations. The main spring migration occurs in March when daily counts at Brier Island can reach 4000 birds (Laviolette, 2003). The peak of autumn migration occurs in early November. In recent years small numbers have wintered at Brier Island (Tufts, 1986).

Brier Island was the only location where observations were made of Atlantic brant during winter and spring aerial surveys conducted between 1992 and 2000 by NSDNR of the coasts of the southern Bay of Fundy and St Marys Bay. While these birds may fly past the Whites Point property during migration, there is no indication that they would stage in this area. Their preferred food is eelgrass (*Zostera sp*.) which does not occur in the coastal waters adjacent to this property.

Common Loon

The Province of Nova Scotia has assigned the common loon a colour rank "yellow" based mainly on the fact that the Nova Scotia breeding population appears to have a lower reproductive rate than breeding populations in other parts of eastern Canada (Kerkes, 1992). COSEWIC considers this species as "not at risk" in Canada.

There are only two lakes on Digby Neck that are large enough to provide breeding habitat for common loons; Harris Lake and Lake Midway. Harris Lake is the closer being approximately 7 km (4.5 mi.) from the Whites Point property and nesting there by common loons has been confirmed.

Very small numbers of immature, nonbreeding common loons (one in 2002; two in 2004) were observed using the coastal waters of the Whites Point property during summer. Larger numbers of wintering common loons (14 birds on February 7, 2005) were found using the coastal waters of the property between Whites Cove and the northern boundary of the property. During the CWS boat survey of February 9, 2005 from Bear Cove, Long Island to Trout Cove, Digby Neck, the highest density index (3.2/km) recorded for common loons was in the coastal waters of the Whites Point property.

Common loons are migratory and in Nova Scotia there are “definite migrations along the coast: north largely between mid-March and late April, and south between mid-September and late November” (Tufts, 1986). Since there is a general southward migration of common loons during autumn, the common loons wintering along the coasts of Nova Scotia, including the Whites Point property, are likely to be from populations that breed in more northerly areas and not from the Nova Scotia breeding population that is considered at risk. Immature common loons may remain on their wintering grounds throughout the year (Viet and Petersen,1993) so immature birds using the coastline during summer are also unlikely to be from the Nova Scotia breeding population.

Although densities of wintering common loons observed along the coast of the Whites Point property in February 2005 were higher than in adjacent areas, since common loons do not tend to aggregate in flocks but are generally widely distributed, the actual numbers that might be exposed to project activities are not large. Fourteen common loons were counted during the survey that was conducted on February 7, 2005, under perfect viewing conditions, of the Whites Point property coastline from Whites Cove to the north boundary.

Like many waterbird species, common loons have a “catastrophic” moult during which they simultaneously lose their flight feathers and become flightless for about a month. Unlike most waterbird species, adult common loons moult during winter (January to March) (McIntyre, 1988; Woolfenden, 1972). Immature common loons moult during spring and summer. Moulting common loons are less mobile and hence more vulnerable during this period.

Atlantic Puffin

Worldwide, the Atlantic puffin is a relatively common species with an estimated 6 million pairs breeding in colonies from northwest Russia to eastern North America (Chardine, 1999; Nettleship and Evans, 1985). It is because of the small number and size of these breeding colonies on islands off the Nova Scotia coast, at the southern periphery of their range, and their vulnerability, while concentrated at their breeding colonies, to accidents (e.g. oil spills), disturbance and predation, that the Province of Nova Scotia has assigned this species a colour rank “yellow”.

There are no Atlantic puffin colonies in the southern Bay of Fundy - Saint Marys Bay area. The six colonies in Nova Scotia are on islands off the coast of Cape Breton and the South Shore. There are also several small colonies in the Gulf of Maine.
While gregarious during the breeding season, outside the breeding season Atlantic puffins are widely distributed in “ones and twos” generally far offshore in the North Atlantic. The two winter observations of Atlantic puffins made in the vicinity of the Whites Point property constitute uncommon occurrences of a species that is widely distributed in winter and, in general, shows a marked preference for offshore wintering areas.

9.2.4.1.12 Other Waterbirds

Red-necked grebes and black guillemots are two species that were observed in significant numbers in the coastal waters adjacent to the Whites Point property during the land based survey conducted on February 7, 2005 (see **Table CC**). Relatively low numbers of these species were recorded in the same area two days later during a boat survey (see **Table BB**). Although neither of these species is identified on the four priority lists used in the identification of species at risk for this EIS, both are identified as being at risk in Nova Scotia by ACCDC.

9.2.4.1.13 Invasive Species

Invasive species lists such as the Global Invasive Species Database for Canada include the European green crab, Common periwinkle, and Zebra mussel (Dreissena polymorpha) as invasive species inhabiting marine environments. Also, Invasive species.gov lists the European green crab and the Zebra mussel. As previously mentioned, the European green crab and common periwinkle were observed in the intertidal zone at the Whites Point quarry site. In view of the lack of baseline data specific to the marine waters at Whites Point regarding phytoplankton and zooplankton, Bilcon of Nova Scotia Corporation surveyed nearshore waters for these marine organisms (Brylinsky 2005 **Ref. Vol. II, Tab 11)**. The results of the phytoplankton and zooplankton survey are included in Appendix 44.

9.2.4.2 Analyses

Potential impacts of the Whites Point Quarry and Marine Terminal on nearshore areas of the Outer Bay of Fundy will be confined to areas immediately adjacent to the Whites Point property. The primary direct disturbance of coastal – nearshore marine habitat would occur in the area of the proposed marine terminal– see **Figures 2 and 3**. Secondary direct disturbances within the nearshore waters would result from vessel arrivals, loading, and departure which is scheduled for approximately once per week throughout the year with a twenty-four hour length of stay. An 800 m radius (one half mile) seaward from the marine terminal berth would be required by the vessel as a turning radius during arrival and departure as it manoeuvres to and from the berth, depending on weather and tidal conditions. In addition to these direct disturbances, land based activities and the noise produced by construction, quarry operations and, particularly, blasting, could also affect fauna using adjacent nearshore areas. These issues are addressed in the sections that follow. Blasting is treated separately from other potential impacts (see below). The potential impacts on nearshore marine areas of runoff from the site has been addressed in a previous section (see Surface Water Drainage, **paragraph 9.1.6)**.

9.2.4.2.1 Benthic Community

The bottom conditions off Whites Point in the area of the proposed marine terminal provide good habitat for American lobster which generally occur from 1 m (3.3 ft.) below low tide – seaward. Bottom samples and underwater video of this area also revealed the presence of sea cucumbers, sea urchins, starfish, and crabs, all food sources for lobster. Pelagic fish such as herring are also present in the nearshore shallow waters (less than 10 m – 33 ft.) and off shore to depths of 200 m (660 ft.).

There appears to be little or no infauna (animals that burrow into sediments) present as a result of the instability of the sediment surface and the strong erosional processes as evidenced by the 2002 bottom grab samples. This is common in high energy environments where waves and water currents are strong enough to create an unstable bottom substrate which prevents the deposition and accumulation of fine sediments. Further, analysis of the 2005 bottom sediment samples also produced few living organisms.

9.2.4.2.2 Plankton

The nearshore area of the proposed Whites Point Quarry and Marine Terminal falls within the outer Bay of Fundy and contains a distinct plankton community. Early studies of this region of the Bay over the past 60 years have reported results similar to the research cited previously (Brylinsky 2005 **Ref. Vol. II, Tab 11**). The zooplankton community along the Digby Neck shoreline is dominated by species that are common to the southwest Nova Scotia shoreline, such as *Acartia sp., Calanus finmarchicus, Oithona sp., Pseudocalanus sp., and Temora lonicornis*. This region also tends to have higher concentrations of zooplankton than the central Gulf area as a result of upwelling systems that bring in nutrient rich waters. This is reflected in this research by the high chlorophyll *a* concentrations observed during the spring survey and the relatively high zooplankton numbers observed.

Populations of euphausiids, a major food item of whales, are common within the Bay of Fundy, but are typically located in areas where water depths range between 125 – 200 m (410 – 660 ft.). Euphausiids are not commonly found in large numbers along the southwest Nova Scotia shelf, however there have been reports of populations present during the summer off Brier Island. No euphausiid species were observed in this survey and it is unlikely that they would be abundant or common to the Whites Point area because of the shallow water depth.

A number of potentially harmful algal species are common in the Bay of Fundy and were observed during this survey. The most common species are the dinoflagellate *Alexandrium sp.* and the diatom *Pseudo-nitzschia sp. Alexandrium sp.* produces a Paralytic Shellfish Poisoning (PSP) toxin. *Mesodinium rubren* is another dinoflagellate observed in this survey which can produce red tides that result in a depletion of dissolved oxygen in areas where tidal mixing is weak and flushing rates low. Red tides have occurred in Passamaquoddy Bay and resulted in mortality of cage-reared salmon.

In conclusion, the phytoplankton and zooplankton community along the Whites Point shoreline is typical of the region. In terms of species composition and abundance, numbers are similar to other surveys. Based on comparisons with the results of other plankton surveys, there does not appear to be any unique characteristics associated with the plankton community along this shoreline (Brylinsky 2005).

9.2.4.2.3 Fish

A direct loss of bottom fish habitat and alteration of water column habitat will result from the placement of pipe piles in nearshore waters. This loss and alteration of fish habitat will be compensated for with an area of bottom habitat three times the size of the area lost and with features attached to selected pipe piles in various depths in the water column to enhance food sources for pelagic fish. For a detailed discussion of the compensation plan see **paragraph 9.2.4.3** and Appendix 17**.** Potential effects of shading on the euphotic zone resulting from the mooring dolphins was discussed with the Department of Fisheries and Oceans – Habitat Management Division and deemed not to be a concern.

9.2.4.2.4 Marine Mammals

The most frequent species of marine mammals observed during coastline whale and waterbird boat trips conducted in the immediate area of the proposed marine terminal during July and August, 2002, were lone and small groups of harbour seals. However, a seal colony of 40 to 60 individuals was observed in the area of Crowells Cove, approximately 3 km (2 mi.) north of Whites Point.

Although during Bilcon of Nova Scotia Corporation's studies, the only whales observed along the coastline were minke whales (four sightings), historic records indicate that North Atlantic right whales have strayed toward the Digby Neck coast. Satellite – monitored movements of a North Atlantic right whale adult female with calf were recorded in the nearshore waters off west Sandy Cove (Mate, et al 1992, Ref. 71). Harbour porpoises were regularly observed in the inshore waters during summer boat reconnaissances between East Ferry and Sandy Cove. On three occasions harbour porpoises were recorded at Whites Cove; twice in summer by land based observers and once during a winter boat survey of harlequin ducks

9.2.4.2.5 Waterbirds

During the summers of 2002 and 2004 relatively few waterbirds were recorded using the coastal waters of the Whites Point property and adjacent areas. Marine bird species that breed at these latitudes are generally colonial and often nest on islands, cliffs or in talus slopes and are concentrated in the vicinity of these nesting areas. With the possible exception of some small cormorant and gull colonies, there are no colonies of marine birds in the vicinity of the Whites Point property.

Birds that use these coastal waters in summer are generally non-breeding, immature birds, post-breeding birds, or breeding birds whose nesting attempts have failed. One immature common loon in 2002 and two in 2004 were observed in the coastal waters adjacent to the Whites Point property. Small groups of immature northern gannets were also observed there. Small flocks (max. 52 birds) of common eiders were observed using the coastal waters between East Ferry and Sandy Cove, including the Whites Point property. Two pelagic seabird species/species groups were recorded during the nearshore summer boat reconnaissances; storm petrels and greater shearwaters. Both are common in offshore waters of the Bay of Fundy during summer months but are not common in nearshore areas.

In winter greater numbers of waterbirds use the coastal waters of the Whites Point property and adjacent areas than in the summer. During boat surveys conducted in February 2004 and 2005 a total of 17 species of wintering waterbirds was observed using the coastal waters of the Bay of Fundy between Bear Cove, Long Island and Trout Cove, Digby Neck (see **Table BB**). Ten of these species were waterfowl. Of the 1918 waterbirds counted on the 2005 survey (when survey conditions were optimal) 1730 (90%) were waterfowl and of these 1182 (68%) were common eiders. Of the common eiders, 623 (53%) were in Petite Passage.

From aerial surveys of wintering waterfowl conducted by NSDNR between 1992 and 2000 we know that there can be considerable annual variation in the numbers of waterfowl using various portions of the coastline of the southern Bay of Fundy and Saint Marys Bay. Despite these annual variations, it was evident that some areas are favoured over others (see **Map 22)** In relation to other coastal areas in this region, waterfowl survey block 117, in which the Whites Point property is located, would rank as having moderate significance, which may be influenced by high concentrations of common eiders that regularly occur in Petite Passage. All of Saint Mary's Bay and Petite Passage are considered significant habitat for migratory waterfowl by the NSDNR (see Significant Species and Habitat database). Other than Petite Passage, survey block 117 is not identified on this database as containing significant migratory waterfowl habitat. However, within block 117, in the area surrounding Trout Cove, and in block 118 in the area surrounding Bear Cove, are important wintering areas for harlequin ducks; a species at risk.

For waterbird species, other than waterfowl, that winter along the coasts of southwestern Nova Scotia (e.g. loons, grebes, alcids), information similar to that for waterfowl is not available, so favoured areas within a regional context, and annual and within-year variations in usage of different sections of coastline are unknown . The winter boat survey of February 9, 2005, which was conducted under exceptionally favourable weather conditions, provides a good "snapshot" of the distribution of these "non-waterfowl" waterbirds between Bear Cove, Long Island and Trout Cove, Digby Neck (see **Table BB**). Similarly, the land-based survey of February 7, 2005, also conducted under exceptionally favourable weather conditions, provides a good "snapshot" of the usage of the coastal waters of the Whites Point property between Whites Cove and the north boundary of the property by all waterbird species (see **Table CC**).

The coast of the Whites Point property does not have appropriate habitat for staging shorebirds and spring aerial surveys conducted between 1992 and 2000 revealed a general lack of waterfowl in the 36 km (22 mi.) block of coastline that contains the Whites Point property. It would seem quite unlikely that the property coastline would serve as a staging area for other waterbird species but this is not known.

Some migratory waterbirds may follow coastal routes that take them past the Whites Point quarry and terminal. The terminal and loading facility might pose a hazard to coastal migrants under poor visibility conditions. The probability of collisions would be maximum when a bulk carrier was docked, thus presenting the maximum surface area at right angles to the birds direction of travel. Although this presents a hypothetical risk, we are unaware of similar situations where bird collisions have been identified as being a problem.

Waterbirds following coastal migration routes are likely to be using mainly visual cues to determine their migration paths. Unlike land birds migrating over water, waterbirds are able to land on the water if visibility becomes poor. Observations of coastal migrants in other areas suggest that many species migrate by day and follow paths over water that are some distance from shoreline .

The eastern populations of both the Harlequin duck and Barrow's goldeneye are designated as "special concern" by SARA/COSEWIC and have been recorded in the region of the proposed Whites Point Quarry. Accordingly, these species will be treated as VECs and discussed in **paragraph 9.2.7 .**

Other waterbird species considered to be at risk (yellow) by the Province of Nova Scotia and known to occur within the region include the common loon, Atlantic brant, and Atlantic puffin. Of these three species, only the common loon is a regular inhabitant of the nearshore waters of the Whites Point property.

Common Loon

As discussed above, small numbers of immature common loons (1 in 2002; 2 in 2004) were observed using the coastal waters adjacent the Whites Point property in summer. Larger numbers (14 in 2005) of wintering birds were observed using these same waters. Since common loons are migratory, and immature loons may remain year round on their wintering grounds, the common loons that use the coastal waters of the Whites Point property in summer and winter are unlikely to be from the Nova Scotia breeding population that is considered at risk.

Common loons, as well as other waterbird species using these coastal waters, are likely to be excluded from nearshore areas immediately adjacent to where human activity and noise is being generated. Flightless, moulting birds are more vulnerable and tend to be more sensitive to disturbance. Moulting common loons tend to seek out protected areas with a reliable supply of food (fish).

It is not known whether wintering adult common loons remain along the rather exposed coastline of the Whites Point property or move to more sheltered bays during their moult.

The marine environment, particularly in the nearshore area, is a naturally noisy environment. Given the restrictions on noise levels at the property boundaries (65 dBA during the day and 55 dBA at night) the distance from the property boundary at which normal operations based noise is masked by background noise, under most circumstances, would not be great. Most animals also acclimate to some level of disturbance (noise & visual) once they learn that the disturbance does not pose a direct threat. All wintering waterbirds using the coastal waters of Digby Neck must have developed some degree of acclimation to disturbance given the level of boat activity associated with the lobster fishing season in these waters (December to May). Boats operating in the waters the birds are using would likely be perceived as a greater threat than land-based activities generating disturbances of a similar nature and magnitude.

9.2.4.3 Mitigation

The proposed construction system for the marine terminal, including the ship loader and conveyor supports, is designed to have minimal effect on the nearshore bottom habitat and water column see **Figures 2 and 3.** The marine terminal infrastructure will be supported on pipe piles anchored to the bedrock bottom. Construction in the nearshore waters below low tide will require drilling sockets and anchor holes for the pipe piles supporting the berthing dolphins, ship loader, and conveyors. Proposed pipe piles, pending detailed design, are thirty-six inch diameter resulting in a permanent displacement of sublittoral nearshore bottom habitat of 31.2 m^2 (336 ft^2) or 0.003 ha (0.008 acres) resulting in a harmful alteration, disruption or destruction (HADD) of fish habitat and will require a *Fisheries Act Subsection 35(2) Authorization*. A “Fish Habitat Compensation Plan” – see Appendix 17 - to balance this loss has been approved in principle by the Department of Fisheries and Oceans – Habitat Management Division.

Construction will be carried out from a floating platform. Socket drilling will produce aggregate size material with little fines. Anchor drilling will be carried out within the pile casing thus confining any fines. Since construction will be carried out in basalt bedrock, and no bottom sediments are present, water quality in the nearshore should experience negligible alteration with this construction process. The use of this construction technique will maintain virtually unobstructed shoreline and nearshore currents.

Although more expensive than other construction techniques, no long term loss of bottom habitat is anticipated that cannot be compensated. As part of the Compensation Plan, selected pipe piles will have increased surface area of vertical habitat in the water column to attract food sources for pelagic fish. No dredging, filling, or blasting in the coastal – nearshore waters is proposed.

Intermittent (weekly) surface water disturbance can be expected within an 800 m (0.5 mi.) radius of the marine terminal when the vessel arrives, loads, and departs. During the months of January and February vessel traffic will be reduced, possibly to zero, depending upon weather conditions. No other disturbances are proposed within the coastal marine environment along the shoreline of the property.

Ship/marine mammal and waterbird interactions within this 800 m (0.5 mi.) radius are unlikely due to the slow movement of the vessel while manoeuvring into and out of the berth. The overall duration is expected to be less than 24 hours from arrival to departure. In any event, an onshore observer, situated on the elevated ship loader, will be in place at least one hour prior to the vessel arriving and departing. The observer will wear polarized sunglasses, be equipped with pedestal mounted 7 x 50 binoculars and radio communication with the vessel captain. If marine mammals or waterbirds are sighted, communications regarding their location will be transmitted to the captain of the vessel. In the event the vessel arrives or departs at night or in times of low visibility, the work boat will be used for on water surveys of the vessel's route.

By meeting the stipulated noise requirements at the coastal property boundaries (65 dBA during the day and 55 dBA at night) the noise from land-based activities should not penetrate far into the often noisy nearshore marine environment. Animals that could potentially be affected are those that use habitats closest to shore which would be waterbirds, pinnipeds and one cetacean, the harbour porpoise. Animals often acclimate to some level of acoustic and visual disturbance once they learn that it does not constitute a direct threat.

The tallest structure proposed for the Whites Point Quarry and Marine Terminal is the ship loader, which extends to a maximum height of 30 m (100 ft.) above the ordinary high water line. Lighting on the ship loader would only be used when loading a ship at night and will be shaded so that light is directed downward. At most, loading would occur once a week. When not being used, the ship loader would not be lighted. These measures should minimize any possible attraction of coastal migrant waterbirds to the marine terminal facilities.

9.2.4.4 Monitoring

During construction of the marine terminal, especially when sockets are being drilled for the pipe piles, visual monitoring of possible turbidity will be undertaken. If excessive change occurs in the turbidity levels 100 m (330 ft.) from the construction site that differs from existing conditions (i.e. distinct colour differences) as a result of the drilling activities, the work will be stopped and turbidity levels will be assessed in relation to marine aquatic life guidelines. Assessment of turbidity levels would be conducted 100 m (330 ft.) from the construction site using a turbidity meter giving nephelometric turbidity units (NTUs).

A moored datalogger would be installed if required. A maximum allowable increase of 8 NTUs from background levels under clear flow conditions for a short-term exposure (e.g. 24-h period) would be considered to be within acceptable guideline criteria. The Department of Fisheries and Oceans representative will be notified to determine if additional mitigation measures are required if the guideline criteria is exceeded.

Due to the public and fishing industry concerns expressed regarding invasive species in the marine environment, especially as a result of ballast water discharge at the Whites Point Marine Terminal, Bilcon of Nova Scotia Corporation will conduct monitoring at the Marine terminal to document any changes from baseline conditions. Monitoring of phytoplankton and zooplankton in waters adjacent to the marine terminal will be conducted to provide an early detection of possible invasive species. For a detailed discussion of ballast water refer to **paragraph 9.2.1.4.**

Monitoring of the effectiveness of the proposed fish habitat compensation plan will also be carried out by Bilcon of Nova Scotia Corporation. Details of this monitoring program will be determined in consultation with DFO.

9.2.4.5 Impact Statements

Coastal – Nearshore Marine Habitat – Construction

Since construction in nearshore marine waters for berthing, ship loader, and conveyor supports is expected to take one year and will be conducted during periods of low biological activity, this would result in a ***short term, insignificant negative effect, of local scale.***

Coastal – Nearshore Marine Habitat – Life of Project

Since the only disturbance in the coastal – nearshore marine habitat along the entire shoreline is berthing, ship loader, and conveyor supports anchored to the bottom and loss or alteration of marine habitat is compensated, this would result in a ***long term, neutral (no) effect, of local scale.***

Marine Mammals and Waterbirds

Given the frequency (weekly), duration (24 hours), and the slow speed of the vessel within 800 m (0.5 mi.) of the marine terminal, together with the proposed visual monitoring during arrival and departure, marine mammal, or waterbird/vessel direct interactions are not anticipated. However, disturbance due to land based activities, ship loading (noise) and vessel manoeuvring could result in temporary or longer term displacement of animals from part of their home range resulting in a ***long term, insignificant negative effect, of local scale.***

9.2.5 Fish – Endangered

Introduction

Two different population assemblages of anadromous Atlantic salmon are present in the Bay of Fundy. The "outer Bay of Fundy salmon" and the "inner Bay of Fundy salmon" (iBoF) salmon. The iBoF salmon populations are found in drainages of the Bay of Fundy above a line connecting the Saint John River in New Brunswick and the Annapolis River in Nova Scotia. Historically, the iBoF salmon most likely inhabited at least 40 rivers and streams entering the Bay of Fundy. iBof salmon, except for the Gaspereau River population, all have similar life history traits that differ from the outer Bay of Fundy salmon. iBoF salmon demonstrate more localized migration, earlier age at maturity, high survival between spawning events, and a dependence on repeat spawning for population stability. Although the Gaspereau River population possesses the same genetic uniqueness common to the iBoF populations, marine migratory patterns and life history traits are similar to the outer Bay of Fundy salmon.

Since 1989, wild populations of the iBoF salmon have declined 90% or more in abundance and are currently considered at risk of extinction. Documentation of continued population declines prompted immediate actions to prevent the iBoF salmon's extinction. In May 2001, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the inner Bay of Fundy Atlantic salmon as endangered. As a result, a National Recovery Strategy for the inner Bay of Fundy (iBoF) salmon populations was prepared in 2002. This recovery strategy presents actions necessary to protect, conserve and ensure the recovery of the assemblages of iBoF salmon. A national recovery team is presently in place to implement the recovery strategy.

9.2.5.1 Research

Extensive literature research on the biology, movements, and migrations of Atlantic salmon in the Bay of Fundy was conducted by M. J. Dadswell, PhD – see Dadswell, M.J. "Migration of Inner Bay of Fundy Salmon in Relation to the Proposed Quarry in the Digby Neck Region of Nova Scotia", November 2004 (**Ref. Vol. V, Tab 25)**. Research included available tag return data from the last 90 years on Atlantic salmon released from sites within and outside the Bay of Fundy.

This research indicates that the seaward migration or departure of kelts (spawned-out adult salmon) from inner and outer Bay of Fundy rivers is along the New Brunswick shore. The rate of migration is rapid (up to 50 km/day), taking only a few weeks during May and June. Spawning migration or return of adults to outer Bay of Fundy rivers occurs during May to August and return to inner Bay of Fundy rivers occurs during July to October. Salmon returning to the outer Bay of Fundy rivers (e.g., the Saint John River) appear to move directly across the Bay at its outer end. Salmon returning to the inner Bay of Fundy rivers do not appear inshore until they reach the mid-Bay region around Kings County, Nova Scotia. Migration routes of Atlantic Salmon are shown on **Map 26.**

No recapture of tagged Atlantic salmon have been recorded along the shore of Digby Neck between Brier Island and the Digby Gut even though herring weirs have been operated in the Digby Neck region for over 100 years. The only recorded tag return of an Atlantic salmon from this region was from a weir along the Kings County shore of the inner Bay of Fundy. Also, by-catch of salmon in herring weirs, herring gill nets, and groundfish gill nets along the Bay of Fundy shore of Digby Neck has been minimal for the past 100 years.

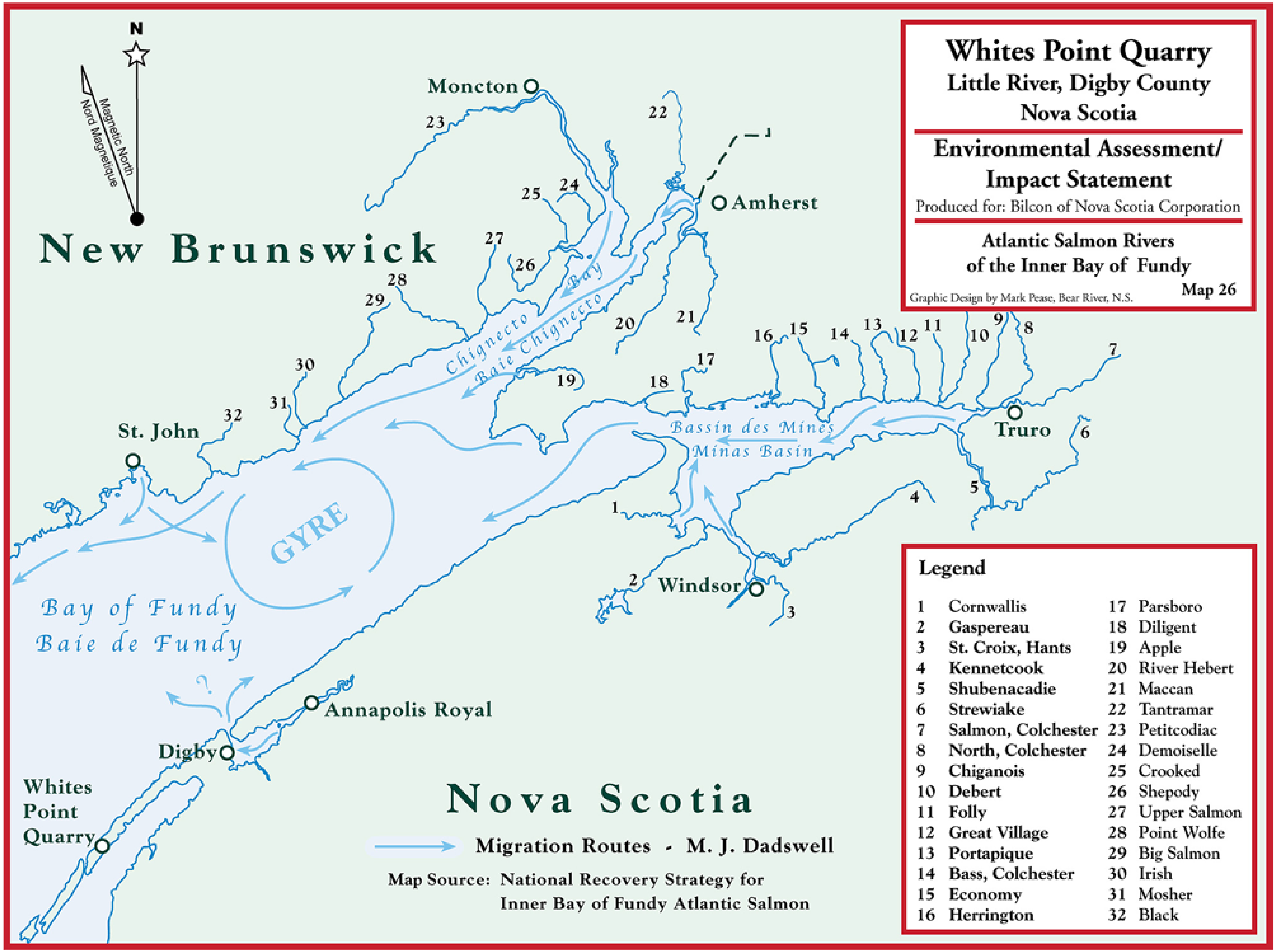
9.2.5.2 Analysis

No evidence exists that the loss of fresh water productive capacity is responsible for, or contributes to, the recent population declines of iBoF salmon. Intermittent drainages on the proposed Whites Point Quarry site have been determined to be not suitable or marginal as fish habitat by DFO Habitat Management Division. On-site drainages are also not considered suitable habitat for salmonoid populations. Also, a significant distance exists between the proposed quarry site and known iBoF salmon rivers – see **Map 26**. Evidence does indicate that the population decline of iBoF salmon could be attributed to low marine survival, for which the cause is presently unknown. Trends in marine waters including changes in physical and chemical conditions, continued commercial fishing activities, numerous tidal barriers, and the development of an extensive aquaculture industry all could have potential negative effects on salmon populations within the Bay of Fundy. Again, the manner in which these factors could be affecting marine salmon habitat is not understood and may not be resolvable.

Recreational fisheries on all iBoF rivers have been closed since 1998. However, fishing which could produce iBoF salmon bycatch was observed during 2002 and 2003. Herring seiners and herring gill nets were observed fishing in the nearshore waters off Whites Point. As well, natural predators such as seals were observed in nearshore waters in the Whites Point area and a seal colony exists at Crowells Cove.

As shown on **Map 26** , tag return data indicates that migrating iBoF salmon do not pass along the coast of Digby Neck in the proposed Whites Point Quarry area. However, their range during migration, does extend into this portion of the Bay of Fundy on the New Brunswick coast. Since the iBoF salmon is a species at risk, a precautionary approach has been taken regarding possible adverse effects from the proposed quarry and marine terminal construction and operation.

The proposed marine terminal for the Whites Point Quarry consists of three berthing dolphins located approximately 200 m (660 ft.) off-shore. Pipe piles, anchored to the nearshore bedrock, are proposed as foundation structures for the berthing dolphins. This pipe pile design is intended to allow unobstructed coastal current flows thereby maintaining any nearshore iBoF salmon migration routes/patterns along this section of the coast. During construction, turbidity will be monitored to insure that the “Guidelines for the Protection of Aquatic Life – Total Particulate Matter” are not exceeded.


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Atlantic Salmon Rivers
of the Inner Bay of Fundy
Map 26
Graphic Design by Mark Pease, Bear River, N.S.
N
Magnetic North
Nord Magnetique
New Brunswick
Nova Scotia
Moncton
Amherst
St. John
Truro
Windsor
Annapolis Royal
Digby
Whites
Point
Quarry
Chignecto Bay
Baie Chignecto
Bassin des Mines
Minas Basin
GYRE
Bay of Fundy
Baie de Fundy
?
Migration Routes - M. J. Dadswell
Map Source: National Recovery Strategy for
Inner Bay of Fundy Atlantic Salmon
Legend
1 Cornwallis
2 Gaspereau
3 St. Croix, Hants
4 Kennetcook
5 Shubenacadie
6 Strewiake
7 Salmon, Colchester
8 North, Colchester
9 Chiganois
10 Debert
11 Folly
12 Great Village
13 Portapique
14 Bass, Colchester
15 Economy
16 Herrington
17 Parsboro
18 Diligent
19 Apple
20 River Hebert
21 Maccan
22 Tantramar
23 Petitcodiac
24 Demoiselle
25 Crooked
26 Shepody
27 Upper Salmon
28 Point Wolfe
29 Big Salmon
30 Irish
31 Mosher
32 Black

No blasting is proposed within marine waters and setbacks from marine waters to points of explosive detonations will meet the guideline criteria set forth in "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". Again, a precautionary approach has been taken. Based on recommendations by the Department of Fisheries and Oceans – Habitat Management Division in their November 12, 2004 letter RE: Whites Point Quarry and Marine Terminal – Blasting Activity, – See Appendix 20 , a horizontal distance from shore line to the blast location has been established at least triple that determined by application of the equations in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". Also, the size of individual charges will be minimized. Explosive charges will be "decked" if required to further reduce effects. Since the inner Bay of Fundy salmon generally spawn in streams and rivers in the upper Bay of Fundy, possible effects of blasting on spawning habitat are highly unlikely. Thus, possible effects from blasting on the iBoF salmon would be limited to possible migration occurrence on the Nova Scotia coast during July to October. The above precautionary measures would be followed when blasting is conducted during the July to October time period.

As mentioned previously, the CONWEP model was used to verify potential effects on fish habitat using site specific data and a proposed blast design. Model runs indicate that the proposed on land blasting would likely not exceed 25 kPa in the nearest marine water column. This is well below the maximum 100 kPa recommended in the guideline criteria. Further, iBoF salmon migratory routes are expected to be much further off shore. Again, a conservative approach has been taken to reduce risk to iBoF salmon during blasting operations.

9.2.5.3 Mitigation

Recovery of the iBoF salmon populations in the Bay of Fundy is expected to be a long term effort. If industrial activities such as fishing, agriculture, forestry, aquaculture or quarrying are identified as impeding recovery efforts, mitigation without conflicts with the respective industry would be the preferred resolution, as suggested in the National Recovery Strategy. In this regard, Bilcon of Nova Scotia Corporation would be prepared to participate in developing appropriate mitigation measures for their quarry operations in relation to recovery efforts for the iBoF salmon and to work with the National Recovery Team. Presently, mitigation measures being implemented by Bilcon of Nova Scotia Corporation during quarry operations include sediment and blasting controls to meet or exceed published criteria and guidelines – e.g. "Canadian Water Quality Guidelines for the Protection of Aquatic Life", "Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments" and "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters".

9.2.5.4 Monitoring

9.2.5.4.1 Water Quality

During the period 2002 and 2003, Bilcon of Nova Scotia Corporation has developed a water and sediment monitoring program for the four hectare quarry site at Whites Point. Background water sampling for ph and Total Suspended Solids (TSS) in freshwater drainages and the intertidal zone was conducted during the spring and summer of 2002, before quarry operation. This sampling documented a range of TSS of less than 0.5 mg/L to 2.2 mg/L in drainages entering the Bay of Fundy from the quarry site. Concurrently, ph ranged from 5.7 to 7.2 units. Background intertidal TSS ranged from 9.6 mg/L to 19.2 mg/L.

Operations at the 4 ha (10 acre) quarry began in the spring of 2003. Erosion control measures including a sediment retention pond with a capacity of 1 ha-m (8 acre-ft.) were constructed. Drainage channels, silt fences, and check dams were installed prior to and during clearing and grubbing the four hectare quarry site. Weekly grab samples during the initial construction phase indicated TSS of less than 0.5 mg/L to 4.2 mg/L. The latter occurred after a heavy rainfall and during construction of a sediment retention pond dyke. Concurrently, ph ranged from 6.4 to 7.0 units. The Nova Scotia Department of Environment and Labour's approval permit for the four hectare quarry requires TSS not to exceed 50 mg/L (grab sample) and pH to be in the range of 5.0 to 9.0 units. Although not a requirement of the 4 ha (10 acre) quarry approval, tide pools within and beyond the influence area of the four hectare quarry were monitored. Sediment samples were taken from tide pools above and below the ordinary high water line. No elevated inorganic sediment accumulation in tide pools located within the influence of the operating four hectare quarry was evident.

The guidelines for aquatic life in fresh, marine and estuarine waters indicate that when background is less than or equal to 25 mg/L, the maximum induced suspended sediment load is not to exceed 25 mg/L in twenty-four hours. Results of ongoing water monitoring for pH, TSS and sediments in tide pools indicates no significant increases are occurring based on the above criteria in waters entering the receiving waters of the Bay of Fundy from ongoing quarry operations.

For long term periods (30 days or more) average TSS levels should not be increased by more than 5 mg/L over ambient levels. Before quarrying begins beyond the four hectare site, the average ambient clear flow levels (clear flow periods refer to "normal" flow periods and specifically exclude both low and high flow conditions) will be established. Similar monitoring procedures are proposed to be continued over the life of the Whites Point Quarry project.

9.2.5.4.2 Blasting

Monitoring of blasting activities would include video documentation of each blast event and land monitoring for concussion and ground vibration for each blast event. The latter would be done in accordance with the Nova Scotia Department of Environment and Labour's regulatory requirements. Also, monitoring of the initial blast event will be conducted at selected locations within nearshore marine waters.

9.2.5.5 Impact Statements

Inner Bay of Fundy Atlantic Salmon – Water Quality

Water quality and sediment monitoring during construction work on the four hectare quarry indicates Nova Scotia Department of Environment and Labour regulatory requirements and the Canadian Water Quality Guidelines are not being exceeded resulting in a ***long term, neutral (no) effect, of national/international scale.***

Inner Bay of Fundy Atlantic Salmon – Blasting

Modeling of peak pressure in the marine environment as a result of blasting indicates that it is well within guideline criteria contained in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters" and as a further precautionary measure during July to October, the set back distance from the shore line to the blast site will be tripled and if required, explosive charges will be decked within the holes to further reduce over pressure effects resulting in a ***long term, neutral (no) effect, of national/international scale.***

Inner Bay of Fundy Atlantic Salmon – Migration

The method of construction for the marine terminal allows free flow of nearshore currents without major obstruction resulting in a ***long term, neutral (no) effect, of national/international scale.***

9.2.6 Fish – Threatened and Special Concern

9.2.6.1 Research

Striped Bass

The striped bass (*Morone saxatilis*), Bay of Fundy population was designated as "threatened" by COSEWIC in November 2004. A COSEWIC assessment and status report was prepared in 2004 (**Ref. 53**).

The striped bass is an anadromous species which spawns in three rivers of the Bay of Fundy including the Annapolis and Shubenacadie in Nova Scotia and the Saint John in New Brunswick. Canadian striped bass populations occur in the northern portion of their range and overwinter in rivers to escape the cold ocean waters. The probable extent of occurrence in the Bay of Fundy does not extend toward the mouth of the Bay beyond a line from the Digby Gut across the Bay to the mouth of the Saint John River. However, striped bass catch records are not enough to define the extent of occurrence as the Bay is also used by bass from U.S. rivers. During the past 20 years, no evidence of spawning has been observed and no catches of local bass have been authenticated in the Annapolis and Saint John Rivers. The Shubenacadie River population still appears to produce new individuals.

Spawning failures have led to the disappearance of the Annapolis and Saint John River populations. The primary causes of population decline are thought to be due to changes in flow regime and poor water quality. In the case of the Annapolis River, the river closest to the Whites Point site, obstruction by the Annapolis causeway, agricultural pollution, and low pH are thought to be primary causes. Also, by-catch of striped bass from various commercial fisheries and recreational fishing pressure are also contributing factors.

Atlantic Cod

The Atlantic cod Maritimes population was designated as " special concern" by COSEWIC in May 2003. A COSEWIC assessment and status report was prepared in 2003 (Ref. 56).

Declines in Atlantic cod Maritimes populations vary according to region. The region including the Bay of Fundy identified for the purpose of stock management is the Bay of Fundy/Western Scotia Shelf (NAFO Division 4X). This is the southern end of the Canadian range on the east coast which extends from Georges Bank and the Bay of Fundy north to Labrador. Overall, the Maritime population has declined 14% in the past 30 years.

From a spawning perspective, it is not known if cod have specific habitat requirements. They are known to spawn in various habitats throughout the inshore, nearshore and offshore waters.

The primary cause of decline is attributed to overfishing. Sensitivities of the species to human activities include direct fishing, by-catch in other fisheries, natural predation, and natural and fishing-induced changes to the ecosystem. Cod continues to be a major species landed by the Digby Neck/Islands fishery (Gardner Pinfold 2005 **Ref. Vol. VI, Tab 32**).

9.2.6.2 Analysis

Construction, operation and maintenance, reclamation and closure of the Whites Point Quarry and Marine Terminal will not contribute to further population declines in striped bass or Atlantic cod. In the case of striped bass, no productive spawning estuaries or rivers exist in the region. No coastline barriers will be created at the marine terminal. Quarry land uses will not produce acid runoff or increases of Total Suspended Solids above acceptable levels.

Loss of bottom habitat which could affect food sources for cod and alteration of water column habitat for striped bass are proposed to be compensated for at three times the loss. Construction of the marine terminal will not require dredging or dredge spoil disposal, or fill which could produce adverse effects on both striped bass and Atlantic cod.

9.2.6.3 Mitigation

Implementation of the proposed Fish Habitat Compensation Plan will provide three times the bottom habitat lost by construction of the marine terminal. Enhanced pelagic fish habitat is also part of the compensation plan. The design of the marine terminal on pipe piles will allow unobstructed flow of tides and currents.

9.2.6.4 Monitoring

Monitoring in the marine environment will be conducted during construction to ensure turbidity levels do not exceed acceptable levels – see **paragraph 9.2.3.4.** Nearshore waters will also be monitored during operation of the quarry and marine terminal for noise and water quality – see **paragraph 9.2.4.4 .**

9.2.6.5 Impact Statement

Fish – Threatened and Special Concern Species

Compensation for loss of bottom habitat and alteration of pelagic fish habitat are planned and blasting will be conducted in accordance with the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters" resulting in a ***long term, neutral (no) effect, of national/international scale.***

9.2.7 Waterfowl – Special Concern

9.2.7.1 Research

Harlequin Duck

There are two separate, major populations of harlequin ducks in North America; a relatively large western population and a much smaller eastern population. The eastern population was designated as “Endangered” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1990, but was subsequently (May 2001) downgraded to “Special Concern” . Presently, its status under SARA is “special concern” on Schedule 1. In 2000 the eastern population of harlequin ducks was designated as “Endangered” under the NSESA.

The eastern population is further divided into two sub-populations that are defined by their wintering areas; one in Greenland and the other along the eastern seaboard of North America. The population that winters in Greenland breeds in northern Québec and northern Labrador. The population that winters along the eastern seaboard breeds in northern New Brunswick, the Gaspé Peninsula, Newfoundland and southern Labrador. Preliminary genetic studies appear to confirm reproductive isolation between these two eastern North American “sub-populations”. Of the two eastern populations, the eastern seaboard population is the smaller with a wintering population currently (pre-2005) estimated at between 1800 and 2000 birds. Annual winter censuses indicate that this population has been increasing in recent years.

Wintering harlequin ducks generally feed in tight flocks along rocky shorelines where the surf breaks against rocks and ice buildup is minimal. Common food items include crabs, amphipods, gastropods, limpets, chitons, blue mussels, and fish eggs. Harlequins, particularly females, exhibit a very high fidelity to their traditional wintering areas.

Approximately half the population of harlequin ducks that winter along the eastern seaboard seek refuge in New England, primarily in Penobscot Bay, Maine with smaller concentrations occurring south to Chesapeake Bay, Virginia. In Canada, wintering areas also exist in Newfoundland, Nova Scotia and New Brunswick. Surveys conducted by the Canadian Wildlife Service (CWS) have identified harlequin duck wintering areas in the Bay of Fundy including portions of the coastline of Digby Neck, Long Island and Brier Island. Of the wintering areas that have been identified in this area, only in the areas surrounding Trout Cove, Digby Neck and Bear Cove, Long Island have harlequin ducks been found consistently and in good numbers. These two traditional harlequin duck wintering areas are centered approximately 12 km (7.5 mi.) on either side of the Whites Point Quarry. Harlequins have also been observed in Deep Cove/Sandy Cove, Tommy’s Beach and Whale Cove on Digby Neck, and at Peajack Cove and Western Light , Brier Island. Only small numbers have been observed at these latter sites and these sites are apparently not used consistently.

Since 2000, CWS biologists have been monitoring the numbers of wintering harlequin ducks in the Maritime provinces. In the Digby Neck – Long Island area land-based surveys of known harlequin wintering areas were conducted in 2000 and 2001. Beginning in 2002, annual boat surveys of the entire coastline between the Bear Cove and Trout Cove areas have been conducted. During the 2004 (February 24) and 2005 (February 9) boat surveys, Dr. George Alliston and Mr. Bernard Forsythe, on behalf of Bilcon of Nova Scotia Corporation, were guests of CWS wildlife biologist Andrew Boyne. During the 2005 boat survey a total of 118 harlequin ducks was counted; the largest number recorded for this area since surveys were initiated.

In response to concerns expressed by government agencies regarding the possibility of harlequin ducks traveling between their traditional wintering areas to the north (Trout Cove) and south (Bear Cove) of the project, in 2005 Bilcon of Nova Scotia Corporation contracted Dr. George Alliston to conduct a study to determine if frequent movement of harlequin ducks occurred between these two wintering areas. A study of the possible movements of harlequin ducks between their traditional wintering grounds in the Bear Cove and Trout Cove areas was conducted in early February, 2005 (see Alliston, W. George, "Wintering Harlequin Ducks in the Digby Neck – Long Island Area, Digby County, Nova Scotia – 2005" 20 May 2005, **Ref. Vol. I, Tab 2**). The study consisted of three elements;

1 Simultaneous land based monitoring of harlequin ducks at their two traditional wintering grounds in an attempt to a) establish total numbers using each of these areas and b) observe if changes in numbers at one site were correlated negatively with changes at the other site.
2 Conduct observations at Whites Point to determine if harlequin ducks were flying between the two wintering areas via these nearshore waters.
3 Using the annual CWS survey of wintering harlequin ducks to provide an independent estimate, after some time had elapsed from the land based studies, of the total numbers and distribution of harlequin ducks using the coastline from the Bear Cove to the Trout Cove areas.

Simultaneous land based monitoring of the harlequin numbers in the Trout Cove and Bear Cove areas revealed no correlation between any apparent changes in the numbers at the two sites. Under perfect observation conditions, no observations were made of harlequin ducks flying over nearshore waters adjacent Whites Point (February 7). The CWS boat survey produced results that were nearly identical to the land based monitoring study:

Survey Method	**Date**	**Trout Cove**	**Bear Cove**	**Other**	**Total**
Land-based	February 1-2	68	51	-	119
Boat	February 9	66	49	3	118

These results suggest that there was little or no movement of harlequin ducks between the two traditional wintering areas during the study period (February 1-9). Furthermore, both surveys indicated that sex ratios differed between the two areas with females outnumbering males at Trout Cove (0.79M:1F) and the opposite situation (1.55M:1F) at Bear Cove while the ratio for the two populations taken together was close to equal (1.05M:1F). Harlequin ducks form pairs on their wintering grounds and most would have been paired by the time surveys were conducted. Had there been substantial movement of birds between these two areas over the winter period it would be expected that more pairing would have occurred and the sex ratios of the Bear Cove and Trout Cove populations would be much closer to equal than what was observed.

Barrow's Goldeneye

Like the harlequin duck, there are two major populations of Barrow's goldeneye in North America; a large western population and a much smaller eastern population. The Barrow's goldeneye, eastern population, was designated as a species of "special concern" by COSEWIC in November 2000 and is given a "yellow" (sensitive) status under the NS GSR.

The distribution, numbers and habitat requirements of the eastern population of Barrow's goldeneye are not well understood (Savard and Dupuis, 1999). Their breeding grounds have not been well defined but are believed to be entirely within Canada with the only confirmed breeding in southeastern Québec. The total wintering population is estimated at about 4,500 birds of which about 4,000 winter in the St. Lawrence estuary and Gulf of St Laurence. An estimated 400 Barrow's goldeneye winter in the Atlantic Provinces and Maine. Currently, there are no known winter concentrations of this species anywhere in Atlantic Canada (Sea Duck Joint Venture, Continental Technical Team, 2003; CWS Waterfowl Committee, 2002).

The closest area to the Whites Point property that wintering Barrow's goldeneye can be regularly found is in the Annapolis Basin. Only a few birds are found there. Migratory bird observations at Brier Island indicate daily peaks of one to two Barrow's goldeneye in December. No Barrow's goldeneye have been recorded during annual winter boat surveys conducted by CWS since 2002, of coastal waters from Bear Cove, Long Island to Trout Cove, Digby Neck (Andrew Boyne – *pers. comm.*). These surveys included the entire coastline of the Whites Point property.

9.2.7.2 Analysis

Whites Point is situated midway between two traditional harlequin duck wintering areas; one centered around Trout Cove, Digby Neck, approximately 12 km (7.5 mi.) to the northeast, and another centered around Bear Cove, Long Island, a similar distance to the southwest.

Canadian Wildlife Service's boat surveys during the past four winters have included the shoreline of the proposed Whites Point Quarry site and no harlequin ducks have been observed in these waters. A land based search of the Whites Point property shoreline from Whites Cove to the northern boundary was conducted on February 7, 2005 and no harlequin ducks were observed. These observations suggest that the coastal waters of the Whites Point property are probably not traditional wintering areas for this species.

The closest to the Whites Point property that harlequin ducks have been recorded was near Tommys Beach, approximately 1 km (0.6 mi.) south of the southern boundary of the property, where a single pair was observed during the February 9, 2005 CWS boat survey.

Observations from studies conducted in 2005 suggest that, once settled, there is little movement of harlequin ducks between these two traditional wintering areas. It would therefore appear that currently the chances of harlequin ducks interacting with the Whites Point Quarry operations appear small and likely limited mainly to the migration periods. The project recognizes that harlequin duck populations appear to be increasing, and with increasing populations, these birds could extend the areas of coastline used for wintering.

Very small numbers of Barrow's goldeneye winter in the Annapolis Basin and very small numbers (3 records) have been reported as late autumn migrants at Brier Island. CWS winter boat surveys over the past four years, which include the coastline of the Whites Point property, have not produced any sightings of Barrow's goldeneye. Indeed there are no known areas in the province of Nova Scotia where concentrations of wintering Barrow's goldeneye are found. It would appear most unlikely that the coastal waters of the Whites Point property would support a concentration of wintering Barrow's goldeneye. It is possible that very small numbers of Barrow's goldeneye might pass by the quarry site during migration.

9.2.7.3 Mitigation

None proposed.

9.2.7.4 Monitoring

Bilcon of Nova Scotia Corporation proposes to continue coordination and cooperation with the CWS in monitoring waterfowl of special concern (harlequin duck and Barrow's goldeneye). If direct effects of shipping or on site activities on these species become evident, adaptive management procedures will be discussed with CWS.

9.2.7.5 Impact Statement

Migratory Waterfowl – Species of Special Concern

Since traditional wintering areas for the harlequin duck and Barrow's goldeneye do not exist in the nearshore marine waters of the quarry coastline and only occasional occurrences are expected with no loss of habitat, this would result in a ***long term, neutral (no) effect, of national/international scale.***

9.2.8 Marine Reptiles – Endangered Species

9.2.8.1 Research

The Leatherback turtle was listed by COSEWIC as endangered in 2001 and is presently on the SARA species list. It is one of only two marine turtles that are regularly found in Canadian waters, the other is the loggerhead turtle (*Caretta caretta*) for which a COSEWIC Status Report is presently in progress and will be assessed at the May 2006 COSEWIC meeting. Currently, there is no status under COSEWIC assigned to this species. A recent screening document prepared by the Nova Scotia Museum (July 19, 2005) for the Whites Point quarry indicates another marine turtle – the Ridleys (*Lepidochelys kempi*) has been reported or recorded in the adjacent marine waters. This species is not presently listed by COSEWIC and does not presently appear on either a candidate or status report list. During the weekly observations of marine mammals and seabirds in July and August 2002 in the nearshore waters from Petite Passage to Sandy Cove, no marine turtles were sighted

The leatherback turtle is unique in that it is the only marine turtle that does not have scales. Leatherbacks are wide ranging from the warm tropics where they nest, to temperate waters of Canada on the Atlantic coast. Sightings have been recorded in waters off New Brunswick in the Bay of Fundy. Their migration to temperate waters and Canada's Atlantic coast is to forage on seasonally abundant populations of jelly fish. Thus, these waters provide important seasonal foraging habitat for these turtles.

A primary limiting factor on land for survival is the destruction of nests on beaches by human activities and natural processes such as flooding and erosion. In the marine environment, principle threats include entanglement in different types of fishing gear (fixed and mobile) such as long lines, buoy anchor lines and other ropes and cables. Marine debris such as plastic bags, tar balls, plastic sheeting and fishing gear may lead to blockages in the digestive tract and subsequent starvation. Another threat could be contaminants in marine waters such as metals and polychlorinated biphenyls (PCBs). However, tissue samples derived from leatherbacks in European waters revealed no significant chemical contamination (COSEWIC 2001, Ref. 52f).

Leatherbacks are globally endangered and endangered in Canada. They are listed as critically endangered by the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Canada is a signatory country of this convention. The Convention on the Conservation of Migratory Species of Wild Animals (CMS) has some provisions regarding harvest of endangered species, however Canada is not currently a party to this convention (2001). Since then, the federal *Species at Risk Act* has been passed in Canada thus providing protection.

9.2.8.2 Analysis

Records of leatherback turtles in Nova Scotia waters are primarily along the Atlantic coast (James 1999, Ref. 67). Occasional records for the Bay of Fundy have been recorded by the Nova Scotia Leatherback Turtle Working Group, 1998. These records for the Bay of Fundy are shown on **Map 23** . Four records from the mouth of the Bay of Fundy were recorded by the Nova Scotia Leatherback Turtle Working Group. Three records are indicated in the area of Brier Island and Long Island and an individual record north of Digby Gut. Aerial surveys conducted by East Coast Ecosystems, Freeport, NS -–1998 recorded no leatherbacks in the Bay of Fundy (James 1999) . A check of stranding records by the Marine Animal Response Society back to 1990 indicates no records of sea turtles in the Bay of Fundy (personal communication – Tonya Wimmer). No sightings of marine reptiles were noted by a local whale and seabird cruise operator during the past ten years (personnel communication – Bay to Bay Adventures). Also, no sightings of marine reptiles were recorded during the whale and waterbird observation trips contracted by Bilcon of Nova Scotia Corporation in 2002 along the Digby Neck coast from East Ferry to Sandy Cove.

Leatherback turtles are fast and deep swimmers. The design of the Whites Point Marine terminal allows free passage of tides and currents and will not obstruct pelagic movement. Also, the characteristic movements of this turtle in the water would not make it susceptible to possible ship interactions due to the slow speed of the bulk carriers to and from the shipping lanes and marine terminal.

Major factors in the population decline of leatherbacks in marine waters is the ingestion of anthropogenic debris and incidental capture in fishing gear. The development at the Whites Point Quarry and Marine Terminal will not contribute to these factors.

9.2.8.3 Mitigation

None proposed.

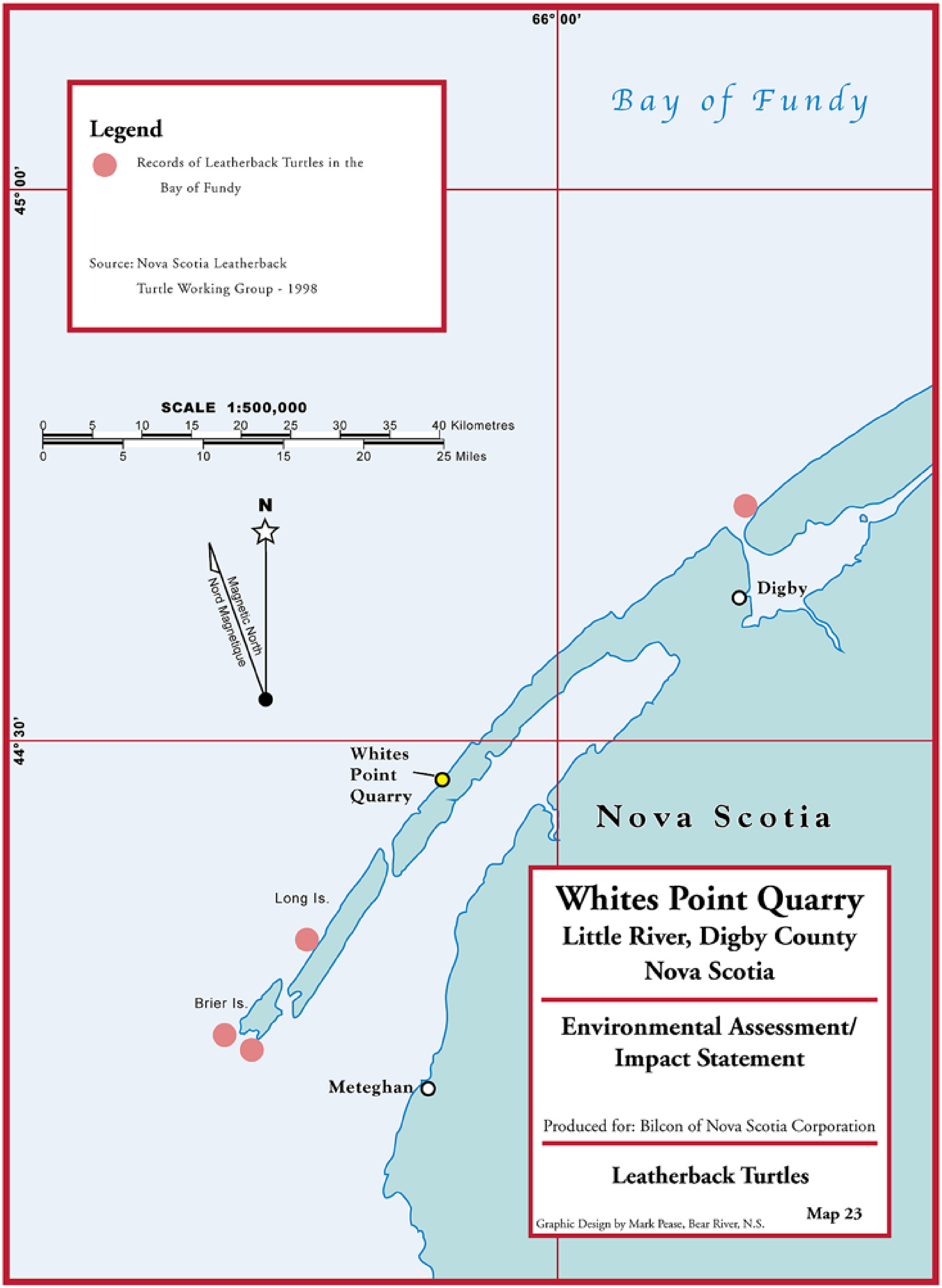
9.2.8.4 Monitoring

During routine monitoring of the weekly arrival and departure of the vessel at the marine terminal, observations for marine reptiles will be conducted. Any sightings will be recorded and coordinated with the Nova Scotia Leatherback Turtle Working Group and the Nova Scotia Museum of Natural history.

9.2.8.5 Impact Statement

Marine Reptiles – Endangered Species

The occasional occurrence of leatherback turtles during the summer, no impediment from nearshore construction, and no project induced factors that would contribute to population declines, would result in a ***long term, neutral (no) effect, of national/international scale***


66° 00'
Bay of Fundy
Legend
Records of Leatherback Turtles in the Bay of Fundy
Source: Nova Scotia Leatherback Turtle Working Group - 1998
45° 00'
SCALE 1:500,000
0 5 10 15 20 25 30 35 40 Kilometres
0 5 10 15 20 25 Miles
N
Magnetic North
Nord Magnetique
Digby
44° 30'
Whites Point Quarry
Nova Scotia
Long Is.
Brier Is.
Meteghan
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/ Impact Statement
Produced for: Bilcon of Nova Scotia Corporation
Leatherback Turtles
Graphic Design by Mark Pease, Bear River, N.S.
Map 23

9.2.9 Fish Habitat - Blasting

9.2.9.1 Research

When an explosive is detonated, pressure changes and vibrations generally result. Sudden rises to high peak pressure occur followed by rapid decay to below ambient hydrostatic pressure. Most effects on fish result from the resultant pressure deficit which can cause lethal and sub-lethal damage. Also, vibrations may cause damage to incubating eggs and noise may cause changes in behavioural patterns. Lethal, sub-lethal, and behavioural effects on crustaceans and shell fish are believed to be negligible, although little information exists on these aspects. It is, however, reasonable to assume that the unmitigated detonation of explosives in or adjacent to fish habitat can cause harmful effects on fish and fish habitat.

The Canadian Technical Report of Fisheries and Aquatic Sciences 2107, (Wright and Hopky 1998 Ref. 92) contains "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters". These Guidelines set forth guideline criteria to the effect that no explosive is to be detonated in or near fish habitat that is likely to produce an instantaneous pressure change greater than 100 kPa (14.5 psi) in the swim bladder of a fish. Also, no explosive is to be detonated that is likely to produce a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation. Tables 1 and 2 contained in the aforementioned Technical Report provide setback distances from the centre of detonation of a confined explosive to fish and spawning habitat. These setback distances are essentially based on the weight of explosive charge and type of substrate. Further, formulas are presented upon which setback distances can be calculated.

Modeling, based on physical data specific to the Whites Point site was used to determine possible effects on fish and fish habitat from blasting during quarry operations. These investigations concentrated on the marine environment since no freshwater fish habitat exists in the area of active quarry operations. (The freshwater watercourse shown on **Map 12** flowing east to west from a small pond/wetland through the northern portion of the quarry property was visited by the Department of Fisheries and Oceans, Habitat Management Division. In their September 18, 2002 letter – see Appendix18, they concluded that "this watercourse cannot be categorized as 'Fish Habitat', therefore the *Fisheries Act* does not apply").

Shock wave propagation from the proposed blast sites to the marine water column were modeled. This investigation was conducted by JASCO Research Limited and LGL Limited – see Hannay, David E. M.Sc. and Thomson, Denis M.Sc. "Peak Pressure and Ground Vibration Study for Whites Cove Quarry Blasting Plan". August 2003 (Hannay and Thomson 2003 **Ref. Vol. V, Tab 27**). Site specific topography, bedrock composition, and bathymetry were used to illustrate a "worst case" situation for quarry blasting in relation to the marine water column. Also, specifications outlined in Bilcon of Nova Scotia Corporation's Blasting Protocol – see Appendix 9 - were input into the model – e.g., weight and type of explosive, shot pattern and spacing, shot hole depth and diameter, and delay sequence. The blast effects model CONWEP (Hyde 1992) was then run to predict the shape of the shock wave pressure at various distances from the detonation site.

9.2.9.2 Analyses

The floor of the quarry is proposed to be at or above the 10 m (33 ft.) land elevation. Essentially, no blasting is proposed to take place between the 10 m elevation and the ordinary high water line – see **Figure 1.** More specifically, the weight and type of explosive, shot pattern and delay sequence for proposed detonations will be designed to be less than the 100 kPa pressure change in the water column and less than 13mm/s peak ground velocity in a potential spawning bed as required by the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". These values (100 kPa and 13 mm/s) therefore establish the threshold criteria for adverse effects on fish habitat and fish spawning areas respectively.

Results from the CONWEP model indicate that the proposed 73 m (240 ft.) setback from the detonation of a confined explosive to the nearest fish habitat (the ordinary high water line) are not expected to exceed pressures of 50 kPa. Blasting is proposed to take place within the period of three hours before to three hours after low tide to further reduce pressure change to less than approximately 25 kPa in the water. This is significantly below the 100 kPa guideline/threshold criteria as required by the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". Further, a conservative water depth of one metre at the ordinary high water line was assumed rather than a zero depth.

Also, the CONWEP model predicts peak velocity of 13 mm/s corresponding with the ordinary high tide line. As proposed, blasting will be conducted from three hours before to three hours after low tide or at low tide if weather and marine mammal observation conditions permit. The setback distance from the detonation site to the water column within three hours of low tide would be 118 m (387 ft.). This is within the 100.5 m (330 ft.) at the point of producing 13 mm/s in the guideline/threshold criteria. Again, a conservative approach has been taken to reduce risk to potential spawning areas. In summary, proposed setback distances are within the guideline/threshold criteria of 100 kPa peak pressure and 13mm/s ground vibration for fish, fish habitat, and spawning areas.

9.2.9.3 Mitigation

The timing of blasting activities is proposed to be within 3 hours of low tide. When no atmospheric inversions exist, blasting will be conducted at low tide whenever possible. This will result in a conservative setback distance from the marine water column and within the guideline/threshold criteria set forth in the " Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters".

The explosive ANFO will be used whenever possible. ANFO has a lower yield per equivalent weight than TNT which was presumably used to derive the Department of Fisheries and Oceans Guidelines. The use of ANFO will further reduce pressure and vibration in fish habitat when Guideline criteria are applied. Although ANFO will be used on site, the residual products of ANFO will not enter either the fresh water or marine environments.

The frequency of blasting is proposed to be once per week initially and once every two weeks during full quarry operation with an event duration of less than one second. Thus the frequency and duration of blasting will have minimal effects on fish behaviour, fish health or movements.

9.2.9.4 Monitoring

To ensure that the proposed mitigation is having the expected effect, monitoring of blasting activities will include on land video documentation of each blast event. Land monitoring for concussion and ground vibration for each blast event will be done in accordance with the Nova Scotia Department of Environment and Labour regulatory requirements. Also, monitoring of the initial series of blasts is proposed at three stations located within near-shore marine waters. Monitoring for peak pressure and ground vibration will be conducted at locations in one metre of water depth in the tidal zone and at approximately 170 m (560 ft.) and 500 m (1640 ft.) from the detonation site. All monitoring data (video, concussion, and vibration) will be prepared for Bilcon of Nova Scotia Corporation and will be made available to regulatory agencies.

9.2.9.5 Impact Statement

Fish Habitat – Blasting.

Considering the frequency, duration, meeting of threshold criteria, (as required in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters") and proposed setbacks from fish habitat and spawning areas, effects on marine fish habitat from blasting would result in a ***long term, insignificant negative effect, of local scale.***

9.2.10 American Lobster - Blasting

9.2.10.1 Research

The nearshore area along the coast of the proposed Whites Point Quarry supports a commercial lobster fishery. As mentioned previously, construction of the marine terminal and intermittent ship approaches and departures would have an insignificant negative effect on the lobster and lobster fishing in this particular area. Additionally, the potential interactions between blasting and the American lobster were investigated – see Christian, John M.Sc. "Whites Cove Quarry Blasting: Potential Impacts on American Lobster" 8 October 2003 (Christian 2003 **Ref. Vol. V, Tab 24**).

American lobster typically exhibits seasonal inshore – off shore movements and tend to move into shallower areas in the summer and back to deeper areas in the winter. Molting, mating, egg extrusion and fertilization, and larval hatch generally occur during the summer months when they are in the shallower nearshore waters. Juvenile and adult lobsters would likely only occur below the low tide mark. However, the larvae and early benthic stages could possibly be present for short periods within the intertidal area. This is typical of lobster activity in the waters off Whites Point.

The limited scientific research and information available regarding the sensitivities of various decapod crustaceans to acoustic stimuli and waterborne vibrations does not pertain specifically to the American lobster. Due to the general lack of data on decapod crustaceans and specifically lobster, recent research on snow crabs *(Chionoecetes opilio)* may provide the best data for establishing threshold criteria for adverse effects on the American lobster from blasting activities. Reported studies on Dungeness crab (*Cancer magister*) larvae exposed to peak pressures as high as 231 dB re 1 µPa from seismic air gun arrays indicated no statistically acute or chronic effects (Pearson et al 1994).

More recently, Christian et al. (2003) studied the effects of seismic energy on snow crabs. This study involved the exposure of snow crabs, including adults and one fertilized egg mass, to approximately 220 dB re 1 µPa. Exposed and control animals were then examined for acute effects of seismic energy on their health with no significant differences found between the exposed and control crabs. With respect to effects of seismic energy on the fertilized eggs, there is some indication that those eggs exposed to 0 – P (zero to peak) received levels of approximately 220 db re 1 µPa were affected negatively during this study.

Based on experiments relating to the commercial snow crab fishery, there is some evidence that noise may affect catch rates of crustaceans. Snow crabs receiving less than 182 dB re 1 µPa 0-P were more easily caught than those receiving more than 185 dB re 1 µPa 0-P. The blast could temporarily affect lobster activity patterns thereby resulting in less lobster movement and possible lower catches.

9.2.10.2 Analyses

As stated in the "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters", the number of shellfish and crustaceans killed by the detonation of explosives is believed to be negligible, however, few data are available. Sub-lethal effects of explosives on shellfish and crustaceans including behavioural modifications are little known or understood (Wright 1982, Wright in prep.).

Based on the CONWEP modeling previously discussed, no American lobster life stage would be exposed to peak pressure levels exceeding 210 – 216 dB re 1 µPa if blasting is conducted at ordinary high tide. Blasting at the Whites Point Quarry is proposed to be conducted within 3 hours of low tide resulting in peak pressure levels of less than 204 – 210 dB re 1 µPa 0-P. Also, quarry blasting will consist of explosions of less than 0.5 seconds in duration as compared to the 33 minutes of seismic exposure experienced by the snow crab eggs used in the study by Christian et al (2003). Both of the above blasting scenarios would therefore result in peak sound pressure levels less than those measured when the snow crab fertilized eggs were exposed to seismic energy. Regarding behaviour patterns relative to catchability, there could be temporary effects. However, considering the short duration (less than 0.5 seconds) and infrequency of the blasts (once per week during construction and once per two weeks during operation), possible behavioural effects would likely be negligible.

The possibility of producing triploid eggs due to overpressure was investigated. Triploids are organisms that contain three, rather than two, sets of chromosomes. They are usually sterile and are also larger than their diploid counterparts, because little energy is expended on the development of sexual characteristics. Triploidy can be induced by subjecting newly fertilized eggs to temperature or pressure shock or to chemicals. At this stage, prevention of the second polar body in the cell nucleus results in the presence of a third set of chromosomes in all cells subsequently formed in that organism. The third set interferes with the normal pairing of chromosomes during meiotic cell division thereby disrupting gametogenesis. Triploid females are 100% sterile or "non-maturing". Triploid males do mature, and produce small numbers of functional but aneuploid sperm. While they may go through the spawning process and compete with normal males, their progeny are not viable. Although times may vary as pressure increases, production of triploid eggs can occur at pressure/time of 10,000 psi for 5 minutes. At Whites Point, overpressure will be below 100 kPa or 14.5 psi and the duration of the blast will be less than 1 second and no production of triploid eggs is expected.

A precautionary approach has been taken to reduce risk to all life cycle stages of the American lobster. Proposed setback distances exceed the general guideline/threshold criteria for 100 kPa peak pressure and 13 mm/s ground vibration for fish, fish habitat, and spawning areas. Specifically, based on available research data on other decapod crustaceans, blasting at Whites Point Quarry would likely have insignificant negative physical and behavioural effects on all life cycle stages of the American lobster.

9.2.10.3 Mitigation

The timing of blasting activities is proposed to be within 3 hours of low tide, and when atmospheric inversions are not present, blasting will be conducted as close as possible to low tide. This will result in the maximum setback distance from the marine environment and be within the guideline criteria set forth in the "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters". The frequency of blasting is proposed to be once per week initially and once every two weeks during full quarry operation. Duration of the blast event will be less than one second. Thus, the frequency and duration of the blasting will be transitory and should have minimal effect on the American lobster.

9.2.10.4 Monitoring

To ensure that the mitigation is having the expected effect, monitoring of blasting activities will include on land video documentation of each blast event and land monitoring for concussion and vibration in accordance with the Nova Scotia Department of Environment and Labour's regulatory requirements. Also, monitoring of the initial series of blasts is proposed at three stations located within near-shore marine waters. Monitoring for peak pressure and ground vibration will be conducted at locations in one metre tidal zone depth and at approximately 170 m (560 ft.) and 500 m (1640 ft.) from the detonation site.

9.2.10.5 Impact Statement

American Lobster – Blasting

Considering the frequency, duration, adherence to threshold criteria, (as required in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters") and proposed setbacks from American lobster habitat and spawning areas, effects from blasting would result in a ***long term, insignificant negative effect, of local scale.***

9.2.11 Marine Mammals - Blasting

9.2.11.1 Research

The sixteen species of marine mammals (whales, dolphins, porpoises, and seals) that are likely to be found in the Bay of Fundy (Beatty 1989) have been previously listed. Further to the above general list, more specific data regarding the status of marine mammals under the *Species at Risk Act*, was provided by the Department of Fisheries and Oceans – Habitat Management Division.

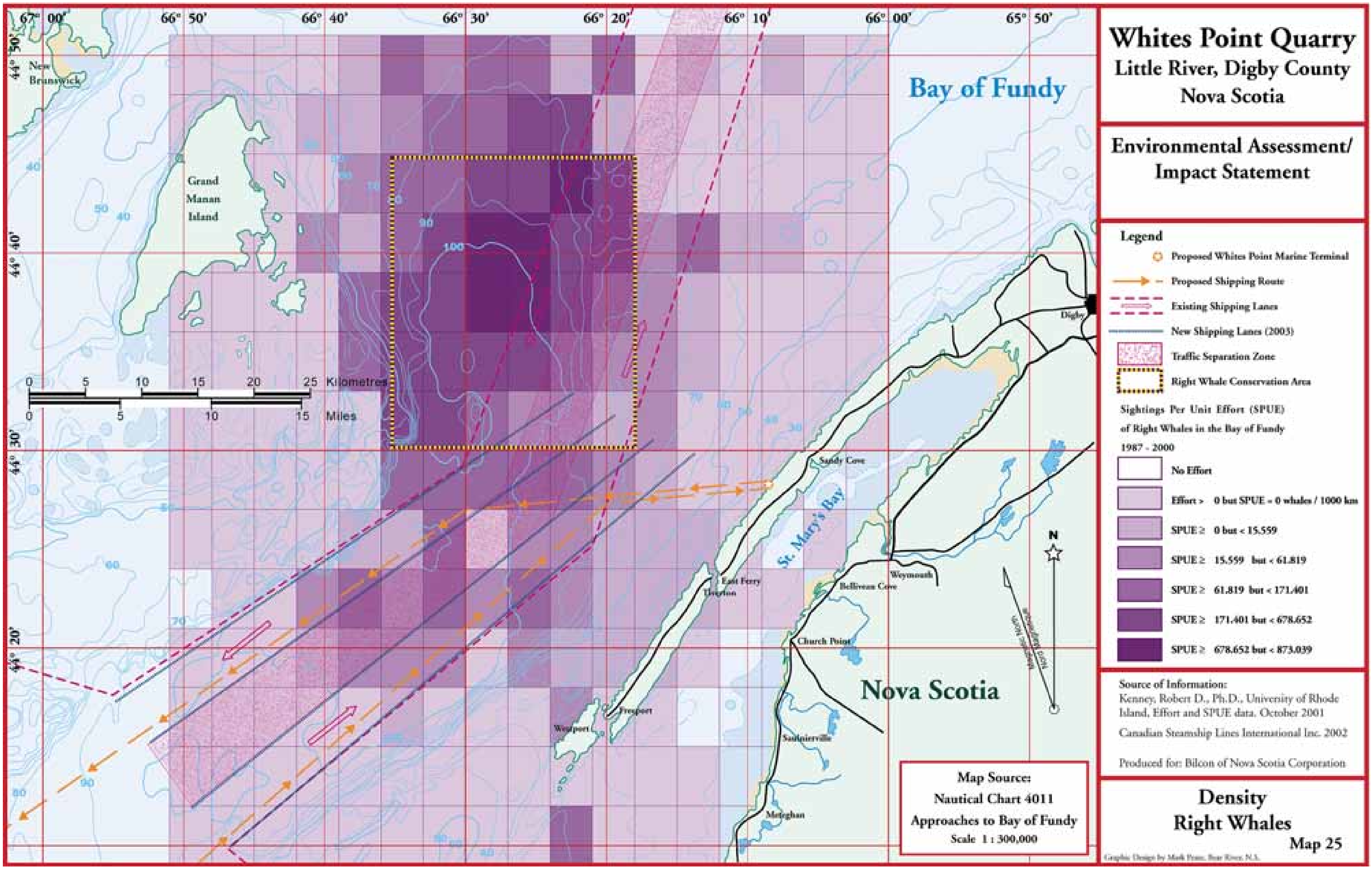
Species	Found in Bay of Fundy	Status Assigned by COSEWIC	Listed on SARA
North Atlantic right whale	June-Nov.	Endangered	Yes
Blue whale (occasional)	June-Nov.	Endangered	Yes
Harbour porpoise	All year	Special Concern	Oct. 2005 (earliest)
Fin whale	All year	Special Concern	July 2006 (earliest)
Minke whale	All year	Not yet Assigned	2007 (earliest)
Humpback whale	June – Nov.	Not yet Assigned	No

9.2.11.1.1 North Atlantic Right Whale

The North Atlantic right whale was designated as "endangered" by COSEWIC in 2003 and is presently listed on the SARA registry. A COSEWIC assessment and update status report was prepared in 2003 (COSEWIC 2003, Ref.51).

The total population of North Atlantic right whales currently numbers about 322 animals (about 220-240 mature animals) and has been decreasing during the last decade. The western North Atlantic population is distributed from Florida to Newfoundland and the Gulf of St. Lawrence. They are abundant in the Bay of Fundy from June to November and congregate in the lower Bay of Fundy mainly east of Grand Manan Island – see **Map 25 .** Their primary food source is the zooplankton copepod *Calanus finmarchicus*.

Limiting factors and threats influencing population decline are serious injury and mortality from collisions with ships and from entanglement in fishing gear. Other contributing factors include the genetic and demographic effects of small population size, habitat loss and degradation, infectious disease, contaminants, marine biotoxins, an inadequacy of prey resources as a result of changes in ocean climate and circulation, and disturbance from tourism (COSEWIC 2003).


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Proposed Whites Point Marine Terminal
Proposed Shipping Route
Existing Shipping Lanes
New Shipping Lanes (2003)
Traffic Separation Zone
Right Whale Conservation Area
Sightings Per Unit Effort (SPUE)
of Right Whales in the Bay of Fundy
1987 - 2000
No Effort
Effort > 0 but SPUE = 0 whales / 1000 km
SPUE ≥ 0 but < 15.559
SPUE ≥ 15.559 but < 61.819
SPUE ≥ 61.819 but < 171.401
SPUE ≥ 171.401 but < 678.652
SPUE ≥ 678.652 but < 873.039
Source of Information:
Kenney, Robert D., Ph.D., University of Rhode Island, Effort and SPUE data. October 2001
Canadian Steamship Lines International Inc. 2002
Produced for: Bilcon of Nova Scotia Corporation
Density
Right Whales
Map 25
Map Source:
Nautical Chart 4011
Approaches to Bay of Fundy
Scale 1 : 300,000
Bay of Fundy
Nova Scotia
New Brunswick
Grand Manan Island
St. Mary's Bay
Digby
Sandy Cove
East Ferry
Tiverton
Freeport
Westport
Weymouth
Belliveau Cove
Church Point
Saulnierville
Meteghan
Kilometres
Miles
67° 00'
66° 50'
66° 40'
66° 30'
66° 20'
66° 10'
66° 00'
65° 50'
44° 50'
44° 40'
44° 30'
44° 20'

9.2.11.1.2 Fin Whale

The fin whale, Atlantic population, was designated as "special concern" by COSEWIC in 2005. A COSEWIC assessment and update status report was prepared in 2005 (COSEWIC 2005, Ref.54).

Sightings remain relatively common off Atlantic Canada. They are found in the Bay of Fundy all year and are abundant from June to October. Although the fin whale faces a number of current threats including ship strikes and entanglement in fishing gear, human-generated underwater noise may also degrade fin whale habitat and impair communications, but details are uncertain (COSEWIC 2005).

9.2.11.1.3 Blue Whale

The blue whale, Atlantic population, was designated as "endangered" by COSEWIC in May 2002 and is listed on the SARA registry. A COSEWIC assessment and update status report was prepared in 2002 (COSEWIC 2002, Ref. 57).

The blue whale is extremely rare in the Bay of Fundy (Beatty 1989). Threats influencing the population of blue whales include ship strikes, increased whale watching activity, entanglement in fishing gear and pollution (COSEWIC 2002).

9.2.11.1.4 Harbour Porpoise

The harbour porpoise, northwest Atlantic population was designated as "special concern" by COSEWIC in 2003. A COSEWIC assessment and update status report was prepared in 2003 (COSEWIC 2003, Ref.55).

The harbour porpoise is common in the Bay of Fundy and sightings have been made in all months and they are abundant during summer months. Harbour porpoises have been observed in nearshore waters off Whites Point. The most important recent threat to harbour porpoises is bycatch in bottom-set gill nets used to catch groundfish such as cod. However, due to recent depletion of the groundfish stocks and reduction of fishing effort, there has been a notable decrease in bycatch mortality. The relatively secure status of harbour porpoises in eastern Canada at present is in large part due to reduced ground fish stocks and associated fishing effort (COSEWIC 2003).

During July and August of 2002, weekly reconnaissances of marine mammals and waterbirds were conducted by boat along the Bay of Fundy coast from Petite Passage to Sandy Cove and return. The outbound survey route was within approximately 150 m (500 ft.) of the coast and the return trip approximately 1.9 km (1.2 mi.) from shore. These reconnaissance trips were conducted under contract to Bilcon of Nova Scotia Corporation by Bay to BayAdventures Ltd., an experienced, local whale watching tour business operating out of East Ferry. Duration of the trips was approximately two hours depending on the weather and sea conditions. The observation route is shown on **Map 21.**

Groups of four to ten and the occasional lone harbour porpoise were observed during four of the nine surveys. Occurrence of porpoises were generally along the route one mile off shore in the area of Whale Cove and from West Mink Cove to Burns Point. The closest sighting to the proposed Whites Point Quarry was approximately 2 km (1.25 mi.) from shore. The location of the sightings are shown on **Map 21.**

Weekly observations of near-shore waters by David W. Kern B.Sc. were conducted from the shore at Whites Point from May to October 2003. Mr. Kern observed a lone harbour porpoise feeding in Whites Cove on June 24, 2003. Casual observations of harbour porpoises were made during other faunal investigations. On June 22, 2002 a small group (2+) of harbour porpoises was observed just off Whites Point during breeding bird surveys (Alliston, 2004a). On February 9, 2005, during a CWS boat survey for harlequin ducks, a single harbour porpoise was observed off Whites Cove (George Alliston - personal communication) - **See Figure 10**

The detonation of explosives may be lethal to marine mammals and may cause auditory damage under certain conditions. The detonation of explosives in the proximity of marine mammals has also been demonstrated to induce changes in behaviour (Wright in prep. **,** Wright 1982**,** Wright and Hopkey 1998, Ref. 92). The Canadian Technical Report of Fisheries and Aquatic Sciences 2107 – 1998 contains "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters" (Wright and Hopkey 1998) and establishes guidelines for blasting in relation to fish and fish habitat.

Noting that the guideline criteria contained in this Technical Report, especially Tables 1 and 2 is generalized, site specific data was used to model shock wave propagation from the proposed blast sites to the marine water column. This investigation was conducted by JASCO Research Limited and LGL Limited – see Hannay, David E. M.Sc. and Thomson, Denis M.Sc. "Peak Pressure and Ground Vibration Study for Whites Cove Quarry Blasting Plan" August 2003 (**Ref. Vol. V, Tab 27 –** Hannay and Thomson 2003). Site specific topography, bedrock composition, and bathymetry were used to illustrate a "worst case" situation for quarry blasting in relation to the marine water column. Also, a proposed blast design including the weight and type of explosive, shot pattern and spacing, shot hole depth and diameter, and delay sequence was included. The blast effects model CONWEP (Hyde 1992) was then run to predict the shape of the shock wave pressure at various distances from the detonation site.

9.2.11.2 Analysis

The floor of the quarry is proposed to be at or above the 10 m (33 ft.) land elevation. Essentially, no blasting is proposed to take place between the 10 m elevation and the ordinary high water line. No blasting is proposed within the water column. General guideline criteria as published in Fisheries and Oceans Canada – Newfoundland Region "Factsheet – Blasting – Fish andFish Habitat Protection" 1999 (Ref. 58) indicates blasting activities are not to be carried out in the marine environment within 500 m (1640 ft.) of marine mammals. This 500 m setback radius was then used as the distance to assess possible harassment to marine mammals during modeling procedures.

The Department of Fisheries and Oceans has in the past, adapted guidelines on a case by case basis to more accurately reflect actual site conditions. Recently they accepted safety standoff thresholds of 180 db RMS for toothed whales and 190 dB for pinnipeds in the vicinity of air gun systems used for seismic explorations (Hannay and Thomson 2003 **Ref. Vol. V, Tab 27**). These thresholds represent received levels at which marine mammals could sustain temporary threshold shift (TTS). TTS is a temporary and recoverable increase in hearing threshold, similar to what a human would experience at a loud rock concert. The distance at which TTS could occur is commonly used as a distance for a safety radius around a noise source. The pulse raise times for air gun signals and the explosive blast pressure wave at this range will be similar for these two types of noise source. As a result, a 180 dB RMS threshold for whales and a 190 dB threshold for pinnipeds has been established.

CONWEP model results indicate peak pressure at 500 m (1640 ft.) will be approximately 5kPa in the basalt which corresponds with a peak level in the water of approximately 2 kPa or equivalently 186 dB re 1 μPa peak. Root – mean – square (RMS) levels are typically 5 – 10 dB less than peak level as a result of signal spreading in time due to multi path propagation.

Therefore the proposed 500 m (1640 ft.) distance from the point of detonation for a safety radius appears appropriate for whales. The safety range for pinnipeds presumably could be approximately one third this range or approximately 170 m (550 ft.) if inverse distance (1r) acoustic spreading transmission loss is assumed. It should be noted that during seismic operations, air guns are shot every 20 seconds for hours on end. In the case of the proposed blasting at the Whites Point Quarry, the entire event will be over in less than 1 second. The National Marine Fisheries Service in the United States, responsible for implementation of the Marine Mammal Protection Act, has ruled that a single, short, noise pulse, such as that caused by an under water explosion, does not constitute disturbance (U.S. Federal Register 61 (#234, 4 Dec. 1996, page 64, 337).

Subsequently, in a letter dated February 10, 2006 (Appendix 22), the Department of Fisheries and Oceans Environmental Assessment and Major Projects Division furnished comments on Bilcon of Nova Scotia Corporation's Whites point Quarry and Marine

Terminal Blasting Protocol. This letter provides an analyses of the potential impacts of blasting on fish species, particularly the inner Bay of Fundy Atlantic Salmon population and an analyses of the potential impact of blasting on marine mammals. It was concluded that: "While the zone of disturbance of marine organisms by sound may extend beyond the 500 m suggested in the Whites Point Quarry proposal, it is considered unlikely that blasting would result in physical effects on marine mammals, endangered or otherwise, beyond 500 m. However, there is a high level of uncertainty associated with this conclusion. If the project proceeds, an initial blast prior to project initiation would help to validate the sound propagationmodelling used to reach this conclusion and would significantly increase the level of certainty in short-range impact estimations."

Subtle behavioural effects on marine mammals are expected to extend beyond 2500 m from the blast site. However, these are not expected to result in overall changes to the distribution of the population or other population-scale impacts. There is a moderate level of uncertainty associated with this conclusion. An initial blast as described above would also help to increase the level of certainty in long-range impact estimations.

Proposed mitigation, i.e. the 500 m safety zone for marine mammals and the 2500 m safety zone for endangered marine mammals, is expected to reduce the potential for harmful impacts of blasting on marine mammals under good visibility conditions".

9.2.11.3 Mitigation

Blasting will be executed using the minimum weight of explosives and greatest safety radius in relation to the marine environment as conditions warrant. Blasting will not be conducted if pinnipeds (seals) are present within 170 m (550 ft.) of the point of detonation or if cetaceans (whales, porpoises, dolphins) are within 500 m (1640 ft.) of detonations. If endangered marine mammal species such as North Atlantic right whales, blue whales, or fin whales are sighted in the near-shore area of Whites Point, the safety radius will be increased to 2,500 m (1.55 mi.).

An experienced onshore observer will be in place at least one hour prior to the start of the scheduled blasting to identify the possible presence of marine mammals within the safety radii mentioned above. The observer will be equipped with pedestal mounted 7x50 laser range finder binoculars with a plus or minus 1 m (3.3 ft.) accuracy and have communications with the blast coordinator. If marine mammals are sighted within the safety zones, the blast coordinator will be notified and the detonation will not take place until the animals move out of the safety radius under their own volition and an "all clear" signal is given by the observer. If the animal(s) are not sighted a second time, the blast would resume thirty minutes after the last sighting. The observer will remain in place until at least one half hour after detonations are complete to observe post blast conditions.

An additional, more conservative, setback radius of 2,500 m (1.55 mi.) will be used if endangered marine mammals such as the North Atlantic right whale have been sighted in the immediate near-shore area.

This setback or safety radius for endangered marine mammals would be based on the formula r = 260 (cube root of w)(7.28) where r = radius in feet, w = weight of explosive (TNT equivalent in pounds) as outlined in the Florida Fish and Wildlife Conservation Commission "Endangered Species Conservation Conditions for Blasting Activities" (Ref. 61 2001). Communications will be maintained with local whale and seabird cruise operators operating in the Digby Neck area. If these operators report right whale sightings in these near-shore waters, verification of right whale activity within the 2,500 m (1.55 mi.) safety zone will be conducted prior to any blasting activity. If endangered species are verified within the 2,500 m safety zone, detonations will be delayed until the endangered marine mammals move out of the safety radius under their own volition and an "all clear" signal is given by the observer. A written report indicating the time of observation, sightings of any marine mammals, and time of detonation will be prepared by the observer for each blast. These reports will be prepared for Bilcon of Nova Scotia Corporation and will be made available to regulatory agencies.

A conservative approach is proposed to protect marine mammals in accordance with published guideline/threshold criteria. In summary, the proposed 170 m (550 ft.) safety radius for pinnipeds, a 500 m (1640 ft.) safety radius for cetaceans, and an increased safety radius of 2,500 m (1.55 mi.) if endangered marine mammals are sighted in the immediate area, meet and are within accepted guideline/threshold criteria for the protection of marine mammals during proposed blasting activities at the Whites Point Quarry.

9.2.11.4 Monitoring

Monitoring of the initial series of blasts is proposed on land and in the near-shore waters- **see Map 31**. Three monitoring stations are proposed in the water column adjacent to the land detonation site. Monitoring for peak pressure and ground vibration will be conducted at locations in one m of water depth in the tidal zone and at approximately 170 m (550 ft.) and 500 m (1640 ft.) from the detonation site. This data will be used to verify the model results and as a baseline for any future adaptive management practices.

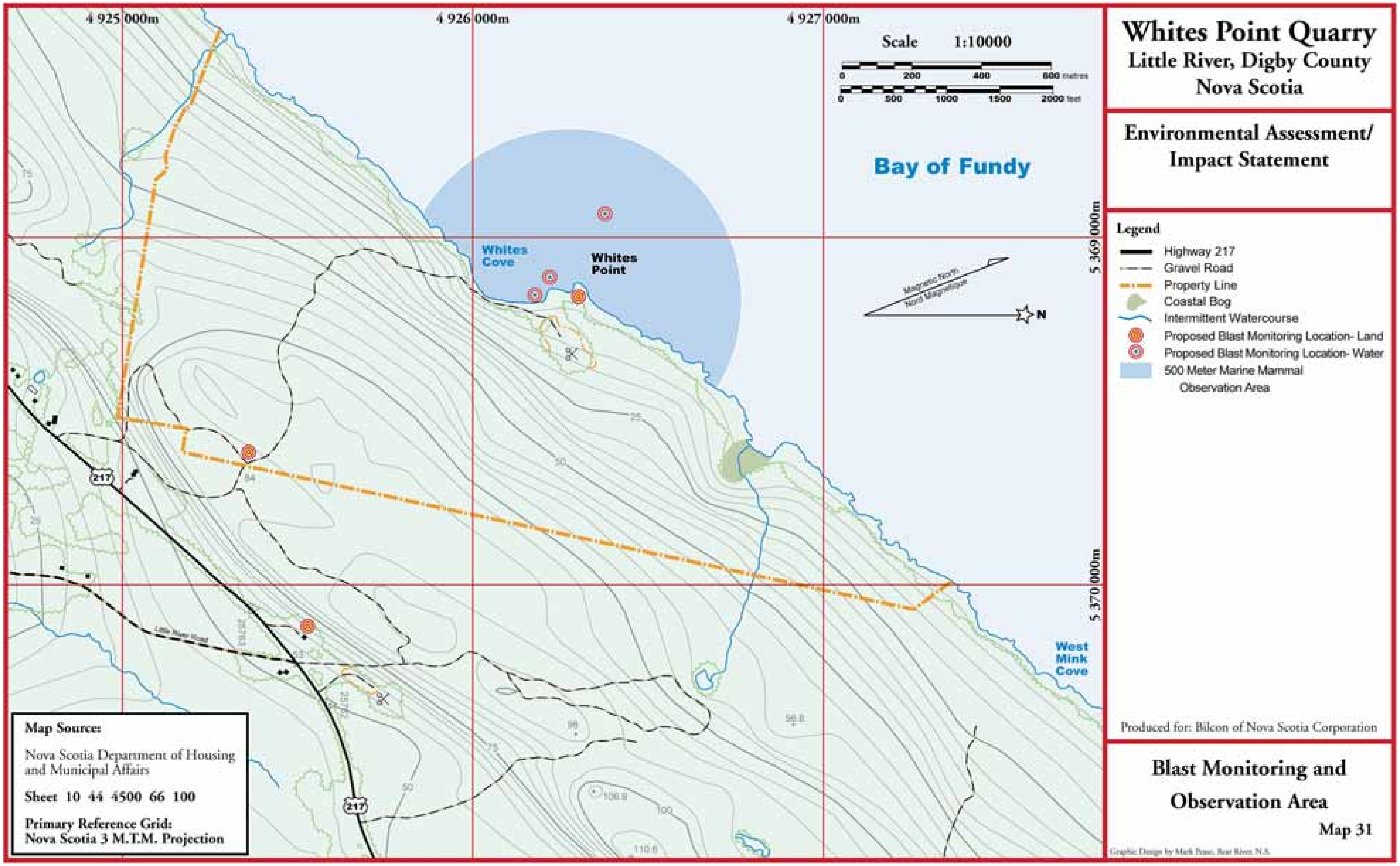
9.2.11.5 Impact Statement

Marine Mammals – Blasting

Considering the adequacy of the proposed safety zone radii for specific marine mammal species in relation to the on land blast site, meeting threshold criteria, and short duration of the blast event, effects on marine mammals from blasting would result in a ***long term, insignificant negative effect, of local scale.***

Marine Mammals Species at Risk – Blasting

Considering the adequacy of the proposed safety zone radii for endangered marine mammals in relation to the on land blast site, meeting threshold criteria, and the short duration of the blast event, effects on endangered marine mammals from blasting would result in a ***long term, insignificant negative effect, of national/international scale.***


Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Highway 217
Gravel Road
Property Line
Coastal Bog
Intermittent Watercourse
Proposed Blast Monitoring Location- Land
Proposed Blast Monitoring Location- Water
500 Meter Marine Mammal
Observation Area
Produced for: Bilcon of Nova Scotia Corporation
Blast Monitoring and
Observation Area
Map 31
Scale 1:10000
0 200 400 600 metres
0 500 1000 1500 2000 feet
Bay of Fundy
Magnetic North
Nord Magnétique
N
4 925 000m
4 926 000m
4 927 000m
5 369 000m
5 370 000m
Whites Cove
Whites Point
West Mink Cove
217
Map Source:
Nova Scotia Department of Housing and Municipal Affairs
Sheet 10 44 4500 66 100
Primary Reference Grid:
Nova Scotia 3 M.T.M. Projection

9.2.12 Waterbirds – Blasting

9.2.12.1 Research

While 14 species of waterbirds have been recorded in the nearshore waters adjacent to the Whites Point property, only two of these species, the common loon and the Atlantic puffin are considered to be at risk in Nova Scotia. Of these two species, only the common loon would be regularly found in these waters. While common loons might be present in these waters year round, they are more numerous during winter months. Numbers of common loons using the waters adjacent the property are not large. In surveys conducted between Whites Cove and the northern boundary of the property one common loon was observed during the survey conducted on June 23, 2002, two were observed on the survey of June 22, 2004 and 14 were observed during the survey of February 7, 2005. Furthermore, it is unlikely that loons using these waters during summer and winter are from the Nova Scotia breeding population that is considered to be at risk.(For more information see above sections on common loons and Atlantic puffins.)

During winter, waterfowl species, particularly common eiders, can be quite abundant in the waters adjacent the Whites Point property. During the February 7, 2005 survey of coastal waters between Whites Cove and the northern boundary of the property, 601 waterfowl of 8 species were counted, 467 of which were common eiders (see Table CC).

9.2.12.2 Analysis

Sounds of high intensity and or long duration are known to have physiological effects on the auditory system of terrestrial birds. Permanent effects may involve damage to sensory hair cells in the inner ear. Unlike mammals, replacement of damaged sensory hair cells occurs in birds although it is not clear if hearing returns to normal. In general, birds appear to be less susceptible to both TTS and PTS than are mammals (Saunders and Dooling, 1974, Ref 222).

There are almost no data on the effects of intensive sounds on the hearing of waterbirds. Furthermore, gas voids within waterbirds (e.g. lungs, sinuses, gastrointestinal tract etc.) and other aquatic fauna are susceptible to the effects of underwater sound. The most dramatic effects occur during exposure to blasts and high energy impulse noise. Yelverton et al. (1973, Ref. 226), as reported in Gisiner (1998, Ref. 217), using submerged mallard ducks (*Anas platyrhynchos*) as a surrogate for diving birds, observed that with a shock wave impulse of 35.2 psi-msec there was no eardrum rupture but there was extensive lung haemorrhage, and liver and kidney damage was observed in 50% of the test birds.

We are unaware of any guidelines for blasting in relation to use of aquatic habitats by diving birds.

9.2.12.3 Mitigation

Results of the CONWEP model indicate that with the proposed 73 m setback from the blast site, pressures not exceeding 50 kPa would be experienced at normal high water line. Blasting is to take place within three hours of low tide which further reduces maximum pressure change at shoreline to approximately 25 kPa (3.7 psi). This is substantially below the maximum pressure change criteria of 100 kPa (14.5 psi) for fish with swim bladders as put forward in the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopkey, 1998). The swim bladders of fish are gas filled voids that may be somewhat analogous to the lungs in waterbirds. Although it would seem that pressure levels in the nearshore waters resulting from land based blasting are unlikely to cause physiological damage in waterbirds, lacking any firm guidelines, the project proposes to apply the same separation requirements for waterbirds as are being used for pinnipeds; a minimum 170 m (550 ft.) separation between waterbirds and the blast site.

An experienced onshore observer will be in place at least one hour prior to the start of the scheduled blasting to identify the possible presence of waterbirds within 170 m (550 ft.) of the blast site. The observer will be equipped with pedestal mounted 7x50 laser range finder binoculars with a plus or minus 1 m (3.3 ft.) accuracy and have communications with the blast coordinator. If waterbirds are sighted within the 170 m (550 ft.) radius, the blast coordinator will be notified and the detonation will not take place until the birds move out of the safety radius under their own volition and an "all clear" signal is given by the observer. The observer will remain in place until at least one half hour after detonations are complete to observe post blast conditions.

9.2.12.4 Monitoring

Monitoring will be conducted as proposed for marine mammals.

9.2.12.5 Impact Statement

Waterbirds – Blasting

Given the absence of guidelines for waterbirds, by the application of a proposed safety zone radius derived for pinnipeds (170 m or 550 ft.) in relation to the on land blast site, the meeting of threshold criteria, and the short duration and low frequency (once every one or two weeks) of the blast event, effects on waterbirds from blasting would result in a ***long term, insignificant negative effect, of local scale.***

9.2.13 North Atlantic Right Whale – Ship Interactions

9.2.13.1 Research

The North Atlantic right whale is an endangered species with an estimated population of 300 – 350 individuals remaining. Three critical habitat areas are identified in U.S. waters and two conservation areas in Canadian waters – see **Map 24 .** The South East critical habitat is along the coastline of Georgia and Florida and is the only known calving ground for the population. Right whales are present in this area from December throughout March. The Cape Cod Bay critical habitat is a winter feeding area while the Great South Channel critical habitat, and the Roseway Basin and Bay of Fundy conservation areas are primarily summer and fall feeding grounds. The Bay of Fundy conservation area and its relation to the inbound and outbound shipping lanes is shown in greater detail on **Map 25.**

After significant research effort by the New England Aquarium et al. using transect surveys from 1987 – 2000, density mapping of right whale occurrence was compiled for the Lower Bay of Fundy/Grand Mannan Channel (Ring 2001). This was completed by developing an index of sightings per unit effort (SPUE whales per 1000 km of survey track) per three minute quadrats. This index was created by dividing the number of whales sighted by the total length of survey track. This resulted in 248 quadrats with non-zero effort but no right whale sightings (SPUE = 0) and 111 quadrats with SPUE > 0. The latter quadrats were classified into quartiles, and the upper quartile further subdivided into two classes to show more detail. Data from this research effort is displayed on **Map25.**

Effective June 1st, 1983, the International Maritime Organization adopted a traffic separation scheme (TSS) in the Bay of Fundy. This traffic separation provides for specific inbound and outbound shipping lanes through an extensively used fishing area. These lanes also significantly infringed on the Bay of Fundy right whale conservation area. The right whale is especially susceptible to ship interactions due to its slow movement and extended periods at or near the surface. Approximately 800 vessels use the shipping lanes annually with more than 600 of the largest vessels, mainly tankers, going to the port of Saint John. Other ports such as Bayside, New Brunswick, Eastport, Maine and Hantsport, Nova Scotia account for an additional 200 ships per year. In addition to the large tankers and bulk carriers; container ships, government research vessels, tugs, cruise ships, ferries, fishing vessels, whale watching boats, and recreational craft also operate throughout the Bay of Fundy.

As a result of the potential for ship interactions with the right whale, a change in the TSS and designated inbound and outbound shipping lanes was proposed. This change was intended to reduce the occurrence of ship strikes by moving the shipping lanes toward the Nova Scotia side of the Bay and further from the right whale conservation area, a primary summer and fall feeding area with the greatest density of right whales. As a result, effective July 2003, the proposed lane changes came into effect.


New Brunswick
Bay of Fundy Conservation Area
St John, N.B.
Nova Scotia
Portland, ME
Boston, MA
Roseway Basin Conservation Area
New York City, N.Y.
Great South Channel Critical Habitat
Cape Cod Bay Critical Habitat
Baltimore, MD
Atlantic Ocean
Wilmington, NC
Charleston, SC
South East Critical Habitat
N
Magnetic North
Nord Magnetique
SCALE
0 50 100 150 200 250 300 350 400 Kilometres
0 50 100 150 200 250 Miles
Whites Point Quarry
Little River, Digby County
Nova Scotia
Environmental Assessment/
Impact Statement
Legend
Conservation Area
Critical Habitat
Source: J. Beaudin Ring, April 2000
Produced for: Bilcon of Nova Scotia Corporation
North Atlantic Right Whale
Critical Habitats/Conservation Areas
Map 24
Graphic Design by Mark Pease, Bear River, N.S.

The existing shipping lanes location (pre July 2003) and the new shipping lanes location (post July 2003) in the lower and upper Bay of Fundy adjacent to the proposed Whites Point Quarry are outlined on **Map 4 .**

Bulk carriers are proposed to transport basalt rock products from the marine terminal at Whites Point. These vessels will depart the inbound shipping lane, follow a designated route to the marine terminal and return to the outbound shipping lane along the same designated route. The location of the proposed route to and from the shipping lanes to the marine terminal is shown on **Map 4.** Approximately 50 inbound/outbound bulk carrier trips are anticipated at the Whites Point Quarry annually. The primary destination of the rock products is the New York/New Jersey area and more specifically the ultimate destination is South Amboy, New Jersey.

In September 2000, the "Canadian North Atlantic Right Whale Recovery Plan" was prepared by the North Atlantic Right Whale Recovery Team (Ref. 87). This plan identifies five strategies to improve the species chances of survival and recovery.

1. Reduction of Vessel Collisions. Ship strikes are thought to be the principal immediate threat to the North Atlantic right whale population.

2. Reduction of the Impacts of Encounters with Fishing Gear. Entanglement and entrapment in fishing gear is another clearly defined threat.

3. Reduction of Disturbance from Human Activities. Disturbance resulting from acoustic deterrent devices, loud underwater sounds, and vessels operating in the vicinity of right whales also pose potential threats to existing populations.

4. Reduction of Exposure to Contaminants and Habitat Degradation. Although difficult to directly associate, pollution and habitat degradation were also identified as potential threats.

5. Population Monitoring and Research. This strategy is critical to provide base information and to assess the effectiveness of the recovery plan.

9.2.13.2 Analyses

The Whites Point Quarry will generate additional ship traffic in the Bay of Fundy and the eastern seaboard of the U.S. consisting of approximately 50 bulk carriers annually. These vessels are required to use the designated inbound/outbound shipping lanes. This constitutes a 6% increase in this category of vessel traffic in the Bay of Fundy. It should be noted that this increase is based only on the estimated number of large vessels (primarily bulk carriers and tankers) and not on total vessels (fishing boats, container ships, cruise ships, ferries etc.).

If based on the latter total vessel traffic, the per cent increase is miniscule.The probability of right whale and vessel interactions was investigated by C. Taggart and A. Vanderlaan using the SPUE data previously mentioned. Vessel traffic data was then combined with the abundance distribution data to estimate a standardized probability index of a whale and a vessel being in the same place at the same time. The results of the analysis indicate the greatest probability of interaction occurs in the area of highest right whale density. Secondly, the highest relative probability of encounter increases markedly WNW of a line that extends from 44°28.5'N x 66°30.00'W to 44°36.00'N x 66°21.00'W and to 44°45.00'N x 66°16.50'W. In areas of the Bay ESE of this line, the relative probability of encounter decreases markedly (rapidly) toward zero **Map 25.**

The proposed ship route from and to the inbound/outbound shipping lanes from the proposed Whites Point marine terminal is through two quadrats of SPUE = 0 whales/ 1000km and one quadrat of SPUE >0 but<15.559 whales/1000km. The low occurrence of right whales in this area is also verified by Bilcon of Nova Scotia Corporation's Marine Mammal and Seabird Observations in 2002 which recorded no sightings of right whales in this nearshore area. Another indicator of low probability for right whales or other species of whales is the lack of whale sightings from whale watching boats frequenting this particular area of the Bay.

A factor contributing to whale mortality or severe injury as a result of ship/whale interaction is the size and speed of ships. Although all ships can cause injury, most lethal or severe injuries are caused by ships 80 m (260 ft.) or longer and traveling 26 kph (14 knots) or faster (Laist et al 2001 Ref. 130). In 33 cases of collisions causing lethal or severe injuries, 89% involved vessels moving at 26 kph or faster. The remaining 11% involved vessels moving at 18.5 to 26 kph (10 to 14 knots). No lethal or severe injuries occurred at speeds below 18.5 kph (Laist et al 2001).

Vessels arriving and departing the Whites Point marine terminal are "rule" vessels (vessels > 20 m (66 ft.) in length and > 300 gross registered tonnes (330 tons)). Therefore, for the purpose of this EIS, the possible area of effects regarding ship/whale interactions is defined as the spatial area between the designated inbound/outbound shipping lanes and the Whites Point marine terminal. Presently, there are no speed limits on vessels traveling in the Bay of Fundy waters. As mentioned previously, the location of the marine terminal in close proximity to the designated shipping lanes is considered a primary mitigation measure.

Taggart et al. (2003, Ref. 171) investigated the probability of a mortal collision of a "rule" vessel with a right whale over the 400 grid-cell domain in the Bay of Fundy over the June through October 2000 period.

Rule vessel speeds were calculated from existing data. The overall daily mean (mean of the daily means) for "rule" vessels in the shipping lanes ranged from 22 kph to 26 kph (12 to 14 knots). Vessel speeds during this time in nearshore waters between the shipping lanes and the proposed marine terminal ranged from 11 to 22 kph (6 to 12 knots) (Taggart et al. 2003 Figure 11,). Also, the relative probability of whale mortality based on "rule" vessel speed and right whale SPUE distributions for this time period is practically zero (Taggart et al. 2003 Figure 21).

Further, the overall daily mean probability of a mortal collision (if there was a right whale/vessel encounter), based on vessel speed (knots) for "rule" vessels across the 400 grid-cell domain in the Bay of Fundy over the June through October 2000 period in the area between the shipping lanes and the marine terminal is 0.0 – 0.2 (Taggart et al 2003 Figure 14). Since vessel speeds in this area already range from 11 to 22 kph (6 – 12 knots), this probability would be generally applicable to the proposed vessel traffic as a result of the Whites Point marine terminal. As a further precautionary measure, vessel speed upon departing the inbound lane would begin to be reduced. Also, upon departing the marine terminal to the outbound shipping lane, vessel speed would be gradually increased. It should be noted that the vessel's speed is the responsibility of the ships captain and dependent in part upon prevailing sea conditions.

In conclusion, the probability of a right whale/vessel encounter in the area between the inbound/outbound shipping lanes and the marine terminal at Whites Point as a result of quarry activities i.e. shipping, is highly unlikely.

It should be noted that the Roseway Basin conservation area between Browns and Baccaro Banks on the southern Scotian Shelf, has no traffic separation scheme for large vessels. The route of the bulk carrier to and from the Whites Point marine terminal will, at the ships captain's discretion, treat this as an "area to be avoided".

9.2.13.3 Mitigation

Although not a specific responsibility of Bilcon of Nova Scotia Corporation, the following mitigation measures are currently in place by Transport Canada and Fisheries and Oceans Canada. Vessels transporting rock materials from the Whites Point Quarry will use the designated inbound/outbound shipping lanes shown on the Canadian Hydrographic Chart. Also, there is presently a vessel traffic services system in operation for the Bay of Fundy and participation is mandatory for all ships more than 20 m (66 ft.) in length. The Canadian Notices to Mariners annual edition also provides detailed information about right whales in the Bay of Fundy and Roseway Basin. Vessel captains operating in the Bay of Fundy also receive regular advisories on right whale locations through Saint John vessel traffic services (Fundy Traffic).

Mitigation measures specific to the proposed ship route to and from the inbound/outbound shipping lanes may be more effectively implemented by Bilcon of Nova Scotia Corporation through direct communication with the vessel captain. This would require cooperation and communication between whale research vessels and local whale watching boats to reportsighting locations of right whales to Bilcon of Nova Scotia Corporation. Any sightings of right whales in the area would then be relayed to the vessel captain before he exits the inbound lane or leaves the marine terminal for the outbound shipping lane. This type of communication is proposed to reduce possible risk of ship/right whale interaction along that portion of the proposed shipping route. As mentioned earlier, this route will be designated.

Bilcon of Nova Scotia Corporation is also committed to cooperating with the North Atlantic Right Whale Recovery Team to improve the right whales chances for recovery.

9.2.13.4 Monitoring

Shipping activity will be monitored through existing regulatory requirements of Transport Canada. Additionally, Bilcon of Nova Scotia Corporation along with the shipping company will keep records of arrival and departure of bulk carriers to and from the marine terminal.

9.2.13.5 Impact Statement

Right Whale/Vessel Interaction – Conservation Area

Since ship traffic will avoid the Bay of Fundy conservation area, this would result in a ***long term, neutral (no) effect, of national/international scale.***

Right Whale/Vessel Interaction – Whites Point Marine Terminal

Considering the low density of right whales, the slow speed of vessels, and low probability of interactions along the route from the shipping lanes to the marine terminal, this would result in a ***long term, insignificant negative effect, of national/international scale.***

Species at Risk/Vessel Interaction – Whites Point Marine Terminal

Considering the low density of marine mammals at risk, the slow speed of vessels, and the proposed mitigation measures, this would result in a ***long term, insignificant negative effect, of national/international scale.***

9.2.14 Ballast Water

Introduction

The introduction and establishment of “invasive”, “non-indigenous”, “exotic” etc. marine species may adversely affect marine ecosystems. Invasive species can be transported long distances by various carriers including wildlife (migratory waterfowl and marine mammals) and various types of boats and ships. Many types of vessels from various ports of origin including fishing boats, cruise ships, ferries, tankers, bulk carriers, and container ships presently frequent Bay of Fundy waters. Species such as the now common and commercially valuable periwinkle, the European green crab, and certain species of rockweed and other marine plants were probably all introduced at some point in time to the Bay of Fundy waters.

9.2.14.1 Research

Realizing the potential for harmful effects on marine ecosystems from ballast water discharge, the International Maritime Organization (IMO) adopted RESOLUTION A. 868 (20) on 27 November 1997 entitled “Guidelines for the Control and Management of Ships’ Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens” (Ref. 66). An important aspect of these guidelines is that every ship that carries ballast water have a Ballast Water Management Plan. Also, the guidelines include management options for ballast water exchange at sea in relation to ship safety.

Subsequently, Transport Canada issued “Guidelines for the Control of Ballast Water Discharge from Ships in Waters Under Canadian Jurisdiction” as amended June 8, 2001 (Ref. 88). More specifically, Annex V of the guidelines addressing east coast waters is presently in draft form and under review (April 7, 2003). Recommended procedures in this Annex are intended to protect the integrity of all waters in the Atlantic Canadian region from risk of species introductions. Annex V strongly recommends that ballast water originating from the eastern seaboard of the U.S. south of Cape Cod or south of 42º 00' north latitude should not be released in defined vulnerable areas. The Bay of Fundy is considered a vulnerable area.

Subsequently, on June 11, 2005, proposed “Ballast Water Control and Management Regulations” were placed in the Canada Gazette (Ref. 38). These proposed regulations, in general with exceptions, apply to every ship in waters under Canadian jurisdiction that is designed or constructed to carry ballast water. Compliance with these regulations lies with the owner of a ship and the master of a ship. Items of compliance include ballast water management, ballast water exchange – transoceanic navigation, ballast water exchange – non-transoceanic navigation, ballast water exchange standard, ballast water treatment standard, sediment disposal, ballast water management plan, and exceptional circumstances and reporting procedures.

The "Ballast Water Control and Management Regulations" are proposed to come into effect early in 2006 (personal communication M. Balaban, Transport Canada – Marine Safety). These regulations would be administered by Transport Canada under the *Canada Shipping Act.*

To more clearly define the risk of introducing invasive marine species during shipping of aggregate products by bulk carrier to and from Whites Point, Bilcon of Nova Scotia Corporation engaged Mallet Research Services Ltd. to perform a risk assessment – see Carver, C.E. and Mallet, A.L. "A Preliminary Assessment of the Risks of Introducing Non-indigenous Phytoplankton and Zooplankton Species or Pathogens/Parasites from South Amboy, New Jersey (Raritan Bay) into Whites Point, Digby Neck, Nova Scotia" October 6, 2003 (**Ref. Vol. II, Tab 13**). This risk assessment is based on available information from the scientific literature and personal communications. The objective of the assessment is to evaluate the potential for transferring non-indigenous and possibly invasive species in ballast water taken on at a port in South Amboy (Raritan Bay) to the proposed port at Whites Point, Nova Scotia. First, the assessment focuses on species of concern in the South Amboy (Raritan Bay) region and secondly on evaluating the factors which may affect the risk of introduction into the Bay of Fundy at Whites Point. Further, phytoplankton and zooplankton present in Raritan Bay which are of greatest immediate concern were reviewed. These include phytoplankton associated with harmful algal blooms, non-indigenous invertebrate species (zooplankton) with a pelagic larval phase, and pathogens or parasites responsible for disease.

Additionally, Bilcon of Nova Scotia Corporation contracted a seasonal baseline survey of phytoplankton and zooplankton in the area of the proposed Whites Point Marine Terminal – see Brylinsky 2005, (**Ref. Vol. II, Tab 11**). This comprehensive baseline data collection, including larval stages, was collected as a precautionary measure and is maintained by Bilcon of Nova Scotia Corporation for future reference.

9.2.14.2 Analyses

As presented in the "alternate means" section of this EIS, the selected method of aggregate transportation is by a "common", reputable, bulk carrier such as Canadian Steamship Lines at this time. It is likely that the ship will not be a "dedicated" ship traveling to and from the Whites Point Terminal to Perth Amboy in northern New Jersey on a weekly schedule. Scheduling and ship selection would rest with the shipping company.

Therefore, Bilcon of Nova Scotia Corporation will have no control over what port ballast water is taken on or where exchanged en route to the Whites Point Terminal.

Clearly, the responsibility for ballast water management is with the shipping company, to either follow the current guidelines or comply with the pending regulations. Bilcon of Nova Scotia Corporation will contract reputable shipping companies that are following prescribed guidelines and complying with any regulations regarding ballast water control and management.

9.2.14.3 Mitigation

None proposed.

9.2.14.4 Monitoring

Due to the public and fishing industry concerns expressed regarding invasive species in the marine environment, especially as a result of ballast water discharge at the Whites Point Marine Terminal, Bilcon of Nova Scotia Corporation will conduct monitoring at the marine terminal. Monitoring in waters adjacent to the marine terminal will be conducted to provide an early detection of possible invasive species. A written report of findings will be submitted to Environment Canada upon completion of the investigations.

9.2.14.5 Impact Statement

Ballast Water

Since the responsibility for ballast water management lies with the shipping company to comply with existing guidelines and pending regulations, and ballast water exchange in designated areas, this would result in a ***long term, neutral (no) effect, of regional scale.***

9.2.15 Noise and Vibration - Marine

9.2.15.1 Research

Historical background noise levels in the Bay of Fundy were unavailable until a pilot study of 29 July 1999 in the North Atlantic right whale Conservation Area was conducted (Desharnais 2000 Ref. 108). Eleven sonobuoys were deployed in the area of the overlap of the Conservation Area and the shipping lanes. The sonobuoys were deployed to a depth of 30 m in the water column. Noise levels measured during this pilot study were in the order of 75 -–80 dB re 1 mPa²/Hz at 500 Hz and 81 – 93 dB re 1 µPa²/Hz at 100 Hz.

9.2.15.2 Analysis

The 100 Hz levels are representative of moderate to heavy shipping and are similar to levels measured near the Halifax harbour approaches. Aerial surveys on the same date as the pilot project, indicate a high density of shipping in the area. The noise levels at 500 Hz were very high considering the calm conditions (light wind, sea state 1 and fog). It was therefore assumed that shipping noise was contaminating the normally wind-dominated noise levels above 200 Hz.

The frequency of shipping aggregate products by bulk carrier is once per week. Presently, only fishing boats are known to frequent the waters between the inbound/outbound shipping lanes and the Whites Point shoreline. Arrival and departure of the bulk carrier once per week during operation of the quarry will add to existing sound and vibration levels in these marine waters. Due to the close proximity of the marine terminal to the inbound/outbound shipping lanes, the vessel will be traveling at low speed. Background noise levels are therefore expected to be less than noise levels recorded in the North Atlantic right whale Conservation Area study previously mentioned.

9.2.15.3 Mitigation

None proposed.

9.2.15.4 Monitoring

Sound and vibration level monitoring in the water column is proposed in the vicinity of the marine terminal moorings. This monitoring station will be used to record background noise levels and noise and vibration levels during arrival and departure of the bulk carrier. This background data will be used to establish baseline conditions and for any future adaptive management practices.

9.2.1.15.5 Impact Statement

Noise and Vibration - Marine

Considering the infrequent arrival and departure, reduced speeds of the bulk carrier and existing background marine noise, effects on marine organisms from ship noise levels would result in a ***long term, insignificant negative effect, of local scale.***