Project Number: 031208

Prepared for:
Atlantic Wind Power Corporation Ltd.

Pubnico Point
Wind Farm
Environmental Assessment

September 2003

CBCL LIMITED
Consulting Engineers
ISO 9001
Registered Company

ATLANTIC WIND POWER CORPORATION LTD.

Contents

List of Acronyms

ACCDC	Atlantic Canada Conservation Data Centre
ATV	All-terrain Vehicle
AWPC	Atlantic Wind Power Corporation
BSC	Bird Studies Canada
CEAA	Canadian Environmental Assessment Act
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Department of Fisheries and Oceans
DNR	Nova Scotia Department of Natural Resources
EA	Environmental Assessment
EPP	Environmental Protection Plan
HADD	Harmful Alteration Disruption and Destruction
IBA	Important Bird Area
LFA	Lobster Fishing Areas
NAD	North American Datum
NAFO	Northwest Atlantic Fisheries Organization
NCNS	Native Council of Nova Scotia
NRCan	Natural Resources Canada
NSDEL	Nova Scotia Department of Environment and Labour
NSDOT&PW	Nova Scotia Department of Transportation and Public Works
NSPI	Nova Scotia Power Inc.
NWPA	Navigable Waters Protection Act
PPWF	Pubnico Point Wind Farm
RA	Responsible Authorities
REPP	Renewable Energy Policy Project
VEC	Valued Ecosystem Components
WHMIS	Workplace Hazardous Materials Information System
WPPI	NRCan's Wind Power Production Incentive Program
WTG	Wind Turbine Generator

Chapter 1 **Introduction**

1.1 Proponent Information

Project Name:	Pubnico Point Wind Farm
WPPI Registration No.:	5902-A3-2
Project Location:	Pubnico Point, Yarmouth County, Nova Scotia.
Size of the Project	30 Megawatts
Proponent Information:	Atlantic Wind Power Corporation Ltd. PO Box 812, Yarmouth, Nova Scotia, B5A 4K4
Proponent Contact Person:	Joerg Losse, President Phone/Fax (902) 649-2588
Applicant:	CBCL Limited 1489 Hollis Street PO Box 606 Halifax, NS, B3J 2R7
Applicant Contact Person:	Ann Wilkie, VP Environment Telephone: (902) 492-6764 Fax: (902) 423-3938

The Following documentation was prepared as required under the *Canadian Environmental Assessment Act* and the *Nova Scotia Environmental Assessment Regulations* and submitted for review on September ___ 2003.

_____	_____
Proponent's Signature	Applicant's Signature
_____	_____
Date	Date

Atlantic Wind Power Corporation (AWPC) is wholly owned and managed by Nova Scotia residents. It was established in the Province in August, 2001. Three of the four principles live and work in southwest Nova Scotia. The company's intent is to draw upon the European experience of its president to develop and operate wind farms in Nova Scotia in accordance with the provincial energy strategy. AWPC has engaged both local and international parties to provide specific expertise and professional services.

The contact coordinates for the proponent and the applicant are provided on the preceding page.

1.2 Project Overview

AWPC proposes the development of the Pubnico Point Wind Farm (PPWF) at a location on the southern portion of Pubnico Point, West Pubnico, Nova Scotia, as shown in Figure 1.1. Based on the field work and associated analysis that has been done, the proposed wind farm will consist of 17 turbines and generate approximately 100,000,000 kW/hr of electricity annually. This is enough to power 10,000-13,000 average Canadian homes each year. The power will be sold to Nova Scotia Power Inc. (NSPI).

The Project will be executed in two phases. Phase I consists of the installation of two Wind Turbine Generators (WTGs) and related structures and equipment, including transmission lines and access roads. The location of the two Phase I WTGs are shown on Figure 2.2. Phase I is scheduled to commence immediately upon release from the federal and provincial environmental assessment processes and attainment of the necessary permitting. It will conclude before the end of the first quarter of 2004. The most time sensitive component of Phase I is the installation of the submarine cables. AWPC hopes to complete this prior to the commencement of the lobster fishing season in the West Pubnico area, i.e., November 24, 2003.

Phase II consists of the installation of the balance of the WTGs, i.e., 15, for a total of 17 WTGs. Phase II is expected to be completed in the fall of 2004.

Additional information on the project configuration under consideration is provided in Section 2.0.

1.3 Methodology and Study Boundaries

The methodology used in this assessment has evolved from methods proposed by Beanlands and Duinker (1983) who stressed the importance of focusing on the environmental components of greatest concern. Valued Ecosystem Components (VECs) represent key species or species groups, as well as primary elements such as air and water that are integral to environmental health. In this analysis VECs are complimented by the identification of a number of socio-economic issues that reflect matters with social, cultural or economic value that may be impacted by the Project. The final selection of the VECs and socio-economic issues reflects an informed understanding of the potential relationship between the Project and the receiving environment.

The study areas for this environmental assessment include the footprint of all works associated with the proposed wind farm and those areas within which most project-environment interactions could reasonably be expected to occur. It is, however, impossible to set a single study area boundary to accurately reflect the

Figure: 1.1
Location of Project Site

spatial characteristics of all project-environment interactions. More specific spatial and temporal boundaries are referenced with respect to specific socio-economic issues and VECs.

1.4 Canadian Environmental Assessment Act

The *Canadian Environmental Assessment Act (CEAA)* establishes the federal environmental assessment (EA) process. Under the Act, an EA is required before a federal authority:

- carries out a project;
- provides financial assistance to enable a project to be carried out;
- sells, leases or otherwise transfers control or administration of land to enable a project to be undertaken; or
- permits, approves or takes any other action specified in the Law List Regulations authorizations for the purpose of enabling a project to be carried out.

As such, the installation of a wind energy farm at Pubnico Point as proposed by AWPC has triggered an EA under the *CEAA*. The Responsible Authorities (RAs) have been identified as:

- Natural Resources Canada (NRCan) triggered by the proponent indicating that financial assistance will be sought under NRCan's Wind Power Production Incentive Program (WPPI)[1];
- Fisheries and Oceans Canada (DFO) Habitat Management Division triggered under the *Fisheries Act, Sections 32 and 35(2), i.e., Destruction of Fish by Means Other than Fishing and Harmful Alteration Disruption and Destruction (HADD)* of fish habitat; and
- DFO Navigable Waters Protection Agency triggered under the *Navigable Waters Protection Act (NWPA) Section 5 (1) Construction of Work in Navigable Water*[2].

Under the *CEAA*, the type of assessment required varies depending on the complexity, size, and the significance of the possible environmental effects of the project. The proposed PPWF requires that an environmental screening be completed. "A screening systematically documents the anticipated environmental effects of a proposed project and determines the need to modify the project plan or recommend further assessment to eliminate or minimize these effects" (*CEAA*, 2003*). CEAA Section 16 (1)*, stipulates that the environmental screening must provide the following information:

- The project's environmental effects, including the environmental impact of malfunctions or accidents that may occur in relation to the project, and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- The significance of the effects listed in the previous statement;
- Comments from the public received in accordance with the *CEAA* and its regulations;
- Measures that are technically and economically feasible which would mitigate any significant environmental effects of the project; and
- Any other matters relevant to the screening, such as the need for the project and alternatives to the project.

[1] AWPC filed a *Letter of Interest* (dated June 23rd, 2003) with NRCan's WWPI Program. This updated a previous filing by AWPC and provided current information on the timing and size of the Project.
[2] The application for a Navigable Waters Permit was submitted on Friday, May 9, 2003.

NRCan is developing environmental assessment "*Guidelines for Screenings of Inland Wind Farms Under the Canadian Environment Assessment Act*" as a component of the WPPI Program. These guidelines in a draft format have served as a guide for the environmental screening required for the proposed Project. Although the RAs ultimately determine the scope and completeness of the assessment, a typical screening document will address the following:

- Construction, including reference to any pre-construction survey, site preparation, excavation, transportation of material, turbine erection, power connection, site remediation and demobilization of construction work;
- Operation and maintenance requirements; and
- Decommissioning of the wind turbine and site remediation.

These phases in the life of the wind farm are addressed in Section 5.0.

1.5 Other Regulatory Approvals

1.5.1 Federal Approvals and Authorizations

The principle federal approvals and authorizations that are required for the development and operation of the Project are those identified above in Section 1.4. These include authorizations under the *Fisheries Act* and *NWPA* and the need to address the requirements of *CEAA*. In addition, AWPC will have to mark and/or light the WTGs to address the requirements of the Canadian Aviation Regulations administered by Transport Canada. Finally, AWPC are cognisant of their responsibilities under the *Species at Risk Act (SARA)* and *Migratory Birds Convention Act (MBCA)* and have taken the intent and requirements of this legislation into account in the planning of the Project and the preparation of the environmental assessment.

1.5.2 Provincial Approvals and Authorizations

As a result of changes to the Nova Scotia Environmental Assessment Regulations that came into force in March of this year, the proposed wind farm at Pubnico Point will be subject to a Class I environmental assessment as defined in the said regulations. This necessitates the registration of the Project with the Nova Scotia Department of Environment and Labour (NSDEL). The registration requires information on the following:

(a) the location of the proposed undertaking and the nature and sensitivity of the surrounding area;

(b) the size and scope of the proposed undertaking;

(c) concerns expressed by the public about the adverse effects or the environmental effects of the proposed undertaking;

(d) steps taken by the proponent to address environmental concerns expressed by the public;

(e) potential and known adverse effects or environmental effects of the technology to be used in the proposed undertaking;

(f) project schedules;

(g) planned or existing land use in the area of the undertaking;

(h) other undertakings in the area; and

(i) such other information as the Minister may require.

No later than 25 days following the date of registration, the NSDEL is required to advise the proponent in writing of the Minister's decision. At this stage the Minister may require additional information prior to making a decision, may make a decision to enable the project to proceed with or without conditions, or may require the proponent to comply with a more extensive assessment process. As many of the concerns that the Minister may have relate to the decisions and issues that are being considered by the federal regulators, it is prudent to facilitate the exchange of information between the regulating parties and to the extent possible minimise duplication of effort by both the Proponent and the various agencies and departments with interests to be addressed (see Section 1.5.3).

In addition to seeking a determination under the Nova Scotia Environmental Assessment Regulations, the Project will be seeking other required provincial permits and authorisations including, but not necessary limited to, the following:

- an authorization from the Nova Scotia Department of Natural Resources (NSDNR) for a license/easement permitting overhead transmission lines to cross an abandoned railway bed;
- a Waterlot Easement from the NSDNR to enable the installation of the submarine electrical cables under Pubnico Harbour;[3]
- a permit from NSDEL to construct an access road across a wetland; and
- a Use of Highway Right-of-Way for Pole Lines Permit from the Nova Scotia Department of Transportation & Public Works (NSDT&PW).

At the current time AWPC is considering the re-opening of an abandoned quarry on site as a source of rock for the access roads to the wind turbine generators. A decision on whether or not to utilize rock from this source is dependent on a number of factors including information received from competing contractors for specific works. It may well be that rock is sourced off-site. Discussions, have been initiated with the NSDEL to permit the opening of the quarry, which, if the decision is made to proceed with such works shall be undertaken in accordance with the Pit and Quarry Guidelines.

Because no removal of sand from a designated beach is anticipated authorization under the *Beaches Act* has been waived (Rod Fraser, NSDNR, Pers. Comm. 2003).

1.5.3 Environmental Assessment Harmonization

In an effort to streamline the environmental assessment process, the Government of Canada, the Territories and Provinces excluding Quebec have signed the *Canada-Wide Accord on Environmental Harmonization* and the *Sub-Agreement on Environmental Assessment.* A Memorandum of Understanding between the federal

[3] AWPC submitted the required details in support of their application in June 2003. The processing of this application is well advanced. The Integrated Resource Management Report has been prepared by regional staff of NSDNR and forwarded to the Halifax Office. Research is being conducted at the Crown Lands Record Centre with respect to the existence of encumbrances, if any, on the lands. AWPC has received early indication that there would appear to be no encumbrances. A letter of offer for an easement from NSDNR is anticipated in early fall, 2003.

RAs, i.e., NRCan and DFO, and the Province of Nova Scotia represented by NSDEL has been signed for this Project. This environmental assessment document serves the requirements of both levels of government.

1.5.4 Municipal Authorizations

The proponent has carried out an extensive public and municipal council consultation process and has gained local support for the proposed Project (see Section 3.6.1). As a result of the consultation process and the supportive feedback provided to Council, the Municipality of the District of Argyle has amended its zoning bylaws to enable the proposed wind farm to be developed at the proposed site.

1.6 Approach and Methodologies

Environmental assessment is a process that is executed early in the project planning to enable environmental factors to influence decisions and detailed engineering. It is in essence a planning tool, the underlying intent of which is to ensure that all works associated with the Project's construction, operation and termination are executed in a manner that causes minimal harm to the physical, ecological and socio-economic environments. By virtue of the legislation referenced above, it has been determined that the proposed Project is subject to an environmental screening federally and a Class I assessment provincially. It is also appreciated that the wind farm is the first of its type to be proposed in Nova Scotia. The resultant approach to the environmental assessment, therefore, has been to:

- research pertinent work that has been executed to date with respect to comparable projects undertaken in Canada and elsewhere;
- meet or talk with all pertinent federal, provincial and municipal agencies, other parties and local interests who may have information on the site or relevant to the development and operation of the proposed wind farm;
- compile all pertinent secondary ecological data with respect the site and its surroundings; and
- execute selected field programs.

Appendix A provides a listing of the consultations carried out and a bibliography of the documents and papers consulted.

In addition to the pertinent secondary research and consultation program that was executed, the following field programs were undertaken:

- a vegetation survey to determine the presence, if any, of rare plants;
- a survey of breeding birds and herptiles at the site;
- an archaeological survey;
- a survey to field-truth the extent and nature of an on-site wetland; and
- a survey of the intertidal zone.

The following paragraphs provide additional information on each of the above field programs.

1.6.1 Vegetation Survey

The vegetation survey was carried out over two full days at the end of June, beginning of July, 2002, by two specialists from St. Francis Xavier University and a botanist from the CBCL Limited's environmental team[4]. The study team executed three east-west transects of the proposed wind farm site. In addition, they made several excursions into the more forested areas of the site from the transects, walked the access road and inspected the Project related lands on the east side of the harbour. Each of the vegetation communities on the site were sampled, but particular attention was spent surveying the wetland because of its potential for rare species, especially spikerushes, sedges and orchids.

The nature and species composition of the vegetation was noted along each transect and specimens of less obvious species were taken back to the university for identification; all taxonomy followed Zinck (1998). Specimens of some species, especially sedges and grasses, were deposited in the St. Francis Xavier University herbarium. A small wetland plant found to be abundant within and around the wetland area and in the roadside ditches was originally thought to be the endangered *Eleocharis tuberculosa.* Subsequent consultation, however, with the authorities at the Nova Scotia Museum in May 2003, disproved this initial identification. Based on the immature achenes provided to the NS Museum, it is believed that the plants may be either *E. tenuis* or, less likely, *E. acicularis*, neither of which are species of concern for the Project.[5] To confirm the identification of the species, the botanist has determined that the best time to collect mature specimens will be in September. This visit has been arranged, and specimens will be deposited with Museum personnel for confirmatory identification.

It is acknowledged that it is not feasible to obtain a comprehensive catalogue of vascular plants at a particular site with a single survey. Some species can only be positively identified in flower, and different species flower at different times. However, if only one pass is anticipated, the best compromise is to do the survey in the summer or early autumn. At these times, most late flowering species will be sufficiently developed to permit identification, while spring flowering plants are not yet senescent, though they may be in seed.

At the time of the survey at Pubnico Point, most of the non-woody species were in bloom or sufficiently well developed to ascertain that they were not species of concern. Those who conducted the field program are confident that none of the species identified in Table 3.1 would have been missed. It may have been difficult to identify the golden rod *Euthamia galetorum* without flowers, but the genus is distinctive and no *Euthamia* were found at the site. Similarly, the orchids *Spiranthes lucida* and *s. ochroleuca* would only be positively identifiable when in flower, but habitat for these species does not occur at Pubnico Point.

1.6.2 Survey of Breeding Birds and Herptiles

A survey of breeding birds and herptiles was conducted at the proposed wind farm site by personnel[6] from St. Xavier University in early June, 2003. This involved intensive bird observation on two consecutive mornings, a dusk to after dark survey on a separate day concurrent with an auditory survey for amphibians. Herptiles were surveyed separately late one morning and again one afternoon. Logs, rocks and large detritus were all

[4] The botanical specialists were Dr. Barry R. Taylor and Ms. Chrystiane Mallaley (St. Franics Xavier University) and Mr. Clinton Pinks (CBCL Limited).
[5] Communication from Marion C. Munro, Assistant Curator of Botany, Nova Scotia Museum of Natural History, 29 May 2003.
[6] The ornithologist was Randy Lauff (St. Francis Xavier University).

overturned to find snakes and salamanders. The wetland pools, created by all terrain vehicle (ATV) activity, were sieved using a conventional D-net for amphibians.

In early August, 2003, an e-mail was distributed to the membership of NatureNS to elicit information on the importance of the Project site and surroundings as bird habitat and its relevance to migratory patterns. Three responses were received from approximately 100 birders circulated.

1.6.3 Archaeological Survey

Prior to the execution of the archaeological survey at the proposed site by Davis Archaeological Consultants Limited[7], a heritage research permit was obtained from the Nova Scotia Museum (Appendix B). In the permit application the investigative procedures outlined included a basic presence/absence reconnaissance that could involve sub-surface testing. The procedures also included a background study and consultations with individuals who might have knowledge of cultural resources within the area.

The field work was carried out over two days in May, 2003, by the principal investigator assisted by an experienced social scientist. The field notes from this work are provided in Appendix B.

1.6.4 Wetland Survey

The wetland survey was undertaken in June, 2003, by a botanist and a hydrogeologist, members of the CBCL Limited environmental team. The delineation of the boundaries of the most common vegetation types were determined by spatial positioning (foot pacing and compass) along a series of transects. These were measured beginning at the tree line. The tree line was defined on the ground where the trees, mainly black spruce, willow and larch, were greater than head height, i.e., >2 meters, and at a density of greater than 50% ground cover. This boundary was very distinct, as interspersion of the botanical communities in the wetland was low. Within theses boundaries, the dominant plant species were documented in order of prominence.

The tree line was interpreted from aerial photographs taken in 2000 and georeferenced with the Wetlands Inventory Database for comparison between the photo-interpreted boundary (DNR, 2002) and the field checked boundary.

The wetland boundaries were defined using the US Army Corps Wetlands Delineation Manual which defines wetlands through the combination of soil, hydrologic and botanical conditions, as well as a series of secondary indicators. Due to the inability to identify many species this early in the growing season, only a few indicator species were used, and the delineation was based mainly on hydrologic and soil indicators. Few obligate species were present near the margins of the open bog area, but it was noted that the maturity of obligate species decreased from the central portion of the bog to the outer edges, likely due to differing conditions (e.g., *Eriophorum*). Botanical indicators are proof positive, but their lack of presence does not mean lack of hydrology, particularly early in the growing season. Table 1.1 summarizes the primary botanical indicators used to locate the wetland boundary.

Table 1.1: Primary Botanical Indicators

[7] The archaeologist was Dr. Steve Davis (St. Mary's University).

Salix and *Ilex* species	Riparian species
Mainanthemum trifolium	Obligate wetland species
Picea mariana	Based on stature. Tall and slender versus dense and spreading
Sphagnum and *Carex* mat	Continuous and saturated
Acer rubrum	Common on the margins of bogs

Where the botanical community indicated a change in hydrology, small test pits were dug using a trowel. Pits were generally dug to 30 cm and the conditions were logged. The depth to the water table was measured, soil stratigraphy was documented, and depth to bedrock was measured. Table 1.2 summarizes the primary hydrologic indicators described by the US Army Corps of Engineers and used for the verification of wetland boundary.

Table 1.2: Soil and Hydrological Indicators

Water table	If free water surface is visually observed <30 cm below surface, system described as wetland.
Silty-sand horizon with some clay	When encountered within 20 cm of surface (peat <20 cm thick) system described as poorly drained forest/barrens
Bedrock	When encountered within 20 cm of surface (peat <20 cm thick) system described as poorly drained forest/barrens
Peat presence	If soils had mineral character, system was described as non-wetland

Secondary indicators were also used to confirm wetland status. These indicators are summarized in Table 1.3.

Table 1.3: Secondary Indicators

Leaf litter colour	Black-grey plant litter on exposed soils indicates prolonged anoxic conditions
Iron oxide in root channels	Iron oxide presence is indicative of plants photosynthesising in prolonged anoxic conditions

Many plants were not respiring actively enough to have observable iron oxide on roots because the leaves had not yet emerged. Although its absence may not be a strong indicator of the absence of hydrology, with other conditions taken into account, a confident delineation was made.

1.6.5 Survey of Intertidal Zone

The intertidal zone at Pubnico Harbour was visited by senior marine ecologists[8] on August 31, 2003, to coincide with a very low tide, namely 0.3 m at 17.19. The purpose of the visit was to characterize the rocky

[8] The survey participants included Drs. Annamarie and Bruce Hatcher (senior marine ecologists and principals of Hatcher Research Associates), Dr. Stan Watts (a local diver from Wedgeport and the former Dalhousie University diving officer) and Ms. Rochelle Watts (a longtime resident of Wedgeport and local naturalist).

intertidal areas where AWPC proposes to lay submarine cables. A transect was followed from the upper shoreline on both sides of the harbour to the water's edge. The intertidal zones were geo-referenced and the abundance of various ecosystem components estimated as percent cover. Details are provided in Appendix C.

1.7 Draft Document Review

To facilitate the preparation of a comprehensive environmental assessment report, a draft environmental assessment report was prepared and submitted to the Canadian Environmental Assessment Agency on July 9, 2003. The agency then circulated the draft report to pertinent federal government departments and to the NSDEL. The latter, in turn, circulated the report to other provincial departments. The comments, observations and input received as a result of this process has proved invaluable in clarifying specific issues and thereby finalizing this document. Appendix D provides a concordance table that references the observations received from these reviewers to specific sections in this report.

1.8 Structure of the Document

This report documents the assessment of the environmental effects of the proposed construction, operation and decommissioning of the Pubnico Point Wind Farm. The report consists of seven sections:

Section 1.0 provides an introduction to the proponent and the proposed Project, an overview of the environmental assessment process and an account of the approach and methodologies used in the assessment.

Section 2.0 provides information on the site's wind resources, justification for the Project and a review of Project alternatives. This section also identifies the principal Project components, activities, scheduling, anticipated emissions and discharges, as well as outlining the Project's health, safety and environmental management plan and how malfunctions and accidents will be addressed.

Section 3.0 describes the existing biophysical and socio-economic environment as well as the public consultation process undertaken by the proponent.

Section 4.0 describes the scope of the assessment and identifies the Valued Ecosystem Components, the socio-economic issues and the pathways that may be associated with impacts.

Section 5.0 details the analysis of anticipated environmental effects, identifies appropriate mitigation and discusses cumulative effects.

Section 6.0 describes follow-up commitments and monitoring initiatives.

Section 7.0 summarizes the assessment results.

The report includes an appropriate mapping and the following appendices:

A Bibliography and Contacts
B Heritage Research Permit, Archaeology Field Notes and Museum Authorization
C Intertidal Zone Survey
D Document Concordance with Observations Received from Reviewers
E Wetland Evaluation
F ACCDC Categorizations
G Letters from Local Lobster Fishermen and Ornithologist
H Open House Survey Form
I Draft Bird Monitoring Protocol

Chapter 2 **Project Description**

2.1 Overview of the Project

From the inception of the Project idea, to the realization of an operating wind farm, there are many activities that are required. These include, but are not limited to:

- corporate planning and Project financing;
- obtaining access to required lands;
- increasingly detailed studies of meteorological conditions to facilitate the final determination of wind turbine generator siting;
- consideration and negotiation of the strategic acceptability of the power source with all levels of government and with the 'client', i.e., Nova Scotia Power Inc. (NSPI);
- public consultation and regular discussion with the local municipality;
- scoping of Project parameters including connection to the grid;
- initial field investigations;
- conceptual engineering;
- environmental field investigations and preparation of assessment documentation and related permit applications;
- detailed field investigations, e.g., geotechnical investigations, to facilitate detailed engineering;
- detailed engineering;
- tender calls for specific activities or components, e.g., transportation of components to the site, construction of the access roads and associated site preparation;
- environmental protection and safety plans;
- preparatory site works;
- phased construction and start-up; and
- Project operation.

Each step in the process involves a different mix of parties and new financial and corporate commitments. The process is not iterative. Many facets take place in parallel, but it is also essential to the planning process and the ultimate success of the Project that no one phase, and associated financial commitment, occurs in isolation too far ahead of associated decision points. As indicated in Section 1.6, and as required by legislation, this environmental assessment has been undertaken prior to detailed engineering and the awarding of important tender packages. Considerations raised as a consequence of the environmental assessment will likely influence both the scope and detail of subsequent work, including detailed engineering and the content and detail of the environmental protection and safety plans.

As previously noted, the proposed wind farm will be located on the southern portion of Pubnico Point, approximately 5 km south of West Pubnico,[9] Nova Scotia, (see Figure 1.1). The digitally-altered aerial photograph, Figure 2.1, shows a hypothetical configuration of turbines in the landscape. Based on the field work and associated analysis that has been done, the preferred configuration of the proposed wind farm

[9] There are four Pubnicos that are together commonly referred to as West Pubnico: Upper West, West, Middle West and Lower West which are respectively 7, 5.5, 4 and 2 km from the most northerly of the proposed WTGs.

Figure 2.1: Pubnico Point

Note: This depiction of Pubnico Point is for illustrative purposes only; it is not an accurate depiction of the number or scale of the turbines proposed for the site.

involves the placement of 17 wind turbines in four rows as depicted in Figure 2.2. This will generate approximately 100,000,000 kW/hr of electricity annually which will be sold to NSPI.

Consultation with the Municipality of Argyle has resulted in an amendment being made to the municipality's land use bylaw to accommodate the siting of a windfarm at Pubnico Point. The amended bylaw[10] has stipulations that govern the distance of any WTG to the shoreline and to the nearest residential property. With respect to the buffer between a WTG and the shoreline this will be "one-half (1/2) the diameter of the rotor blade's full arc (40 m) plus the applicable minimum yard requirement of Part 21(9)" (of the bylaw). This means that there will be a minimum buffer of between 44.5 m and 47.6 m depending on the orientation of the WTGs. This is of particular relevance to the WTGs that will be located to the west of the site. Section 2(a) of the amended bylaw stipulates that a WTG "shall be located not less than twice the height of WTG as measured from ground level to the highest point of the rotor blade's arc from any existing dwelling in any zone." Based on this requirement, no WTG can be closer than 242 m to an existing dwelling. The nearest residence is approximately 300 metres distant.

2.1.1 Meteorological Conditions

The strength, direction and consistency of the local wind resource are key factors when considering the siting of a wind farm. AWPC, because of their presence in the region, had general knowledge of the geography and wind conditions in southwest Nova Scotia. AWPC had also examined the historical meteorological records held by Environment Canada for the weather stations at Yarmouth and Baccaro Point. Based on AWPC's technical understanding of the meteorological and locational conditions necessary for the successful development of a wind farm, AWPC identified Pubnico Point as being a potential development site. Both the wind conditions and the relatively mild ambient winter temperatures at the site appeared conducive to wind farming.

In August 2001, AWPC started to measure the wind resource at Pubnico Point. The geographical coordinates of the meteorological mast at Pubnico Point are N34-35-64 and W65-48-29. As depicted in Figure 2.3, the prevailing wind direction at the Pubnico Point site is from the northwest to the southwest. This is comparable to, but distinguishable from, data from Yarmouth and Baccaro Point. To further assess the commercial viability of the Pubnico Point site, AWPC engaged the services of a professional wind energy consulting firm to analyze and report on the attributes of the wind data[11]. This data included a correlation of the site-specific data to the long-term data collected by Environment Canada. This analysis included statistical comparisons to the independent long-term data, thereby increasing the proponent's confidence in the validity of the on-site data.

[10] The Municipality of Argyle, Municpal Planning Bylaw, Part 8A-Special Provision and Requirements for Wind Turbine Generators (WTG) as a Utility.

[11] The more detailed climatic data compiled and its analysis are considered proprietary to the design and execution of this Project.

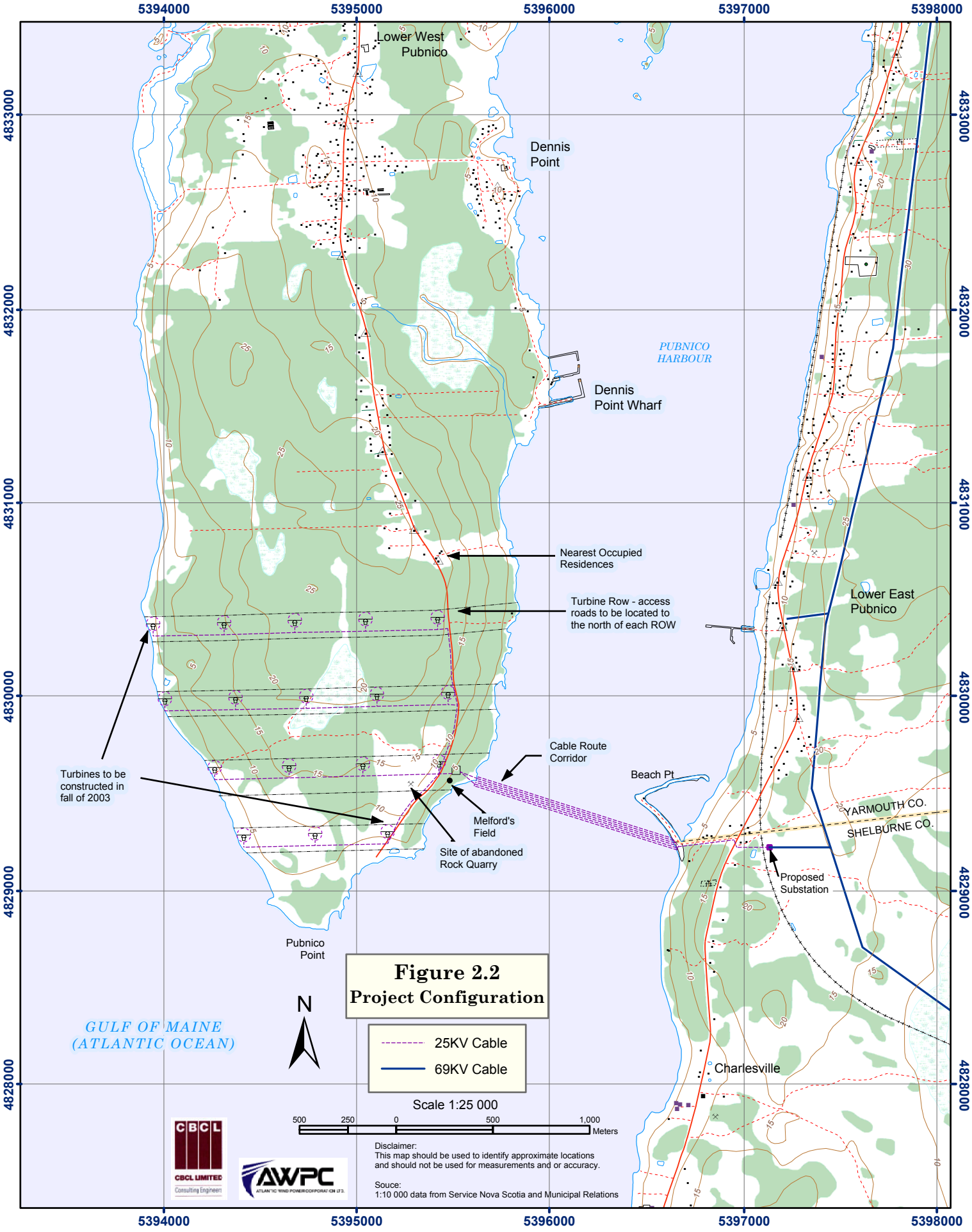
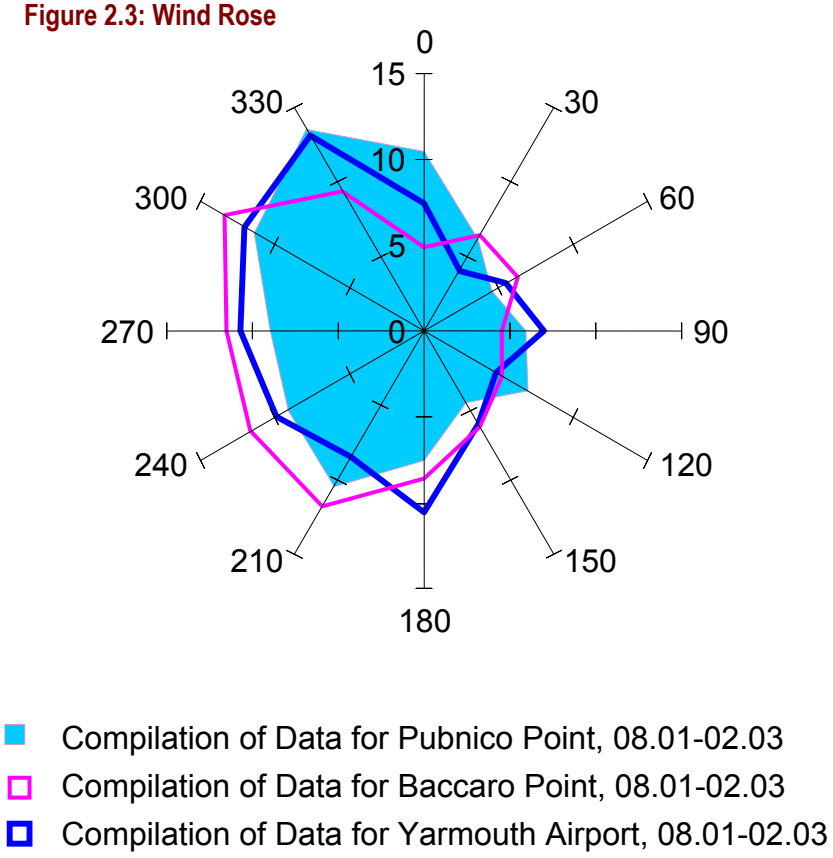


Figure 2.2
Project Configuration

Figure 2.3: Wind Rose



Source: AWPC, 2003

The detailed measured wind data has been used by AWPC and its analysts to model the proposed wind farm. Commonly referred to as micro-siting, the placement of individual wind turbines based on site specific data is an important step in the development process to ensure that array losses and turbulence effects from neighbouring wind turbines are minimized. In addition to this analysis, a comparable analysis was completed by AWPC's potential wind turbine suppliers with respect to the Pubnico Point site. The manufacturers' micro-siting analyses indicated energy yields similar to the company's, thus confirming the site's performance expectations. Based on industry knowledge including the meteorological attributes of other regions that are farmed, the wind resource at the Pubnico Point site is believed to be commercially farmable based on a development as contemplated by the micro-siting and reflected in Figure 2.2.

2.1.2 Need and Justification

Canadians are among the highest per-capita producers of carbon dioxide (CO_2) in the world due to their heavy reliance on fossil fuel based energy (NRCan 2003). In Atlantic Canada, 44% of greenhouse gas emissions come from the generation of electricity; much of the electricity is used for residential space and water heating (Hughes *et.al*. 2003). On December 17, 2002, the Government of Canada announced its ratification of the *Koyoto Protocol* to the *United Nations Framework Convention on Climate Change*. Under this legally binding agreement, industrialized countries have pledged to reduce their collective emissions of greenhouse gases by 2012. Canada's reduction target is 6% below 1990 levels by 2012. According to climate

change experts, this will require a 25 percent drop in emissions from "business as usual" projections (NRCan 2003c).

The use of electricity from renewable energy sources, particularly wind, contributes to a reduction of greenhouse gas emissions, a result consistent with stated federal and provincial environmental objectives. NRCan's WPPI Program announced in the December 2001 budget is an acknowledgement that federal authorities intend to support appropriate renewable energy initiatives as an avenue to meet their greenhouse gas reduction targets. Indeed, the $260-million WPPI initiative is anticipated to increase the amount of wind energy available across the country by 500 percent over a five year period as part of Canada's commitment to address climate change (NRCan, 2003a).

The Nova Scotia government has also committed the province to a reduction of greenhouse gas emissions in its 2001, Energy Strategy "Seizing the Opportunity". More specifically the government has plans to see the regulated utility, NSPI, obtain approximately 2% (50 MW in capacity) of the province's electricity requirements from renewable sources within three years. As Nova Scotia prepares to draft a provincial renewable portfolio standard (RPS), i.e., legislation created to ensure that a portion of the province's energy comes from renewables, the province's CO_2 emissions continue to increase over its emission target. Industry experts estimate that in order to reduce the province's greenhouse gas emissions by one megatonne by 2012, the provincial RPS would require NSPI to increase its use of renewable energy sources by 11.5 MW annually for the next 10 years, thereby displacing the need for an equivalent amount of conventional production (Hughes *et.al.* 2003).

Although wind energy is one of the most economical and cleanest renewable energy sources available, the potential for negative impacts on avian wildlife is of concern. From the work that has been done, bird deaths are known to be a significant problem at two wind farm locations, i.e., Altamont Pass in Calfornia, and Tarifa, Spain. Improved technologies and increasingly sensitive siting, however, have dramatically reduced the potential impact for such kills. There will always be a potential for avian deaths, but it is essential to balance this against both the benefits of wind generated power and the kills arising from fossil fuel power generation and other activities. In the United States, for example, it is estimated that 57 million birds die in vehicle collisions, 1.25 million collide with tall structures, and 97.5 million fly into plate glass, while domestic cats are estimated to kill approximately 100 million birds each year (AWEA, 2000).

Wind energy displaces the need for other more harmful fossil fuel generated energy. The latter is also a cause of avian mortality directly through the destruction of habitat, oil spills and mercury emissions, and indirectly through acid rain and global climate change. One migratory songbird species that is known to have been negatively affected by acid rain over its breeding range on the eastern seaboard is the Wood Thrush. Its decline has been linked to nonviable egg production caused by a deficiency of calcium rich food in their acid rain receiving environments (AWEA, 2000 and Chu and Hames, 2002).

A Life-Cycle Value Assessment carried out by the Pembina Institute estimates that energy generated from wind farms have 98.5 and 98.9 percent less emissions than natural gas and coal-fueled systems respectively (McCullough *et al*., 2000). The proposed PPWF would have the capacity to contribute up to 30 MW of renewable energy to the provincial grid, moving NSPI closer to meeting its mandate and reducing Nova Scotia's greenhouse emissions.

2.1.3 Alternatives

For any site to be considered for a commercially viable wind farm, it must have at least the following attributes:

- Located at a farmable wind resource (winds above a threshold taking into account all attributes including turbulences);
- In close proximity to the end user or the off-taker, i.e., NSPI's electrical grid, at a physical location where the planned capacity of the wind farm can technically be accommodated in the grid and preferably in an area where additional load is welcome or needed;
- In a community in which there is reasonable acceptance of the development;
- Available land at an economical cost; and
- Accessibility for transportation of the wind turbine equipment and related structures.

AWPC generally evaluated locations in the southern portion of Yarmouth County and the north-western portion of Shelburne County for placement of wind farms. Throughout much of the southwest region, not only is much of the coastal land populated, but many locations are subject to other commercial uses. There are also many areas of valued and sensitive coastal habitat. Land availability, to the extent of the space and physical conditions necessary for a wind farm, is therefore limited. It was decided that the Pubnico Point site offers the above noted attributes, is not inhabited, or intensively used, and is not characterized in any register as valued habitat. Currently southwest Nova Scotia draws most of its supply on NSPI's electricity generating capacity from the east. The prospect of new generation at the Pubnico Point site therefore offers a positive addition to the grid's electricity supply in the region.

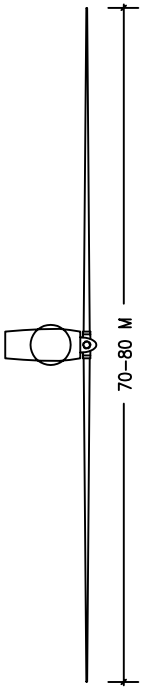
2.2 Principal Project Components

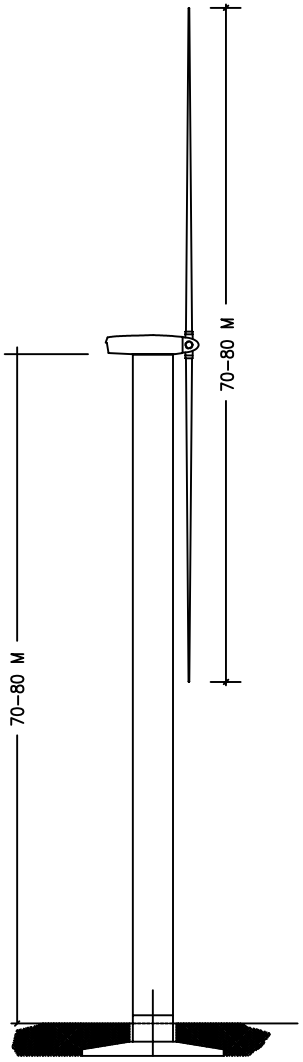
2.2.1 The Wind Turbine Generators

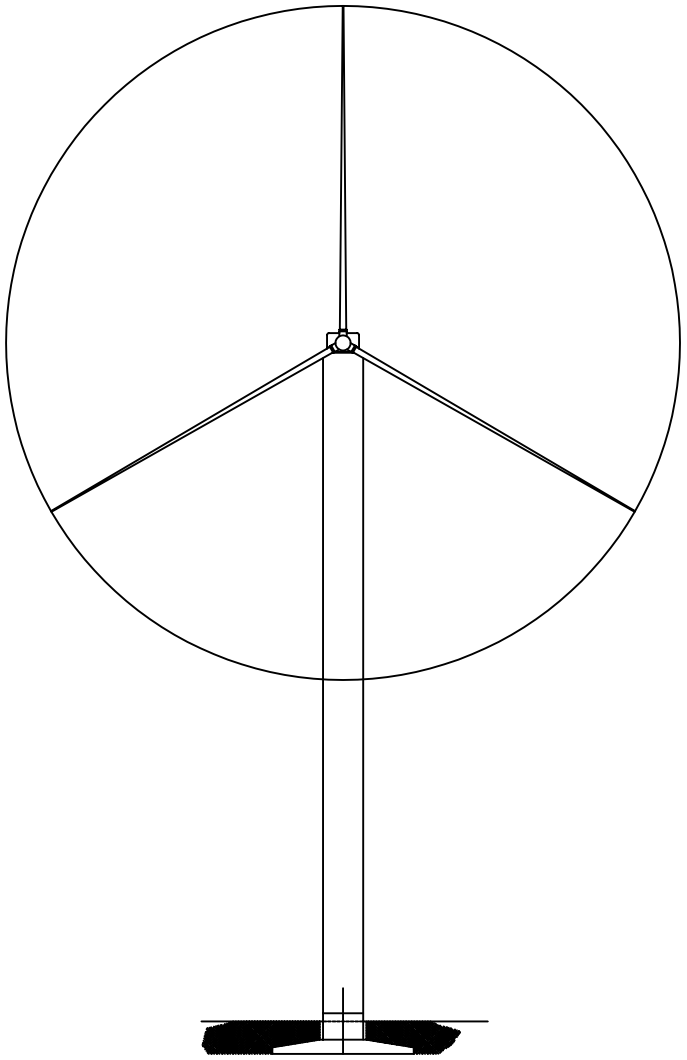
The WTGs to be installed on site consist of towers that are approximately 80 metres tall with a blade diameter of 82 metres. The specifications of an individual WTG is graphically presented in Figure 2.4.

A WTG is generally comprised of four components: the foundation, the tower, the nacelle and the blades. The foundation is a large, steel reinforced concrete base on which the tower is permanently bolted. The extent and specific design of the foundation will be determined through the course of detailed engineering. Geotechnical information with respect to the site is being compiled and will be taken into account during design. To enhance the knowledge base, proven foundation design recommendations from manufacturers have been made available to the proponent's engineers. It is, however, the professional engineers' ultimate responsibility to approve a particular foundation structure for use at the Pubnico Point site.

Geotechnical investigations have been undertaken at the proposed locations of the first two WTGs. One of these is the WTG installation in the northwest corner of the site. At this location, a 3.3 m thick layer of compact to dense silty sand with gravel till was encountered over fractured to sound gneiss bedrock. The other is the WTG site located at the southeast corner of the site. Here, a 10.3 m thick layer of compact to dense silty sand was encountered over fractured to sound gneiss bedrock. No blasting will be required at either site to accommodate the WTG foundations. The sulphide sulphur content of the rock was 0.121% and







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Designed	Drawn	Checked	Approved
D.K.	D.M.M.	X	X

Approx. Scale	Contract No
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21208_M1

SPECIFICATION OF WIND TURBINES
(FOR ILLUSTRATION PROPOSES ONLY)

ADDENDUM No. XX

Figure 2.4

Drawing File: PLAN_ELEV.DWG Date: 7/7/2003 10:56 A.M.

0.355% respectively, i.e., below NSDEL guidelines for sulphide bearing rock. As detailed design for the Project proceeds, further geotechnical investigations will be undertaken at the other WTG sites.

The tower is a conical shaped steel structure. For the WTGs being considered, the tower will be approximately 80 metres in height. The tower consists of, depending on the specific manufacturer, three or four sections assembled on site by bolting the sections in place. The base of the tower is approximately 5 metres in diameter. The tower, which will have a locked entrance to enable access for maintenance personnel, will accommodate internal ladders and safety harnesses. There are no external devices or attachments that would invite anyone to scale the tower, or that would allow birds to perch. Some of the specific control devices for the individual WTG are located at the base of the tower enclosure.

The nacelle is the enclosure that contains the generation equipment, gearbox, electronics, other internals and, in the case of one manufacturer's, the unit's transformer. The nacelle is placed atop the tower and bolted into place during installation. Cables from the generation equipment in the nacelle are threaded down through the tower and out the protected base to the on-site cable collection system.

Each WTG has three blades which are typically made of reinforced fiberglass and are about 40 or 41 metres in length for the class of WTG to be used at the Pubnico Point site. The total diameter of the swath is 80 to 82 metres and the total height of the structure (base to tip of blade when at its highest point) is approximately 120 metres for this class of WTGs. The blades turn at a revolution of approximately 15 revolutions per minute (rpm).

Some of the individual WTGs will require to be lit in accordance with the Canadian Aviation Regulations administered by Transport Canada. AWPC will consult with Canada Wildlife Service in course of discussions with Transport Canada to ascertain what is acceptable and prudent and in accordance with the said Regulations.

The preliminary engineering that has been done to date by the proponent has resulted in preferred configuration involving 17 WTGs in four rows (see Figure 2.2). This configuration is expected to generate approximately 100,000,000 kW/hr of electricity annually which would be fed to the NSPI grid.

The output of each WTG will be 600V or 690V, 3 phase, 60 Hz. Each unit will have its own main breaker which will provide both protection and isolation to the unit. Connected to the main breaker of each unit will be 1000V cables installed underground in ducts which will run to a pad-mounted unit transformer located approximately 5 m from the base of each wind generator tower.

A cable collection system will be connected to each of the unit transformers. To ensure that the cable system will be consistent with typical distribution practices and to keep the cables to a reasonable and economical size, a 25 kV system is proposed. The cables on site will be triplexed and will either run on overhead lines, or will be installed underground. This latter decision will depend on the outcome of further engineering and geotechnical analysis. AWPC's preference will be to place the cable collection system underground, although economics and environmental concerns will be factors that will be taken into consideration in the finalization of the engineering specifications.

In the event that geotechnical investigations indicate an insufficient depth of excavatable earth at certain locations, AWPC will consider the benefits and detriments of blasting to facilitate burial of the cables on site. A key factor in this determination will be the presence or absence of pyritic slate, a factor that will be determined by ongoing geotechnical investigations.[12] Where there is sufficient surface material and it is economically feasible to place portions, or all of the collection cable system underground, this will be the preferred approach. If rock needs to be blasted, and if the cable can be buried economically and in accordance with all applicable codes, underground placement will remain the preferred approach. Where underground cables are installed, the thermal resistivity of the soil conditions will be taken into account to ascertain whether and to what extent of the ducts will be used. In the alternative, 25 kV overhead lines will be installed.

2.2.2 The Submarine Cable

As depicted on Figure 2.2, the shortest route (1,093 metres) from the wind farm on Pubnico Point to the NSPI 69kV grid is across the mouth of Pubnico Harbour. As indicated above, it is proposed that this connection be made via a 25kV submarine cable system installed across and beneath the bed of the harbour. Although subject to further consideration, subsequent to detailed engineering, it is currently proposed that up to six cables (two circuits of three single phase cables) be installed each 10 metres apart in a 60 metre wide cable corridor. This would be the widest that the cable corridor would be. If subsequent work indicated that fewer cables would be technically feasible and cost effective, the resultant submarine corridor could be narrower. The cables will be buried to a depth of 1.2 metres for most of the crossing. During the laying of the cables, navigation in Pubnico Harbour may in places be disrupted for short periods of time, i.e., hours, not days. At no time, however, will navigation in the harbour be totally halted, and at no time will there be an exclusion zone imposed at, or in the vicinity of, the proposed cable corridor.

The proposed construction schedule to lay the cables is estimated to be approximately 18 days. The laying of each cable will require approximately three days: one for set up, one to complete a test run and the third for the cable installation. It is planned that the proposed work will take place in the fall of 2003 to take advantage both of the calmer weather at that time of year and reduced vessel traffic in the Harbour as this would be outside the peak lobster-fishing season, i.e., late November to June. Clearly, the preferred approach is that work is initiated on the installation of the cables in early November to allow completion before the beginning of the lobster season, i.e., the last Monday in November which is November 24, 2003.

i) *Route Across Pubnico Harbour*

The selected route (see Figure 2.2) for the submerged cable across Pubnico Harbour is located from 43°37.984 N and 65°47.541 W (West Pubnico) across the estuary to 43°35.757 N and 65°46.788 W (East Pubnico). The exact distance is 1,093 meters. At its deepest, the water in the channel is approximately 23 metres (see Figure 2.5). Typical cross sections of the proposed corridor and cable placements are shown on Figures 2.5 and 2.6.

[12] AWPC has engaged geotechnical engineers who have supervised the drilling of rock samples at the sites of the first two WTG locations and extraction of samples at the site of the abandoned quarry. The results at these locations show no significant traces of pyritic slate. Similar results are predicted at the other planned WTG sites and locations on the access roads. Future geotechnical investigations will be undertaken to verify the prediction that pyritic slate will not be a problem.

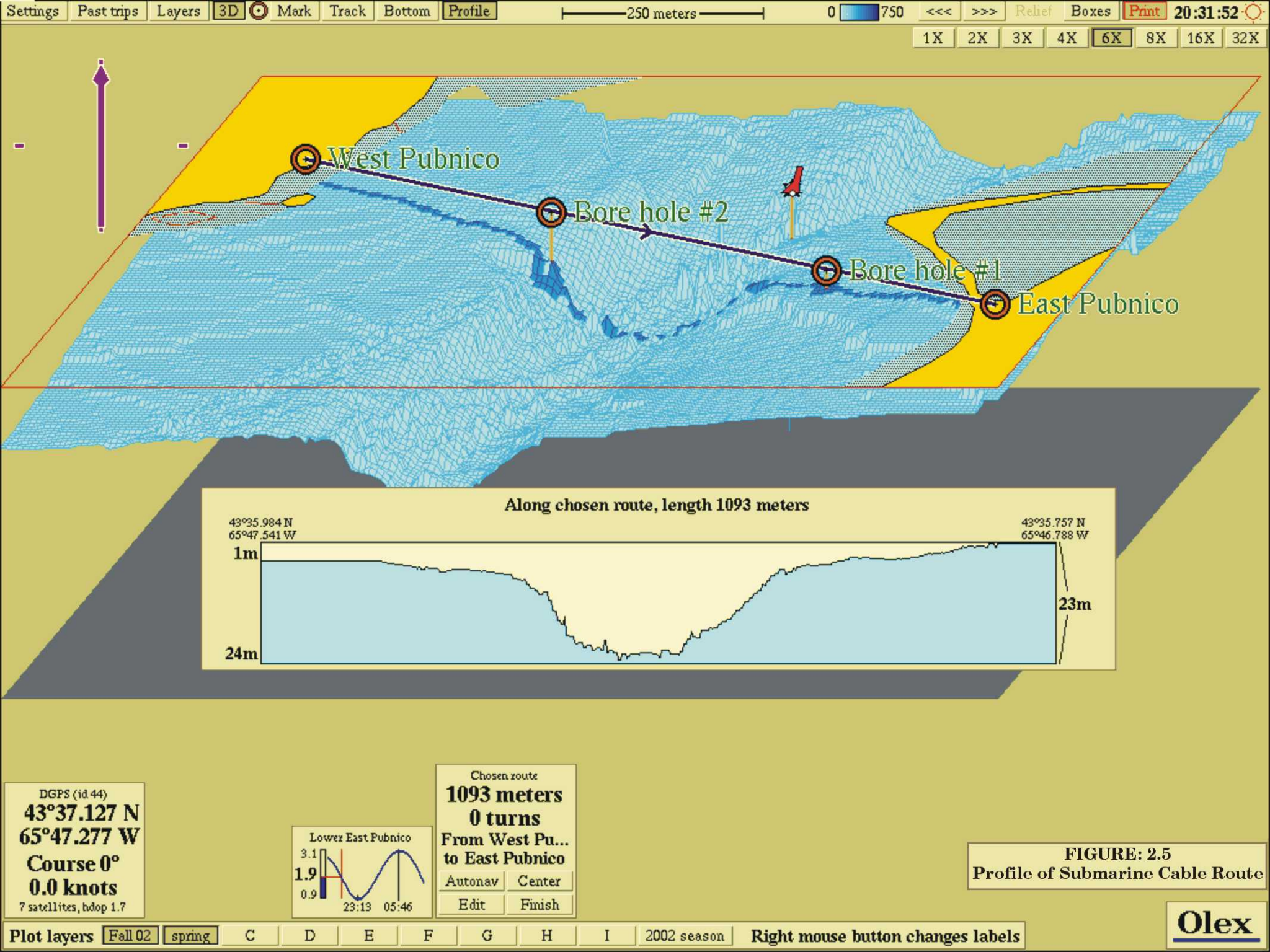
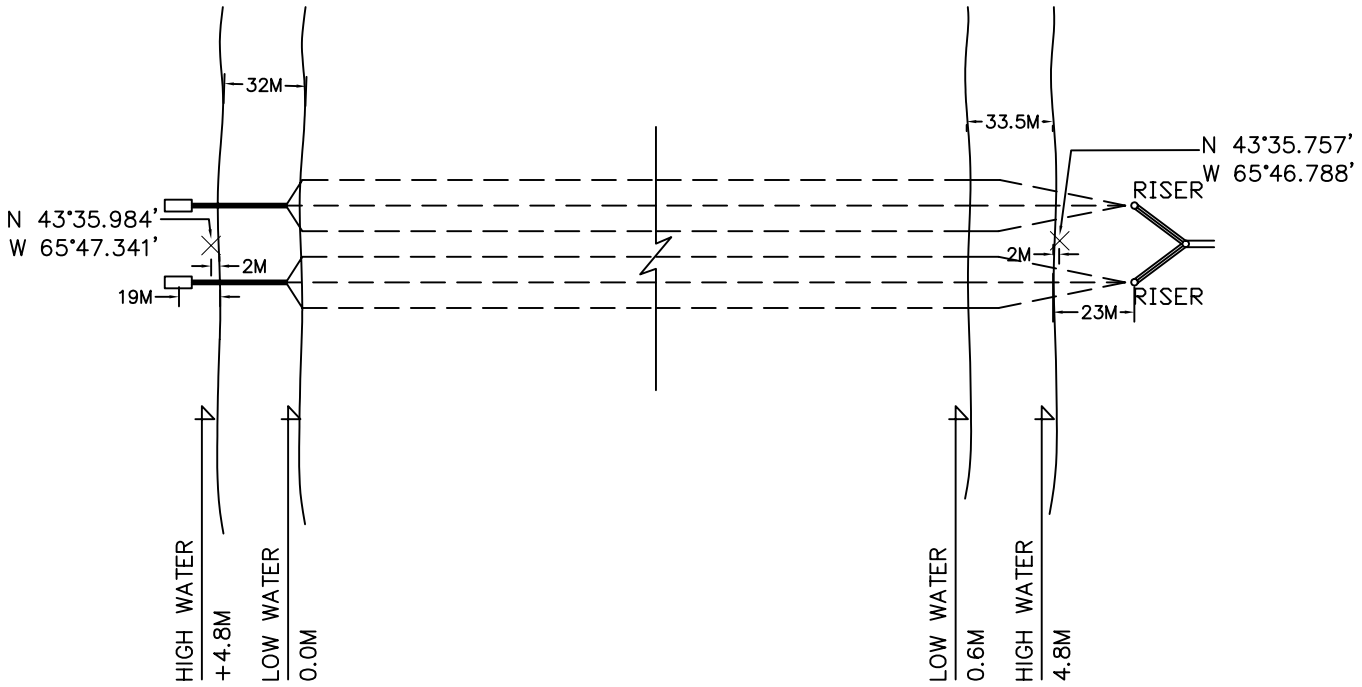
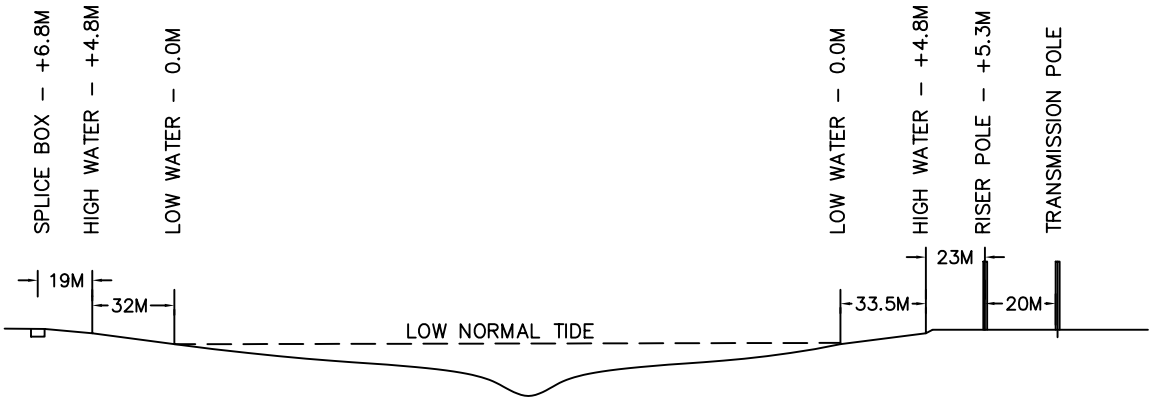


FIGURE: 2.5
Profile of Submarine Cable Route



VIEW FROM TOP
SCALE 1:75



PROFILE ALONG CENTER LINE
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PUBNICO POINT WIND FARM
PROPOSED PUBNICO HARBOUR SUBMARINE CABLE PLACEMENT AERIAL VIEW & PROFILE

DWG No.

Figure 2.6

In March, 2003, a borehole and diver survey was conducted on the route of the proposed crossing. Samples were taken from two boreholes. The first borehole was drilled at low tide in 6 m of water; samples were taken at 0-1 m and 1-2 m. The second borehole was drilled in 11.0 m of water; the sample was taken at 0-1.5 m. The findings indicated that the first 1.5 m of the seabed is composed primarily of fine gravel with silt. There are some isolated areas of cobbles, boulders and rock outcrops; the preferred channel, appeared to be free of outcrops. A gradation of the samples of the channel material showed it to contain 50% gravel (maximum 25 mm), 35% sand and 15% fines.

On the approaches to the west side of the crossing, there is bedrock within 25 m of low water. On the east side, cobbles and boulders extend from just below the low water mark to above the high watermark. Both shores are rocky. Indeed, the entire coast around the point is rocky and exposed. There are no sand dunes or beaches in this area. There is no salt marsh, coastal wetland or associated vegetation in the vicinity of the proposed cable alignment. The nearest salt marsh is approximately 6 km to the north at Double Island.

ii) *Submarine Cable*

Two circuits of three, single phase 25 kV single conductor cables are proposed. It is anticipated that the cables will be 40 mm in diameter and weigh 5 kg/meter. The underwater cable will have two levels of shielding: the first is a semi-conductor shield surrounding the conductor; the other is a copper neutral which acts as a second shield. Although the final design of the cable system has yet to be undertaken, what is proposed is typical of submarine cables including those designed and installed by NSPI. There are, for example, two sets of untrenched 138 kV cables of similar design installed across the Northumberland Strait between New Brunswick and Prince Edward Island. The electro magnetic field (EMF) outside the cables as proposed should be negligible.

AWPC has had extensive discussions with Marenco Consulting (PEI), a firm with substantial experience in the installation of such cables. Their representative has visited Pubnico Harbour and conducted investigations of the proposed crossing. Based on these investigations, digital maps of the harbour bottom, harbour chart information and the proponent's general knowledge of the area, Marenco Consulting was able to assess the scope of the task and provide a detailed appraisal of what would be involved to install the cables.

Prior to the installation of the cables, a test run will be carried out on each of the proposed alignments to identify any obstructions. No attempt will be made to move any rock ledge or to remove any large boulders that may be encountered, i.e., the burying machine (jetting sled) and cable will be directed around any such obstacles. Based on the work that has been done to date, it is predicted that the only location where cable will not be buried is in the vicinity of the low water mark on the West Pubnico side of the harbour. In this location divers will install split-articulated pipe (SAP)[13] to facilitate the transition from the buried situation in the harbour to the trenches in the intertidal zone.

[13] SAP are interconnecting lengths of pipe (0.5 m in each length) which are longitudinally split to fit over cabling systems, providing additional cable protection. The walls of SAP are 13 mm thick and each has a diameter of 150 mm. Each length of pipe has a small end and a large end; the small end of one length is fitted into the large end of the next section, forming string or "necklace". The lengths are secured together using 10 mm stainless steel bolts (see Figure 2.7). The SAP provides the flexibility necessary to drop the cable armour over the ledge.

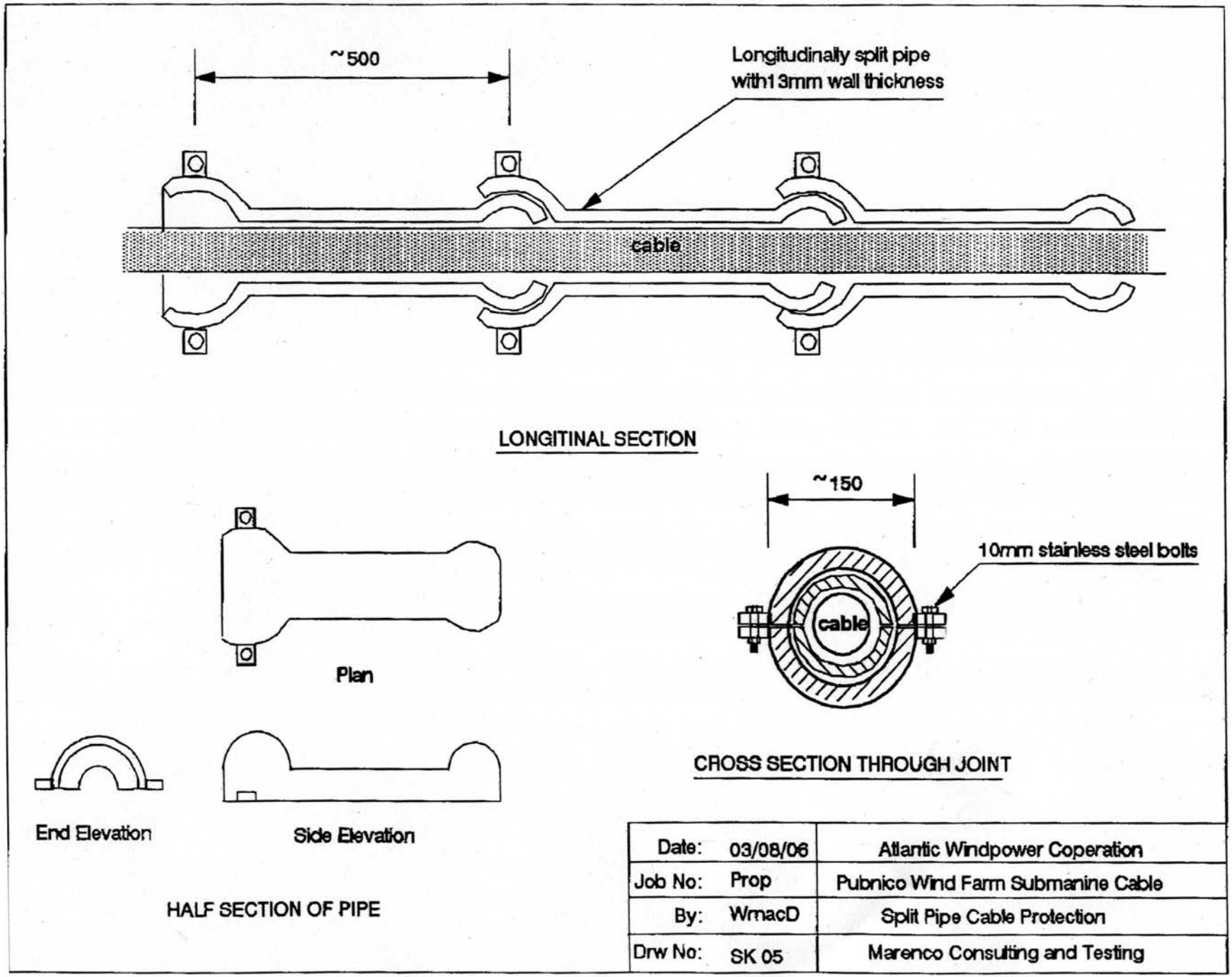


Figure 2.7: Split Articulated Pipe Drawings

The jetting sled will be placed on the east side of the harbour, the cable fed through the burying arm, and a tow wire laid across the harbour bottom to a winch on the west side. A barge with the reel of cable and a pump will move ahead of the sled as the laying train is pulled across the harbour to bury the cable. The anticipated speed of the laying operation is between 2 and 5 meters per minute for a total crossing time of between five and 12 hours. There will be no side-casting of materials associated with the use of the jetting sled to lay the submarine cables. The minimizing of silt disturbance is a distinct advantage associated with the use of this machine. It employs a simultaneous dig and bury operation which results in a trench which is only slightly wider than the cable itself and which, under most circumstances, does not require backfilling. In sand and gravel conditions, all that is evident only minutes after the machine has passed is a slight depression behind the arm. After a day or two, there is often no sign of the machine's passing.

As the machine moves across the seabed, it creates a small sediment cloud which is often not visible from the surface, even in shallow depths. When used in silts, clays and tills, a sediment plume may be visible: this plume trails behind the machine before settling to the bottom. As the machine is moved across the seabed, the skis may also disturb the bottom, sometimes creating a plume similar to that caused by the burying arm. The total disturbance is comparable to that caused by a small fishing boat in very shallow water. There have been attempts made to pull silt curtains behind the machines on the downstream side, but such attempts have not been very successful. One of the main challenges is to keep the bottom of the curtain close to the seabed without causing additional disturbance.

Where bottom conditions, water depths and equipment size are suitable, the burying machine can be used from high water to high water. The disturbances on the shore approaches are then similar to those on the rest of the crossing. In many circumstances, however, the material on the approaches is more difficult, or the logistics do not allow the use of sleds or plows. In such circumstances, cut and cover operations are used between the low and highwater marks.

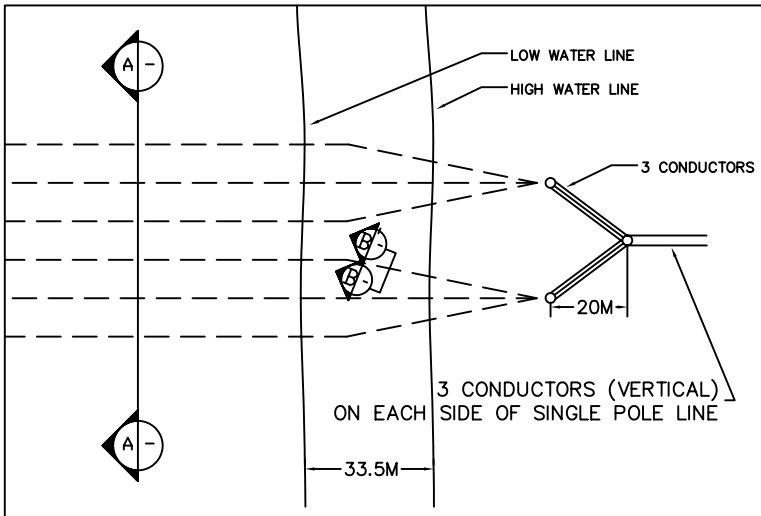
On reaching the bedrock on the west side of the estuary, the sled will be removed from the cable and the cable laid on the ledge, protected with SAP as previously discussed. Subject to further detailed site investigation, the intent is not to trench in the intertidal zone. To the extent possible, natural channels within the exposed bedrock will be used, if they are appropriately located. Where this is not feasible, some excavating of a trench in the bedrock may be necessary[14]. In such cases the materials excavated from the resultant trenches within the 32 metre intertidal zone will be handled in one of the following ways:

- removed from the site and disposed of at an appropriate waste management facility;
- back filled into the trenches on top of a layer of concrete designed to protect the trenched cables. Cross-section CC in Figure 2.8 provides a profile of such backfilling where excavation proves necessary; or
- backfilled into the trenches without the use of the concrete.

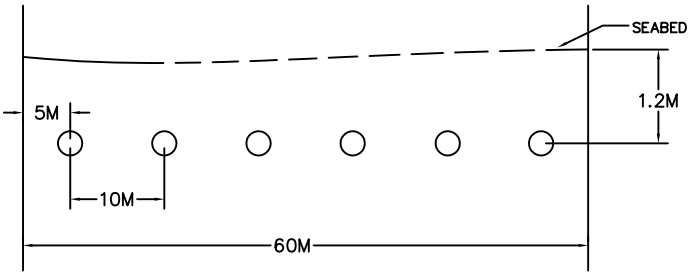
The latter is the most likely method to be used.

Based on the technical field investigations that have been done to date, the only location where blasting may be required is in the intertidal zone on the west side of the harbour. Until the detailed site investigations have

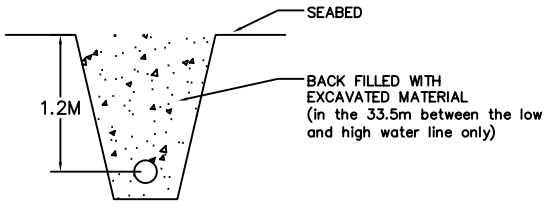
[14] The requisite application for authorization to destroy fish by means other than fishing (i.e., by virtue of Section 32 of the *Fisheries Act*) will be submitted to the Habitat Management Division of DFO in Dartmouth. This application will be pursued should the findings of detailed engineering determine that blasting in the intertidal zone is necessary.



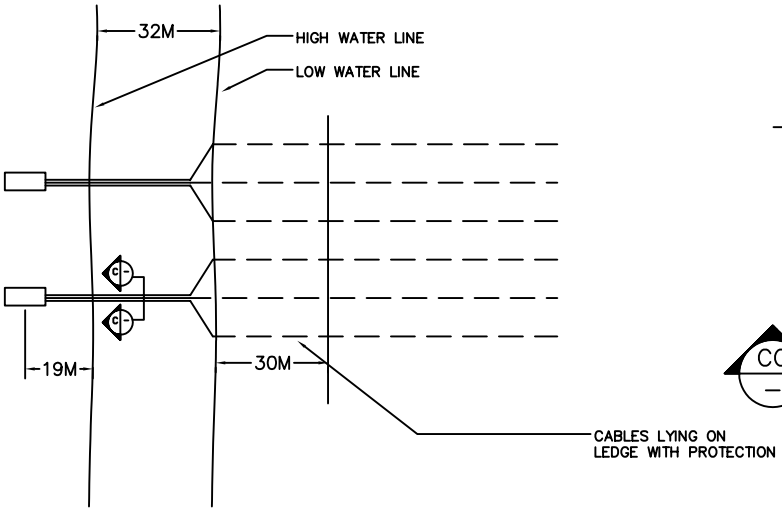
CABLES ON EAST SIDE
1:50



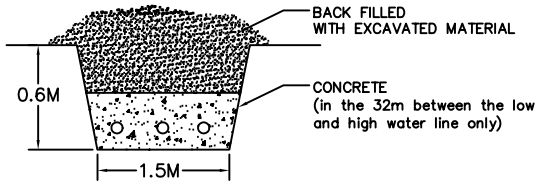
AA SECTION: CABLE CORRIDOR
NTS



BB SECTION: INDIVIDUAL CABLES
IN LOW WATER AREA
NTS



CABLES ON WEST SIDE
1:50



CC SECTION: TRENCH IN WATER,
LOW WATER AREA
NTS

Scale	Date	Designed	Drawn	Checked	Approved	Contract
AS NOTED	MAY 06, 2003	MARENCO	SM	MARENCO	MARENCO	031208

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PUBNICO POINT WIND FARM
PROPOSED PUBNICO HARBOUR
SUBMARINE CABLE PLACEMENT
CROSS SECTIONS

DWG No.

Figure 2.8

been completed, the extent of the blasting in this area cannot be fully determined. Should blasting be necessary at all, it will be done at low tide and in accordance with all regulatory requirements.

On the east side of the estuary, a trench will be excavated to 1.2 metres and the cable buried for approximately 60 metres landward of the low water line where it will be installed on a riser pole and connected to the transmission line.

2.2.3 Connection to the Grid

As noted above and indicated on Figures 2.6 and 2.8, the cables will be trenched approximately 60 metres in from the highwater line on the East Pubnico side and continue on overhead lines to a substation and then to the NSPI 65 kV grid. The substation itself has not yet been engineered, but will be designed to meet NSPI requirements and in all ways will be comparable to NSPI designed substations. It will have a single oil-filled transformer with a capacity of 20,000 litres of non PCB oil. A standard NSPI oil containment system will be installed. The balance of the equipment contains neither oils nor other liquids. No equipment or materials will be stored at the substation.

2.2.4 Ancillary Components

In addition to the principal project components detailed above, the following works or ancillary components are either required, or are being considered:

- access roads to facilitate the transportation of the materials to each of the WTG sites;
- temporary assembly and associated construction space, i.e., lay-down areas;
- re-opening of quarry on site;
- installation of a fibre optics cable; and
- administrative building.

Access Roads

Access to the site and to each of the WTG rows from the existing public road (Route 335) is necessary to enable construction and subsequent servicing and maintenance of each WTG. The access roads will be located adjacent to each WTG row and will be cleared of all vegetation. These roads will be approximately 4 m in width and will be constructed on a base of crushed stone to enable the passage and handling of the large and heavy loads associated with the construction. The first access road to be constructed in its entirety, i.e., in the fall of 2003, will be the most northerly one, i.e., the access to Row A (see Figure 3.2).[15] This will enable the construction of the WTGs in the north-west corner of the site. Some 75 m of this roadway will be built across the northern portion of the wetland as indicated on Figure 3.2. The detailed design of this roadway will take into account the footprint of the wetland and the need to ensure that the nutrient and surface water flow associated with the wetland from north to south is maintained.

Some portion of the southernmost access road, i.e., the access road to Row D, will be constructed in the same timeframe to enable the construction of the second WTG. No portion of this road impinges on the wetland.

[15] It is noted that a Water Rights Application will be made to NSDEL to construct this and access Row B across the wetland.

The balance of the access roads will be constructed during the fall and winter of 2003-2004. The second most northerly access road, i.e., the access road to Row B, will be developed across approximately 325 m of wetland. Detailed engineering will address the issue of ensuring that the nutrient and surface water flows in the wetland are maintained. The Environmental Protection Plan will reflect the requirements of the detailed engineering and will identify the specific measures that will be employed to minimize disturbance to the wetland through the construction period and to protect the wetland during Project operation.

Assembly and Associated Construction Space (Lay-Down Areas)

In addition to the access roads described above, there will be a need for land in the vicinity of each of the WTGs to facilitate their construction. It is anticipated that an area of approximately 600 sq. m will be required in the vicinity of each tower. Only one of the towers in Row B would possibly impinge on the wooded western extremity of the wetland as the latter has been ground-truthed (see Figure 3.2). To the extent possible this WTG will be located to minimize its impingement on the wetland. The necessary construction area will be similarly sited. Subsequent to the completion of WTG construction, the lay-down areas in the vicinity of each WTG will be cleared and revegetated with local plant species.

In addition to the space required in the vicinity of each WTG, lands will be required within the site perimeter for administrative, storage and parking purposes. Although the detailing of such requirements has not yet been undertaken, such uses will be located to the east of the site and to the west of the public road. A minimum area of 50 m will be maintained between the eastern edge of the wetland and the location of such temporary assembly and laydown areas. Apart from the construction area necessary to take the cables to the western shore of Pubnico Harbour, no lands to the east of the public road, i.e., between the road and high water mark will be used as a laydown or assembly area. After construction has been completed, a lesser area will be retained to the west of the public road for parking, and much of the area used during construction for lay-down will be rehabilitated and revegetated.

Quarry

Since crushed rock is required for the construction of the access roads, the proponent is considering the reopening an old quarry which is located on the site (see Figure 2.2). This quarry was worked in the 1980s for rock for the construction of the Dennis Point Wharf; a local construction company removes previously blasted rock from the site on a regular basis. A final decision as to whether this quarry will be used has not been made and will not be made until submissions have been received from proposed contractors. Initial discussions with construction professionals who had visited the site to see the rock resource suggested that the product would not necessarily be of typical road grade quality, but might be suitable for the proposed access roads. Discussions are proceeding with a number of parties, and it may prove to be more economical to truck rock in from elsewhere for the access roads. Such sources will not be determined until the final contractor bids have been received. AWPC has attained geotechnical information with respect to the quarry and determined that it does not contain pyritic slate. The proponent initiated discussions with the NSDEL in early July with respect to the permits necessary to work this quarry. Should it be decided to reopen the quarry, the necessary authorizations to work the rock in accordance with the Pit and Quarry Guidelines will be sought.

Fibre Optics Cable

Discussions with NSPI and wind turbine vendors have identified the possible need for a centralized control and monitoring system between the proposed wind turbines and the substation. The intent is to facilitate

electrical compatibility between the proposed facilities and the NSPI grid, an objective which can be efficiently accomplished by bundling a fibre optic cable from the substation across the harbour in one of the trenches proposed for the electrical cables to the proposed site. If required, this will result in the more technically centralized control of voltage and enhanced compatibility with the grid.

Administrative Building

There will be a need for administrative space both during construction and during project operation. Some portion of such requirements will certainly be accommodated in temporary trailer structures; indeed, it is likely that all the space required during Project construction will be provided by such structures that will be removed at the conclusion of the construction period. Two alternatives are being considered to meet the needs for administrative and storage space during Project operation: the construction of a small permanent building to the east of the proposed site in proximity to the public road, or the use of appropriate space in an existing structure in West Pubnico. The final decision as to which alternative would best serve the needs of the Project may not be made for some time. When the decision is made, applications will be made for the pertinent permits for construction or rehabilitation and occupation.

2.3 Project Activities

2.3.1 Construction Activities

In determining the scope of the Project for environmental assessment, AWPC has given consideration to the following:

- What is involved in the construction of the principal structural elements necessary to the Project including the towers, the submarine cable and the substation; and
- Other ancillary physical works that are necessary to accommodate the construction of the principal elements.

As described in Section 2.1, the evolution of the Project involves discrete activities and tasks. At this time the detailed engineering has not been completed, and specific tenders have neither been scoped nor awarded. Construction, therefore, will involve a range of activities including, but not necessarily limited to, the following:

- The undertaking of a number of surveys including a site survey and geotechnical surveys;
- The phased preparation of the site for construction activity including the construction of access to the site and preparation of the site itself which will involve the clearing of vegetation for the access roads and the mobilization of construction equipment;
- Excavation, where necessary, to accommodate the concrete foundations of the WTG bases and the disposal of the excavated materials in accordance with provincial regulatory requirements;
- The preparation of the building forms for the foundation, the pouring of the reinforced concrete foundation and the attachment of the mounting ring for the WTG;
- The transportation of the WTG, including the tower, to the site by the supplier on flatbed trucks and/or barge and ship to near-site wharfs;
- The lifting by crane of the WTG sections which will be sequentially bolted into place. The nacelle, which contains the gear box, generating and other mechanisms, will then be placed onto the top of the tower;

- The rotor, i.e., the blades of the WTG, will be assembled, or partially assembled, on the ground and then lifted to the nacelle and bolted into place;
- The transformer, which will be approximately 1.5 cubic meters in size, will be sited within or in close proximity to the WTG base, unless it is situated in the nacelle;
- The trenches for the power cables will be dug and after the placement of the cables, the trenches will be backfilled; and
- Demobilization and site remediation which will include the restoration of vegetation around the WTGs, and the remediation of construction areas.

The transportation of equipment with dimensions and weights similar to the tower sections and blades of a large turbine is a rare occurrence in Nova Scotia. Consideration is being given both to their transportation by road and by sea from the Port of Halifax to either Shelburne, or directly to the wharf at Dennis Point, West Pubnico. Components would then be trucked to the site. Discussions with various parties are ongoing, but until decisions are made as to the manufacturer and the shipper, the details of the routing to the site are not known. It is certain that their safe transportation will necessitate careful planning and discussion with all pertinent authorities including the NSDT&PW and possibly the RCMP. It is known that for the heaviest components, special permitting will be required.[16] The intent is to select a cost effective and efficient means of transportation and to work with all authorities to ensure safety for all involved including road users. This will likely include the timing of the transportation, the use of escort vehicles, etc.; the details will be worked out in association with the regulatory authority prior to the permits being sought.

2.3.2 Operations and Maintenance

It is expected that AWPC will enter into a service and maintenance agreement with the manufacturer of the WTGs supplied to the Project. This agreement will provide for the placement of on-site experienced staff, some of whom may be locally trained professionals, who will maintain the WTGs. AWPC will manage the operation of the Project ensuring that it meets its contractual obligations to supply quality power in a safe and reliable manner to NSPI. AWPC will work closely on a day-to-day basis with the provider of the maintenance services.

The wind turbines will be operational on a continual basis except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. Each turbine will be subject to periodic maintenance and inspection; regular maintenance will involve oil changes, and any waste products, e.g., the waste oil, will be disposed of in accordance with municipal and provincial waste management regulations.

Generally the rotors of the WTGs will automatically shut down operations in conditions where wind speeds exceed about 25 metres per second (about 90 km per hour).

2.3.3 Decomissioning and Abandonment

The design life of a wind farm is typically 20 – 25 years and capital improvement and replacement programs can extend safe and efficient operations beyond this timeframe. Decommissioning of both the turbines and the site, when it is necessary or desirable, will be undertaken in accordance with the regulatory regime in place at the time. Uses on the lands at Pubnico Point are subject to the bylaws of the Municipality of Argyle.

[16] Personnel Communication, Jim Francis, Nova Scotia Department of Transportation and Public Works.

Recent amendments to these bylaws specifically require the land owner to deal with the wind farm decommissioning issue at the end of a defined period of time in which the WTGs are not used to generate electricity, unless other acceptable uses are then available.

At the end of its useful life, the wind farm will be refurbished, replaced or decommissioned, and in the latter case all equipment will be dismantled and disposed of in a manner that meets all regulatory requirements. Such activities would likely involve the preparation of the site, e.g., the establishment of access for construction equipment and the mobilization of that equipment including cranes, etc. The sections of the towers would be taken apart and would be reused, recycled or disposed of in accordance with regulatory requirements. Underground cabling on the wind farm site and the foundations would remain in situ to minimize disturbance to the site. The WTGs would be dismantled and removed from the site, and the site itself would be restored to the extent practical to a state similar to what currently exists through, where and if necessary, regrading and revegetation.

The submarine cable would be removed in accordance with the anticipated requirements of the Navigable Waters Permit.[17] Until recently most submarine cables were left in situ at the end of the their life, but this is changing, and it anticipated that the conditions of the permitting will require their removal. Removal of unburied cable is relatively simple: one end of the cable is picked up and attached to a power reel on a barge which moves forward and pulls the cable into the reel. Buried cables are more challenging. In water depths of less than 100 ft, the present method is to have divers uncover the cable using air lifts as it is fed onto a barge. In deeper water, there are more sophisticated machines that work like a jetting sled in reverse. It is anticipated that when the time comes for the submarine cables associated with this Project to be decommissioned, comparable machines will be available for smaller projects.

2.4 Project Schedule

As indicated in Section 1.2., AWPC plans to construct and install the wind farm in two distinct phases (See Figure 2.9). The first phase, scheduled to commence in the fall of 2003, will involve the clearing and construction of the four access roads, the construction of two WTGs (as identified in Figure 2.2), the installation of the necessary cabling to connect these WTGs, the installation of the underwater cable and the connections to the grid. The second phase, which would take place from late spring through to the fall of 2004, will involve the construction of the balance of the WTGs, associated cabling and the substation.

Construction in the fall of 2003 is dependent on the receipt of the requisite approvals and authorizations, failing which the construction timelines and the overall approach to the Project will need to be revisited. It is estimated that road construction, site clearing, onshore trenching, installation of the submarine cables and connection into the NSPI grid and initial testing of the installed WTGs can be completed within approximately three to four months. During this period two WTGs would be constructed with commissioning and energy production starting in the first quarter of 2004. In the late summer or early fall of 2004, the remaining WTGs would be erected and commissioned.

[17] The removal of the submarine cable at the owner's expense is a normal condition of any work approved by a Navigable Water's Permit. Personal communication, DFO, Heidi Schaefer, August, 2003.

CBCL LIMITED
Consulting Engineers

AWPC
ATLANTIC WIND POWER CORPORATION LTD.

Pubnico Point Wind Farm

Atlantic Wind Power Corporation

Figure 2.9

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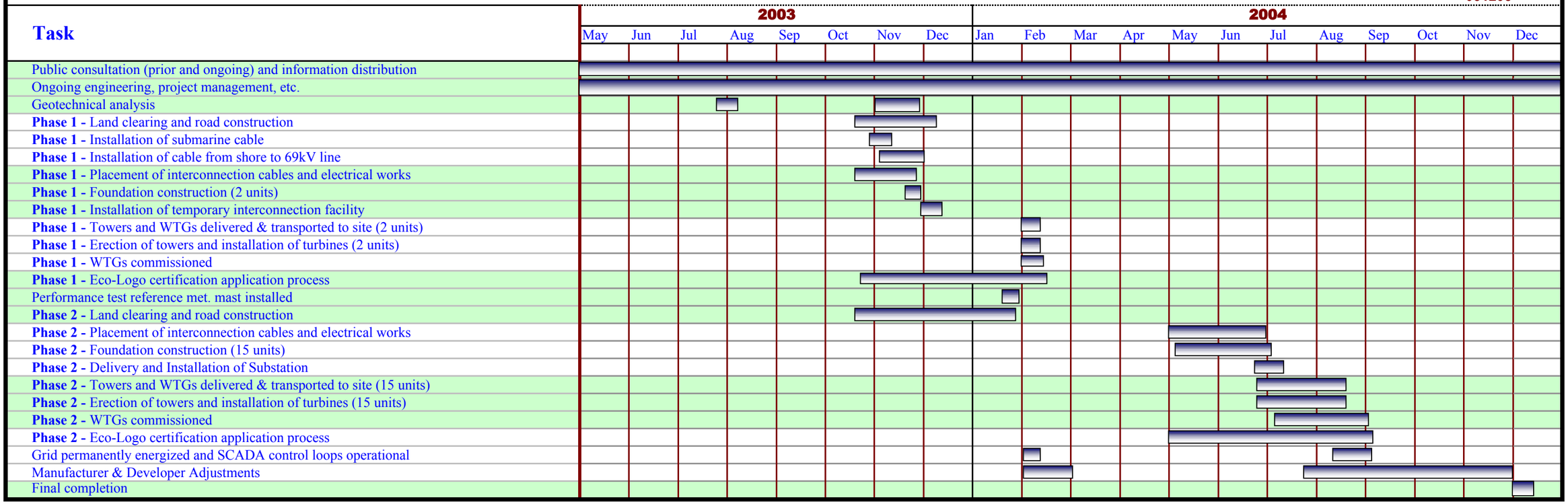

2.5 Anticipated Emissions and Discharges

The proposed wind farm will not generate air emissions, and anticipated discharges are limited to the waste oils that will be handled during the course of regular maintenance. These wastes will be managed and disposed of in accordance with all applicable regulations.

During the construction phase of the Project, control of silt-laden run-off will be an important issue. Erosion and sediment control measures will be stringently applied during the construction period and maintained until soils have been re-established through revegation or other permanent means. Should construction occur during periods of particularly dry weather, dust could conceivably be a factor on site. Given the location, however, and the probability that construction will take place during the fall, spring and early summer, dust is not anticipated to be a substantive concern. Construction debris will be managed on site or at off-site disposal locations in an approved manner. Solid wastes will be recovered for reuse or recycling as required by provincial legislation.

A limited number of hazardous materials will be required for the construction and operation of the proposed turbines. Prior to construction, an Environmental Protection Plan (EPP) will be developed and implemented to ensure that all staff working at the site are appropriately trained to handle, store and dispose of hazardous materials which may include one or more of the following:

- Corrosion and fouling inhibitors;
- Paints;
- Industrial cleaners; and
- Lubricating oils and fuels.

The EPP will be updated to address the specific needs of Project operation. All hazardous materials will be stored and handled according to relevant federal and provincial regulations. Staff will receive the required training specified by law.

EMFs are created when electrical charges flow within any object that conducts electricity. For a transmission line, these fields are created by current in a conductor. When a voltage is applied to a conductor, a magnetic field is created in the space around the conductor, but field intensity decreases rapidly with distance. There has been some public concern expressed with respect to a perception that exposure to magnetic fields is associated with health. The available EMF research does not establish this linkage. Indeed, the National Research Council has concluded that "…. the current body of evidence does not show that exposures to (magnetic) fields present a human-health hazard" (National Research Council, 1996). As stated in Section 2.2.2, the EMF outside the cables as proposed should be negligible.

2.6 Environmental Management

The objective of environmental management is to implement safe, environmentally responsible, and sound engineering, construction, operation, and training practices. AWPC is committed to articulate and adhere to systems, procedures, practices and materials that will ensure the development and operation of the wind farm at Pubnico Point is executed in a manner that protects the environment and facilitates the safety of all who

work or visit the site. To the extent practical AWPC will seek to eliminate sources of pollution at source. The principle components of an environmental management system include the preparation of the following:

- Environmental Protection Plan (EPP); and
- Contingency and Safety Plan.

These plans can only be finalized once the project design is finalized.

The primary components of the environmental management system are:

- defined environmental, health and safety responsibilities and accountabilities for personnel;
- a plan to ensure compliance with regulations, goals and objectives;
- requirements for contractors to establish minimum standards for a contractor safety and environmental program;
- safe work practices and procedures documentation that establish basic precautions for preventing accidents, injuries or illnesses in the performance of work;
- environmental practices and procedures that establish minimum standards for all operations that have a potential to cause environmental problems;
- minimum safety training standards to ensure that all personnel are aware of potential hazards and know safe work practices and emergency procedures; and
- an accident/incident reporting system that standardizes prompt reporting of all injuries and environmental incidents.

Environmental Protection Plan (EPP): the EPP will be developed in consultation with relevant federal and provincial agencies including EC, DFO Habitat Management Division and Navigable Waters Protection and NSDEL, will be completed prior to construction and will outline specific environmental and engineering measures that must be employed during construction, e.g., the deployment of techniques to control erosion and sedimentation and measures to prevent spills of hazardous materials. The EPP will expand upon measures identified in this environmental assessment report and will accommodate recommendations from the regulatory authorities. These requirements will be brought to the attention of all personnel working on the site, including contractors.

Contingency and Safety Plan: the goal of such a plan is to reduce the frequency, extent and duration of accidental events and to reduce the risk to the environment and public safety from such events. A contingency and safety plan will be developed in consultation with relevant federal and provincial agencies for both the construction and operation of the Project. The plan will designate personnel responsible for specific actions, and ensure that an effective communications and reporting system is in place.

2.7 Malfunctions and Accidents

AWPC is cognisant that malfunctions and accidents that pose a risk to human health and safety and to the environment can occur and are committed to ensuring that all requisite protocols are established to:

i) minimize the risk to human health and safety during both construction and operation; and

ii) minimize the risk to the environment during both construction and operation.

These protocols will be incorporated into the site specific contingency and safety plan to ensure the application of environmental protection measures and good engineering practices through construction, operation and decommissioning. An emergency response plan to address responses in the unlikely event of an accident or equipment failure during construction, operation or decommissioning will be included.

The construction and operation of a wind farm, though handling structural elements that are relatively new to this region, employs techniques and technologies that are familiar to the construction industry. If construction occurs during the winter months, it will be necessary to take standard construction site precautions with respect to icing. Wind technicians ("windsmiths"), i.e., those who will be directly associated with the construction of the WTGs, receive training on the hazards associated with ice on tall structures during construction.

The likelihood of serious malfunctions or accidents associated with the operation of a wind farm that would pose a risk to human health and safety or the environment are substantially less than those associated with many alternative forms of power generation. Icing is perhaps the predominant safety concern, and this can be addressed through technical safeguards incorporated in the equipment, staff training and the use of warning signs. The operating staff will be trained to respond appropriately in the event of different scenarios including technical failure, icing and a lightening strike.