

## Appendix E

AMEC Foster Wheeler VEC Reports

Atmospheric Environment

Groundwater

Wildlife & Wildlife Habitat

Wetlands & Vegetation

Land Use & Economy

Road Transportation Network



**ENVIRONMENTAL FIELD STUDIES  
VALUED ENVIRONMENTAL COMPONENT  
ASSESSMENT  
ROUTE 11 GLENWOOD AREA TO MIRAMICHI  
BYPASS PROJECT  
  
FINAL DRAFT REPORT**

Submitted to:  
**New Brunswick Department of Transportation and  
Infrastructure**  
Fredericton, New Brunswick

Submitted by:  
**Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited**  
Fredericton, New Brunswick

January 2017

TE161006



amec  
foster  
wheeler

30 January, 2017

TE161006

Ms. Melissa Cummings  
Environmental Unit Manager, Design Branch  
New Brunswick Department of Transportation and Infrastructure  
Kings Place, PO Box 6000  
Fredericton, New Brunswick E3B 5H1

Dear Ms. Cummings:

**Re: Environmental Studies in Support of Environmental Impact Assessment, Glenwood Area to Miramichi Bypass Project - Final Draft Report**

Enclosed please find 1 editable pdf on a USB and one hard copy of the Final Draft Field Study Report for the Environmental Field Studies Rte. 11 Glenwood Area to Miramichi for your Department's review. We look forward to your Department's comments, at which time we shall proceed to produce the Final Field Study Report.

Sincerely,

**Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited**

**DRAFT**

Douglas Prosser, BSc. For, RPF  
Environmental Sciences – New Brunswick, Environment & Infrastructure, Amec Foster Wheeler  
Direct Tel: 506.450.8852  
Mobile Tel: 506.476.5083  
E-mail: doug.prosser@amecfw.com

DP/kk

TE161006\_NBDTI\_MasterTOC\_20170130.docx

Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited  
495 Prospect Street, Suite 1  
Fredericton, NB E3B 9M4  
Tel +1 (506) 458-1000  
Fax +1 (506) 450-0829

www.amecfw.com

**TABLE OF CONTENTS**

	<b>PAGE</b>
<b>1.0 ATMOSPHERIC ENVIRONMENT.....</b>	<b>1-1</b>
1.1 RATIONALE FOR SELECTION AS A VALUED ENVIRONMENTAL COMPONENT (VEC).....	1-1
1.2 BOUNDARIES FOR ENVIRONMENTAL EFFECTS ASSESSMENT.....	1-1
1.2.1 Spatial Boundaries.....	1-1
1.2.2 Temporal Boundaries.....	1-2
1.3 METHODOLOGY.....	1-2
1.3.1 Air Quality Assessment.....	1-2
1.3.2 Climate Assessment.....	1-2
1.3.3 Sound Quality Assessment.....	1-3
1.4 DESCRIPTION OF EXISTING ENVIRONMENT.....	1-3
1.4.1 Air Quality.....	1-5
1.4.2 Climate.....	1-8
1.4.3 Background Sound Quality.....	1-10
1.5 POTENTIAL EFFECTS ASSESSMENT.....	1-11
1.5.1 Construction Phase Potential Effects.....	1-11
1.5.2 Accidents, Malfunctions and Unplanned Events.....	1-14
1.6 MITIGATION MEASURES.....	1-14
1.7 SIGNIFICANCE OF RESIDUAL EFFECTS.....	1-17
1.8 MONITORING AND FOLLOW-UP REQUIREMENTS.....	1-18
1.9 Atmospheric Environment - References	1-19
<b>2.0 GROUNDWATER</b>	<b>To be Provided Under Separate Cover</b>
<b>3.0 WILDLIFE AND WILDLIFE HABITAT.....</b>	<b>3-1</b>
3.1 VEC DESCRIPTION.....	3-1
3.2 BOUNDARIES FOR ENVIRONMENTAL EFFECTS ASSESSMENT.....	3-1
3.2.1 Spatial Boundaries.....	3-1
3.2.2 Temporal Boundaries.....	3-3
3.3 METHODOLOGY.....	3-3
3.4 DESCRIPTION OF EXISTING ENVIRONMENT.....	3-4
3.4.1 Wildlife Habitat.....	3-4
3.4.2 Designated Areas.....	3-4
3.4.3 Wildlife.....	3-9
3.4.4 Wildlife Observations	3-12

3.5	POTENTIAL EFFECTS ASSESSMENT .....	3-12
3.5.1	Construction Phase Potential Effects .....	3-12
3.5.2	Operation, Maintenance and Rehabilitation (OMR) Phase Potential Effects .	3-13
3.5.3	Accidents, Malfunctions and Unplanned Events .....	3-14
3.6	MITIGATION MEASURES .....	3-15
3.7	SIGNIFICANCE OF RESIDUAL EFFECTS .....	3-20
3.8	MONITORING AND FOLLOW-UP REQUIREMENTS .....	3-21
3.9	WILDLIFE AND WILDLIFE HABITAT - REFERENCES .....	3-21
3.9.1	Personal Communications .....	3-22
<b>4.0</b>	<b>WETLANDS AND VEGETATION .....</b>	<b>4-1</b>
4.1	RATIONALE FOR SELECTION AS A VEC .....	4-1
4.1.1	Wetlands Definition .....	4-1
4.1.2	Vegetation Species of Conservation Concern Definition .....	4-1
4.2	BOUNDARIES FOR ENVIRONMENTAL EFFECTS ASSESSMENT .....	4-2
4.2.1	Spatial Boundaries .....	4-2
4.2.2	Temporal Boundaries .....	4-2
4.3	METHODOLOGY .....	4-2
4.3.1	Wetlands .....	4-2
4.3.2	Vegetation Species of Conservation Concern (SOCC) .....	4-4
4.4	DESCRIPTION OF EXISTING ENVIRONMENT .....	4-4
4.4.1	Wetlands .....	4-4
4.4.2	Vegetation Species of Conservation Concern (SOCC) .....	4-10
4.5	POTENTIAL EFFECTS ASSESSMENT .....	4-12
4.5.1	Construction Phase Potential Effects .....	4-13
4.5.2	Operation, Maintenance and Rehabilitation Phase Potential Effects .....	4-14
4.5.3	Accidents, Malfunctions and Unplanned Events .....	4-14
4.6	MITIGATION MEASURES .....	4-15
4.7	SIGNIFICANCE OF RESIDUAL EFFECTS .....	4-15
4.8	MONITORING AND FOLLOW-UP REQUIREMENTS .....	4-19
4.9	WETLANDS AND VEGETATION - REFERENCES .....	4-19
4.9.1	Personal Communications	4-19
<b>5.0</b>	<b>LAND USE AND ECONOMY .....</b>	<b>5-1</b>
5.1	RATIONALE FOR SELECTION AS A VEC .....	5-1
5.2	BOUNDARIES FOR ENVIRONMENTAL EFFECTS ASSESSMENT .....	5-1
5.2.1	Spatial Boundaries .....	5-1
5.2.2	Temporal Boundaries .....	5-1
5.3	Methodology	5-1

5.4	DESCRIPTION OF EXISTING ENVIRONMENT .....	5-1
5.4.1	Population and Labour Force.....	5-1
5.4.2	Local Economy.....	5-2
5.4.3	Existing Land Use .....	5-2
5.4.4	Cultural/Institutional.....	5-4
5.4.5	Recreational.....	5-4
5.4.6	Traffic Circulation .....	5-5
5.4.7	Utility Corridors.....	5-5
5.4.8	Emergency and Medical Services.....	5-5
5.5	POTENTIAL EFFECTS ASSESSMENT .....	5-6
5.5.1	Construction Phase Potential Effects.....	5-6
5.5.2	Operation, Maintenance and Rehabilitation (OMR) Phase Potential Effects.....	5-6
5.5.3	Accidents, Malfunctions and Unplanned Events .....	5-7
5.6	MITIGATION MEASURES.....	5-7
5.7	SIGNIFICANCE OF RESIDUAL EFFECTS .....	5-10
5.8	MONITORING AND FOLLOW-UP REQUIREMENTS.....	5-10
5.9	LAND USE AND ECONOMY - REFERENCES .....	5-11
5.9.1	Personal Communications .....	5-11
<b>6.0</b>	<b>ROAD TRANSPORTATION NETWORK .....</b>	<b>6-1</b>
6.1	RATIONALE FOR SELECTION AS A VEC .....	6-1
6.2	BOUNDARIES FOR ENVIRONMENTAL EFFECTS ASSESSMENT.....	6-1
6.2.1	Spatial Boundaries.....	6-1
6.2.2	Temporal Boundaries.....	6-1
6.3	METHODOLOGY.....	6-1
6.3.1	Rideability Comfort Index (RCI) .....	6-2
6.3.2	LEVEL OF SERVICE (LOS).....	6-2
6.3.3	EXISTING TRAFFIC VOLUME DATA .....	6-4
6.3.4	Traffic Safety .....	6-6
6.4	DESCRIPTION OF EXISTING ENVIRONMENT .....	6-6
6.4.1	Description of Existing Environment .....	6-6
6.4.2	Description of Route 11.....	6-10
6.4.3	Description of the Ramps on the Interchange of Route 11 and Route 8 (University Avenue) .....	6-12
6.4.4	Description of North Napan Road .....	6-12
6.4.5	Description of South Napan Road.....	6-12
6.4.6	Description of O'Donnell Road	6-12

6.5	POTENTIAL EFFECTS ASSESSMENT .....	6-13
6.5.1	Construction Phase Potential Effects .....	6-13
6.5.2	Operation, Maintenance and Rehabilitation (OMR) Phase Potential Effects .....	6-13
6.5.3	Accidents, Malfunctions and Unplanned Events .....	6-14
6.6	MITIGATION MEASURES .....	6-14
6.7	SIGNIFICANCE OF RESIDUAL EFFECTS .....	6-16
6.8	MONITORING AND FOLLOW-UP REQUIREMENTS .....	6-17
6.9	ROAD TRANSPORTATION NETWORK - REFERENCES .....	6-17
6.9.1	Personal Communications .....	6-17
<b>7.0</b>	<b>BREEDING BIRDS.....</b>	<b>7-1</b>
7.1	RATIONALE FOR SELECTION AS A VEC .....	7-1
7.2	BOUNDARIES FOR ENVIRONMENTAL EFFECTS ASSESSMENT .....	7-1
7.2.1	Spatial Boundaries .....	7-1
7.2.2	Temporal Boundaries .....	7-1
7.3	METHODOLOGY .....	7-1
7.3.1	Field Surveys .....	7-1
7.3.2	Desktop Data Review .....	7-5
7.4	DESCRIPTION OF EXISTING ENVIRONMENT .....	7-5
7.4.1	Results of Field Surveys .....	7-5
7.4.2	Results of Desktop Data Review .....	7-11
7.5	POTENTIAL EFFECTS ASSESSMENT .....	7-13
7.5.1	Construction Phase Potential Effects .....	7-14
7.5.2	Operation, Maintenance and Rehabilitation (OMR) Phase Potential Effects .	7-14
7.5.3	Accidents, Malfunctions and Unplanned Events .....	7-14
7.6	MITIGATION MEASURES .....	7-15
7.7	SIGNIFICANCE OF RESIDUAL EFFECTS .....	7-19
7.8	MONITORING AND FOLLOW-UP REQUIREMENTS .....	7-20
7.9	Breeding Birds - References	7-20

**TABLE OF CONTENTS (cont)**

**PAGE**

**LIST OF TABLES**

Table 1.1	Air Quality Guidelines in New Brunswick .....	1-5
Table 1.2	Canadian Ambient Air Quality Standards for Fine Particulate Matter (PM <sub>2.5</sub> ) and Ozone .....	1-7
Table 1.3	Temperature Data (1981 to 2010) Miramichi A Climate Station (Government Canada, 2016) .....	1-9
Table 1.4	Precipitation Data (1981 to 2010) Miramichi A Climate Station (Environment Canada, 2016a).....	1-10
Table 1.5	Wind Data (1981 to 2010) Miramichi A Climate Station (Environment Canada, 2016a) .....	1-10
Table 1.6	Noise Monitoring Results .....	1-11
Table 1.7	Construction Equipment Sound Levels at a Distance of 15 m (50 ft) <sup>1</sup> .....	1-12
Table 1.8	Estimated Sound Pressure Levels during Construction.....	1-12
Table 1.9	Predicted Sound Pressure Levels during Operation .....	1-14
Table 1.10	Summary of Mitigation Measures for Air Quality.....	1-15
Table 1.11	Significance of Residual Effects to Air Quality after Mitigation .....	1-18

**2.0 GROUNDWATER**

**To be Provided Under Separate Cover**

Table 3.1	Total Number of Ungulate (Moose and Deer) Collisions Reported between 2008 and 2012, Inclusive Between North Black River Road to Miramichi.....	3-10
Table 3.2	Potential Project Construction Effects on Wildlife and SOCC.....	3-13
Table 3.3	Potential Project OMR Effects on Wildlife and SOCC .....	3-13
Table 3.5	Significance of Residual Effects to Wildlife and Habitat after Mitigation .....	3-20
Table 4.1	Flora Species of Conservation Concern Recorded within 5 km.....	4-5
Table 4.2	Wetland Areas .....	4-8
Table 4.3	Potential Project Construction Effects on Wetlands.....	4-13
Table 4.4	Potential Project OMR Effects on Wetlands .....	4-14
Table 4.5	Summary of Mitigation Measures for Wetlands .....	4-16
Table 4.6	Significance of Residual Effects to Wetlands and Flora SOCC after Standard Mitigation .....	4-18
Table 5.1	Census Population by Study Area Municipality .....	5-2
Table 5.2	Summary of Mitigation Measures for Land Use and Economy.....	5-8
Table 5.3	Significance of Residual Effects to Land Use and Economy after Mitigation.....	5-10



Table 6.1	Surface Condition .....	6-2
Table 6.2	Level of Service (LOS).....	6-3
Table 6.3	Kouchibouguac Traffic Count Station Data - AADT .....	6-5
Table 6.4	Accident Data in the Study Area .....	6-6
Table 6.5	Summary of Mitigation Measures for Road Transportation Network .....	6-15
Table 6.6	Significance of Residual Effects to the Road Transportation Network after Mitigation.....	6-16
Table 7.1	Field Survey Locations.....	7-5
Table 7.2	Bird Species Observed during May Field Surveys.....	7-6
Table 7.3	Bird Species Observed during June Field Surveys.....	7-8
Table 7.4	Avian SAR Recorded Within 5 km of the Project Location .....	7-12
Table 7.5	Summary of Mitigation Measures for Breeding Birds.....	7-16
Table 7.6	Significance of Residual Effects to Breeding Birds after Mitigation .....	7-19

#### LIST OF FIGURES

Figure 1.1	Noise Quality Assessment.....	1-4
------------	-------------------------------	-----

## 2.0 GROUNDWATER

To be Provided Under Separate Cover

Figure 3.1	General Site Layout .....	3-2
Figure 3.2	Field Verified Wildlife Habitat Map 1 of 2 .....	3-5
Figure 3.3	Field Verified Wildlife Habitat Map 2 of 2 .....	3-6
Figure 3.4	Designated Areas .....	3-8
Figure 3.5	Wildlife Species of Conservation Concern.....	3-11
Figure 4.1	Mapped Wetlands and Flora Species of Conservation Concern Overview .....	4-3
Figure 4.2	Mapped Wetlands and Flora Species of Conservation Concern Map 1 of 2 .....	4-6
Figure 4.3	Mapped Wetlands and Flora Species of Conservation Concern Map 2 of 2 .....	4-7
Figure 4.4	Field Verified Flora Species of Conservation Concern (Southern Twayblade) .....	4-11
Figure 5.1	Land Use.....	5-3

Figure 6.1	Additional Counting Stations in the Study Area .....	6-5
Figure 6.2	Current Route 11 Alignment and Applicable Control Sections and Proposed Bypass Alignment.....	6-8
Figure 6.3	Study Area Network – General View .....	6-9
Figure 6.4	Study Area Network – Magnified O’Donnell Road Sector.....	6-9
Figure 6.5	Study Area Network – Magnified South/North Napan Rd Sector.....	6-10
Figure 7.1	Bird Survey Locations – Map 1 of 2 .....	7-2
Figure 7.2	Bird Survey Locations – Map 2 of 2 .....	7-3

### LIST OF APPENDICES

Appendix 1A	Background Noise Measurements Data
Appendix 1B	Weather from 22-26 June, 2016 at Miramichi RCS
Appendix 3A	Site Photographs
Appendix 3B	Wildlife Observations
Appendix 4A	ACCDC Report 5555: Miramichi, NB
Appendix 4B	Wetland Data Sheets and Site Photographs
Appendix 4C	Vegetation Species Observed
Appendix 6A	RCI Data for CS 10 and CS 11
Appendix 7A	ACCDC Report
Appendix 7B	Breeding Bird Field Observations
Appendix 7C	ACCDC and MBBA Species Lists

## LIST OF ACRONYMS

AADT	Average Annual Daily Traffic
ACCDC	Atlantic Canada Conservation Data Centre
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited
ATV	All-terrain Vehicles
AZMF	Air Zone Management Framework
BSC	Bird Studies Canada
CAAQs	Canadian Ambient Air Quality Standards
CACs	Criteria Air Contaminants
CBC	Canadian Broadcasting Corporation
CCME	Canadian Council of Ministers of the Environment
CH <sub>4</sub>	methane
cm	centimetres
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> e	carbon dioxide equivalent
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CS	Control Section
CWS	Canada-wide Standard
dB	decibels
dBA	A-weighted decibels
DTWT	Depth to Water Table
DWA	Deer Wintering Area
EIA	Environmental Impact Assessment
EMM	Environmental Management Manual
ESA	Environmentally Significant Area
FHWA	(US Department of Transportation) Federal Highway Administration
GCDWQ	Canadian Drinking Water Quality Guidelines
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GPS	Global Positioning System
GS	General Status
H <sub>2</sub> S	hydrogen sulphide
ha	hectares
HFCs	hydrofluorocarbons
IBA	Important Bird Areas
IR	Infrared Radiation
kg	kilogram
km	kilometres
km/h	kilometres per hour
km <sup>2</sup>	square kilometres
L	litre
L <sub>Aeq-1h</sub>	1-hour equivalent sound level

L <sub>Aeq-24h</sub>	A-weighted 24-hour equivalent sound levels
L <sub>Amax</sub>	Maximum Sound Level
LOS	Level of Service
m	metres
m/day	metres per day
masl	metres above sea level
MBBA	Maritimes Breeding Bird Atlas
MBCA	<i>Migratory Birds Convention Act</i>
mm	millimetres
MRMA	Miramichi Regional Multicultural Association
MT	Mega-tonnes
N <sub>2</sub> O	nitrous oxide
NB	New Brunswick
NBAQO	New Brunswick Air Quality Objectives
NBDELG	New Brunswick Department of Environment and Local Government
NBDNR	New Brunswick Department of Natural Resources
NBDNRE	New Brunswick Department of Natural Resources and Energy
NBDTI	New Brunswick Department of Transportation and Infrastructure
NBENV	New Brunswick Department of Environment
NBERD	New Brunswick Department of Energy and Resource Development
NBFSC	New Brunswick Federation of Snowmobile Clubs
NBSRA	<i>New Brunswick Species at Risk Act</i>
NF <sub>3</sub>	nitrogen trifluoride
NO	nitric oxide
NO <sub>2</sub>	nitrogen dioxide
NO <sub>x</sub>	nitrogen oxides
NPRI	National Pollutant Release Inventory
NTU	nephelometric turbidity units
°	degrees
O <sub>3</sub>	oxygen
OMR	Operation, Maintenance and Rehabilitation
OWLS	Online Well Log System
PAR	Parishes
pc/mi/ln	passenger cars per mile per lane
PCE	tetrachloroethylene
PFCs	perfluorocarbons
PID	Property Identification
PM	Particulate Matter
PM <sub>10</sub>	Particles less than 10 µmin diameter
PM <sub>2.5</sub>	Particles less than 2.5 µmin diameter
PNA	Protected Natural Areas
ppb	parts per billion
PTSF	Percent Time Spent Following
RCI	Rideability Comfort Index

RCMP	Royal Canadian Mounted Police
RCNM	Roadway Construction Noise Model
ROW	Right-of-Way
SAR	Species at Risk
SARA	<i>Species at Risk Act</i>
SF <sub>6</sub>	sulphur hexafluoride
SO <sub>2</sub>	sulphur dioxide
SOCC	Species of Conservation Concern
SO <sub>x</sub>	sulphur oxides
TCE	trichloroethylene
the Project	Route 11-Glenwood area bypass
TMN	Traffic Noise Model
TSP	Total suspended particulate
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
VEC	Valued Environmental Component
VOCs	Volatile Organic Compounds
WAWA	Watercourse and Wetland Alteration Permit
WfPADO	Wellfield Protection Designation Order
WMAs	Wildlife Managed Areas
WMZ	Wildlife Management Zone
µg/m <sup>3</sup>	micrograms per cubic metres
µm	micrometres