

Atlantic Climate Adaptation Solutions Association  
Solutions d'adaptation aux changements climatique pour l'Atlantic

## Nova Scotia Department of Natural Resources Report on the Atlantic Regional Adaptation Collaborative Program

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*Shoreline near Lorneville, Cumberland County, during a storm in 2010. Photo courtesy of Mike Cullen.*



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Shoreline near Lorneville, Cumberland County, during a storm in 2010. Photo courtesy of Mike Cullen.

**Nova Scotia Department of Natural Resources**  
**Report on the Atlantic Regional Adaptation Collaborative Program**

By

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## **Introduction**

The Geological Services Division (GSD) of the Nova Scotia Department of Natural Resources (DNR) operates a long-term program to map the vulnerability of the province's coast to flooding and erosion. The division is building capacity within the provincial government to undertake this work. Currently, we have one geologist assigned full time to the coastal mapping program, with one geologist and a GIS specialist working part time on the program.

The longer term goal is to provide relevant geoscience information and expertise to provincial and municipal agencies to assist with planning for adapting to climate change in coastal areas. The GSD sees participating in the Regional Adaptation Collaborative (RAC) Atlantic Climate Adaption Solutions (ACASA) program as an important opportunity to build partnerships and working relationships with government and non-government agencies dealing with coastal science and climate change.

## **Description and Background on the Department of Natural Resources**

The department has broad responsibilities relative to the management of Nova Scotia's biodiversity, forest, geological, and park resources and the administration of the province's Crown land. Within the Mineral Resources Branch responsibilities include implementing policies and programs that help to ensure the best use of the province's mineral, groundwater and geoheritage resources; collecting and managing geoscientific information; monitoring compliance with regulatory requirements; administering the mineral rights tenure system and mineral royalties; and promoting an understanding of the risks geological hazards pose to Nova Scotians.

The Geological Services Division of the Mineral Resources Branch in the Department of Natural Resources is the principal source in the Government of Nova Scotia of information and expertise regarding the geology and geological resources of the province. The division compiles and disseminates geological databases, reports, maps and models in order to promote responsible mineral, energy and water resource evaluation and development, support better land-use planning, and enhance public health and safety.

The GSD has an Environmental Geology program that provides expertise on geological hazards and land-use issues in Nova Scotia that may affect public health and safety. The program has four full-time geologists who are supported by the branch's Geographic Information System (GIS) Group and Editorial staff. A number of the objectives of the program are directly relevant to the ACASA Project including efforts to:

- Document the coastal areas of Nova Scotia that are at risk of being adversely affected by erosion and/or flooding due to major storms,
- Determine how the shore environment is being affected by measures taken to mitigate coastal erosion,
- Document the quality, availability and vulnerability of groundwater in Nova Scotia,
- Provide the main source of expertise on geological hazards within the Government of Nova Scotia.

## **Climate Change and Adaption Issues**

### **Coastal Erosion and Flooding**

Sea level is, and has been, rising in Nova Scotia for about 10,000 years, since the last glaciers retreated. The rate of sea-level rise has varied with time and location: a rate of ~32 cm/century has been measured in Halifax (Forbes et al., 2009), based on tidal gauge data (Fisheries and Oceans Canada, 2011). This rate of rise is expected to continue or accelerate because of global warming (Intergovernmental Panel on Climate Change, 2007). In combination with sea-level rise, global warming may also increase storm events affecting coastal ecosystems and infrastructure. Sea-level rise may increase the risk of flooding and coastal erosion, affecting coastal ecosystems and infrastructure.

Nova Scotia has what is characterized geomorphologically as a drowned coastline. This means that relative sea level is rising with respect to the land. As a result, over decade to century time scales, the coastline is generally eroding with storm surges and flooding increasingly affecting public and private infrastructure and the safety of Nova Scotia residents who live near the shore line. Mapping of Nova Scotia's coastline with respect to various dynamic coastal processes is necessary to understand present and future effects of shoreline erosion and coastal flooding.

Marine processes affecting Nova Scotia's shoreline vary based on regional factors such as the local geomorphology, different effects from storms and hurricanes, tidal ranges, and the presence or absence of ice. It is necessary to understand these effects on a regional basis to assist the public, industry and government to respond appropriately in both the near term and for longer term planning.

### **Vulnerability of Coastal Aquifers**

Approximately 50% of Nova Scotians rely on groundwater for their water supply, and about 60% of Nova Scotians reside within 20 km of the coastline. Seawater intrusion into coastal aquifers, driven by sea-level rise and changes in groundwater recharge resulting from climate change, is a concern for water resource management in the province. DNR has been involved in a multi-partner ACASA project to assess the vulnerability of coastal aquifers. The report on this project is contained in a separate ACASA report titled *Vulnerability of Nova Scotia's Coastal Groundwater Supplies to Climate Change* (Ferguson and Beebe, 2012), and this report will not refer to the issue further.

# **ACASA - Related Activities**

## **Project: Coastal Hazard Mapping**

### ***Purpose***

The purpose of this project was to improve planning and decision making in a context of rising sea level. The GSD worked on this project in collaboration with the Maritime Provinces Spatial Analysis Research Center at Saint Mary's University and the Applied Geomatics Research Group at the College of Geographic Sciences. The division is focused on three study areas for coastal hazard mapping: Yarmouth, Lunenburg and Oxford-River Phillip. These areas represent approximately 130 km of coastline (seven 1:10 000 map areas - three in the Yarmouth area, two in the Lunenburg area and two in the Oxford-River Phillip area), with diverse coastal environments.

### ***Approach***

The approach was initially subdivided into three scientific components: coastal characterization, coastal change analysis, and coastal sensitivity mapping. A key additional component of the project is termed knowledge transfer, where efforts will be made to provide local planners and other decision makers with information on coastal hazards.

Coastal characterization is a systematic analysis (i.e. mapping) of the coastline, delineating shoreline features (landforms and anthropogenic features), processes and sediment characteristics. The approach selected for this project is to map the surficial materials of an entire 1:10 000 NTS map area adjacent to the coast. The advantage with this approach over mapping only a strip along the coast (e.g. Finck, 2009) is that it provides users with additional information (especially in the backshore) in a more readable format, and can complement coastal ecosystem mapping (e.g. Utting et al., 2010). Coastal characterization maps will be the basis for interpretation of coastal hazards. This information is collected from a number of sources, both by remote sensing (aerial videos, satellite imagery, lidar and aerial photographs) and by field observation.

### ***Human Resources***

The coastal characterization mapping program was led by Dan Utting (Geologist - DNR) beginning with the 2010 field season and concluding in the fall of 2011. During the 2010 field season Dan was supported by three summer students funded by the ACASA project and by Sandra Johnston (Geologist - DNR) mapping in the Lunenburg study area. During the 2011 field season Dan was supported again by Sandra Johnson in the Lunenburg area and two summer students funded by ACASA and one by DNR.

### ***Results***

Six 1:10 000 maps are currently still in production and should be released in the summer of 2012. DNR will also release a digital product containing all the GIS databases for free download from its web site in the summer of 2012. For a listing of all the maps and digital products see Appendix 1.

## **Project: Coastal Change Analysis**

### ***Purpose***

Coastal change analysis provides a measure of erosion or accretion rates, which are significant for coastal management. A simple method of measuring coastal change is to compare the shoreline from archival aerial photographs to the present-day shoreline. In some coastal environments indicators other than the coastline might be used to measure change. For example, in mudflats and salt marshes mapping channels and/or the seaward edge of the feature, or mapping changes in vegetation levels, reveals cyclical or permanent changes in these environments.

### ***Approach***

Aerial photographs were georeferenced in ArcMap (Geographic Information System-GIS), and coastal change was measured using the 'endpoint' method (i.e. comparing the oldest available aerial photography to the most recent). In areas of higher susceptibility, coastal change may be measured using photographs from intervening years.

### ***Human Resources***

This analysis was carried out by Laura Trudell (Dalhousie Planning School) and Dan Utting during the summer of 2011. They measured the change along the shoreline in 18 different areas.

### ***Results***

The results of this study can be found in Utting (2011), and in an unpublished document *Coastal Change Analysis: case studies in Pugwash, Lunenburg and Yarmouth areas* (see Appendix 2).

## **Project: Coastal Sensitivity Mapping**

The purpose of this project was to integrate all of the available data from the coastal hazard mapping and coastal change analysis project to produce a map of the sensitivity of the coastline. In the fall of 2011 geologist Dan Utting resigned his position with the department and was not able to complete the coastal sensitivity mapping part of the program. The sensitivity mapping would have resulted in a number of maps and a report that would have aided in coastal planning and decision making.

## **Project: Impacts of Coastal Processes on Public and Private Infrastructure**

Although this GSD project is not directly an ACASA project it fits well within the goals of the program and the work should be mentioned.

In many coastal areas of Nova Scotia, costly repairs to public and private infrastructure are occurring continually. Geological and geotechnical evaluations in these areas aim to identify factors that increase and/or decrease the risk of infrastructure loss.



The project aims to demonstrate how applying basic geological knowledge to development and planning processes will result in both immediate and long-term cost savings. The intent is that knowledge gained in this project will be directly applicable to other areas. Thus, the project may also provide valuable information for long-term planning processes.

A number of study areas have been identified, particularly in provincial parks, including Little Dyke, Glenholme, Blomidon Provincial Park, Dominion Beach, Gabarus, Rissers Beach Provincial Park, Cabot Plaster Park, Graves Island Provincial Park, Malagawatch and Blue Beach. Phil Finck (Geologist - DNR) has been visiting these locations and trying to document the coastal processes that are affecting the coastline, and in particular the infrastructure in the area.

These studies will provide necessary information to DNR's Parks Division, other governmental departments (municipal, provincial, federal), non-governmental organizations, private companies and the public on coastal hazards and the long-term effects of coastal processes on people, safety, environment and infrastructure. It will provide important information for planning and sustainability. The results of some of this work have been released in a series of reports by DNR (e.g. Finck, 2012); further reports will be released in 2012.

### **Project: ACASA Map Production**

The intent of this project is to produce a number of high quality, peer reviewed and scientifically edited maps for three of the mapping projects that are part of the ACASA program. The initial data gathering and interpretation were done by the organization in charge of the project. The databases were passed on to the GSD GIS Group, including Brian Fisher, Jeff McKinnon and Angie Ehler, who worked on developing the DNR databases and then reviewed all the GIS map databases and performed quality control on them as required. The GSD cartographer, Angie Ehler, worked on the final cartographic map products. ACASA funded a part-time editor, Kathy Mills, who was hired to edit all the maps. Kathy's position ended in March and further editing of the maps was done by Doug MacDonald and Eugene MacDonald. The maps will be published by DNR and will also be available for free download from the DNR web site in the summer of 2012.

## **ACASA-Related Products**

A list of all maps, reports and digital products produced as a result of this program can be found in appendices 1-4 as outlined below.

Appendix 1 - list of Surficial and Coastal Materials maps and GIS digital products for the Yarmouth, Lunenburg and Oxford study areas produced by DNR

Appendix 2 - reference for an unpublished report produced by DNR on coastal change analysis in 18 areas of the province in the Pugwash, Yarmouth and Lunenburg ACASA study areas, reports on the Impacts of Coastal Processes on Public and Private Infrastructure project, and a list of other DNR reports that may be of interest

Appendix 3 - list of the Shore Zone Characterization Maps for the Amherst and Grand Pré study areas produced by the Maritime Provinces Spatial Analysis Research Center at Saint Mary's University

Appendix 4 - list of the Coastal Flood Risk from Sea-level Rise and Storm Surge Maps for the Yarmouth, Oxford, Minas Basin, Lunenburg and Amherst study areas produced by the Applied Geomatics Research Group, Nova Scotia Community College

# **Adaptation Priorities and Future Program Plans**

## **Project: Coastal Processes on Public and Private Infrastructure**

DNR has already found that this project has benefited staff that maintain parks in Nova Scotia. They are now better able to understand why some infrastructure is not holding up well against coastal erosion, and how to correct the problems in a more cost-effective way, resulting in longer term solutions to the problem. This should save the government money in the long term. The workshops we have been holding with staff, contractors and local interested parties appear to be resulting in a better understanding of coastal processes and how to mitigate their effects.

We plan to continue this program this fiscal year and hopefully into the future.

## **Project: Coastal Hazard Mapping, Change Analysis and Sensitivity Mapping**

This project suffered greatly from the resignation of the project geologist before the project was completed. It is the intention of the GSD to fill this position in 2012 with an individual with a background and experience in geoscience and coastal processes. This person will be asked to review the work done on this project and make recommendations on how to complete the work and produce the required coastal sensitivity maps. It will be part of this person's responsibility to meet with planners and local community people to produce products that will be useful to them in their land-use decisions.

Nova Scotia has an incredibly long and varied coastline, which is affected by many processes. There is no way that the whole coastline can be mapped in detail. Instead, we plan to identify areas of coastline that are similar in geology and how they are affected by coastal processes. Then we will choose sample study areas that could be considered similar to 'type sections' and start a program of mapping these areas of the coastline in detail. The results of this mapping will lead to a better understanding of coastal processes in Nova Scotia and we can take what we have learned and apply the lessons to similar areas. This should allow us to provide more information to Nova Scotians over a shorter period of time.

## Conclusions and Lessons Learned

This project has been a very good experience for the Geological Services Division and its participants have learned a great deal as they attempt to better understand coastal process and learn how to map the coastline and produce products that will be useful to coastal communities, planners and individuals making land-use decisions along the coastline. There are a number of important lessons that we have learned including:

- We must have staff that are properly trained to understand coastal processes and how to map them.
- If we want to do detailed mapping of the coastline lidar data and imagery are key components for appropriate accuracy. Existing topographic maps are not suitable because of scale issues and errors.
- We have the ability to map the coastline at incredible detail, but this would take an extremely long time to complete and not cover many important types of areas. At the other end of the spectrum we could map the coastline at a very high level in a general way but not gather enough information to make proper decisions. We need to find the proper level of detail to answer the questions asked of us and provide products that will assist land-use decision makers.
- We are still struggling with determining the best type of products to produce that will be useful to decision makers. We feel that we may need to look at an on-line interactive mapping application or another digital product version, such as layered PDFs, to assist in this process.
- We need to meet with more planners and community groups to learn how to better help them.

## References

- Ferguson, G. and Beebe, C. 2012: Vulnerability of Nova Scotia's Coastal Groundwater Supplies to Climate Change; Atlantic Climate Adaptation Solutions Association web site, <http://atlanticadaptation.ca/acasa/sites/discoveryspace.upei.ca/acasa/files/Nova%20Scotia%20ACAS%20groundwater%20report%20.pdf>.
- Finck, P. W. 2009: Coastal hazard assessment mapping in St. Margarets Bay (NTS 21A/09 and 11D/12), Nova Scotia; in Mineral Resources Branch, Report of Activities 2008; Nova Scotia Department of Natural Resources, Report ME 2009-001, p. 15. <http://www.gov.ns.ca/natr/meb/pdf/09re01.asp>.
- Finck, P. W. 2012: A Coastal Hazard Assessment of the Gabarus Seawall, Cape Breton County, Nova Scotia; Nova Scotia Department of Natural Resources, Open File Report ME 2012-002. [http://www.gov.ns.ca/natr/meb/data/pubs/12ofr02/OFR\\_ME\\_2012-002.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/12ofr02/OFR_ME_2012-002.pdf).
- Fisheries and Oceans Canada 2011: Station Inventory Data, Station 365 (Yarmouth). <http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/twlmne/inventory-inventaire/sd-ds-eng.asp?no=365&user=isdm-gdsi&region=ATL&ref=mapscartes>, last accessed on March 16th, 2011.
- Forbes, D. L., Manson, G. K., Charles, J., Thompson, K. R., and Taylor, R. B. 2009: Halifax Harbour extreme water levels in the context of climate change: scenarios for a 100-year planning horizon; Geological Survey of Canada, Open File 6346, p. 22.
- Intergovernmental Panel on Climate Change (IPCC) 2007: Technical Summary. <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-ts.pdf>, last accessed on March 17, 2011.
- Utting, D. J., Basquill, S. P., DeMont, G. J. and Benjamin, L. K. 2010: An interdepartmental study at Carters Beach (NTS 20P/15), Queens County, to assess coastal stability and develop a pilot coastal ecosystem classification; in Mineral Resources Branch Report of Activities 2009; Nova Scotia Department of Natural Resources, Report ME 2010-001, p. 133-135. <http://www.gov.ns.ca/natr/meb/pdf/10re01.asp>.
- Utting, D. J. 2010: Yarmouth Coastal Mapping, a Component of the Atlantic Climate Adaptation Solutions (ACAS) Project; in Mineral Resources Branch Report of Activities 2010; Nova Scotia Department of Natural Resources, Report ME 2011-001, p. 137-143. [http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01\\_21UttingYarmouth.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01_21UttingYarmouth.pdf).

# Appendix 1

## **Nova Scotia Department of Natural Resources, Geological Resources Division**

### ***Maps and Digital Products of the Yarmouth Study Area***

Utting, D. J.: Map of Surficial and Coastal Materials of the Yarmouth Area, Yarmouth County, Nova Scotia; Nova Scotia Department of Natural Resources, scale 1:10 000, pending publication.

Utting, D. J.: Map of Surficial and Coastal Materials of the Rockville Area, Yarmouth County, Nova Scotia; Nova Scotia Department of Natural Resources, scale 1:10 000, pending publication.

Utting, D. J., Fisher, B. E. and McKinnon, J. S.: Digital Geoscience Data Generated as Part of the Atlantic Climate Adaptation Solutions Association Coastal Hazard Mapping Project in the Yarmouth Study Area, 2010-2011, Parts of Map Area 21O/16, pending publication.

Utting, D. J.: Yarmouth Coastal Mapping, a Component of the Atlantic Climate Adaptation Solutions (ACAS) Project; Nova Scotia Department of Natural Resources, Report ME 2011-001, p. 137-143.

### ***Maps and Digital Products of the Oxford Study Area***

Utting, D. J.: Map of Surficial and Coastal Materials of the Port Howe Area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, scale 1:10 000, pending publication.

Utting, D. J.: Map of Surficial and Coastal Materials of the Pugwash Area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, scale 1:10 000, pending publication.

Utting, D. J., Fisher, B. E. and McKinnon, J. S.: Digital Geoscience Data Generated as Part of the Atlantic Climate Adaptation Solutions Association Coastal Hazard Mapping Project in the Oxford Study Area, 2010-2011, Parts of Map Area 11E/13, pending publication.

### ***Maps and Digital Products of the Lunenburg Study Area***

Utting, D. J.: Map of Surficial and Coastal Materials of the Lunenburg Area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, scale 1:10 000, pending publication.

Utting, D. J., Fisher, B. E. and McKinnon, J. S.: Digital Geoscience Data Generated as Part of the Atlantic Climate Adaptation Solutions Association Coastal Hazard Mapping Project in the Lunenburg Study Area, 2010-2011, Parts of Map Area 21A/08, pending publication.

## Appendix 2

### Reports resulting from the Coastal Change Analysis Project

Trudell, L. L. and Utting, D. J.: Coastal Change Analysis: case studies in Pugwash, Lunenburg and Yarmouth Areas; Nova Scotia Department of Natural Resources, pending publication.

### Reports resulting from the Impacts of Coastal Processes on Public and Private Infrastructure Project

Finck, P. W. 2012: A Coastal Hazard Assessment of the Gabarus Seawall, Cape Breton County, Nova Scotia; Nova Scotia Department of Natural Resources, Open File Report ME 2012-002.

[http://www.gov.ns.ca/natr/meb/data/pubs/12ofr02/ofr\\_me\\_2012-002.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/12ofr02/ofr_me_2012-002.pdf).

Finck, P. W. 2011: An Assessment of Coastal Erosion at the Malagawatch Graveyard Archeological Site; Nova Scotia Department of Natural Resources, Report ME 2011-001, p. 21-28.

[http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01\\_06FinckMalagawatch.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01_06FinckMalagawatch.pdf).

Finck, P. W. 2011: Coastal Hazard Assessment Along the Blue Beach Fossil Cliffs, Kings County; Nova Scotia Department of Natural Resources, Report ME 2011-001, p. 29-39.

[http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01\\_07FinckUttingBlueBeach.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01_07FinckUttingBlueBeach.pdf).

### Other DNR reports that may be of interest

Finck, P. W. and Utting, D. J. 2010: Assessing the Potential for Coastal Flooding and Erosion in Nova Scotia: Case Studies [Abstract]; Nova Scotia Department of Natural Resources, Report ME 2010-002, p. 9.

[http://www.gov.ns.ca/natr/meb/data/pubs/10re02/10re02\\_16.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/10re02/10re02_16.pdf).

Utting, D. J., Basquill, S. P., DeMont, G. J. and Benjamin, L. K. 2010: An Interdepartmental Study at Carters Beach (NTS 20P/15), Queens County, to Assess Coastal Stability and Develop a Pilot Coastal Ecosystem Classification; Nova Scotia Department of Natural Resources, Report ME 2010-001, p. 133-135.

[http://www.gov.ns.ca/natr/meb/data/pubs/10re01/10re01\\_17Utting.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/10re01/10re01_17Utting.pdf).

Finck, P. W. 2009: Coastal Hazard Assessment Mapping in St. Margarets Bay (NTS 21A/09 and 11D/12), Nova Scotia; NSDNR, Report ME 2009-001, p. 15.

[http://www.gov.ns.ca/natr/meb/data/pubs/09re01/09re01\\_03Finck.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/09re01/09re01_03Finck.pdf).

DeMont, G. J. and Utting, D. J. 2011: 2010 Report on the Central Antigonish County Land-use Planning and Climate Change Adaptation Project; Report ME 2011-001, p. 5-13.

[http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01\\_04DeMontandUtting.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/11re01/11re01_04DeMontandUtting.pdf).

DeMont, G. J., Utting, D. J., Finck, P. W. and Broughm, T. 2010: Surficial Geology Mapping + Geohazard Identification + Coastal Zone Mapping = Better Land-use Planning in Central Antigonish County; Nova Scotia Department of Natural Resources, Report ME 2010-001, p. 11-21.

[http://www.gov.ns.ca/natr/meb/data/pubs/10re01/10re01\\_02DeMont.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/10re01/10re01_02DeMont.pdf).

Utting, D. J. and Gallacher, A. F. 2009: Coastal Environments and Erosion in Southwest St. Georges Bay, Antigonish County; Nova Scotia Department of Natural Resources, Report ME 2009-001, p. 139-149.

[http://www.gov.ns.ca/natr/meb/data/pubs/09re01/09re01\\_20Utting.pdf](http://www.gov.ns.ca/natr/meb/data/pubs/09re01/09re01_20Utting.pdf).



## Appendix 3

### Maritime Provinces Spatial Analysis Research Center, Saint Mary's University

#### *Maps of the Minas Basin Study Area*

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Canning area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-002, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-002.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-002.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Kingsport area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-003, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-003.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-003.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Canard area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-004, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-004.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-004.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Grand Pré area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-005, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-005.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-005.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Avonport Station area, Hants and Kings counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-006, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-006.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-006.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Kempt Shore area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-007, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-007.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-007.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Kentville (east) area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-008, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-008.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-008.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Wolfville area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-009, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-009.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-009.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the West Brooklyn area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-010, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-010.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-010.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Hantsport area, Hants and Kings counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-011, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-011.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-011.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Cogmagun area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-012, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-012.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-012.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Mount Denson area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-013, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-013.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-013.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Brooklyn area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-014, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-014.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-014.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Windsor area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-015, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-015.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-015.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Five Mile Plains area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-016, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-016.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-016.asp).

## ***Maps of the Amherst Study Area***

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Fort Lawrence Ridge area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-017, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-017.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-017.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Minudie Marsh area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-018, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-018.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-018.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Amherst area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-019, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-019.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-019.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Minudie area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-020, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-020.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-020.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Nappan area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-021, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-021.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-021.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Lower River Hebert area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-022, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-022.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-022.asp).

van Proosdij, D. and Pietersma-Perrott, B. 2012: Shore zone characterization map of the Maccan area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-023, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-023.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-023.asp).

## Appendix 4

### Applied Geomatics Research Group, Nova Scotia Community College

#### *Maps of the Amherst Study Area*

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Fort Lawrence Ridge area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-024, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-024.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-024.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Minudie Marsh area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-025, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-025.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-025.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Amherst area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-026, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-026.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-026.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Minudie area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-027, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-027.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-027.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Nappan area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-028, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-028.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-028.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Lower River Hebert area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-029, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-029.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-029.asp).

#### *Maps of the Lunenburg Study Area*

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Martins River area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-030, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-030.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-030.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Mahone Bay area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-031, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-031.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-031.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Lunenburg area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-032, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-032.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-032.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the East LaHave area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-033, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-033.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-033.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Feltz South area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-034, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-034.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-034.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Riverport area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-035, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-035.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-035.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Lower Rose Bay area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME citation Open File Map ME 2012-036, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-036.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-036.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Petite Rivière area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-037, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-037.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-037.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the West Iron area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-038, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-038.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-038.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Broad Cove area, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-039, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-039.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-039.asp).

## Maps of the Minas Basin Study Area

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Blomidon area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-040, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-040.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-040.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Canning area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-041, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-041.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-041.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Kingsport area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-042, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-042.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-042.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Cheverie area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-043, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-043.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-043.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Centreville area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-044, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-044.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-044.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Canard area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-045, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-045.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-045.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Grand Pré area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-046, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-046.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-046.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Avonport Station area, Hants and Kings counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-047, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-047.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-047.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Kempt Shore area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-048, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-048.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-048.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Kentville (west) area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-049, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-049.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-049.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Kentville (east) area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-050, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-050.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-050.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Wolfville area, Kings County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-051, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-051.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-051.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the West Brooklyn area, Hants and Kings counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-052, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-052.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-052.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Hantsport area, Hants and Kings counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-053, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-053.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-053.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Cogmagun area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-054, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-054.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-054.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Mount Denson area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-055, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-055.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-055.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Brooklyn area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-056, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-056.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-056.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Upper Falmouth area, Hants and Kings counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-057, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-057.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-057.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Windsor area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-058, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-058.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-058.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Five Mile Plains area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-059, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-059.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-059.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Mill Section area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-060, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-060.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-060.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Windsor Forks area, Hants County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-061, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-061.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-061.asp).

### ***Maps of the Oxford Study Area***

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Linden area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-062, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-062.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-062.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Port Howe area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-063, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-063.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-063.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Pugwash area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-064, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-064.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-064.asp).



Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Rockley area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-065, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-065.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-065.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Pugwash Basin area, Cumberland County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-066, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-066.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-066.asp).

### ***Maps of the Yarmouth Study Area***

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Cape St. Marys area, Digby County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-067, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-067.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-067.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Salmon River area, Digby County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-068, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-068.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-068.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Beaver River area, Digby and Yarmouth counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-069, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-069.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-069.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Port Maitland area, Digby and Yarmouth counties, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-070, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-070.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-070.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Wellington area, Yarmouth County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-071, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-071.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-071.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Yarmouth (northwest) area, Yarmouth County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-072, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-072.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-072.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Yarmouth (northeast) area, Yarmouth County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-073, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-073.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-073.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Yarmouth (southwest) area, Yarmouth County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-074, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-074.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-074.asp).

Webster, T., McGuigan, K. and MacDonald, C. 2012: Map of coastal flood risk from sea-level rise and storm surge of the Rockville area, Yarmouth County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-075, scale 1:10 000.

[http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm\\_2012-075.asp](http://www.gov.ns.ca/natr/meb/download/mg/ofm/htm/ofm_2012-075.asp).