Labrador – Island Transmission Link

2011 Marine Habitat and Water, Sediment and Benthic Survey: Strait of Belle Isle Cable Corridor Segment - Shoal Cove Option

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1.0 INTRODUCTION

Nalcor Energy is proposing to develop the *Labrador – Island Transmission Link* (the Project), a High Voltage Direct Current (HVdc) transmission system extending from Central Labrador to the Island of Newfoundland's Avalon Peninsula. The proposed Project includes the installation and operation of marine cables across the Strait of Belle Isle (SOBI). The environmental assessment (EA) of the Project was initiated in January 2009 and is in progress.

The original Project concept for the SOBI marine cables identified cable landing sites at Forteau Point, Labrador and Mistaken Cove, Newfoundland (with alternatives at L'Anse Amour and Yankee Point in Labrador and on the Island of Newfoundland, respectively). From there, multiple cables would be placed in two identified submarine corridors across the Strait of Belle Isle. Since the original concept development, Nalcor Energy has continued with its Project planning and engineering work, and in doing so, has proceeded to evaluate other possible design options and alternatives.

Although Forteau Point continues to be the proposed cable landing site in Labrador, on the Newfoundland side, Shoal Cove has also been identified as a possible option. If the Forteau Point and Shoal Cove cable landing sites were to be finalized, on-land horizontal directional drilling technology may be used to install the cables from these locations, out to and under the Strait for up to several kilometers. From there, the cables would be placed on the seabed and protected with rock berms. With this option, the cables would be placed within one marine corridor (rather than two) across the Strait. This single corridor is essentially an amalgamation of the original two marine corridors, utilizing portions of each along with the addition of a new (approximately 12 km long) corridor segment in to the Shoal Cove area, hereafter referred to as '2011 Corridor: Shoal Cove Segment'.

Marine flora, fauna and habitat surveys have been completed by Nalcor Energy in 2008 and 2009 (AMEC 2010) and water, sediment and benthos surveys were conducted in 2010 (Sikumiut 2011a). The studies have provided marine environmental baseline information for most of this identified SOBI submarine cable corridor, with the exception of the above described marine corridor segment to Shoal Cove.

This study therefore involved the planning, execution and reporting of a Marine Habitat and Water, Sediment and Benthic Survey along the above described 2011 Corridor: Shoal Cove Segment. Studies were also conducted to characterize water, sediment, benthos and habitats at Shoal Cove. Additionally, surveys were conducted to characterize the marine habitat, flora, and fauna of an approximately 3 km section of the previously identified submarine cable corridor, hereafter referred to as '2011 Corridor: Central Segment'.

1.1 Study Purpose and Objectives

The objective of this study was to collect and compile marine environmental data within the proposed submarine cable corridor in the Strait of Belle Isle for two segments, the '2011 Corridor: Shoal Cove Segment' and the '2011 Corridor: Central Segment', and for the proposed cable landing site at Shoal Cove associated with the *Labrador – Island Transmission Link.* This included collection of habitat information, including macroflora and macrofauna, as well as water and sediment quality data and benthic invertebrate community data. This information will be used to characterize the marine environment in the study areas in support of the Environmental Impact Statement (EIS) for the proposed Project. The study further complements previous

surveys in 2008 and 2009 (AMEC 2010) as well as in 2010 (Sikumiut 2011a and b), and other studies by Nalcor Energy including a literature review of environmental, oceanographic, biological, and fish habitat information in the study area (Sikumiut 2010a and b).

2.0 APPROACH AND METHODS

This study provides marine environmental baseline information for the proposed Strait of Belle Isle submarine cable crossing corridor. The study consisted of field study design and planning, implementation, laboratory and data analyses, and report preparation. The study was divided into three components, as follows: proposed submarine corridor for the (1) 2011 Corridor: Central Segment and the (2) 2011 Corridor: Shoal Cove Segment, both of which were focused exclusively on deep subtidal fish habitats, and the (3) Shoal Cove Proposed Cable Landing Site (hereafter referred to as Shoal Cove Marine Survey Area), which focused on the nearshore marine environment (intertidal and shallow subtidal) and associated backshore, on the Newfoundland coastline.

Sampling in the proposed submarine cable corridor for the 2011 Corridor: Central Segment consisted of collection of underwater video data to classify and quantify marine habitat, including substrate, flora and fauna. These data were collected to complement and expand upon data collected by AMEC in 2008 and 2009 (AMEC 2010). Sampling in the proposed submarine cable corridor for the 2011 Corridor: Shoal Cove Segment consisted of collection of underwater video data (to classify and quantify substrate, flora, fauna, and habitat), water and sediment quality data, as well as benthic community data. These data were collected such that the environmental baseline information for the 2011 Corridor: Shoal Cove Segment was consistent, to the extent possible, with data collected for the proposed submarine cable corridor (2008) in 2008 and 2009 (AMEC 2010), 2010 (Sikumiut 2011), and this year for 2011 Corridor: Central Segment (as included in this report). Nearshore sampling at Shoal Cove also included the collection of the water and sediment quality data, benthos community data and underwater video data in the shallow subtidal habitats. Habitat surveys in the nearshore also consisted of classification, quantification and subsequent mapping of the intertidal and backshore (based on shoreline survey) habitats in Shoal Cove.

2.1 Study Area

The study area for the marine surveys was directed at the proposed submarine cable corridor crossing segment for the *Labrador-Island Transmission Link* within the Strait of Belle Isle and included study sites in both the 2011 Corridor: Central and Shoal Cove Segments, and the nearshore proposed cable landing site at Shoal Cove, Newfoundland. Various sampling locations were selected within these three discrete study areas (Figure 2.1).

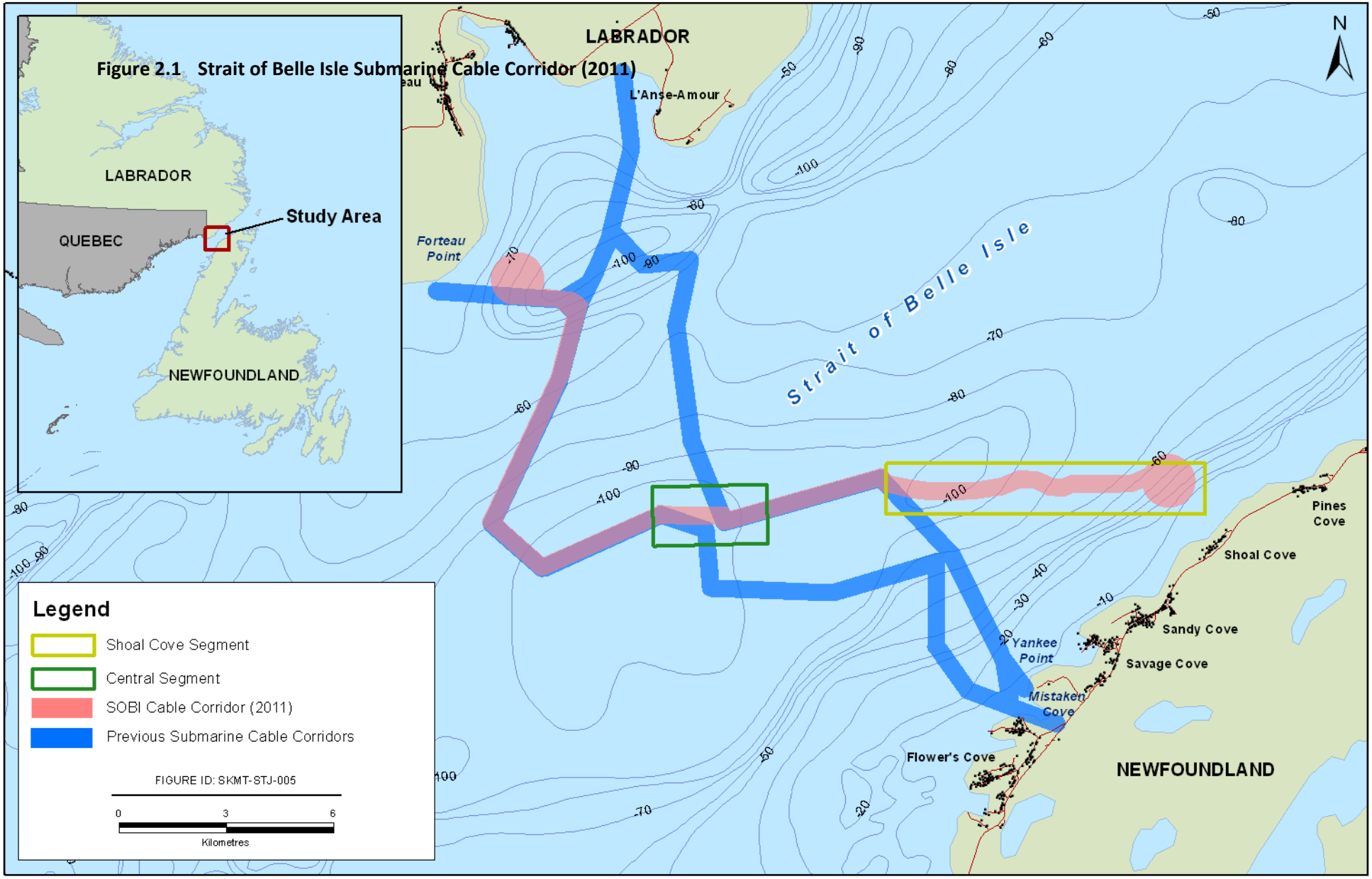

FIGURE 2.1

Strait of Belle Isle Submarine Cable Corridor (2011)

2.2 Study Team

The Study Team (Table 2.1) was led by Dave Scruton, Project Manager, who also provided senior technical advice and contributed to report preparation. The field team was led by Narcissus Walsh, with field technical and geomatics support provided by Grant Vivian. Lloyd Normore was contracted to provide large vessel support for water, sediment, benthos, and video data collection in the proposed submarine cable corridor. Kevin Diamond was contracted to provide small boat support for the nearshore surveys and provided overall field technical support for all study components. Report preparation was completed by Dave Scruton, Suzanne Thompson and Grant Vivian. Report review and QA/QC was provided by Larry LeDrew.

Table 2.1 Study Team Roles and Responsibilities

Name	Role	Responsibilities
Dave Scruton, M.E.S.	Senior Scientist, Project Manager	Project management, client liaison, advisor, and report preparation
Narcissus Walsh, B.Sc., B.Ed.	Lead Field Survey Team	Technical lead for mobilization, implementation and completion of field study
Grant Vivian, B. Tech	Geomatics Lead, Field Survey Team Member	Field technical support and geomatics specialist; data analyses, graphics and mapping support
Lloyd Normore	Boat Contractor and Operator	Provision and operation of boat during the field study component
Kevin Diamond	Field Survey Team Member, Boat Operator	Field technical support
Suzanne Thompson, B.Sc.	Biologist	Data analyses and report preparation
Larry LeDrew, M.Sc.	Senior Scientist	Health and Safety Plan, Project Management, Report review and QA/QC
Cynthia Mercer	Biologist	Analyses of underwater video

2.3 Study Design and Planning

The sampling program was planned and conducted in consideration of field studies completed in 2007, 2008, 2009, and 2010; specifically:

(i) Marine Habitats in the Strait of Belle Isle: Interpretation of 2007 Geophysical (Sonar) Survey Information for the Submarine Cable Crossings Corridors (Fugro-Jacques Geosurveys 2010);

(ii) Marine Flora, Fauna and Habitat Survey - Strait of Belle Isle Submarine Cable Crossings Corridors, 2008 and 2009 (AMEC Earth and Environmental 2010);

(iii) Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation (Sikumiut 2010a);

(iv) Strait of Belle Isle Submarine Cable Crossing Corridors: Marine Water, Sediment and Benthic Surveys (Sikumiut 2011a); and

(v) Marine Water, Sediment, Benthos and Nearshore Habitat Surveys: Potential Electrode Sites (Sikumiut 2011b).

These documents informed the study design by identifying locations amenable to sample collection, identifying sampling methods and approaches that have been successfully used in the Study Area, identifying areas where data (either spatial or temporal) may be lacking, and identification of any sampling constraints and challenges that may be related to current, tides, water depths, and other natural features. Historical weather summaries were also consulted in order to schedule the field sampling campaign in consideration of expected weather and sea state conditions (Environment Canada 2011). Long term marine forecasts were also consulted on an ongoing basis to plan the daily study tasks.

The initial sampling design was developed to be consistent with studies conducted in 2010 (Sikumiut 2011a and b) and included:

- collection of samples to provide good spatial distribution within the study areas;
- co-location of water, sediment and benthic sample collections, whenever possible or practical, recognizing this had not been possible in 2010; and
- collection of samples in consideration of the proportional representation of substrate and depth (i.e., habitat) categories, considering that sediment and benthic samples had to be collected from the less coarse sediment types.

Based on these broad objectives, the Study Team conducted a desktop assessment of the available information to identify sample requirements and candidate sites for discussion with Nalcor Energy. On the basis of the above approach, the Study Team and Nalcor Energy determined that a total of 13 sediment and benthos samples (five samples from the 2011 Corridor: Shoal Cove Segment; eight from the Shoal Cove cable landing site) and 19 water samples (three samples from each of the five stations in the 2011 Corridor: Shoal Cove Segment and four samples from sites at the Shoal Cove cable landing site), plus 10 % quality assurance/quality control (QA/QC) replicate samples, would be targeted for collection and analyses.

During the study planning stages, it was evident that sediment sampling during previous studies in the Strait of Belle Isle had a very low rate in retrieval of sediment grabs (AMEC Earth and Environmental 2010; Sikumiut 2011a). In consideration of the challenges in sediment and benthos sampling, it was decided that the video data collected during this study would be reviewed in real time to attempt to select sampling locations with substrate

material (unconsolidated seabed material with fine, coarse-small, and shell substrates) suitable for sediment/benthos sample collection. Consequently, the video survey was planned to be conducted in advance of the sediment and benthos sampling.

In recognition of the documented challenges in obtaining sediment samples from the Strait of Belle Isle, an *a priori* protocol was developed, in consultation with Nalcor Energy, for sediment grab attempts. This was developed to ensure that an inordinate amount of time was not spent at any one location attempting to collect sediment samples, without success. A maximum of seven attempts to collect a sediment sample were to be made at the pre-selected sampling stations and, if the attempts were not successful, then the sampling platform would relocate to the next sampling station.

An underwater video survey was planned to be conducted along the centerline of the approximately 12 km corridor in the 2011 Corridor: Shoal Cove Segment and an additional three km corridor in the 2011 Corridor: Central Segment using a drop-down and towed video system. The previous surveys conducted within the proposed submarine cable corridors by AMEC in 2008 (towed video survey) and 2009 (diver collection of video) were transect/reach based and were designed considering the results of geophysical program completed by Fugro-Jacques in 2007. The 2008/2009 surveys were conducted on transects/reaches owing to the extensive area that required coverage. For the 2011 video data collection, bathymetric data collected during the 2007 geophysical (sonar) survey were used to plan and design the data collection so the study team, and vessel captain, were aware of any steep variations in topography of the seabed during conduct of the survey. It was also decided to complete the survey of the designated corridor in both the 2011 Corridor: Central (three km) and Shoal Cove (12 km) Segments as largely continuous transects then delineate shorter transects, after data collection, on the basis of distance and or time, for consistency with the previous data.

The need to select sediment sampling locations based on distribution of unconsolidated sediments required that sampling sites could not be evenly distributed on a geographical basis. The water and sediment/benthos sampling components were subsequently conducted as independent sampling campaigns so that the water sampling could be completed on a more geographically distributed basis. This also permitted the water samples to be collected and stored, prior to sediment sampling, so as to eliminate any chances of sample cross-contamination.

The data collection for the Shoal Cove Marine Survey Area was conducted in consideration of the study area extent as identified by Nalcor Energy which included a length of shoreline of 3 km. The study area included this length of coastline and all wetted habitat area from the high tide mark into the shallow subtidal zone to a seaward limit of approximately 10 m depth for consistency with the 2010 (Sikumiut 2011b) surveys. The study site also extended from the high tide mark to the backshore or inland limit of marine processes (e.g., coastal cliff), above any tidal influence. The study had four key sub-components including:

a) collection of water, sediment, and benthic samples;
b) completion of a bathymetric survey from the shoreline to approximately the 10 m depth contour or the seaward limit;
c) conduct of an underwater video survey along two transects parallel to the shoreline to characterize and classify marine habitats (substrate and marine plants), and quantify marine fauna; and

d) conduct of an assessment of the backshore from the high tide mark to the inland limit of the backshore using standard Fisheries and Oceans Canada (DFO)/Environment Canada criteria.

The Shoal Cove surveys were conducted consistent with the DFO guidance document 'A System for Characterizing and Quantifying Coastal Marine Habitat in Newfoundland and Labrador' (Kelly et al. 2009, draft). This system includes a four level hierarchical approach to coastal marine habitat classification moving from the large scale, general, and descriptive level (ecosystem, ecoregion) to the more small scale, detailed level (Shore Unit, shore zone. The DFO system specified various approaches to data collection and classification of information collected. This study was conducted to collect data for the detailed Shore Unit/shore zone level of characterization, requiring site specific characterization.

2.4 General Field Study Program

The field sampling component of this study was initiated on June 3 and completed on June 10, 2011. Throughout the survey, the field crew and the field sampling platforms (longliner and speed boat) were stationed in Flower's Cove. All necessary field sampling equipment, including backups, were transported by the field team to Flower's Cove. The field crew mobilized from St. John's to Flower's Cove on June 3 and set up the vessel and equipment for the study on June 4, which included completing a detailed safety briefing and orientation for the field team and vessel crew, and testing and calibration of all field equipment. An overview of the progress of the field program and the sampling components completed are provided in Table 2.2. Details on the sampling platform are provided below as well as the details on the various study components; sampling protocols; sample collection; handling, and preservation; sample analyses; and approach to analyses and interpretation of results are provided in the ensuing sections.

Table 2.2 Overview of the Field Sampling Program for the 2011 Strait of Belle Isle Surveys

Date	Study Component
June 3, 2011	Travel St. John's to Flower's Cove
June 4, 2011	Safety briefings, field mobilization, equipment testing and calibration,
June 5, 2011	Video surveys, 2011 Corridor: Shoal Cove Segment, 50 % completed
June 6, 2011	Video surveys, 2011 Corridor: Shoal Cove Segment, completed; 2011 Corridor: Central Segment completed; one transect at Shoal Cove completed
June 7, 2011	Water sampling, CTD profiles completed, one site in the 2011 Corridor: Shoal Cove Segment, completed
June 8, 2011	Water sampling, four sites in the 2011 Corridor: Shoal Cove Segment, completed; sediment sampling completed
June 9, 2011	Nearshore surveys (water, sediment, benthos, bathymetry, video and backshore) completed
June 10, 2011	Field demobilization, travel Flower's Cove to St. John's

2.5 Sampling Platform

The water, sediment and benthos sampling program as well as the collection of underwater video in the proposed submarine cable corridor was completed through the charter of a 14.0 m longliner, the *Trina N* (Figure 2.2). The vessel is owned and operated by Lloyd Normore and is based in L'Anse au Loup, Labrador but was deployed to Flower's Cove for the duration of the study. The longliner was certified as both a fishing and charter vessel and contained suitable safety equipment including inflatable life rafts and immersion suits for all crew and Study Team members. Based on the 2010 survey, the Study Team determined that a Honda hauler, with a new 0.95 cm braided rope, with a metering system for determining sampling depth, was the preferred sampling equipment for the rapid deployment and retrieval of the conductivity/temperature/depth (CTD) meter, water sampling bottles, and sediment grabs. The hauler permitted more control of the speed of descent of the sediment grab, particularly during contact with the sediment/water interface, which was important in successfully obtaining grabs. The hauler was subsequently mounted on the stern of the boat which also afforded the Study Team more protection from open sea conditions during sample collection.

The boat was equipped with an onboard GPS Navigation system and had onboard refrigeration for sample storage. A second GPS system with external antenna, was installed on the survey vessel by the Study Team and connected to a computer based GPS/mapping software (Fugawi™) which displayed the vessel position and survey targets, in real time, on a pre-loaded map of the survey area. All positions collected throughout the large vessel survey were recorded using a Wide Area Augmentation System (WAAS) enabled GPS with a manufacturer's stated accuracy within 3 m, 95 % of the time. Positions were recorded in latitude and longitude with reference to a WGS84 datum.

Sampling locations were set up as 'navigational targets' and the vessel captain was directed to position the vessel on the center of each target. Sampling equipment (CTD meter; sediment grab and water sampling equipment) was prepared in advance of arriving at the location. The vessel was brought to the sampling location; the location number was verbally verified and the sampling equipment was deployed. Strong currents and persistent winds introduced some challenges in maintaining position at sampling locations. If the vessel moved a substantial distance from the target during equipment deployment it was repositioned and the sampling effort was repeated.

The survey of Shoal Cove was completed using a chartered 7.0 m fiberglass speedboat, with 70 hp outboard engine. The Van Veen sediment grab and Nisken water sampling bottle were deployed over the side of the vessel. The boat was launched from Flower's Cove and the Study Team travelled to/from Shoal Cove for the survey work which included water, sediment, and benthos sampling, bathymetric survey, and the collection of underwater video for substrate, marine flora and fauna assessment. The field team was also deployed to the shoreline for the intertidal and backshore survey and sediment and benthos samples were collected within the intertidal zone during low tide conditions.

Figure 2.2 Large Vessel Sampling Platform for the Study

2.6 Water Quality

Water quality samples were collected from pre-selected locations within the 2011 Corridor: Shoal Cove Segment and from the Shoal Cove Marine Survey Area. Water quality sampling included collection of CTD profiles, determination of field water quality parameters, as well as collection of water samples for chemical and hydrocarbon analyses at an analytical laboratory. Sampling locations are provided in Figure 2.3 and 2.4 for the 2011 Corridor: Shoal Cove Segment and Shoal Cove, respectively. The methods are detailed in the following sections.

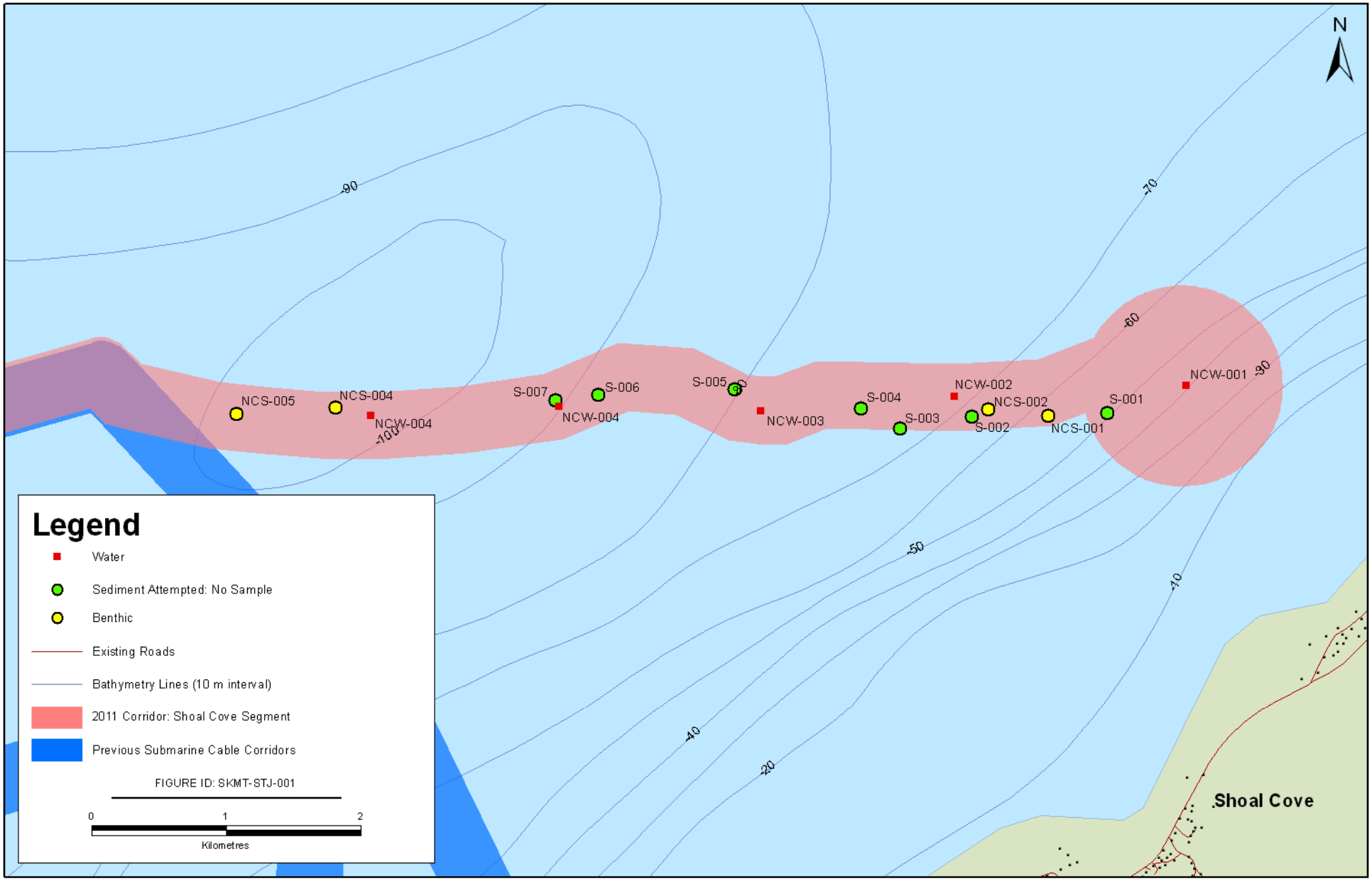

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FIGURE 2.3

2011 SOBI Marine Surveys Sample Locations - 2011 Corridor: Shoal Cove Segment

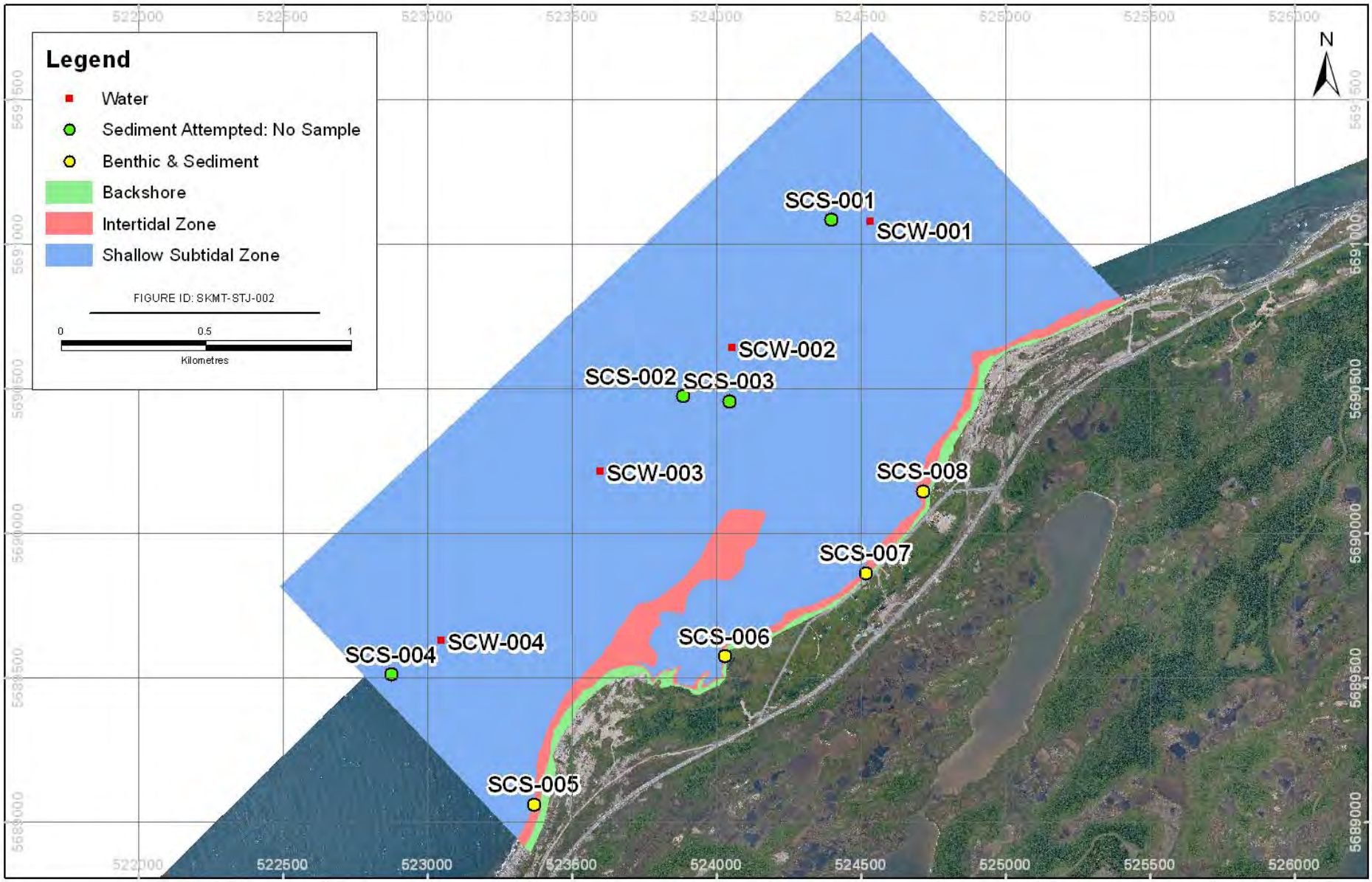

FIGURE 2.4

2011 SOBI Marine Surveys Sample Locations - Shoal Cove

2.6.1 **Site Selection**

Water quality sampling sites were pre-selected prior to the field program, and included five sites within the 2011 Corridor: Shoal Cove Segment, and four sites within the shallow subtidal zone at Shoal Cove. The sites were generally equally distributed to provide good spatial coverage within both study areas.

At sampling stations in the 2011 Corridor: Shoal Cove Segment, a CTD profile was conducted to characterize the water mass parameters at the time of sampling. The CTD data was observed by the Study Team in real time to examine the profile for evidence of stratification (temperature, salinity or both) for delineation of sampling depths. At each sampling station, three water samples were collected: (i) near surface; (ii) near bottom; and (iii) within the thermocline or halocline (if present) as determined from the CTD profile.

The water column at sites within the shallow subtidal zone at Shoal Cove was expected to be thoroughly mixed at the time of sampling, and this was confirmed by CTD profiling therefore only one water sample was collected per sampling station, at a depth of 1 to 2 m below the water surface, at four representative locations distributed throughout the study area.

2.6.2 **Conductivity, Temperature and Depth (CTD) Profiles**

A Sea-Bird Electronics SEACAT SBE-19 CTD meter was used to profile conductivity (salinity), temperature, and depth (pressure) at all water quality stations. The unit measures conductivity from 0 to 9 $S \cdot cm^{-1}$ (resolution of 0.00005 $S \cdot cm^{-1}$) and temperature from -5 to +35 $^{\circ}C$ (resolution of 0.0001 $^{\circ}C$).

Initially, to ensure the unit would not contact the bottom during use, a three meter line with weight was attached to the bottom of the SBE-19. At each station, the vessel operator stabilized the boat and provided the depth from the vessel sonar to the Study Team. The main cable on the unit was metered so the Study Team could monitor water depth when approaching the seabed. The SBE-19 was pre-programmed for data collection and storage, and deployed in profiling mode where vertical profiles were recorded at a rate of two times a second as the instrument was being lowered to the bottom. In profiling mode, the unit recorded a header, containing real time and cast number data, and stored the CTD data in memory for each profile.

At each station, the SBE-19 was placed in the water and held at the surface for 90 seconds to allow the unit sensors to fully initialize. The unit was then lowered in the water column at an approximate rate of one meter per second. The unit was then retrieved to the surface and connected to an onboard computer (laptop) to download and store the CTD data.

2.6.3 **Water Sample Collection**

Water samples were collected by 2.5 liter Niskin bottles which were triggered remotely to collect samples at the desired depths (see above). After retrieval to the water surface, water from the Niskin bottles was carefully transferred and placed in various sampling bottles (n=4 per station), as required for analyses and as directed by the selected analytical laboratory, Maxxam Analytics (Maxxam) in Bedford, Nova Scotia.

All water samples were stored in coolers prior to collection of sediment to ensure no cross contamination of samples. After collection, samples were packed and shipped with ice packs to the analytical laboratory, along with completed Chain of Custody (CoC) forms, within 48 hours of collection.

2.6.3.1 Field Measurements

Field water quality measurements were recorded at the time of sample collection using YSI 600QS water quality multi-parameter sonde. For field measurements, water was decanted into a 500 ml Nalgene® bottle, and the probe of the water quality meter was placed in the sample, allowed to equilibrate, and the appropriate measurements were recorded. Field measurements included temperature (0.01 $^{\circ}$C), dissolved oxygen (DO, 0.01 $mg \cdot L^{-1}$), percent saturation of dissolved oxygen (% DO, 0.1 % sat), pH (0.01 pH units), conductivity (1 $mS \cdot cm^{-1}$), and oxygen reduction potential (ORP, 0.1 mV).

2.6.3.2 Laboratory Analysis and Interpretation

Laboratory analyses of water samples by Maxxam Analytics included general chemistry, major ions, nutrients, metals and hydrocarbons. Maxxam Analytics is accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL) which regulates, monitors, and accredits the performance of analytical laboratories in Canada.

Water samples were analyzed for various parameters as summarized in Table 2.3. Methods of analyses, units of reporting, reportable detection limits (RDL), and Canadian Council of Ministers of the Environment (CCME) values for Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2007), where applicable, are included. Major ions were determined using Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES), while trace elements were determined using Inductively Coupled Plasma – Mass Spectrometry (ICP-MS), with the exception of mercury which was analyzed using Cold-Vapor Atomic Absorption Spectrometry (CVAA) methods.

Water samples were also analyzed for Total Petroleum Hydrocarbons (TPH) and included Benzene, Toluene, Ethylbenzene, and Xylene(s) (BTEX), gasoline range organics (C_6 to C_{10}), and analysis of extractable hydrocarbons – diesel ($>C_{10}$ to C_{16}), diesel ($>C_{16}$ to C_{21}) and lube ($>C_{21}$ to C_{32}) range organics. BTEX and gasoline range organics were analyzed by purge and trap-gas chromatography/ mass spectrometry or headspace – gas chromatography (MS/flame ionization detectors). Extractable hydrocarbons, including diesel and lube range organics were analyzed using capillary column gas chromatography (flame ionization detector).

Table 2.3 Water Quality Parameters Measured in the Strait of Belle Isle 2011

	Units	RDL	CCME Guideline	Analysis Method
Conventional Parameters				
pH	pH	N/A	7.0 - 8.7	meter
Total Alkalinity (Total as $CaCO_3$)	$mg \cdot L^{-1}$	5		colourimetry
Hardness ($CaCO_3$)	$mg \cdot L^{-1}$	1		calculation
Turbidity	NTU	0.1		nephelometer
Conductivity	$\mu S \cdot cm^{-1}$	1		meter
Colour	TCU	1		colourimetry
Total Suspended Solids (TSS)	$mg \cdot L^{-1}$	1		dry weight
Calculated TDS	$mg \cdot L^{-1}$	5		gravimetric
Total Organic Carbon (C)	$mg \cdot L^{-1}$	5		spectrophotometry
Reactive Silica (SiO_2)	$mg \cdot L^{-1}$	0.5		spectrophotometry
Nutrients				
Nitrate + Nitrite	$mg \cdot L^{-1}$	0.05		chromatography
Nitrite (N)	$mg \cdot L^{-1}$	0.01		chromatography
Nitrate (N)	$mg \cdot L^{-1}$	0.05	16[a]	chromatography
Nitrogen (Ammonia)	$mg \cdot L^{-1}$	0.05		colourimetry
Total Phosphorous (P)	$mg \cdot L^{-1}$	10		OES
Orthophosphate (P)	$mg \cdot L^{-1}$	0.01		spectrophotometry
Major Ions				
Total Calcium (Ca)	$mg \cdot L^{-1}$	10		OES
Total Magnesium (Mg)	$mg \cdot L^{-1}$	10		OES
Total Sodium (Na)	$mg \cdot L^{-1}$	10		OES
Total Potassium (K)	$mg \cdot L^{-1}$	10		OES
Dissolved Chloride (Cl)	$mg \cdot L^{-1}$	300		colourimetry
Dissolved Sulphate (SO_4)	$mg \cdot L^{-1}$	50		spectrophotometry
Trace Elements				
Total Mercury (Hg)	µg·L-1	0.013	0.016[b]	CVAA
Total Aluminum (Al)	$\mu g \cdot L^{-1}$	500		ICP-MS
Total Antimony (Sb)	$\mu g \cdot L^{-1}$	100		ICP-MS
Total Arsenic (As)	$\mu g \cdot L^{-1}$	100	12.5	ICP-MS
Total Barium (Ba)	$\mu g \cdot L^{-1}$	100		ICP-MS
Total Beryllium (Be)	$\mu g \cdot L^{-1}$	100		ICP-MS
Total Bismuth (Bi)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Boron (B)	$\mu g \cdot L^{-1}$	500		ICP-MS
Total Cadmium (Cd)	$\mu g \cdot L^{-1}$	30	0.12	ICP-MS
Total Chromium (Cr)	$\mu g \cdot L^{-1}$	100	56, 1.5[c]	ICP-MS
Total Cobalt (Co)	$\mu g \cdot L^{-1}$	40		ICP-MS
Total Copper (Cu)	$\mu g \cdot L^{-1}$	200		ICP-MS

Table 2.3 Water Quality Parameters Measured in the Strait of Belle Isle 2011 (Cont'd)

	Units	RDL	CCME Guideline	Analysis Method
Trace Elements				
Total Iron (Fe)	$\mu g \cdot L^{-1}$	5000		ICP-MS
Total Lead (Pb)	$\mu g \cdot L^{-1}$	50		ICP-MS
Total Manganese (Mn)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Molybdenum (Mo)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Nickel (Ni)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Selenium (Se)	$\mu g \cdot L^{-1}$	100		ICP-MS
Total Silver (Ag)	$\mu g \cdot L^{-1}$	10		ICP-MS
Total Strontium (Sr)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Thallium (Tl)	$\mu g \cdot L^{-1}$	10		ICP-MS
Total Tin (Sn)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Titanium (Ti)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Uranium (U)	$\mu g \cdot L^{-1}$	10		ICP-MS
Total Vanadium (V)	$\mu g \cdot L^{-1}$	200		ICP-MS
Total Zinc (Zn)	$\mu g \cdot L^{-1}$	500		ICP-MS
Petroleum Hydrocarbons				
Benzene	$mg \cdot L^{-1}$	0.001	0.11	gas chromatography/MS
Toluene	$mg \cdot L^{-1}$	0.001	0.215	gas chromatography/MS
Ethylbenzene	$mg \cdot L^{-1}$	0.001	0.025	gas chromatography/MS
Xylene (Total)	$mg \cdot L^{-1}$	0.002		gas chromatography/MS
C_6 - C_{10} (less BTEX)	$mg \cdot L^{-1}$	0.010		gas chromatography/MS
$>C_{10}$-C_{16} Hydrocarbons	$mg \cdot L^{-1}$	0.050		gas chromatography
$>C_{16}$-C_{21} Hydrocarbons	$mg \cdot L^{-1}$	0.050		gas chromatography
$>C_{21}$-$<C_{32}$ Hydrocarbons	$mg \cdot L^{-1}$	0.100		gas chromatography
Modified TPH (Tier1)	$mg \cdot L^{-1}$	0.100		gas chromatography
Reached Baseline at C_{32}	$mg \cdot L^{-1}$	N/A		gas chromatography
Surrogate Recovery (%)				
Isobutylbenzene - Extractable	%			N/A
n-Dotriacontane - Extractable	%			N/A
Isobutylbenzene - Volatile	%			N/A

Notes:

RDL = Reportable Detection Limit

Results relate only to the items tested.

[a] - CCME Guideline is for direct effects only and does not consider indirect effects from eutrophication

[b] - CCME Guideline is for inorganic mercury only, whereas the concentration reported is for total mercury

[c] - CCME Guideline values are for hexavalent and trivalent chromium, whereas the concentration reported is for total chromium

The purpose of the water sampling program was to characterize spatial patterns in marine water quality of the study area for baseline conditions. Appropriate descriptive and summary statistics (minimums, maximums, means and standard deviations) were calculated for each parameter analyzed and presented separately for the 2011 Corridor: Shoal Cove Segment and Shoal Cove Marine Survey Area.

2.7 Sediment Quality

Sediment sampling was conducted along the 2011 Corridor: Shoal Cove Segment, as well as in the subtidal and intertidal zones at the Shoal Cove Marine Survey Area. Sediment samples were not successfully collected along the 2011 Corridor: Shoal Cove Segment, nor were they collected in the subtidal zone at Shoal Cove, despite repeated attempts (see below). However, sediment samples were successfully collected from the Shoal Cove intertidal zone, and were analyzed to determine the sediment quality (chemistry and hydrocarbons) and physical characteristics. Sampling stations are provided in Figure 2.3 and 2.4 for the 2011 Corridor: Shoal Cove Segment and Shoal Cove, respectively. Detailed methods for the collection and analyses of sediment samples are described in the following sections.

2.7.1 **Site Selection**

After discussion with Nalcor Energy, it was determined that five samples along the proposed cable crossing corridor in the 2011 Corridor: Shoal Cove Segment, as well as eight samples at the proposed Shoal Cove Marine Survey Area were sufficient to characterize the sediment chemistry and physical characteristics.

For the cable corridor sampling, the underwater video survey was conducted in advance of the sediment and benthos sample collection. The field team reviewed the video footage in real time and noted the location of substrates suitable for sediment sampling, and their GPS location, and these were subsequently used as sampling targets for the vessel captain. It was apparent during the video data collection that there were few locations with fine sediments that were suitable for sediment, and to a lesser degree, benthos sample collection and these substrate types were mostly evident in small patches rather than in extensive reaches of finer materials. Despite repeated attempts, no sediment samples for physical and chemical analyses were collected from the proposed cable crossing 2011 Corridor: Shoal Cove Segment.

For the at Shoal Cove Marine Survey Area, it was determined that sediment (and benthos) samples would be collected from different locations with respect to tidal cycles and wave action, with four samples to be collected from each of the intertidal and shallow subtidal zones. Sites were selected prior to the field program and were distributed evenly throughout the study area. Despite repeated attempts, no samples were collected from the shallow subtidal zone at Shoal Cove, due to the coarse nature of the substrate. Samples were successfully collected from the intertidal zone at Shoal Cove.

2.7.2 **Sample Collection**

Sediment grabs were attempted along the 2011 Corridor: Shoal Cove Segment and in the subtidal zone at Shoal Cove Marine Survey Area using a Van Veen grab (30 cm by 30 cm, volume of 13.5 L). At each sampling site, the survey vessel was maintained in position and the Van Veen grab was primed for release and attached to a 0.95 cm braided rope and Honda hauler system. The sampler was lowered over the side of the vessel and allowed to

freefall to the ocean bottom. After closure of the grab, the sampler was retrieved, and the grab was opened and examined by the study team. The depth and geo-position of each sampling station were recorded. In total, 12 candidate sites were identified to be attempted for sediment grab collection and 36 grabs were attempted without successful collection of sediment samples.

At the intertidal sites in Shoal Cove, suitable sampling locations were identified by examining the area for appropriate substrate for sampling and sites were then selected to be evenly distributed in the study area. Samples were collected from four sites which were demarked using 0.25 m^2 quadrats. Substrate materials within these quadrats were then scooped using a stainless steel spoon into a 20 liter Rubbermaid™ container and thoroughly mixed. Two sub-samples, one each for chemical/hydrocarbon analyses and physical characterization of sediment, were collected in 500 ml pre-labelled glass sampling jars. After collection, sample jars were retained at 4˚C in insulated coolers with freezer packs and then stored in a refrigerator on shore until they were shipped, along with CoC forms, to the analytical laboratory. Sampling equipment was thoroughly rinsed with sea water, and then distilled water, between collections.

2.7.3 **Physical Analyses**

Physical characteristics of sediment samples analyzed at the laboratory included classifying the proportion (%) of gravel, sand, silt and clay, based on the Wentworth (1922) substrate scale. A more detailed particle size analysis (PSA) of the silt/clay fraction was also conducted.

To determine the proportion of sample as gravel, sand, silt and clay, organic matter and carbonates were destroyed by hydrogen peroxide. Wet sieving (63 micron mesh sieve) was used to separate the gravel and sand fractions. Samples were passed through a series of nested sieves to separate the fractions based on particle diameter.

A detailed PSA was determined by pipette analysis. Sample aliquots were extracted by pipette from the sample and dried to constant weight. Stoke's Law was used to determine the diameter of each fraction and quantify it on the Phi Scale. The Phi Scale is a logarithmic representation of the Wentworth scale and is computed as follows:

Φ = - log 2 (grain size, mm) (Krumbein 1936).

2.7.4 **Chemical Analyses**

Parameters analyzed in sediment samples are listed in Table 2.4, including analysis methods and reportable detection limits. Metals were determined via Atomic Emission Spectrometry (AES), with the exception of mercury, which was determined using CVAA. Total Organic Carbon (TOC) was also determined using Leco furnace methods. Samples were analyzed for 'available' metals which targets the analyses to the biologically available fraction and does not remove metals bound in the lattice framework of the sediment. Available metals are determined using a mild digestion method with a nitric acid solution for digestion. Available metals are reported and discussed as they are more biologically relevant for assessing sediment quality.

Sediment samples were also analyzed for TPH and included BTEX, gasoline range organics (C_6 to C_{10}), and analysis of extractable hydrocarbons – diesel (> C_{10} to C_{16}), diesel (> C_{16} to C_{21}) and lube (> C_{21} to C_{32}) range

organics. BTEX and gasoline range organics were analyzed by purge and trap-gas chromatography/mass spectrometry or headspace – gas chromatography (MS/flame ionization detectors). Extractable hydrocarbons, including diesel and lube range organics were analyzed using capillary column gas chromatography (flame ionization detector).

Methods of analyses, units of reporting, RDL, and CCME (2002) Interim Sediment Quality Guideline (ISQG) limits for the Protection of Aquatic Life and Potential Effect Level (PEL) guidelines, where available, are included.

Table 2.4 Sediment Quality Parameters Measured During 2011 Marine Surveys

	Units	RDL	ISQG	PEL	Analysis Method
Major Ions					
Acid Extractable Calcium (Ca)	$mg \cdot g^{-1}$	0.5			ICP-AES
Acid Extractable Magnesium (Mg)	$mg \cdot g^{-1}$	0.5			ICP-AES
Acid Extractable Phosphorous (P)	$mg \cdot g^{-1}$	0.02			ICP-AES
Acid Extractable Potassium (K)	$mg \cdot g^{-1}$	0.20			ICP-AES
Acid Extractable Sodium (Na)	$mg \cdot g^{-1}$	0.10			ICP-AES
Acid Extractable Sulphur (S)	$mg \cdot g^{-1}$	0.05			ICP-AES
Metals					
Available Aluminum (Al)	$mg \cdot kg^{-1}$	100			ICP-AES
Available Antimony (Sb)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Arsenic (As)	$mg \cdot kg^{-1}$	20	7.24	41.6	ICP-AES
Available Barium (Ba)	$mg \cdot kg^{-1}$	50			ICP-AES
Available Beryllium (Be)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Bismuth (Bi)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Boron (B)	$mg \cdot kg^{-1}$	50			ICP-AES
Available Cadmium (Cd)	$mg \cdot kg^{-1}$	3	0.7	4.2	ICP-AES
Available Chromium (Cr)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Cobalt (Co)	$mg \cdot kg^{-1}$	10			ICP-AES
Available Copper (Cu)	$mg \cdot kg^{-1}$	20	18.7	108	ICP-AES
Available Iron (Fe)	$mg \cdot kg^{-1}$	500			ICP-AES
Available Lead (Pb)	$mg \cdot kg^{-1}$	5	30.2	112	ICP-AES
Available Lithium (Li)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Manganese (Mn)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Mercury (Hg)	$mg \cdot kg^{-1}$	1	0.13	0.7	CVAA
Available Molybdenum (Mo)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Nickel (Ni)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Rubidium (Rb)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Selenium (Se)	$mg \cdot kg^{-1}$	10			ICP-AES
Available Silver (Ag)	$mg \cdot kg^{-1}$	5			ICP-AES
Available Strontium (Sr)	$mg \cdot kg^{-1}$	50			ICP-AES

Table 2.4 Sediment Quality Parameters Measured During 2011 Marine Surveys (Cont'd)

	Units	RDL	ISQG	PEL	Analysis Method
Metals					
Available Thallium (Tl)	$mg \cdot kg^{-1}$	1			ICP-AES
Available Tin (Sn)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Uranium (U)	$mg \cdot kg^{-1}$	1			ICP-AES
Available Vanadium (V)	$mg \cdot kg^{-1}$	20			ICP-AES
Available Zinc (Zn)	$mg \cdot kg^{-1}$	50	124	271	ICP-AES
Organic Carbon					
Organic Carbon (TOC)	$g \cdot kg^{-1}$	0.7			Leco furnace
Inorganics					
Moisture	%	1			
Petroleum Hydrocarbons					
Benzene	$mg \cdot kg^{-1}$	0.003			gas chromatography/MS
Toluene	$mg \cdot kg^{-1}$	0.03			gas chromatography/MS
Ethylbenzene	$mg \cdot kg^{-1}$	0.01			gas chromatography/MS
Xylene (Total)	$mg \cdot kg^{-1}$	0.05			gas chromatography/MS
C_6 - C_{10} (less BTEX)	$mg \cdot kg^{-1}$	3			gas chromatography/MS
>C_{10}-C_{16} Hydrocarbons	$mg \cdot kg^{-1}$	10			gas chromatography
>C_{16}-C_{21} Hydrocarbons	$mg \cdot kg^{-1}$	10			gas chromatography
>C_{21}-<C_{32} Hydrocarbons	$mg \cdot kg^{-1}$	15			gas chromatography
Modified TPH (Tier1)	$mg \cdot kg^{-1}$	20			gas chromatography
Reached Baseline at C_{32}	$mg \cdot kg^{-1}$	N/A			
Hydrocarbon Resemblance	$mg \cdot kg^{-1}$	N/A			
Surrogate Recovery (%)					
Isobutylbenzene - Extractable	%	N/A			
n-Dotriacontane - Extractable	%	N/A			
Isobutylbenzene - Volatile	%	N/A			

Notes:
RDL - Reportable Detection Limit
ISQG - Interim Marine Sediment Quality Guidelines
PEL - Potential Effect Levels
ICP-AES - Inductively Coupled Plasma - Atomic Emission Spectrometry
CVAA - Cold-Vapor Atomic Absorption Spectrometry

2.7.5 **Analyses and Interpretation**

The purpose of the sediment sampling program in 2011 was to characterize marine sediment quality at each study site. Appropriate descriptive and summary statistics (minimums, maximums, means and standard deviations) were calculated and presented for each parameter analyzed.

The CCME has established ISQGs and PELs for the Protection of Aquatic Life in the marine environment (CCME 2002; Table 2.4). ISQGs and PELs have been established for several metals that were analyzed for in this study

including arsenic, cadmium, chromium, copper, lead, zinc and mercury (CCME 2002). The data generated during this study have been tabulated and compared with these two sets of sediment quality guidelines.

2.8 Benthic Invertebrates

Collection of benthic invertebrate samples was attempted from the 2011 Corridor: Shoal Cove Segment and Shoal Cove at the same locations as sediment sampling. Despite repeated attempts, benthic samples were not successfully collected in the shallow subtidal zone in Shoal Cove due to the coarse nature of substrates. Four benthic samples were collected from each of the 2011 Corridor: Shoal Cove Segment and the intertidal zone at Shoal Cove, and were analyzed to determine the benthic community characteristics. Even though benthic samples were successfully collected from the 2011 Corridor: Shoal Cove Segment, sediment samples were not because benthos were associated with coarser substrate materials not suitable for physical and chemical analyses. Detailed methods for collection and analyses of benthic invertebrate samples are described in the following sections.

2.8.1 **Sample Collection**

The approach to benthic invertebrate sample collection, including QA/QC principles, was developed from Environment Canada's Pulp and Paper and Metal Mining environmental effects monitoring (EEM) programs (Environment Canada 1998; 2002). These documents detail the sampling equipment to be used, sample collection protocols, sample handling protocols, describe the *a priori* acceptance criteria for samples, detail the methods for field sieving and preservation, and describe the appropriate shipping and storage procedures for samples.

Benthic samples were collected at the sediment sampling locations and the method of collection were as described in Section 2.7.2, Sample Collection for sediment sampling. Samples within the 2001 Corridor: Shoal Cove Segment were collected using a Van Veen grab, while the intertidal samples at Shoal Cove were collected using 0.25 m^2 quadrats during low tide. For grab sampling, each grab was landed in a sturdy tray and examined to determine if the grab was fully intact (i.e., the grab captured all surface material and was closed properly and did not lose material upon retrieval). Any grabs deemed not fully intact were discarded. All intact grabs were examined and then transferred to a 20 L bucket. For the intertidal sampling, substrate materials within quadrats were scooped using a stainless steel spoon into a 20 liter Rubbermaid™ container, however the contents were not thoroughly mixed to avoid any damage to the soft bodied organisms. To save time and ensure integrity of samples, no field sorting of samples was conducted. Samples were immediately transferred to 20 L sample buckets, and preserved in 10 % buffered formalin.

Benthic samples were kept cool prior to shipment to Envirosphere Consultants Limited, Windsor, Nova Scotia who sorted and conducted analyses of biological species composition and abundance/biomass of the benthic samples. This company has considerable experience with marine benthic sample analyses and has completed most of the benthic identifications for the offshore oil production EEM programs in Atlantic Canada.

2.8.2 **Laboratory Analyses of Benthic Samples**

Benthic samples were collected in the field, preserved, and shipped to the benthic laboratory immediately upon completion of sampling.

2.8.2.1 Sieving, Sorting and Identification

Upon arrival at the analytical laboratory, all of the samples were sieved and washed using a 30 cm by 60 cm, 500 µm mesh, sieving table by elutriating the sample with water flow to suspend the organisms that were not readily visible in the sample. The samples were lightly washed with gentle manipulation by laboratory staff so as to avoid damage to any of the benthic organisms. Mud and fine sand were washed directly through the sieve while coarser sand and larger materials were retained on the sieve and visually examined for the presence of organisms. All identified organisms were subsequently transferred to labeled 500 ml sample jars. Within a week to ten days of receipt of samples, all samples were again washed to remove any residual formalin and then transferred to 70 % isopropanol.

Processing involved sorting and/or removing organisms from samples at 6.4 to 10x magnification, with a final brief check at 16x, on a stereomicroscope. Sorting efficiency was checked by resorting 10 % of samples to ensure sorting efficiencies of 95 % or better. Organisms were removed from the sample debris using fine forceps, transferred to a separate container, and re-preserved (70 % ethanol). Wet weight biomass (g/sample) was estimated by weighing organisms at the time of sorting to the nearest milligram after blotting to remove surface water. Species abundance and number of taxa were also determined for each sample. Larger samples were sub-sampled because of time constraints, and for sub-samples the volume of sediment processed relative to the total volume of sediment in the various containers from the station was estimated and noted.

Organisms were sorted and identified to the lowest practical taxonomic level (LPL), typically genus or species, using current literature (general and regional keys) for the groups involved and enumerated. Organisms were identified by experienced taxonomic experts with Envirosphere Consultants Limited. Several small types of organisms collectively known as meiofauna (e.g., nematodes worms and harpacticoid copepods) were not included in abundance estimates because they are not sampled quantitatively by the 500 µm sieve. Polychaete worms in several groups which contained a range of species which are typically small and numerous in the samples (e.g., Ampharetidae, Syllidae, Sabellidae) were identified to the family level only. Species abundance, number of species and wet weight biomass were estimated from the data. The data were entered into a spreadsheet in the form of a species by sample matrix and all entries were double-checked to ensure accuracy of data transcription. Principles employed in the sample analysis followed environmental monitoring protocols for benthic analysis in national Pulp and Paper and EEM programs (Environment Canada 1998) and the Metal Mining EEM Guidance Document (Environment Canada 2002).

A reference collection has been developed and archived for future use.

2.8.3 **Data Analyses and Interpretation**

All of the descriptors used to describe the results of the benthic sample analyses were determined from equations and methods provided in Environment Canada's Metal Mining EEM Guidance Document (Environment Canada 2002) and references within. The selected benthic community indicators also followed recommendations in Costello et al. (2001) which identified suitable approaches for characterizing benthic biodiversity in marine environmental assessments for the Canadian Environmental Assessment Agency (CEAA). The selected descriptors included:

- total abundance;
- biomass;
- taxonomic richness; and
- diversity indices including:
    - (i) Shannon-Wiener Diversity;
    - (ii) Pielou's Evenness;
    - (iii) McIntosh's Index;
    - (iv) Simpson's Index; and
    - (v) Margalef's Index.

Species diversity was estimated by the *Shannon-Wiener Index* (H') (Pielou 1974). The Shannon-Wiener Diversity index is widely used in ecology and represents both the number of species and distribution among individuals, with higher numbers of species generally resulting in increased values and high values of single species resulting in low diversity measures. The Shannon-Wiener index is defined as:

$$H' = -\sum(p_i \times \log_{10} p_i)$$

where *p* is the probability that an individual belongs to species *i*. *p* is the proportion of individuals in the *i*th species to the total number of individuals in the sample.

Pielou's Evenness Index (J') (Pielou 1974) was used to express equitability of distribution of individuals among species. It is defined as:

$$J' = H'/ \log_{10} S$$

where S is the total number of species present.

McIntosh's Index (M) measures evenness (a measure of whether the species are present in about the same numbers or whether single species dominate) and the value falls in a range of from zero to one, reaching a maximum if all individuals are present in perfectly equal numbers (Legendre and Legendre 1983). It is defined as:

$$M = \frac{N - \sqrt{(\sum n_i^2)}}{N - \sqrt{N}}$$

where N is the total number of organisms in the sample, and n_i is the abundance of each species.

Simpson's Index of diversity measures the probability that two individuals randomly selected from a sample will belong to the same species (or some category other than species). *Simpson's Index* (P) measures dominance and is higher when a few species make up a large proportion of the individuals in a sample, i.e., the greater the value, the greater the diversity. It is defined as:

$$P = \sum p_1^2$$

where p_i = proportion of the number of individuals of a given species to the total number of individuals in the sample ($p_i = n_i/N$).

Margalef's Index (R) measures species richness (number of species per individual) and so is generally higher when more species are present, although it can be reduced for a given number of species if single species are present in high abundance. It is defined as:

$$R = \frac{S - 1}{\ln N}$$

where S is the total number of species and N is the total number of organisms in the sample.

2.9 Habitat Surveys

Habitat surveys were conducted using underwater video along both the 2011 Corridor: Central and Shoal Cove Segments and at the Shoal Cove Marine Survey Area (Figure 2.5). Underwater video was collected at these study areas to characterize the habitat based on a classification of substrate, marine flora, and marine fauna. At Shoal Cove, habitat surveys included shoreline and backshore surveys, bathymetric surveys and underwater video collection, as above, to characterize the shallow subtidal habitat. The methods employed during these surveys are described in the following sections.

For the purposes of describing the marine habitat surveyed in 2011, depth categories were delineated as described in AMEC (2010), which in turn were based on categories provided by DFO (2008). The depth categories used for the data interpretation are provided in Table 2.5. Owing to the nature and location of the two study areas, the Shoal Cove video data was collected exclusively from the shallow subtidal zones while the video collected from the 2011 Corridor: Central and Shoal Cove Segments was primarily from the deep subtidal zones.

Table 2.5 Depth Categories for the 2011 Marine Surveys in the 2011 Corridors: Central and Shoal Cove Segments

Depth Category	Description
Intertidal Zone	Between high and low tide
Shallow Subtidal Zone	Mean low tide to 30 m
Deep Subtidal Zone, 30-60 m	30-60 m
Deep Subtidal Zone, 60-90 m	60-90 m
Deep Subtidal Zone, 90-120 m	90-120 m

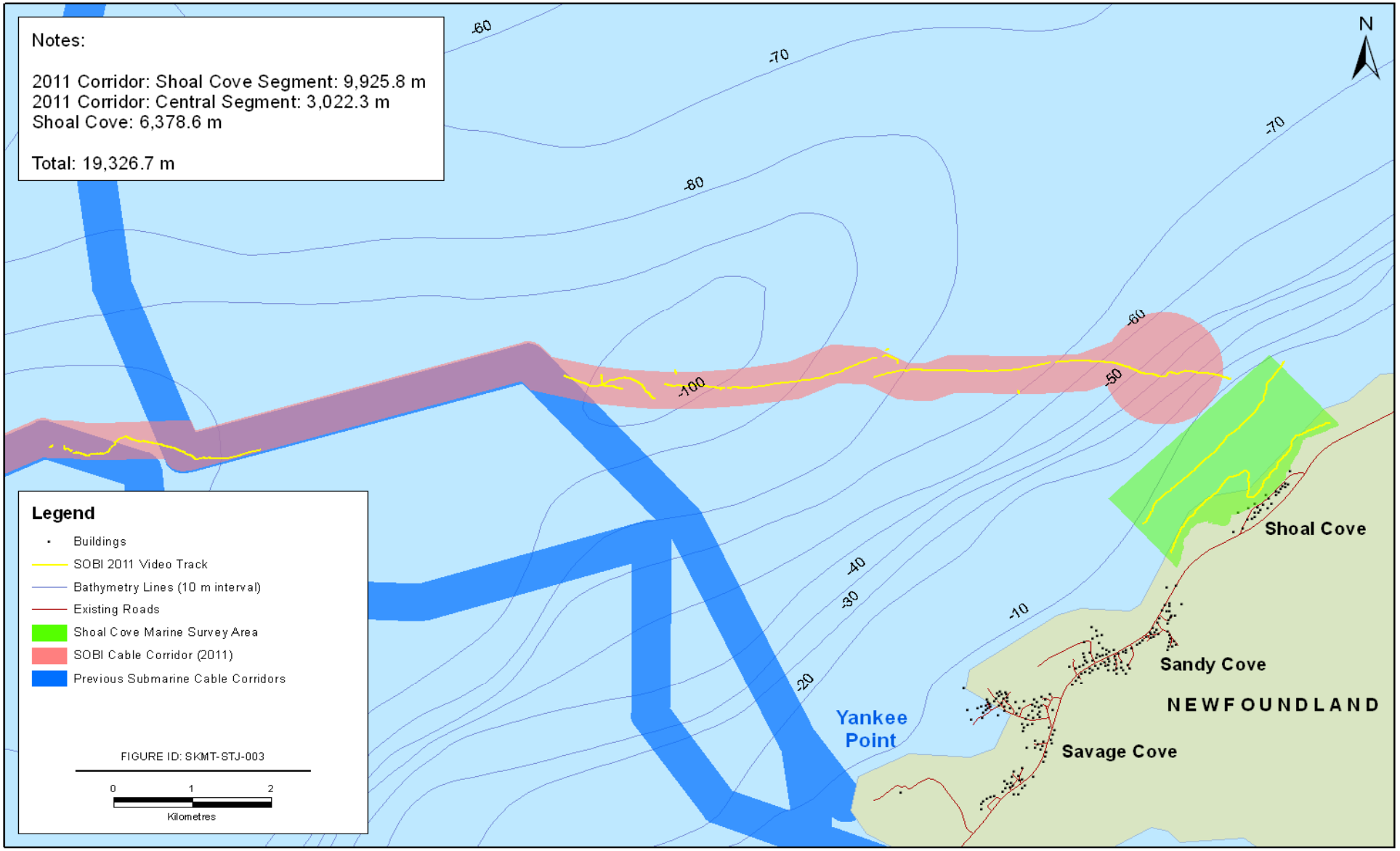

Figure 2.5

2011 SOBI Marine Surveys Video Tracks

Surveys were conducted to assess the habitat characteristics at the Shore Zone level of detail as defined in Kelly et al. (2009, draft) which included:

- backshore;
- intertidal zone;
- shallow subtidal zone; and
- deep subtidal zone.

The major features to be assessed at this Shore Zone Level of detail included:

- water depth;
- substrate type and class;
- macrofloral presence by species/class; and
- macrofaunal presence (fish and invertebrates).

2.9.1 **Underwater Video Survey of Marine Habitats (Substrate, Flora and Fauna)**

Underwater marine video surveys were completed for the 2011 Corridor: Central and Shoal Cove Segments, as well as in the shallow subtidal zone at Shoal Cove. Surveys were conducted consistent with accepted DFO methodology of using substrate and vegetation classes to describe physical habitat features (Bradbury et al. 2001). This method was initially developed for lacustrine habitat characterization, however the approach and description have been adapted for the DFO Coastal Marine Habitat Classification (Kelly et al. 2009, draft) and were utilized for habitat characterization in the 2011 Strait of Belle Isle coastal electrode sites (Sikumiut 2011b).

The video survey involved the use of an underwater drop video camera system (Sony VX 2000 digital video camera), enclosed in a stainless steel frame, with a series of lights powered by 24-V marine battery. A communication cable, encased by an armored cable, connected the camera to a GPS and computer system on the vessel through. The frame was constructed for protection and to allow addition of appropriate ballast to maintain stability of the camera system during deployment and towing. The video was collected as one continuous transect, to the extent possible, at an approximate speed of 1 to 2 $km \cdot hr^{-1}$. Based on camera orientation and height above the bottom, a field of view of approximately 2 m on either side of the centerline (4 m frame of reference) of the transect was recorded. A scale bar with 10 cm increments was displayed in the field of view to provide a size reference for video interpretation (e.g., substrate).

As the vessel approached the survey location the drop camera system was lowered in the water column to a depth of 1 – 1.5 m above the seafloor. The track file and video recorder were started and the vessel then travelled along the mid-line of the corridor at the slowest possible speed to maintain forward direction. The camera system was lowered and raised, using the hauler, as needed to maintain a clear visualization of the seafloor. This required continual adjustment for water depth and sea state. The towed video system recorded and displayed, in real time, the digital video data and stored it to high definition video tapes. Concurrent with the collection and storage of video data, the system recorded time (each second) and GPS position (every two to three seconds). The video was reviewed by the field team in real time to ensure the data collected was acceptable for subsequent analyses and to identify possible locations for other sampling components (e.g., sediment and benthos). At the completion of each survey, the video data was backed up and archived on

separate digital media (i.e., a portable hard drive). All data were digitally logged with the necessary metadata information.

A continuous transect totaling 3,022 m along the 2011 Corridor: Central Segment while a continuous transect totaling 9,925 m was completed along the 2011 Corridor: Shoal Cove Segment. At Shoal Cove, two transects totaling a length of 6,378 m were completed. The continuous transects were subsequently subdivided into shorter transects based on time and/or distance criteria. The drop video camera transects are illustrated for each of the 2011 Corridor: Central Segment (Figure 2.6), the 2011 Corridor: Shoal Cove Segment (Figures 2.7 to 2.10), and for Shoal Cove (Figure 2.11).

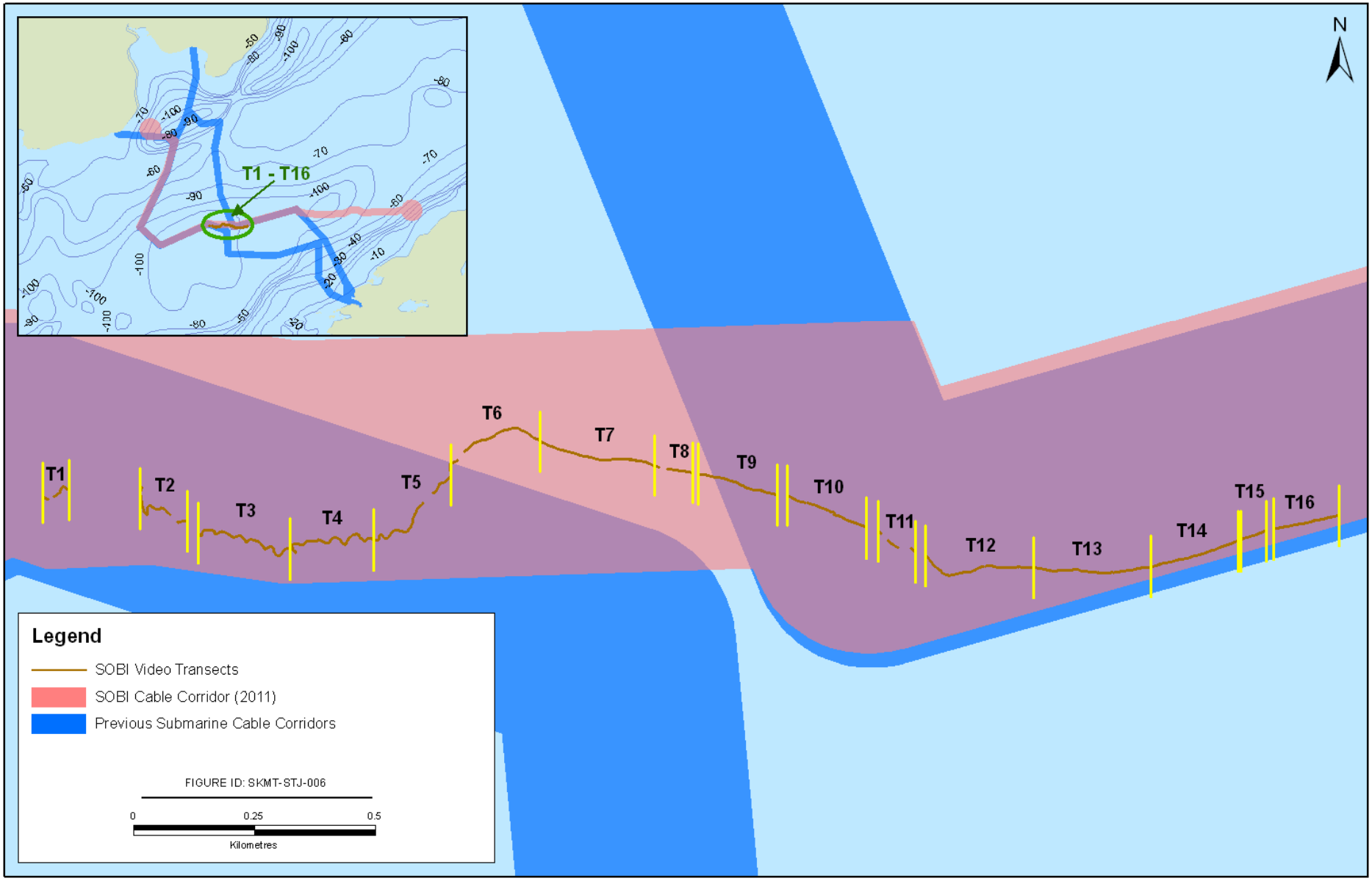

FIGURE 2.6

Video Transects - 2011 Corridor: Central Segment

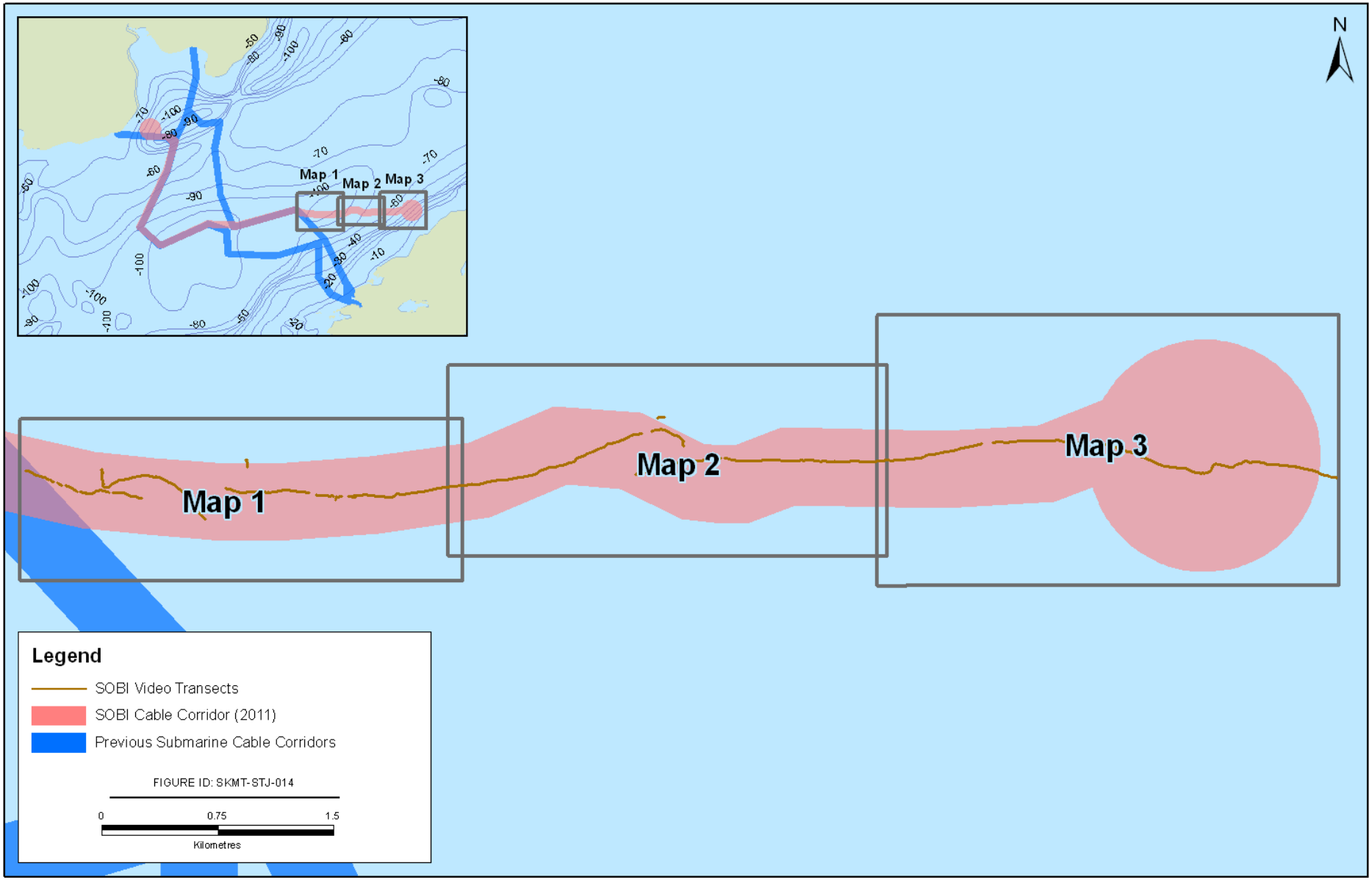

FIGURE 2.7

Video Transects - 2011 Corridor: Shoal Cove Segment Index Map

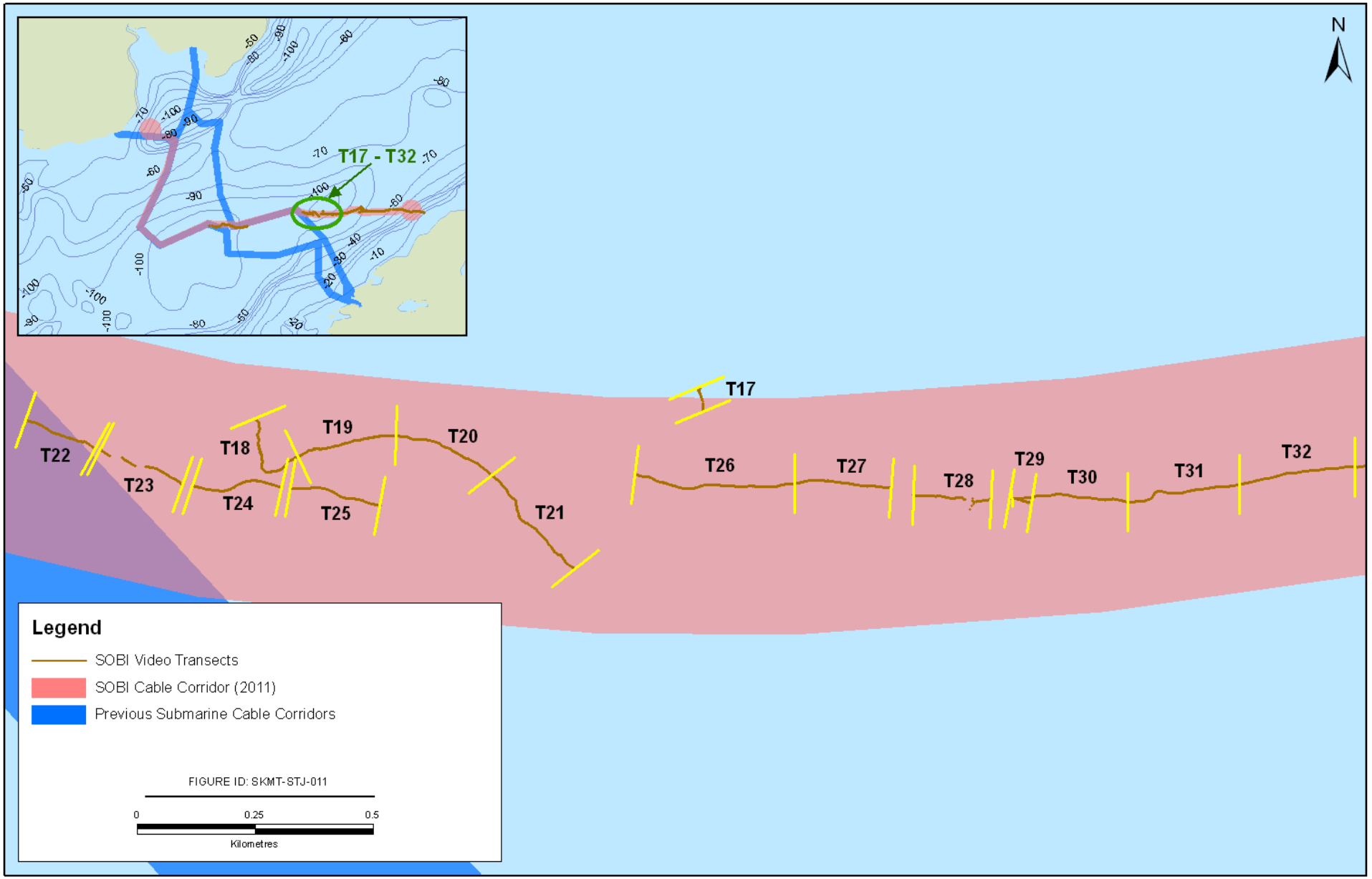

FIGURE 2.8

Video Transects - 2011 Corridor: Shoal Cove Segment Map 1

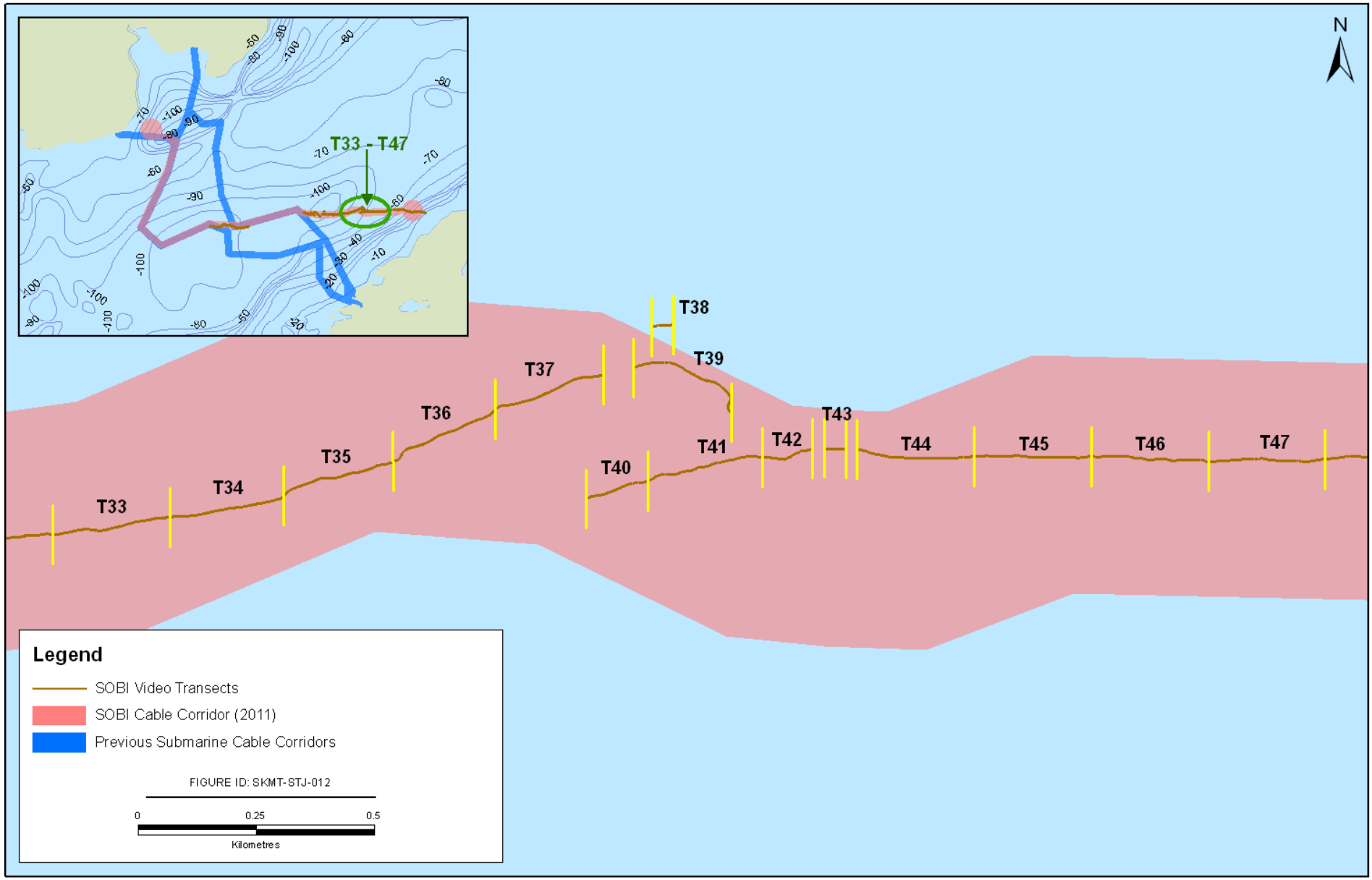

FIGURE 2.9

Video Transects - 2011 Corridor: Shoal Cove Segment Map 2

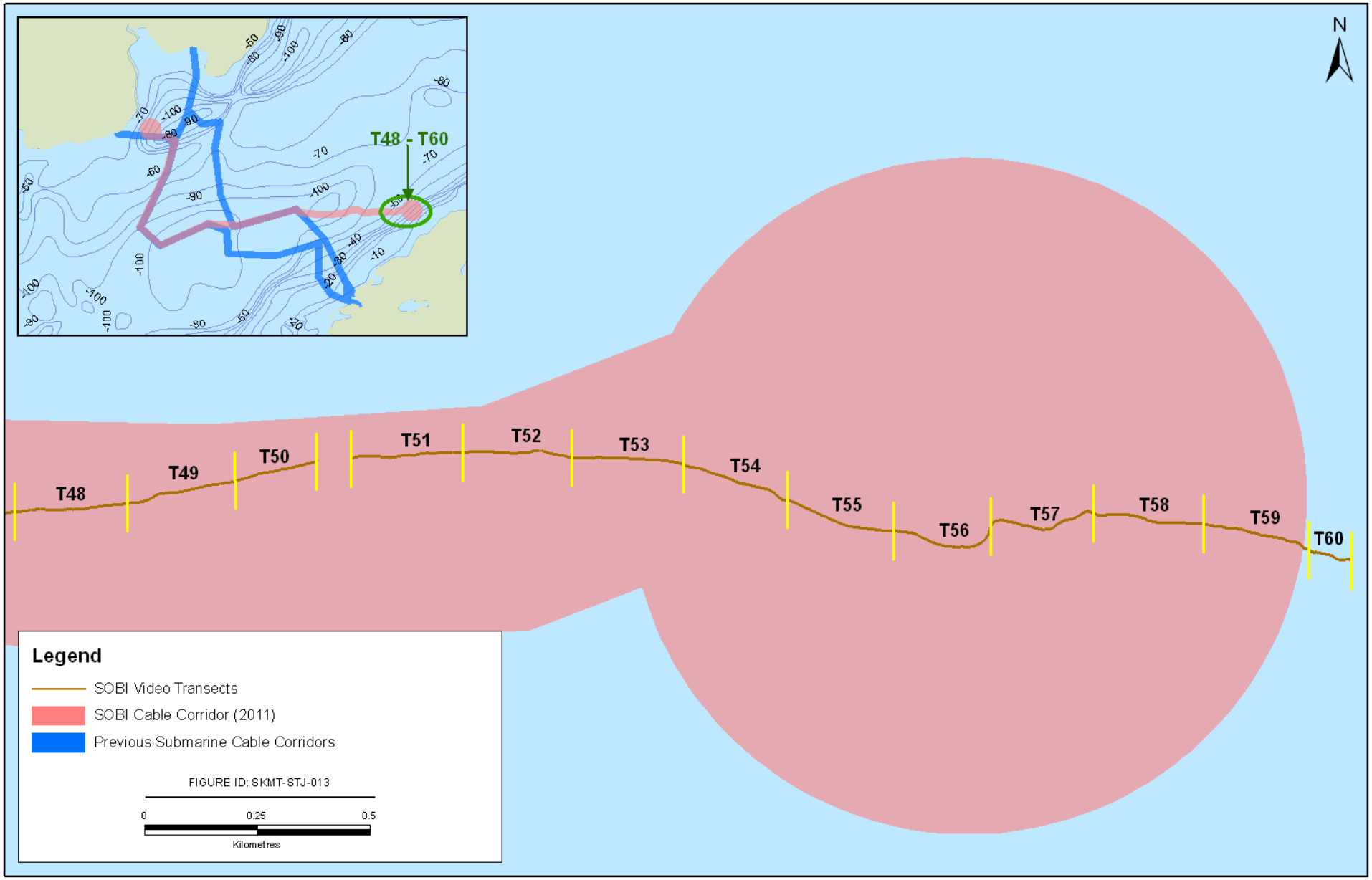

FIGURE 2.10

Video Transects - 2011 Corridor: Shoal Cove Segment Map 3

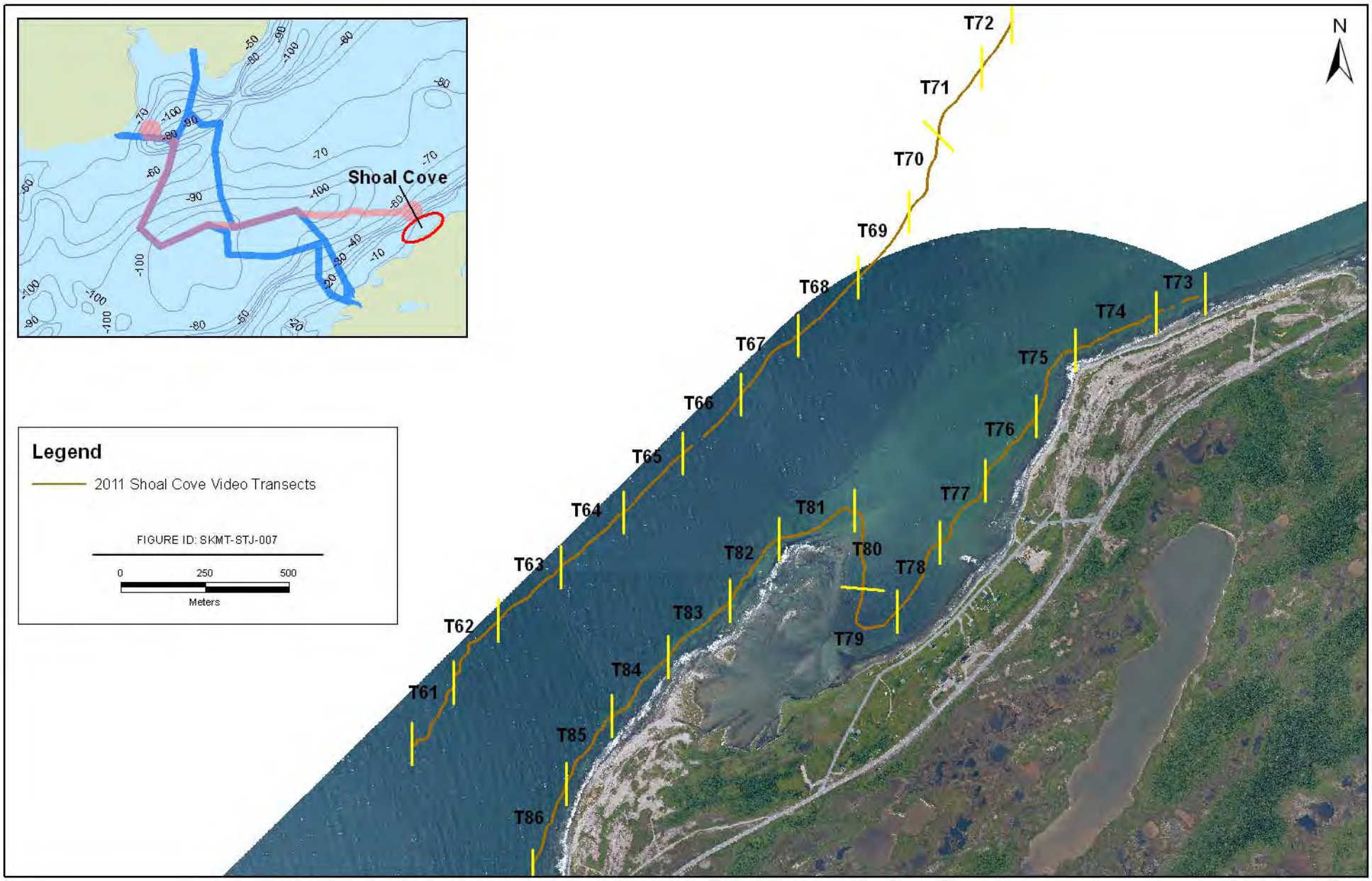

FIGURE 2.11

Video Transects - Shoal Cove

2.9.1.1 Analyses of Video Data

The video data field was reviewed to characterize and quantify the habitat characteristics. The video was viewed by a biologist experienced in the assessment and interpretation of marine habitat characteristics and flora and fauna to be expected in the study area. The biologist recorded, on a frame by second basis, the dominant substrate types, and marine flora and fauna (invertebrates and fish) observed in each frame.

It was apparent during analyses of the video data, that portions of the video could not be interpreted for various reasons including: water clarity, camera speed, height off the bottom, and contact with the bottom. These segments of video were removed from any further analyses.

Substrate

Analysis of the video footage for substrate characteristics followed classification criteria identified by DFO in Kelly et al. (2009, draft). Initially, each video frame was reviewed and characterized as to detailed substrate type and generally each classification was based on combinations of one, two, or three substrate types. Substrate types were determined based on the Wentworth-Udden (Wentworth 1922) size-based classifications in Table 2.6. The detailed substrate types were aggregated into broad substrate types as per Kelly et al. (2009, draft). AMEC (2010) utilized a further amalgamation of substrate types for the 2008 and 2009 data, however in 2011 the broad substrate categories used in Kelly et al. (2009, draft) have been used to maintain the level of detail available in the data and for consistency with the 2010 data (Sikumiut 2011b).

Table 2.6 Classification of Marine Substrates

Broad Substrate Category [1]	Detailed Substrate Category [1]	Definition
Bedrock	Bedrock	Continuous solid rock exposed by scouring forces.
Coarse	Boulder	Rocks greater than 250 mm in diameter.
	Rubble	Large rocks ranging from 130 mm – 250 mm in diameter.
Medium	Cobble	Rocks ranging from 30 mm – 130 mm.
	Gravel	Granule size or coarser, 2 mm – 30 mm.
Fine	Sand	Fine deposits ranging from 0.06 mm – 2 mm.
	Mud	Material encompassing both silt and clay < 0.06 mm.
Organic	Organic/Detritus	Soft material 85 % or more organic materials.
Shell	Shells	Calcareous remains of shellfish and other invertebrates.

Note [1]: Marine substrates as adapted from Wentworth-Udden (Kelly et al. 2009, draft)

Macroflora

The macroflora classification was also based on criteria identified in Kelly et al. (2009, draft) which is reproduced in Table 2.7. Where possible, the macroflora observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or vegetation class. Owing to the speed of the survey in some sections, contact with the ocean bottom, water clarity, distance off the bottom, and for other reasons identification to species and/or genus was often difficult.

Table 2.7 Classification of Marine Vegetation

Vegetation Class[1]	**Definition**
Red Algae	Common name or Rhodophyta (e.g., *Chondrus crispus* – Irish moss, *Lithothamium* – coralline algae, *Ptilota, Porphyra, Rhodymenia* – dulse, etc.)
Brown Algae	Common name for the seaweeds of the Laminariales (Phaeophyta), brown alga with a large broad-bladed thallus attached to the substrate by a tough stalk and holdfast (e.g., *Laminaria longicruris* – cabbage kelp, *L. digitata* – finger kelp, *Alaria esculenta* – winged kelp, *Chorda filum* – Mermaid's trusses, *Agarium clathratum, Saccorhiza deratodea*, etc.)
Green Algae	Common name for Chlorophyta (e.g., *Chlamydomonas, Spirogyra, Ulva lactuca* – sea lettuce, *Urospora,* etc.)
Rock Weed	*Fucus sp.* – rock weed, *Ascophyllum nodosum* – knotted wrack
Eelgrass	*Zostera marina* is a green flowering plant (Anthophyta) and is primarily a subtidal species that penetrates to some extent into the intertidal zone. It is common on mud flats, that are exposed at low tide, in estuaries, and shallow, protected bays.
Salt Marsh	Aquatic plants developing on wet soil (e.g., tidal or salt marshes)
Other	Any other type of flora not identified in the above categories

Note [1]: Classification of marine vegetation after Kelly et al. (2009, draft)

Macrofauna

The macrofaunal assessment also followed the approach identified in Kelly et al. (2009, draft). All macrofauna encountered in the video footage were identified to the lowest practical taxonomic level which included species, genus, or faunal class. As for the macroflora, survey conditions often prevented identification to the more detailed taxonomic level. Subsequently, the total number of observations for each taxon were summed to determine the relative (%) occurrence of each. Taxa that were extremely abundant, such as urchin species, were not enumerated and observations were simply classified as abundant. It is noteworthy that the macrofauna were often well camouflaged on the sea bottom making them difficult to identify and quantify. When the camera frame came in contact with the seafloor, macrofauna were often disturbed into the water column making them more evident for observation. These occurrences suggested that the macrofauna were much more abundant than was apparent from the video analyses.

2.9.2 **Intertidal and Backshore Survey**

The intertidal and backshore at Shoal Cove was surveyed using methods described in Kelly et al. (2009, draft), Catto et al. (1997), and following other classifications that were defined in AMEC (2010). The survey delineated habitats which were areas of coastline, in the intertidal and backshore areas, with similar topography, sediment type, vegetation, and geomorphic processes. Catto et al. (1997) identified 24 different Shore Units, based primarily on geomorphology and substrate type, and descriptors in that document were used, to the extent possible, to classify the habitat types for this study (Table 2.8). Vegetation was also an important feature of the shoreline and backshore that is not well captured in the Catto et al. (2007) classification and subsequently additional backshore types were identified, consistent with the classifications used in AMEC (2010).

Table 2.8 Classification of Shore Units

Bedrock Shore Units • Rock Platform • Cliff
Rock and Sediment Shore Units • Gravel Beach on Rock Platform/Cliff • Sand, Gravel Beach on Rock Platform/Cliff • Sand, Gravel Beach on Rock Cliff • Sand Beach on Rock Platform/Cliff
Sediment Shore Units • Gravel Flat/Beach • Sand and Gravel Flat/Beach • Sand Flat/Beach • Mudflats • Estuary and Fringing Lagoon • Boulder Tidal Flat
Man-modified • Seawall • Wharf • Bulkhead • Rip Rap • Slipway

Notes:
Sand beaches: > 90 % sand by volume, > 75 % by mass
Gravel beaches: > 90 % gravel
Sand and gravel beaches: > 30 % and < 70 % sand
Shore units as identified in Catto et al. (1997)

The study team assessed the intertidal and backshore by walking the shoreline and recording the habitat features in field notebooks. Digital photographs were taken to provide ground level details of the habitat characteristics to support subsequent mapping. Features used to delineate the habitat types included:

landform, substrate, shore width and length (m), slope (%), and vegetation type. The boundaries of each habitat type were delineated and mapped from interpretation of high quality digital aerial photographs and Light Detection and Ranging (LiDAR) imagery, as provided by Nalcor Energy, supported by the ground level surveys. The resulting habitat types, as delineated for the intertidal and backshore zones, was an integration of habitat attributes defined in Kelly et al. (2009, draft), shore zones as identified in Catto et al. (2007), and additional habitat types identified in AMEC (2010) and these are provided in Table 2.9.

Table 2.9 Intertidal and Backshore Habitat Classes for the 2011 Marine Survey of Shoal Cove

Intertidal Classes	
Class	**Description**
Medium with Kelp	Medium substrates (after Kelly et al. 2009, draft), overlain with kelp
Mixed with Kelp	Mixed substrates which include two or more broad substrate categories (after Kelly et al. 2009, draft), overlain with kelp
Fine with Kelp	Fine substrates (after Kelly et al. 2009, draft), overlain with kelp
Mixed	Mixed substrates which include two or more broad substrate categories (after Kelly et al. 2009, draft)
Medium	Medium substrates (after Kelly et al. 2009, draft)
Coarse	Coarse substrates (after Kelly et al. 2009, draft)
Grass	Grasses of terrestrial origin with salt water tolerance
Backshore Classes	
Class	**Description**
Estuary and Fringing Lagoon	Confluence of freshwater stream/river and associated lagoon (after Catto et al. 2007)
Grasses	Terrestrial grasses (after AMEC 2010)
Grasses and Shrubs	Terrestrial grasses and shrubs (after AMEC 2010)
Gravel Flat/Beach	Medium to coarse substrates on low slope beach (after Catto et al. 2007)
Rip Rap	Man modified shoreline involving addition of coarse substrate material (after Catto et al. 2007)
Sand and Gravel Flat/Beach	Fine to medium substrates on low slope beach (after Catto et al. 2007)

The slope (%) of the intertidal and backshore area, measured from the mean low tide of the intertidal zone to the furthest inland extent of the backshore zone, was determined every 250 m from the topography generated from the LiDAR imagery as provided by Nalcor Energy, and from GPS positions and elevations as determined during the shore based survey.

2.9.3 **Bathymetry**

A bathymetric survey was conducted in the shallow subtidal zone at Shoal Cove using a Marinetek Sonar system which consisted of the sounder, GPS antenna, single beam transducer, power source, and notebook computer for data logging. Data sent to the notebook allowed the user to review, in real time, data including depth, GPS position, magnetic heading, speed, and temperature.

All depth measurements collected during surveys were reduced to chart datum. To achieve this correction, the time of the survey was recorded and matched with the daily tidal data for Flower's Cove. Each recorded depth was converted to chart datum by subtracting the tidal data provided by Canadian Hydrographic Service (CHS) for

that day and hour (DFO 2011). It should be noted that in the interest of navigational safety these data are not to be used for marine navigation.

Data processing involved application of a general process model which included smoothing, transient filtering, and bottom delineation of the raw data. Once all initial processing was complete, the x, y, z data (longitude, latitude, and depth) were exported to a .csv file for additional analysis and modelling in ArcGIS and Golden Software Surfer 8. Kriging was chosen as the preferred processing method for bathymetric modelling. Final maps were created in ArcGIS Version 10.0 using the exported shapefile from Surfer 8, and projected to NAD 83 Zone 21 Coordinate System.

2.9.4 **Post-processing of Video Data**

Post-processing of video data for analyses involved sub-dividing the continuous transects into separate smaller transects. For the 2011 Corridor: Central Segment continuous video transect of 3,022 m, comprising 18 transects averaging 146.8 m in length, was delineated. For the 2011 Corridor: Shoal Cove Segment, a continuous video transect of 9,925 m, comprising 44 transects averaging 222.6 m in length, was delineated. For the Shoal Cove Marine Survey Area, two continuous video transects totaling 6,378 m, comprising 26 transects averaging 244.7 m in length, was delineated. Data for substrate, macroflora and macrofauna were summarized on a transect basis and presented as per Kelly et al. (2009, draft) and AMEC (2010). Parameters included habitat zone, surveyed length and area, video time, depth range, substrate type (% coverage, predominant substrate group), macroflora (% coverage, predominant macrofloral class), and macrofauna (estimated relative abundance).

The relative abundance of macroflora for each identifiable taxon was assessed and described on a percent (%) coverage basis, in 5 % increments.

The relative abundance of macrofauna for each identifiable taxon was assessed and described, on a relative ranking scale, as:

Abundant (A) – numerous (not quantifiable) observations made throughout the study area;
Common (C) – numerous (not quantifiable) observations made intermittently throughout the study area;
Occasional (O) – quantifiable observations made intermittently throughout the study area; and
Uncommon (U) – quantifiable observations made infrequently throughout the study area.

It is important to note that this scale is not quantifiable in most circumstances and the divisions between each rank are relative, as assigned by the video interpreter, and not absolute.

2.9.5 **Habitat Attribute Assessment and Mapping**

Basemap

For the Shoal Cove study area, a basemap was developed from high resolution aerial photography and/or LiDAR survey images provided by Nalcor Energy. The basemap was used to delineate broad zones within each study site such as backshore, intertidal and subtidal zones and to present intertidal and backshore habitat information and the bathymetry for Shoal Cove.

Intertidal and Backshore

The intertidal and backshore at Shoal Cove were delineated as habitat types as defined by Kelly et al (2009, draft), Catto et al. (1997) and AMEC (2010). These habitat types were subsequently mapped as polygons in two dimensions and presented relative to the basemap.

Bathymetry

All depth measurements collected during bathymetric surveys were corrected to chart datum. After correction, all bathymetric (x, y, z) data were modelled using Surfer 8 software at 0.5 m contour intervals. The outer (seaward) limit of the intertidal zone was delineated as the chart datum '0 depth', which is defined as the 'lower, low water tide' on Canadian charts. The inner (landward) limit of the intertidal zone was inferred from the 'higher, high water mean tide' values from adjacent tide gauge sites, the slope of the shoreline, and aerial photographs and information collected during the shore based surveys.

Habitat

It was initially intended to present the substrate and macrofloral distributions, and subsequently an integrated habitat map based on these attributes, for the shallow subtidal zone as two-dimensional maps. Owing to the extent of the Shoal Cove study area, two longitudinal video transects were collected parallel to the shoreline, at the approximate 3.0 and 10.0 m depth contour. The data collected in this fashion do not lend themselves to two dimensional modelling and mapping. Consequently, the substrate, macroflora and macrofauna data for the Shoal Cove shallow subtidal study site have been analyzed and presented in tabular format as per Kelly et al. (2009, draft). Parameters included survey length, video time, depth, substrate type (% coverage, predominant substrate group), macroflora (% coverage, predominant macrofloral class), and macrofauna (estimated relative abundance).

2.10 Quality Management

The Study Team developed a Quality Management System which was implemented during the field study components as well as during the analyses of data and preparation of the final reports. Quality is achieved through the use of skilled personnel, adequate planning, use of suitable tools and procedures, proper definition of job requirements, proper supervision and effective technical direction. This section outlines the specific QA/QC techniques utilized by the Study Team during this study.

2.10.1 **Field Quality Assurance/Quality Control**

The following control procedures were implemented by Study Team personnel during field sampling:

- Standard Operating Procedures (SOPs) were developed for key study components and were present with field crews at all times, and samples were collected accordingly;
- All major study components had key personnel designated as lead responsibility and these individuals ensured that SOPs were being followed;

- Regular meetings of field team members were held to review study progress, assess methodologies and sample collection efforts, discuss any health and safety issues, and to set and revise priorities in relation to accomplishments and field conditions;
- All personnel involved in field procedures had appropriate education, training, and experience;
- Sampling methodologies were consistently applied among sites throughout the study area;
- Sampling equipment was appropriate for the habitat/study component being studied, properly cleaned, and properly calibrated;
- All samples were collected in the proper container with the appropriate preservative and/or fixative added;
- Field personnel maintained detailed notes in waterproof field notebooks and/or on waterproof field data sheets, specifically developed for the study;
- All data were transcribed from field note books and field data sheets into a digital format (spreadsheet), and duplicated onto separate digital media, on a frequent basis (nightly when possible). Study component leads were responsible to ensure data integrity;
- All sample movements/shipments were recorded on detailed CoC forms; and
- QA/QC stations were randomly selected prior to sampling, and represented approximately 10 % of all samples collected for water and sediment samples.

2.10.2 **Laboratory Quality Assurance/Quality Control**

Samples were given randomly assigned numbers and submitted 'blind' to the respective laboratory. Water and sediment samples were sent to Maxxam Analytics in Bedford, Nova Scotia, while benthic samples were sent to Envirosphere in Windsor, Nova Scotia.

Maxxam Analytics implemented a rigorous internal QA/QC program. This entailed:

- laboratory duplicates (10 %);
- laboratory internal spikes;
- analyses of certified reference material (sediment only); and
- analyses of method blanks.

The results of the laboratory's internal QA/QC procedures for water and sediment analysis are reported with analytical results in Appendix A.

The QA/QC followed by Envirosphere for processing of benthic invertebrate sampling in the laboratory included:

- 10 % replication of any sub-sampling procedures;
- re-sorting of randomly selected samples;
- use of appropriate regional and recent identification keys;
- preparation of a reference collection;
- archiving of samples; and
- maintaining detailed notes of sample processing.

2.10.3 **Data Analyses and Report Preparation Quality Assurance/Quality Control**

Data collected in the field and reported by the analytical laboratories were maintained in central databases, checked for accuracy, completeness and reasonableness of data. Databases were routinely backed up on an internal network and backup hard drive. The draft and final reports were reviewed by senior staff within Sikumiut prior to submission to Nalcor Energy.

3.0 RESULTS

The results of the 2011 Marine Habitat, Water, Sediment and Benthic Surveys within the Strait of Belle Isle are presented and summarized below. Results are presented separately for the three discrete study areas: (1) 2011 Corridor: Shoal Cove Segment, which focused on subtidal habitats in a newly delineated corridor segment; (2) the nearshore Shoal Cove Marine Survey Area, which included backshore, intertidal and shallow subtidal habitats; and (3) 2011 Corridor: Central Segment, which focused on subtidal habitats in an area to complement previous surveys. The results and discussion are largely descriptive in nature and the results are compared with available habitat, water, sediment, and benthic data for the study area as summarized in Sikumiut (2010), as well as previous surveys in the study area (e.g., AMEC 2010; Sikumiut 2011a and b). Also, where appropriate, comparisons with relevant guidelines are made.

3.1 2011 Corridor: Shoal Cove Segment

In June 2011, within the 2011 Corridor: Shoal Cove Segment, water quality data and benthic invertebrate community data were collected. Repeated attempts were made to collect sediment quality data from this area; however due to the coarse nature of the substrate, no successful grabs were obtained. Underwater video surveys were conducted along pre-defined transects within the corridor to classify and quantify the marine habitat by collecting data on substrate, macroflora and macrofauna.

3.1.1 **Water Quality**

Water quality was determined at five pre-selected sites along the 2011 Corridor: Shoal Cove Segment in the Strait of Belle Isle (see Figure 2.3). At each sampling station, CTD profiles were collected and examined in situ to identify presence of a thermocline or halocline. A total of 15 water samples were collected at these five sampling stations (NCW-001 through NCW-005) with samples taken at each of three depths representing near surface (labeled A), near bottom (labeled C), and within a thermocline or halocline (labeled B). In addition, one duplicate QA/QC sample, identified W-002B, was collected at a random, pre-determined location (W-003A). Water quality included measurement of selected field parameters and chemical and hydrocarbon analyses at an analytical laboratory. The detailed results of the analysis of these samples, including associated QA/QC data from the laboratory, are contained in Appendix A. Sampling depths, timing and locations (in UTM NAD 83, Zone 21 coordinate system) of the sampling sites are listed in Table 3.1.

Table 3.1 Summary of Date and Location of Water Sampling During Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

Date	Station ID	Location (see Figure 2.3)		Water Depth (m)	Sampling Depths (m)		
		Easting	Northing		A (near surface)	B (mid)	C (near bottom)
8-Jun-2011	NCW-001	523217	5691556	71	10	40	55
8-Jun-2011	NCW-002	521490	5691476	79	5	35	70
8-Jun-2011	NCW-003	520051	5691364	88	5	25	75
8-Jun-2011	NCW-004	518548	5691396	101	5	25	75
7-Jun-2011	NCW-005	517141	5691332	95	8	40	85

3.1.1.1 Conductivity, Temperature, and Depth Profiles

The CTD profiles, as collected with the SEACAT SBE-19, are illustrated in Figure 3.1 (Stations NCW-001 to NCW-005), and data are summarized in Table 3.2. In two instances (at stations NCW-002 and NCW-005) the depth of the CTD cast was slightly deeper than the maximum depth of the water quality station as determined by the depth sounder on the boat. This may reflect the relative accuracies of the two measurements or that the position of the sampling platform may have moved slightly during the CTD cast.

All of the five stations were relatively deep, ranging from 71 to 101 m in depth. Thermoclines were apparent at all stations, and three out of five stations (NCW-001, NCW-003 and NCW-004) had two apparent thermoclines. NCW-001, with a maximum depth of 71 m, had a temperature difference of 2.69 C˚ and appeared to have two thermoclines at 15 to 20 m and again at 25 to 30 m. Similarly, station NCW-003, which had a maximum depth of 88 m, had a temperature difference of 3.77 C˚, and two apparent thermoclines at 3 to 6 m and 30 to 45 m depth. Station NCW-004 had the largest temperature difference of all sites at 4.38 C˚ and a depth of 101 m, and a thermocline apparent at 2 to 5 m and again at 18 to 45 m depth. The temperature difference at station NCW-002 was 3.49 C˚, with a total depth of 79 m, a thermocline was evident at 5 to 10 m, while the temperature difference for station NCW-005 was similar at 3.64 C˚, and a total depth of 95 m, with an apparent thermocline at 15 to 30 m depth. The relatively shallow thermoclines at NCW-002, NCW-003, and NCW-004 may reflect the influence of very strong currents in the study area.

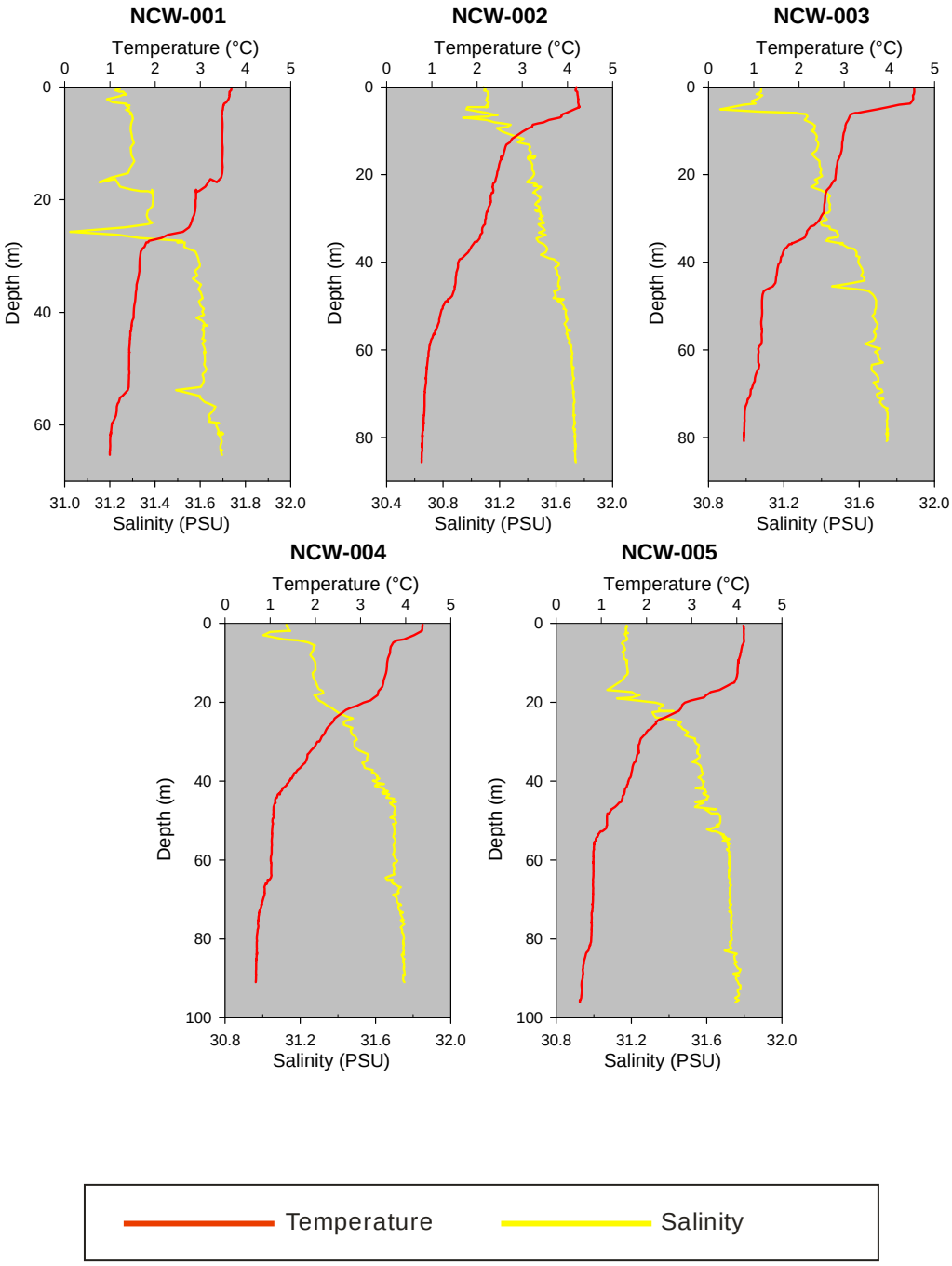

Figure 3.1 Salinity, Temperature and Depth Profiles During Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

Table 3.2 Summary of CTD Data Collected During Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

Station	Maximum Depth (m)	Depth of CTD Cast (m)	Min Temp (˚C)	Max Temp (˚C)	Temperature Difference (˚C)	Salinity Difference (PSU[1])	Approx. Depth of Thermocline (m)
NCW-001	71	65	1.00	3.69	2.69	0.68	15 to 20, 25 to 30
NCW-002	79	85	0.77	4.27	3.49	0.80	5 to 10
NCW-003	88	80	0.78	4.55	3.77	0.89	3 to 6, 30 to 45
NCW-004	101	91	0.68	4.38	4.38	0.75	2 to 5, 18 to 45
NCW-005	95	96	0.52	4.16	3.64	0.71	15 to 30

Note[1]: PSU = Practical Salinity Units

3.1.1.2 Field Water Quality

Field water quality measurements were taken at all sampling stations, and at all depths at which samples were collected. Table 3.3 presents the field water quality measurements for all stations and depths sampled. Field water quality measurements were generally comparable between sites. Temperature ranged from 1.51 to 5.22 °C, and showed a decrease with increasing depth. Conductivity was similar at all sites and all depths, with a slight increase with increasing depth, ranging from 4.78 to 5.02 $S \cdot m^{-1}$. The values of pH were also comparable between sites and depths, with a range of 7.97 to 8.04. Dissolved oxygen ($mg \cdot L^{-1}$) showed a slight increase with increasing depth, ranging from 10.67 to 11.51 $mg \cdot L^{-1}$. Percent saturation (% sat) of dissolved oxygen was generally supersaturated (ranging from 99.5 to 105.7 % saturation), and generally decreased with depth in the B sample (in the thermocline) at each site, and increased again in the C sample (near bottom). ORP ranged from 117.0 to 220.3 mV.

Table 3.3 Results of Field Water Quality Measurements for Samples Collected During Marine Surveys in the 2011: Shoal Cove Segment, June 2011

Sampling ID	Sample Depth (m)	Temperature °C	Conductivity ($S \cdot m^{-1}$)	pH	DO ($mg \cdot L^{-1}$)	DO (% sat)	ORP (mV)
W-001-A	10	4.98	4.78	8.03	11.03	105.7	131.5
W-001-B	40	2.24	4.90	7.99	11.09	101.4	165.1
W-001-C	55	1.87	5.00	7.97	11.51	103.9	210.4
W-002-A	5	4.04	4.80	8.02	10.74	101.3	196.6
W-002-B	35	2.65	4.90	8.00	10.87	99.5	218.5
W-002-C	70	1.54	5.02	7.99	11.23	99.7	199.3

Table 3.3 Results of Field Water Quality Measurements for Samples Collected During Marine Surveys in the 2011: Shoal Cove Segment, June 2011 (Cont'd)

Sampling ID	Sample Depth (m)	Temperature (°C)	Conductivity ($S \cdot m^{-1}$)	pH	DO ($mg \cdot L^{-1}$)	DO (% sat)	ORP (mV)
W-003-A	5	3.99	4.84	8.03	10.72	99.8	220.7
W-003-B	25	2.56	4.88	8.01	10.99	99.6	171.3
W-003-C	75	1.93	4.94	8.02	11.09	100.5	220.3
W-004-A	5	4.25	4.84	8.03	10.67	100.5	164.5
W-004-B	25	2.97	4.91	8.04	10.99	101.1	147.3
W-004-C	75	1.51	5.00	8.02	11.25	101.0	211.0
W-005-A	8	5.22	4.80	8.04	10.80	104.9	117.4
W-005-B	40	2.67	4.90	8.01	10.87	100.2	117.0
W-005-C	85	1.56	5.02	7.99	11.25	100.3	117.3

3.1.1.3 Laboratory Water Quality

Results of water quality analysis for conventional parameters, nutrients, major ions, metals and petroleum hydrocarbons are presented in Table 3.4. Summary statistics were calculated and include all depths and stations, and are presented in Table 3.5. Although water samples were collected at different depths, noticeable differences were not evident between depths at each sampling station. Detailed results of laboratory water analysis are presented in Appendix A including sample duplicates and laboratory QA/QC data. Note that in several cases the RDL for Total Suspended Solids (TSS) was elevated due to the sample matrix. This was noted and outlined in each table when necessary.

Conventional parameters were relatively similar between all sampling stations and at all depths. Values for pH were slightly alkaline, ranging from 7.69 to 7.75 with an average of 7.72, which is well within the CCME Water Quality Guidelines for the Protection of Aquatic Life (2002). Nutrients were mostly undetectable in most samples, with only orthophosphate detected in all samples, excepting W-005A. Ammonia Nitrogen (n=13) was also detected at low levels. Metals in samples were mostly below detectable levels and only mercury (n=3), aluminum (n=1), boron (n=1), copper (n=1), strontium (n=15), and zinc (n=1) were detected, all at low levels. Antimony, arsenic, barium, beryllium, bismuth, cadmium chromium, cobalt, iron, lead, manganese, nickel, selenium, silver, thallium, tin, titanium, uranium, and vanadium were not detected in any samples collected in 2011. Total mercury in sample W-003A exceeded the CCME guideline for mercury, however, it is important to note that the CCME guideline value listed for mercury (0.016 μg/L) is for inorganic mercury only, whereas the concentration reported was for total mercury. No other parameters exceeded the CCME guidelines. For petroleum hydrocarbons, all samples were below the RDL for all parameters.

Table 3.4 Results for Analysis of Water Quality Samples during Marine Surveys in the 2011 Corridor: Shoal Cove Segment Including Conventional Parameters, Nutrients, Major Ions, Metals and Petroleum Hydrocarbons

	Units	RDL	CCME Guideline	W-001			W-002			W-003			W-004			W-005		
				W-001A	W-001B	W-001C	W-002A	W-002B	W-002C	W-003A	W-003B	W-003C	W-004A	W-004B	W-004C	W-005A	W-005B	W-005C
Conventional Parameters																		
pH	pH	N/A	7.0 - 8.7	7.72	7.72	7.71	7.75	7.72	7.69	7.74	7.73	7.69	7.75	7.72	7.69	7.74	7.73	7.72
Total Alkalinity (Total as $CaCO_3$)	$mg \cdot L^{-1}$	5		99	98	100	98	99	99	99	99	140	97	99	99	97	98	98
Hardness ($CaCO_3$)	$mg \cdot L^{-1}$	1		6,200	6,100	6,000	5,800	6,000	6,200	6,400	6,000	6,700	6,600	6,000	6,200	6,200	6,300	6,700
Turbidity	NTU	0.1		0.2	ND	0.2	0.2	ND	ND	ND	0.1	0.1	0.2	0.3	ND	0.2	0.3	ND
Conductivity	$\mu S\ cm^{-1}$	1		47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	46,000	47,000	47,000	46,000	47,000	47,000
Total Suspended Solids (TSS)[a]	$mg \cdot L^{-1}$	1		ND*	3*	ND*	ND	ND*	3	2	1	ND*	ND	ND*	ND*	ND	ND	ND
Calculated TDS	$mg \cdot L^{-1}$	1		32,200	32,100	31,900	31,600	32,100	32,500	32,600	32,200	33,600	33,100	32,100	33,000	31,700	32,300	33,500
Colour	TCU	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Organic Carbon (C)	$mg \cdot L^{-1}$	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Reactive Silica (SiO_2)	$mg \cdot L^{-1}$	0.5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nutrients																		
Nitrate + Nitrite	$mg \cdot L^{-1}$	0.05		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite (N)	$mg \cdot L^{-1}$	0.01		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate	$mg \cdot L^{-1}$	0.05	16[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen (Ammonia Nitrogen)	$mg \cdot L^{-1}$	0.05		0.06	0.19	0.08	0.05	0.39	0.05	0.10	ND	0.43	0.05	ND	0.16	0.06	0.21	0.08
Total Phosphorous (P)	$mg \cdot L^{-1}$	10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Orthophosphate (P)	$mg \cdot L^{-1}$	0.01		0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	ND	0.01	0.02
Major Ions																		
Total Calcium (Ca)	$\mu g \cdot L^{-1}$	10,000		409,000	394,000	387,000	380,000	396,000	408,000	423,000	392,000	437,000	431,000	390,000	399,000	396,000	406,000	432,000
Total Magnesium (Mg)	$\mu g \cdot L^{-1}$	10,000		1,260,000	1,240,000	1,210,000	1,180,000	1,220,000	1,260,000	1,290,000	1,230,000	1,360,000	1,330,000	1,210,000	1,270,000	1,260,000	1,280,000	1,360,000
Total Sodium (Na)	$\mu g \cdot L^{-1}$	10,000		10,200,000	9,830,000	9,680,000	9,500,000	9,820,000	10,200,000	10,300,000	9,900,000	10,900,000	10,700,000	9,700,000	10,200,000	10,000,000	10,100,000	10,900,000
Total Potassium (K)	$\mu g \cdot L^{-1}$	10,000		383,000	377,000	370,000	355,000	373,000	388,000	391,000	374,000	414,000	409,000	368,000	382,000	384,000	389,000	416,000
Dissolved Chloride (Cl)	$mg \cdot L^{-1}$	300		17,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	17,000	18,000	18,000
Dissolved Sulphate (SO_4)	$mg \cdot L^{-1}$	50		2,400	2,500	2,400	2,400	2,400	2,200	2,400	2,400	2,400	2,400	2,400	2,400	2,300	2,300	2,300
Metals																		
Total Mercury (Hg)	$\mu g \cdot L^{-1}$	0.013	0.016[c]	ND	ND	ND	0.014	ND	ND	0.017	ND	ND	0.014	ND	ND	ND	ND	ND
Total Aluminum (Al)	$\mu g \cdot L^{-1}$	500		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10,700	ND
Total Antimony (Sb)	$\mu g \cdot L^{-1}$	100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Arsenic (As)	$\mu g \cdot L^{-1}$	100	12.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Barium (Ba)	$\mu g \cdot L^{-1}$	100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Beryllium (Be)	$\mu g \cdot L^{-1}$	100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Bismuth (Bi)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Boron (B)	$\mu g \cdot L^{-1}$	5,000		ND	ND	ND	ND	ND	ND	ND	ND	5,070	ND	ND	ND	ND	ND	ND
Total Cadmium (Cd)	$\mu g \cdot L^{-1}$	1.7	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Chromium (Cr)	$\mu g \cdot L^{-1}$	100	56, 1.5[d]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Cobalt (Co)	$\mu g \cdot L^{-1}$	40		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Copper (Cu)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	781	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Iron (Fe)	$\mu g \cdot L^{-1}$	5,000		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 3.4 Results for Analysis of Water Quality Samples during Marine Surveys in the 2011 Corridor: Shoal Cove Segment Including Conventional Parameters, Nutrients, Major Ions, Metals and Petroleum Hydrocarbons (Cont'd)

	Units	RDL	CCME Guideline	W-001			W-002			W-003			W-004			W-005		
				W-001A	W-001B	W-001C	W-002A	W-002B	W-002C	W-003A	W-003B	W-003C	W-004A	W-004B	W-004C	W-005A	W-005B	W-005C
Metals																		
Total Lead (Pb)	$\mu g \cdot L^{-1}$	50		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Manganese (Mn)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Nickel (Ni)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Selenium (Se)	$\mu g \cdot L^{-1}$	100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Silver (Ag)	$\mu g \cdot L^{-1}$	10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Strontium (Sr)	$\mu g \cdot L^{-1}$	200		7,430	7,580	7,340	7,220	7,330	7,700	7,910	7,360	8,380	8,020	7,410	7,520	7,400	7,730	8,110
Total Thallium (Tl)	$\mu g \cdot L^{-1}$	10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Tin (Sn)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Titanium (Ti)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Uranium (U)	$\mu g \cdot L^{-1}$	10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Vanadium (V)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Zinc (Zn)	$\mu g \cdot L^{-1}$	500		ND	ND	ND	517	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons																		
Benzene	$mg \cdot L^{-1}$	0.001	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	$mg \cdot L^{-1}$	0.001	0.215	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	$mg \cdot L^{-1}$	0.001	0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (Total)	$mg \cdot L^{-1}$	0.002		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C_6 - C_{10} (less BTEX)	$mg \cdot L^{-1}$	0.010		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
>C_{10}-C_{16} Hydrocarbons	$mg \cdot L^{-1}$	0.050		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
>C_{16}-C_{21} Hydrocarbons	$mg \cdot L^{-1}$	0.050		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
>C_{21}-<C_{32} Hydrocarbons	$mg \cdot L^{-1}$	0.100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Modified TPH (Tier1)	$mg \cdot L^{-1}$	0.100		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Reached Baseline at C32	$mg \cdot L^{-1}$	N/A		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Surrogate Recovery (%)																		
Isobutylbenzene - Extractable	%			101	97	101	105	101	101	103	99	102	102	104	101	105	98	100
n-Dotriacontane - Extractable	%			103	101	102	107	109	99	104	96	99	101	106	103	109	99	99
Isobutylbenzene - Volatile	%			101	98	100	95	99	95	90	97	90	88	94	94	102	98	97

Notes:
ND = Not detected
RDL = Reportable Detection Limit
Results relate only to the items tested.
a - Those values marked with an asterisk (*) have elevated RDL for TSS (RDL = 2 mg/L)
b - CCME Guideline is for direct effects only and does not consider indirect effects from eutrophication
c - CCME Guideline is for inorganic mercury only, whereas the concentration reported is for total mercury
d - CCME Guideline values are for hexavalent and trivalent chromium, whereas the concentration reported is for total chromium

Table 3.5 Summary Statistics for Water Quality Data during Marine Surveys in the 2011 Corridor: Shoal Cove Segment

	Units	RDL	CCME Guideline	N	Min	Max	Mean	Std. Dev
Conventional Parameters								
pH	pH	N/A	7.0 - 8.7	15	7.69	7.75	7.72	0.02
Total Alkalinity (Total as $CaCO_3$)	$mg \cdot L^{-1}$	5		15	97.00	140.00	101.27	10.75
Hardness ($CaCO_3$)	$mg \cdot L^{-1}$	1		15	5800.00	6700.00	6226.67	271.15
Turbidity	NTU	0.1		9	0.10	0.30	0.20	0.07
Conductivity	$\mu S\ cm^{-1}$	1		15	46000.00	47000.00	46866.67	351.87
Total Suspended Solids (TSS)[a]	$mg \cdot L^{-1}$	1		3	1.00	3.00	2.00	1.00
Calculated TDS	$mg \cdot L^{-1}$	1		15	31600.00	33600.00	32433.33	613.73
Colour	TCU	5						
Total Organic Carbon (C)	$mg \cdot L^{-1}$	5						
Reactive Silica (SiO_2)	$mg \cdot L^{-1}$	0.5						
Nutrients								
Nitrate + Nitrite	$mg \cdot L^{-1}$	0.05						
Nitrite (N)	$mg \cdot L^{-1}$	0.01						
Nitrate	$mg \cdot L^{-1}$	0.05	16[b]					
Nitrogen (Ammonia Nitrogen)	$mg \cdot L^{-1}$	0.05		13	0.05	0.43	0.15	0.13
Total Phosphorous (P)	$mg \cdot L^{-1}$	10						
Orthophosphate (P)	$mg \cdot L^{-1}$	0.01		14	0.01	0.02	0.01	0.00
Major Ions								
Total Calcium (Ca)	$\mu g \cdot L^{-1}$	10,000		15	380,000	437,000	405,333	17,807
Total Magnesium (Mg)	$\mu g \cdot L^{-1}$	10,000		15	1,180,000	1,360,000	1,264,000	53,692
Total Sodium (Na)	$\mu g \cdot L^{-1}$	10,000		15	9,500,000	10,900,000	10,128,667	430,562
Total Potassium (K)	$\mu g \cdot L^{-1}$	10,000		15	355,000	416,000	384,867	17,312
Dissolved Chloride (Cl)	$mg \cdot L^{-1}$	300		15	17,000	1,8000	17,867	352
Dissolved Sulphate (SO_4)	$mg \cdot L^{-1}$	50		15	2,200	2,500	2,373	70
Metals								
Total Mercury (Hg)	$\mu g \cdot L^{-1}$	0.013	0.016[c]	3	0.01	0.02	0.02	0.00
Total Aluminum (Al)	$\mu g \cdot L^{-1}$	500		1	10700.00	10700.00	10700.00	N/A
Total Antimony (Sb)	$\mu g \cdot L^{-1}$	100						
Total Arsenic (As)	$\mu g \cdot L^{-1}$	100	12.5					
Total Barium (Ba)	$\mu g \cdot L^{-1}$	100						
Total Beryllium (Be)	$\mu g \cdot L^{-1}$	100						
Total Bismuth (Bi)	$\mu g \cdot L^{-1}$	200						
Total Boron (B)	$\mu g \cdot L^{-1}$	5,000		1	5070.00	5070.00	5070.00	N/A
Total Cadmium (Cd)	$\mu g \cdot L^{-1}$	1.7	0.12					
Total Chromium (Cr)	$\mu g \cdot L^{-1}$	100	56, 1.5[d]					
Total Cobalt (Co)	$\mu g \cdot L^{-1}$	40						
Total Copper (Cu)	$\mu g \cdot L^{-1}$	200		1	781.00	781.00	781.00	N/A
Total Iron (Fe)	$\mu g \cdot L^{-1}$	5,000						

Table 3.5 Summary Statistics for Water Quality Data during Marine Surveys in the 2011 Corridor: Shoal Cove Segment (Cont'd)

	Units	RDL	CCME Guideline	N	Min	Max	Mean	Std. Dev
Metals								
Total Lead (Pb)	$\mu g \cdot L^{-1}$	50						
Total Manganese (Mn)	$\mu g \cdot L^{-1}$	200						
Total Molybdenum (Mo)	$\mu g \cdot L^{-1}$	200						
Total Nickel (Ni)	$\mu g \cdot L^{-1}$	200						
Total Selenium (Se)	$\mu g \cdot L^{-1}$	100						
Total Silver (Ag)	$\mu g \cdot L^{-1}$	10						
Total Strontium (Sr)	$\mu g \cdot L^{-1}$	200		15	7220.00	8380.00	7629.33	339.04
Total Thallium (Tl)	$\mu g \cdot L^{-1}$	10						
Total Tin (Sn)	$\mu g \cdot L^{-1}$	200						
Total Titanium (Ti)	$\mu g \cdot L^{-1}$	200						
Total Uranium (U)	$\mu g \cdot L^{-1}$	10						
Total Vanadium (V)	$\mu g \cdot L^{-1}$	200						
Total Zinc (Zn)	$\mu g \cdot L^{-1}$	500		1	517.00	517.00	517.00	N/A
Petroleum Hydrocarbons								
Benzene	$mg \cdot L^{-1}$	0.001	0.11					
Toluene	$mg \cdot L^{-1}$	0.001	0.215					
Ethylbenzene	$mg \cdot L^{-1}$	0.001	0.025					
Xylene (Total)	$mg \cdot L^{-1}$	0.002						
$C_6 – C_{10}$ (less BTEX)	$mg \cdot L^{-1}$	0.010						
$>C_{10}$-C_{16} Hydrocarbons	$mg \cdot L^{-1}$	0.050						
$>C_{16}$-C_{21} Hydrocarbons	$mg \cdot L^{-1}$	0.050						
$>C_{21}$-$<C_{32}$ Hydrocarbons	$mg \cdot L^{-1}$	0.100						
Modified TPH (Tier1)	$mg \cdot L^{-1}$	0.100						
Reached Baseline at C_{32}	$mg \cdot L^{-1}$	N/A						
Surrogate Recovery (%)								
Isobutylbenzene - Extractable	%			15	97.00	105.00	101.33	2.32
n-Dotriacontane - Extractable	%			15	96.00	109.00	102.47	3.93
Isobutylbenzene - Volatile	%			15	88.00	102.00	95.87	4.16

Notes:
ND = Not detected
RDL = Reportable Detection Limit
Results relate only to the items tested.

3.1.2 Benthic Invertebrates

Within the 2011 Corridor: Shoal Cove Segment, a total of four sites were successfully sampled for benthos (Figure 2.3). A brief description of the substrate characteristics as described in the field, and the sediment and organism community as provided by the benthic laboratory, are provided in Table 3.6. All four samples were collected on June 8, 2011.

Table 3.6 Sediment Characteristics and Benthic Community in Samples Collected during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

Sample ID	Field Collection and Sediment Assessment	Laboratory Assessment of Sediment and Organism Community Description
NCS-001	Six grabs attempted; four with material including large rock, patchy small gravel and encrusted cobble.	Large cobble and a boulder covered in encrusting bryozoans and *Spirorbis* spp. as well as some gravel. Biological community included foraminifers and hydrozoans, as well as brittle stars, polychaetes, bivalves, brachiopods, sea spiders and a sea urchin.
NCS-002	Four successful grabs; included mostly cobble and rubble with shell fragments and brittle stars.	Cobbles with some shell, organic debris, encrusting and branching bryozoans, foraminiferans and hydrozoans. Brittle stars and *Spirorbis* spp. were abundant, as well as sea urchins, bivalves and polychaetes.
NCS-004	Three successful grabs. Small quantity of rock, sea urchins, brittle stars and shell fragments.	Predominantly substrate was gravel and some cobble with encrusting bryozoans, foraminiferans, *Spirorbis* worms, amphipods, brittle stars and sea urchins.
NCS-005	Six grab attempts; two successful but partial grabs. Generally coarse material.	Substrate included gravel and some cobble with bryozoans and foraminifers and some small pieces of hard corals. Various polychaetes, amphipods, isopods, brittle stars, sponges, ascidians (sea squirts) and pycnogonids (sea spiders), as well as sea urchins, soft corals, molluscs and barnacles were present.

Detailed species identifications and enumerations are provided in Appendix B.

Three of the four samples collected within the 2011 Corridor: Shoal Cove Segment were enumerated in their entirety, while one station (NCS-001) was sub-sampled owing to the large numbers of organisms in this sample. Approximately 50 % of this sample was sub-sampled. Abundance and biomass estimates for this sample was scaled up to represent 100 % of the sample. Abundance and community measures did not include meiofauna and plankton taxa, as these groups are not sampled quantitatively with the sieve. These taxa were however included in the tables for information purposes. It is also important to note that the abundance and biomass estimates should be considered semi-quantitative at best and these variables should not be compared between sites. This is because in many instances grabs were composited in order to get sufficient volume of sample for analyses and, as a result, the volume of sample retained for benthic analyses is variable between stations.

A total of 3,554 benthic organisms were identified from the four deep subtidal stations within the 2011 Corridor: Shoal Cove Segment. The benthic community collected from these samples were dominated by Polychaetes (2,170 organisms, 61.1 %), mainly due to high numbers of spirorbids, followed by Amphipoda (607 organisms, 17.1 %), Echinodermata (168 organisms, 4.7 %). Other taxa present in these samples making up less than 5 % of total organisms, included Chordata (109 organisms), Cnidaria (109 organisms), Porifera (97 organisms), Bivalvia (86 organisms), Isopoda (58 organisms), Gastropoda (41 organisms), marine Oligochaetes (20 organisms), Pycnogonida (18 organisms), Platyhelminthes (16 organisms), Nemertea (15 organisms), Miscellaneous (15

organisms), Brachiopoda (11 organisms), Polyplacophora (eight organisms), Cirripedia (four organisms) and Sipuncuida (two organisms).

Table 3.7 presents the relative occurrence of benthic taxa in the 2011 Corridor: Shoal Cove Segment. A total of 141 taxa were identified and 15 of those occurred in all four samples including the Polychaetes - Spirorbidae, Sabellidae, *Exogene* spp.*,* and the Echinoderms - *Ophiura robusta, Ophiopholis aculeata*, and *Strongylocentrotus pallidus,* the Isopod - *Munna kroyeri*, the Bivalve - *Anomia squamula*, as well as unidentified Amphipods, Gastropods and Flatworms. Nematoda and Harpacticoid Copepod (Meiofauna/Plankton) were also found in all samples.

Table 3.7 Relative Occurrence of Benthic Taxa during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

Species	Taxon	Occurrence	Species	Taxon	Occurrence
100 % Distribution					
Anomia squamula	BIVALVIA	4	*Ophiura robusta* (Ophiuroid B)	ECHINODERMATA	4
Unidentified Gastropod	GASTROPODA	4	*Strongylocentrotus pallidus*	ECHINODERMATA	4
Ischnochiton albus	POLYPLACOPHORA	4	Unidentified Amphipod	AMPHIPODA	4
Exogene spp.	POLYCHAETA	4	*Munna kroyeri*	ISOPODA	4
Sabellidae	POLYCHAETA	4	Flatworm sp. C	PLATYHELMINTHES	4
Spirorbidae	POLYCHAETA	4	Harpacticoid Copepod	MEIOFAUNA/PLANKTON	4
Syllidae	POLYCHAETA	4	Nematoda	MEIOFAUNA/PLANKTON	4
Ophiopholis aculeata (Ophiuroid A)	ECHINODERMATA	4			
75 % Distribution					
Hiatella arctica	BIVALVIA	3	*Jassa falcata* (*Ischyrocerus* sp. A)	AMPHIPODA	3
Puncturella noachina	GASTROPODA	3	Stenothoidae	AMPHIPODA	3
Eumida sanquinea	POLYCHAETA	3	*Pseudopallene? discoidea*	PYCNOGONIDA	3
Ericthonius rubricornis	AMPHIPODA	3			
50 % Distribution					
Chlamys islandicus	BIVALVIA	2	*Ischyrocerus commensalis*	AMPHIPODA	2
Cyclocardia novaeangliae	BIVALVIA	2	*Ischyrocerus* sp.	AMPHIPODA	2
Unidentified Bivalve	BIVALVIA	2	Unidentified Ischyroceridae	AMPHIPODA	2
Boreotrophon truncatus	GASTROPODA	2	*Metopa boecki?*	AMPHIPODA	2
Margarites groenlandicus	GASTROPODA	2	*Nymphon rubrum?*	PYCNOGONIDA	2
Onchidoris sp. A	GASTROPODA	2	*Hermithiris psittacea*	BRACHIOPODA	2
Unidentified Cirratulidae	POLYCHAETA	2	*Gersemia rubiformis*	CNIDARIA	2
Harmothoe extenuata	POLYCHAETA	2	Unidentified Hydroid	CNIDARIA	2
Maldanidae sp. D	POLYCHAETA	2	*Ascidia callosa?*	CHORDATA	2
Unidentified Polychaete	POLYCHAETA	2	Ascidian sp. B	CHORDATA	2
Thelepus cincinnatus	POLYCHAETA	2	Unidentified Ascidian	CHORDATA	2
Marine Oligochaete	ARCHIANNELIDA	2	Porifera sp. D?	PORIFERA	2
Ophiuroid C	ECHINODERMATA	2	Porifera sp. F?	PORIFERA	2
Strongylocentrotus droebachiensis?	ECHINODERMATA	2	Fish Lice	MEIOFAUNA/PLANKTON	2

Table 3.7 Relative Occurrence of Benthic Taxa during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Species	Taxon	Occurrence	Species	Taxon	Occurrence
25 % Distribution					
Eurystheus melanops	AMPHIPODA	2	Hydrachnidia	MEIOFAUNA/PLANKTON	2
Astarte undata	BIVALVIA	1	*Metopa* sp. D	AMPHIPODA	1
Crenella? faba	BIVALVIA	1	*Odius carinatus*	AMPHIPODA	1
Gastropod L	GASTROPODA	1	*Parapleustes pulchellus*	AMPHIPODA	1
Gastropod M	GASTROPODA	1	*Photis* sp.	AMPHIPODA	1
Gastropod N	GASTROPODA	1	Pleustidae sp. A	AMPHIPODA	1
Lepeta caeca	GASTROPODA	1	Pleustidae	AMPHIPODA	1
Nudibranch sp. A	GASTROPODA	1	*Tiron spiniferum*	AMPHIPODA	1
Nudibranch sp. D	GASTROPODA	1	*Edotea montosa?*	ISOPODA	1
Tachyrhynchus erosus	GASTROPODA	1	Isopod sp. C	ISOPODA	1
Trichotropis borealis	GASTROPODA	1	*Munna fabricii*	ISOPODA	1
Velutina sp.	GASTROPODA	1	*Pleurogonium spinosissimum*	ISOPODA	1
Unidentified Ampharetidae	POLYCHAETA	1	*Synidotea nodulosa*	ISOPODA	1
Arcidea sp.	POLYCHAETA	1	*Balanus* sp.	CIRRIPEDIA	1
Asabellides sp.	POLYCHAETA	1	Unidentified Barnacle	CIRRIPEDIA	1
Cirratulus sp.	POLYCHAETA	1	Pycnogonid B	PYCNOGONIDA	1
Euchone sp.	POLYCHAETA	1	Pycnogonid C	PYCNOGONIDA	1
Maldanidae sp. E	POLYCHAETA	1	*Glaciarcula spitzbergensis?*	BRACHIOPODA	1
Maldanidae sp. F	POLYCHAETA	1	Brachiopod sp. B	BRACHIOPODA	1
Nereis sp.	POLYCHAETA	1	*Cerebratulus* sp.	NEMERTEA	1
Nothria conchylega	POLYCHAETA	1	*Cerebratulus*? sp.	NEMERTEA	1
Unidentified Paraonidae	POLYCHAETA	1	Nemertean sp. F	NEMERTEA	1
Parougia caeca	POLYCHAETA	1	Nemertean sp. G	NEMERTEA	1
Pectinaria granulata	POLYCHAETA	1	Unidentified Nemertean	NEMERTEA	1
Pholoe minuta	POLYCHAETA	1	*Phascolion strombi*	SIPUNCUIDA	1
Phyllodoce maculata?	POLYCHAETA	1	Anemone sp. B	CNIDARIA	1
Phyllodocidae sp. C	POLYCHAETA	1	Anemone sp. C	CNIDARIA	1
Phyllodocidae sp. D	POLYCHAETA	1	Unidentified Anemone	CNIDARIA	1

Table 3.7 Relative Occurrence of Benthic Taxa during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Species	Taxon	Occurrence	Species	Taxon	Occurrence
25 % Distribution					
Polychaete sp. A	POLYCHAETA	1	Ascidian sp. C	CNIDARIA	1
Polychaete sp. F	POLYCHAETA	1	Ascidian sp. D	CNIDARIA	1
Polychaete sp.G	POLYCHAETA	1	Ascidian sp. E	CNIDARIA	1
Terebellidae	POLYCHAETA	1	Ascidian sp. F	CNIDARIA	1
Leptasterias polaris	ECHINODERMATA	1	Ascidian sp. G	CNIDARIA	1
Ophiuroid D	ECHINODERMATA	1	Ascidian sp. H	CNIDARIA	1
Ophiuroid F?	ECHINODERMATA	1	Ascidian juvenile, unidentified	CNIDARIA	1
Psolus phantapus	ECHINODERMATA	1	*Scypha* sp. A	PORIFERA	1
Strongylocentrotus sp.	ECHINODERMATA	1	*Scypha* sp. B	PORIFERA	1
Amphilochus manudens	AMPHIPODA	1	Porifera sp. A?	PORIFERA	1
Amphilochus sp.?	AMPHIPODA	1	Porifera sp. C?	PORIFERA	1
Anonyx sarsi (= *Anonyx* sp. A, 2010)	AMPHIPODA	1	Porifera sp. E	PORIFERA	1
Caprellid sp. B	AMPHIPODA	1	Porifera sp. G	PORIFERA	1
Dulichia porrecta	AMPHIPODA	1	Porifera sp. H	PORIFERA	1
Ischyrocerus megalops	AMPHIPODA	1	Unidentified Taxon A	MISCELLANEOUS	1
Metopa longicornis	AMPHIPODA	1	Unidentified Taxon B	MISCELLANEOUS	1
Metopa norvegica	AMPHIPODA	1	Odstracoda	MEIOFAUNA/PLANKTON	1
Metopa sp.	AMPHIPODA	1			

The benthic taxa are listed in order of abundance from all samples in Table 3.8. Similar to relative occurrence the Polychaetes were the dominant group with members of the encrusting, tube building family Spirorbidae an order of magnitude greater in abundance than all other benthic taxa. Sabellidae and Syllidae were also dominant in the samples. Amphipods *Ericthonius rubricornis*, Stenothoidae as well as Ischyroceridae were also commonly found in samples in the proposed submarine cable crossing corridor. Also noteworthy in the samples was an abundance of Nematoda.

Table 3.8 Abundance (Total Number of Organisms) of Benthic Taxa during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

Species	Taxon	Total
Spirorbidae	POLYCHAETA	1667
Sabellidae unid.	POLYCHAETA	235
Ericthonius rubricornis	AMPHIPODA	223
Nematoda	MEIOFAUNA/PLANKTON	164
Stenothoidae unidentified	AMPHIPODA	155
Syllidae unid.	POLYCHAETA	145
Gersemia rubiformis	CNIDARIA	92
Metopa norvegica	AMPHIPODA	84
Ophiura robusta (Ophiuroid B)	ECHINODERMATA	77
Ophiopholis aculeata (Ophiuroid A)	ECHINODERMATA	60
Exogone spp.	POLYCHAETA	53
Ischyroceridae unidentified	AMPHIPODA	42
Munna kroyeri	ISOPODA	41
Ischyrocerus commensalis	AMPHIPODA	40
Anomia squamula	BIVALVIA	37
Hiatella arctica	BIVALVIA	37
Ascidian juvenile, unidentified	CHORDATA	32
Ascidian sp. B	CHORDATA	26
Porifera sp. C?	PORIFERA	23
Ascidian sp. F	CHORDATA	22
MARINE OLIGOCHAETE	MARINE OLIGOCHAETE	20
Porifera sp E	PORIFERA	20
Eumida sanquinea	POLYCHAETA	17
Flatworm sp. C	PLATYHELMINTHES	16
Harpacticoid Copepod	MEIOFAUNA/PLANKTON	15
Puncturella noachina	GASTROPODA	14
Unidentified Taxon B	MISCELLANEOUS	14
Hydroid unid.	CNIDARIA	13
Porifera sp. F	PORIFERA	13
Munna fabricii	ISOPODA	12
Porifera sp. A?	PORIFERA	12
Porifera sp. H	PORIFERA	12
Fish Lice	MEIOFAUNA/PLANKTON	12
Ascidian sp. C	CHORDATA	11
Pseudopallene? discoidea	PYCNOGONIDA	10
Strongylocentrotus pallidus	ECHINODERMATA	9
Eurystheus melanops	AMPHIPODA	9

Table 3.8 Abundance (Total Number of Organisms) of Benthic Taxa during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Species	Taxon	Total
Cerebratulus sp.	NEMERTEA	9
Hydrachnidia	MEIOFAUNA/PLANKTON	9
Ischnochiton albus	POLYPLACOPHORA	8
Amphipod unidentified	AMPHIPODA	8
Ascidia callosa?	CHORDATA	8
Thelepus cincinnatus	POLYCHAETA	7
Ophiuroid D	ECHINODERMATA	7
Metopa boecki?	AMPHIPODA	7
Hermithiris psittacea	BRACHIOPODA	7
Porifera sp D?	PORIFERA	7
Gastropod unidentified	GASTROPODA	6
Ophiuroid C	ECHINODERMATA	6
Parapleustes pulchellus?	AMPHIPODA	6
Jassa falcata (Ischyrocerus sp. A)	AMPHIPODA	5
Metopa sp.	AMPHIPODA	5
Porifera sp. G	PORIFERA	5
Cyclocardia novaeangliae	BIVALVIA	4
Harmothoe extenuata	POLYCHAETA	4
Phyllodocidae sp. C	POLYCHAETA	4
Terebellidae unidentified	POLYCHAETA	4
Ischyrocerus sp.	AMPHIPODA	4
Nymphon rubrum?	PYCNOGONIDA	4
Scypha sp. A	PORIFERA	4
Bivalve unidentified	BIVALVIA	3
Boreotrophon truncatus	GASTROPODA	3
Onchidoris sp A	GASTROPODA	3
Asabellides sp.	POLYCHAETA	3
Cirratulidae unidentified	POLYCHAETA	3
Strongylocentrotus droebachiensis?	ECHINODERMATA	3
Amphilochus manudens	AMPHIPODA	3
Pycnogonid B	PYCNOGONIDA	3
Ascidian sp. D	CHORDATA	3
Ascidian unidentified	CHORDATA	3
Ostracoda	MEIOFAUNA/PLANKTON	3
Astarte undata	BIVALVIA	2
Chlamys islandicus	BIVALVIA	2
Gastropod M	GASTROPODA	2
Gastropod N	GASTROPODA	2
Lepeta caeca	GASTROPODA	2
Margarites groenlandicus	GASTROPODA	2
Trichotropis borealis	GASTROPODA	2
Maldanidae sp. D	POLYCHAETA	2

Table 3.8 Abundance (Total Number of Organisms) of Benthic Taxa during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Species	Taxon	Total
Maldanidae sp. F	POLYCHAETA	2
Nothria conchylega	POLYCHAETA	2
Parougia caeca	POLYCHAETA	2
Pholoe minuta	POLYCHAETA	2
Phyllodocidae sp. D	POLYCHAETA	2
Polychaete sp. F	POLYCHAETA	2
Polychaete sp. G	POLYCHAETA	2
Polychaete unidentified	POLYCHAETA	2
Leptasterias polaris?	ECHINODERMATA	2
Ophiuroid F?	ECHINODERMATA	2
Amphilochus? sp.	AMPHIPODA	2
Metopa sp. D	AMPHIPODA	2
Pleustidae sp. A	AMPHIPODA	2
Tiron spiniferum	AMPHIPODA	2
Synidotea nodulosa	ISOPODA	2
Balanus sp.	CIRRIPEDIA	2
Barnacle unidentified	CIRRIPEDIA	2
Glaciarcula spitzbergensis?	BRACHIOPODA	2
Brachiopod sp. B	BRACHIOPODA	2
Nemertean sp. G	NEMERTEA	2
Nemertean unidentified	NEMERTEA	2
Phascolion strombi	SIPUNCUIDA	2
Anemone unid.	CNIDARIA	2
Ascidian sp. E	CHORDATA	2
Crenella? faba	BIVALVIA	1
Gastropod L	GASTROPODA	1
Nudibranch sp. A	GASTROPODA	1
Nudibranch sp. D	GASTROPODA	1
Tachyrhynchus erosus	GASTROPODA	1
Velutina sp.	GASTROPODA	1
Ampharetidae unidentified	POLYCHAETA	1
Aricidea sp.	POLYCHAETA	1
Cirratulus sp.	POLYCHAETA	1
Euchone sp.	POLYCHAETA	1
Maldanidae sp. E	POLYCHAETA	1
Nereis sp.	POLYCHAETA	1
Paraonidae? unidentified	POLYCHAETA	1
Pectinaria granulata	POLYCHAETA	1
Phyllodoce maculata?	POLYCHAETA	1
Polychaete sp. A	POLYCHAETA	1
Psolus phantapus	ECHINODERMATA	1
Strongylocentrotus sp.	ECHINODERMATA	1

Table 3.8 Abundance (Total Number of Organisms) of Benthic Taxa during Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Species	Taxon	Total
Anonyx sarsi	AMPHIPODA	1
Caprellid sp. B	AMPHIPODA	1
Dulichia porrecta	AMPHIPODA	1
Ischyrocerus megalops	AMPHIPODA	1
Metopa longicornis	AMPHIPODA	1
Odius carinatus	AMPHIPODA	1
Photis sp.	AMPHIPODA	1
Pleustidae unidentified	AMPHIPODA	1
Edotea montosa?	ISOPODA	1
Isopod sp. C	ISOPODA	1
Pleurogonium spinosissimum	ISOPODA	1
Pycnogonid C	PYCNOGONIDA	1
Cerebratulus? sp.	NEMERTEA	1
Nemertean sp. F	NEMERTEA	1
Anemone sp. B	CNIDARIA	1
Anemone sp. C	CNIDARIA	1
Ascidian sp. G	CHORDATA	1
Ascidian sp. H	CHORDATA	1
Scypha sp. B	PORIFERA	1
Unidentified Taxon A	MISCELLANEOUS	1

Abundance, biomass, and selected community measures are provided in Table 3.9. Abundance was moderate to high, ranging from 140 organisms per sample to 1,545 organisms per sample (Table 3.9, Figure 3.2). The high abundance of organisms in sample NCS-001 was due to the elevated numbers of the Polychaete Spirorbidae, while the high abundance for NCS-005 was in part due to the relatively high abundance of the Polychaetes - Spirorbidae, Syllidae and the Amphipods *Ericthonius rubricornis* and Stenothoidae, as well as Cnidarian *Gersemia rubiformis.* Biomass (grams per sample wet weight) ranged from 11.2 to 123.2 g/sample, with higher biomass for samples NCS-002 and NCS-005 (Table 3.9, Figure 3.3), owing to the relatively higher numbers of the sea urchins present in these two samples. Taxon richness was moderate to high, ranging from 28 to 94, with sample NCS-005 having the highest numbers of taxa per sample (Table 3.9, Figure 3.4).

The Shannon-Wiener Diversity Index, the most widely used index used to describe the proportional abundance of species (Costello et al. 2001), ranged from 0.51 to 1.40 (mean ± Std. Dev. of 0.934 ± 0.395). Pielou's Evenness Index, constrained to a scale from 0 to 1, is the most widely used measure of species evenness and a biodiversity index (Costello et al. 2001), and ranged from 0.30 to 0.77 (mean ± Std. Dev. of 0.553 ± 0.110) (Table 3.9).

McIntosh's Index, also constrained to a scale from 0 to 1, is an indicator of proportional abundances of species, and ranged from 0.21 to 0.76 (mean ± Std. Dev. of 0.499 ± 0.136). Simpson's Index, constrained from 0 (high diversity) to 1 (low diversity), is also an indicator of proportional abundances of species, ranged from 0.07 to 0.64 (mean ± Std. Dev. of 0.326 ± 0.136), with the highest diversity in the NCS-005 sample, and the lowest in the NCS-001 sample (Table 3.9).

Margalef's Index, a commonly used species richness or community diversity index with the higher the index the higher the diversity, ranged from 5.46 to 12.67 (mean ± Std. Dev. of 7.971 ± 1.601) (Table 3.9).

Table 3.9 Abundance, Biomass, Taxon Richness, and Community Diversity Indices for Benthic Samples Collected During Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

Station ID	Abundance (# per sample)	Biomass (g)	Taxon Richness	Shannon-Wiener Diversity	Pielou's Evenness	McIntosh's Index	Simpson's Index	Margalef's Index
NCS-001	1,301	11.2	51	0.514	0.301	0.207	0.639	6.973
NCS-002	568	123.2	44	0.719	0.438	0.331	0.466	6.78
NCS-004	140	43.2	28	1.107	0.765	0.699	0.13	5.464
NCS-005	1,545	96.4	94	1.397	0.708	0.758	0.068	12.666
Mean	888.50	68.50	54.25	0.934	0.553	0.499	0.326	7.971
Median	934.50	69.80	47.50	0.913	0.573	0.515	0.298	6.877
Std. Dev.	649.13	50.64	28.19	0.395	0.110	0.136	0.136	1.601
Min.	140	11.20	28.00	0.514	0.301	0.207	0.068	5.464
Max.	1,545	123.20	94.00	1.397	0.765	0.758	0.639	12.666

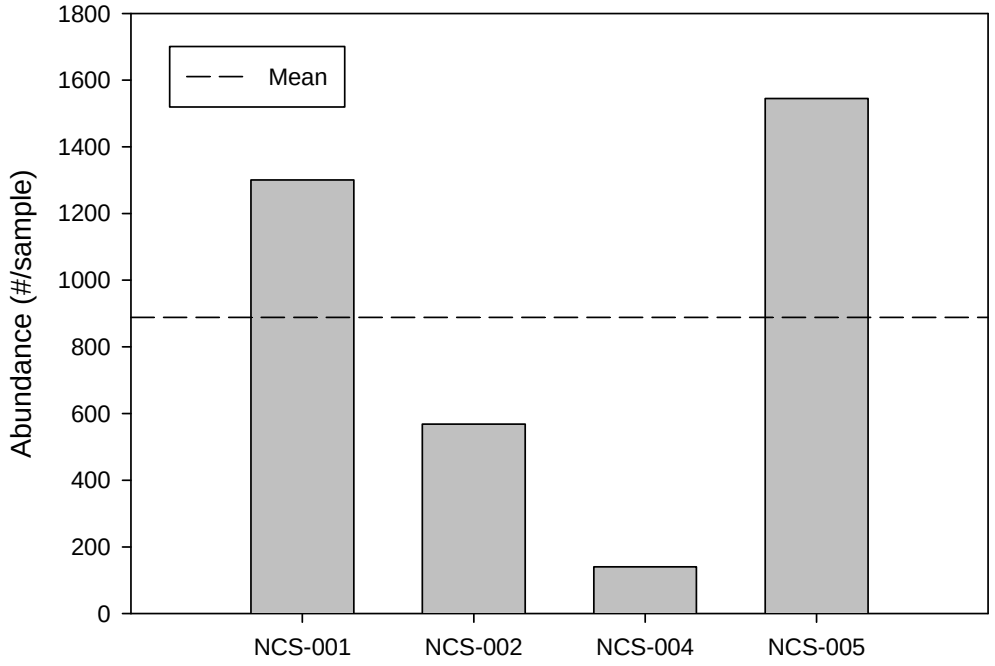

Figure 3.2 Abundance of Benthic Organisms (# organisms/sample) for Samples Collected During Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

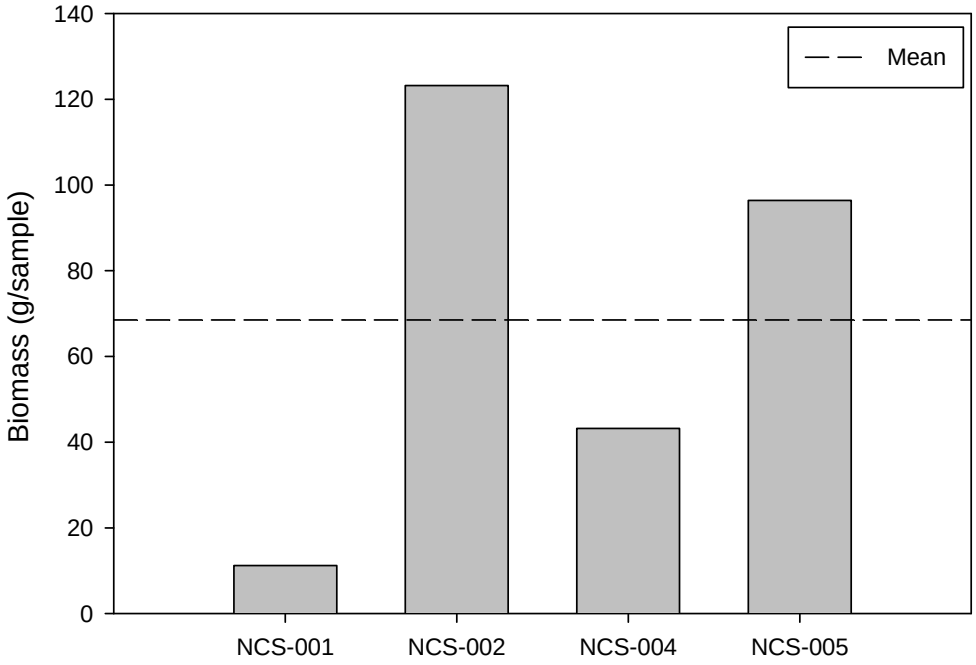

Figure 3.3 Biomass of Benthic Organisms (g/sample) for Samples Collected During Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

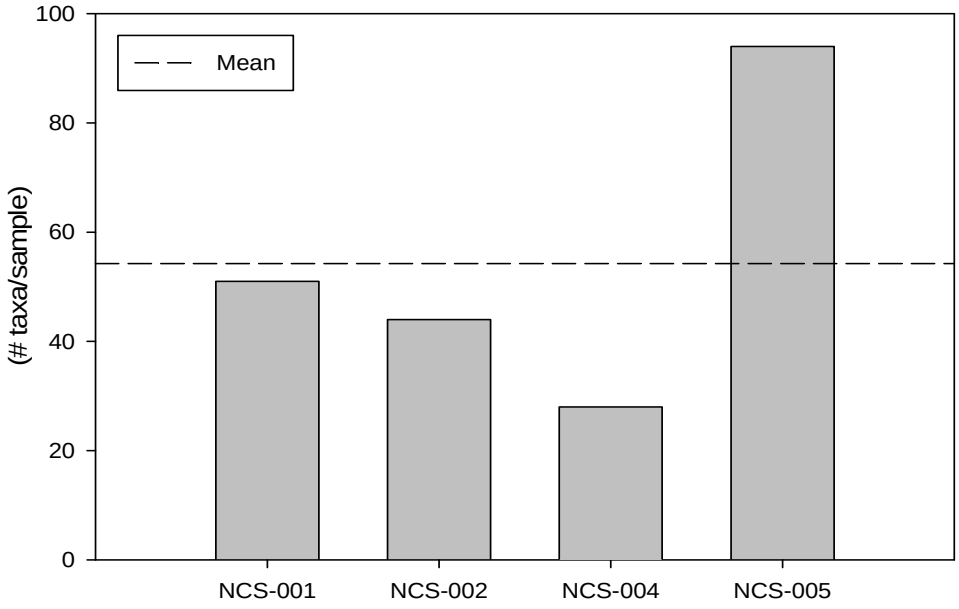

Figure 3.4 Taxon Richness of Benthic Organisms (# species/sample) for Samples Collected During Marine Surveys in the 2011 Corridor: Shoal Cove Segment, June 2011

3.1.3 **Marine Habitats**

In June 2011, underwater video surveys were conducted along pre-defined transects within the 2011 Corridor: Shoal Cove Segment to classify and quantify the marine habitat by collecting data on substrate, macroflora and macrofauna. A continuous video transect of 9,926 was completed and this was subsequently delineated into 44 transects ranging from 47 to 308 m in length and averaging 222.6 m in length. A summary of the transect information is provided in Table 3.10. It is noteworthy that, for varying reasons, portions of the video tape could not be interpreted and this ranged from 0 to 56 % for each transect, however overall 8,972 m or 92 % of the video collected was assessed in detail.

Data for substrate, macroflora and macrofauna were summarized on a transect basis and presented as per Kelly et al. (2009, draft) and AMEC (2010). Parameters included habitat zone, surveyed length and area, video time, depth range, substrate type (% coverage, predominant substrate group), macroflora (% coverage, predominant macrofloral class), and macrofauna (estimated relative abundance). The transect by transect results for this analyses are provided in Appendix C.

Table 3.10 Summary of Video Transects for the 2011 Corridor: Shoal Cove Segment, June 2011

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
1	T17	13:06:16 - 13:09:12	74	15	63
1	T18	13:55:58 - 14:09:42	250	5	238
1	T19	14:09:44 - 14:24:06	250	3	243
1	T20	14:24:08 - 14:39:18	250	0	250
1	T21	14:39:20 - 14:54:24	295	34	195
2	T22	16:02:26 - 16:10:10	167	16	140
2	T23	16:10:40 - 16:19:16	267	25	200
2	T24	16:19:56 - 16:26:54	199	11	177
2	T25	16:27:56 - 16:35:32	201	5	191
2	T26	16:52:24 - 16:57:40	250	23	192
2	T27	16:57:42 - 17:11:34	308	0	308
2	T28	17:11:36 - 17:17:00	213	47	113
3	T29	17:18:34 - 17:20:22	51	0	51
3	T30	17:20:24 - 17:28:28	250	0	250
3	T31	17:28:30 - 17:35:48	250	0	250
3	T32	17:35:50 - 17:42:54	250	0	250
3	T33	17:42:56 - 17:50:22	250	0	250
3	T34	17:50:24 - 17:58:26	250	0	250
3	T35	17:58:28 - 18:06:02	250	0	250
3	T36	18:06:04 - 18:13:06	250	0	250
3	T37	18:13:08 - 18:19:30	245	0	245
4	T38	18:56:24 - 18:57:18	47	0	47
4	T39	19:05:58 - 19:12:48	275	56	121
4	T40	19:28:10 - 10:33:36	250	46	135
4	T41	10:33:38 - 10:38:58	250	5	237

Table 3.10 Summary of Video Transects for the 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
4	T42	10:39:00 - 10:41:40	116	0	116
4	T43	10:42:12 - 10:43:22	49	25	37
4	T44	10:43:52 - 10:49:28	250	4	240
4	T45	10:49:30 - 10:55:10	250	0	250
4	T46	10:55:12 - 11:00:20	250	0	250
4	T47	11:00:22 - 11:05:26	250	0	250
4	T48	11:05:28 - 11:10:08	250	0	250
4	T49	11:10:10 - 11:15:08	250	11	222
4	T50	11:15:10 - 11:18:56	188	0	188
5	T51	11:20:18 - 11:25:14	250	0	250
5	T52	11:25:16 - 11:30:24	250	0	250
5	T53	11:30:26 - 11:36:06	250	0	250
5	T54	11:36:08 - 11:42:36	250	12	220
5	T55	11:42:38 - 11:48:34	250	0	250
5	T56	11:48:36 - 11:54:56	250	2	245
5	T57	11:54:58 - 12:02:32	250	0	250
5	T58	12:02:34 - 12:10:40	250	0	250
5	T59	12:10:42 - 12:19:18	250	0	250
5	T60	12:19:20 - 12:22:46	101	43	58

Notes:
[1]Video was not interpretable owing to distance off bottom, water clarity, speed of video camera, contact with the seafloor, and other reasons.
[2]Length of video analyzed included total transect length minus the proportion that was deemed not interpretable.

3.1.3.1 Substrate Distribution

Analysis of the video footage for substrate characteristics followed classification criteria identified by DFO in Kelly et al. (2009, draft) which included detailed substrate type, based on the Wentworth-Udden (Wentworth 1922) size-based classifications, which were also aggregated into broad substrate types (Table 2.6). A summary of the distribution of detailed substrate types in the 2011 Corridor: Shoal Cove Segment is provided in Table 3.11.

The dominant detailed substrate type was cobble (25,300 m^2, 70 %, for all transects) followed by boulder (7,739 m^2, 22 %, 40 transects). Gravel accounted for 2,150 m^2, (6 %, 15 transects), sand accounted for 594 m^2 (2 %, five transects), while shell was found in only 25 m^2 (0.07 %, one transect). There was no bedrock, rubble or silt/mud encountered during the survey. By broad substrate category, medium substrates (cobble and gravel) accounted for 27,450 m^2 and 92 % of the area, with coarse substrates (boulder only) comprising 7.739 m^2 (22 %), fine substrates (sand only) comprising 594 m^2 (2 %) and shells comprising the remainder (25 m^2, 0.07 %).

Table 3.11 Summary of the Detailed Substrate Type Distribution for 2011 Corridor: Shoal Cove Segment, June 2011

Transect	Length (m)	Area Covered (m^2)					
		Total Area (m^2)	Boulder	Cobble	Gravel	Sand	Shells
T17	63	252		113.4	113.4		25.2
T18	238	952	95.2	523.6	333.2		
T19	243	972	194.4	534.6	243		
T20	250	1,000	200	550	250		
T21	195	780	156	429	195		
T22	140	560	56	308	196		
T23	200	800	80	480	160		
T24	177	708	212.4	495.6			
T25	191	764	152.8	573	38.2		
T26	192	768	307.2	384	76.8		
T27	308	1,232	308	862.4	61.6		
T28	113	452	203.4	248.6			
T29	51	204	102	102			
T30	250	1,000	200	800			
T31	250	1,000	250	750			
T32	250	1,000	150	850			
T33	250	1,000	200	800			
T34	250	1,000	400	600			
T35	250	1,000	400	600			
T36	250	1,000	300	700			
T37	245	980	441	539			
T38	47	188		94	94		
T39	121	484	145.2	338.8			
T40	135	540	81	243	216		
T41	237	948	94.8	758.4	47.4	47.4	
T42	116	464	92.8	324.8		46.4	
T43	37	148	22.2	118.4		7.4	
T44	240	960	144	816			
T45	250	1,000	50	950			
T46	250	1,000	250	750			
T47	250	1,000	150	850			
T48	250	1,000	300	700			
T49	222	888	222	621.6	44.4		
T50	188	752	75.2	676.8			
T51	250	1,000	400	600			
T52	250	1,000	300	700			
T53	250	1,000	200	800			
T54	220	880	308	572			

Table 3.11 Summary of the Detailed Substrate Type Distribution for 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Transect	Length (m)	Area Covered (m^2)					
		Total Area (m^2)	Boulder	Cobble	Gravel	Sand	Shells
T55	250	1,000	150	850			
T56	245	980	245	735			
T57	250	1,000	50	950			
T58	250	1,000	50	950			
T59	250	1,000		600		400	
T60	58	232		58	81.2	92.8	
Total		**35,888**	**7,738.6**	**25,300**	**2,150.2**	**594**	**25.2**
%			**22 %**	**70 %**	**6 %**	**2 %**	**0 %**

Notes
[1]Transect length is the total length surveyed minus the proportion deemed not interpretable
[2]Area is the transect length that was interpretable times the 4 m field of view of the video camera

3.1.3.2 Macrofloral Distributions

Analysis of the video footage for macroflora was also based on criteria identified in Kelly et al. (2009, draft) and, where possible, the macroflora observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or vegetation class. Identification to species and/or genus was often difficult resulting in a more general classification of observed macroflora.

Macroflora were relatively common in the transects from the video survey of the 2011 Corridor: Shoal Cove Segment and were identified in all but one transect for a total of 22,225 m^2 with 61.9 % occurrence by area surveyed (Table 3.12). Percent (%) occurrence by area is the total area of all of the transects in which the taxon was observed. Five vegetation classes were identified with three classes common in the study area including coralline algae (16 transects, 1,642 m^2, 5 %), calcareous encrusting Rhodophyta (39 transects, 9,725 m^2, 27 %), and red filamentous algae (34 transects, 10,412 m^2, 29 %). The other two macroflora classes were uncommon and included *Lithothamnium* sp. (three transects, 149 m^2, 0.4 %), and Sea colander (two transects, 297 m^2, 0.8 %).

Table 3.12 Macrofloral Distributions in the 2011 Corridor: Shoal Cove Segment, June 2011

Transect	Length (m)	Area Covered (m^2)					
		Total Area (m^2)	Coralline Algae	Calcareous encrusting Rhodophyta	Red Filamentous Algae	*Lithothamnium* sp.	Sea Colander
17	63	252					
18	238	952		95.2			
19	243	972		97.2			
20	250	1,000		150			
21	195	780		78			
22	140	560		56			
23	200	800		80			

Table 3.12 Macrofloral distributions in the 2011 Corridor: Shoal Cove Segment, June 2011 (Cont'd)

Transect	Length (m)	Area Covered (m^2)					
		Total Area (m^2)	Coralline Algae	Calcareous encrusting Rhodophyta	Red Filamentous Algae	*Lithothamnium* sp.	Sea Colander
24	177	708		177			
25	191	764	38.2	152.8			
26	192	768		153.6	76.8		
27	308	1232	123.2	369.6	123.2		
28	113	452	22.6	271.2	22.6		
29	51	204		20.4	40.8		
30	250	1,000	100	250	300		
31	250	1,000	100	300	400		
32	250	1,000	100	400	250		
33	250	1,000	50	400	250		
34	250	1,000	300	400	100	50	
35	250	1,000	300	450	100		
36	250	1,000	150	350	250	50	
37	245	980		441	147		
38	47	188					
39	121	484		121			
40	135	540			189		
41	237	948		521.4	94.8		
42	116	464	116				
43	37	148			81.4		
44	240	960	48	240	144		
45	250	1,000		300	250		
46	250	1,000		450	250		
47	250	1,000		300	350		
48	250	1,000		350	500		
49	222	888		222	310.8		
50	188	752		75.2	413.6		
51	250	1,000	50	100	850		
52	250	1,000	50	100	850		
53	250	1,000	50	50	900		
54	220	880	44	44	572		
55	250	1,000		50	900		
56	245	980		98	784	49	
57	250	1,000		200	800		
58	250	1,000		900	100		
59	250	1,000		900			100
60	58	232		11.6	11.6		197.2
Total		**35,888**	**1,642**	**9725.2**	**10411.6**	**149**	**297.2**
%			**5 %**	**27 %**	**29 %**	**0 %**	**0.8 %**

3.1.3.3 Macrofauna Distributions

Analysis of the video footage for macrofauna also followed the approach identified in Kelly et al. (2009, draft) and, where possible, all macrofauna observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or faunal class. Identification to the species level was often not possible. Subsequently, the total number of observations for each taxon were summed to determine the relative (%) abundance of each. Taxa that were extremely abundant, such as Scallop and urchin species, were not enumerated and observations were simply classified as abundant.

A total of 20 macrofaunal taxa were identified in the video transects from the 2011 Corridor: Shoal Cove Segment, and these are presented and ranked in relation to percent (%) occurrence by area, and are described in relation to relative abundance. Percent (%) occurrence by area is the total area of all the transects in which the taxon was observed. In some instances, where a species could not be identified a generalized taxon was described (e.g., unidentified crab when the animal could not be identified as a toad or snow crab). Percent occurrence ranged from 2.65 % (unidentified shrimp, one transect) to 97.67 % (Polar sea star, 40 transects). Table 3.13 summarizes the percent (%) occurrence by area by categories (i.e. 75-100 %, 50-75 %, 25-50 %, and < 25 %).

Table 3.13 Macrofauna by Percent Occurrence Category in the 2011 Corridor: Shoal Cove Segment, June 2011

75 to 100 %	50 to 75 %	25 to 50 %	Less than 25 %
Polar sea star (*Leptasterias polaris*)	Scallops (*Pectinidae* sp.)	Stalked sea squirt (*Boltenia* sp.)	Toad crab (*Hyas* sp.)
Sea urchin (*Strongylocentrotus* sp.)	Sea anemone	Unidentified fish	Sculpin (*Myoxocephalus* sp.)
Unidentified crab	Sunstar (*Crossaster* sp.)	Sand dollar (*Echniarachnius parma*)	Snow crab (*Chionoecetes opilio*)
Brittle star (*Ophiuroidea* sp.)		Basket star (*Gorgonocephalus* sp.)	Other unidentified coral
Sea star (*Asterias* sp.)			Gadoid fish
Sponge (Porifera)			Sea cucumber
Soft coral (*Gersemia* sp.)			Unidentified shrimp

Polar sea star (40 transects, 97.67 %) and Sea urchin (41 transects, 97.61 %) had the highest percent occurrence by area and Polar sea star were occasional in nine transects and uncommon in 31 transects, while Sea urchin were abundant in two transects, common in one transect, occasional in 17 transects and uncommon in 21 transects (Table 3.14). Unidentified crab had 85.73 % occurrence and were occasional in five transects and uncommon in 30 transects. Other species that were abundant or common in the study area included Brittle star (abundant in six transects, common in eight transects), Soft coral (abundant in six transects, common in three transects), Scallops (abundant in one transects, common in 15 transects), and Sea anemone (abundant in nine transects, common in 16 transects). Other taxa that were less frequently encountered included Sunstar (60.04 %, occasional in 13 transects, uncommon in 14 transects), Stalked sea squirt (44.27 %, occasional in two transects, uncommon in 17 transects), Unidentified fish (38.46 %, uncommon in 16 transects), Sand dollar (32.39 %, occasional in four transects, uncommon in eight transects), Basket star (30.48 %, occasional in 11 transects, uncommon in two transects) and Toad crab (16.73 %, uncommon in seven transects). All other taxa had percent occurrences of less than 10 % and were uncommon in all transects in which they were observed.

Table 3.14 Macrofaunal Species Distribution Summary with Relative Abundances for the 2011 Corridor: Shoal Cove Segment, June 2011

	Total (all abundance categories)			Abundant			Common			Occasional			Uncommon		
Taxon	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**
Polar sea star (*Leptasterias polaris)*	40	8,763	97.67 %	-	-		-	-		9	2,208	24.61 %	31	6,555	73.06 %
Sea urchin (*Strongylocentrotus* sp.)	41	8,758	97.61 %	2	500	5.57 %	1	250	2.79%	17	3,622	40.37 %	21	4,386	48.89 %
Unidentified crab	35	7,692	85.73 %	-	-		-	-		5	1,182	13.17 %	30	6,510	72.56 %
Brittle star (Ophiuroidea sp.)	34	7,471	83.27 %	6	1,299	14.48 %	8	1,835	20.45%	16	3,481	38.80 %	4	856	9.54 %
Sea star (*Asterias* sp.)	34	7,411	82.60 %	-	-		-	-		1	250	2.79 %	33	7,161	79.81 %
Sponge (*Porifera)*	31	6,794	75.72 %	-	-		-	-		12	2,654	29.58 %	19	4,140	46.14 %
Soft coral (*Gersemia* sp.)	32	6,743	75.16 %	6	1,425	15.88 %	3	517	5.76%	12	2,510	27.98 %	11	2,291	25.53 %
Scallops (*Pectinidae* sp.)	30	6,728	74.99 %	1	200	2.23 %	15	3,586	39.97%	2	375	4.18 %	12	2,567	28.61 %
Sea anemone	41	8,414	68.17 %	9	2,298		16	3,440	38.34%	13	2,316	25.81 %	3	360	4.01 %
Sunstar (*Crossaster* sp.)	27	5,387	60.04 %	-	-		-	-		13	2,942	32.79 %	14	2,445	27.25 %
Stalked sea squirt (*Boltenia* sp.)	19	3,972	44.27 %	-	-		-	-		2	438	4.88 %	17	3,534	39.39 %
Unidentified fish	16	3,451	38.46 %	-	-		-	-		-	-		16	3,451	38.46 %
Sand dollar (*Echniarachnius parma)*	12	2,906	32.39 %	-	-		-	-		4	988	11.01 %	8	1,918	21.38 %
Basket star (*Gorgonocephalus* sp.)	13	2,735	30.48 %	-	-		-	-		11	2,372	26.44 %	2	363	4.05 %
Toad crab (*Hyas* sp.)	7	1,501	16.73 %	-	-		-	-		-	-		7	1,501	16.73 %
Sculpin (*Myoxocephalus* sp.)	3	808	9.01 %	-	-		-	-		-	-		3	808	9.01 %
Snow crab (*Chionoecetes opilio*)	4	756	8.43 %	-	-		-	-		-	-		4	756	8.43 %
Other unidentified coral	3	628	7.00 %	-	-		-	-		-	-		3	628	7.00 %
Gadoid fish	1	250	2.79 %	-	-		-	-		-	-		1	250	2.79 %
Sea cucumber	1	250	2.79 %	-	-		-	-		-	-		1	250	2.79 %
Unidentified shrimp	1	238	2.65 %	-	-		-	-		-	-		1	238	2.65 %

3.2 Shoal Cove Marine Survey Area

Water samples were collected from the subtidal region at the Shoal Cove Marine Survey Area on June 8, 2011, while water, sediment and benthic samples were collected in the intertidal region at this site on June 9, 2011. Attempts were made to collect sediment and benthic samples from the subtidal region on June 8, 2011, however due to the coarse nature of the substrate, no successful grabs were made. Habitat surveys, which included collection of bathymetric data, underwater video and intertidal and backshore habitat mapping was completed at this site on June 5 and 9, 2011. The results of each of these components are presented below.

3.2.1 **Water Quality**

Water quality was determined at four pre-selected locations within the Shoal Cove Marine Survey Area (Figure 2.4). Water quality included measurement of selected field parameters, including CTD profiles, and chemical and hydrocarbon analyses at an analytical laboratory. The detailed results of the analyses of these samples are contained in Appendix A. Date collected, station ID's, coordinates (in UTM NAD 83, Zone 21 coordinate system) and total depths at the sampling station are presented in Table 3.15

Table 3.15 Summary of Date and Location of Water Sampling at the Shoal Cove Marine Survey Area, June 2011

Date	Station ID	Location (see Figure 2.4)		Water Depth (m)
		Easting	Northing	
7-June-2011	SCW-001	524530	5691124	3.5
7-June-2011	SCW-002	524054	5690643	8.5
7-June-2011	SCW-003	523596	5690216	9.3
7-June-2011	SCW-004	523048	5689629	12.3

3.2.1.1 Conductivity, Temperature, and Depth Profiles

CTD profiles were collected with a SEACAT SBE-19 CTD meter at the four water quality stations at Shoal Cove. The CTD profiles are presented in Figure 3.5. The CTD profiles indicate that there is very little evidence of a salinity or temperature gradient with depth, and clearly no thermocline was evident. This was expected owing to the shallow nature of the sampling sites and the influence that wave and tidal action has on the mixing of the water in this study area. Consequently, only one water sample (at approximately 2 m depth) was collected at each site to characterize the water chemistry conditions.

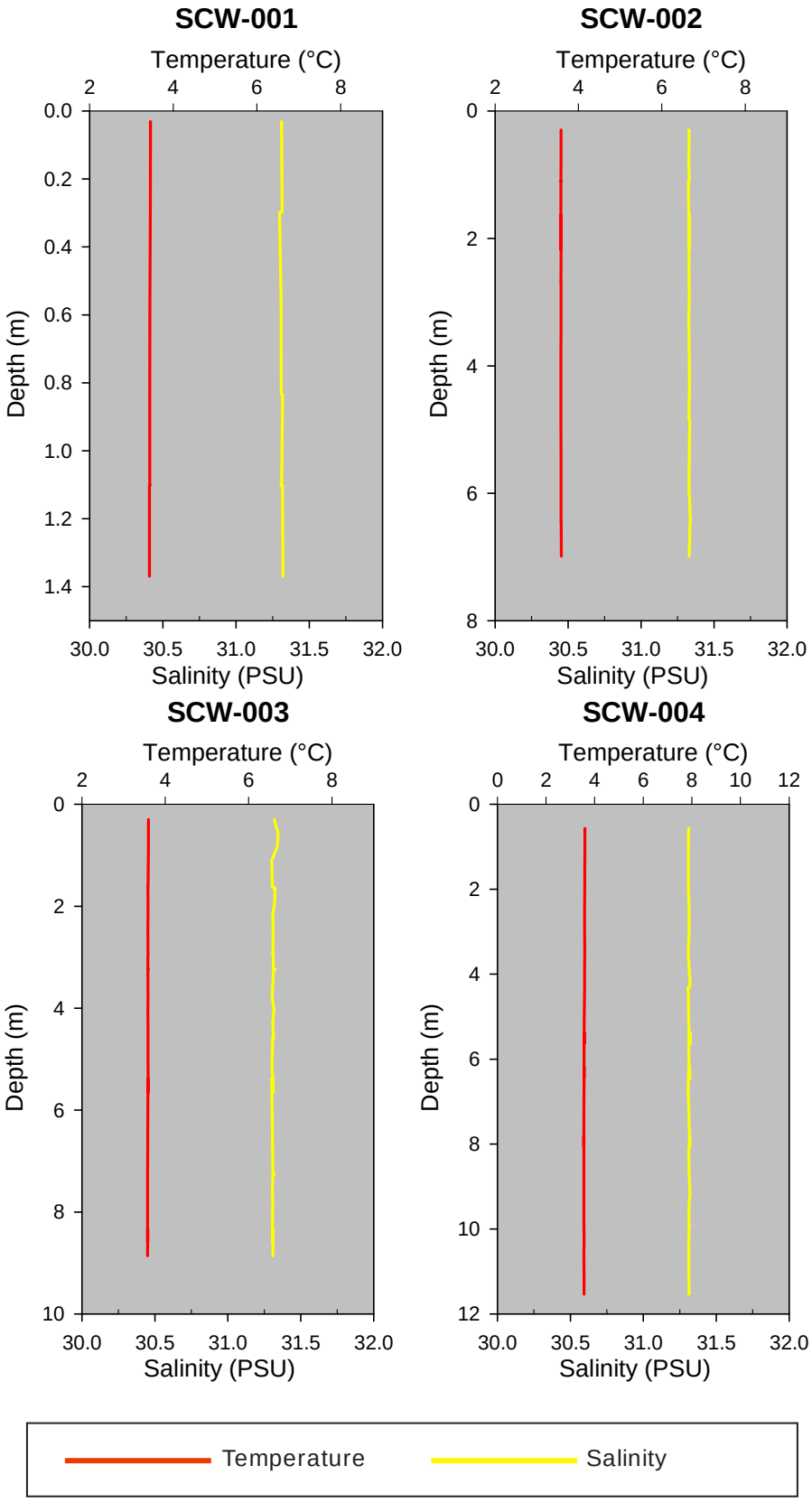

Figure 3.5 Salinity, Temperature and Depth Profiles at the Shoal Cove Marine Survey Area, June 2011

3.2.1.2 Field Water Quality Data

Field water quality measurements were taken at all four sampling stations at the Shoal Cove Marine Survey Area on June 9, 2011 and are presented in Table 3.16. Field water quality results were comparable between sites, with no evident variability between sites, excepting ORP values at SCW-004 which was slightly higher than the other sampling stations. Temperature had very little variability between sites and ranged from 3.51 to 3.61 °C. Similarly conductivity ranged only 0.01 $S \cdot m^{-1}$, with values of 4.85 and 4.86 $S \cdot m^{-1}$. The values for pH also showed very little variability ranging from 8.02 to 8.06. Dissolved oxygen values ranged from 11.11 to 11.25 $mg \cdot L^{-1}$, and were supersaturated, ranging from 103.3 to 104.6 % saturation.

Table 3.16 Summary of Field Water Quality Data from Water Sampling at the Shoal Cove Marine Survey Area, June 2011

Station ID	Temperature (°C)	Conductivity ($S \cdot m^{-1}$)	pH	DO ($mg \cdot L^{-1}$)	DO (% sat)	ORP (mV)
SCW-001	3.51	4.86	8.02	11.11	103.3	111.2
SCW-002	3.61	4.86	8.06	11.13	103.7	111.6
SCW-003	3.60	4.86	8.05	11.13	103.5	112.0
SCW-004	3.57	4.85	8.05	11.25	104.6	155.5

3.2.1.3 Laboratory Water Quality Analysis

Results of water quality analyses, including statistical summaries, for conventional parameters, nutrients, major ions, metals and petroleum hydrocarbons are presented in Table 3.17. Detailed results of laboratory water analyses are presented in Appendix A including sample duplicates and laboratory QA/QC data.

Conventional parameters were generally comparable between all sampling stations at Shoal Cove. Values for pH were alkaline, ranging from 7.66 to 7.78, and an average of 7.74, which is well within the CCME guidelines. Water samples at this site were generally clear, with low turbidity (not detectable to 0.2 NTU) and low TSS (not detectable to 2 $mg \cdot L^{-1}$). Colour and Total Organic Carbon were both below the detectable limit in all samples. Very few nutrients were detected in the samples at Shoal Cove, with nitrogen detected in two samples, and orthophosphate detected in all samples. Metals in samples were also low, with only strontium detected in all samples, and mercury detected in two of four samples. In sample SCW-003, mercury was slightly above the CCME guideline level. Note that this guideline level is for inorganic mercury only, whereas the parameter tested is total mercury. For petroleum hydrocarbons, all parameters were below the reportable detection levels in all samples.

Table 3.17 Results for Analysis of Water Quality Samples and Summary Statistics from Samples Collected During 2011 Marine Surveys at Shoal Cove, Including Conventional Parameters, Nutrients, Major Ions, Metals and Petroleum Hydrocarbons

	Units	RDL	CCME Guideline	SCW-001	SCW-002	SCW-003	SCW-004	N	Min	Max	Mean	Std. Dev
Conventional Parameters												
pH	pH	N/A	7.0 - 8.7	7.76	7.78	7.77	7.66	4	7.66	7.78	7.74	0.06
Total Alkalinity (Total as $CaCO_3$)	$mg{\cdot}L^{-1}$	5		96	97	97	150	4	96.00	150.00	110.00	26.67
Hardness ($CaCO_3$)	$mg{\cdot}L^{-1}$	1		6,400	6,000	6,800	6,300	4	6000.00	6800.00	6375.00	330.40
Turbidity	NTU	0.1		0.1	0.2	ND	0.2	3	0.10	0.20	0.17	0.06
Conductivity	$\mu S\ cm^{-1}$	1		47,000	47,000	47,000	47,000	4	47000	47000	47000	0
Total Suspended Solids	$mg{\cdot}L^{-1}$	1		ND	2	2	ND	2	2.00	2.00	2.00	0
Calculated TDS	$mg{\cdot}L^{-1}$	1		32,400	32,100	33,500	32,500	4	32100.00	33500.00	32625.00	607.59
Colour	TCU	5		ND	ND	ND	ND					
Total Organic Carbon (C)	$mg{\cdot}L^{-1}$	5		ND	ND	ND	ND					
Reactive Silica (SiO_2)	$mg{\cdot}L^{-1}$	0.5		ND	ND	ND	ND					
Nutrients												
Nitrate + Nitrite	$mg{\cdot}L^{-1}$	0.05		ND	ND	ND	ND					
Nitrite (N)	$mg{\cdot}L^{-1}$	0.01		ND	ND	ND	ND					
Nitrate (N)	$mg{\cdot}L^{-1}$	0.05	16[b]	ND	ND	ND	ND					
Nitrogen (Ammonia Nitrogen)	$mg{\cdot}L^{-1}$	0.05		0.14	0.08	ND	ND	2	0.08	0.14	0.11	0.04
Total Phosphorus (P)	$mg{\cdot}L^{-1}$	10,000		ND	ND	ND	ND					
Orthophosphate (P)	$mg{\cdot}L^{-1}$	0.01		0.01	0.01	0.01	0.01	4	0.01	0.01	0.01	0.00
Major Ions												
Total Calcium (Ca)	$\mu g{\cdot}L^{-1}$	10,000		418,000	394,000	443,000	420,000	4	394,000	443,000	418,750	20022.90
Total Magnesium (Mg)	$\mu g{\cdot}L^{-1}$	10,000		1,290,000	1,230,000	1,390,000	1,280,000	4	1,230,000	1,390,000	1,297,500	67019.90
Total Sodium (Na)	$\mu g{\cdot}L^{-1}$	10,000		10,300,000	9,780,000	11,100,000	10,200,000	4	9,780,000	11,100,000	10,345,000	551452.63
Total Potassium (K)	$\mu g{\cdot}L^{-1}$	10,000		394,000	372,000	428,000	390,000	4	372,000	428,000	396,000	23380.90
Dissolved Chloride (Cl)	$mg{\cdot}L^{-1}$	300		18,000	18,000	18,000	18,000	4	18,000	18,000	18,000	0
Dissolved Sulphate (SO_4)	$mg{\cdot}L^{-1}$	100		2,300	2,400	2,400	2,400	4	2,300	2,400	2,375	50.00
Metals												
Total Mercury (Hg)	$\mu g{\cdot}L^{-1}$	0.013	0.016[c]	0.013	ND	0.017	ND	2	0.01	0.02	0.02	0
Total Aluminum (Al)	$\mu g{\cdot}L^{-1}$	500		ND	ND	ND	ND					
Total Antimony (Sb)	$\mu g{\cdot}L^{-1}$	100		ND	ND	ND	ND					
Total Arsenic (As)	$\mu g{\cdot}L^{-1}$	100	12.5	ND	ND	ND	ND					
Total Barium (Ba)	$\mu g{\cdot}L^{-1}$	100		ND	ND	ND	ND					
Total Beryllium (Be)	$\mu g{\cdot}L^{-1}$	100		ND	ND	ND	ND					
Total Bismuth (Bi)	$\mu g{\cdot}L^{-1}$	200		ND	ND	ND	ND					
Total Boron (B)	$\mu g{\cdot}L^{-1}$	5,000		ND	ND	ND	ND					
Total Cadmium (Cd)	$\mu g{\cdot}L^{-1}$	1.7	0.12	ND	ND	ND	ND					
Total Chromium (Cr)	$\mu g{\cdot}L^{-1}$	100	56, 1.5[d]	ND	ND	ND	ND					
Total Cobalt (Co)	$\mu g{\cdot}L^{-1}$	40		ND	ND	ND	ND					
Total Copper (Cu)	$\mu g{\cdot}L^{-1}$	200		ND	ND	ND	ND					

Table 3.17 Results for Analysis of Water Quality Samples and Summary Statistics from Samples Collected During 2011 Marine Surveys at Shoal Cove, Including Conventional Parameters, Nutrients, Major Ions, Metals and Petroleum Hydrocarbons (Cont'd)

	Units	RDL	CCME Guideline	SCW-001	SCW-002	SCW-003	SCW-004	N	Min	Max	Mean	Std. Dev
Metals												
Total Iron (Fe)	$\mu g \cdot L^{-1}$	5000		ND	ND	ND	ND					
Total Lead (Pb)	$\mu g \cdot L^{-1}$	50		ND	ND	ND	ND					
Total Manganese (Mn)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND					
Total Molybdenum (Mo)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND					
Total Nickel (Ni)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND					
Total Selenium (Se)	$\mu g \cdot L^{-1}$	100		ND	ND	ND	ND					
Total Silver (Ag)	$\mu g \cdot L^{-1}$	10		ND	ND	ND	ND					
Total Strontium (Sr)	$\mu g \cdot L^{-1}$	200		7,890	7,340	8,230	7,870	4	7340.00	8230.00	7832.50	367.55
Total Thallium (Tl)	$\mu g \cdot L^{-1}$	10		ND	ND	ND	ND					
Total Tin (Sn)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND					
Total Titanium (Ti)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND					
Total Uranium (U)	$\mu g \cdot L^{-1}$	10		ND	ND	ND	ND					
Total Vanadium (V)	$\mu g \cdot L^{-1}$	200		ND	ND	ND	ND					
Total Zinc (Zn)	$\mu g \cdot L^{-1}$	500		ND	ND	ND	ND					
Petroleum Hydrocarbons												
Benzene	$mg \cdot L^{-1}$	0.001	0.11	ND	ND	ND	ND					
Toluene	$mg \cdot L^{-1}$	0.001	0.215	ND	ND	ND	ND					
Ethylbenzene	$mg \cdot L^{-1}$	0.001	0.025	ND	ND	ND	ND					
Xylene (Total)	$mg \cdot L^{-1}$	0.002		ND	ND	ND	ND					
C_6 - C_{10} (less BTEX)	$mg \cdot L^{-1}$	0.010		ND	ND	ND	ND					
$>C_{10}$-C_{16} Hydrocarbons	$mg \cdot L^{-1}$	0.050		ND	ND	ND	ND					
$>C_{16}$-C_{21} Hydrocarbons	$mg \cdot L^{-1}$	0.050		ND	ND	ND	ND					
$>C_{21}$-$<C_{32}$ Hydrocarbons	$mg \cdot L^{-1}$	0.100		ND	ND	ND	ND					
Modified TPH (Tier1)	$mg \cdot L^{-1}$	0.100		ND	ND	ND	ND					
Reached Baseline at C_{32}	$mg \cdot L^{-1}$	N/A		Yes	Yes	Yes	Yes					
Surrogate Recovery (%)												
Isobutylbenzene - Extractable	%			100	103	108	105	4.00	100.00	108.00	104	3.37
n-Dotriacontane - Extractable	%			104	99	102	105	4.00	99.00	105.00	102.5	2.65
Isobutylbenzene - Volatile	%			101	105	96	99	4.00	96.00	105.00	100.25	3.77

Notes:
ND = Not detected
RDL = Reportable Detection Limit
Results relate only to the items tested.
a - Those values marked with an asterisk (*) have elevated RDL for TSS (RDL = 2 mg/L)
b - CCME Guideline is for direct effects only and does not consider indirect effects from eutrophication
c - CCME Guideline is for inorganic mercury only, whereas the concentration reported is for total mercury
d - CCME Guideline values are for hexavalent and trivalent chromium, whereas the concentration reported is for total chromium

3.2.2 **Sediment Quality**

Sediment quality data were collected at four locations within the Shoal Cove Marine Survey Area, all within the intertidal zone (Figure 2.4). Attempts were made within the shallow sub-tidal zone, however, there were no successful grabs due to the coarse nature of the substrate. Sediment quality assessment included chemical and hydrocarbon analyses, as well as physical characterization (particle size analyses) at an analytical laboratory. Date, locations (UTM NAD 83, Zone 21 Coordinate System) and substrate description of the sampling sites are listed in Table 3.18. The detailed results of the analyses of these samples are contained in Appendix A.

Table 3.18 Date, Locations, and Substrate Description of the Sediment Sampling Sites at the Shoal Cove Marine Survey Area, June 2011

Date	Station ID	Habitat	Location		Description
			Easting	Northing	
9-June-2011	SCS-005	Intertidal	523369	5689062	Sand/no smell
9-June-2011	SCS-006	Intertidal	524027	5689575	Anoxic smell/sand/shell/dark grey colour
9-June-2011	SCS-007	Intertidal	524517	5689864	Sand/no smell/sample near road
9-June-2011	SCS-008	Intertidal	524715	5690147	Sand/no smell

3.2.2.1 Physical Analysis of Sediment

Substrate composition (i.e., gravel, sand, silt or clay) for each sample collected in the intertidal zone at Shoal Cove is presented in Figure 3.6, while a more detailed analysis of sediment composition (i.e., the Phi scale) is presented in Figure 3.7. The physical analysis of sediment demonstrated that three of the four samples were dominated by sand with fractions ranging 41 to 64 % in all samples. Gravel was dominant in one sample (SCS-005) at 58 %, and ranged from 34 to 58 % in all samples. Clay was present at very small amounts in all samples (0.6 to 1.4 %), while silt was only evident in two samples, at very low amounts (0.1 and 0.3 %).

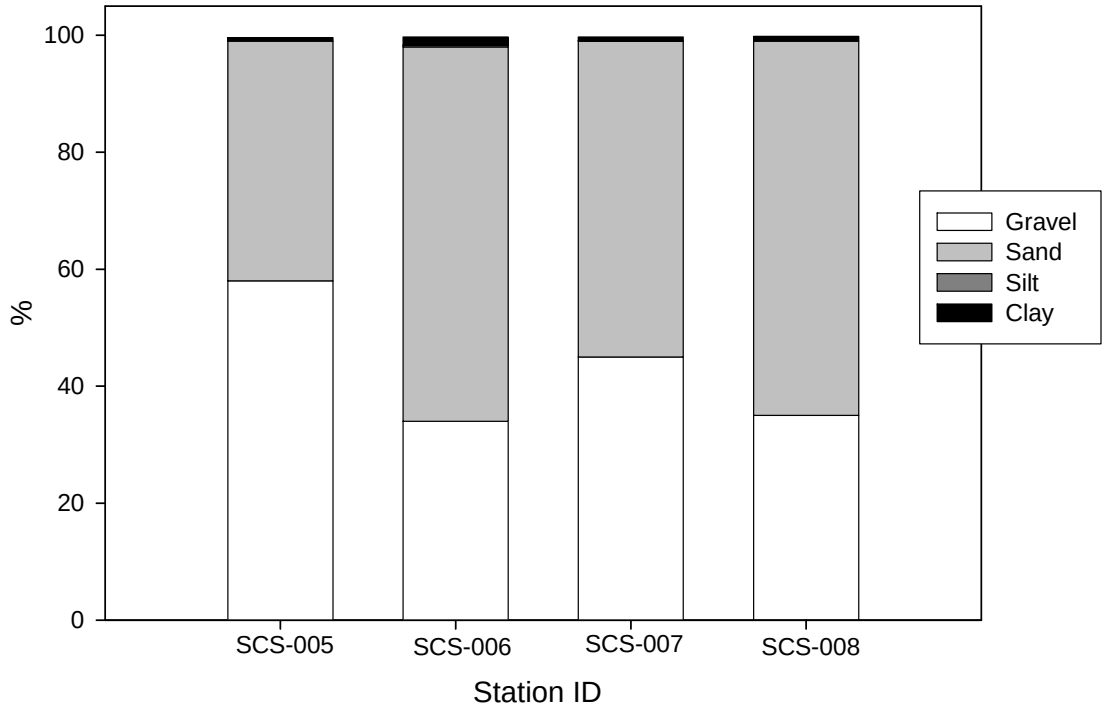

Figure 3.6 Particle Size Analysis (after Wentworth 1922) of Sediment Samples Collected from the Intertidal Zone at Shoal Cove, June 2011

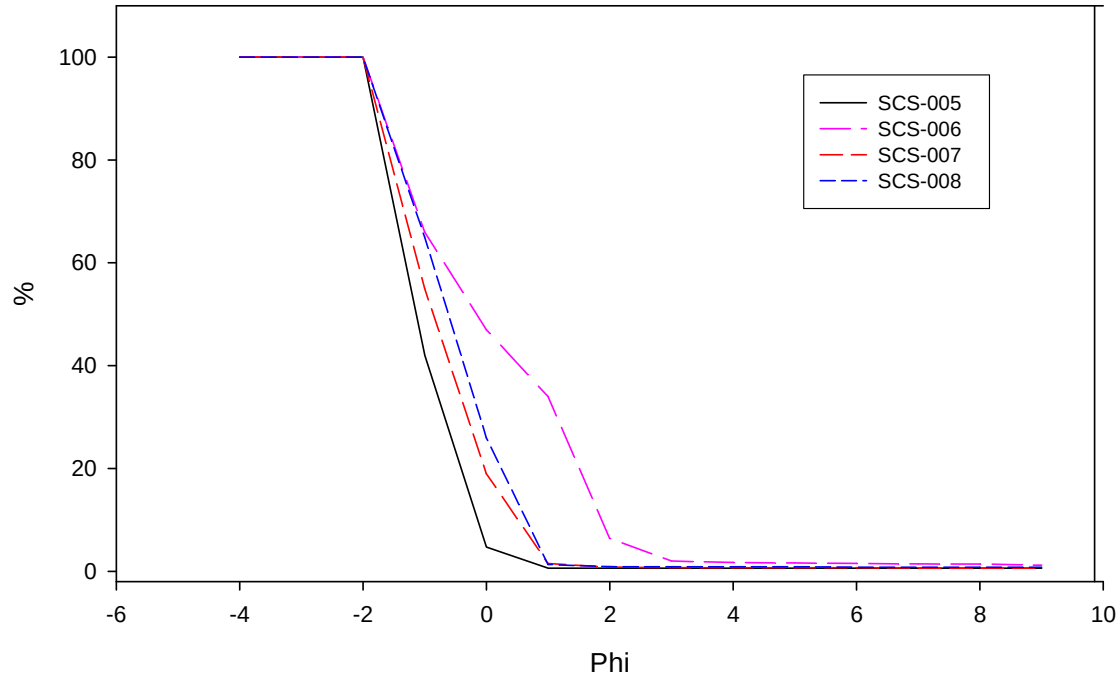

Figure 3.7 Particle Size Analysis (Phi Scale) of Sediment Samples Collected from the Intertidal Zone at Shoal Cove, June 2011

3.2.2.2 Chemical Analysis of Sediment

Results of chemical analyses of sediment and summary statistics, including analyses for major ions, metals, total organic carbon, moisture content and petroleum hydrocarbons, are presented in Table 3.19 for the samples from the intertidal zone at Shoal Cove in June 2011. Detailed results of all chemical analysis of sediment samples are presented in Appendix A, including sample duplicates and laboratory QA/QC data.

Major ions within the sediment samples were generally comparable between sampling stations. Metal levels were generally low, with only aluminum, iron, manganese and strontium measured in all samples. All other metals tested were undetected, excepting lead in one sample (SCS-008). No CCME (2002) ISQGs or PELs for the protection of aquatic life were exceeded in sediment samples collected at Shoal Cove. Petroleum hydrocarbons were below detectable limits in most samples, with the exception of Benzene which was detected in one sample (SCS-006).

Table 3.19 Sediment Analysis and Statistical Summary for Major Ions, Metals, Total Organic Carbon, Moisture and Petroleum Hydrocarbons from Intertidal Samples at the Shoal Cove Marine Survey Area, June 2011

	Units	RDL	ISQG	PEL	SCS-005	SCS-006	SCS-007	SCS-008	N	Min	Max	Mean	Std. Dev.
Major Ions													
Acid Extractable Calcium (Ca)	$mg \cdot g^{-1}$	0.5			190	160	200	210	4	160	210	190.00	21.60
Acid Extractable Magnesium (Mg)	$mg \cdot g^{-1}$	0.5			97	66	98	67	4	66	98	82.00	17.91
Acid Extractable Phosphorus (P)	$mg \cdot g^{-1}$	0.02			0.17	0.29	0.11	0.17	4	0.11	0.29	0.19	0.08
Acid Extractable Potassium (K)	$mg \cdot g^{-1}$	0.20			0.65	0.55	0.61	0.76	4	0.55	0.76	0.64	0.09
Acid Extractable Sodium (Na)	$mg \cdot g^{-1}$	0.10			2.20	2.50	4.80	5.40	4	2.20	5.40	3.73	1.61
Acid Extractable Sulphur (S)	$mg \cdot g^{-1}$	0.05			1.30	0.70	0.75	1.20	4	0.70	1.30	0.99	0.31
Metals													
Available Aluminum (Al)	$mg \cdot kg^{-1}$	100			1,500	1,600	1,300	1,400	4	1,300	1,600	1,450	129.0994
Available Antimony (Sb)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Arsenic (As)	$mg \cdot kg^{-1}$	20	7.24	41.6	ND	ND	ND	ND					
Available Barium (Ba)	$mg \cdot kg^{-1}$	50			ND	ND	ND	ND					
Available Beryllium (Be)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Bismuth (Bi)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Boron (B)	$mg \cdot kg^{-1}$	50			ND	ND	ND	ND					
Available Cadmium (Cd)	$mg \cdot kg^{-1}$	3	0.7	4.2	ND	ND	ND	ND					
Available Chromium (Cr)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Cobalt (Co)	$mg \cdot kg^{-1}$	10			ND	ND	ND	ND					
Available Copper (Cu)	$mg \cdot kg^{-1}$	20	18.7	108	ND	ND	ND	ND					
Available Iron (Fe)	$mg \cdot kg^{-1}$	500			5,900	5,400	5,500	6,200	4	5,400	6,200	5750.00	369.68
Available Lead (Pb)	$mg \cdot kg^{-1}$	5	30.2	112	ND	ND	ND	5	1	5	5	5.00	N/A
Available Lithium (Li)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Manganese (Mn)	$mg \cdot kg^{-1}$	20			430	370	430	400	4	370	430	407.50	28.72
Available Mercury (Hg)	$mg \cdot kg^{-1}$	1	0.13	0.7	ND	ND	ND	ND					
Available Molybdenum (Mo)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Nickel (Ni)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Rubidium (Rb)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Selenium (Se)	$mg \cdot kg^{-1}$	1			ND	ND	ND	ND					
Available Silver (Ag)	$mg \cdot kg^{-1}$	5			ND	ND	ND	ND					

Table 3.19 Sediment Analysis and Statistical Summary for Major Ions, Metals, Total Organic Carbon, Moisture and Petroleum Hydrocarbons from Intertidal Samples at the Shoal Cove Marine Survey Area, June 2011 (Cont'd)

	Units	RDL	ISQG	PEL	SCS-005	SCS-006	SCS-007	SCS-008	N	Min	Max	Mean	Std. Dev.
Metals													
Available Strontium (Sr)	$mg \cdot kg^{-1}$	50			150	220	120	330	4	120	330	205	93.27
Available Thallium (Tl)	$mg \cdot kg^{-1}$	1			ND	ND	ND	ND					
Available Tin (Sn)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Uranium (U)	$mg \cdot kg^{-1}$	1			ND	ND	ND	ND					
Available Vanadium (V)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Available Zinc (Zn)	$mg \cdot kg^{-1}$	50	124	271	ND	ND	ND	ND					
Organic Carbon													
Organic Carbon (TOC)	$g \cdot kg^{-1}$	0.9			44	50	30	39	4	30	50	40.75	8.46
Inorganics													
Moisture	%	1			12	15	8	11	4	8	15	11.50	2.89
Petroleum Hydrocarbons													
Benzene	$mg \cdot kg^{-1}$	0.003			ND	0.013	ND	ND	1	0.013	0.013	N/A	N/A
Toluene	$mg \cdot kg^{-1}$	0.03			ND	ND	ND	ND					
Ethylbenzene	$mg \cdot kg^{-1}$	0.01			ND	ND	ND	ND					
Xylene (Total)	$mg \cdot kg^{-1}$	0.05			ND	ND	ND	ND					
C_6 - C_{10} (less BTEX)	$mg \cdot kg^{-1}$	3			ND	ND	ND	ND					
$>C_{10}$-C_{16} Hydrocarbons	$mg \cdot kg^{-1}$	10			ND	ND	ND	ND					
$>C_{16}$-C_{21} Hydrocarbons	$mg \cdot kg^{-1}$	10			ND	ND	ND	ND					
$>C_{21}$-$<C_{32}$ Hydrocarbons	$mg \cdot kg^{-1}$	15			ND	ND	ND	ND					
Modified TPH (Tier1)	$mg \cdot kg^{-1}$	20			ND	ND	ND	ND					
Reached Baseline at C_{32}	$mg \cdot kg^{-1}$	N/A			NA	NA	NA	NA					
Hydrocarbon Resemblance	$mg \cdot kg^{-1}$	N/A			NA	NA	NA	NA					
Surrogate Recovery (%)													
Isobutylbenzene - Extractable	%				88	89	88	88	4	88	89	88.25	0.50
n-Dotriacontane - Extractable	%				87 (1)	101	95 (1)	93	4	87	101	94	5.77
Isobutylbenzene - Volatile	%				95	97	95	97	4	95	97	96.00	1.15

ND = Not detected
RDL = Reportable Detection Limit
Comment (1) TEH samples were extracted using a flat-bed shaker instead of the accelerated mechanical shaker due to matrix incompatibility.
ISQG - Interim Marine Sediment Quality Guideline
PEL - Probably Effect Levels

3.2.3 **Benthic Invertebrates**

Benthic invertebrate sample collection was attempted at four locations within the shallow subtidal zone at Shoal Cove on June 7, 2011, however the field team was not successful in collecting any samples due to the coarse nature of the substrate in this area. Four benthic samples were collected using a quadrat based approach within the intertidal zone at Shoal Cove. All four samples were collected on June 9, 2011. A brief description of the sediment characteristics as described in the field, and the sediment organism community as provided by the benthic laboratory, are provided in Table 3.20.

Table 3.20 Sediment Characteristics and Benthic Community in Samples Collected at the Shoal Cove Marine Survey Area, June 2011

Sample ID	Field Collection and Sediment Assessment	Laboratory Assessment of Sediment and Organism Community Description
SCS-005	0.25 m^2 quadrat sample; sand, no smell.	Contained predominantly gravel with some cobbles, shelly debris and sea urchin spines, as well as red coralline algae (*Corallina officinalis*), flatworms, saccoglossans, mussels, and polychaetes present.
SCS-006	0.25 m^2 quadrat sample; anoxic smell, sand with shell fragments, dark gray in color.	Contained sand and gravel with some sea urchin spines and test pieces. Numerous dead gastropods, abundant small marine oligochaetes, nematodes and polychaetes present.
SCS-007	0.25 m^2 quadrat sample; sand, no smell, sample near road.	Contained gravel with some cobbles and stringy organic debris. Abundant empty gastropod shells, pieces of coralline algae, saccoglossans, oligochaetes, and some flatworms, nematodes and nemerteans.
SCS-008	0.25 m^2 quadrat sample; sand, no smell.	Contained gravel with some sand and cobbles mixed with sea urchin spines and shell debris. Fragments of coralline algae present, Oligochaetes, flatworms and saccoglossans were dominant in the sample, with occasional gastropods and an archiannelid present.

All samples were sub-sampled owing to the large numbers of organisms in these samples. Approximately 50 % each of samples SCS-005, SCS-007 and SCS-008 were sub-sampled, while approximately 12.5 % of sample SCS-006 was sub-sampled. Abundance and biomass estimates were scaled up to represent 100 % of the sample. Detailed species identifications and enumerations are provided in Appendix B.

A total of 42,181 benthic organisms were identified from the four intertidal stations at Shoal Cove. Small unidentified marine Oligochaetes accounted for 41,873 organisms or 99 % of the benthos in these samples. Table 3.21 presents the relative occurrence of benthic taxa in the Shoal Cove intertidal stations. A total of 15 taxa were identified in the four samples. Marine Oligochaetes, an unidentified Hemicordata and flatworm species were identified in three of the four samples, while the Isopod *Jaera marina* and Nematoda were identified in two of the four samples. All other taxa were identified in only one sample.

Table 3.21 Relative Occurrence of Benthic Taxa Collected from the Intertidal Sites at Shoal Cove, June 2011

Species	Taxon	Occurrence
Marine Oligochaete	MARINE OLIGOCHAETE	3
Hemichordate? sp. 1	HEMICHORDATA	3
Flatworm sp. B	PLATYHELMINTHES	3
Jaera marina	ISOPODA	2
Nematoda	MEIOFAUNA/PLANKTON	2
Modious modiolus	BIVALVIA	1
Mytilus edulis	BIVALVIA	1
Bittium sp.	GASTROPODA	1
Lacuna vincta	GASTROPODA	1
Unidentified Chiton	POLYPLACOPHORA	1
Nereis virens	POLYCHAETA	1
Prionospio? sp.	POLYCHAETA	1
Unidentified Spionidae	POLYCHAETA	1
Unidentified Archiannelid	ARCHIANNELIDA	1
Unidentified Nemertean	NEMERTEA	1

The benthic taxa are listed in order of abundance in Table 3.22 for the intertidal samples at Shoal Cove. Similar to relative occurrence, small unidentified marine Oligochaeta accounted for 99 % of the organisms identified.

Table 3.22 Abundance (total number of organisms) of Benthic Taxa Collected from the Intertidal Sites at Shoal Cove, June 2011

Species	Taxa	Total
Marine Oligochaete	MARINE OLIGOCHAETE	41,873
Nematoda	MEIOFAUNA/PLANKTON	2,778
Hemichordate? sp. 1	HEMICHORDATA	202
Flatworm sp. B	PLATYHELMINTHES	54
Unidentified Nemertean	NEMERTEA	22
Modiolus modiolus	BIVALVIA	6
Bittium sp.	GASTROPODA	4
Lacuna vincta	GASTROPODA	4
Jaera marina	ISOPODA	4
Unidentified Chiton	POLYPLACOPHORA	2
Nereis virens	POLYCHAETA	2
Prionospio? sp.	POLYCHAETA	2
Unidentified Spionidae	POLYCHAETA	2
Unidentified Archiannelid	ARCHIANNELIDA	2
Mytilus edulis	BIVALVIA	2

Abundance, biomass, and selected community measures for benthos at the intertidal sites in Shoal Cove are provided in Table 3.23. Samples were low to high abundance (#/sample) ranging from 22 to 41,621 organisms per sample (mean ± Std. Dev. of 10,545.25 ± 20,717.76) with high variability (Table 3.23, Figure 3.8). Biomass (g/sample wet weight) ranged from 0.1 to 12.7 g (mean ± Std. Dev of 3.25 ± 6.3) with similarly high biomass in sample SCS-006 (Table 3.23, Figure 3.9). Taxon richness (# taxa/sample) ranged from 2 to 9 taxa (mean ± Std. Dev. of 5 ± 3), with relatively little variability between stations (Table 3.23, Figure 3.10).

The Shannon-Wiener Diversity Index, the most widely used index to describe the proportional abundance of species (Costello et al. 2001), ranged from 0.000 to 0.544 (mean ± Std. Dev. 0.359 ± 0.246). Pielou's Evenness Index, constrained to a scale from 0 to 1, is the most widely used measure of species evenness and a biodiversity index (Costello et al. 2001), and ranged from 0.001 to 0.809 (mean ± Std. Dev. of 0.475 ± 0.340). McIntosh's Index, constrained to a scale from 0 to 1, is an indicator of proportional abundances of species and ranged from 0.000 to 0.479 (mean ± Std. Dev. of 0.294 ± 0.213). Simpson's Index, constrained to range from 0 (high diversity) to 1 (low diversity), is also an indicator of proportional abundances of species, ranged from 0.363 to 1.00 (mean ± Std. Dev. of 0.577 ± 0.295). Margalef's Index, a commonly used species richness or community diversity index with the higher the index the higher the diversity, ranged from 0.094 to 1.336 (mean ± Std. Dev. of 0.853 ± 0.532).

All samples were relatively low in abundance and biomass, with the exception of sample SCS-006 which was two to three orders of magnitude higher in abundance and biomass. This was due to the high number of small unidentified marine Oligochaetes. Diversity was low in all samples, while evenness was low to moderate.

Table 3.23 Abundance, Biomass, Taxon Richness and Benthic Diversity Indices for Benthos From Intertidal Sites at Shoal Cove, June 2011

Sample ID	Abundance	Biomass	Taxon Richness	Shannon-Wiener Diversity	Pielou's Evenness	McIntosh's Index	Simpson's Index	Margalef's Index
SCS-005	22	0.1	4	0.487	0.809	0.479	0.388	0.971
SCS-006	41,621	12.7	2	0.000	0.001	0.000	1.000	0.094
SCS-007	398	0.1	9	0.544	0.570	0.419	0.363	1.336
SCS-008	140	0.1	6	0.405	0.520	0.278	0.555	1.012
Mean	10545.25	3.25	5	0.359	0.475	0.294	0.577	0.853
Median	269	0.1	5	0.446	0.545	0.349	0.472	0.992
Std. Dev.	20717.762	6.3	3	0.246	0.340	0.213	0.295	0.532
Min.	22	0.1	2	0.000	0.001	0.000	0.363	0.094
Max.	41,621	12.7	9	0.544	0.809	0.479	1.000	1.336

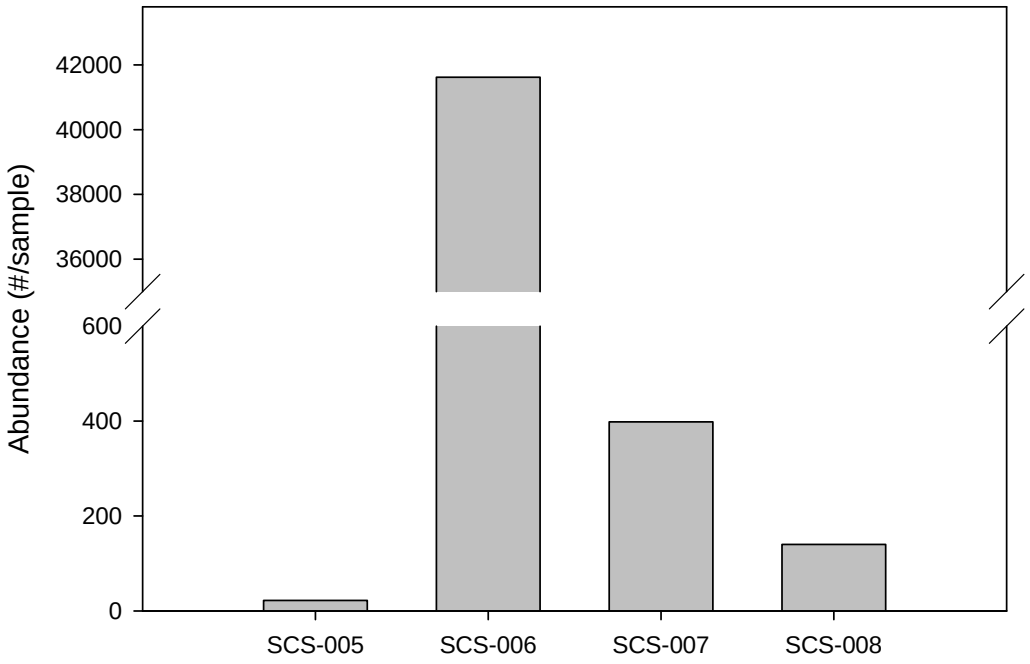

Figure 3.8 Abundance of Benthic Taxa (# Organisms/Sample) Collected from the Intertidal Sites at Shoal Cove, June 2011

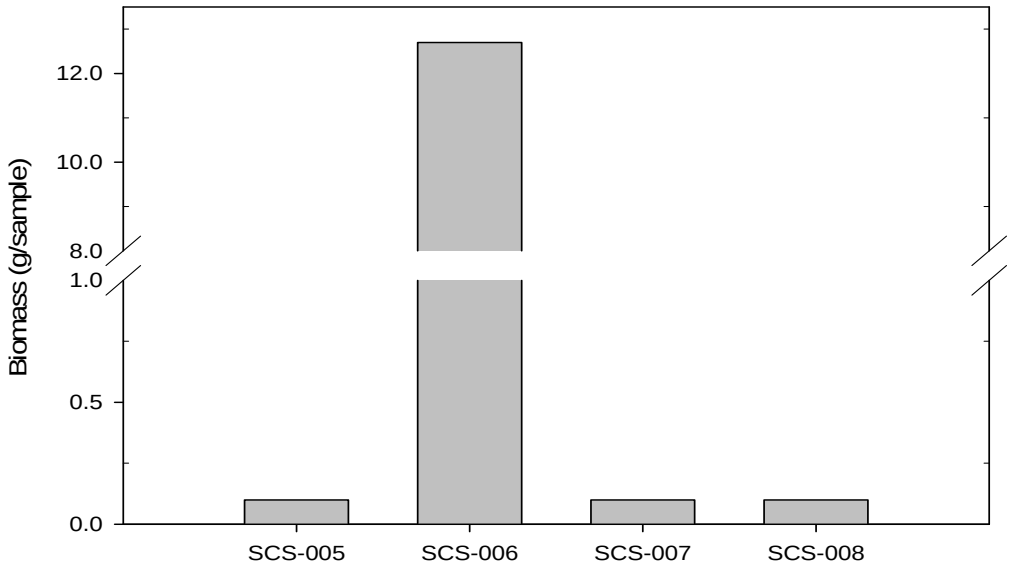

Figure 3.9 Biomass of Benthic Taxa (g/sample) Collected from the Intertidal Sites at Shoal Cove, June 2011

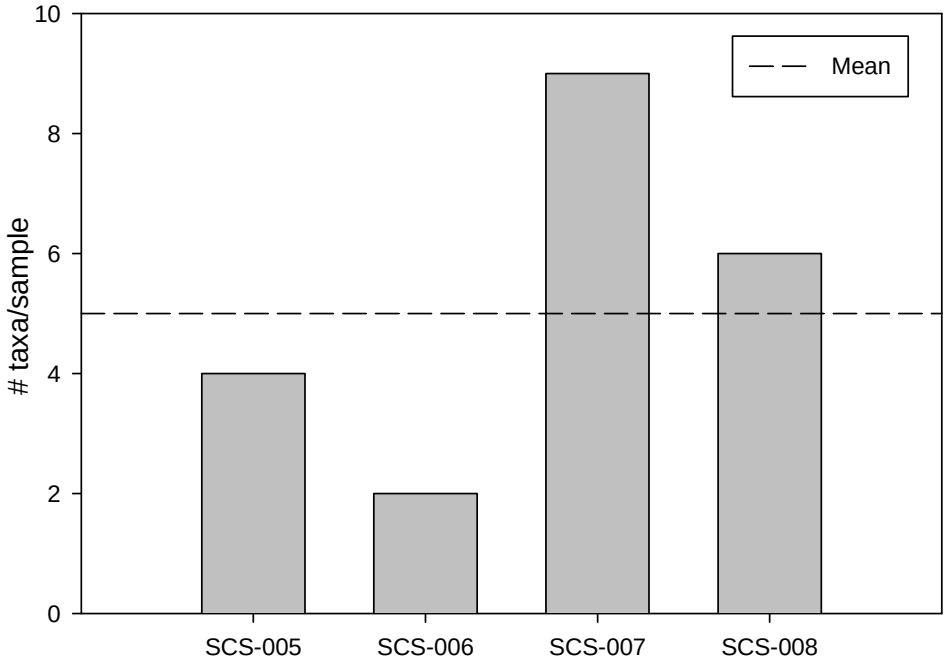

Figure 3.10 Taxon Richness of Benthic Organisms (# species/sample) Collected from the Intertidal Sites at Shoal Cove, June 2011

3.2.4 Backshore, Intertidal and Subtidal Habitats

The Shoal Cove Marine Survey Area is located along the Newfoundland side of the Strait of Belle Isle in the Northern Peninsula-Gulf Coast Ecoregion (Kelly et al. 2009, draft), and is described as an open coast marine ecosystem. The Shoal Cove site would be considered representative for this area with mixed substrate shorelines, with occasional sheltered embayments, and overall is characterized by low coastal relief. An ice pack may develop in the area and Arctic ice and ice bergs are extensive in the Strait of Belle Isle resulting in considerable ice scour. Sea ice in the Strait is a combination of locally formed ice and pack ice that drifts down from the Arctic and Labrador Sea. The current adjacent to Shoal Cove flows parallel to the shore in a northeast direction and tidal currents in the Strait are very strong. The coastline at Shoal Cove would be considered semi-exposed and is partially oriented towards the prevailing winds, while the inner embayment is protected by a peninsula and would be considered as semi-protected. The maximum fetch from the northwest would be 20 km (i.e., the Labrador shoreline). Shoal Cove would be considered stable in nature with respect to sediment transport with a variety of mixed substrate types dominating the intertidal zones.

3.2.4.1 Bathymetry

The depth distributions from the bathymetric survey were modelled and mapped in two-dimensions and are presented in Figure 3.11. The maximum depth apparent in the study area was 16.0 m and 156.8 ha had a depth of 10 m or less, while 129.2 ha were less than 5.0 m in depth. The inner protected embayment at Shoal Cove was very shallow, largely 1.0 m or less. Along the southeast shoreline, and the peninsula protecting the embayment, water depths drop off quickly from the shoreline to a depth of 5.0 to 7.0 m, over a distance of 100 to 200 m.

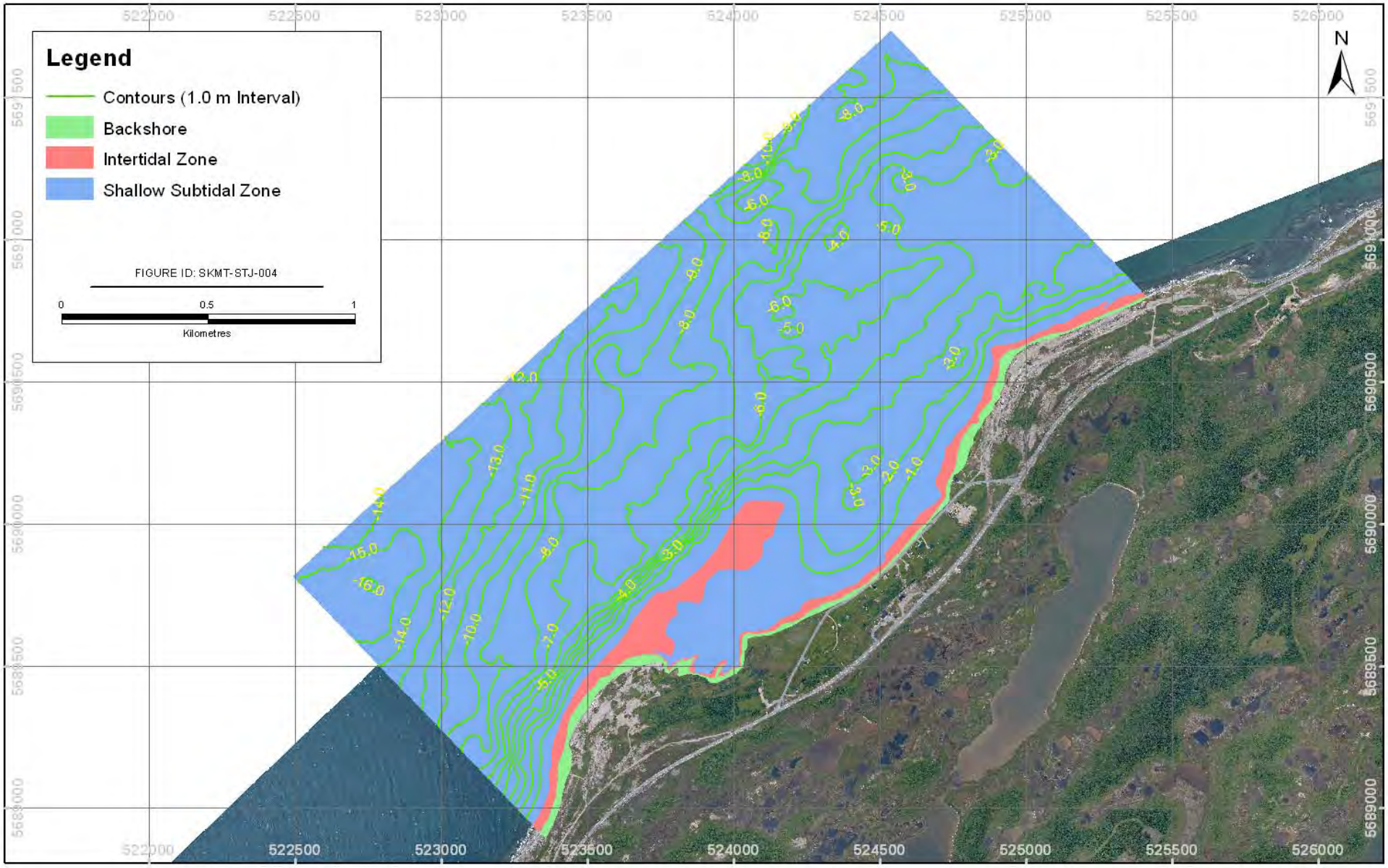

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FIGURE 3.11

Shoal Cove Bathymetry

3.2.4.2 Intertidal and Backshore Habitats

The intertidal and backshore habitats at Shoal Cove have been mapped in two dimensions based on air photo and LiDAR interpretation, supplemented with shore based surveys. The results are provided in an overview map, Figure 3.12, while additional detail is provided in two sub-maps for the West Block and East Block, in Figures 3.13 and 3.14, respectively. A total of seven intertidal habitat types and six backshore habitat types were delineated. The areas (m^2) and relative proportion of each type, for the intertidal and backshore zones, are provided in Table 3.24. Representative photographs of these intertidal and backshore habitat types are provided in Appendix D.

For the intertidal zone, which consisted of 160,347 m^2 (16.04 ha), the dominant habitat type was coarse substrate which included a total of 109,409 m^2, or 68.2 % of the intertidal area at the Shoal Cove study site. This included extensive areas with bedrock ledges and platforms. Medium substrates with kelp were next most important (20,107 m^2, 12.5 %). Kelp was associated with three different substrate classes, medium and fine substrates, as well as mixed, which included more than one broad substrate type. Substrate with kelp combinations totaled 18,599 m^2 and 11.6 % of the total area.

For the backshore zone, which consisted of 61,744 m^2 (6.17 ha), there were two dominant habitat types: grasses (26,285 m^2, 42.6 %) and sand and gravel flat/beach (25,123 m^2, 40.7 %). Grasses were a dominant backshore habitat likely due to the exposed nature of the coastline which has prevented larger shrubs and trees from growing. Sand and gravel flat/beach was also an important backshore habitat type reflecting the removal of these materials from the intertidal zones and deposition in the backshore, again related to exposure and the strong erosive forces on this coastline. Grasses and shrubs were evident in 8,050 m^2 (13.0 %), in areas that were somewhat protected from the coastal winds and waves. The three remaining habitat types comprised 2,285 m^2 and 3.7 % of the backshore area.

Table 3.24 Area (ha) and Proportion (%) of Intertidal and Backshore Habitat Classes at Shoal Cove

	Area (m^2)	Percent
Intertidal Classes		
Coarse	109,409	68.2
Medium	20,107	12.5
Mixed w/Kelp	15,398	9.6
Grass	9,036	5.6
Mixed	3,196	2.0
Medium w/Kelp	2,104	1.3
Fines w/Kelp	1,097	0.7
Total	**160,347**	**100.00**
Backshore Classes		
Grasses	26,285	42.6
Sand & Gravel Flat/Beach	25,123	40.7
Grasses and Shrubs	8,050	13.0
Gravel Flat/Beach	1,243	2.0
Rip Rap	799	1.3
Estuary & Fringing Lagoon	243	0.4
Total	**61,744**	**100.00**

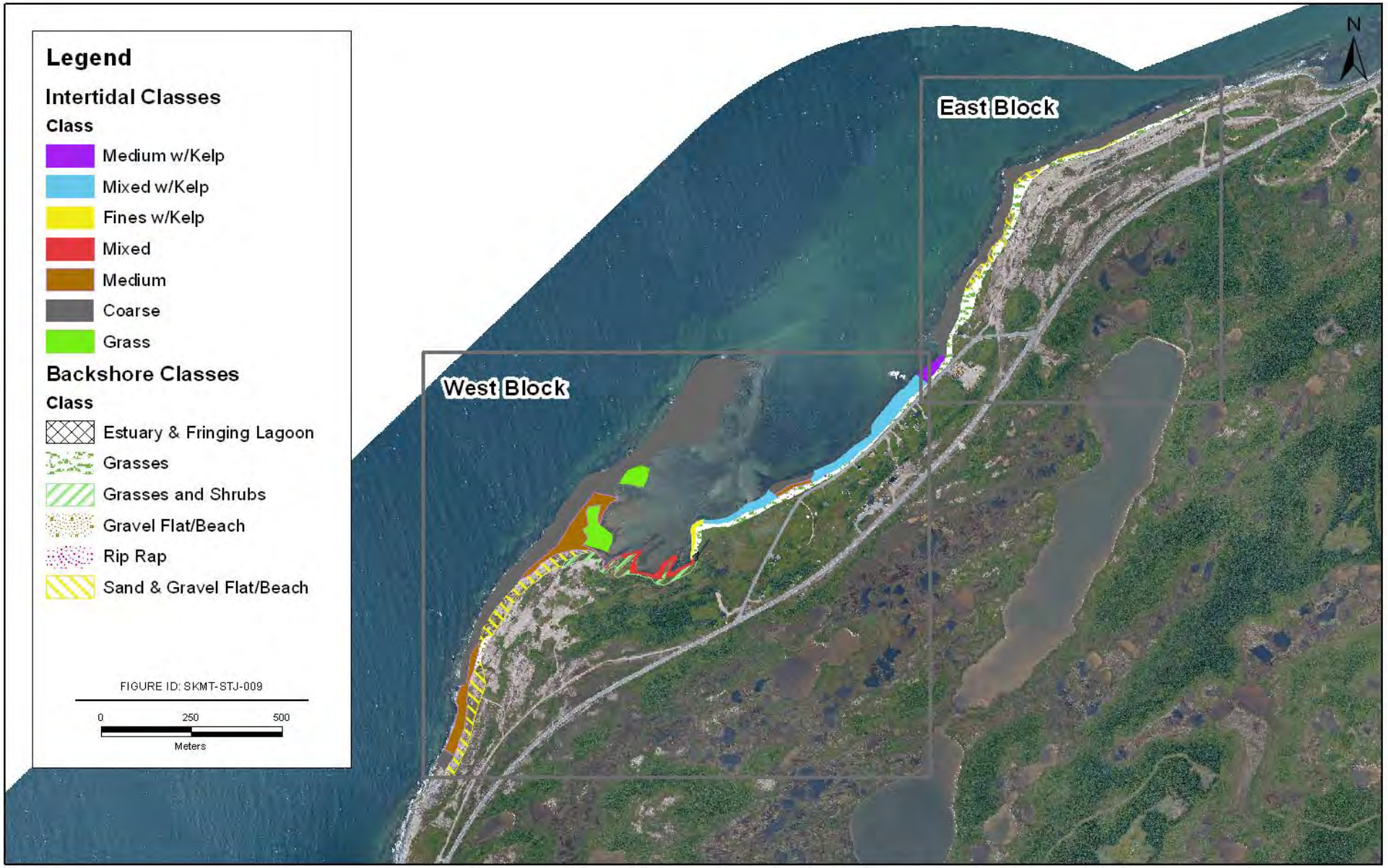

FIGURE 3.12

Shoal Cove Intertidal and Backshore Habitats Index Map

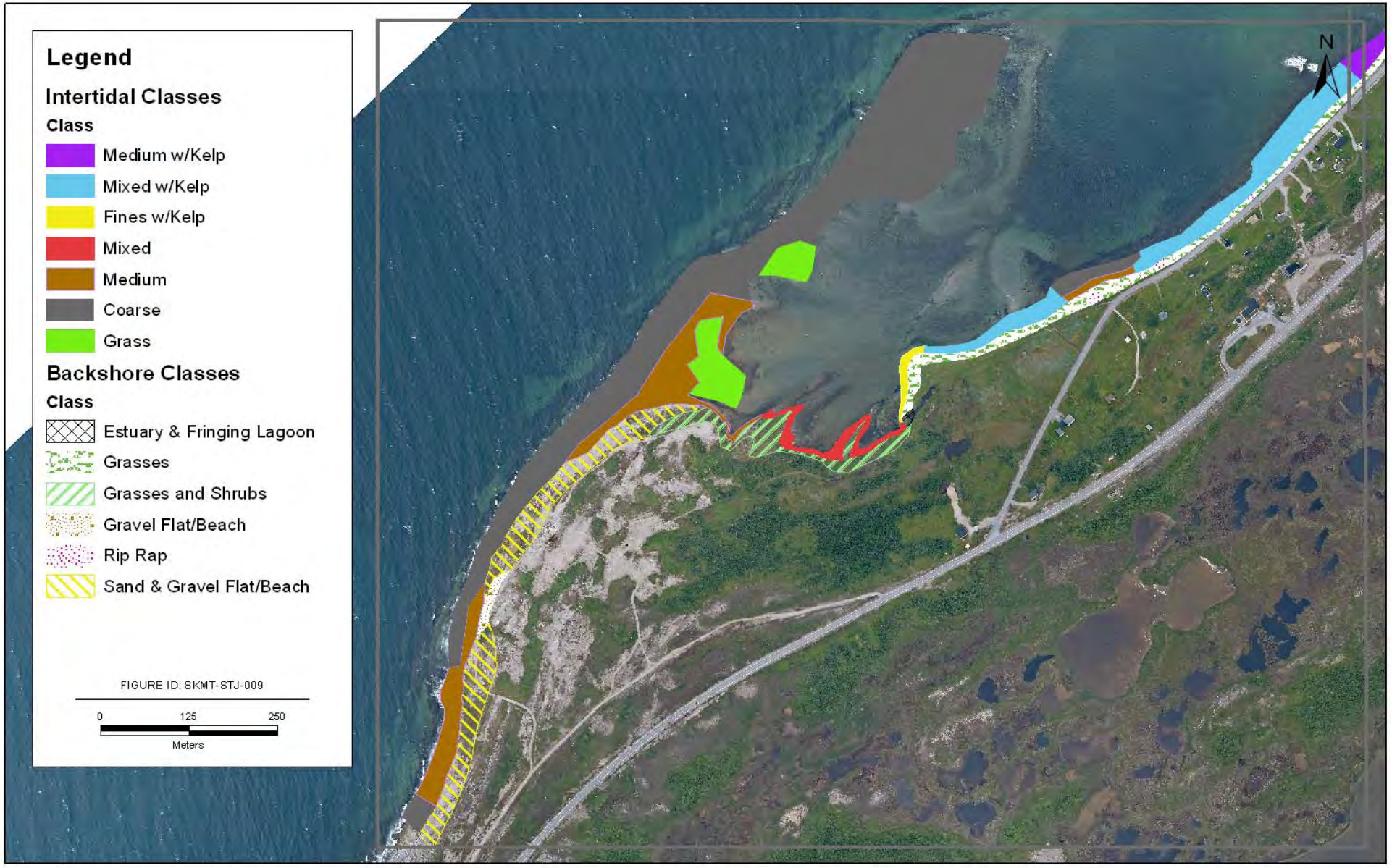

FIGURE 3.13

Shoal Cove Intertidal and Backshore Habitats (West Block)

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FIGURE 3.14

Shoal Cove Intertidal and Backshore Habitats (East Block)

The data collected in relation to the shoreline slope of the Shoal Cove intertidal and backshore habitats are summarized in Table 3.25. Slopes were determined at 250 intervals along the 3 km study area. The shoreline slopes, determined from the low tide mark to the furthest inland extent of the backshore, ranged from 0.9 to 7.8 % and averaged 4.7 %. The width of this area ranged from 27 to 125 m, and averaged 60.9 m. The low slopes confirm the overall low coastal relief associated with this ecosystem contributing to the high degree of exposure.

Table 3.25 Shoreline Width and Slope at Shoal Cove

Transect Distance (m)	Shoreline Width (m)	Slope %
0	64	7.8
250	65	4.6
500	67	3.4
750	125	2.4
1,000	65	1.5
1,250	125	0.9
1,500	37	5.1
1,750	43	4.6
2,000	30	6.6
2,250	48	6.2
2,500	57	5.2
2,750	39	5.1
3,000	27	7.4
Average	**60.9**	**4.7**
Range	**27 to 125**	**0.9 to 7.8**

3.2.5 **Marine Habitats**

Habitat surveys were conducted using underwater video to characterize the subtidal habitat at Shoal Cove based on a classification of substrate, marine flora, and marine fauna. Two continuous video transects totaling 6,379 m were completed and subsequently delineated into 26 transects ranging from 250 to 288 m in length (average 244.7 m). A summary of the transect information is provided in Table 3.26. For varying reasons, portions of the video tape could not be interpreted and this ranged from 0 to 41 % per transect, however overall 5,976 m or 94 % of the video collected was assessed in detail.

Data for substrate, macroflora and macrofauna were summarized on a transect basis and presented as per Kelly et al. (2009, draft) and AMEC (2010). Parameters included habitat zone, surveyed length and area, video time, depth range, substrate type (% coverage, predominant substrate group), macroflora (% coverage, predominant macrofloral class), and macrofauna (estimated relative abundance). These results are provided in Appendix C.

Table 3.26 Summary of Video Transects for the Shoal Cove Marine Survey Area, June 2011

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
7	T61	13:28:32 - 13:35:22	250	15	212
7	T62	13:35:24 - 13:43:20	250	0	250
7	T63	13:43:22 - 13:49:50	250	0	250
7	T64	13:49:52 - 13:58:32	250	6	235
7	T65	13:58:34 - 14:03:30	250	6	235
7	T66	14:03:32 - 14:08:56	250	41	147
7	T67	14:08:58 - 14:12:44	250	13	217
7	T68	14:12:46 - 14:16:20	250	0	250
7	T69	14:16:22 - 14:20:00	250	30	175
7	T70	14:20:02 - 14:23:44	250	0	250
7	T71	14:23:46 - 14:27:36	250	0	250
7	T72	14:27:38 - 14:30:06	165	0	165
9	T73	18:23:52 - 18:33:30	160	0	160
9	T74	18:33:31 - 18:39:28	250	0	250
9	T75	18:39:29 - 18:44:38	250	0	250
9	T76	18:44:39 - 18:49:16	250	0	250
9	T77	18:49:17 - 18:53:54	250	0	250
9	T78	18:53:55 - 18:57:32	250	0	250
9	T79	18:57:53 - 19:01:28	250	0	250
9	T80	19:01:29 - 19:05:52	250	0	250
9	T81	19:05:53 - 19:10:48	250	0	250
9	T82	19:10:49 - 19:15:16	250	0	250
9	T83	19:15:17 - 19:18:48	250	5	237
9	T84	19:18:49 - 19:22:52	250	8	230
9	T85	19:22:53 - 19:27:46	250	30	175
9	T86	19:27:47 - 19:32:26	288	0	288

Notes:
[1]Video was not interpretable owing to distance off bottom, water clarity, speed of video camera, contact with the seafloor, and other reasons.
[2]Length of video analyzed included total transect length minus the proportion that was deemed not interpretable.

3.2.5.1 Substrate Distribution

Analysis of the video footage for substrate characteristics followed classification criteria identified by DFO in Kelly et al. (2009, draft) which included detailed substrate type, based on the Wentworth-Udden (Wentworth 1922) size-based classifications, which were also aggregated into broad substrate types. A summary of the distribution of detailed substrate types is provided in Table 3.27.

The detailed substrate types were boulder (6,432 m^2, 27 %, 15 transects), cobble (6,136 m^2, 26 %, 20 transects), gravel (4,960 m^2, 21 %, 17 transects), bedrock (4,939 m^2, 21 %, 15 transects), and sand (1,436 m^2, 6 %, 8 transects). There was no rubble, silt/mud, or shells encountered during the survey. By broad substrate category, medium substrates (cobble, gravel) accounted for 11,096 m^2 and 47 % of the area, with bedrock (4,939 m^2, 21 %,), coarse substrate (6,432 m^2, 27 %, all boulder), and fine substrate (1,436 m^2, 6 %, sand) being represented by the single detailed habitat type.

Table 3.27 Summary of the Detailed Substrate Type Distribution for Shoal Cove Marine Survey Area, June 2011

Transect	Length (m)[1]	Area Covered (m^2)					
		Total Area (m^2)[2]	Bedrock	Boulder	Cobble	Gravel	Sand
T61	212	848	42.4		127.2	424	254.4
T62	250	1,000	400		100	350	150
T63	250	1,000	650	50	300		
T64	235	940	470	94	376		
T65	235	940	47		282	611	
T66	147	588			294	294	
T67	217	868			347.2	520.8	
T68	250	1,000	500		300	200	
T69	175	700	560		70	70	
T70	250	1,000	450		350	200	
T71	250	1,000			650	350	
T72	165	660			330	330	
T73	160	640		288	160	160	32
T74	250	1,000		600		350	50
T75	250	1,000	100	600	250	50	
T76	250	1,000	500	200	300		
T77	250	1,000		500	500		
T78	250	1,000		100	350	250	300
T79	250	1,000				450	550
T80	250	1,000	100	50	500	300	50
T81	250	1,000		400	500	50	50
T82	250	1,000	350	600	50		
T83	237	948	331.8	616.2			
T84	230	920	368	552			
T85	175	700	70	630			
T86	288	1,152		1,152			

Table 3.27 Summary of the Detailed Substrate Type Distribution for Shoal Cove Marine Survey Area, June 2011 (Cont'd)

Transect	Length (m)[1]	Area Covered (m^2)					
		Total Area (m^2)[2]	Bedrock	Boulder	Cobble	Gravel	Sand
Total	**5,976**	**23,904**	**4939.2**	**6432.2**	**6136.4**	**4959.8**	**1436.4**
%			**21 %**	**27 %**	**26 %**	**21 %**	**6 %**

Notes
[1]Transect length is the total length surveyed minus the proportion deemed not interpretable
[2]Area is the transect length that was interpretable times the 4 m field of view of the video camera

3.2.5.2 Macrofloral Distributions

Analysis of the video footage for macroflora was also based on criteria identified in Kelly et al. (2009, draft) and, where possible, the macroflora observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or vegetation class. Identification to species and/or genus was often difficult resulting in a more general classification of observed macroflora.

Macroflora were relatively common and were identified in all transects for a total of 23,904 m^2 with 87.9 % occurrence by area surveyed (Table 3.28). Percent (%) occurrence by area is the total area of all of the transects in which the taxon was observed. A total of nine vegetation classes were identified in the study area with two classes commonly identified including Kelp, *Laminaria longicruris* (18 transects, 8,640 m^2, 36.1 %) and unidentified calcareous algae (12 transects, 7,502 m^2, 31.4 %). The other macroflora classes were less common and included Sea colander (7.7 %), Unidentified green algae (4.5 %), Sea lettuce (0.2 %), Edible kelp (4.9 %), Rockweed (1.3 %), Dulse (1.8 %), and Kelp, *L. digitata* (0.1 %).

Table 3.28 Macrofloral distributions in the Shoal Cove Marine Survey Area, Segment, June 2011

Area Covered (m^2)									
Total Area (m^2)	Kelp (*L. longicruris*)	Sea Colander	Unidentified Green Algae	Sea Lettuce	Edible Kelp	Calcareous Unidentified Algae	Rockweed	Dulse	Kelp (*L. digitata*)
848	466.4	381.6							
1,000	300	400	250	50					
1,000	450	500	50						
940	376	564							
940	799		141						
588	588								
868	868								
1,000	1,000								
700	665		35						
1,000	400		300		300				
1,000	1,000								
660	627		33						

Table 3.28 Macrofloral distributions in the Shoal Cove Marine Survey Area, Segment, June 2011 (Cont'd)

Area Covered (m^2)									
Total Area (m^2)	**Kelp (*L. longicruris*)**	**Sea Colander**	**Unidentified Green Algae**	**Sea Lettuce**	**Edible Kelp**	**Calcareous Unidentified Algae**	**Rockweed**	**Dulse**	**Kelp (*L. digitata*)**
640						640			
1,000						1,000			
1,000						1,000			
1,000						1,000			
1,000						1,000			
1,000	150		50			100			
1,000	50						300		
1,000						200			
1,000						400			
1,000	150				200	650			
948						900.6			
920	230				184	506			
700	175		105		140	105		140	
1,152	345.6		115.2		345.6			288	5
23,904	**86,40**	**1845.6**	**1079.2**	**50**	**1169.6**	**7501.6**	**300**	**428**	**5**
	36.1 %	**7.7 %**	**4.5 %**	**0.2 %**	**4.9 %**	**31.4 %**	**1.3 %**	**1.8 %**	**0.1 %**

3.2.5.3 Macrofauna Distributions

Analysis of the video footage for macrofauna also followed the approach identified in Kelly et al. (2009, draft) and, where possible, all macrofauna observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or faunal class. Identification to the species level was often not possible. Subsequently, the total number of observations for each taxon were summed to determine the relative (%) abundance of each. Taxa that were extremely abundant, such as urchin species, were not enumerated and observations were simply classified as abundant.

A total of six macrofaunal taxa were identified in 22 video transects from the Shoal Cove Marine Survey Area, and these are presented and ranked in relation to percent (%) occurrence by area, and are described in relation to relative abundance, in Table 3.29. Percent (%) occurrence by area is the total area of all the transects in which the taxon was observed. In some instances, where a species could not be identified, a generalized taxon was described (e.g. unidentified fish). Percent occurrence by area ranged from 3.93 % (unidentified fish) to 58.89 % (Sea urchin, 15 transects). Sea urchin (15 transects, 58.89 %) had the highest percent occurrence by area and were abundant in seven transects, common in seven transects, and occasional in one transect. The only other taxa to be present in more than one transect were Sea star (uncommon in three transects). The other four taxa, Polar sea star, Sculpin, Flatfish, and unidentified fish were uncommon in one transect each.

Table 3.29 Macrofauna Distribution Summary by Relative Abundance in the Shoal Cove Marine Survey Area, June 2011

	Total (all abundance categories)			Abundant			Common			Occasional			Uncommon		
Taxon	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**
Sea urchin	15	3,519	58.89 %	7	1,737	29.07 %	7	1,565	26.19 %	1	217	3.63 %			
Sea star	3	712	11.91 %	-	-		-	-					3	712	11.91 %
Polar sea star	1	250	4.18 %				-	-					1	250	4.18 %
Sculpin	1	250	4.18 %										1	250	4.18 %
Flatfish	1	250	4.18 %	-	-		-	-					1	250	4.18 %
Unidentified fish	1	235	3.93 %										1	235	3.93 %

3.3 2011 Corridor: Central Segment

Underwater video surveys were also conducted along pre-defined transects within the 2011 Corridor: Central Segment to classify and quantify the marine habitat by collecting data on substrate, macroflora and macrofauna. This work was conducted to compliment previous surveys in the proposed submarine cable corridors which had been completed by AMEC in 2008 and 2009 (AMEC 2010) and to provide information on a short segment of corridor that had not previously been surveyed. Collection of water quality data, sediment quality data, and benthic invertebrate community data were not part of the scope of work as this information had been collected by Sikumiut in 2010 (Sikumiut 2011a).

3.3.1 **Marine Habitats**

Habitat surveys were conducted using underwater video to characterize the habitat based on a classification of substrate, marine flora, and marine fauna. For the 2011 Corridor: Central Segment, a continuous video transect of 3,022 m was completed and this was subsequently delineated into 18 transects ranging from 9 to 250 m in length (average 146.8 m). A summary of the transect information is provided in Table 3.30. For varying reasons, portions of the video tape could not be interpreted and this ranged from 0 to 43 % per transect, however overall 2,324 m or 82 % of the video collected was assessed in detail.

Data for substrate, macroflora and macrofauna were summarized on a transect basis and presented as per Kelly et al. (2009, draft) and AMEC (2010). Parameters included habitat zone, surveyed length and area, video time, depth range, substrate type (% coverage, predominant substrate group), macroflora (% coverage, predominant macrofloral class), and macrofauna (estimated relative abundance). The transect by transect results for this analyses are provided in Appendix C.

Table 3.30 Summary of Video Transects for the 2011 Corridor: Central Segment, June 2011

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
7	T1	16:15:12 -16:17:26	69	0	69
7	T2	16:17:27 - 16:28:12	176	0	176
7	T3	16:29:22 - 16:38:54	250	8	230
7	T4	16:38:55 - 16:49:12	250	11	223
7	T5	16:49:13 - 16:59:24	250	20	200
7	T6	16:59:25 - 17:08:00	250	43	143
7	T7	17:08:01 - 17:16:48	250	22	195
7	T8	17:16:49 - 17:19:48	81	25	61
8	T9	17:20:12 - 17:26:18	175	9	159
8	T10	17:27:00 - 17:33:52	184	3	184
8	T11a	17:34:54 - 17:35:24	9	0	9
8	T11b	17:36:10 - 17:37:20	28	0	28
8	T11c	17:38:08 - 17:38:32	10	0	10

Table 3.30 Summary of Video Transects for the 2011 Corridor: Central Segment, June 2011 (Cont'd)

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
8	T12	17:39:36 - 17:48:12	250	6	235
8	T13	17:48:14 - 17:55:50	25	0	25
8	T14	17:55:52 - 18:01:20	192	4	184
8	T15	18:01:46 - 18:03:40	58	0	58
8	T16	18:04:06 - 18:08:24	135	0	135

Notes:
[1]Video was not interpretable owing to distance off bottom, water clarity, speed of video camera, contact with the seafloor, and other reasons.
[2]Length of video analyzed included total transect length minus the proportion that was deemed not interpretable.

3.3.1.1 Substrate Distribution

Analysis of the video footage for substrate characteristics followed classification criteria identified by DFO in Kelly et al. (2009, draft) which included detailed substrate type, based on the Wentworth-Udden (Wentworth 1922) size-based classifications, which were also aggregated into broad substrate types. A summary of the distribution of detailed substrate types in the 2011 Corridor: Central Segment is provided in Table 3.31.

The dominant detailed substrate type was cobble (4,446 m^2, 47.8 %, all transects), followed by gravel (3, 149 m^2, 33.9 %, all transects), and boulder (1,554 m^2, 16.7 %, 15 transects). The other two substrate types, shells and rubble, accounted for 110 and 37 m^2, respectively, and were both found in one transect only (T14). There was no bedrock, sand, or silt/mud encountered during the survey. By broad substrate category, medium substrates accounted for 7,595 m^2 and 81.7 % of the area, with coarse (boulder and rubble) comprising 1, 591 m^2 (17.1 %), and shells the remainder (110 m^2, 1.2 %).

Table 3.31 Summary of the Detailed Substrate Type Distribution for 2011 Corridor: Central Segment, June 2011

Transect	Length (m)[1]	Area Covered (m^2)					
		Total Area (m^2)[2]	Boulder	Rubble	Cobble	Gravel	Shells
T1	69	276			138	138	
T2	176	704	70.4		281.6	352	
T3	230	920	92		460	368	
T4	223	892	178.4		446	267.6	
T5	200	800	80		400	320	
T6	143	572	114.4		286	171.6	
T7	195	780	78		390	312	
T8	61	244	24.4		122	97.6	
T9	159	636	159		318	159	
T10	184	736	73.6		368	294.4	
T11a	9	36	3.6		18	14.4	
T11b	28	112	11.2		56	44.8	

Table 3.31 Summary of the Detailed Substrate Type Distribution for 2011 Corridor: Central Segment, June 2011 (Cont'd)

Transect	Length (m)[1]	Area Covered (m^2)					
		Total Area (m^2)[2]	Boulder	Rubble	Cobble	Gravel	Shells
T11c	10	40			20	20	
T12	235	940	141		470	329	
T13	25	100			50	50	
T14	184	736	257.6	36.8	294.4	36.8	110.4
T15	58	232	162.4		58	11.6	
T16	135	540	108		270	162	
Total		**9,296**	**1,554**	**36.8**	**4,446**	**3148.8**	**110.4**
%			**16.7 %**	**0.4 %**	**47.8 %**	**33.9 %**	**1.2 %**

Notes
[1]Transect length is the total length surveyed minus the proportion deemed not interpretable
[2]Area is the transect length that was interpretable times the 4 m field of view of the video camera

3.3.1.2 Macrofloral Distributions

Analysis of the video footage for macroflora was also based on criteria identified in Kelly et al. (2009, draft) and, where possible, the macroflora observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or vegetation class. Identification to species and/or genus was often difficult resulting in a more general classification of observed macroflora.

Macroflora were not abundant and were identified from only four transects in a total of 346 m^2 and 3.7 % of the area surveyed. Only two vegetation classes were identified including Coralline algae (four transects, 309 m^2, 3.3 %) and brown algae (one transect, 37 m^2, 0.4 %).

3.3.1.3 Macrofauna Distributions

Analysis of the video footage for macrofauna also followed the approach identified in Kelly et al. (2009, draft) and, where possible, all macrofauna observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or faunal class. Identification to the species level was often not possible. Subsequently, the total number of observations for each taxon were summed to determine the relative (%) abundance of each. Taxa that were extremely abundant, such as urchin species, were not enumerated and observations were simply classified as abundant.

A total of 20 macrofaunal taxa were identified in the video transects from the 2011 Corridor: Central Segment, and these are presented and ranked in relation to percent (%) occurrence by area, and are described in relation to relative abundance. Percent (%) occurrence by area is the total area of all the transects in which the taxon was observed. In some instances, where a species could not be identified a generalized taxon was described (e.g., unidentified crab when the animal could not be identified as a toad or snow crab). Percent occurrence ranged from 6.87 % (skate, one transect) to 99.57 % (unidentified crab and sea anemone, 16 transects each). Table 3.32 summarizes the percent (%) occurrence by area by categories (i.e., 75-100 %, 50-75 %, 25-50 %, and < 25 %).

Table 3.32 Macrofauna by Percent Occurrence Category in the 2011 Corridor: Central Segment, June 2011

75 to 100 %	50 to 75 %	25 to 50 %	Less than 25 %
Unidentified crab	Scallop (Pectinidae sp.)	Toad crab (*Hyas sp*.)	Polar sea star (*Leptasterias polaris*)
Sea anemone	Sea urchin (*Strongylocentrotus* sp.)	Snow crab (*Chionoecetes opilio*)	Sculpin (*Myoxocephalus* sp.)
Stalked sea squirt (*Boltenia* sp.)	Basket star (*Gorgonocephalus* sp.)	Sea star (*Asterias* sp.)	Flat fish
Sunstar (*Crossaster* sp.)			Sand dollar (*Echniarachnius parma*)
Soft coral (*Gersemia* sp.)			Hydroids
Brittle star (Ophiuroidea sp.)			Unidentified small fish
Sponge (Porifera)			Skate

Unidentified crab and sea anemone had the highest percent occurrence by area (99.57 %) and unidentified crab were occasional in four transects and uncommon in 12 transects, while sea anemone were common in one transect, occasional in nine transects and uncommon in six transects (Table 3.33). Stalked sea squirt (98.36 %), Sunstar (97.37 %), Soft coral (90.06 %), Brittle star (85.66 %), and Sponge (81.34 %) all had percent occurrences greater than 80 % and only Soft coral and Brittle star were considered common, in one transect each. Scallop had 62.63 % occurrence and was found in nine transects and was abundant in one transect, common in one transect, occasional in one transect, and uncommon in six transects. Sea urchin (% occurrence of 55.94 %) were uncommon in ten transects while Basket star (% occurrence of 52.10 %) were occasional in one transect and uncommon in six transects. All other taxa had present occurrences of less than 50 % and were uncommon in all transects in which they were observed.

Table 3.33 Macrofauna Distribution Summary by Relative Abundance in the 2011 Corridor: Central Segment, June 2011

	Total (all abundance categories)			Abundant			Common			Occasional			Uncommon		
Taxon	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**	**Transect (#)**	**Distance (m)**	**Area (%)**
Unidentified crab	16	2,305	99.57 %	-	-	-	-	-		4	713	30.80 %	12	1,592	68.77 %
Sea anemone	16	2,305	99.57 %	-	-	-	1	135	5.83 %	9	1,418	61.25 %	6	752	32.48 %
Stalked sea squirt (*Boltenia* sp.)	15	2,277	98.36 %	-	-	-	-	-		11	1,735	74.95 %	4	542	23.41 %
Sunstar (*Crossaster* sp.)	16	2,254	97.37 %	-	-	-	-	-		8	1,396	60.30 %	8	858	37.06 %
Soft coral (*Gersemia* sp.)	14	2,085	90.06 %	-	-	-	1	184	7.95 %	3	318	13.74 %	10	1,583	68.38 %
Brittle star (Ophiuroidea sp.)	14	1,983	85.66 %	-	-	-	1	223	9.63 %	2	319	13.78 %	11	1,441	62.25 %
Sponge (Porifera)	13	1,883	81.34 %	-	-	-	-	-		1	58	2.51 %	12	1,825	78.83 %
Scallop (Pectinidae sp.)	9	1,450	62.63 %	1	184	7.95 %	1	135	5.83 %	1	58	2.51 %	6	1,073	46.35 %
Sea urchin (*Strongylocentrotus* sp.)	10	1,295	55.94 %	-	-	-	-	-		-	-		10	1,295	55.94 %
Basket star (*Gorgonocephalus* sp.)	7	1,206	52.10 %	-	-	-				1	223	9.63 %	6	983	42.46 %
Toad crab (*Hyas sp.*)	6	894	38.62 %	-	-	-	-	-		-	-		6	894	38.62 %
Snow crab (*Chionoecetes opilio*)	5	815	35.21 %	-	-	-	-	-		-	-		5	815	35.21 %
Sea star (*Asterias* sp.)	4	659	28.47 %	-	-	-	-	-		-	-		4	659	28.47 %
Polar sea star (*Leptasterias polaris*)	3	538	23.24 %	-	-	-	-	-		-	-		3	538	23.24 %
Sculpin (*Myoxocephalus* sp.)	2	425	18.36 %	-	-	-	-	-		-	-		2	425	18.36 %
Flat fish	1	184	7.95 %	-	-	-	-	-		-	-		1	184	7.95 %
Sand dollar (*Echniarachnius parma*)	1	184	7.95 %	-	-	-	-	-		-	-		1	184	7.95 %
Hydroids	1	176	7.60 %	-	-	-	-	-		-	-		1	176	7.60 %
Unidentified small fish	2	168	7.26 %	-	-	-	-	-		-	-		2	168	7.26 %
Skate	1	159	6.87 %	-	-	-	-	-		-	-		1	159	6.87 %

4.0 DISCUSSION AND CONCLUSIONS

The results of the 2011 Marine Habitat and Water, Sediment and Benthic Survey: Strait of Belle Isle Cable Corridor Segment: Shoal Cove Option are discussed in relation to the descriptive characteristics of the samples and data collected. Water and sediment characteristics are discussed in relation to relevant CCME environmental quality guidelines and the potential for demonstration of anthropogenic influences. The water, sediment, benthos, and habitat characteristics are further discussed in relation to comparable information for these characteristics and information previously collected for the Project. The 2011 marine surveys were planned and executed as three different but complementary study components, in consideration they were conducted in discrete geographical areas, and they are discussed as separate study components.

4.1 2011 Corridor: Shoal Cove Segment

4.1.1 **Water Quality**

CTD profiles were collected at five sites in the 2011 Corridor: Shoal Cove Segment and field water quality measurements were taken at all stations, with three samples taken from different depths. Thermoclines were apparent at all stations and two thermoclines were apparent at two sites. Relatively shallow thermoclines at three locations suggested the influence of the strong currents in the Strait.

Field water quality results were generally comparable between sampling sites. Temperatures ranged from 1.51 to 5.22 °C and decreased with increasing depth. Conductivity values ranged from 4.78 to 5.02 $S \cdot m^{-1}$ while pH demonstrated a narrow range from 7.97 to 8.04 pH units. Dissolved oxygen values ranged from 10.67 to 11.51 $mg \cdot L^{-1}$ and were supersaturated at all sampling sites. ORP ranged from 117.0 to 220.3 mV.

Water samples were analyzed at a laboratory for conventional parameters, nutrients, major ions, metals and petroleum hydrocarbons. Conventional parameters were similar between all sampling stations. Values for pH were alkaline within a narrow range for each site. Nutrients were largely undetectable with only orthophosphate detected in all samples, excepting one, and nitrogen in 13 samples. The low marine nutrient content is consistent with the generally pristine nature of the marine environment in the study areas (Sikumiut 2010a and b, 2011a and b).

Metals in samples at both sites were also low, with only strontium detected in all samples with mercury (n=3), and aluminum, boron, copper and zinc (n=1, each) also detected. All metals detected were within CCME limits while mercury in one sample exceeded CCME guideline limits. The CCME guideline value however is for inorganic mercury while the analytical result is for total mercury. For petroleum hydrocarbons, all samples were below the RDL for all parameters tested. Water quality data collected in 2011 has confirmed the pristine nature of the marine environment in the study area and there is no evidence of any anthropogenic influence on marine water quality for trace elements/metals and hydrocarbons.

4.1.2 **Benthic Invertebrates**

Four sites were successfully sampled for benthos and a total of 3,554 benthic organisms were identified from the 2011 Corridor: Shoal Cove Segment. A total of 141 taxa were identified and 15 of those occurred in all four samples. The benthic community was dominated by Polychaetes (61.1 %), due to high numbers of spirorbids, followed by Amphipoda (17.1 %) and Echinodermata (4.7 %), while all other taxa each made up less than 5 % of the total organisms.

Abundance was moderate to high, ranging from 140 organisms per sample to 1,545 organisms per sample (mean of 888.5) while biomass ranged from 11.2 to 123.2 g/sample (mean of 68.5). Taxon richness was moderate to high, ranging from 28 to 94 (mean of 28.19). The Shannon-Wiener Diversity Index, used to describe the proportional abundance of species, ranged from 0.51 to 1.40 (mean of 0.934), while Pielou's Evenness Index, a measure of species evenness and biodiversity, ranged from 0.30 to 0.77 (mean of 0.553). McIntosh's Index, an indicator of proportional abundances of species, ranged from 0.21 to 0.76 (mean of 0.499) while Simpson's Index, also an indicator of proportional abundances of species, ranged from 0.07 to 0.64. Margalef's Index, a species richness or community diversity index, ranged from 5.46 to 12.67 (mean of 7.971).

In comparison, a survey of sites in the Strait of Belle Isle in 2010 (Sikumiut 2011a), a total of 308 taxa were identified and average abundance (1,162 organisms/sample), biomass (37.0 g/sample), and taxon richness (60.1 taxa/sample) were comparable to the 2011 survey. The benthic community in that study was also dominated by Polychaetes, while other benthic groups were also well represented indicating a diverse benthic community of both infauna and epifauna. Substrates sampled in both studies were coarse providing numerous attachment sites for epifauna and diverse micro-niches for various organisms.

4.1.3 **Marine Habitat**

Underwater video surveys were conducted along pre-defined transects within the 2011 Corridor: Shoal Cove Segment to classify and quantify the marine habitat by collecting data on substrate, macroflora and macrofauna. A continuous transect of 9,926 was completed and subsequently delineated into 44 transects ranging from 47 to 308 m in length (mean of 222.6 m). Portions of the video tape could not be interpreted however overall 8,972 m of the 9,796 m or 92 % of the video collected was assessed in detail.

Substrate classification within the 2011 Corridor: Shoal Cove Segment was based on Wentworth-Udden (Wentworth 1922) size-based classifications. The dominant substrate type was cobble (70 %) followed by boulder (22 %), gravel (6 %), sand (2 %), and shell (0.07 %) Bedrock, rubble, or silt/mud were not encountered during the survey. By broad substrate category, medium substrates (cobble and gravel) accounted for 27,450 m^2 or 72 % of the area.

The macroflora observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or vegetation class. Macroflora were relatively common in the 2011 Corridor: Shoal Cove Segment and were identified in a total of 22,225 m^2 with 61.9 % occurrence by area surveyed. Five vegetation classes were frequently identified with three classes commonly identified in the study area including coralline algae (5 %), calcareous encrusting Rhodophyta (27 %), and red filamentous algae (29 %). The other two macroflora classes, *Lithothamnium* sp. (0.4 %), and Sea Colander (0.8 %), were uncommon.

Macrofauna observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or faunal class. A total of 20 macrofaunal taxa were identified in the video transects from the 2011 Corridor: Shoal Cove Segment, and percent occurrence ranged from 2.65 % (unidentified shrimp, one transect) to 97.67 % (Polar sea star, 40 transects). Polar sea star (97.67 %) and Sea urchin (97.61 %) had the highest percent occurrence. Based on relative abundance, Polar sea star were considered occasional and uncommon in 40 transects, while Sea urchin were abundant (n=2), common (n=1), occasional (n=17), and uncommon (n=21). Unidentified crab had 85.73 % occurrence and were occasional and uncommon. Other species that were abundant or common in the study area included Brittle star, Soft coral, Scallops, and Sea anemone while other taxa less frequently encountered included Sunstar, Stalked sea squirt, Unidentified fish, Sand dollar, and Basket star. All other taxa had percent occurrences of less than 10 % and were uncommon in all transects in which they were observed.

4.2 Shoal Cove Marine Survey Area

The Shoal Cove Marine Survey Area is located in the Northern Peninsula-Gulf Coast Ecoregion and is characterized by mixed substrate shorelines, occasional sheltered embayments, and low coastal relief. Sea ice in the area is a combination of locally formed ice and pack ice that drifts down from the Arctic and Labrador Sea. The current flows parallel to the shore in a northeast direction and are very strong. The coastline is semi-exposed and is partially oriented towards the prevailing winds with the maximum fetch from the northwest of 20 km.

4.2.1 **Water Quality**

CTD profiles were collected at four water quality stations in the subtidal zone at Shoal Cove. CTD profiles indicated little evidence of a salinity or temperature gradient and no thermocline was evident, and this was expected owing to the shallow nature of the site and wave and tidal action mixing the water column.

Field water quality measurements were comparable between sites, excepting ORP which was slightly higher at one sampling station. Temperature had very little variability between sites and ranged from 3.51 to 3.61 °C, while conductivity ranged only from 4.85 and 4.86 $S \cdot m^{-1}$, and pH values ranged from 8.02 to 8.06. Dissolved oxygen values were high (11.11 to 11.25 $mg \cdot L^{-1}$) and were supersaturated.

Water samples were analyzed at a laboratory for conventional parameters, nutrients, major ions, metals and petroleum hydrocarbons. Conventional parameters were generally comparable between all sampling stations at Shoal Cove with alkaline pH (7.66 to 7.78), low turbidity (not detectable to 0.2 NTU), low TSS (not detectable to 2 $mg \cdot L^{-1}$) and colour and Total Organic Carbon were below the detectable limit. Very few nutrients were measured with only nitrogen (n=2) and orthophosphate (n=3) detected. Metals in samples were also low, with only strontium detected in all samples and mercury detected in two samples. In one sample, mercury was slightly above the CCME guideline limit, however the guideline level is for inorganic mercury, whereas the parameter tested was total mercury. For petroleum hydrocarbons, all parameters were below the reportable detection levels in all samples. Water quality data collected at Shoal Cove has confirmed the pristine nature of the marine environment, and absence of any anthropogenic influence on marine water quality for trace elements/metals and hydrocarbons, at this location.

4.2.2 **Sediment Quality**

Sediment samples were collected at four intertidal locations within the Shoal Cove marine Survey Area. Attempts to sample within the shallow sub-tidal zone were unsuccessful due to the coarse nature of the substrate. Sediment quality assessment included chemical and hydrocarbon analyses, as well as physical characterization (particle size analyses) at an analytical laboratory. The physical analysis of sediment determined that three of the four samples were dominated by sand (41 to 64 %) while gravel was also important (34 to 58 %). Clay was present at very small amounts (0.6 to 1.4 %), while silt was only evident in two samples. Metal levels were generally low, with only aluminum, iron, manganese and strontium measured in all samples while all other metals tested were undetected. Petroleum hydrocarbons were below detectable limits in most samples, with the exception of benzene which was detected in one sample. No CCME (2002) ISQGs or PELs for the protection of aquatic life were exceeded in sediment samples. Metal and other contaminant levels in marine sediments are often related to particle size and organic content and the low proportions of clays and organic matter in the sediments at Shoal Cove may make them less apt to bind and retain metals and hydrocarbons.

4.2.3 **Benthic Invertebrates**

Four benthic samples were collected using a quadrat based approach within the intertidal zone at Shoal Cove. A total of 15 taxa representing 42,181 benthic organisms were identified from the stations at Shoal Cove and small unidentified marine Oligochaetes accounted for 41,873 organisms or 99 % of the benthos in these samples.

Samples had low to high abundance ranging from 22 to 41,621 (mean of 10,545.25) with high variability, biomass ranged from 0.1 to 12.7 g (mean of 3.25), and taxon richness ranged from two to nine taxa (mean of five). Shannon-Wiener Diversity Index, describing proportional abundance of species, ranged from 0.000 to 0.544 (mean of 0.359) and Pielou's Evenness Index, a biodiversity index, ranged from 0.001 to 0.809 (mean of 0.475). McIntosh's Index, an indicator of proportional abundance of species, ranged from 0.000 to 0.479 (mean of 0.294), and Simpson's Index, an indicator of proportional abundance of species, ranged from 0.363 to 1.00 (mean of 0.577). Margalef's Index, a community diversity index, ranged from 0.094 to 1.336 (mean of 0.853). Generally, the samples were relatively low in abundance and biomass, with the exception of one sample which was two to three orders of magnitude higher, due to the high number of small unidentified marine Oligochaetes. Diversity was low in all samples, while evenness was low to moderate.

In comparison, a survey of intertidal sites at L'Anse au Diable on the Labrador side of the Strait also showed a benthic community with low to moderate abundance while biomass and taxon richness were also low. Benthos at L'Anse au Diable was also dominated by small unidentified marine Oligochaetes (99 %). The benthic community at L'Anse au Diable reflected both the substrate from which they were collected and the semi-exposed nature of the shallow subtidal and intertidal habitats. Substrate materials for benthos collections were dominated by sand and consequently the benthic community was dominated by infauna, particularly small Oligochaetes.

4.2.4 **Marine Habitat (Shallow Subtidal)**

Underwater video surveys were conducted along pre-defined transects within the Shoal Cove Marine Survey Area to classify and quantify the marine habitat by collecting data on substrate, macroflora and macrofauna. Two continuous video transects totaling of 6,379 m was completed and this was subsequently delineated into 26 transects ranging from 250 to 288 m in length (mean of 244.7 m). Portions of the video tape could not be interpreted however overall 5,976 m of the 6,363 m or 94 % of the video collected was assessed in detail.

Substrate classification within Shoal Cove Marine Survey Area was based on Wentworth-Udden (Wentworth 1922) size-based classifications. Substrate types were relatively evenly represented and included boulder (27 %), cobble (26 %), gravel (21 %), bedrock (21 %), and sand (6 %). There was no rubble, silt/mud, or shells encountered during the survey. By broad substrate category, medium substrates (cobble, gravel) accounted for 11,096 m^2 and 47 % of the area, followed by bedrock (21 %), coarse substrate (27 %), and fine substrate (6 %).

The macroflora observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or vegetation class. Macroflora were relatively common in the shallow subtidal zone of the Shoal Cove Marine Survey Area and were identified in a total of 23,904 m^2 with 87.9 % occurrence by area surveyed. Nine vegetation classes were identified with two classes commonly identified including Kelp, *Laminaria longicruris* (36.1 %) and unidentified calcareous algae (31.4 %). The other macroflora classes were less common and included Sea colander (7.7 %), Unidentified green algae (4.5 %), Sea lettuce (0.2 %), Edible kelp (4.9 %), Rockweed (1.3 %), Dulse (1.8 %), and Kelp, *L. digitata* (0.1 %).

Macrofauna observed on the video tape were identified to the lowest practical taxonomic level which included species, genus, or faunal class. A total of six macrofaunal taxa were identified in the video transects from the Shoal Cove Marine Survey Area, and percent occurrence by area ranged from 3.93 % (unidentified fish) to 58.89 % (Sea urchin, 15 transects). Sea urchin (58.89 %) had the highest percent occurrence by area and were considered abundant and common in most transects. Sea star were uncommon in three transects while Polar sea star, Sculpin, Flatfish, and unidentified fish were uncommon in one transect each.

4.2.5 **Marine Habitat (Intertidal and Backshore)**

The intertidal and backshore habitats at Shoal Cove were mapped in two dimensions based on air photo and LiDAR interpretation, and shore based surveys. A total of seven intertidal habitat types and six backshore habitat types were delineated. The intertidal zone consisted of 16.04 ha and the dominant habitat type was coarse substrate (68.2 %), which included extensive areas with bedrock ledges and platforms, while medium substrates with kelp were next most important (12.5 %). Kelp was associated with three different substrate classes and totaled 11.6 % of the area. The backshore zone consisted of 6.17 ha and there were two dominant habitat types: grasses (42.6 %) and sand and gravel flat/beach (40.7 %). Grasses were a dominant backshore habitat due to the exposed nature of the coastline while sand and gravel flat/beach was also important reflecting the removal of these materials from the intertidal zones and deposition in the backshore. Grasses and shrubs were evident in 13.0 %, in areas protected from the coastal winds and waves. The three remaining habitat types comprised 3.7 % of the backshore area.

Shoreline slopes, determined from the low tide mark to the furthest inland extent of the backshore, ranged from 0.9 to 7.8 % (mean of 4.7 %), while width ranged from 27 to 125 m (mean of 60.9 m). The low slopes confirm the overall low coastal relief associated with this ecosystem contributing to the high degree of exposure.

4.2.6 **Bathymetry**

The bathymetric survey of the study area was surveyed, modelled and mapped in two-dimensions. The maximum depth apparent in the study area was 16.0 m while 156.8 ha had a depth of 10 m or less, and 129.2 ha of that was less than 5.0 m in depth. The inner protected embayment at Shoal Cove was very shallow, largely 1.0 m or less. Along the peninsula protecting the embayment water depths dropped off quickly to a depth of 5.0 to 7.0 m over a distance of 100 to 200 m.

4.3 2011 Corridor: Central Segment

4.3.1 **Marine Habitat**

Underwater video surveys were conducted along pre-defined transects within the 2011 Corridor: Central Segment to classify and quantify the marine habitat by collecting data on substrate, macroflora and macrofauna. A continuous transect of 3,022 m was completed and subsequently delineated into 18 transects ranging from 9 to 250 m in length (mean of 146.8 m). Portions of the video tape could not be interpreted however overall 2,324 m of the 2,642 m or 82 % of the video collected was assessed in detail.

Substrate classification was size-based on the Wentworth-Udden scale and the dominant detailed substrate type was cobble (47.8 %), followed by gravel (33.9 %), and boulder (16.7 %). Shells and rubble accounted for 1.2 % and 0.4 %, respectively, and were both found in one transect only. There was no bedrock, sand, or silt/mud encountered during the survey. By broad substrate category, medium substrates accounted for 81.7 % of the area, with coarse substrates comprising 17.1 %, and shells 1.2 %.

Macroflora observed on the video tape for the 2011 Corridor: Central Segment were identified to the lowest practical taxonomic level which included species, genus, or vegetation. Macroflora were not abundant in the video survey and were identified from four of 18 transects in a total of 346 m^2 and 3.7 % of the area surveyed. Only two vegetation classes were identified including Coralline algae (3.3 %) and brown algae (0.4 %).

Macrofauna observed were identified to the lowest practical taxonomic level which included species, genus, or faunal class. A total of 20 macrofaunal taxa were identified in the video transects from the 2011 Corridor: Central Segment, and percent occurrence ranged from 6.87 % (skate, one transect) to 99.57 % (unidentified crab and sea anemone, 16 transects each). Unidentified crab and sea anemone had the highest percent occurrence by area (99.57 %) and unidentified crab were occasional (n=4) and uncommon (n=1), while sea anemone were common (n=1), occasional (n=9) and uncommon (n=6). Stalked sea squirt (98.36), Sunstar (97.37 %), Soft coral (90.06 %), Brittle star (85.66 %), and Sponge (81.34 %) were frequently observed in transects. Scallop (62.63 %) was abundant (n=1), common (n=1), occasional (n=1), and uncommon (n=6). Sea urchin and Basket star were also apparent in the study area. All other taxa had present occurrences of less than 50 % and were uncommon in all transects.

4.4 Summary

In summary the water and sediment chemistry within the 2011 Corridor: Central and Shoal Cove Segments, and the Shoal Cove Marine Survey Area, indicated a pristine environment with no evidence of anthropogenic influence. The water column in the deeper waters was stratified with respect to temperature and shallow thermoclines indicated the influence of the strong currents in the area. The benthic community of the deep subtidal habitats was moderately abundant and diverse, containing both epifauna and infauna, reflecting the substrate materials in the Strait. Deep subtidal habitats in both the 2011 Corridor: Shoal Cove Segment and Central Segment were dominated by medium substrates (cobbles and gravel). Macroflora was relatively uncommon in 2011 Corridor: Central Segment and more abundant in the 2011 Corridor: Shoal Cove Segment. Macrofauna in the deep subtidal habitats in the 2011 Corridor: Shoal Cove Segment and 2011 Corridor: Central Segment were abundant with 20 taxa identified for each segment.

The Shoal Cove shallow subtidal habitats had a relatively heterogeneous distribution of substrates. Intertidal habitats at Shoal Cove were dominated by coarse substrates, in particular bedrock ledges, and kelp was associated with three habitat types substrate types. Backshore habitats were dominated by grasses and gravel flat/beach. Macroflora was very abundant at Shoal Cove with several vegetation classes identified. Conversely, the macrofauna at Shoal Cove was less abundant and dominated by Sea urchins.

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APPENDIX A

Water and Sediment Quality Data

Your Project #: NALCOR 2011 STRAIT OF BELLE
Site Location: NALCOR 2011 STRAIT OF BELLE IS
Your C.O.C. #: C#259274

Attention: Suzanne Thompson
Sikumiut Environmental
PO Box 39089
175 Hamyln Road
St. John's, NL
A1E 5Y7

Report Date: 2011/06/22

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B185175
Received: 2011/06/10, 17:05

Sample Matrix: Soil
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
TEH in Soil (PIRI)	5	2011/06/15	2011/06/15	ATL SOP 00111 R3	Based on Atl. PIRI
Total Metals Analysis by ICP ◊	5	2011/06/20	2011/06/20	CAM SOP-00408	EPA 6010
Metals Solid Avail. Unified MS Low N-per	5	2011/06/16	2011/06/16	ATL SOP 00024 R5	Based on EPA6020A
Moisture	5	N/A	2011/06/14	ATL SOP 00001 R3	MOE Handbook 1983
VPH in Soil - Low Level	5	2011/06/14	2011/06/16	ATL SOP 00119 R6	Based on Atl. PIRI
Particle size in solids (pipette&sieve)	5	N/A	2011/06/22	ATL SOP 00012 R3	based on MSAMS-1978
Total Organic Carbon in Soil	2	2011/06/16	2011/06/16	ATL SOP 00044 R4/00045 R4	LECO 203-601-224
Total Organic Carbon in Soil	3	2011/06/20	2011/06/20	ATL SOP 00044 R4/00045 R4	LECO 203-601-224
ModTPH (T1) Calc. for Soil	5	2011/06/14	2011/06/17		Based on Atl. PIRI

Sample Matrix: Water
Samples Received: 21

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Carbonate, Bicarbonate and Hydroxide	21	N/A	2011/06/20	CAM SOP-00102	APHA 4500-CO2 D
Alkalinity	21	N/A	2011/06/20	ATL SOP 00013 R4	Based on EPA310.2
Chloride	21	N/A	2011/06/20	ATL SOP 00014 R6	Based on SM4500-Cl-
Colour	21	N/A	2011/06/17	ATL SOP 00020 R3.	Based on SM2120C
Conductance - water	21	N/A	2011/06/20	ATL SOP 00004 R5/00006 R4	Based on SM2510B
TEH in Water (PIRI) ◊	2	2011/06/16	2011/06/17	ATL SOP 00198 R2	Based on Atl. PIRI
TEH in Water (PIRI) ◊	19	2011/06/20	2011/06/21	ATL SOP 00198 R2	Based on Atl. PIRI
Hardness (calculated as CaCO3)	21	N/A	2011/06/20	ATL SOP 00048	Based on SM2340B
Mercury - Total (CVAA,LL)	21	2011/06/16	2011/06/17	ATL SOP 00026 R6	Based on EPA245.1
Metals Water Total MS	4	2011/06/15	2011/06/17	ATL SOP 00059 R1	Based on EPA6020A
Metals Water Total MS	17	2011/06/15	2011/06/18	ATL SOP 00059 R1	Based on EPA6020A
Ion Balance (% Difference)	21	N/A	2011/06/21		
Anion and Cation Sum	21	N/A	2011/06/20		
Nitrogen Ammonia - water	21	N/A	2011/06/16	ATL SOP 00015 R5	Based on USEPA 350.1
Nitrogen - Nitrate + Nitrite	21	N/A	2011/06/17	ATL SOP 00016 R4	Based on USGS - Enz.
Nitrogen - Nitrite	21	N/A	2011/06/20	ATL SOP 00017 R4	Based on SM4500-NO2B
Nitrogen - Nitrate (as N)	21	N/A	2011/06/21	ATL SOP 00018 R3	Based on ASTMD3867
pH	21	N/A	2011/06/20	ATL SOP 00003 R5/00005 R7	Based on SM4500H+B

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Your Project #: NALCOR 2011 STRAIT OF BELLE
Site Location: NALCOR 2011 STRAIT OF BELLE IS
Your C.O.C. #: C#259274

Attention: Suzanne Thompson
Sikumiut Environmental
PO Box 39089
175 Hamyln Road
St. John's, NL
A1E 5Y7

Report Date: 2011/06/22

CERTIFICATE OF ANALYSIS

Sample Matrix: Water
Samples Received: 21

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Phosphorus - ortho	21	N/A	2011/06/20	ATL SOP 00021 R3	Based on USEPA 365.1
VPH in Water (PIRI) @	1	2011/06/16	2011/06/16	ATL SOP 00200 R4	Based on Atl. PIRI
VPH in Water (PIRI) @	12	2011/06/16	2011/06/17	ATL SOP 00200 R4	Based on Atl. PIRI
VPH in Water (PIRI) @	2	2011/06/17	2011/06/17	ATL SOP 00200 R4	Based on Atl. PIRI
VPH in Water (PIRI) @	6	2011/06/17	2011/06/18	ATL SOP 00200 R4	Based on Atl. PIRI
Sat. pH and Langelier Index (@ 20C)	21	N/A	2011/06/21		
Sat. pH and Langelier Index (@ 4C)	21	N/A	2011/06/21		
Reactive Silica	21	N/A	2011/06/16	ATL SOP 00022 R3	Based on EPA 366.0
Sulphate	21	N/A	2011/06/20	ATL SOP 00023 R3	Based on EPA 375.4
Total Dissolved Solids (TDS calc)	21	N/A	2011/06/21		
Organic carbon - Total (TOC)	21	N/A	2011/06/17	ATL SOP 00037 R4	Based on SM5310C
ModTPH (T1) Calc. for Water @	2	N/A	2011/06/17		Based on Atl. PIRI
ModTPH (T1) Calc. for Water @	19	N/A	2011/06/21		Based on Atl. PIRI
Total Suspended Solids	21	N/A	2011/06/15	ATL SOP 00007 R3	based on EPA 160.2
Turbidity	21	N/A	2011/06/20	ATL SOP 00011 R5	based on EPA 180.1

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Analytics Mississauga
(2) This test was performed by ST. JOHN'S NFLD

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

CYNTHIA KENDALL MACKENZIE, Bedford Inorganics
Email:
Phone# (902) 420-0203

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF SOIL

Maxxam ID		JV2794			JV2814			JV2815	JV2816		
Sampling Date		2011/06/10			2011/06/10			2011/06/10	2011/06/10		
COC Number		C#259274			C#259274			C#259274	C#259274		
	Units	**SCS-005**	**RDL**	**QC Batch**	**SCS-006**	**RDL**	**QC Batch**	**SCS-007**	**SCS-008**	**RDL**	**QC Batch**
Inorganics											
Moisture	%	12	1	2519262	15	1	2519262	8	11	1	2519262
Organic Carbon (TOC)	g/kg	44	0.7	2525632	50	0.3	2522403	30	39	0.9	2525632
< -4 Phi (16 mm)	%	100	0.1	2526158	100	0.1	2526158	100	100	0.1	2526158
< -3 Phi (8 mm)	%	100	0.1	2526158	100	0.1	2526158	100	100	0.1	2526158
< -2 Phi (4 mm)	%	100	0.1	2526158	100	0.1	2526158	100	100	0.1	2526158
< -1 Phi (2 mm)	%	42	0.1	2526158	66	0.1	2526158	55	65	0.1	2526158
< 0 Phi (1 mm)	%	4.7	0.1	2526158	47	0.1	2526158	19	26	0.1	2526158
< +1 Phi (0.5 mm)	%	0.6	0.1	2526158	34	0.1	2526158	1.5	1.3	0.1	2526158
< +2 Phi (0.25 mm)	%	0.6	0.1	2526158	6.4	0.1	2526158	0.8	0.9	0.1	2526158
< +3 Phi (0.12 mm)	%	0.6	0.1	2526158	2.0	0.1	2526158	0.7	0.9	0.1	2526158
< +4 Phi (0.062 mm)	%	0.6	0.1	2526158	1.7	0.1	2526158	0.7	0.9	0.1	2526158
< +5 Phi (0.031 mm)	%	0.6	0.1	2526158	1.6	0.1	2526158	0.7	0.9	0.1	2526158
< +6 Phi (0.016 mm)	%	0.6	0.1	2526158	1.5	0.1	2526158	0.7	0.8	0.1	2526158
< +7 Phi (0.0078 mm)	%	0.6	0.1	2526158	1.4	0.1	2526158	0.6	0.8	0.1	2526158
< +8 Phi (0.0039 mm)	%	0.6	0.1	2526158	1.4	0.1	2526158	0.6	0.8	0.1	2526158
< +9 Phi (0.0020 mm)	%	0.6	0.1	2526158	1.2	0.1	2526158	0.6	0.8	0.1	2526158
Gravel	%	58	0.1	2526158	34	0.1	2526158	45	35	0.1	2526158
Sand	%	41	0.1	2526158	64	0.1	2526158	54	64	0.1	2526158
Silt	%	ND	0.1	2526158	0.3	0.1	2526158	0.1	ND	0.1	2526158
Clay	%	0.6	0.1	2526158	1.4	0.1	2526158	0.6	0.8	0.1	2526158

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF SOIL

Maxxam ID		JV2817		
Sampling Date		2011/06/10		
COC Number		C#259274		
	Units	**S-001**	**RDL**	**QC Batch**
Inorganics				
Moisture	%	15	1	2519262
Organic Carbon (TOC)	g/kg	42	0.3	2522403
< -4 Phi (16 mm)	%	100	0.1	2526158
< -3 Phi (8 mm)	%	100	0.1	2526158
< -2 Phi (4 mm)	%	100	0.1	2526158
< -1 Phi (2 mm)	%	64	0.1	2526158
< 0 Phi (1 mm)	%	47	0.1	2526158
< +1 Phi (0.5 mm)	%	25	0.1	2526158
< +2 Phi (0.25 mm)	%	5.4	0.1	2526158
< +3 Phi (0.12 mm)	%	2.2	0.1	2526158
< +4 Phi (0.062 mm)	%	1.9	0.1	2526158
< +5 Phi (0.031 mm)	%	1.8	0.1	2526158
< +6 Phi (0.016 mm)	%	1.6	0.1	2526158
< +7 Phi (0.0078 mm)	%	1.6	0.1	2526158
< +8 Phi (0.0039 mm)	%	1.5	0.1	2526158
< +9 Phi (0.0020 mm)	%	1.4	0.1	2526158
Gravel	%	36	0.1	2526158
Sand	%	62	0.1	2526158
Silt	%	0.3	0.1	2526158
Clay	%	1.5	0.1	2526158

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		JV2794	JV2814	JV2815	JV2816	JV2817		
Sampling Date		2011/06/10	2011/06/10	2011/06/10	2011/06/10	2011/06/10		
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**	**S-001**	**RDL**	**QC Batch**
Metals								
Acid Extractable Calcium (Ca)	ug/g	190000	160000	200000	210000	150000	500	2525104
Acid Extractable Magnesium (Mg)	ug/g	97000	66000	98000	67000	66000	500	2525104
Acid Extractable Phosphorus (P)	ug/g	170	290	110	170	280	20	2525104
Acid Extractable Potassium (K)	ug/g	650	550	610	760	570	200	2525104
Acid Extractable Sodium (Na)	ug/g	2200	2500	4800	5400	2800	100	2525104
Acid Extractable Sulphur (S)	ug/g	1300	700	750	1200	770	50	2525104
Available Aluminum (Al)	mg/kg	1500	1600	1300	1400	1400	100	2521762
Available Antimony (Sb)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Arsenic (As)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Barium (Ba)	mg/kg	ND	ND	ND	ND	ND	50	2521762
Available Beryllium (Be)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Bismuth (Bi)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Boron (B)	mg/kg	ND	ND	ND	ND	ND	50	2521762
Available Cadmium (Cd)	mg/kg	ND	ND	ND	ND	ND	3	2521762
Available Chromium (Cr)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Cobalt (Co)	mg/kg	ND	ND	ND	ND	ND	10	2521762
Available Copper (Cu)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Iron (Fe)	mg/kg	5900	5400	5500	6200	4600	500	2521762
Available Lead (Pb)	mg/kg	ND	ND	ND	5	ND	5	2521762
Available Lithium (Li)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Manganese (Mn)	mg/kg	430	370	430	400	340	20	2521762
Available Mercury (Hg)	mg/kg	ND	ND	ND	ND	ND	1	2521762
Available Molybdenum (Mo)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Nickel (Ni)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Rubidium (Rb)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Selenium (Se)	mg/kg	ND	ND	ND	ND	ND	1	2521762
Available Silver (Ag)	mg/kg	ND	ND	ND	ND	ND	5	2521762
Available Strontium (Sr)	mg/kg	150	220	120	330	270	50	2521762
Available Thallium (Tl)	mg/kg	ND	ND	ND	ND	ND	1	2521762
Available Tin (Sn)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Uranium (U)	mg/kg	ND	ND	ND	ND	ND	1	2521762

ND = Not detected
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QC Batch = Quality Control Batch

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Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		JV2794	JV2814	JV2815	JV2816	JV2817		
Sampling Date		2011/06/10	2011/06/10	2011/06/10	2011/06/10	2011/06/10		
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**	**S-001**	**RDL**	**QC Batch**
Available Vanadium (V)	mg/kg	ND	ND	ND	ND	ND	20	2521762
Available Zinc (Zn)	mg/kg	ND	ND	ND	ND	ND	50	2521762

ND = Not detected
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QC Batch = Quality Control Batch

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Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

ATLANTIC RBCA HYDROCARBONS (SOIL)

Maxxam ID		JV2794	JV2814	JV2815	JV2816	JV2817		
Sampling Date		2011/06/10	2011/06/10	2011/06/10	2011/06/10	2011/06/10		
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**	**S-001**	**RDL**	**QC Batch**
Petroleum Hydrocarbons								
Benzene	mg/kg	ND	0.013	ND	ND	0.009	0.005	2521627
Toluene	mg/kg	ND	ND	ND	ND	ND	0.03	2521627
Ethylbenzene	mg/kg	ND	ND	ND	ND	ND	0.01	2521627
Xylene (Total)	mg/kg	ND	ND	ND	ND	ND	0.05	2521627
C6 - C10 (less BTEX)	mg/kg	ND	ND	ND	ND	ND	3	2521627
>C10-C16 Hydrocarbons	mg/kg	ND	ND	ND	ND	ND	10	2520246
>C16-C21 Hydrocarbons	mg/kg	ND	ND	ND	ND	ND	10	2520246
>C21-<C32 Hydrocarbons	mg/kg	ND	ND	ND	ND	ND	15	2520246
Modified TPH (Tier1)	mg/kg	ND	ND	ND	ND	ND	20	2519496
Reached Baseline at C32	mg/kg	NA	NA	NA	NA	NA	N/A	2520246
Hydrocarbon Resemblance	mg/kg	NA	NA	NA	NA	NA	N/A	2520246
Surrogate Recovery (%)								
Isobutylbenzene - Extractable	%	88	89	88	88	92		2520246
n-Dotriacontane - Extractable	%	87 (1)	101	95	93 (1)	95 (1)		2520246
Isobutylbenzene - Volatile	%	95	97	95	97	92		2521627

ND = Not detected
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QC Batch = Quality Control Batch
(1) TEH samples were extracted using a flat-bed shaker instead of the accelerated mechanical shaker due to matrix incompatibility.

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Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF WATER

Maxxam ID		JU8806	JU8806	JU8821	JU8838	JU8839		
Sampling Date								
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**W-002B**	**W-002B Lab-Dup**	**NCW-001A**	**NCW-001B**	**NCW-001C**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	553		545	553	554	N/A	2519208
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	94		98	97	99	1	2519203
Calculated TDS	mg/L	32300		32200	32100	31900	1	2519211
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND		ND	ND	ND	1	2519203
Cation Sum	me/L	569		577	559	550	N/A	2519208
Hardness (CaCO3)	mg/L	6200		6200	6100	6000	1	2519206
Ion Balance (% Difference)	%	1.40		2.85	0.470	0.430	N/A	2519207
Langelier Index (@ 20C)	N/A	0.383		0.514	0.493	0.482		2519209
Langelier Index (@ 4C)	N/A	0.143		0.274	0.254	0.243		2519210
Nitrate (N)	mg/L	ND		ND	ND	ND	0.05	2519485
Saturation pH (@ 20C)	N/A	7.24		7.21	7.23	7.23		2519209
Saturation pH (@ 4C)	N/A	7.48		7.45	7.47	7.47		2519210
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	94		99	98	100	5	2523027
Dissolved Chloride (Cl)	mg/L	18000		17000	18000	18000	300	2523028
Colour	TCU	ND		ND	ND	ND	5	2523032
Nitrate + Nitrite	mg/L	ND		ND	ND	ND	0.05	2523034
Nitrite (N)	mg/L	ND		ND	ND	ND	0.01	2523035
Nitrogen (Ammonia Nitrogen)	mg/L	0.07		0.06	0.19	0.08	0.05	2522060
Total Organic Carbon (C)	mg/L	ND		ND	ND	ND	5	2523729
Orthophosphate (P)	mg/L	0.01		0.01	0.02	0.01	0.01	2523033
pH	pH	7.62	7.68	7.72	7.72	7.71	N/A	2524944
Reactive Silica (SiO2)	mg/L	ND		ND	ND	ND	0.5	2523030
Total Suspended Solids	mg/L	ND		ND	3	ND	2	2520226
Dissolved Sulphate (SO4)	mg/L	2400		2400	2500	2400	100	2523029
Turbidity	NTU	ND		0.2	ND	0.2	0.1	2525517
Conductivity	uS/cm	47000	47000	47000	47000	47000	1	2524945

ND = Not detected
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Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF WATER

Maxxam ID		JU8840	JU8840			JU8841		JU8842		
Sampling Date										
COC Number		C#259274	C#259274			C#259274		C#259274		
	Units	**NCW-002A**	**NCW-002A Lab-Dup**	**RDL**	**QC Batch**	**NCW-002B**	**RDL**	**NCW-002C**	**RDL**	**QC Batch**
Calculated Parameters										
Anion Sum	me/L	550		N/A	2519208	555	N/A	553	N/A	2519208
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	98		1	2519203	98	1	98	1	2519203
Calculated TDS	mg/L	31600		1	2519211	32100	1	32500	1	2519211
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND		1	2519203	ND	1	ND	1	2519203
Cation Sum	me/L	539		N/A	2519208	557	N/A	579	N/A	2519208
Hardness (CaCO3)	mg/L	5800		1	2519206	6000	1	6200	1	2519206
Ion Balance (% Difference)	%	1.08		N/A	2519207	0.240	N/A	2.28	N/A	2519207
Langelier Index (@ 20C)	N/A	0.506			2519209	0.499		0.486		2519209
Langelier Index (@ 4C)	N/A	0.267			2519210	0.260		0.247		2519210
Nitrate (N)	mg/L	ND		0.05	2519485	ND	0.05	ND	0.05	2519485
Saturation pH (@ 20C)	N/A	7.24			2519209	7.22		7.20		2519209
Saturation pH (@ 4C)	N/A	7.48			2519210	7.46		7.44		2519210
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	98		5	2523027	99	5	99	5	2523027
Dissolved Chloride (Cl)	mg/L	18000		300	2523028	18000	300	18000	300	2523028
Colour	TCU	ND		5	2523032	ND	5	ND	5	2523032
Nitrate + Nitrite	mg/L	ND		0.05	2523034	ND	0.05	ND	0.05	2523034
Nitrite (N)	mg/L	ND		0.01	2523035	ND	0.01	ND	0.01	2523035
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	ND	0.05	2522060	0.39	0.05	0.05	0.05	2522063
Total Organic Carbon (C)	mg/L	ND		5	2523729	ND	5	ND	5	2523729
Orthophosphate (P)	mg/L	0.01		0.01	2523033	0.01	0.01	0.01	0.01	2523033
pH	pH	7.75		N/A	2524944	7.72	N/A	7.69	N/A	2524944
Reactive Silica (SiO2)	mg/L	ND		0.5	2523030	ND	0.5	ND	0.5	2523030
Total Suspended Solids	mg/L	ND		1	2520226	ND	2	3	1	2520226
Dissolved Sulphate (SO4)	mg/L	2400		100	2523029	2400	100	2200	100	2523029
Turbidity	NTU	0.2		0.1	2525517	ND	0.1	ND	0.1	2525517
Conductivity	uS/cm	47000		1	2524945	47000	1	47000	1	2524945

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B185175
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Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF WATER

Maxxam ID		JU8843	JU8844			JU8845	JU8845		
Sampling Date									
COC Number		C#259274	C#259274			C#259274	C#259274		
	Units	**NCW-003A**	**NCW-003B**	**RDL**	**QC Batch**	**NCW-003C**	**NCW-003C Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	me/L	552	554	N/A	2519208	560		N/A	2520622
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	98	98	1	2519203	144		1	2520619
Calculated TDS	mg/L	32600	32200	1	2519211	33600		1	2520626
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND	ND	1	2519203	ND		1	2520619
Cation Sum	me/L	587	561	N/A	2519208	618		N/A	2520622
Hardness (CaCO3)	mg/L	6400	6000	1	2519206	6700		1	2520620
Ion Balance (% Difference)	%	3.02	0.590	N/A	2519207	4.88		N/A	2520621
Langelier Index (@ 20C)	N/A	0.553	0.505		2519209	0.693			2520624
Langelier Index (@ 4C)	N/A	0.313	0.266		2519210	0.453			2520625
Nitrate (N)	mg/L	ND	ND	0.05	2519485	ND		0.05	2519485
Saturation pH (@ 20C)	N/A	7.19	7.23		2519209	7.00			2520624
Saturation pH (@ 4C)	N/A	7.43	7.46		2519210	7.24			2520625
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	99	99	5	2523027	140		30	2523027
Dissolved Chloride (Cl)	mg/L	18000	18000	300	2523028	18000		300	2523028
Colour	TCU	ND	ND	5	2523032	ND		5	2523032
Nitrate + Nitrite	mg/L	ND	ND	0.05	2523034	ND		0.05	2523034
Nitrite (N)	mg/L	ND	ND	0.01	2523035	ND		0.01	2523035
Nitrogen (Ammonia Nitrogen)	mg/L	0.10	ND	0.05	2522063	0.43	0.48	0.05	2522063
Total Organic Carbon (C)	mg/L	ND	ND	5	2523729	ND		5	2523729
Orthophosphate (P)	mg/L	0.01	0.01	0.01	2523033	0.02		0.01	2523033
pH	pH	7.74	7.73	N/A	2524944	7.69		N/A	2524944
Reactive Silica (SiO2)	mg/L	ND	ND	0.5	2523030	ND		0.5	2523030
Total Suspended Solids	mg/L	2	1	1	2520226	ND		2	2520407
Dissolved Sulphate (SO4)	mg/L	2400	2400	100	2523029	2400		100	2523029
Turbidity	NTU	ND	0.1	0.1	2525517	0.1		0.1	2525517
Conductivity	uS/cm	47000	47000	1	2524945	47000		1	2524945

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF WATER

Maxxam ID		JU8846			JU8847	JU8848	JU8848		
Sampling Date									
COC Number		C#259274			C#259274	C#259274	C#259274		
	Units	**NCW-004A**	**RDL**	**QC Batch**	**NCW-004B**	**NCW-004C**	**NCW-004C Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	me/L	553	N/A	2520622	557	565		N/A	2520622
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	96	1	2520619	98	99		1	2520619
Calculated TDS	mg/L	33100	1	2520626	32100	33000		1	2520626
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND	1	2520619	ND	ND		1	2520619
Cation Sum	me/L	609	N/A	2520622	551	580		N/A	2520622
Hardness (CaCO3)	mg/L	6600	1	2520620	6000	6200		1	2520620
Ion Balance (% Difference)	%	4.82	N/A	2520621	0.590	1.31		N/A	2520621
Langelier Index (@ 20C)	N/A	0.567		2520624	0.493	0.482			2520624
Langelier Index (@ 4C)	N/A	0.327		2520625	0.254	0.242			2520625
Nitrate (N)	mg/L	ND	0.05	2519485	ND	ND		0.05	2520623
Saturation pH (@ 20C)	N/A	7.18		2520624	7.23	7.21			2520624
Saturation pH (@ 4C)	N/A	7.42		2520625	7.47	7.45			2520625
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	97	5	2523027	99	99		5	2523027
Dissolved Chloride (Cl)	mg/L	18000	300	2523028	18000	18000		300	2523028
Colour	TCU	ND	5	2523032	ND	ND		5	2523032
Nitrate + Nitrite	mg/L	ND	0.05	2523034	ND	ND		0.05	2523034
Nitrite (N)	mg/L	ND	0.01	2523035	ND	ND		0.01	2523035
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	0.05	2522063	ND	0.16		0.05	2522063
Total Organic Carbon (C)	mg/L	ND	5	2523729	ND	ND	ND	5	2523752
Orthophosphate (P)	mg/L	0.01	0.01	2523033	0.01	0.01		0.01	2523033
pH	pH	7.75	N/A	2524944	7.72	7.69		N/A	2524944
Reactive Silica (SiO2)	mg/L	ND	0.5	2523030	ND	ND		0.5	2523030
Total Suspended Solids	mg/L	ND	1	2520407	ND	ND		2	2520407
Dissolved Sulphate (SO4)	mg/L	2400	100	2523029	2400	2400		100	2523029
Turbidity	NTU	0.2	0.1	2525520	0.3	ND		0.1	2525520
Conductivity	uS/cm	46000	1	2524945	47000	47000		1	2524945

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B185175
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Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF WATER

Maxxam ID		JU8849	JU8850	JU8851		JU8852		JU8853		
Sampling Date										
COC Number		C#259274	C#259274	C#259274		C#259274		C#259274		
	Units	**NCW-005A**	**NCW-005B**	**NCW-005C**	**RDL**	**SCW-001**	**RDL**	**SCW-002**	**RDL**	**QC Batch**
Calculated Parameters										
Anion Sum	me/L	538	550	556	N/A	547	N/A	556	N/A	2520622
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	96	97	97	1	96	1	96	1	2520619
Calculated TDS	mg/L	31700	32300	33500	1	32400	1	32100	1	2520626
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND	ND	ND	1	ND	1	ND	1	2520619
Cation Sum	me/L	568	576	620	N/A	585	N/A	555	N/A	2520622
Hardness (CaCO3)	mg/L	6200	6300	6700	1	6400	1	6000	1	2520620
Ion Balance (% Difference)	%	2.73	2.34	5.44	N/A	3.34	N/A	0.100	N/A	2520621
Langelier Index (@ 20C)	N/A	0.508	0.518	0.547		0.556		0.549		2520624
Langelier Index (@ 4C)	N/A	0.268	0.279	0.308		0.317		0.310		2520625
Nitrate (N)	mg/L	ND	ND	ND	0.05	ND	0.05	ND	0.05	2520623
Saturation pH (@ 20C)	N/A	7.23	7.21	7.17		7.20		7.23		2520624
Saturation pH (@ 4C)	N/A	7.47	7.45	7.41		7.44		7.47		2520625
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	97	98	98	5	96	5	97	5	2523027
Dissolved Chloride (Cl)	mg/L	17000	18000	18000	300	18000	300	18000	300	2523028
Colour	TCU	ND	ND	ND	5	ND	5	ND	5	2523032
Nitrate + Nitrite	mg/L	ND	ND	ND	0.05	ND	0.05	ND	0.05	2523034
Nitrite (N)	mg/L	ND	ND	ND	0.01	ND	0.01	ND	0.01	2523035
Nitrogen (Ammonia Nitrogen)	mg/L	0.06	0.21	0.08	0.05	0.14	0.05	0.08	0.05	2522063
Total Organic Carbon (C)	mg/L	ND	ND	ND	5	ND	5	ND	5	2523752
Orthophosphate (P)	mg/L	ND	0.01	0.02	0.01	0.01	0.01	0.01	0.01	2523033
pH	pH	7.74	7.73	7.72	N/A	7.76	N/A	7.78	N/A	2524944
Reactive Silica (SiO2)	mg/L	ND	ND	ND	0.5	ND	0.5	ND	0.5	2523030
Total Suspended Solids	mg/L	ND	ND	ND	1	ND	2	2	1	2520407
Dissolved Sulphate (SO4)	mg/L	2300	2300	2300	100	2300	100	2400	100	2523029
Turbidity	NTU	0.2	0.3	ND	0.1	0.1	0.1	0.2	0.1	2525520
Conductivity	uS/cm	46000	47000	47000	1	47000	1	47000	1	2524945

ND = Not detected
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Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

RESULTS OF ANALYSES OF WATER

Maxxam ID		JU8854	JU8854			JU8855	JU8855		
Sampling Date									
COC Number		C#259274	C#259274			C#259274	C#259274		
	Units	**SCW-003**	**SCW-003 Lab-Dup**	**RDL**	**QC Batch**	**SCW0004**	**SCW0004 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	me/L	551		N/A	2520622	552		N/A	2520622
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	96		1	2520619	145		1	2520619
Calculated TDS	mg/L	33500		1	2520626	32500		1	2520626
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND		1	2520619	ND		1	2520619
Cation Sum	me/L	630		N/A	2520622	581		N/A	2520622
Hardness (CaCO3)	mg/L	6800		1	2520620	6300		1	2520620
Ion Balance (% Difference)	%	6.76		N/A	2520621	2.59		N/A	2520621
Langelier Index (@ 20C)	N/A	0.603			2520624	0.637			2520624
Langelier Index (@ 4C)	N/A	0.363			2520625	0.398			2520625
Nitrate (N)	mg/L	ND		0.05	2520623	ND		0.05	2520623
Saturation pH (@ 20C)	N/A	7.17			2520624	7.02			2520624
Saturation pH (@ 4C)	N/A	7.41			2520625	7.26			2520625
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	97	98	5	2523027	150		30	2523036
Dissolved Chloride (Cl)	mg/L	18000	18000	300	2523028	18000		300	2523037
Colour	TCU	ND	ND	5	2523032	ND		5	2523041
Nitrate + Nitrite	mg/L	ND	ND	0.05	2523034	ND		0.05	2523043
Nitrite (N)	mg/L	ND	ND	0.01	2523035	ND		0.01	2523044
Nitrogen (Ammonia Nitrogen)	mg/L	ND		0.05	2522063	ND		0.05	2522063
Total Organic Carbon (C)	mg/L	ND		5	2523752	ND		5	2523752
Orthophosphate (P)	mg/L	0.01	0.01	0.01	2523033	0.01		0.01	2523042
pH	pH	7.77		N/A	2524944	7.66	7.69	N/A	2524946
Reactive Silica (SiO2)	mg/L	ND	ND	0.5	2523030	ND		0.5	2523039
Total Suspended Solids	mg/L	2		1	2520407	ND		1	2520407
Dissolved Sulphate (SO4)	mg/L	2400	2100	100	2523029	2400		100	2523038
Turbidity	NTU	ND		0.1	2525520	0.2		0.1	2525520
Conductivity	uS/cm	47000		1	2524945	47000	47000	1	2524948

ND = Not detected
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RESULTS OF ANALYSES OF WATER

Maxxam ID		JU8856		
Sampling Date				
COC Number		C#259274		
	Units	**W-001**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	551	N/A	2520622
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	99	1	2520619
Calculated TDS	mg/L	32200	1	2520626
Carb. Alkalinity (calc. as CaCO3)	mg/L	ND	1	2520619
Cation Sum	me/L	569	N/A	2520622
Hardness (CaCO3)	mg/L	6200	1	2520620
Ion Balance (% Difference)	%	1.62	N/A	2520621
Langelier Index (@ 20C)	N/A	0.523		2520624
Langelier Index (@ 4C)	N/A	0.284		2520625
Nitrate (N)	mg/L	ND	0.05	2520623
Saturation pH (@ 20C)	N/A	7.21		2520624
Saturation pH (@ 4C)	N/A	7.45		2520625
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L	99	5	2523036
Dissolved Chloride (Cl)	mg/L	18000	300	2523037
Colour	TCU	ND	5	2523041
Nitrate + Nitrite	mg/L	ND	0.05	2523043
Nitrite (N)	mg/L	ND	0.01	2523044
Nitrogen (Ammonia Nitrogen)	mg/L	0.08	0.05	2522063
Total Organic Carbon (C)	mg/L	ND	5	2523752
Orthophosphate (P)	mg/L	0.01	0.01	2523042
pH	pH	7.73	N/A	2524946
Reactive Silica (SiO2)	mg/L	ND	0.5	2523039
Total Suspended Solids	mg/L	2	1	2520407
Dissolved Sulphate (SO4)	mg/L	2400	100	2523038
Turbidity	NTU	0.3	0.1	2525520
Conductivity	uS/cm	47000	1	2524948

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B185175
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Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

MERCURY BY COLD VAPOUR AA (WATER)

Maxxam ID		JU8806	JU8821	JU8838	JU8839	JU8840	JU8841		
Sampling Date									
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**W-002B**	**NCW-001A**	**NCW-001B**	**NCW-001C**	**NCW-002A**	**NCW-002B**	**RDL**	**QC Batch**
Metals									
Total Mercury (Hg)	ug/L	ND	ND	ND	ND	0.014	ND	0.013	2523024

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		JU8842	JU8843	JU8844	JU8845	JU8846		JU8847		
Sampling Date										
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274		C#259274		
	Units	**NCW-002C**	**NCW-003A**	**NCW-003B**	**NCW-003C**	**NCW-004A**	**QC Batch**	**NCW-004B**	**RDL**	**QC Batch**
Metals										
Total Mercury (Hg)	ug/L	ND	0.017	ND	ND	0.014	2523024	ND	0.013	2523025

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		JU8847	JU8848	JU8849	JU8850	JU8851	JU8852		
Sampling Date									
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**NCW-004B Lab-Dup**	**NCW-004C**	**NCW-005A**	**NCW-005B**	**NCW-005C**	**SCW-001**	**RDL**	**QC Batch**
Metals									
Total Mercury (Hg)	ug/L	ND	ND	ND	ND	ND	0.013	0.013	2523025

ND = Not detected
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QC Batch = Quality Control Batch

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Sikumiut Environmental
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MERCURY BY COLD VAPOUR AA (WATER)

Maxxam ID		JU8853	JU8854	JU8855	JU8856		
Sampling Date							
COC Number		C#259274	C#259274	C#259274	C#259274		
	Units	**SCW-002**	**SCW-003**	**SCW0004**	**W-001**	**RDL**	**QC Batch**
Metals							
Total Mercury (Hg)	ug/L	ND	0.017	ND	ND	0.013	2523025

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ICP/MS (WATER)

Maxxam ID		JU8806	JU8821		JU8838	JU8838	JU8839		
Sampling Date									
COC Number		C#259274	C#259274		C#259274	C#259274	C#259274		
	Units	**W-002B**	**NCW-001A**	**QC Batch**	**NCW-001B**	**NCW-001B Lab-Dup**	**NCW-001C**	**RDL**	**QC Batch**
Metals									
Total Aluminum (Al)	ug/L	ND	ND	2523114	ND	ND	ND	500	2520551
Total Antimony (Sb)	ug/L	ND	ND	2523114	ND	ND	ND	100	2520551
Total Arsenic (As)	ug/L	ND	ND	2523114	ND	ND	ND	100	2520551
Total Barium (Ba)	ug/L	ND	ND	2523114	ND	ND	ND	100	2520551
Total Beryllium (Be)	ug/L	ND	ND	2523114	ND	ND	ND	100	2520551
Total Bismuth (Bi)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Boron (B)	ug/L	ND	ND	2523114	ND	ND	ND	5000	2520551
Total Cadmium (Cd)	ug/L	ND	ND	2523114	ND	ND	ND	1.7	2520551
Total Calcium (Ca)	ug/L	397000	409000	2523114	394000	391000	387000	10000	2520551
Total Chromium (Cr)	ug/L	ND	ND	2523114	ND	ND	ND	100	2520551
Total Cobalt (Co)	ug/L	ND	ND	2523114	ND	ND	ND	40	2520551
Total Copper (Cu)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Iron (Fe)	ug/L	ND	ND	2523114	ND	ND	ND	5000	2520551
Total Lead (Pb)	ug/L	ND	ND	2523114	ND	ND	ND	50	2520551
Total Magnesium (Mg)	ug/L	1260000	1260000	2523114	1240000	1220000	1210000	10000	2520551
Total Manganese (Mn)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Molybdenum (Mo)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Nickel (Ni)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Phosphorus (P)	ug/L	ND	ND	2523114	ND	ND	ND	10000	2520551
Total Potassium (K)	ug/L	375000	383000	2523114	377000	365000	370000	10000	2520551
Total Selenium (Se)	ug/L	ND	ND	2523114	ND	ND	ND	100	2520551
Total Silver (Ag)	ug/L	ND	ND	2523114	ND	ND	ND	10	2520551
Total Sodium (Na)	ug/L	10000000	10200000	2523114	9830000	9670000	9680000	10000	2520551
Total Strontium (Sr)	ug/L	7490	7430	2523114	7580	7520	7340	200	2520551
Total Thallium (Tl)	ug/L	ND	ND	2523114	ND	ND	ND	10	2520551
Total Tin (Sn)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Titanium (Ti)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Uranium (U)	ug/L	ND	ND	2523114	ND	ND	ND	10	2520551
Total Vanadium (V)	ug/L	ND	ND	2523114	ND	ND	ND	200	2520551
Total Zinc (Zn)	ug/L	ND	ND	2523114	ND	ND	ND	500	2520551

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

ELEMENTS BY ICP/MS (WATER)

Maxxam ID		JU8840	JU8841	JU8842	JU8843	JU8844	JU8845		
Sampling Date									
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**NCW-002A**	**NCW-002B**	**NCW-002C**	**NCW-003A**	**NCW-003B**	**NCW-003C**	**RDL**	**QC Batch**
Metals									
Total Aluminum (Al)	ug/L	ND	ND	ND	ND	ND	ND	500	2523249
Total Antimony (Sb)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Arsenic (As)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Barium (Ba)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Beryllium (Be)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Bismuth (Bi)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Boron (B)	ug/L	ND	ND	ND	ND	ND	5070	5000	2523249
Total Cadmium (Cd)	ug/L	ND	ND	ND	ND	ND	ND	1.7	2523249
Total Calcium (Ca)	ug/L	380000	396000	408000	423000	392000	437000	10000	2523249
Total Chromium (Cr)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Cobalt (Co)	ug/L	ND	ND	ND	ND	ND	ND	40	2523249
Total Copper (Cu)	ug/L	781	ND	ND	ND	ND	ND	200	2523249
Total Iron (Fe)	ug/L	ND	ND	ND	ND	ND	ND	5000	2523249
Total Lead (Pb)	ug/L	ND	ND	ND	ND	ND	ND	50	2523249
Total Magnesium (Mg)	ug/L	1180000	1220000	1260000	1290000	1230000	1360000	10000	2523249
Total Manganese (Mn)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Molybdenum (Mo)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Nickel (Ni)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Phosphorus (P)	ug/L	ND	ND	ND	ND	ND	ND	10000	2523249
Total Potassium (K)	ug/L	355000	373000	388000	391000	374000	414000	10000	2523249
Total Selenium (Se)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Silver (Ag)	ug/L	ND	ND	ND	ND	ND	ND	10	2523249
Total Sodium (Na)	ug/L	9500000	9820000	10200000	10300000	9900000	10900000	10000	2523249
Total Strontium (Sr)	ug/L	7220	7330	7700	7910	7360	8380	200	2523249
Total Thallium (Tl)	ug/L	ND	ND	ND	ND	ND	ND	10	2523249
Total Tin (Sn)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Titanium (Ti)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Uranium (U)	ug/L	ND	ND	ND	ND	ND	ND	10	2523249
Total Vanadium (V)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Zinc (Zn)	ug/L	517	ND	ND	ND	ND	ND	500	2523249

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Sikumiut Environmental
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ELEMENTS BY ICP/MS (WATER)

Maxxam ID		JU8846	JU8847	JU8848	JU8849	JU8850	JU8851		
Sampling Date									
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**NCW-004A**	**NCW-004B**	**NCW-004C**	**NCW-005A**	**NCW-005B**	**NCW-005C**	**RDL**	**QC Batch**
Metals									
Total Aluminum (Al)	ug/L	ND	ND	ND	ND	10700	ND	500	2523249
Total Antimony (Sb)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Arsenic (As)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Barium (Ba)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Beryllium (Be)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Bismuth (Bi)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Boron (B)	ug/L	ND	ND	ND	ND	ND	ND	5000	2523249
Total Cadmium (Cd)	ug/L	ND	ND	ND	ND	ND	ND	1.7	2523249
Total Calcium (Ca)	ug/L	431000	390000	399000	396000	406000	432000	10000	2523249
Total Chromium (Cr)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Cobalt (Co)	ug/L	ND	ND	ND	ND	ND	ND	40	2523249
Total Copper (Cu)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Iron (Fe)	ug/L	ND	ND	ND	ND	ND	ND	5000	2523249
Total Lead (Pb)	ug/L	ND	ND	ND	ND	ND	ND	50	2523249
Total Magnesium (Mg)	ug/L	1330000	1210000	1270000	1260000	1280000	1360000	10000	2523249
Total Manganese (Mn)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Molybdenum (Mo)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Nickel (Ni)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Phosphorus (P)	ug/L	ND	ND	ND	ND	ND	ND	10000	2523249
Total Potassium (K)	ug/L	409000	368000	382000	384000	389000	416000	10000	2523249
Total Selenium (Se)	ug/L	ND	ND	ND	ND	ND	ND	100	2523249
Total Silver (Ag)	ug/L	ND	ND	ND	ND	ND	ND	10	2523249
Total Sodium (Na)	ug/L	10700000	9700000	10200000	10000000	10100000	10900000	10000	2523249
Total Strontium (Sr)	ug/L	8020	7410	7520	7400	7730	8110	200	2523249
Total Thallium (Tl)	ug/L	ND	ND	ND	ND	ND	ND	10	2523249
Total Tin (Sn)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Titanium (Ti)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Uranium (U)	ug/L	ND	ND	ND	ND	ND	ND	10	2523249
Total Vanadium (V)	ug/L	ND	ND	ND	ND	ND	ND	200	2523249
Total Zinc (Zn)	ug/L	ND	ND	ND	ND	ND	ND	500	2523249

ND = Not detected
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Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
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Project name: NALCOR 2011 STRAIT OF BELLE IS

ELEMENTS BY ICP/MS (WATER)

Maxxam ID		JU8852	JU8853	JU8854	JU8855	JU8856		
Sampling Date								
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**SCW-001**	**SCW-002**	**SCW-003**	**SCW0004**	**W-001**	**RDL**	**QC Batch**
Metals								
Total Aluminum (Al)	ug/L	ND	ND	ND	ND	ND	500	2523249
Total Antimony (Sb)	ug/L	ND	ND	ND	ND	ND	100	2523249
Total Arsenic (As)	ug/L	ND	ND	ND	ND	ND	100	2523249
Total Barium (Ba)	ug/L	ND	ND	ND	ND	ND	100	2523249
Total Beryllium (Be)	ug/L	ND	ND	ND	ND	ND	100	2523249
Total Bismuth (Bi)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Boron (B)	ug/L	ND	ND	ND	ND	ND	5000	2523249
Total Cadmium (Cd)	ug/L	ND	ND	ND	ND	ND	1.7	2523249
Total Calcium (Ca)	ug/L	418000	394000	443000	420000	404000	10000	2523249
Total Chromium (Cr)	ug/L	ND	ND	ND	ND	ND	100	2523249
Total Cobalt (Co)	ug/L	ND	ND	ND	ND	ND	40	2523249
Total Copper (Cu)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Iron (Fe)	ug/L	ND	ND	ND	ND	ND	5000	2523249
Total Lead (Pb)	ug/L	ND	ND	ND	ND	ND	50	2523249
Total Magnesium (Mg)	ug/L	1290000	1230000	1390000	1280000	1260000	10000	2523249
Total Manganese (Mn)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Molybdenum (Mo)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Nickel (Ni)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Phosphorus (P)	ug/L	ND	ND	ND	ND	ND	10000	2523249
Total Potassium (K)	ug/L	394000	372000	428000	390000	385000	10000	2523249
Total Selenium (Se)	ug/L	ND	ND	ND	ND	ND	100	2523249
Total Silver (Ag)	ug/L	ND	ND	ND	ND	ND	10	2523249
Total Sodium (Na)	ug/L	10300000	9780000	11100000	10200000	10000000	10000	2523249
Total Strontium (Sr)	ug/L	7890	7340	8230	7870	7590	200	2523249
Total Thallium (Tl)	ug/L	ND	ND	ND	ND	ND	10	2523249
Total Tin (Sn)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Titanium (Ti)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Uranium (U)	ug/L	ND	ND	ND	ND	ND	10	2523249
Total Vanadium (V)	ug/L	ND	ND	ND	ND	ND	200	2523249
Total Zinc (Zn)	ug/L	ND	ND	ND	ND	ND	500	2523249

ND = Not detected
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QC Batch = Quality Control Batch

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Sikumiut Environmental
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Project name: NALCOR 2011 STRAIT OF BELLE IS

ATLANTIC RBCA HYDROCARBONS (WATER)

Maxxam ID		JU8806	JU8821		JU8838	JU8838	JU8839		
Sampling Date									
COC Number		C#259274	C#259274		C#259274	C#259274	C#259274		
	Units	**W-002B**	**NCW-001A**	**QC Batch**	**NCW-001B**	**NCW-001B Lab-Dup**	**NCW-001C**	**RDL**	**QC Batch**
Petroleum Hydrocarbons									
Benzene	mg/L	ND	ND	2522228	ND		ND	0.001	2522228
Toluene	mg/L	ND	ND	2522228	ND		ND	0.001	2522228
Ethylbenzene	mg/L	ND	ND	2522228	ND		ND	0.001	2522228
Xylene (Total)	mg/L	ND	ND	2522228	ND		ND	0.002	2522228
C6 - C10 (less BTEX)	mg/L	ND	ND	2522228	ND		ND	0.01	2522228
>C10-C16 Hydrocarbons	mg/L	ND	ND	2521852	ND	ND	ND	0.05	2525401
>C16-C21 Hydrocarbons	mg/L	ND	ND	2521852	ND	ND	ND	0.05	2525401
>C21-<C32 Hydrocarbons	mg/L	ND	ND	2521852	ND	ND	ND	0.1	2525401
Modified TPH (Tier1)	mg/L	ND	ND	2517614	ND		ND	0.1	2517614
Reached Baseline at C32	mg/L	Yes	Yes	2521852	Yes	Yes	Yes	N/A	2525401
Surrogate Recovery (%)									
Isobutylbenzene - Extractable	%	101	101	2521852	97	94	101		2525401
n-Dotriacontane - Extractable	%	100	103	2521852	101	92	102		2525401
Isobutylbenzene - Volatile	%	100	101	2522228	98		100		2522228

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B185175
Report Date: 2011/06/22

Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

ATLANTIC RBCA HYDROCARBONS (WATER)

Maxxam ID		JU8840	JU8841	JU8842	JU8843	JU8844	JU8845		
Sampling Date									
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**NCW-002A**	**NCW-002B**	**NCW-002C**	**NCW-003A**	**NCW-003B**	**NCW-003C**	**RDL**	**QC Batch**
Petroleum Hydrocarbons									
Benzene	mg/L	ND	ND	ND	ND	ND	ND	0.001	2522228
Toluene	mg/L	ND	ND	ND	ND	ND	ND	0.001	2522228
Ethylbenzene	mg/L	ND	ND	ND	ND	ND	ND	0.001	2522228
Xylene (Total)	mg/L	ND	ND	ND	ND	ND	ND	0.002	2522228
C6 - C10 (less BTEX)	mg/L	ND	ND	ND	ND	ND	ND	0.01	2522228
>C10-C16 Hydrocarbons	mg/L	ND	ND	ND	ND	ND	ND	0.05	2525401
>C16-C21 Hydrocarbons	mg/L	ND	ND	ND	ND	ND	ND	0.05	2525401
>C21-<C32 Hydrocarbons	mg/L	ND	ND	ND	ND	ND	ND	0.1	2525401
Modified TPH (Tier1)	mg/L	ND	ND	ND	ND	ND	ND	0.1	2517614
Reached Baseline at C32	mg/L	Yes	Yes	Yes	Yes	Yes	Yes	N/A	2525401
Surrogate Recovery (%)									
Isobutylbenzene - Extractable	%	105	101	101	103	99	102		2525401
n-Dotriacontane - Extractable	%	107	109	99	104	96	99		2525401
Isobutylbenzene - Volatile	%	95	99	95	90	97	90		2522228

ND = Not detected
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QC Batch = Quality Control Batch

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ATLANTIC RBCA HYDROCARBONS (WATER)

Maxxam ID		JU8846	JU8847	JU8848		JU8849	JU8849		
Sampling Date									
COC Number		C#259274	C#259274	C#259274		C#259274	C#259274		
	Units	**NCW-004A**	**NCW-004B**	**NCW-004C**	**QC Batch**	**NCW-005A**	**NCW-005A Lab-Dup**	**RDL**	**QC Batch**
Petroleum Hydrocarbons									
Benzene	mg/L	ND	ND	ND	2522228	ND	ND	0.001	2523541
Toluene	mg/L	ND	ND	ND	2522228	ND	ND	0.001	2523541
Ethylbenzene	mg/L	ND	ND	ND	2522228	ND	ND	0.001	2523541
Xylene (Total)	mg/L	ND	ND	ND	2522228	ND	ND	0.002	2523541
C6 - C10 (less BTEX)	mg/L	ND	ND	ND	2522228	ND	ND	0.01	2523541
>C10-C16 Hydrocarbons	mg/L	ND	ND	ND	2525401	ND		0.05	2525401
>C16-C21 Hydrocarbons	mg/L	ND	ND	ND	2525401	ND		0.05	2525401
>C21-<C32 Hydrocarbons	mg/L	ND	ND	ND	2525401	ND		0.1	2525401
Modified TPH (Tier1)	mg/L	ND	ND	ND	2517614	ND		0.1	2517614
Reached Baseline at C32	mg/L	Yes	Yes	Yes	2525401	Yes		N/A	2525401
Surrogate Recovery (%)									
Isobutylbenzene - Extractable	%	102	104	101	2525401	105			2525401
n-Dotriacontane - Extractable	%	101	106	103	2525401	109			2525401
Isobutylbenzene - Volatile	%	88	94	94	2522228	102	105		2523541

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ATLANTIC RBCA HYDROCARBONS (WATER)

Maxxam ID		JU8850	JU8851	JU8852	JU8853	JU8854	JU8855		
Sampling Date									
COC Number		C#259274	C#259274	C#259274	C#259274	C#259274	C#259274		
	Units	**NCW-005B**	**NCW-005C**	**SCW-001**	**SCW-002**	**SCW-003**	**SCW0004**	**RDL**	**QC Batch**
Petroleum Hydrocarbons									
Benzene	mg/L	ND	ND	ND	ND	ND	ND	0.001	2523541
Toluene	mg/L	ND	ND	ND	ND	ND	ND	0.001	2523541
Ethylbenzene	mg/L	ND	ND	ND	ND	ND	ND	0.001	2523541
Xylene (Total)	mg/L	ND	ND	ND	ND	ND	ND	0.002	2523541
C6 - C10 (less BTEX)	mg/L	ND	ND	ND	ND	ND	ND	0.01	2523541
>C10-C16 Hydrocarbons	mg/L	ND	ND	ND	ND	ND	ND	0.05	2525401
>C16-C21 Hydrocarbons	mg/L	ND	ND	ND	ND	ND	ND	0.05	2525401
>C21-<C32 Hydrocarbons	mg/L	ND	ND	ND	ND	ND	ND	0.1	2525401
Modified TPH (Tier1)	mg/L	ND	ND	ND	ND	ND	ND	0.1	2517614
Reached Baseline at C32	mg/L	Yes	Yes	Yes	Yes	Yes	Yes	N/A	2525401
Surrogate Recovery (%)									
Isobutylbenzene - Extractable	%	98	100	100	103	108	105		2525401
n-Dotriacontane - Extractable	%	99	99	104	99	102	105		2525401
Isobutylbenzene - Volatile	%	98	97	101	105	96	99		2523541

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B185175
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Sikumiut Environmental
Client Project #: NALCOR 2011 STRAIT OF BELLE
Project name: NALCOR 2011 STRAIT OF BELLE IS

ATLANTIC RBCA HYDROCARBONS (WATER)

Maxxam ID		JU8856		
Sampling Date				
COC Number		C#259274		
	Units	**W-001**	**RDL**	**QC Batch**
Petroleum Hydrocarbons				
Benzene	mg/L	ND	0.001	2523541
Toluene	mg/L	ND	0.001	2523541
Ethylbenzene	mg/L	ND	0.001	2523541
Xylene (Total)	mg/L	ND	0.002	2523541
C6 - C10 (less BTEX)	mg/L	ND	0.01	2523541
>C10-C16 Hydrocarbons	mg/L	ND	0.05	2525401
>C16-C21 Hydrocarbons	mg/L	ND	0.05	2525401
>C21-<C32 Hydrocarbons	mg/L	ND	0.1	2525401
Modified TPH (Tier1)	mg/L	ND	0.1	2517614
Reached Baseline at C32	mg/L	Yes	N/A	2525401
Surrogate Recovery (%)				
Isobutylbenzene - Extractable	%	96		2525401
n-Dotriacontane - Extractable	%	93		2525401
Isobutylbenzene - Volatile	%	93		2523541

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Project name: NALCOR 2011 STRAIT OF BELLE IS

Package 1	6.3°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

TOC: The detection limit was increased due to sample matrix.

Sample JU8806-01: Total Suspended Solids: DL raised based on available sample volume.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8821-01: Total Suspended Solids: DL raised based on available sample volume.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8838-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8839-01: Total Suspended Solids: DL raised based on available sample volume.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8840-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8841-01: Total Suspended Solids: DL raised based on available sample volume.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8842-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8843-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8844-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8845-01: Total Suspended Solids: Limited sample available for analysis, DL raised accordingly.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8846-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8847-01: Total Suspended Solids: Limited sample available for analysis, DL raised accordingly.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8848-01: Total Suspended Solids: Limited sample available for analysis, DL raised accordingly.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8849-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8850-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8851-01: Elevated reporting limits for trace metals due to sample matrix.

Poor RCAp Ion Balance due to sample matrix.

Sample JU8852-01: Total Suspended Solids: Limited sample available for analysis, DL raised accordingly.

Elevated reporting limits for trace metals due to sample matrix.

Sample JU8853-01: Elevated reporting limits for trace metals due to sample matrix.

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Maxxam Job #: B185175
Report Date: 2011/06/22

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Sample JU8854-01: Elevated reporting limits for trace metals due to sample matrix.

Poor RCAp Ion Balance due to sample matrix.

Sample JU8855-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JU8856-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JV2794-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JV2814-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JV2815-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JV2816-01: Elevated reporting limits for trace metals due to sample matrix.

Sample JV2817-01: Elevated reporting limits for trace metals due to sample matrix.

Results relate only to the items tested.

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Quality Assurance Report

Maxxam Job Number: DB185175

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2520226	JDW	QC Standard	Total Suspended Solids	2011/06/15		101	%	80 - 120
		Method Blank	Total Suspended Solids	2011/06/15	ND, RDL=1		mg/L	
		RPD	Total Suspended Solids	2011/06/15	2.1		%	25
2520246	SHR	Matrix Spike	Isobutylbenzene - Extractable	2011/06/15		91	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/15		88	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/15		97	%	30 - 130
			>C16-C21 Hydrocarbons	2011/06/15		95	%	30 - 130
			>C21-<C32 Hydrocarbons	2011/06/15		NC	%	30 - 130
		Spiked Blank	Isobutylbenzene - Extractable	2011/06/15		95	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/15		84	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/15		102	%	30 - 130
			>C16-C21 Hydrocarbons	2011/06/15		101	%	30 - 130
			>C21-<C32 Hydrocarbons	2011/06/15		100	%	30 - 130
		Method Blank	Isobutylbenzene - Extractable	2011/06/15		90	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/15		93	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/15	ND, RDL=10		mg/kg	
			>C16-C21 Hydrocarbons	2011/06/15	ND, RDL=10		mg/kg	
			>C21-<C32 Hydrocarbons	2011/06/15	ND, RDL=15		mg/kg	
		RPD	>C10-C16 Hydrocarbons	2011/06/15	NC		%	50
			>C16-C21 Hydrocarbons	2011/06/15	NC		%	50
			>C21-<C32 Hydrocarbons	2011/06/15	1.8		%	50
2520407	JDW	QC Standard	Total Suspended Solids	2011/06/15		98	%	80 - 120
		Method Blank	Total Suspended Solids	2011/06/15	ND, RDL=1		mg/L	
		RPD	Total Suspended Solids	2011/06/15	NC		%	25
2520551	DLB	Matrix Spike						
		[JU8839-02]	Total Aluminum (Al)	2011/06/17		113	%	80 - 120
			Total Bismuth (Bi)	2011/06/17		101	%	80 - 120
			Total Boron (B)	2011/06/17		NC	%	80 - 120
			Total Calcium (Ca)	2011/06/17		NC	%	80 - 120
			Total Magnesium (Mg)	2011/06/17		NC	%	80 - 120
			Total Molybdenum (Mo)	2011/06/17		102	%	80 - 120
			Total Phosphorus (P)	2011/06/17		120	%	80 - 120
			Total Potassium (K)	2011/06/17		NC	%	80 - 120
			Total Sodium (Na)	2011/06/17		NC	%	80 - 120
			Total Thallium (Tl)	2011/06/17		95	%	80 - 120
			Total Tin (Sn)	2011/06/17		120	%	80 - 120
		Spiked Blank	Total Aluminum (Al)	2011/06/17		110	%	80 - 120
			Total Antimony (Sb)	2011/06/17		100	%	80 - 120
			Total Bismuth (Bi)	2011/06/17		104	%	80 - 120
			Total Boron (B)	2011/06/17		101	%	80 - 120
			Total Calcium (Ca)	2011/06/17		104	%	80 - 120
			Total Iron (Fe)	2011/06/17		113	%	80 - 120
			Total Magnesium (Mg)	2011/06/17		106	%	80 - 120
			Total Molybdenum (Mo)	2011/06/17		104	%	80 - 120
			Total Phosphorus (P)	2011/06/17		110	%	80 - 120
			Total Potassium (K)	2011/06/17		106	%	80 - 120
			Total Sodium (Na)	2011/06/17		99	%	80 - 120
			Total Thallium (Tl)	2011/06/17		105	%	80 - 120
			Total Tin (Sn)	2011/06/17		106	%	80 - 120
		Method Blank	Total Aluminum (Al)	2011/06/17	6.4, RDL=5.0 (1)		ug/L	
			Total Antimony (Sb)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Arsenic (As)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Barium (Ba)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Beryllium (Be)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Bismuth (Bi)	2011/06/17	ND, RDL=2.0		ug/L	

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Quality Assurance Report (Continued)

Maxxam Job Number: DB185175

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2520551	DLB	Method Blank	Total Boron (B)	2011/06/17	ND, RDL=50		ug/L	
			Total Cadmium (Cd)	2011/06/17	ND, RDL=0.017		ug/L	
			Total Calcium (Ca)	2011/06/17	ND, RDL=100		ug/L	
			Total Chromium (Cr)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Cobalt (Co)	2011/06/17	ND, RDL=0.40		ug/L	
			Total Copper (Cu)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Iron (Fe)	2011/06/17	ND, RDL=50		ug/L	
			Total Lead (Pb)	2011/06/17	ND, RDL=0.50		ug/L	
			Total Magnesium (Mg)	2011/06/17	ND, RDL=100		ug/L	
			Total Manganese (Mn)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Molybdenum (Mo)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Nickel (Ni)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Phosphorus (P)	2011/06/17	ND, RDL=100		ug/L	
			Total Potassium (K)	2011/06/17	ND, RDL=100		ug/L	
			Total Selenium (Se)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Silver (Ag)	2011/06/17	ND, RDL=0.10		ug/L	
			Total Sodium (Na)	2011/06/17	ND, RDL=100		ug/L	
			Total Strontium (Sr)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Thallium (Tl)	2011/06/17	ND, RDL=0.10		ug/L	
			Total Tin (Sn)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Titanium (Ti)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Uranium (U)	2011/06/17	ND, RDL=0.10		ug/L	
			Total Vanadium (V)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Zinc (Zn)	2011/06/17	ND, RDL=5.0		ug/L	
		RPD [JU8838-02]	Total Aluminum (Al)	2011/06/17	NC		%	25
			Total Antimony (Sb)	2011/06/17	NC		%	25
			Total Arsenic (As)	2011/06/17	NC		%	25
			Total Barium (Ba)	2011/06/17	NC		%	25
			Total Beryllium (Be)	2011/06/17	NC		%	25
			Total Bismuth (Bi)	2011/06/17	NC		%	25
			Total Boron (B)	2011/06/17	NC		%	25
			Total Cadmium (Cd)	2011/06/17	NC		%	25
			Total Calcium (Ca)	2011/06/17	0.7		%	25
			Total Chromium (Cr)	2011/06/17	NC		%	25
			Total Cobalt (Co)	2011/06/17	NC		%	25
			Total Copper (Cu)	2011/06/17	NC		%	25
			Total Iron (Fe)	2011/06/17	NC		%	25
			Total Lead (Pb)	2011/06/17	NC		%	25
			Total Magnesium (Mg)	2011/06/17	1.6		%	25
			Total Manganese (Mn)	2011/06/17	NC		%	25
			Total Molybdenum (Mo)	2011/06/17	NC		%	25
			Total Nickel (Ni)	2011/06/17	NC		%	25
			Total Phosphorus (P)	2011/06/17	NC		%	25
			Total Potassium (K)	2011/06/17	3.2		%	25
			Total Selenium (Se)	2011/06/17	NC		%	25
			Total Silver (Ag)	2011/06/17	NC		%	25
			Total Sodium (Na)	2011/06/17	1.6		%	25
			Total Strontium (Sr)	2011/06/17	0.8		%	25
			Total Thallium (Tl)	2011/06/17	NC		%	25
			Total Tin (Sn)	2011/06/17	NC		%	25
			Total Titanium (Ti)	2011/06/17	NC		%	25
			Total Uranium (U)	2011/06/17	NC		%	25
			Total Vanadium (V)	2011/06/17	NC		%	25
			Total Zinc (Zn)	2011/06/17	NC		%	25
2521627	ASL	Matrix Spike	Isobutylbenzene - Volatile	2011/06/16		89	%	60 - 140

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Maxxam Job Number: DB185175

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2521627	ASL	Matrix Spike	Benzene	2011/06/16		79	%	60 - 140
			Toluene	2011/06/16		104	%	60 - 140
			Ethylbenzene	2011/06/16		101	%	60 - 140
			Xylene (Total)	2011/06/16		107	%	60 - 140
		Spiked Blank	Isobutylbenzene - Volatile	2011/06/16		96	%	60 - 140
			Benzene	2011/06/16		87	%	60 - 140
			Toluene	2011/06/16		91	%	60 - 140
			Ethylbenzene	2011/06/16		89	%	60 - 140
			Xylene (Total)	2011/06/16		93	%	60 - 140
		Method Blank	Isobutylbenzene - Volatile	2011/06/16		95	%	60 - 140
			Benzene	2011/06/16	ND, RDL=0.005		mg/kg	
			Toluene	2011/06/16	ND, RDL=0.03		mg/kg	
			Ethylbenzene	2011/06/16	ND, RDL=0.01		mg/kg	
			Xylene (Total)	2011/06/16	ND, RDL=0.05		mg/kg	
			C6 - C10 (less BTEX)	2011/06/16	ND, RDL=3		mg/kg	
		RPD	Benzene	2011/06/16	NC		%	50
			Toluene	2011/06/16	NC		%	50
			Ethylbenzene	2011/06/16	NC		%	50
			Xylene (Total)	2011/06/16	NC		%	50
			C6 - C10 (less BTEX)	2011/06/16	NC		%	50
2521762	KGU	QC Standard	Available Aluminum (Al)	2011/06/16		108	%	75 - 125
			Available Arsenic (As)	2011/06/16		121	%	75 - 125
			Available Barium (Ba)	2011/06/16		123	%	75 - 125
			Available Chromium (Cr)	2011/06/16		102	%	75 - 125
			Available Cobalt (Co)	2011/06/16		105	%	75 - 125
			Available Copper (Cu)	2011/06/16		95	%	75 - 125
			Available Iron (Fe)	2011/06/16		109	%	75 - 125
			Available Lead (Pb)	2011/06/16		107	%	75 - 125
			Available Manganese (Mn)	2011/06/16		116	%	75 - 125
			Available Nickel (Ni)	2011/06/16		105	%	75 - 125
			Available Strontium (Sr)	2011/06/16		99	%	75 - 125
			Available Vanadium (V)	2011/06/16		128 (2)	%	75 - 125
			Available Zinc (Zn)	2011/06/16		110	%	75 - 125
		Spiked Blank	Available Aluminum (Al)	2011/06/16		106	%	75 - 125
			Available Antimony (Sb)	2011/06/16		89	%	75 - 125
			Available Arsenic (As)	2011/06/16		101	%	75 - 125
			Available Barium (Ba)	2011/06/16		101	%	75 - 125
			Available Beryllium (Be)	2011/06/16		101	%	75 - 125
			Available Bismuth (Bi)	2011/06/16		100	%	75 - 125
			Available Boron (B)	2011/06/16		93	%	75 - 125
			Available Cadmium (Cd)	2011/06/16		101	%	75 - 125
			Available Chromium (Cr)	2011/06/16		104	%	75 - 125
			Available Cobalt (Co)	2011/06/16		101	%	75 - 125
			Available Copper (Cu)	2011/06/16		103	%	75 - 125
			Available Iron (Fe)	2011/06/16		102	%	75 - 125
			Available Lead (Pb)	2011/06/16		104	%	75 - 125
			Available Lithium (Li)	2011/06/16		103	%	75 - 125
			Available Manganese (Mn)	2011/06/16		107	%	75 - 125
			Available Mercury (Hg)	2011/06/16		114	%	75 - 125
			Available Molybdenum (Mo)	2011/06/16		101	%	75 - 125
			Available Nickel (Ni)	2011/06/16		101	%	75 - 125
			Available Rubidium (Rb)	2011/06/16		105	%	75 - 125
			Available Selenium (Se)	2011/06/16		106	%	75 - 125
			Available Silver (Ag)	2011/06/16		102	%	75 - 125
			Available Strontium (Sr)	2011/06/16		105	%	75 - 125

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Quality Assurance Report (Continued)

Maxxam Job Number: DB185175

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2521762	KGU	Spiked Blank	Available Thallium (Tl)	2011/06/16		109	%	75 - 125
			Available Tin (Sn)	2011/06/16		102	%	75 - 125
			Available Uranium (U)	2011/06/16		102	%	75 - 125
			Available Vanadium (V)	2011/06/16		109	%	75 - 125
			Available Zinc (Zn)	2011/06/16		106	%	75 - 125
		Method Blank	Available Aluminum (Al)	2011/06/16	ND, RDL=10		mg/kg	
			Available Antimony (Sb)	2011/06/16	ND, RDL=2		mg/kg	
			Available Arsenic (As)	2011/06/16	ND, RDL=2		mg/kg	
			Available Barium (Ba)	2011/06/16	ND, RDL=5		mg/kg	
			Available Beryllium (Be)	2011/06/16	ND, RDL=2		mg/kg	
			Available Bismuth (Bi)	2011/06/16	ND, RDL=2		mg/kg	
			Available Boron (B)	2011/06/16	ND, RDL=5		mg/kg	
			Available Cadmium (Cd)	2011/06/16	ND, RDL=0.3		mg/kg	
			Available Chromium (Cr)	2011/06/16	ND, RDL=2		mg/kg	
			Available Cobalt (Co)	2011/06/16	ND, RDL=1		mg/kg	
			Available Copper (Cu)	2011/06/16	ND, RDL=2		mg/kg	
			Available Iron (Fe)	2011/06/16	ND, RDL=50		mg/kg	
			Available Lead (Pb)	2011/06/16	ND, RDL=0.5		mg/kg	
			Available Lithium (Li)	2011/06/16	ND, RDL=2		mg/kg	
			Available Manganese (Mn)	2011/06/16	ND, RDL=2		mg/kg	
			Available Mercury (Hg)	2011/06/16	ND, RDL=0.1		mg/kg	
			Available Molybdenum (Mo)	2011/06/16	ND, RDL=2		mg/kg	
			Available Nickel (Ni)	2011/06/16	ND, RDL=2		mg/kg	
			Available Rubidium (Rb)	2011/06/16	ND, RDL=2		mg/kg	
			Available Selenium (Se)	2011/06/16	ND, RDL=1		mg/kg	
			Available Silver (Ag)	2011/06/16	ND, RDL=0.5		mg/kg	
			Available Strontium (Sr)	2011/06/16	ND, RDL=5		mg/kg	
			Available Thallium (Tl)	2011/06/16	ND, RDL=0.1		mg/kg	
			Available Tin (Sn)	2011/06/16	ND, RDL=2		mg/kg	
			Available Uranium (U)	2011/06/16	ND, RDL=0.1		mg/kg	
			Available Vanadium (V)	2011/06/16	ND, RDL=2		mg/kg	
			Available Zinc (Zn)	2011/06/16	ND, RDL=5		mg/kg	
2521852	SPI	Matrix Spike	Isobutylbenzene - Extractable	2011/06/17		98	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/17		103	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/17		88	%	N/A
			>C16-C21 Hydrocarbons	2011/06/17		97	%	N/A
			>C21-<C32 Hydrocarbons	2011/06/17		93	%	30 - 130
		Spiked Blank	Isobutylbenzene - Extractable	2011/06/17		97	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/17		102	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/17		92	%	N/A
			>C16-C21 Hydrocarbons	2011/06/17		102	%	N/A
			>C21-<C32 Hydrocarbons	2011/06/17		100	%	30 - 130
		Method Blank	Isobutylbenzene - Extractable	2011/06/17		101	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/17		98	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/17	ND, RDL=0.05		mg/L	
			>C16-C21 Hydrocarbons	2011/06/17	ND, RDL=0.05		mg/L	
			>C21-<C32 Hydrocarbons	2011/06/17	ND, RDL=0.1		mg/L	
		RPD	>C10-C16 Hydrocarbons	2011/06/17	NC		%	40
			>C16-C21 Hydrocarbons	2011/06/17	NC		%	40
			>C21-<C32 Hydrocarbons	2011/06/17	NC		%	40
2522060	SMT	Matrix Spike [JU8840-02]	Nitrogen (Ammonia Nitrogen)	2011/06/16		99	%	80 - 120
		QC Standard	Nitrogen (Ammonia Nitrogen)	2011/06/16		100	%	80 - 120
		Spiked Blank	Nitrogen (Ammonia Nitrogen)	2011/06/16		97	%	80 - 120
		Method Blank	Nitrogen (Ammonia Nitrogen)	2011/06/16	ND, RDL=0.05		mg/L	

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QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2522060	SMT	RPD [JU8840-02]	Nitrogen (Ammonia Nitrogen)	2011/06/16	NC		%	25
2522063	SMT	Matrix Spike [JU8845-02]	Nitrogen (Ammonia Nitrogen)	2011/06/16		109	%	80 - 120
		QC Standard	Nitrogen (Ammonia Nitrogen)	2011/06/16		99	%	80 - 120
		Spiked Blank	Nitrogen (Ammonia Nitrogen)	2011/06/16		120	%	80 - 120
		Method Blank	Nitrogen (Ammonia Nitrogen)	2011/06/16	ND, RDL=0.05		mg/L	
		RPD [JU8845-02]	Nitrogen (Ammonia Nitrogen)	2011/06/16	10.1		%	25
2522228	DDE	Matrix Spike	Isobutylbenzene - Volatile	2011/06/17		95	%	70 - 130
			Benzene	2011/06/17		85	%	70 - 130
			Toluene	2011/06/17		80	%	70 - 130
			Ethylbenzene	2011/06/17		85	%	70 - 130
			Xylene (Total)	2011/06/17		82	%	70 - 130
		Spiked Blank	Isobutylbenzene - Volatile	2011/06/17		94	%	70 - 130
			Benzene	2011/06/17		100	%	70 - 130
			Toluene	2011/06/17		100	%	70 - 130
			Ethylbenzene	2011/06/17		95	%	70 - 130
			Xylene (Total)	2011/06/17		98	%	70 - 130
		Method Blank	Isobutylbenzene - Volatile	2011/06/17		100	%	70 - 130
			Benzene	2011/06/17	ND, RDL=0.001		mg/L	
			Toluene	2011/06/17	ND, RDL=0.001		mg/L	
			Ethylbenzene	2011/06/17	ND, RDL=0.001		mg/L	
			Xylene (Total)	2011/06/17	ND, RDL=0.002		mg/L	
			C6 - C10 (less BTEX)	2011/06/17	ND, RDL=0.01		mg/L	
		RPD	Benzene	2011/06/16	NC		%	40
			Toluene	2011/06/16	NC		%	40
			Ethylbenzene	2011/06/16	NC		%	40
			Xylene (Total)	2011/06/16	NC		%	40
			C6 - C10 (less BTEX)	2011/06/16	NC		%	40
2522403	JPU	QC Standard	Organic Carbon (TOC)	2011/06/16		104	%	75 - 125
		Method Blank	Organic Carbon (TOC)	2011/06/16	ND, RDL=0.2		g/kg	
		RPD	Organic Carbon (TOC)	2011/06/16	0.1		%	35
2523024	JRC	Matrix Spike	Total Mercury (Hg)	2011/06/17		94	%	80 - 120
		QC Standard	Total Mercury (Hg)	2011/06/17		100	%	80 - 120
		Spiked Blank	Total Mercury (Hg)	2011/06/17		99	%	80 - 120
		Method Blank	Total Mercury (Hg)	2011/06/17	ND, RDL=0.013		ug/L	
		RPD	Total Mercury (Hg)	2011/06/17	NC		%	25
2523025	JRC	Matrix Spike [JU8848-02]	Total Mercury (Hg)	2011/06/17		87	%	80 - 120
		QC Standard	Total Mercury (Hg)	2011/06/17		101	%	80 - 120
		Spiked Blank	Total Mercury (Hg)	2011/06/17		102	%	80 - 120
		Method Blank	Total Mercury (Hg)	2011/06/17	ND, RDL=0.013		ug/L	
		RPD [JU8847-02]	Total Mercury (Hg)	2011/06/17	NC		%	25
2523027	SMT	Matrix Spike [JU8854-02]	Total Alkalinity (Total as CaCO3)	2011/06/20		NC	%	80 - 120
		QC Standard	Total Alkalinity (Total as CaCO3)	2011/06/20		101	%	80 - 120
		Spiked Blank	Total Alkalinity (Total as CaCO3)	2011/06/20		111	%	80 - 120
		Method Blank	Total Alkalinity (Total as CaCO3)	2011/06/20	ND, RDL=5		mg/L	
		RPD [JU8854-02]	Total Alkalinity (Total as CaCO3)	2011/06/20	1.7		%	25
2523028	ARS	Matrix Spike [JU8854-02]	Dissolved Chloride (Cl)	2011/06/20		NC	%	80 - 120
		QC Standard	Dissolved Chloride (Cl)	2011/06/20		95	%	80 - 120
		Spiked Blank	Dissolved Chloride (Cl)	2011/06/20		99	%	80 - 120
		Method Blank	Dissolved Chloride (Cl)	2011/06/20	ND, RDL=1		mg/L	
		RPD [JU8854-02]	Dissolved Chloride (Cl)	2011/06/20	0.7		%	25
2523029	SMT	Matrix Spike [JU8854-02]	Dissolved Sulphate (SO4)	2011/06/20		NC	%	80 - 120

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QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2523029	SMT	QC Standard	Dissolved Sulphate (SO4)	2011/06/20		93	%	80 - 120
		Spiked Blank	Dissolved Sulphate (SO4)	2011/06/20		110	%	80 - 120
		Method Blank	Dissolved Sulphate (SO4)	2011/06/20	ND, RDL=2		mg/L	
		RPD [JU8854-02]	Dissolved Sulphate (SO4)	2011/06/20	14.5		%	25
2523030	ABU	Matrix Spike						
		[JU8854-02]	Reactive Silica (SiO2)	2011/06/16		95	%	80 - 120
		QC Standard	Reactive Silica (SiO2)	2011/06/16		103	%	75 - 125
		Spiked Blank	Reactive Silica (SiO2)	2011/06/16		101	%	80 - 120
		Method Blank	Reactive Silica (SiO2)	2011/06/16	ND, RDL=0.5		mg/L	
		RPD [JU8854-02]	Reactive Silica (SiO2)	2011/06/16	NC		%	25
2523032	SMT	QC Standard	Colour	2011/06/17		112	%	80 - 120
		Method Blank	Colour	2011/06/17	ND, RDL=5		TCU	
		RPD [JU8854-02]	Colour	2011/06/17	NC		%	25
2523033	SMT	Matrix Spike						
		[JU8854-02]	Orthophosphate (P)	2011/06/20		99	%	80 - 120
		QC Standard	Orthophosphate (P)	2011/06/20		101	%	80 - 120
		Spiked Blank	Orthophosphate (P)	2011/06/20		104	%	80 - 120
		Method Blank	Orthophosphate (P)	2011/06/20	ND, RDL=0.01		mg/L	
		RPD [JU8854-02]	Orthophosphate (P)	2011/06/20	NC		%	25
2523034	SMT	Matrix Spike						
		[JU8854-02]	Nitrate + Nitrite	2011/06/17		103	%	80 - 120
		QC Standard	Nitrate + Nitrite	2011/06/17		104	%	80 - 120
		Spiked Blank	Nitrate + Nitrite	2011/06/17		103	%	80 - 120
		Method Blank	Nitrate + Nitrite	2011/06/17	ND, RDL=0.05		mg/L	
		RPD [JU8854-02]	Nitrate + Nitrite	2011/06/17	NC		%	25
2523035	SMT	Matrix Spike						
		[JU8854-02]	Nitrite (N)	2011/06/20		114	%	80 - 120
		QC Standard	Nitrite (N)	2011/06/20		107	%	80 - 120
		Spiked Blank	Nitrite (N)	2011/06/20		111	%	80 - 120
		Method Blank	Nitrite (N)	2011/06/20	ND, RDL=0.01		mg/L	
		RPD [JU8854-02]	Nitrite (N)	2011/06/20	NC		%	25
2523036	SMT	Matrix Spike	Total Alkalinity (Total as CaCO3)	2011/06/20		NC	%	80 - 120
		QC Standard	Total Alkalinity (Total as CaCO3)	2011/06/20		103	%	80 - 120
		Spiked Blank	Total Alkalinity (Total as CaCO3)	2011/06/20		108	%	80 - 120
		Method Blank	Total Alkalinity (Total as CaCO3)	2011/06/20	ND, RDL=5		mg/L	
		RPD	Total Alkalinity (Total as CaCO3)	2011/06/20	1.5		%	25
2523037	ARS	Matrix Spike	Dissolved Chloride (Cl)	2011/06/20		NC	%	80 - 120
		QC Standard	Dissolved Chloride (Cl)	2011/06/20		97	%	80 - 120
		Spiked Blank	Dissolved Chloride (Cl)	2011/06/20		100	%	80 - 120
		Method Blank	Dissolved Chloride (Cl)	2011/06/20	ND, RDL=1		mg/L	
		RPD	Dissolved Chloride (Cl)	2011/06/20	0.5		%	25
2523038	SMT	Matrix Spike	Dissolved Sulphate (SO4)	2011/06/20		113	%	80 - 120
		QC Standard	Dissolved Sulphate (SO4)	2011/06/20		98	%	80 - 120
		Spiked Blank	Dissolved Sulphate (SO4)	2011/06/20		107	%	80 - 120
		Method Blank	Dissolved Sulphate (SO4)	2011/06/20	ND, RDL=2		mg/L	
		RPD	Dissolved Sulphate (SO4)	2011/06/20	1.3		%	25
2523039	ABU	Matrix Spike	Reactive Silica (SiO2)	2011/06/16		NC	%	80 - 120
		QC Standard	Reactive Silica (SiO2)	2011/06/16		103	%	75 - 125
		Spiked Blank	Reactive Silica (SiO2)	2011/06/16		101	%	80 - 120
		Method Blank	Reactive Silica (SiO2)	2011/06/16	ND, RDL=0.5		mg/L	
		RPD	Reactive Silica (SiO2)	2011/06/16	0.5		%	25
2523041	SMT	QC Standard	Colour	2011/06/17		109	%	80 - 120
		Method Blank	Colour	2011/06/17	ND, RDL=5		TCU	
		RPD	Colour	2011/06/17	NC (3)		%	25
2523042	SMT	Matrix Spike	Orthophosphate (P)	2011/06/20		103	%	80 - 120

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2523042	SMT	QC Standard	Orthophosphate (P)	2011/06/20		100	%	80 - 120
		Spiked Blank	Orthophosphate (P)	2011/06/20		102	%	80 - 120
		Method Blank	Orthophosphate (P)	2011/06/20	ND, RDL=0.01		mg/L	
		RPD	Orthophosphate (P)	2011/06/20	NC		%	25
2523043	SMT	Matrix Spike	Nitrate + Nitrite	2011/06/17		104	%	80 - 120
		QC Standard	Nitrate + Nitrite	2011/06/17		104	%	80 - 120
		Spiked Blank	Nitrate + Nitrite	2011/06/17		103	%	80 - 120
		Method Blank	Nitrate + Nitrite	2011/06/17	ND, RDL=0.05		mg/L	
		RPD	Nitrate + Nitrite	2011/06/17	3.0		%	25
2523044	SMT	Matrix Spike	Nitrite (N)	2011/06/20		102	%	80 - 120
		QC Standard	Nitrite (N)	2011/06/20		105	%	80 - 120
		Spiked Blank	Nitrite (N)	2011/06/20		104	%	80 - 120
		Method Blank	Nitrite (N)	2011/06/20	ND, RDL=0.01		mg/L	
		RPD	Nitrite (N)	2011/06/20	NC		%	25
2523114	DLB	Matrix Spike	Total Aluminum (Al)	2011/06/18		108	%	80 - 120
			Total Antimony (Sb)	2011/06/18		103	%	80 - 120
			Total Arsenic (As)	2011/06/18		100	%	80 - 120
			Total Barium (Ba)	2011/06/18		97	%	80 - 120
			Total Beryllium (Be)	2011/06/18		100	%	80 - 120
			Total Bismuth (Bi)	2011/06/18		101	%	80 - 120
			Total Boron (B)	2011/06/18		98	%	80 - 120
			Total Cadmium (Cd)	2011/06/18		98	%	80 - 120
			Total Calcium (Ca)	2011/06/18		102	%	80 - 120
			Total Chromium (Cr)	2011/06/18		102	%	80 - 120
			Total Cobalt (Co)	2011/06/18		100	%	80 - 120
			Total Copper (Cu)	2011/06/18		NC	%	80 - 120
			Total Iron (Fe)	2011/06/18		111	%	80 - 120
			Total Lead (Pb)	2011/06/18		99	%	80 - 120
			Total Magnesium (Mg)	2011/06/18		105	%	80 - 120
			Total Manganese (Mn)	2011/06/18		102	%	80 - 120
			Total Molybdenum (Mo)	2011/06/18		108	%	80 - 120
			Total Nickel (Ni)	2011/06/18		100	%	80 - 120
			Total Phosphorus (P)	2011/06/18		111	%	80 - 120
			Total Potassium (K)	2011/06/18		107	%	80 - 120
			Total Selenium (Se)	2011/06/18		99	%	80 - 120
			Total Silver (Ag)	2011/06/18		101	%	80 - 120
			Total Sodium (Na)	2011/06/18		98	%	80 - 120
			Total Strontium (Sr)	2011/06/18		103	%	80 - 120
			Total Thallium (Tl)	2011/06/18		103	%	80 - 120
			Total Tin (Sn)	2011/06/18		103	%	80 - 120
			Total Titanium (Ti)	2011/06/18		98	%	80 - 120
			Total Uranium (U)	2011/06/18		103	%	80 - 120
			Total Vanadium (V)	2011/06/18		103	%	80 - 120
			Total Zinc (Zn)	2011/06/18		100	%	80 - 120
		Spiked Blank	Total Aluminum (Al)	2011/06/17		116	%	80 - 120
			Total Antimony (Sb)	2011/06/17		101	%	80 - 120
			Total Arsenic (As)	2011/06/17		101	%	80 - 120
			Total Barium (Ba)	2011/06/17		101	%	80 - 120
			Total Beryllium (Be)	2011/06/17		99	%	80 - 120
			Total Bismuth (Bi)	2011/06/17		104	%	80 - 120
			Total Boron (B)	2011/06/17		98	%	80 - 120
			Total Cadmium (Cd)	2011/06/17		99	%	80 - 120
			Total Calcium (Ca)	2011/06/17		105	%	80 - 120
			Total Chromium (Cr)	2011/06/17		104	%	80 - 120
			Total Cobalt (Co)	2011/06/17		98	%	80 - 120

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2523114	DLB	Spiked Blank	Total Copper (Cu)	2011/06/17		104	%	80 - 120
			Total Iron (Fe)	2011/06/17		116	%	80 - 120
			Total Lead (Pb)	2011/06/17		100	%	80 - 120
			Total Magnesium (Mg)	2011/06/17		107	%	80 - 120
			Total Manganese (Mn)	2011/06/17		104	%	80 - 120
			Total Molybdenum (Mo)	2011/06/17		111	%	80 - 120
			Total Nickel (Ni)	2011/06/17		101	%	80 - 120
			Total Phosphorus (P)	2011/06/17		112	%	80 - 120
			Total Potassium (K)	2011/06/17		109	%	80 - 120
			Total Selenium (Se)	2011/06/17		99	%	80 - 120
			Total Silver (Ag)	2011/06/17		103	%	80 - 120
			Total Sodium (Na)	2011/06/17		101	%	80 - 120
			Total Strontium (Sr)	2011/06/17		104	%	80 - 120
			Total Thallium (Tl)	2011/06/17		105	%	80 - 120
			Total Tin (Sn)	2011/06/17		105	%	80 - 120
			Total Titanium (Ti)	2011/06/17		104	%	80 - 120
			Total Uranium (U)	2011/06/17		104	%	80 - 120
			Total Vanadium (V)	2011/06/17		104	%	80 - 120
			Total Zinc (Zn)	2011/06/17		103	%	80 - 120
		Method Blank	Total Aluminum (Al)	2011/06/17	ND, RDL=5.0		ug/L	
			Total Antimony (Sb)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Arsenic (As)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Barium (Ba)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Beryllium (Be)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Bismuth (Bi)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Boron (B)	2011/06/17	ND, RDL=50		ug/L	
			Total Cadmium (Cd)	2011/06/17	ND, RDL=0.017		ug/L	
			Total Calcium (Ca)	2011/06/17	ND, RDL=100		ug/L	
			Total Chromium (Cr)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Cobalt (Co)	2011/06/17	ND, RDL=0.40		ug/L	
			Total Copper (Cu)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Iron (Fe)	2011/06/17	ND, RDL=50		ug/L	
			Total Lead (Pb)	2011/06/17	ND, RDL=0.50		ug/L	
			Total Magnesium (Mg)	2011/06/17	ND, RDL=100		ug/L	
			Total Manganese (Mn)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Molybdenum (Mo)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Nickel (Ni)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Phosphorus (P)	2011/06/17	ND, RDL=100		ug/L	
			Total Potassium (K)	2011/06/17	ND, RDL=100		ug/L	
			Total Selenium (Se)	2011/06/17	ND, RDL=1.0		ug/L	
			Total Silver (Ag)	2011/06/17	ND, RDL=0.10		ug/L	
			Total Sodium (Na)	2011/06/17	ND, RDL=100		ug/L	
			Total Strontium (Sr)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Thallium (Tl)	2011/06/17	ND, RDL=0.10		ug/L	
			Total Tin (Sn)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Titanium (Ti)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Uranium (U)	2011/06/17	ND, RDL=0.10		ug/L	
			Total Vanadium (V)	2011/06/17	ND, RDL=2.0		ug/L	
			Total Zinc (Zn)	2011/06/17	ND, RDL=5.0		ug/L	
		RPD	Total Arsenic (As)	2011/06/18	NC		%	25
			Total Barium (Ba)	2011/06/18	1.9		%	25
			Total Boron (B)	2011/06/18	NC		%	25
			Total Cadmium (Cd)	2011/06/18	NC		%	25
			Total Chromium (Cr)	2011/06/18	2.8		%	25
			Total Iron (Fe)	2011/06/18	NC		%	25

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2523114	DLB	RPD	Total Lead (Pb)	2011/06/18	2.3		%	25
			Total Manganese (Mn)	2011/06/18	4.1		%	25
			Total Selenium (Se)	2011/06/18	NC		%	25
			Total Uranium (U)	2011/06/18	NC		%	25
2523249	DLB	Matrix Spike	Total Aluminum (Al)	2011/06/18		111	%	80 - 120
			Total Antimony (Sb)	2011/06/18		102	%	80 - 120
			Total Arsenic (As)	2011/06/18		100	%	80 - 120
			Total Barium (Ba)	2011/06/18		94	%	80 - 120
			Total Beryllium (Be)	2011/06/18		100	%	80 - 120
			Total Bismuth (Bi)	2011/06/18		102	%	80 - 120
			Total Boron (B)	2011/06/18		110	%	80 - 120
			Total Cadmium (Cd)	2011/06/18		99	%	80 - 120
			Total Calcium (Ca)	2011/06/18		102	%	80 - 120
			Total Chromium (Cr)	2011/06/18		101	%	80 - 120
			Total Cobalt (Co)	2011/06/18		97	%	80 - 120
			Total Copper (Cu)	2011/06/18		NC	%	80 - 120
			Total Iron (Fe)	2011/06/18		109	%	80 - 120
			Total Lead (Pb)	2011/06/18		98	%	80 - 120
			Total Magnesium (Mg)	2011/06/18		103	%	80 - 120
			Total Manganese (Mn)	2011/06/18		100	%	80 - 120
			Total Molybdenum (Mo)	2011/06/18		102	%	80 - 120
			Total Nickel (Ni)	2011/06/18		98	%	80 - 120
			Total Phosphorus (P)	2011/06/18		111	%	80 - 120
			Total Potassium (K)	2011/06/18		107	%	80 - 120
			Total Selenium (Se)	2011/06/18		99	%	80 - 120
			Total Silver (Ag)	2011/06/18		102	%	80 - 120
			Total Sodium (Na)	2011/06/18		95	%	80 - 120
			Total Strontium (Sr)	2011/06/18		101	%	80 - 120
			Total Thallium (Tl)	2011/06/18		102	%	80 - 120
			Total Tin (Sn)	2011/06/18		99	%	80 - 120
			Total Titanium (Ti)	2011/06/18		103	%	80 - 120
			Total Uranium (U)	2011/06/18		104	%	80 - 120
			Total Vanadium (V)	2011/06/18		102	%	80 - 120
			Total Zinc (Zn)	2011/06/18		NC	%	80 - 120
		Spiked Blank	Total Aluminum (Al)	2011/06/18		111	%	80 - 120
			Total Antimony (Sb)	2011/06/18		97	%	80 - 120
			Total Arsenic (As)	2011/06/18		97	%	80 - 120
			Total Barium (Ba)	2011/06/18		95	%	80 - 120
			Total Beryllium (Be)	2011/06/18		101	%	80 - 120
			Total Bismuth (Bi)	2011/06/18		99	%	80 - 120
			Total Boron (B)	2011/06/18		98	%	80 - 120
			Total Cadmium (Cd)	2011/06/18		98	%	80 - 120
			Total Calcium (Ca)	2011/06/18		104	%	80 - 120
			Total Chromium (Cr)	2011/06/18		99	%	80 - 120
			Total Cobalt (Co)	2011/06/18		96	%	80 - 120
			Total Copper (Cu)	2011/06/18		98	%	80 - 120
			Total Iron (Fe)	2011/06/18		109	%	80 - 120
			Total Lead (Pb)	2011/06/18		96	%	80 - 120
			Total Magnesium (Mg)	2011/06/18		105	%	80 - 120
			Total Manganese (Mn)	2011/06/18		100	%	80 - 120
			Total Molybdenum (Mo)	2011/06/18		104	%	80 - 120
			Total Nickel (Ni)	2011/06/18		98	%	80 - 120
			Total Phosphorus (P)	2011/06/18		108	%	80 - 120
			Total Potassium (K)	2011/06/18		104	%	80 - 120
			Total Selenium (Se)	2011/06/18		99	%	80 - 120

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2523249	DLB	Spiked Blank	Total Silver (Ag)	2011/06/18		102	%	80 - 120
			Total Sodium (Na)	2011/06/18		97	%	80 - 120
			Total Strontium (Sr)	2011/06/18		99	%	80 - 120
			Total Thallium (Tl)	2011/06/18		101	%	80 - 120
			Total Tin (Sn)	2011/06/18		102	%	80 - 120
			Total Titanium (Ti)	2011/06/18		99	%	80 - 120
			Total Uranium (U)	2011/06/18		102	%	80 - 120
			Total Vanadium (V)	2011/06/18		101	%	80 - 120
			Total Zinc (Zn)	2011/06/18		98	%	80 - 120
		Method Blank	Total Aluminum (Al)	2011/06/18	ND, RDL=5.0		ug/L	
			Total Antimony (Sb)	2011/06/18	ND, RDL=1.0		ug/L	
			Total Arsenic (As)	2011/06/18	ND, RDL=1.0		ug/L	
			Total Barium (Ba)	2011/06/18	ND, RDL=1.0		ug/L	
			Total Beryllium (Be)	2011/06/18	ND, RDL=1.0		ug/L	
			Total Bismuth (Bi)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Boron (B)	2011/06/18	ND, RDL=50		ug/L	
			Total Cadmium (Cd)	2011/06/18	ND, RDL=0.017		ug/L	
			Total Calcium (Ca)	2011/06/18	ND, RDL=100		ug/L	
			Total Chromium (Cr)	2011/06/18	ND, RDL=1.0		ug/L	
			Total Cobalt (Co)	2011/06/18	ND, RDL=0.40		ug/L	
			Total Copper (Cu)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Iron (Fe)	2011/06/18	ND, RDL=50		ug/L	
			Total Lead (Pb)	2011/06/18	ND, RDL=0.50		ug/L	
			Total Magnesium (Mg)	2011/06/18	ND, RDL=100		ug/L	
			Total Manganese (Mn)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Molybdenum (Mo)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Nickel (Ni)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Phosphorus (P)	2011/06/18	ND, RDL=100		ug/L	
			Total Potassium (K)	2011/06/18	ND, RDL=100		ug/L	
			Total Selenium (Se)	2011/06/18	ND, RDL=1.0		ug/L	
			Total Silver (Ag)	2011/06/18	ND, RDL=0.10		ug/L	
			Total Sodium (Na)	2011/06/18	ND, RDL=100		ug/L	
			Total Strontium (Sr)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Thallium (Tl)	2011/06/18	ND, RDL=0.10		ug/L	
			Total Tin (Sn)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Titanium (Ti)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Uranium (U)	2011/06/18	ND, RDL=0.10		ug/L	
			Total Vanadium (V)	2011/06/18	ND, RDL=2.0		ug/L	
			Total Zinc (Zn)	2011/06/18	ND, RDL=5.0		ug/L	
		RPD	Total Arsenic (As)	2011/06/18	NC		%	25
			Total Barium (Ba)	2011/06/18	0.7		%	25
			Total Boron (B)	2011/06/18	NC		%	25
			Total Cadmium (Cd)	2011/06/18	NC		%	25
			Total Chromium (Cr)	2011/06/18	4.2		%	25
			Total Iron (Fe)	2011/06/18	NC		%	25
			Total Lead (Pb)	2011/06/18	2.1		%	25
			Total Manganese (Mn)	2011/06/18	NC		%	25
			Total Selenium (Se)	2011/06/18	NC		%	25
			Total Uranium (U)	2011/06/18	NC		%	25
2523541	DDE	Matrix Spike [JU8850-01]	Isobutylbenzene - Volatile	2011/06/20		89	%	70 - 130
			Benzene	2011/06/20		90	%	70 - 130
			Toluene	2011/06/20		85	%	70 - 130
			Ethylbenzene	2011/06/20		85	%	70 - 130
			Xylene (Total)	2011/06/20		87	%	70 - 130

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Quality Assurance Report (Continued)

Maxxam Job Number: DB185175

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2523541	DDE	Spiked Blank	Isobutylbenzene - Volatile	2011/06/20		98	%	70 - 130
			Benzene	2011/06/20		90	%	70 - 130
			Toluene	2011/06/20		85	%	70 - 130
			Ethylbenzene	2011/06/20		85	%	70 - 130
			Xylene (Total)	2011/06/20		87	%	70 - 130
		Method Blank	Isobutylbenzene - Volatile	2011/06/20		100	%	70 - 130
			Benzene	2011/06/20	ND, RDL=0.001		mg/L	
			Toluene	2011/06/20	ND, RDL=0.001		mg/L	
			Ethylbenzene	2011/06/20	ND, RDL=0.001		mg/L	
			Xylene (Total)	2011/06/20	ND, RDL=0.002		mg/L	
			C6 - C10 (less BTEX)	2011/06/20	ND, RDL=0.01		mg/L	
		RPD [JU8849-01]	Benzene	2011/06/17	NC		%	40
			Toluene	2011/06/17	NC		%	40
			Ethylbenzene	2011/06/17	NC		%	40
			Xylene (Total)	2011/06/17	NC		%	40
			C6 - C10 (less BTEX)	2011/06/17	NC		%	40
2523729	CRA	Matrix Spike	Total Organic Carbon (C)	2011/06/17		NC	%	80 - 120
		QC Standard	Total Organic Carbon (C)	2011/06/17		103	%	80 - 120
		Spiked Blank	Total Organic Carbon (C)	2011/06/17		101	%	80 - 120
		Method Blank	Total Organic Carbon (C)	2011/06/17	ND, RDL=0.5		mg/L	
		RPD	Total Organic Carbon (C)	2011/06/17	3.6		%	25
2523752	CRA	Matrix Spike [JU8847-02]	Total Organic Carbon (C)	2011/06/17		88	%	80 - 120
		QC Standard	Total Organic Carbon (C)	2011/06/17		99	%	80 - 120
		Spiked Blank	Total Organic Carbon (C)	2011/06/17		102	%	80 - 120
		Method Blank	Total Organic Carbon (C)	2011/06/17	ND, RDL=0.5		mg/L	
		RPD [JU8848-02]	Total Organic Carbon (C)	2011/06/17	NC		%	25
2524944	MJL	QC Standard	pH	2011/06/20		99	%	80 - 120
		Spiked Blank	pH	2011/06/20		98	%	N/A
		Method Blank	pH	2011/06/20	5.19		pH	
		RPD [JU8806-02]	pH	2011/06/20	0.8		%	25
2524945	MJL	QC Standard	Conductivity	2011/06/20		101	%	80 - 120
		Spiked Blank	Conductivity	2011/06/20		100	%	N/A
		Method Blank	Conductivity	2011/06/20	1, RDL=1		uS/cm	
		RPD [JU8806-02]	Conductivity	2011/06/20	0		%	25
2524946	MJL	QC Standard	pH	2011/06/20		99	%	80 - 120
		Spiked Blank	pH	2011/06/20		99	%	N/A
		Method Blank	pH	2011/06/20	5.29		pH	
		RPD [JU8855-02]	pH	2011/06/20	0.4		%	25
2524948	MJL	QC Standard	Conductivity	2011/06/20		101	%	80 - 120
		Spiked Blank	Conductivity	2011/06/20		101	%	N/A
		Method Blank	Conductivity	2011/06/20	ND, RDL=1		uS/cm	
		RPD [JU8855-02]	Conductivity	2011/06/20	0		%	25
2525104	SUK	Matrix Spike	Acid Extractable Calcium (Ca)	2011/06/20		NC (4)	%	75 - 125
			Acid Extractable Magnesium (Mg)	2011/06/20		105	%	75 - 125
			Acid Extractable Phosphorus (P)	2011/06/20		NC (4)	%	75 - 125
			Acid Extractable Potassium (K)	2011/06/20		98	%	75 - 125
			Acid Extractable Sodium (Na)	2011/06/20		104	%	75 - 125
			Acid Extractable Sulphur (S)	2011/06/20		112	%	75 - 125
		QC Standard	Acid Extractable Calcium (Ca)	2011/06/20		103	%	75 - 125
			Acid Extractable Magnesium (Mg)	2011/06/20		98	%	75 - 125
			Acid Extractable Phosphorus (P)	2011/06/20		120	%	75 - 125
			Acid Extractable Potassium (K)	2011/06/20		102	%	75 - 125
			Acid Extractable Sodium (Na)	2011/06/20		103	%	75 - 125
			Acid Extractable Sulphur (S)	2011/06/20		103	%	75 - 125

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Quality Assurance Report (Continued)

Maxxam Job Number: DB185175

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2525104	SUK	Method Blank	Acid Extractable Calcium (Ca)	2011/06/20	ND, RDL=50		ug/g	
			Acid Extractable Magnesium (Mg)	2011/06/20	ND, RDL=50		ug/g	
			Acid Extractable Phosphorus (P)	2011/06/20	ND, RDL=20		ug/g	
			Acid Extractable Potassium (K)	2011/06/20	ND, RDL=200		ug/g	
			Acid Extractable Sodium (Na)	2011/06/20	ND, RDL=100		ug/g	
			Acid Extractable Sulphur (S)	2011/06/20	ND, RDL=50		ug/g	
2525401	SPI	Matrix Spike						
		[JU8839-01]	Isobutylbenzene - Extractable	2011/06/21		100	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/21		109	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/21		88	%	N/A
			>C16-C21 Hydrocarbons	2011/06/21		99	%	N/A
			>C21-<C32 Hydrocarbons	2011/06/21		97	%	30 - 130
		Spiked Blank	Isobutylbenzene - Extractable	2011/06/21		98	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/21		108	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/21		95	%	N/A
			>C16-C21 Hydrocarbons	2011/06/21		108	%	N/A
			>C21-<C32 Hydrocarbons	2011/06/21		102	%	30 - 130
		Method Blank	Isobutylbenzene - Extractable	2011/06/21		100	%	30 - 130
			n-Dotriacontane - Extractable	2011/06/21		98	%	30 - 130
			>C10-C16 Hydrocarbons	2011/06/21	ND, RDL=0.05		mg/L	
			>C16-C21 Hydrocarbons	2011/06/21	ND, RDL=0.05		mg/L	
			>C21-<C32 Hydrocarbons	2011/06/21	ND, RDL=0.1		mg/L	
		RPD [JU8838-01]	>C10-C16 Hydrocarbons	2011/06/21	NC		%	40
			>C16-C21 Hydrocarbons	2011/06/21	NC		%	40
			>C21-<C32 Hydrocarbons	2011/06/21	NC		%	40
2525517	SSI	QC Standard	Turbidity	2011/06/20		100	%	80 - 120
		Method Blank	Turbidity	2011/06/20	ND, RDL=0.1		NTU	
		RPD	Turbidity	2011/06/20	NC		%	25
2525520	SSI	QC Standard	Turbidity	2011/06/20		98	%	80 - 120
		Method Blank	Turbidity	2011/06/20	ND, RDL=0.1		NTU	
		RPD	Turbidity	2011/06/20	8.5		%	25
2525632	JPU	QC Standard	Organic Carbon (TOC)	2011/06/20		99	%	75 - 125
		Method Blank	Organic Carbon (TOC)	2011/06/20	ND, RDL=0.2		g/kg	
		RPD	Organic Carbon (TOC)	2011/06/20	0.9		%	35
2526158	SBK	RPD	< -4 Phi (16 mm)	2011/06/22	0		%	25
			< -3 Phi (8 mm)	2011/06/22	0		%	25
			< -2 Phi (4 mm)	2011/06/22	0		%	25
			< -1 Phi (2 mm)	2011/06/22	0		%	25
			< 0 Phi (1 mm)	2011/06/22	0.5		%	25
			< +1 Phi (0.5 mm)	2011/06/22	2.0		%	25
			< +2 Phi (0.25 mm)	2011/06/22	1.1		%	25
			< +3 Phi (0.12 mm)	2011/06/22	0.2		%	25
			< +4 Phi (0.062 mm)	2011/06/22	1.5		%	25
			< +5 Phi (0.031 mm)	2011/06/22	11.9		%	25
			< +6 Phi (0.016 mm)	2011/06/22	5.2		%	25
			< +7 Phi (0.0078 mm)	2011/06/22	5.6		%	25
			< +8 Phi (0.0039 mm)	2011/06/22	4.0		%	25
			< +9 Phi (0.0020 mm)	2011/06/22	7.7		%	25
			Gravel	2011/06/22	NC		%	25
			Sand	2011/06/22	3.9		%	25
			Silt	2011/06/22	0.07		%	25
			Clay	2011/06/22	4.0		%	25

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.

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Quality Assurance Report (Continued)

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Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) Low level lab contamination. Minimal impact on data quality.
(2) Secondary RM is acceptable.
(3) Duplicate results meet low level duplicate acceptance criteria.
(4) Metals Analysis:The recovery in the matrix spike was not calculated (NC). Spiked concentration was less than 2x that native to the sample.

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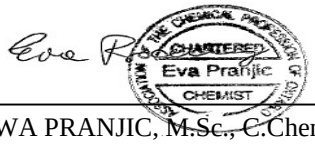
Validation Signature Page

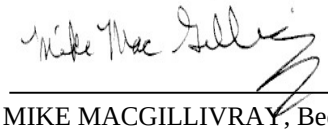
Maxxam Job #: B185175

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

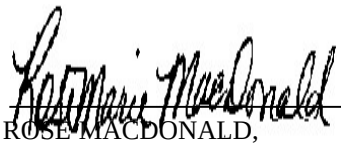


EWA PRANJIC, M.Sc., C.Chem, Scientific Specialist

COLLEEN ACKER,



MIKE MACGILLIVRAY, Bedford Inorg Spvsr



ROSE MACDONALD,

PAULA CHAPLIN, Project Manager

==========

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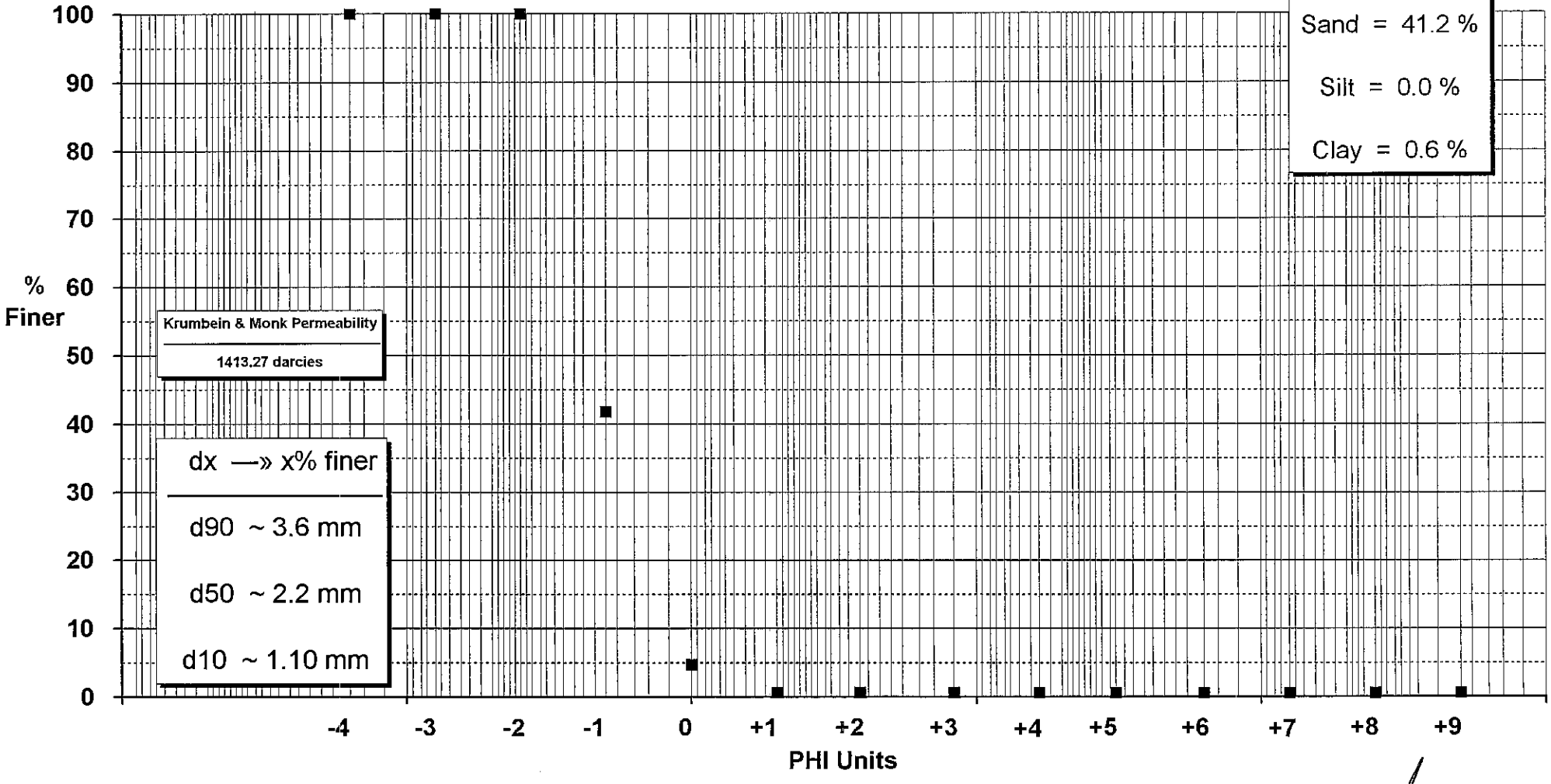
Maxxam ID: JV2794-01

SCS-005

Percent Coarser than 75 µm (PHI = 3.737)	Percent Coarser than 50 µm (PHI = 4.322)
99.4 %	99.4 %

Wentworth	
Gravel	58.2 %
Sand	41.2 %
Silt	0.0 %
Clay	0.6 %



Krumbein & Monk Permeability
1413.27 darcies

dx —» x% finer	
d90	~ 3.6 mm
d50	~ 2.2 mm
d10	~ 1.10 mm

Approved

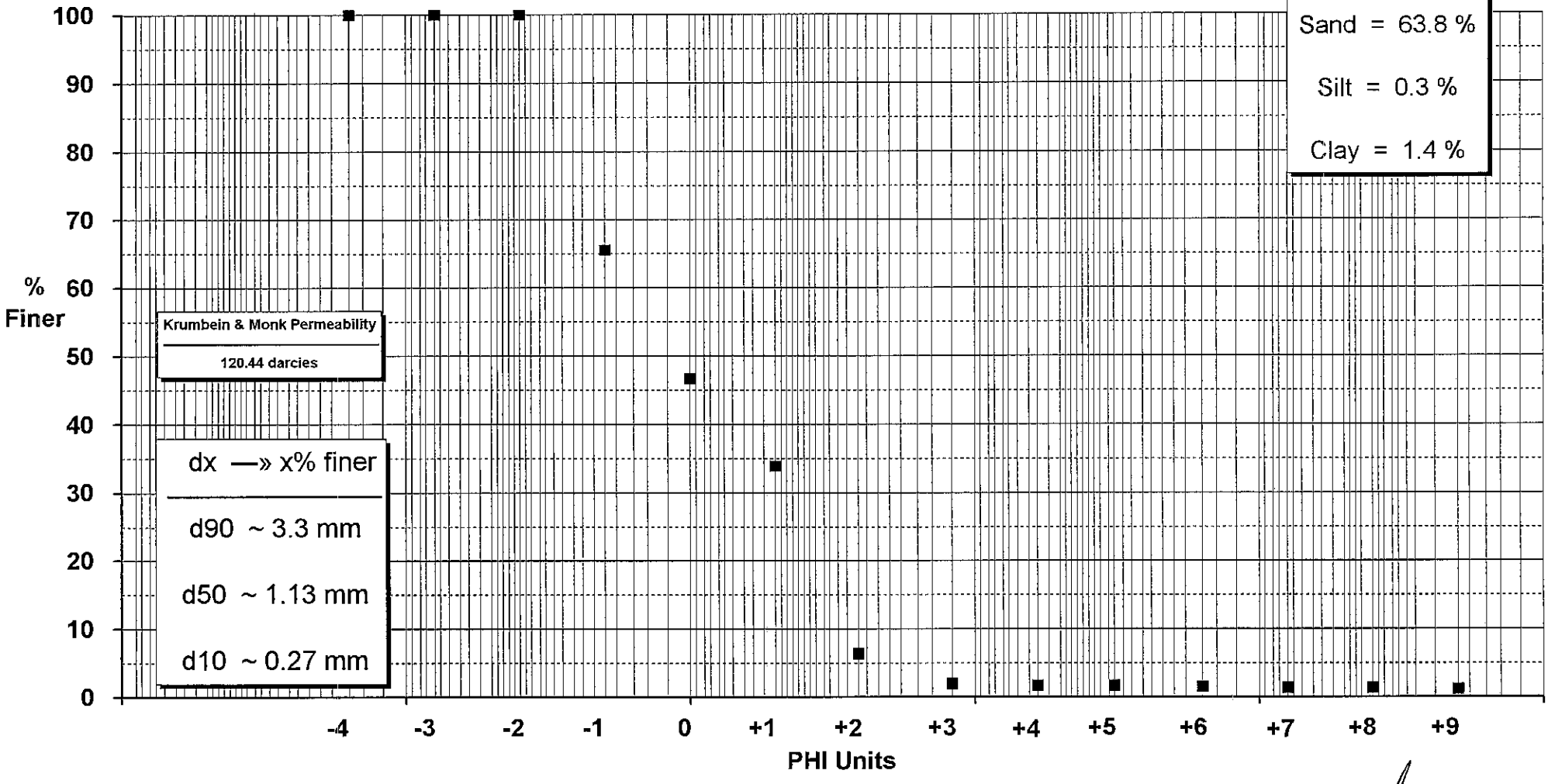
Maxxam

Maxxam ID: JV2814-01

SCS-006

Percent Coarser than 75 µm (PHI = 3.737)	Percent Coarser than 50 µm (PHI = 4.322)
98.2 %	98.3 %

Wentworth	
Gravel	= 34.5 %
Sand	= 63.8 %
Silt	= 0.3 %
Clay	= 1.4 %



Krumbein & Monk Permeability
120.44 darcies

dx —» x% finer
d90 ~ 3.3 mm
d50 ~ 1.13 mm
d10 ~ 0.27 mm

Approved

Maxxam

Maxxam ID: JV2815-01

SCS-007

Percent Coarser than 75 µm (PHI = 3.737)	Percent Coarser than 50 µm (PHI = 4.322)
99.3 %	99.3 %

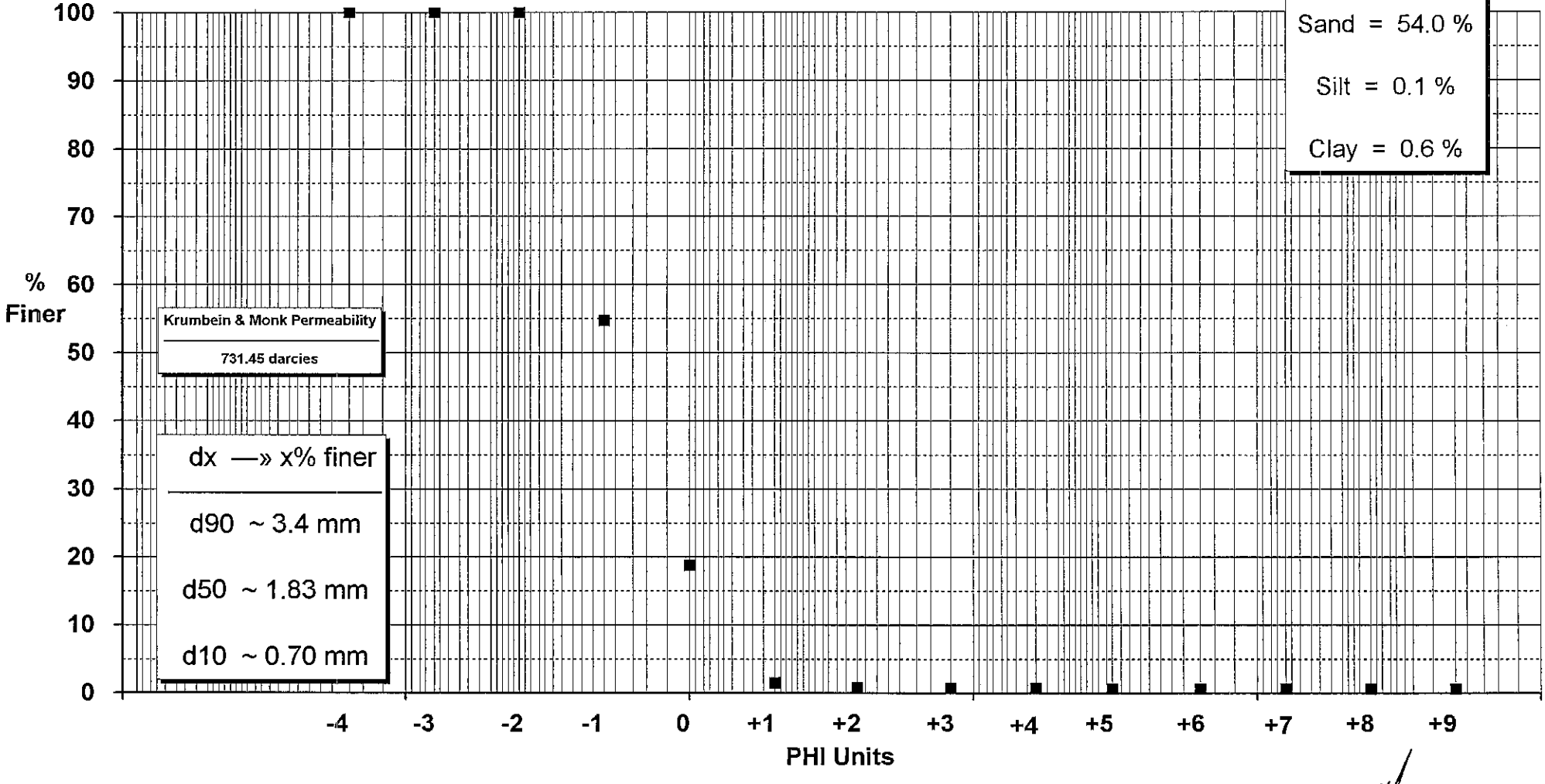
Wentworth

Gravel = 45.3 %

Sand = 54.0 %

Silt = 0.1 %

Clay = 0.6 %



Krumbein & Monk Permeability

731.45 darcies

dx —» x% finer

d90 ~ 3.4 mm

d50 ~ 1.83 mm

d10 ~ 0.70 mm

Approved

Maxxam

Maxxam ID: JV2816-01

SCS-008

Percent Coarser than 75 µm (PHI = 3.737)	Percent Coarser than 50 µm (PHI = 4.322)
99.1 %	99.1 %

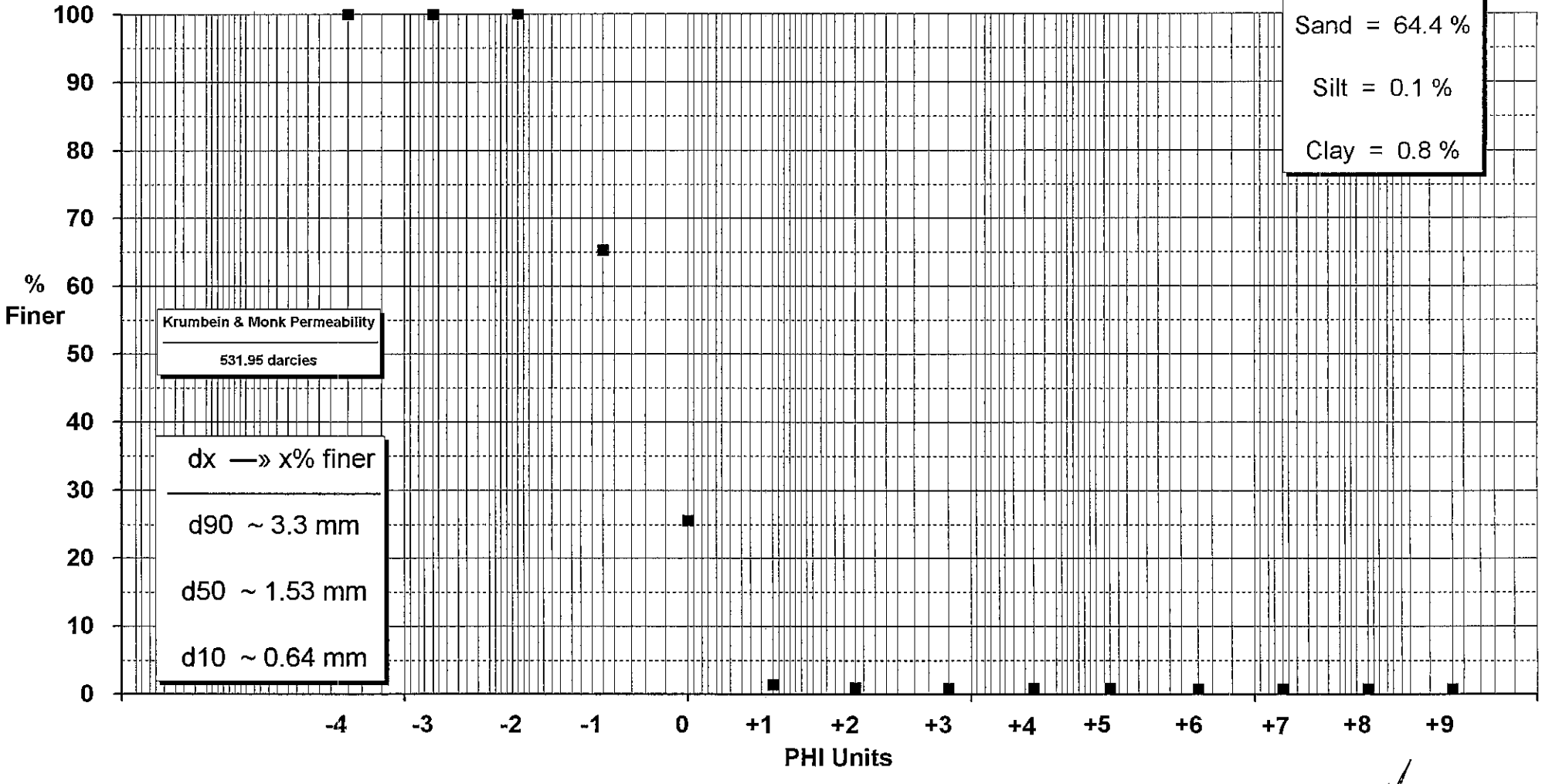
Wentworth

Gravel = 34.7 %

Sand = 64.4 %

Silt = 0.1 %

Clay = 0.8 %



Krumbein & Monk Permeability

531.95 darcies

dx —» x% finer

d90 ~ 3.3 mm

d50 ~ 1.53 mm

d10 ~ 0.64 mm

Approved

Maxxam

Maxxam ID: JV2817-01

S-001

Percent Coarser than 75 µm (PHI = 3.737)	Percent Coarser than 50 µm (PHI = 4.322)
98.1 %	98.2 %

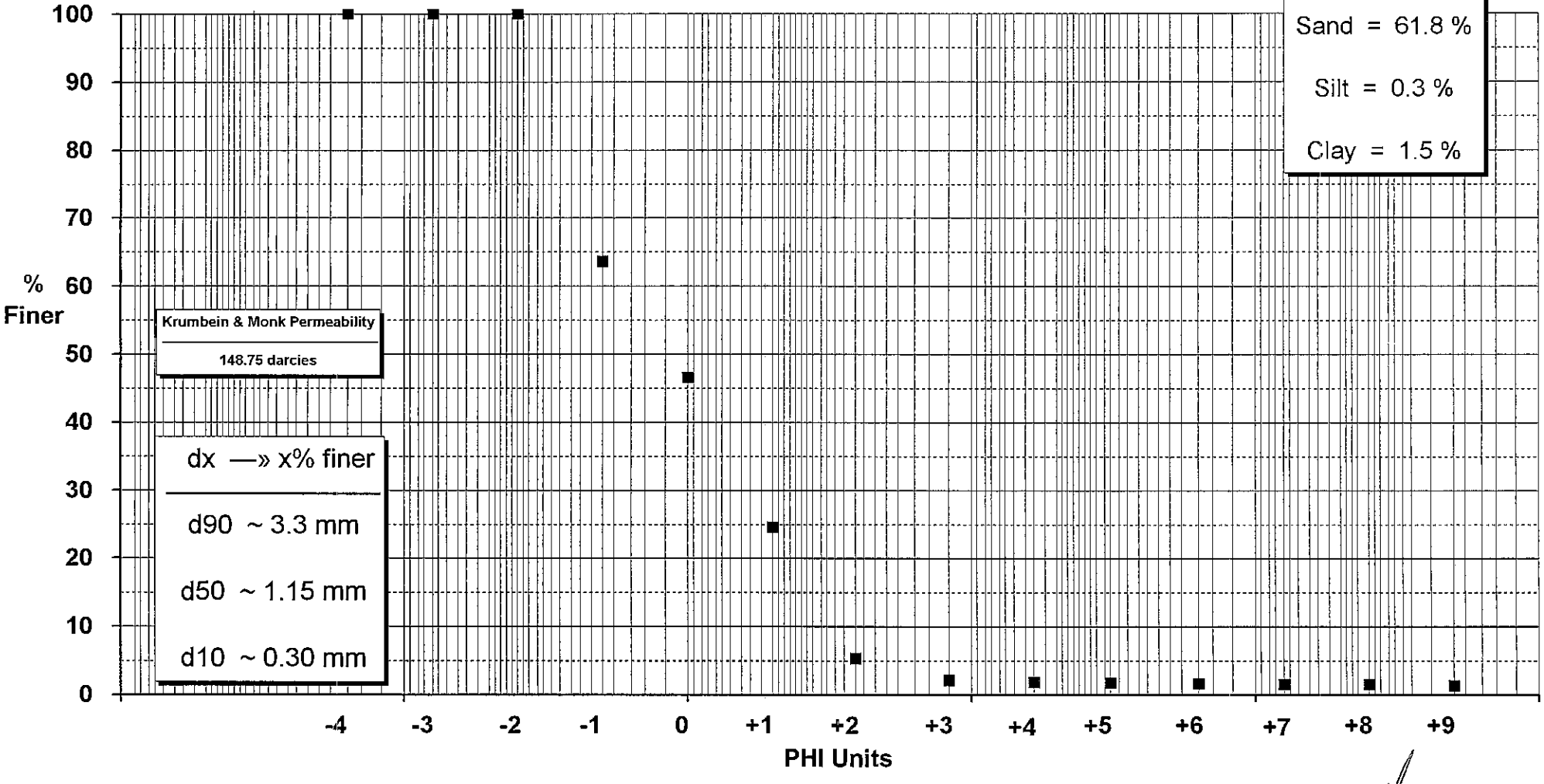
Wentworth

Gravel = 36.3 %

Sand = 61.8 %

Silt = 0.3 %

Clay = 1.5 %



Krumbein & Monk Permeability

148.75 darcies

dx —» x% finer

d90 ~ 3.3 mm

d50 ~ 1.15 mm

d10 ~ 0.30 mm

Approved

APPENDIX B

Benthic Invertebrate Data

Table B-1: Benthic Raw Data for Corridor: Shoal Cove Segment

Station	**NCS-001**	**NCS-002**	**NCS-004**	**NCS-005**
Percent Sampled	**50%**	**100%**	**100%**	**100%**
Species				
MOLLUSCA				
BIVALVIA				
Anomia squamula	19	11	2	5
Astarte undata	0	2	0	0
Bivalve unid.	0	1	0	2
Chlamys islandicus	0	1	0	1
Crenella? faba	0	1	0	0
Cyclocardia novaeangliae	2	2	0	0
Hiatella arctica	18	10	0	9
Modiolus modiolus	0	0	0	0
Mytilus edulis	0	0	0	0
GASTROPODA				
Bittium sp	0	0	0	0
Boreotrophon truncatus	0	1	0	2
Gastropod L	0	0	0	1
Gastropod M	2	0	0	0
Gastropod N	2	0	0	0
Gastropod unid.	2	1	1	2
Lacuna vincta	0	0	0	0
Lepeta caeca	0	0	0	2
Margarites groenlandicus	0	1	0	1
Nudibranch sp A	0	1	0	0
Nudibranch sp D	0	0	0	1
Onchidoris sp A	2	0	0	1
Puncturella noachina	4	5	0	5
Tachyrhynchus erosus	0	1	0	0
Trichotropis borealis	2	0	0	0
Velutina sp.	0	0	0	1
POLYPLACOPHORA				
Ischnochiton albus	2	2	2	2
Chiton unid	0	0	0	0
ANNELIDA				
POLYCHAETA				
Ampharetidae unid.	1	0	0	*0*
Aricidea sp.	0	0	0	1
Asabellides sp.	0	0	0	3
Cirratulidae unid.	2	1	0	0
Cirratulus sp.	0	0	0	1
Euchone sp.	0	0	0	1
Eumida sanquinea	2	8	0	7
Exogone spp.	6	5	9	33
Harmothoe extenuata	0	0	1	3
Maldanidae sp. D	1	0	0	1

Table B-1: Benthic Raw Data for Corridor: Shoal Cove Segment (Cont'd)

Station	**NCS-001**	**NCS-002**	**NCS-004**	**NCS-005**
Percent Sampled	**50%**	**100%**	**100%**	**100%**
Species				
Maldanidae sp. E	0	1	0	0
Maldanidae sp. F	2	0	0	0
Nereis sp.	0	0	0	1
Nereis virens	0	0	0	0
Nothria conchylega	0	2	0	0
Paraonidae? unid	1	0	0	0
Parougia caeca	0	0	0	2
Pectinaria granulata	0	1	0	0
Pholoe minuta	0	0	0	2
Phyllodoce maculata?	0	0	0	1
Phyllodocidae sp. C	0	0	0	4
Phyllodocidae sp. D	2	0	0	0
Polychaete sp. A	0	0	1	0
Polychaete sp. F	0	2	0	0
Polychaete sp G	2	0	0	0
Polychaete unid	1	1	0	0
Prionospio? sp	0	0	0	0
Sabellidae unid.	28	22	9	176
Spionidae unid	0	0	0	0
Spirorbidae	1038	385	31	213
Syllidae unid.	12	8	11	114
Terebellidae unid.	0	0	0	4
Thelepus cincinnatus	4	3	0	0
ARCHIANNELIDA				
Archiannelid unid.	0	0	0	0
OLIGOCHAETA				
MARINE OLIGOCHAETE	16	4	0	0
ECHINODERMATA				
Leptasterias polaris	0	0	0	2
Ophiopholis aculeata (Ophiuroid A)	5	24	5	26
Ophiura robusta (Ophiuroid B)	4	20	1	52
Ophiuroid C	2	0	0	4
Ophiuroid D	0	0	0	7
Ophiuroid F?	0	2	0	0
Psolus phantapus	0	0	0	1
Strongylocentrotus droebachiensis?	0	2	1	0
Strongylocentrotus pallidus	1	4	1	3
Strongylocentrotus sp.	0	0	0	1
ARTHROPODA				
CRUSTACEA				
AMPHIPODA				
Amphilochus manudens	0	3	0	0

Table B-1: Benthic Raw Data for Corridor: Shoal Cove Segment (Cont'd)

Station	**NCS-001**	**NCS-002**	**NCS-004**	**NCS-005**
Percent Sampled	**50%**	**100%**	**100%**	**100%**
Species				
Amphilochus? sp.	2	0	0	0
Anonyx sarsi (=Anonyx sp A, 2010)	0	0	0	1
Caprellid sp. B	0	0	0	1
Dulichia porrecta	0	0	0	1
Ericthonius rubricornis	12	0	34	177
Eurystheus melanops	2	0	0	7
Ischyrocerus commensalis	0	0	4	36
Ischyrocerus megalops	0	0	0	1
Ischyrocerus sp.	2	0	0	2
Ischyroceridae unid	0	0	5	37
Jassa falcata (Ischyrocerus sp A)	2	0	1	2
Metopa boecki?	0	0	1	6
Metopa longicornis	0	0	0	1
Metopa norvegica	0	0	0	84
Metopa sp.	0	0	0	5
Metopa sp. D	0	0	2	0
Odius carinatus	0	1	0	0
Parapleustes pulchellus?	6	0	0	0
Photis sp.	0	0	0	1
Pleustidae sp. A	0	0	0	2
Pleustidae unid.	0	0	1	0
Stenothoidae unid.	28	5	0	122
Tiron spiniferum	2	0	0	0
Amphipod unid.	2	2	2	2
ISOPODA				
Edotea montosa?	0	0	0	1
Isopod sp. C	0	0	0	1
Jaera marina	0	0	0	0
Munna fabricii	12	0	0	0
Munna kroyeri	2	4	6	29
Pleurogonium spinosissimum	0	0	0	1
Synidotea nodulosa	0	0	0	2
CIRRIPEDIA				
Balanus sp	0	0	0	2
Barnacle unid	0	0	0	2
CHELICERATA				
PYCNOGONIDA				
Nymphon rubrum?	0	1	0	3
Pseudopallene? discoidea	4	1	0	5
Pycnogonid B	0	0	0	3
Pycnogonid C	1	0	0	0

Table B-1: Benthic Raw Data for Corridor: Shoal Cove Segment (Cont'd)

Station	**NCS-001**	**NCS-002**	**NCS-004**	**NCS-005**
Percent Sampled	**50%**	**100%**	**100%**	**100%**
Species				
BRACHIOPODA				
Glaciarcula spitzbergensis?	0	2	0	0
Hermithiris psittacea	6	1	0	0
Brachiopod sp B	0	0	0	2
NEMERTEA				
Cerebratulus sp.	0	9	0	0
Cerebratulus? sp.	0	0	0	1
Nemertean sp. F	0	1	0	0
Nemertean sp. G	2	0	0	0
Nemertean unid	2	0	0	0
SIPUNCULIDEA				
Phascolion strombi	0	0	0	2
CNIDARIA				
Anemone sp. B	0	0	0	1
Anemone sp. C	0	0	0	1
Anemone unid.	2	0	0	0
Gersemia rubiformis	0	0	1	91
Hydroid unid.	2	0	0	11
HEMICHORDATA				
Hemichordate? sp. 1	0	0	0	0
CHORDATA				
Ascidia callosa?	0	0	2	6
Ascidian sp. B	0	0	3	23
Ascidian sp. C	0	0	0	11
Ascidian sp. D	0	0	0	3
Ascidian sp. E	0	0	0	2
Ascidian sp. F	0	0	0	22
Ascidian sp. G	0	0	0	1
Ascidian sp. H	1	0	0	0
Ascidian juvenile, unid?	0	0	0	32
Ascidian Unid.	2	0	0	1
PORIFERA				
Scypha sp. A	0	0	0	4
Scypha sp. B	0	0	0	1
Porifera sp A?	0	0	0	12
Porifera sp C?	0	0	0	23
Porifera sp D?	0	0	1	6
Porifera sp E	0	0	0	20
Porifera sp F	0	0	1	12
Porifera sp G	0	0	0	5
Porifera sp H	0	0	0	12

Table B-1: Benthic Raw Data for Corridor: Shoal Cove Segment (Cont'd)

Station	**NCS-001**	**NCS-002**	**NCS-004**	**NCS-005**
Percent Sampled	**50%**	**100%**	**100%**	**100%**
Species				
PLATYHELMINTHES				
Flatworm sp. B	0	0	0	0
Flatworm sp. C	8	3	1	4
MISCELLANEOUS				
Unidentified Taxon A	0	0	0	1
Unidentified Taxon B	14	0	0	0
MEIOFAUNA, PLANKTON & ALGAE				
Bryozoa	Present	Present	Present	Present
Hydrozoa, branching	Present	Present	0	0
Harpacticoid Copepod	4	1	1	9
Egg cases	Present	Present	0	Present
Fish Lice	10	2	0	0
Hydrachnidia	0	0	1	8
Ostracoda	0	0	0	3
Nematoda	8	9	18	129
Foraminifera	Present	Present	Present	Present
Hard Coral	0	0	0	Present
Algae - *Corallina officinalis*	0	0	0	0

Table B-2: Benthic Raw Data for Shoal Cove

Station	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**
Percent Sampled	**50**	**12.5**	**50**	**50**
Species				
MOLLUSCA				
BIVALVIA				
Anomia squamula	0	0	0	0
Astarte undata	0	0	0	0
Bivalve unid.	0	0	0	0
Chlamys islandicus	0	0	0	0
Crenella? faba	0	0	0	0
Cyclocardia novaeangliae	0	0	0	0
Hiatella arctica	0	0	0	0
Modiolus modiolus	0	0	6	0
Mytilus edulis	2	0	0	0
GASTROPODA				
Bittium sp	0	0	4	0
Boreotrophon truncatus	0	0	0	0
Gastropod L	0	0	0	0
Gastropod M	0	0	0	0
Gastropod N	0	0	0	0
Gastropod unid.	0	0	0	0
Lacuna vincta	0	0	0	4
Lepeta caeca	0	0	0	0
Margarites groenlandicus	0	0	0	0
Nudibranch sp A	0	0	0	0
Nudibranch sp D	0	0	0	0
Onchidoris sp A	0	0	0	0
Puncturella noachina	0	0	0	0
Tachyrhynchus erosus	0	0	0	0
Trichotropis borealis	0	0	0	0
Velutina sp.	0	0	0	0
POLYPLACOPHORA				
Ischnochiton albus	0	0	0	0
Chiton unid	0	0	2	0
ANNELIDA				
POLYCHAETA				
Ampharetidae unid.	0	0	0	0
Aricidea sp.	0	0	0	0
Asabellides sp.	0	0	0	0
Cirratulidae unid.	0	0	0	0
Cirratulus sp.	0	0	0	0
Euchone sp.	0	0	0	0
Eumida sanquinea	0	0	0	0
Exogone spp.	0	0	0	0
Harmothoe extenuata	0	0	0	0
Maldanidae sp. D	0	0	0	0

Table B-2: Benthic Raw Data for Shoal Cove (Cont'd)

Station	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**
Percent Sampled	**50**	**12.5**	**50**	**50**
Species				
Maldanidae sp. E	0	0	0	0
Maldanidae sp. F	0	0	0	0
Nereis sp.	0	0	0	0
Nereis virens	0	2	0	0
Nothria conchylega	0	0	0	0
Paraonidae? unid	0	0	0	0
Parougia caeca	0	0	0	0
Pectinaria granulata	0	0	0	0
Pholoe minuta	0	0	0	0
Phyllodoce maculata?	0	0	0	0
Phyllodocidae sp. C	0	0	0	0
Phyllodocidae sp. D	0	0	0	0
Polychaete sp. A	0	0	0	0
Polychaete sp. F	0	0	0	0
Polychaete sp G	0	0	0	0
Polychaete unid	0	0	0	0
Prionospio? sp	0	0	2	0
Sabellidae unid.	0	0	0	0
Spionidae unid	2	0	0	0
Spirorbidae	0	0	0	0
Syllidae unid.	0	0	0	0
Terebellidae unid.	0	0	0	0
Thelepus cincinnatus	0	0	0	0
ARCHIANNELIDA				
Archiannelid unid.	0	0	0	2
OLIGOCHAETA				
Marine Oligochaete	0	41619	152	102
ECHINODERMATA				
Leptasterias polaris?	0	0	0	0
Ophiopholis aculeata (Ophiuroid A)	0	0	0	0
Ophiura robusta (Ophiuroid B)	0	0	0	0
Ophiuroid C	0	0	0	0
Ophiuroid D	0	0	0	0
Ophiuroid F?	0	0	0	0
Psolus phantapus	0	0	0	0
Strongylocentrotus droebachiensis?	0	0	0	0
Strongylocentrotus pallidus	0	0	0	0
Strongylocentrotus sp.	0	0	0	0
ARTHROPODA				
CRUSTACEA				
AMPHIPODA				
Amphilochus manudens	0	0	0	0
Amphilochus? sp.	0	0	0	0

Table B-2: Benthic Raw Data for Shoal Cove (Cont'd)

Station	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**
Percent Sampled	**50**	**12.5**	**50**	**50**
Species				
Anonyx sarsi (=Anonyx sp A, 2010)	0	0	0	0
Caprellid sp. B	0	0	0	0
Dulichia porrecta	0	0	0	0
Ericthonius rubricornis	0	0	0	0
Eurystheus melanops	0	0	0	0
Ischyrocerus commensalis	0	0	0	0
Ischyrocerus megalops	0	0	0	0
Ischyrocerus sp.	0	0	0	0
Ischyroceridae unid	0	0	0	0
Jassa falcata (Ischyrocerus sp A)	0	0	0	0
Metopa boecki?	0	0	0	0
Metopa longicornis	0	0	0	0
Metopa norvegica	0	0	0	0
Metopa sp.	0	0	0	0
Metopa sp. D	0	0	0	0
Odius carinatus	0	0	0	0
Parapleustes pulchellus?	0	0	0	0
Photis sp.	0	0	0	0
Pleustidae sp. A	0	0	0	0
Pleustidae unid.	0	0	0	0
Stenothoidae unid.	0	0	0	0
Tiron spiniferum	0	0	0	0
Amphipod unid.	0	0	0	0
ISOPODA				
Edotea montosa?	0	0	0	0
Isopod sp. C	0	0	0	0
Jaera marina	0	0	2	2
Munna fabricii	0	0	0	0
Munna kroyeri	0	0	0	0
Pleurogonium spinosissimum	0	0	0	0
Synidotea nodulosa	0	0	0	0
CIRRIPEDIA				
Balanus sp	0	0	0	0
Barnacle unid	0	0	0	0
CHELICERATA				
PYCNOGONIDA				
Nymphon rubrum?	0	0	0	0
Pseudopallene? discoidea	0	0	0	0
Pycnogonid B	0	0	0	0
Pycnogonid C	0	0	0	0
BRACHIOPODA				
Glaciarcula spitzbergensis?	0	0	0	0
Hermithiris psittacea	0	0	0	0

Table B-2: Benthic Raw Data for Shoal Cove (Cont'd)

Station	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**
Percent Sampled	**50**	**12.5**	**50**	**50**
Species				
Brachiopod sp B	0	0	0	0
NEMERTEA				
Cerebratulus sp.	0	0	0	0
Cerebratulus? sp.	0	0	0	0
Nemertean sp. F	0	0	0	0
Nemertean sp. G	0	0	0	0
Nemertean unid	0	0	22	0
SIPUNCULIDEA				
Phascolion strombi	0	0	0	0
CNIDARIA				
Anemone sp. B	0	0	0	0
Anemone sp. C	0	0	0	0
Anemone unid.	0	0	0	0
Gersemia rubiformis	0	0	0	0
Hydroid unid.	0	0	0	0
HEMICHORDATA				
Hemichordate? sp. 1	6	0	182	14
CHORDATA				
Ascidia callosa?	0	0	0	0
Ascidian sp. B	0	0	0	0
Ascidian sp. C	0	0	0	0
Ascidian sp. D	0	0	0	0
Ascidian sp. E	0	0	0	0
Ascidian sp. F	0	0	0	0
Ascidian sp. G	0	0	0	0
Ascidian sp. H	0	0	0	0
Ascidian juvenile, unid?	0	0	0	0
Ascidian Unid.	0	0	0	0
PORIFERA				
Scypha sp. A	0	0	0	0
Scypha sp. B	0	0	0	0
Porifera sp A?	0	0	0	0
Porifera sp C?	0	0	0	0
Porifera sp D?	0	0	0	0
Porifera sp E	0	0	0	0
Porifera sp F	0	0	0	0
Porifera sp G	0	0	0	0
Porifera sp H	0	0	0	0
PLATYHELMINTHES				
Flatworm sp. B	12	0	26	16
Flatworm sp. C	0	0	0	0
MISCELLANEOUS				
Unidentified Taxon A	0	0	0	0

Table B-2: Benthic Raw Data for Shoal Cove (Cont'd)

Station	**SCS-005**	**SCS-006**	**SCS-007**	**SCS-008**
Percent Sampled	**50**	**12.5**	**50**	**50**
Species				
Unidentified Taxon B	0	0	0	0
MEIOFAUNA, PLANKTON & ALGAE				
Bryozoa	0	0	0	0
Hydrozoa, branching	0	0	0	0
Harpacticoid Copepod	0	0	0	0
Egg cases	0	0	0	0
Fish Lice	0	0	0	0
Hydrachnidia	0	0	0	0
Ostracoda	0	0	0	0
Nematoda	0	2734.4	44	0
Foraminifera	0	0	0	0
Hard Coral	0	0	0	0
Algae - *Corallina officinalis*	Present	0	Present	Present

APPENDIX C

Underwater Video Transect Data

Table C-1. Description of Transects for the Underwater Video Survey in the Submarine Cable Crossing Corridor: Central Segment, June 2011

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
7	T1	16:15:12 -16:17:26	69	0	69
7	T2	16:17:27 - 16:28:12	176	0	176
7	T3	16:29:22 - 16:38:54	250	8	230
7	T4	16:38:55 - 16:49:12	250	11	223
7	T5	16:49:13 - 16:59:24	250	20	200
7	T6	16:59:25 - 17:08:00	250	43	143
7	T7	17:08:01 - 17:16:48	250	22	195
7	T8	17:16:49 - 17:19:48	81	25	61
8	T9	17:20:12 - 17:26:18	175	9	159
8	T10	17:27:00 - 17:33:52	184	3	184
8	T11a	17:34:54 - 17:35:24	9	0	9
8	T11b	17:36:10 - 17:37:20	28	0	28
8	T11c	17:38:08 - 17:38:32	10	0	10
8	T12	17:39:36 - 17:48:12	250	6	235
8	T13	17:48:14 - 17:55:50	25	0	25
8	T14	17:55:52 - 18:01:20	192	4	184
8	T15	18:01:46 - 18:03:40	58	0	58
8	T16	18:04:06 - 18:08:24	135	0	135

Notes:
[1]video was not interpretable owing to distance off bottom, water clarity, speed of video camera, contact with the seafloor, and other reasons.
[2]length of video analyzed included total transect length minus the proportion that was deemed not interpretable.

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T1	69	Deep subtidal 90-120 m	276	100 - 110	Gravel (50%), Cobble (50%)	Medium	Stalked sea squirt (*Boltenia* sp.) (U), Sea anemone (*Actiniaria* sp.)(U), unidentified crab (U), Sunstar (*Crossaster* sp.) (U), Soft Coral (*Gersemia* sp.) (U)	No Flora Observed	No Flora Observed
T2	176	Deep subtidal 90-120 m	704	100 - 110	Gravel (50%), Cobble (40%), Boulder (10%)	Medium	Sea anemone (O), Stalked sea squirt (*Boltenia* sp.)(O), Soft Coral (*Gersemia* sp.) (U), Unidentified crab (U), Brittle star (Ophiuroidea sp.)(U), Sunstar (*Crossast*er sp.) (U), Snow crab (*Chionoecetes opilio)*(U), Hydroid (U), Basket star (*Gorgonocephalus* sp.)(U), Sea star (*Asterias* sp.)(U), Scallop (Pectinidae sp.)(U)	Coralline algae (< 5%) Brown algae (< 5%)	Total Macrofloral coverage less than 5%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T3	230	Deep subtidal 90-120 m	920	100 - 110	Cobble (50%), Gravel (40%), Boulder (10%)	Medium	Sea anemone (*Actiniaria* sp.)(O), Sunstar (C*rossaster* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(O), Brittle star (Ophiuroidea sp.)(U), Basket star (*Gorgonocephalus* sp.)(U), Soft Coral (*Gersemia* sp.) (U), Sponge (Porifera)(U), unidentified crab (U), Scallop (Pectinidae sp.)(U), Sculpin (*Myoxocephalus* sp.)(U)	Coralline algae (< 5%)	Total Macrofloral coverage less than 5%
T4	223	Deep subtidal 90-120 m	892	100 - 110	Cobble (50%), Gravel (30%), Boulder (20%)	Medium	Brittle star (Ophiuroidea sp.)(C), Sea anemone (*Actiniaria* sp.)(O), Stalked sea squirt (*Boltenia* sp.)(O), Basket star *(Gorgonocephalus* sp.)(O), unidentified crab (U), Sea star (*Asterias* sp.)(U), Sponge (Porifera)(U), Sunstar (*Crossaster* sp.) (U), Soft Coral (*Gersemia* sp.) (U), scallop (Pectinidae*)*(U)	Coralline algae (< 5%)	Total Macrofloral Coverage – 5%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T5	200	Deep subtidal 90-120 m	800	100 - 110	Cobble (50%), Gravel (40%) Boulder (10%)	Medium	Sunstar (*Crossaster* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(O), Basket star (*Gorgonocephalus* sp.)(U), Brittle star (Ophiuroidea sp.)(U), Soft Coral (*Gersemia* sp.) (U), Sea anemone (*Actiniaria* sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Polar sea star (*Leptasterias polaris)*(U), sponges (Porifera*)*(U), unidentified crab (U),	Coralline Algae (10%)	Red Algae - 10%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T6	143	Deep subtidal 90-120 m	572	100 - 110	Cobble (50%), Gravel (30%), Boulder (20%)	Medium	Sunstar (*Crossaster* sp.) (O), Sea anemone (*Actiniaria* sp.)(O), Brittle star (Ophiuroidea sp.)(U), unidentified crab (U), Sea urchin (*Strongylocentrotus* sp.)(U), unidentified small fish (U), Sponge (Porifera)(U), Polar sea star *(Leptasterias polaris*)(U), Stalked sea squirt (*Boltenia* sp.)(U), Soft Coral (*Gersemia* sp.) (U), Toad crab (*Hyas* sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U)	Coralline Algae (20%)	Red Algae – 20%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T7	195	Deep subtidal 90-120 m	780	100 - 110	Cobble (50%), Gravel (40%), Boulder (10%)	Medium	Sea anemone (*Actiniaria* sp.)(O), Sunstar (*Crossaster* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(U), Sponge (Porifera)(U), unidentified crab (U), Sculpin (*Myoxocephalus* sp.)(U), Polar sea star *(Leptasterias polaris)*(U), Brittle star (Ophiuroidea sp.)(U), Soft Coral (*Gersemia* sp.) (U), Toad crab (*Hyas* sp.)(U)	Coralline Algae (10%)	Red Algae – 10%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T8	61	Deep subtidal 90-120 m	244	100 - 110	Cobble (50%), Gravel (40%), Boulder (10%)	Medium	Stalked sea squirt (*Boltenia* sp.)(O), unidentified crab (U), Sea anemone (*Actiniaria* sp.)(U), Snow crab (*Chionoecetes opilio)*(U), Sponge(Porifera)(U), Brittle star (Ophiuroidea sp.)(U), Toad crab (*Hyas* sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U)	Coralline Algae (< 1%)	Total Macrofloral coverage less than 5%
T9	159	Deep subtidal 90-120 m	636	100 - 110	Cobble (50%), Gravel (25%), Boulder (25%)	Medium	unidentified crab (O), Stalked sea squirt (*Boltenia* sp.)(O), Sunstar (*Crossaster* sp.) (U), Snow crab (*Chionoecetes opilio)*(U), Brittle star (Ophiuroidea sp.)(U), Sea anemone (Actiniaria sp.)(U), Skate (U), Sea urchin (*Strongylocentrotus* sp.)(U)	Brown algae (< 5%) Coralline algae (< 5%)	Total Macrofloral coverage less than 5%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T10	184	Deep subtidal 90-120 m	736	100 - 110	Cobble (50%), Gravel (40%), Boulder (10%)	Medium	Soft Coral (*Gersemia* sp.) (C), Sunstar (*Crossaster* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(O), Sea anemone (*Actiniaria* sp.)(O), Sponge (Porifera)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Snow crab (*Chionoecetes opilio*)(U), Brittle star (Ophiuroidea sp.)(U), unidentified crab (U), Scallop (Pectinidae sp.)(U)	Brown algae (<1%)	Total Macrofloral coverage less than 5%
T11a	9	Deep subtidal 90-120 m		100 - 110	Cobble (50%), Gravel (50%)	Medium	No Fauna Observed	No Flora Observed	No Flora Observed

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T11b	28	Deep subtidal 90-120 m	112	100 - 110	Cobble (50%), Gravel (40%), Boulder (10%)	Medium	Sea anemone (*Actiniaria* sp.)(U), Soft Coral (*Gersemia* sp.) (U), Sunstar – (*Crossaster* sp.) (U), unidentified crab (U)	Brown Algae (< 1%)	Total Macrofloral coverage less than 5%
T11c	10	Deep subtidal 90-120 m	40	100 - 110	Cobble (50%), Gravel (50%)	Medium	Sea urchin (*Strongylocentrotus* sp.)(U), sponge (Porifera)(U), Sunstar (*Crossaster* sp.) (U), Brittle star (Ophiuroidea sp.)(U)	No Flora Observed	No Flora Observed

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T12	235	Deep subtidal 90-120 m	940	100 - 110	Cobble (50%), Gravel (35%), Boulder (15%)	Medium	Sunstar (*Crossaster* sp.) (O), Soft Coral (*Gersemia* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(O), unidentified crab (O), sponge (Porifera)(U), Sea anemone (*Actiniaria* sp.)(U), Toad crab (*Hyas* sp.)(U), Snow crab (*Chionoecetes opilio*)(U), Scallop (Pectinidae sp.)(U), Sea star (*Asterias* sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U)	Coralline Algae (< 5%)	Total Macrofloral coverage less than 5%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T13	25	Deep subtidal 90-120 m	100	90 - 100	Cobble (50%), Gravel (50%)	Medium	Sunstar (*Crossaster* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(O), Sea anemone (*Actiniaria* sp.)(O), Soft Coral (*Gersemia* sp.) (O), unidentified crab (U), Sea star (*Asterias* sp.)(U), Sponge (Porifera)(U), Brittle star (Ophiuroidea sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Spider crab (U) Scallop (Pectinidae sp.)(U), unidentified small fish (U)	Coralline algae (< 5%), Brown algae (< 5%)	Total Macrofloral coverage less than 5%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T14	184	Deep subtidal 90-120 m	736	90 – 100	Cobble (40%), Gravel (5%), Boulder (35%), Rubble (5%), Shells (15%)	Medium	Scallop (Pectinidae sp.)(C), Brittle star (Ophiuroidea sp.)(O), Stalked sea squirt (*Boltenia* sp.)(O), unidentified crab (O), Sea anemone (*Actiniaria* sp.)(O), Sunstar (*Crossaster* sp.) (O), Soft Coral (*Gersemia* sp.) (U), Sponge (Porifera)(U), Flatfish (U), Sand dollar (*Echniarachnius parma)*(U), Basket star (*Gorgonocephalus* sp.)(U)	Coralline algae (5%) Brown algae (5%)	Red Algae -5% Brown Algae – 5%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T15	58	Deep subtidal 90-120 m	232	90 – 100	Cobble (25%), Gravel (5%) Boulder (70%)	Coarse	Scallop (Pectinidae sp.)(O), Soft Coral (*Gersemia* sp.)(O), Stalked sea squirt (*Boltenia* sp.)(O), sponge (Porifera)(O), Sea anemone (*Actiniaria* sp.)(O), Sunstar (*Crossaster* sp.)(U), unidentified crab (U), Brittle star (Ophiuroidea sp.)(U), Basket star (*Gorgonocephalus* sp.)(U)	Coralline algae (< 5%) Brown algae (< 5%)	Total Macrofloral coverage less than 5%

Table C-2. Transect Summaries for the Underwater Video in the Submarine Cable Crossing Corridor: Central Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T16	135	Deep subtidal 90-120 m	540	90 - 100	Cobble (50%), Gravel (30%) Boulder (20%)	Medium	Scallop (Pectinidae sp.)(A) Sea anemone (*Actiniaria* sp.)(C), unidentified crab (O), Brittle star (Ophiuroidea sp.)(O), Soft Coral (*Gersemia* sp.) (U), Stalked sea squirt (*Boltenia* sp.)(U), Basket star (*Gorgonocephalus* sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), sponge (Porifera)(U), Sunstar (*Crossaster* sp.) (U)	Coralline algae (< 5%) Brown algae (<5%)	Total Macrofloral coverage less than 5%

Notes:
[1] after AMEC (2010)
[2] after Kelly et al. (2009, draft)
[3] estimated abundance as A = Abundant, C = Common, O = Occasional and U = Uncommon
[4] estimated abundance as % coverage

Table 1. Description of Transects for the Underwater Video in the Submarine Corridor: Shoal Cove Segment

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
1	T17	13:06:16 - 13:09:12	74	15	63
1	T18	13:55:58 - 14:09:42	250	5	238
1	T19	14:09:44 - 14:24:06	250	3	243
1	T20	14:24:08 - 14:39:18	250	0	250
1	T21	14:39:20 - 14:54:24	295	34	195
2	T22	16:02:26 - 16:10:10	167	16	140
2	T23	16:10:40 - 16:19:16	267	25	200
2	T24	16:19:56 - 16:26:54	199	11	177
2	T25	16:27:56 - 16:35:32	201	5	191
2	T26	16:52:24 - 16:57:40	250	23	192
2	T27	16:57:42 - 17:11:34	308	0	308
2	T28	17:11:36 - 17:17:00	213	47	113
3	T29	17:18:34 - 17:20:22	51	0	51
3	T30	17:20:24 - 17:28:28	250	0	250
3	T31	17:28:30 - 17:35:48	250	0	250
3	T32	17:35:50 - 17:42:54	250	0	250
3	T33	17:42:56 - 17:50:22	250	0	250
3	T34	17:50:24 - 17:58:26	250	0	250
3	T35	17:58:28 - 18:06:02	250	0	250
3	T36	18:06:04 - 18:13:06	250	0	250
3	T37	18:13:08 - 18:19:30	245	0	245
4	T38	18:56:24 - 18:57:18	47	0	47
4	T39	19:05:58 - 19:12:48	275	56	121
4	T40	19:28:10 - 10:33:36	250	46	135
4	T41	10:33:38 - 10:38:58	250	5	237
4	T42	10:39:00 - 10:41:40	116	0	116
4	T43	10:42:12 - 10:43:22	49	25	37
4	T44	10:43:52 - 10:49:28	250	4	240
4	T45	10:49:30 - 10:55:10	250	0	250
4	T46	10:55:12 - 11:00:20	250	0	250
4	T47	11:00:22 - 11:05:26	250	0	250

Table C-3. Description of Transects for the Underwater Video in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
4	T48	11:05:28 - 11:10:08	250	0	250
4	T49	11:10:10 - 11:15:08	250	11	222
4	T50	11:15:10 - 11:18:56	188	0	188
5	T51	11:20:18 - 11:25:14	250	0	250
5	T52	11:25:16 - 11:30:24	250	0	250
5	T53	11:30:26 - 11:36:06	250	0	250
5	T54	11:36:08 - 11:42:36	250	12	220
5	T55	11:42:38 - 11:48:34	250	0	250
5	T56	11:48:36 - 11:54:56	250	2	245
5	T57	11:54:58 - 12:02:32	250	0	250
5	T58	12:02:34 - 12:10:40	250	0	250
5	T59	12:10:42 - 12:19:18	250	0	250
5	T60	12:19:20 - 12:22:46	101	43	58

Notes:

[1]video was not interpretable owing to distance off bottom, water clarity, speed of video camera, contact with the seafloor, and other reasons.

[2]length of video analyzed included total transect length minus the proportion that was deemed not interpretable.

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T17	63	Deep Subtidal 90 - 120	252	100 - 110	Cobble (45%), Gravel (45%), Shells (10%)	Medium	Brittle star (Ophiuroidea sp.)(O), Soft coral *(Gersemia* sp.) (U), Sea anemone (Actiniaria sp.)(U), Toad crab (*Hyas* sp.)(U), Sea star (*Asterias* sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Unidentified fish (U),	Coralline algae (< 5%) Red filamentous algae (< 5%)	Total Macrofloral (Red Algae) coverage less than 5%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T18	238	Deep Subtidal 90 - 120	952	100 - 110	Cobble (55%), Gravel (35%) Boulder (10%)	Medium	Soft coral (*Gersemia* sp.) (A), Brittle star (Ophiuroidea sp.)(A), Sea anemone (Actiniaria sp.)(C), Basket star (*Gorgonocephalus* sp.)(O), Sunstar (*Crossaster* sp.) (O), Sea urchin (*Strongylocentrotus* sp.)(O), Sponge (Porifera)(O), Stalked sea squirt (*Boltenia* sp.)(O), Basket star (*Gorgonocephalus* sp.)(O), Sand dollar (*Echniarachnius parma)*(O), Unidentified crab (U), Snow crab (*Chionoecetes opilio)*(U), Scallop (Pectinidae sp.)(U), Sea star (*Asterias* sp.)(U), unidentified soft coral (U), unidentified crab (U), Unidentified shrimp (U), Toad crab (*Hyas* sp.) (U) Polar sea star (*Leptasterias polaris)* (U),	Brown filamentous algae (<5%), Calcareous encrusting Rhodophyta (10%), Red filamentous algae (<5%), Coralline algae (<5%),	Red Algae – 15%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T19	243	Deep Subtidal 90 - 120	972	100 - 110	Cobble (55%), Gravel (25%) Boulder (20%)	Medium	Soft coral (*Gersemia* sp.) (A), Brittle star (Ophiuroidea sp.)(A), Sea anemone (Actiniaria sp.) (C), Scallop (Pectinidea sp.)(C), Sea urchin (*Strongylocentrotus* sp.)(O), Sponge (Porifera)(O), Basket star (*Gorgonocephalus* sp.)(O), Sunstar (*Crossaster* sp.) (O), unidentified crab (O), Unidentified fish (U), Sea star (*Asterias* sp.)(U), Sand dollar (*Echniarachnius parma)*(U), Stalked sea squirt (*Boltenia* sp.)(U), Polar sea star (*Leptasterias polaris*) (U),	Calcareous encrusting Rhodophyta (10%), Red filamentous algae (<5%), Brown filamentous algae (<5%), Coralline algae (<5%)	Red Algae – 15%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T20	250	Deep Subtidal 90 – 120	1,000	100 - 110	Cobble (55%), Gravel (25%) Boulder (20%)	Medium	Sea anemone (A), Brittle star (Ophiuroidea sp.)(A), Soft coral (*Gersemia* sp.) (A), Scallop (Pectinidae sp.)(C), Basket star (*Gorgonocephalus* sp.)(O), Sunstar (*Crossaster* sp.) (O), other coral (U), Sea urchin (*Strongylocentrotus* sp.)(O), Sand dollar (*Echniarachnius parma)*(O), Stalked sea squirt (*Boltenia* sp.)(U), Polar sea star (*Leptasterias polaris)*(U), Sculpin (*Myoxocephalus* sp.)(U) unidentified crab (U), Sponge (Porifera*)*(U), fish (U), Sea star (*Asterias* sp.)(U), Toad crab (*Hyas* sp.)(U) Stalked sea squirt (*Boltenia* sp.)(U),	Calcareous encrusting Rhodophyta (15%), Red filamentous algae (<5%), Lithothamnium (<5%), Coralline algae (<5%), Brown algae (<5%)	Red Algae – 15%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T21	195	Deep Subtidal 90 - 120	780	100 - 110	Cobble (55%), Gravel (25%) Boulder (20%)	Medium	Soft coral (*Gersemia* sp.) (A Scallop (Pectinidae sp.)(C), Sea anemone (Actiniaria sp.) (C), Brittle star (*Ophiuroidea* sp.)(C), Basket star (*Gorgonocephalus* sp.)(O), Sunstar (*Crossaster* sp.) (O) Sponge (*Porifera)*(O), unidentified crab (O), Polar sea star (*Leptasterias polaris)*(U), Sand dollar (*Echniarachnius parma)*(U), Sea urchin (*Strongylocentrotus* sp.)(U), Stalked sea squirt (*Boltenia* sp.)(U), Sea star (*Asterias* sp.)(U),	Calcareous encrusting Rhodophyta (10%), Red filamentous algae (<5%), Lithothamnium (<5%)	Red Algae – 15%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T22	140	Deep Subtidal 90 - 120	560	90 – 100	Cobble (55%), Gravel (35%), Boulder (10%)	Medium	Brittle star (*Ophiuroidea* sp.)(C), Soft coral (*Gersemia* sp.) (C), Sea anemone (*Actiniaria* sp.) (C), Sea urchin (*Strongylocentrotus* sp.)(O), Sunstar (*Crossaster* sp.) (O), Basket star (*Gorgonocephalus* sp.)(O), unidentified crab (U), other coral (U), Polar sea star (*Leptasterias polaris)*(U), Sponge (Porifera*)*(U), Stalked sea squirt (*Boltenia* sp.)(U)	Calcareous encrusting Rhodophyta (10%), Lithothamnium (<5%)	Red Algae – 10%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T23	200	Deep Subtidal 90 - 120	800	90 - 100	Cobble (60%), Gravel (20%), Boulder (10%)	Medium	Brittle star (*Ophiuroidea* sp.)(A), Scallop (Pectinidae sp.)(A), Soft coral (*Gersemia* sp.) (C), Sunstar (*Crossaster* sp.) (O), Sea anemone (*Actiniaria* sp.) (O), Sea urchin (*Strongylocentrotus* sp.)(O), Basket star (*Gorgonocephalus* sp.)(O), Stalked sea squirt (*Boltenia* sp.)(O), unidentified crab (U), unidentified fish (U), Polar sea star (*Leptasterias polaris)*(U), Sand dollar (*Echniarachnius parma)*(U), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U), Toad crab (*Hyas* sp.)(U)	Calcareous encrusting Rhodophyta (10%), Red filamentous algae (< 5%)	Red Algae – 10%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T24	177	Deep Subtidal 90 - 120	708	100 – 110	Cobble (70%), Boulder (30%)	Medium	Brittle star (*Ophiuroidea* sp.)(A), Soft coral (*Gersemia* sp.) (C), Scallop (Pectinidae sp.)(C), Sea anemone (Actiniaria sp.) (C), Sea urchin (*Strongylocentrotus* sp.)(O), Basket star (*Gorgonocephalus* sp.)(O), Sunstar (*Crossaster* sp.) (O), unidentified crab (U), unidentified fish (U), Polar sea star (*Leptasterias polaris)*(U), Sponge (Porifera)(U), Stalked sea squirt (*Boltenia* sp.)(U), Sea star (*Asterias* sp.)(U)	Calcareous encrusting Rhodophyta (25%), Coralline algae (< 1%) Red filamentous algae (< 1%)	Red Algae – 25%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T25	191	Deep Subtidal 90 - 12	764	100 - 110	Cobble (75%), Gravel (5%), Boulder (20%)	Medium	Brittle star (*Ophiuroidea* sp.)(A), Soft coral (*Gersemia* sp.) (A), Scallop (Pectinidae sp.)(C), Sea anemone (Actiniaria sp.) (C), Basket Star (*Gorgonocephalus* sp.)(O), Sunstar *(Crossaster* sp.) (O), Sea urchin (*Strongylocentrotus* sp.)(O), unidentified crab (O), Sponge (Porifera)(O), Polar sea star (*Leptasterias polaris)*(U), Snow crab (*Chionoecetes opilio)*(U), Stalked sea squirt (Boltenia sp.)(U),	Calcareous encrusting Rhodophyta (20%), Coralline algae (5%), Red filamentous algae (< 5%) Lithothamnium (< 5%)	Red Algae – 30%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T26	192	Deep Subtidal 90 - 120	768	100 - 110	Cobble (50%), Boulder (40%), Gravel (10%),	Medium	Brittle star (*Ophiuroidea* sp.)(C), Sea anemone (*Actiniaria* sp.) (O), Sea urchin (*Strongylocentrotus* sp.)(O), Soft coral (*Gersemia* sp.) (O), Basket Star (*Gorgonocephalus* sp.)(O), unidentified crab (U), Polar sea star (*Leptasterias* polaris*)*(U), Scallop (Pectinidae sp.)(U) Snow crab (*Chionoecetes opilio)*(U), Sponge (Porifera)(U) Sea star (*Asterias* sp.)(U), Sunstar *(Crossaster* sp.) (U)	Calcareous encrusting Rhodophyta (20%), Red filamentous algae (10%), Coralline algae (<1%)	Red Algae – 30%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T27	308	Deep Subtidal 90 - 120	1232	100 – 110	Cobble (70%), Gravel (5%), Boulder (25%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Soft coral (*Gersemia* sp.) (A), Brittle star (*Ophiuroidea* sp.)(C), Scallop (Pectinidae sp.)(C), Sea urchin (*Strongylocentrotus* sp.)(O), Sponge (Porifera)(O) Sunstar (*Crossaster* sp.) (O), Polar sea star (*Leptasterias polaris)*(O), Basket star (*Gorgonocephalus* sp.)(O), unidentified crab (O), unidentified fish (U), Sand dollar (*Echniarachnius parma)*(U), Sculpin (*Myoxocephalus* sp.)(U), Stalked sea squirt (*Boltenia* sp.)(U), Sea star (*Asterias* sp.)(U)	Calcareous encrusting Rhodophyta (30%), Coralline algae (10%), Red filamentous algae (10%), Lithothamnium (< 5%), Brown Filamentous algae (< 5%)	Red Algae – 50%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T28	113	Deep Subtidal 90 - 120	452	95 – 105	Cobble (55%), Boulder (45%)	Medium	Sea anemone (*Actiniaria* sp.) (O), Soft coral (*Gersemia* sp.) (O), Brittle star (*Ophiuroidea* sp.)(O), Sponge (Porifera)(O), unidentified crab (U), Polar sea star (*Leptasterias polaris)*(U), Scallop (Pectinidae sp.)(U), Stalked sea squirt (*Boltenia* sp.)(U), Sunstar (*Crossaster* sp.) (U), Basket star (*Gorgonocephalus* sp.)(U)	Calcareous encrusting Rhodophyta (60%), Coralline algae (5%), Red filamentous algae (5%)	Red Algae – 70%
T29	51	Deep Subtidal 90 - 120	204	90 - 100	Cobble (50%), Boulder (50%)	Medium, Coarse	Sea anemone (*Actiniaria* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(U), Sponge (Porifera)(U), Sunstar (*Crossaster* sp.) (U)	Calcareous encrusting Rhodophyta (10%), Red filamentous algae (20%)	Red Algae – 30%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T30	250	Deep Subtidal 90 – 120	1000	90 - 100	Cobble (80%), Boulder (20%)	Medium	Scallop(Pectinidae sp.)(C), Brittle star (Ophiuroidea sp.)(C), Sea anemone (*Actiniaria* sp.) (O), Soft coral (*Gersemia* sp.) (O), Basket star(*Gorgonocephalus* sp.)(U), Stalked sea squirt (*Boltenia* sp.)(U), unidentified crab (U), unidentified fish (U), Sand dollar (*Echniarachnius parma)*(U), Polar sea star (*Leptasterias polaris)*(U), Sea urchin (*Stronglyocentrotus* sp.)(U), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U), Sunstar (*Crossaster* sp.) (U)	Calcareous encrusting Rhodophyta (25%), Coralline algae (10%), Red filamentous algae (30%)	Red Algae – 65%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T31	250	Deep Subtidal 90 – 120	1000	90 – 100	Cobble (75%), Boulder (25%)	Medium	Scallop (Pectinidae sp.)(C), Sea anemone (*Actiniaria* sp.) (O), Brittle star (Ophiuroidea sp.)(O), Soft coral (*Gersemia* sp.) (O), Stalked sea squirt (*Boltenia* sp.)(U), unidentified crab (U), unidentified fish (U) Polar sea star (*Leptasterias polaris)*(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U), Sunstar (*Crossaster* sp.) (U),	Calcareous encrusting Rhodophyta (30%), Coralline algae (10%), Red filamentous algae (40%), *Lithothamnium* (<5%),	Red Algae – 80%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T32	250	Deep Subtidal 90 – 120	1000	90 – 100	Cobble (85%), Boulder (15%)	Medium	Brittle star (Ophiuroidea sp.)(C), Scallop (Pectinidae sp.)(C), Polar sea star (*Leptasterias polaris)*(O), Sea anemone (*Actiniaria* sp.) (O), Sea urchin (*Strongylocentrotus* sp.)(O), Sunstar (*Crossaster* sp.) (O), Soft coral (*Gersemia* sp.) (O), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U), unidentified crab (U), Sand dollar (*Echniarachnius parma)*(U),	Calcareous encrusting Rhodophyta (40%), Coralline algae (10%), Red filamentous algae (25%),	Red Algae – 75%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T33	250	Deep Subtidal Zone, 60 - 90 m Deep Subtidal Zone 90 - 120 m	1000	85 – 95	Cobble (80%), Boulder (20%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Brittle star (Ophiuroidea sp.)(C), Sea urchin (*Strongylocentrotus* sp.)(C), Scallop (Pectinidae sp.)(C), Soft coral (*Gersemia* sp.) (O), Polar sea star (*Leptasterias polaris*)(O) Sand dollar (*Echniarachnius parma*)(O), Sunstar (*Crossaster* sp.) (O), Sponge (Porifera)(O), Stalked sea squirt (*Boltenia* sp.)(U), unidentified crab (U), Sea star (*Asterias* sp.)(U), Toad crab (*Hyas* sp.)(U),	Calcareous encrusting Rhodophyta (40%), Coralline algae (5%), Red filamentous algae (25%), *Lithothamnium* sp. (<5%)	Red Algae – 70%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T34	250	Deep Subtidal Zone, 60 - 90 m	1000	80 - 90	Cobble (60%), Boulder (40%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Brittle star (Ophiuroidea sp.)(C), Soft coral (*Gersemia* sp.) (O), Sponge (Porifera)(O), Sunstar (*Crossaster* sp.) (O), unidentified crab (U), Polar sea star (*Leptasterias polaris)*(U), Sea urchin (*Strongylocentrotus* sp.)(O), Sea star (*Asterias* sp.)(U), Toad crab (*Hyas* sp.)(U) Stalked sea squirt (*Boltenia* sp.)(U),	Calcareous encrusting Rhodophyta (40%), Coralline algae (30%), Red filamentous algae (10%), *Lithothamnium* sp. (5%)	Red Algae – 80%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T35	250	Deep Subtidal Zone, 60 - 90 m	1000	80 – 90	Cobble (60%), Boulder (40%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Scallop (Pectinidae sp.)(C), Brittle star (Ophiuroidea sp.)(O), Sunstar (*Crossaster* sp.) (O), Sea urchin (*Strongylocentrotus* sp.)(O), Soft coral (*Gersemia* sp.) (O), Sponge (Porifera)(O), Sea cucumber (U), Sea star (*Asterias* sp.)(U), Stalked sea squirt (*Boltenia* sp.)(U), unidentified crab (U), Gadoid fish (U), Polar sea star (*Leptasterias polaris)*(U),	Calcareous encrusting Rhodophyta (45%), Coralline algae (30%), Red filamentous algae (10%), *Lithothamnium* sp. (<5%),	Red Algae – 85%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T36	250	Deep Subtidal Zone, 60 - 90 m	1000	80 - 90	Cobble (70%), Boulder (30%)	Medium	Sea anemone (*Actiniaria* sp.) (C), Sunstar (*Crossaster* sp.) (O) Brittle star (Ophiuroidea sp.)(O), Polar sea star (*Leptasterias polaris)*(O), Sea urchin (*Strongylocentrotus* sp.)(O), Sponge (Porifera)(O), Sea star (*Asterias* sp.)(U), Sculpin (*Myoxocephalus* sp.)(U), Soft coral (*Gersemia* sp.) (U), unidentified crab (U), unidentified fish (U),	Calcareous encrusting Rhodophyta (35%), Coralline algae (15%), Red filamentous algae (25%), *Lithothamnium* sp. (5%)	Red Algae – 80%
T37	245	Deep Subtidal Zone, 60 - 90 m	980	80 - 90	Cobble (55%), Boulder (45%)	Medium	Sea anemone (*Actiniaria*.) (C), Sponge (Porifera)(O), unidentified crab (O), Sunstar (*Crossaster* sp.) (O), unidentified fish (U), Polar sea star (*Leptasterias polaris)*(U), Scallop (Pectinidae sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sea star (*Asterias* sp.)(U), Stalked sea squirt (*Boltenia* sp.)(U)	Calcareous encrusting Rhodophyta (45%), Red filamentous algae (15%), Coralline algae (<5%), *Lithothamnium* sp. (<5%)	Red Algae – 65%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T38	47	Deep Subtidal Zone, 60 - 90 m	188	80 - 90	Gravel (50%), Cobble (50%)	Medium	Soft coral (*Gersemia* sp.) (O), unidentified crab (U), Polar sea star (*Leptasterias polaris)*(U), Sea anemone (*Actiniaria* sp.) (U), Sunstar (*Crossaster* sp.) (U),	No Flora Observed	No Flora Observed
T39	121	Deep Subtidal Zone, 60 - 90 m	484	80 - 90	Cobble (70%), Boulder (30%),	Medium	Sea anemone (*Actiniaria* sp.) (O), Sponge (Porifera)(O), Stalked sea squirt (*Boltenia* sp.)(U), Unidentified fish (U), Scallop (Pectinidae sp.)(U), Polar sea star (*Leptasterias polaris)*(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sea star (*Asterias* sp.)(U), Sunstar (*Crossaster* sp.) (U)	Calcareous encrusting Rhodophyta (25%), Red filamentous algae (25%), Coralline algae (<5%), *Lithothamnium* sp. (<5%),	Red Algae – 55%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T40	135	Deep Subtidal Zone, 60 - 90 m	540	80 - 90	Cobble (45%), Boulder (15%), Gravel (40%),	Medium	Brittle star (Ophiuroidea sp.)(O), Scallop (Pectinidae sp.)(O), Sea anemone (*Actiniaria* sp.) (O), Sea urchin (*Strongylocentrotus* sp.)(O), unidentified crab (U), unidentified fish (U), Polar sea star (*Leptasterias polaris)*(U), Snow crab (*Chionoecetes opilio)*(U), Soft coral *(Gersemia* sp.) (U), Sea star (*Asterias* sp.)(U), Sunstar (*Crossaster* sp.)(U)	Red filamentous algae (35%), Calcareous encrusting Rhodophyta (<5%), Coralline algae (<5%)	Red Algae – 40%
T41	237	Deep Subtidal Zone, 60 - 90 m	948	80 - 90	Cobble (80%), Boulder (10%), Gravel (5%), Sand (5%)	Medium	Sea anemone (Actiniaria sp.) (C), Brittle star (Ophiuroidea sp.)(O), unidentified crab (U), unidentified fish (U), Polar sea star (*Leptasterias polaris)*(U), Sea urchin (*Strongylocentrotus* sp.)(U), Soft coral (*Gersemia* sp) (U), Sunstar (*Crossaster* sp.) (U)	Calcareous encrusting rhodophyta (55%), Red filamentous algae (10%), *Lithothamnium* sp. (<5%)	Red Algae – 65%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T42	116	Deep Subtidal Zone, 60 - 90 m	464	75 - 85	Cobble (70%), Boulder (20%), Sand (10%),	Medium	Sea anemone (*Actiniaria* sp.) (C), Brittle star (Ophiuroidea sp.)(U), unidentified crab (U), Polar sea star (*Leptasterias polaris)*(U), Sea urchin (*Strongylocentrotus* sp.)(U), Soft coral (*Gersemia* sp.) (U), Sea star (*Asterias* sp.)(U) Sunstar (*Crossaster* sp.) (U)	Coralline algae (25%), Calcareous encrusting Rhodophyta (<5%), Red filamentous algae (<5%),	Red Algae – 30%
T43	37	Deep Subtidal Zone, 60 - 90 m	148	70 - 80	Cobble (80%), Boulder (15%), Sand (5%),	Medium	Sea anemone (*Actiniaria* sp.) (O)	Red Filamentous Algae (55%)	Red Algae – 55%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T44	240	Deep Subtidal Zone, 60 - 90 m	960	70 - 80	Cobble (85%), Boulder (15%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Sunstar (*Crossaster* sp.) (O) Sea urchin (*Strongylocentrotus* sp.)(O), Polar sea star (*Leptasterias polaris*)(O), Scallop (Pectinidae sp.)(O), Brittle star (Ophiuroidea sp.)(U), unidentified crab (U), Soft coral (*Gersemia* sp.) (U), Sea star (*Asterias* sp.)(U)	Calcareous encrusting Rhodophyta (25%), Red filamentous algae (15%), Coralline algae (5%), *Lithothamnium* sp. (<5%)	Red Algae – 40%
T45	250	Deep Subtidal Zone, 60 - 90 m	1000	70 - 80	Cobble (95%), Boulder (5%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Scallop (Pectinidae sp.)(C), Sea urchin (*Strongylocentrotus* sp.)(O), Sunstar (*Crossaster* sp.) (O), Brittle star (Ophiuroidea sp.)(O), Polar sea star (*Leptasterias polaris*)(O), Sand dollar (*Echniarachnius parma*)(O), Soft coral (*Gersemia* sp.) (U), Sea star (*Asterias* sp.)(U)	Calcareous encrusting Rhodophyta (30%), Red filamentous algae (25%), Coralline algae (<5%)	Red Algae - 55%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T46	250	Deep Subtidal Zone, 60 - 90 m	1000	70 - 80	Cobble (75%), Boulder (25%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Sunstar (*Crossaster* sp.) (O), Brittle star (Ophiuroidea sp.)(U), unidentified crab (U), Polar sea star (*Leptasterias polaris*)(U), Scallop (Pectinidae sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U)	Calcareous encrusting Rhodophyta (45%), Red filamentous algae (25%) Coralline algae (<5%),	Red Algae – 70%
T47	250	Deep Subtidal Zone, 60 - 90 m	1000	70 - 80	Cobble (85%), Boulder (15%)	Medium	Sea anemone (*Actiniaria* sp.) (A), Sunstar (*Crossaster* sp). (O), unidentified crab (U), unidentified fish (U) Sand dollar (*Echniarachnius parma*)(U), Polar sea star (*Leptasterias polaris*)(U), Scallop (Pectinidae sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Soft coral *(Gersemia* sp). (U), Sea star (*Asterias* sp.)(U),	Calcareous encrusting Rhodophyta (30%), Red filamentous algae (35%)	Red Algae – 65%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T48	250	Deep Subtidal Zone, 60 - 90 m	1000	70 - 80	Cobble (70%), Boulder (30%)	Medium	Sea anemone (Actiniaria sp.) (C), Sunstar (*Crossaster* sp.) (O), Polar sea star (*Leptasterias polaris*)(O), Brittle star (Ophiuroidea sp.)(O), Unidentified crab (U), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U)	Red filamentous algae (50%), Calcareous encrusting Rhodophyta (35%),	Red Algae – 85%
T49	222	Deep Subtidal Zone, 60 - 90 m	888	70 - 80	Cobble (70%), Boulder (25%), Gravel (5%)	Medium	Scallop (Pectinidae sp.)(C), Sea anemone (Actiniaria sp.) (O), Polar sea star (*Leptasterias polaris*)(O), Sunstar (*Crossaster* sp.) (O), unidentified crab (U), unidentified fish (U), Sand dollar (*Echniarachnius parma*)(U), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U),	Calcareous encrusting Rhodophyta (25%), Red filamentous algae (35%)	Red Algae – 60%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T50	188	Deep Subtidal Zone, 60 - 90 m	752	70 - 80	Cobble (90%), Boulder (10%)	Medium	Sea anemone (*AcItiniaria* sp.) (C), Soft coral *(Gersemia* sp.) (O), Brittle star (Ophiuroidea sp.)(O), Polar sea star (*Leptasterias polaris*)(O), Scallop (Pectinidae sp.)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sponge (Porifera)(U), Sea star (*Asterias* sp.)(U), Sunstar (*Crossaster sp.)* (U)	Red filamentous algae (55%), Calcareous encrusting Rhodophyta (10%), Coralline algae (<5%)	Red Algae – 65%
T51	250	Deep Subtidal Zone, 60 - 90 m	1000	60 - 70	Cobble (60%), Boulder (40%)	Medium	Sea anemone (*Actiniaria* sp.) (C), Sunstar (*Crossaster* sp.) (O), Brittle star (Ophiuroidea sp.)(U), Polar sea star (*Leptasterias polaris*)(U), Scallop (Pectinidae sp.)(U), Sponge (Porifera)(U), Soft coral (*Gersemia* sp.) (U)	Red filamentous algae (85%), Calcareous encrusting Rhodophyta (10%), Coralline algae (5%),	Red Algae – 100%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T52	250	Deep Subtidal Zone, 60 - 90 m	1000	60 - 70	Cobble (70%), Boulder (30%)	Medium	Scallop (Pectinidae sp.)(C), Sea anemone (Actiniaria sp.) (C), Sunstar (*Crossaster* sp.) (O) Brittle star (Ophiuroidea sp.)(O), unidentified crab (U), Polar sea star (*Leptasterias polaris*)(U), Sponge (Porifera)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sea star (*Asterias* sp.)(U), Soft coral (*Gersemia* sp.) (U),	Red filamentous algae (85%), Calcareous encrusting Rhodophyta (10%), Coralline algae (5%),	Red Algae – 100%
T53	250	Deep Subtidal Zone, 30 - 60 m	1000	50 - 60	Cobble (80%), Boulder (20%)	Medium	Scallop (Pectinidae sp.)(C), Sea anemone (Actiniaria sp.) (O), Soft coral (*Gersemia* sp.) (O), Brittle star (Ophiuroidea sp.)(O), unidentified crab (U), Polar sea star (*Leptasterias polaris*)(U), Sponge (Porifera)(U), Sea urchin (*Strongylocentrotus* sp.)(U) Sea star (*Asterias* sp.)(U), Sunstar (*Crossaster* sp.) (O)	Red filamentous algae (90%), Calcareous encrusting Rhodophyta (5%), Coralline algae (5%),	Red Algae – 100%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T54	220	Deep Subtidal Zone, 30 - 60 m	880	50 – 60	Cobble (65%), Boulder (35%)	Medium	Sea anemone (Actiniaria sp.) (C), Soft coral (*Gersemia* sp.) (O), Sunstar (*Crossaster* sp.) (O), unidentified crab (U), Polar sea star (*Leptasterias polaris*)(U), Scallop (Pectinidae sp.)(U) , Sponge (Porifera)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sea star (*Asterias* sp.)(U),	Red filamentous algae (65%), Calcareous encrusting Rhodophyta (5%), Coralline algae (5%), *Lithothamnium* sp. (<1%),	Red Algae – 75%
T55	250	Deep Subtidal Zone, 30 - 60 m	1000	40 - 50	Cobble (85%), Boulder (15%)	Medium	Sea anemone (Actiniaria sp.) (C), Brittle star (Ophiuroidea sp.)(O), Sunstar (*Crossaster* sp.) (O), Polar sea star (*Leptasterias polaris*)(U), Sea urchin (*Strongylocentrotus* sp.)(U), Sea star (*Asterias* sp.)(U), Sponge (Porifera)(U) Soft coral (*Gersemia* sp.) (U)	Red filamentous algae (90%), Calcareous encrusting Rhodophyta (5%), Coralline algae (< 5%), *Lithothamnium* sp. (<1%),	Red Algae – 95%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T56	245	Deep Subtidal Zone, 30 - 60 m	980	40 - 50	Cobble (75%), Boulder (25%)	Medium	Sea anemone (Actiniaria sp.) (O), Brittle star (Ophiuroidea sp.)(O), unidentified crab (U) Polar sea star (*Leptasterias polaris*)(U), Sea urchin (*Strongylocentrotus* sp.)(U) Sunstar (*Crossaster* sp.) (U),	Red filamentous algae (80%), Calcareous encrusting Rhodophyta (10%), *Lithothamnium* sp. (5%), Coralline algae (<1%),	Red Algae – 95%
T57	250	Deep Subtidal Zone, 30 - 60 m	1000	30 - 40	Cobble (95%), Boulder (5%)	Medium	Brittle star (Ophiuroidea sp.)(O), Sunstar (*Crossaster* sp.) (O), unidentified crab (U), unidentified fish (U), Polar sea star (*Leptasterias polaris*)(U), Scallop (Pectinidae sp.)(U), Sea anemone (Actiniaria sp.) (U), Sea urchin (*Strongylocentrotus* sp.)(U), Toad crab (*Hyas* sp.)(U)	Calcareous encrusting Rhodophyta (20%), Red filamentous algae (80%), *Lithothamnium* sp. (<1%), Coralline algae (<1%),	Red Algae – 100%

Table C-4. Transect Summaries for the Underwater Video Surveys in the Submarine Corridor: Shoal Cove Segment (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T58	250	Subtidal Zone 0 – 30 m Deep Subtidal Zone, 30 - 60 m	1000	25 - 35	Cobble (95%), Boulder (5%)	Medium	Sea urchin (*Strongylocentrotus* sp.)(A), Brittle star (Ophiuroidea sp.)(O), Polar sea star (*Leptasterias polaris*)(U), Sponge *(*Porifera)(U), Sea star (*Asterias* sp.)(U), Sunstar (*Crossaster* sp.) (U)	Calcareous encrusting Rhodophyta (90%), Red filamentous algae (10%), Coralline algae (<1%)	Red Algae – 100%
T59	250	Subtidal Zone 0 – 30 m	1000	15 – 25	Cobble (60%), Sand (40%)	Medium	Sea urchin (*Strongylocentrotus* sp.)(A), Sea star (*Asterias* sp.)(O), unidentified crab (U), Polar sea star (*Leptasterias polaris*)(U), Scallop (Pectinidae sp.)(U), Sunstar (*Crossaster* sp). (U)	Sea colander (10%), Calcareous encrusting Rhodophyta (90%), Red filamentous algae (< 5%),	Red Algae – 90% Brown Algae – 10%
T60	58	Subtidal Zone 0 – 30 m	232	10 - 20	Cobble (25%), Gravel (35%), Sand (40%)	Medium	Sea urchin (*Strongylocentrotus* sp.)(O) Sea star (*Asterias* sp.)(U)	Sea colander (85%), Calcareous encrusting Rhodophyta (5%), Red filamentous algae (5%)	Brown Algae – 85% Red Algae – 10%

Notes:
[1] after AMEC (2010)
[2] after Kelly et al. (2009, draft)
[3]estimated abundance as A = Abundant, C = Common, O = Occasional and U = Uncommon
[4]estimated abundance as % coverage

Table C-5. Description of Transects for the Underwater Video Survey at Shoal Cove, June 2011

Tape ID	Transect ID	Video Time	Transect Length (m)	Not Interpretable (%)[1]	Length Analyzed (m)[2]
7	T61	13:28:32 - 13:35:22	250	15	212
7	T62	13:35:24 - 13:43:20	250	0	250
7	T63	13:43:22 - 13:49:50	250	0	250
7	T64	13:49:52 - 13:58:32	250	6	235
7	T65	13:58:34 - 14:03:30	250	6	235
7	T66	14:03:32 - 14:08:56	250	41	147
7	T67	14:08:58 - 14:12:44	250	13	217
7	T68	14:12:46 - 14:16:20	250	0	250
7	T69	14:16:22 - 14:20:00	250	30	175
7	T70	14:20:02 - 14:23:44	250	0	250
7	T71	14:23:46 - 14:27:36	250	0	250
7	T72	14:27:38 - 14:30:06	165	0	165
9	T73	18:23:52 - 18:33:30	160	0	160
9	T74	18:33:31 - 18:39:28	250	0	250
9	T75	18:39:29 - 18:44:38	250	0	250
9	T76	18:44:39 - 18:49:16	250	0	250
9	T77	18:49:17 - 18:53:54	250	0	250
9	T78	18:53:55 - 18:57:32	250	0	250
9	T79	18:57:53 - 19:01:28	250	0	250
9	T80	19:01:29 - 19:05:52	250	0	250
9	T81	19:05:53 - 19:10:48	250	0	250
9	T82	19:10:49 - 19:15:16	250	0	250
9	T83	19:15:17 - 19:18:48	250	5	237
9	T84	19:18:49 - 19:22:52	250	8	230
9	T85	19:22:53 - 19:27:46	250	30	175
9	T86	19:27:47 - 19:32:26	288	0	288

Notes:
[1]video was not interpretable owing to distance off bottom, water clarity, speed of video camera, contact with the seafloor, and other reasons.
[2]length of video analyzed included total transect length minus the proportion that was deemed not interpretable.

Table C-6. Transect Summaries for the Underwater Video Survey at Shoal Cove

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T61	212	Subtidal Zone 0 – 30 m	848	11 – 12	Gravel (50%), Sand (30%), Cobble (15%), Bedrock (5%)	Medium	Sea star (*Asterias* sp.) (U)	Kelp (*Laminaria longicruris*) (55%), Sea colander (45%)	Brown Algae – 100%
T62	250	Subtidal Zone 0 – 30 m	1,000	10.5 – 11.5	Bedrock (40%), Gravel (35%), Sand (15%), Cobble (10%)	Bedrock	Sea urchin (*Strongylocentrotus* sp.) (C), Polar sea star (*Leptasterias polaris*) (U), Sea star (*Asterias* sp.) (U)	Sea colander (40%), Kelp (*Laminaria longicruris*) (30%), Unidentified Green Algae (25%), Sea Lettuce (5%)	Brown Algae – 70% Green Algae – 30%
T63	250	Subtidal Zone 0 – 30 m	1,000	8.5 – 10.5	Cobble (30%), Boulder (5%), Bedrock (65%)	Bedrock	Sea urchin (*Strongylocentrotus* sp.) (C) Sea star (*Asterias* sp.) (U)	Sea colander (50%), Kelp (*Laminaria longicruris*) (45%), Unidentified Green Algae(5%)	Brown Algae – 95% Green Algae – 5%
T64	235	Subtidal Zone 0 – 30 m	940	7.5 – 8.5	Cobble (40%), Boulder (10%), Bedrock (50%)	Bedrock	No Macrofauna Observed	Sea colander (60%) Kelp (*Laminaria longicruris*) (40%),	Brown Algae – 100%

Table C-6. Transect Summaries for the Underwater Video Survey at Shoal Cove (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T65	235	Subtidal Zone 0 – 30 m	940	8 - 9	Cobble (30%), Bedrock (5%), Gravel (65%)	Medium	unidentified fish (U)	Kelp (*Laminaria longicruris*) (85%), Unidentified Green Algae (15%)	Brown Algae- 85% Green Algae – 15%
T66	147	Subtidal Zone 0 – 30 m	588	7.5 – 8.5	Cobble (50%), Gravel (50%)	Medium	No Macrofauna Observed	Kelp (*Laminaria longicruris*) (100%), Sea colander (<5%), Unidentified Green Algae (<5%)	Brown Algae – 100%
T67	217	Subtidal Zone 0 – 30 m	868	5.5 - 8	Cobble (40%), Gravel (60%)	Medium	Sea urchin (*Strongylocentrotus* sp.) (O)	Kelp (*Laminaria longicruris*) (100%)	Brown Algae – 100%
T68	250	Subtidal Zone 0 – 30 m	1,000	5 – 6	Bedrock (50%), Cobble (30%), Gravel (20%)	Medium, Bedrock	Sea urchin (*Strongylocentrotus* sp.) (U)	Kelp (*Laminaria longicruris*) (100%), Unidentified Green Algae (<5%)	Brown Algae – 100%
T69	175	Subtidal Zone 0 – 30 m	700	4 – 5	Bedrock (80%), Gravel (10%), Cobble (10%)	Bedrock	No Macrofauna Observed	Kelp (*Laminaria longicruris*) (95%), Unidentified Green Algae (5%)	Brown Algae – 95% Green Algae – 5%

Table C-6. Transect Summaries for the Underwater Video Survey at Shoal Cove (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T70	250	Subtidal Zone 0 – 30 m	1,000	4 – 5	Bedrock (45%), Cobble (35%), Gravel (20%)	Medium	No Macrofauna Observed	Kelp (*Laminaria longicruris*) (40%), Edible Kelp (30%), Unidentified Green Algae (30%)	Brown Algae – 70% Green Algae – 30%
T71	250	Subtidal Zone 0 – 30 m	1,000	5 - 7	Cobble (65%), Gravel (35%)	Medium	No Macrofauna Observed	Kelp (*Laminaria longicruris*) (100%), Unidentified Green Algae (<5%)	Brown Algae – 100%
T72	165	Subtidal Zone 0 – 30 m	660	7 – 8	Cobble (50%), Gravel (50%)	Medium	No Macrofauna Observed	Kelp (*Laminaria longicruris*) (95%), Unidentified Green Algae (5%)	Brown Algae – 95% Green Algae – 5%
T73	160	Subtidal Zone 0 – 30 m	640	1 – 2	Boulder (45%), Cobble (25%), Gravel (25%), Sand (5%)	Medium	Sea urchin (*Strongylocentrotus* sp.) (C)	Calcareous Unidentified Algae (100%)	Unidentified Algae – 100%
T74	250	Subtidal Zone 0 – 30 m	1,000	1 – 2	Boulder (60%), Sand (5%), Gravel (35%)	Coarse	Sea urchin (*Strongylocentrotus* sp.) (A)	Calcareous Unidentified Algae (100%)	Unidentified Algae – 100%

Table C-6. Transect Summaries for the Underwater Video Survey at Shoal Cove (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T75	250	Subtidal Zone 0 – 30 m	1,000	0.5 – 2.5	Boulder (60%), Cobble (25%), Gravel (5%), Bedrock (10%)	Coarse	Sea urchin (*Strongylocentrotus* sp.) (A)	Calcareous Unidentified Algae (100%)	Unidentified Algae – 100%
T76	250	Subtidal Zone 0 – 30 m	1,000	1 - 2	Bedrock (50%), Boulder (20%), Cobble (30%)	Bedrock	Sea urchin (*Strongylocentrotus* sp.) (A)	Calcareous Unidentified Algae (100%)	Unidentified Algae – 100%
T77	250	Subtidal Zone 0 – 30 m	1,000	1 - 2	Boulder (50%), Cobble (50%)	Medium, Coarse	Sea urchin (*Strongylocentrotus* sp.) (A)	Calcareous Unidentified Algae (100%)	Unidentified Algae – 100%
T78	250	Subtidal Zone 0 – 30 m	1,000	1 – 2.5	Cobble (35%), Sand (30%), Gravel (25%), Boulder (10%)	Medium	Sea urchin (*Strongylocentrotus* sp.) (C)	Kelp (*Laminaria longicruris*) (15%), Unidentified Green Algae (5%), Calcareous Unidentified Algae (10%)	Brown Algae – 15% Unidentified Algae – 10% Green Algae – 5%
T79	250	Subtidal Zone 0 – 30 m	1,000	1 - 2	Sand (55%), Gravel (45%)	Fine	Sculpin (Myoxocephalus sp.) (U), Flatfish (U)	Kelp (*Laminaria longicruris*) (5%), Rockweed (30%)	Brown Algae – 35%

Table C-6. Transect Summaries for the Underwater Video Survey at Shoal Cove (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T80	250	Subtidal Zone 0 – 30 m	1,000	1 - 2	Cobble (50%), Gravel (30%), Bedrock (10%), Boulder (5%), Sand (5%)	Medium	Sea urchin (*Strongylocentrotus* sp.) (C)	Calcareous Unidentified Algae (20%)	Unidentified Algae – 20%
T81	250	Subtidal Zone 0 – 30 m	1,000	0.5 – 2	Cobble (50%), Boulder (40%), Gravel (5%), Sand (5%)	Medium	Sea urchin (*Strongylocentrotus* sp.) (A)	Calcareous Unidentified Algae (40%)	Unidentified Algae – 40%
T82	250	Subtidal Zone 0 – 30 m	1,000	0.5 – 1.5	Boulder (60%), Bedrock (35%), Cobble (5%),	Coarse	Sea urchin (*Strongylocentrotus* sp.) (A)	Kelp (*Laminaria longicruris*) (15%), Edible Kelp (15%), Calcareous Unidentified Algae (65%)	Unidentified Algae – 65% Brown Algae – 30%
T83	237	Subtidal Zone 0 – 30 m	948	0.5 – 1.5	Boulder (65%), Bedrock (35%)	Coarse	Sea urchin (*Strongylocentrotus* sp.) (A)	Calcareous Unidentified Algae (95%)	Unidentified Algae – 95%

Table C-6. Transect Summaries for the Underwater Video Survey at Shoal Cove (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T84	230	Subtidal Zone 0 – 30 m	920	0.5 – 1.5	Boulder (60%), Bedrock (40%)	Coarse	Sea urchin (*Strongylocentrotus* sp.) (C)	Kelp (*Laminaria longicruris*) (25%), Edible Kelp (20%), Calcareous Unidentified Algae (55%)	Unidentified Algae – 55% Brown Algae – 45%
T85	175	Subtidal Zone 0 – 30 m	700	1 – 2	Boulder (90%), Bedrock (10%)	Coarse	Sea urchin (*Strongylocentrotus* sp.) (C)	Kelp (*Laminaria longicruris*) (25%), Edible Kelp (20%), Unidentified Green Algae (15%), Dulse (20%) Calcareous Unidentified Algae (15%)	Brown Algae – 45% Red Algae – 20% Green Algae- 15% Unidentified Algae – 15%

Table C-6. Transect Summaries for the Underwater Video Survey at Shoal Cove (Cont'd)

Transect ID	Length (m)	Habitat Type[1]	Surveyed Area (m^2)	Depth Range (m)	Substrate Type (% Coverage)[2]	Predominant Substrate Group[2]	Macrofauna (Estimated Abundance)[3]	Macroflora (Estimated abundance)[4]	Predominant Macrofloral Class and Coverage
T86	288	Subtidal Zone 0 – 30 m	1,152	1 – 2.5	Boulder (100%)	Coarse	No Macrofauna Observed	Kelp (*Laminaria longicruris*) (30%), Edible Kelp (30%) Dulse (25%) Unidentified Green Algae (10%) Kelp (*Laminaria digitata*) (5%)	Brown Algae – 65% Red Algae – 25% Green Algae – 10%

Notes:
[1] after AMEC (2010)
[2] after Kelly et al. (2009, draft)
[3]estimated abundance as A = Abundant, C = Common, O = Occasional and U = Uncommon
[4]estimated abundance as % coverage

APPENDIX D

Study Photographs

Representative Photographs from Shoreline Surveys at Shoal Cove

Intertidal Zone - Fines with kelp.

Backshore - Sand and Gravel Flat/Beach

Representative Photographs from Shoreline Surveys at Shoal Cove

Backshore – Bedrock cliffs

Backshore - Grave Flat/Beach

Representative Photographs from Shoreline Surveys at Shoal Cove

Intertidal – Mixed substrates

Backshore – grasses

Representative Photographs from Shoreline Surveys at Shoal Cove

Backshore – grasses and shrubs

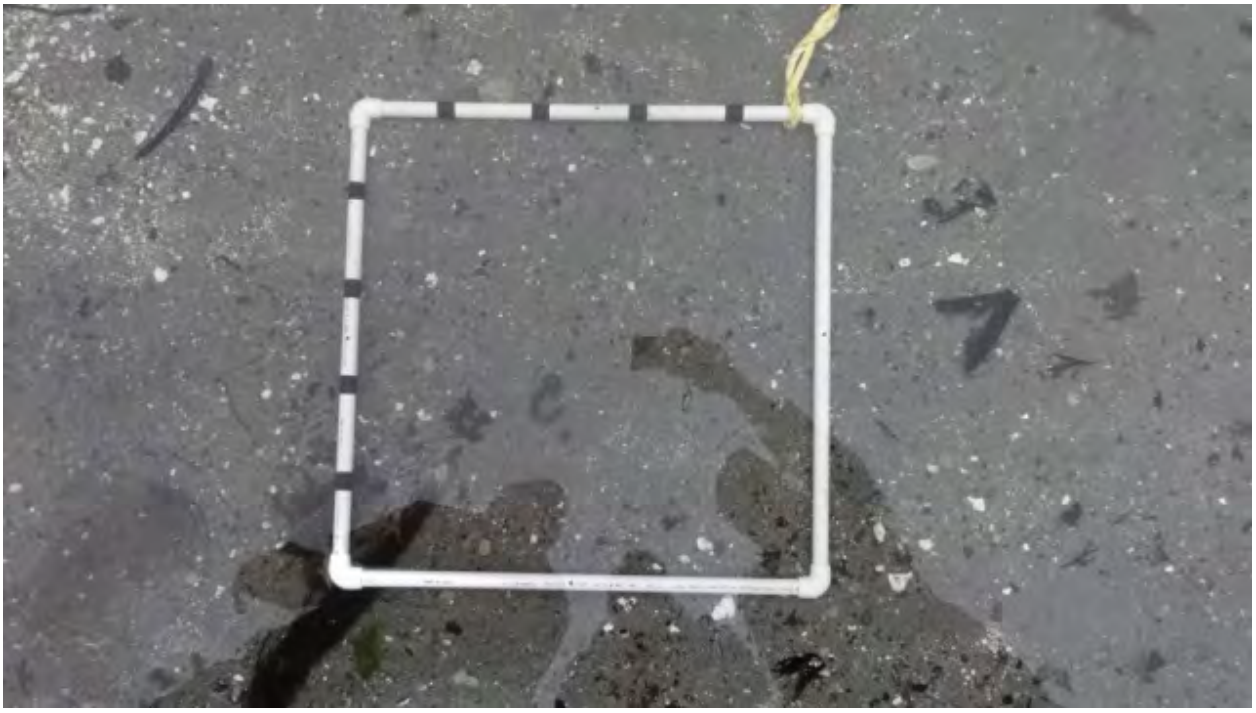
Backshore – estuary and fringing lagoon

Representative Photographs from Shoreline Surveys at Shoal Cove

Backshore – gravel flat/beach

Intertidal - Mixed substrate with kelp

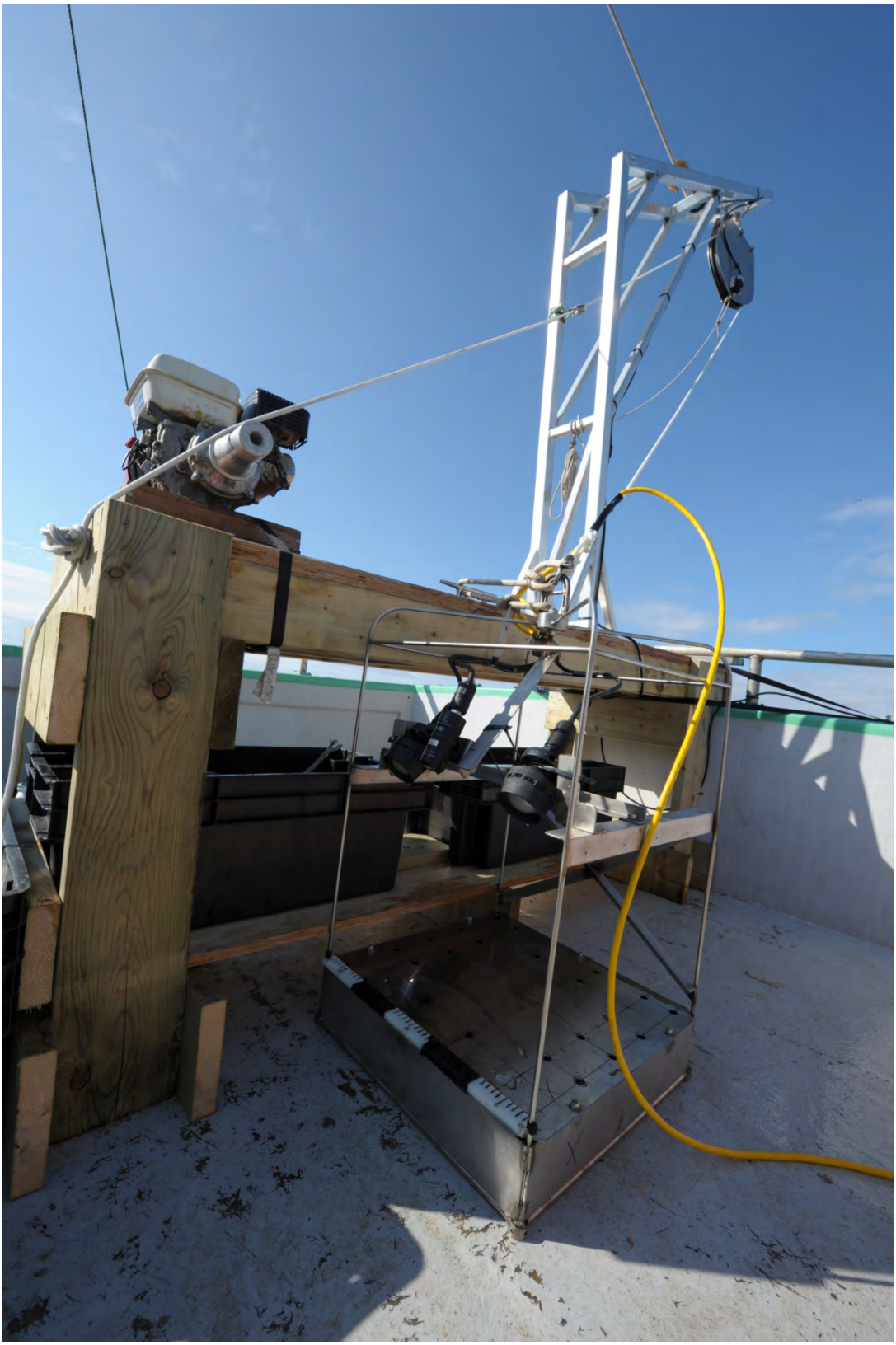
Representative Photographs from Shoreline Surveys at Shoal Cove



Quadrat sediment sampling in intertidal zone - Shoal Cove

Video survey – Shoal Cove

Representative Photographs from Corridor Surveys



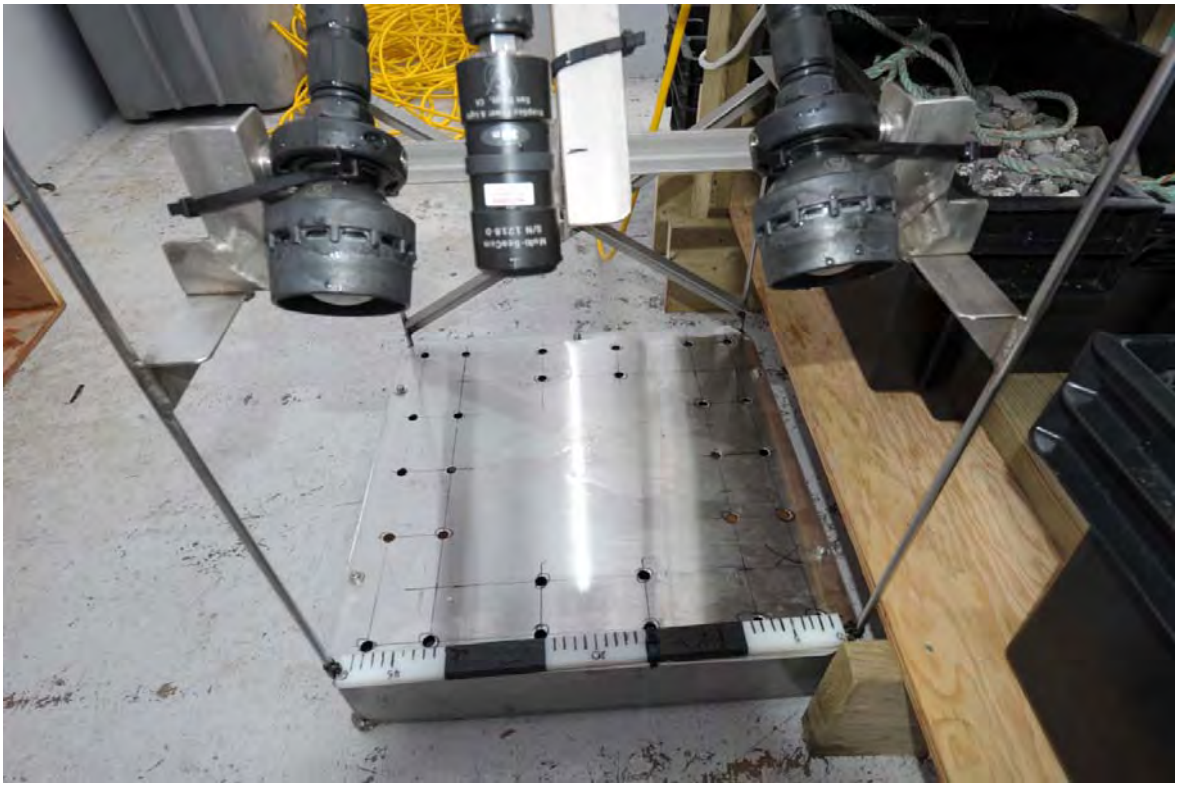
Video Camera System for Corridor Surveys

Representative Photographs from Corridor Surveys

Honda hauler with capstan and video camera system

Representative Photographs from Corridor Surveys

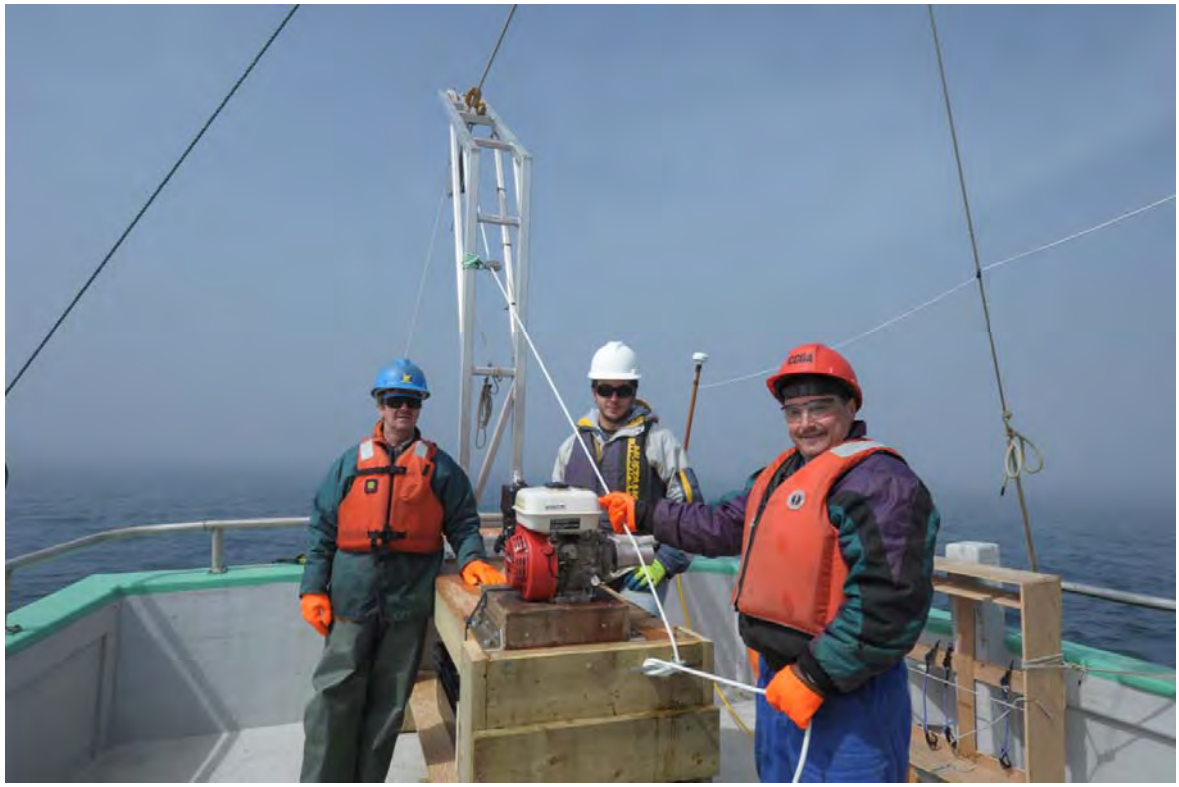
Video Data Collection Corridor Survey



Video camera system with lights and scale reference bar

Representative Photographs from Corridor Surveys

Van Veen Sediment Grab Primed for Release



Field Team During Marine Surveys in the Corridor

Representative Photographs from Corridor Surveys

Benthic Sample Collected During Corridor Surveys

Representative Photographs from Corridor Surveys

Benthic Sample Collected During Corridor Surveys

Representative Photographs from Corridor Surveys

Benthic Sample Collected During Corridor Surveys

Marine Survey Platform for the Corridor Surveys, the *Trina N*

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