

CHALEUR VENTUS WIND ENERGY PROJECT

APPENDIX F - VISUAL IMPACT ASSESSMENT AND PHOTOMONTAGES

CHALEUR VENTUS LIMITED PARTNERSHIP



CHALEUR VENTUS WIND ENERGY
PROJECT
VISUAL IMPACT ASSESSMENT FOR 116 METRE
HUB HEIGHT
CHALEUR VENTUS LIMITED PARTNERSHIP

September 2019





CHALEUR VENTUS WIND ENERGY PROJECT

VISUAL IMPACT ASSESSMENT FOR 116 METRE HUB HEIGHT

CHALEUR VENTUS LIMITED PARTNERSHIP

VERSION 1

WSP PROJECT NO.: 181-07802

DATE: SEPTEMBER 27, 2019

WSP

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PREPARED BY



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1 INTRODUCTION

This report provides the Visual Impact Assessment completed in support of the Chaleur Ventus Wind Energy Project (Project) Registration Document that was submitted to with the Sustainable Development, Planning and Impact Evaluation Branch, Department of Environment and Local Government in September of 2019.

The objective of this analysis was to determine the extent of the visual influence of the wind energy converters (WECs). The results of the analysis are presented as a map that shows the extent of the visibility of the WEC blades at 179 metre (m) above ground for an Enercon E126 EP3 with a 116 m hub height.

1.1 PROJECT OVERVIEW

Chaleur Ventus Limited Partnership (CVLP) is proposing the development of the Project. The Project is located on privately owned land south of route 303 in Gloucester County, New Brunswick, and will have an aggregate electrical capacity of 20 megawatts (MW). The Project will consist of five WECs, access roads, collector system, substation, and associated temporary laydown areas required for construction. An approximate 9 kilometre (km) transmission line is proposed that runs south and southwest from the Project area to a proposed substation that will be located on Crown land approximately 2.8 km southeast of Saint-Leolin.

The Project is expected to consist of Enercon E-126 WECs with a nominal power of 4 MW. Each assembly will consist of the tower, hub, nacelle, rotor blades, and controller, with a total height of 179.5 to 194.5 m dependent on WEC availability from Enercon. The total WEC rotor diameter will be 127 m. It is anticipated that each WEC will be erected on a concrete foundation. The dimensions, depth, and type of foundation will depend on an evaluation of the local soil, surficial geology characteristics, wind forces at the location, and site-specific details of each location.

2 METHODS

A visibility analysis was conducted using the viewshed tool in GlobalMapper (GIS software). The visibility tool identifies which observable points are visible from each raster surface location. Inputs to the model include a grid of ground elevations of the area around the turbines, the height of the object being observed, and the height of the observer (1.5 m).

For the elevation grid, digital elevation model (DEM) data was obtained from Natural Resources Canada. The base resolution for DEM is 0.75 arcseconds along a profile in the south-north direction and varies from 0.75 to 3 arcseconds in the west-east direction, depending upon the geographic location.

In the calculation, a maximum object height of 116 m (nacelle height) was used and maximum distance was limited to 48 km. Beyond 48 km it was assumed that no portion of the turbine would be visible to the unaided eye by a casual observer without extended viewing.¹ The analysis was also completed for a 179.5 m total WEC height with a calculation distance of 5 km. A 5 km calculation distance was selected based on the 48 km visibility radius of a turbine nacelle estimated to be 10 m long. The tip of the blade was assumed to be 1 m wide which has the same subtended angle at approximately 5 km as a 10 m object at 48 km.

¹ "Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes", Sullivan et al, May 2012

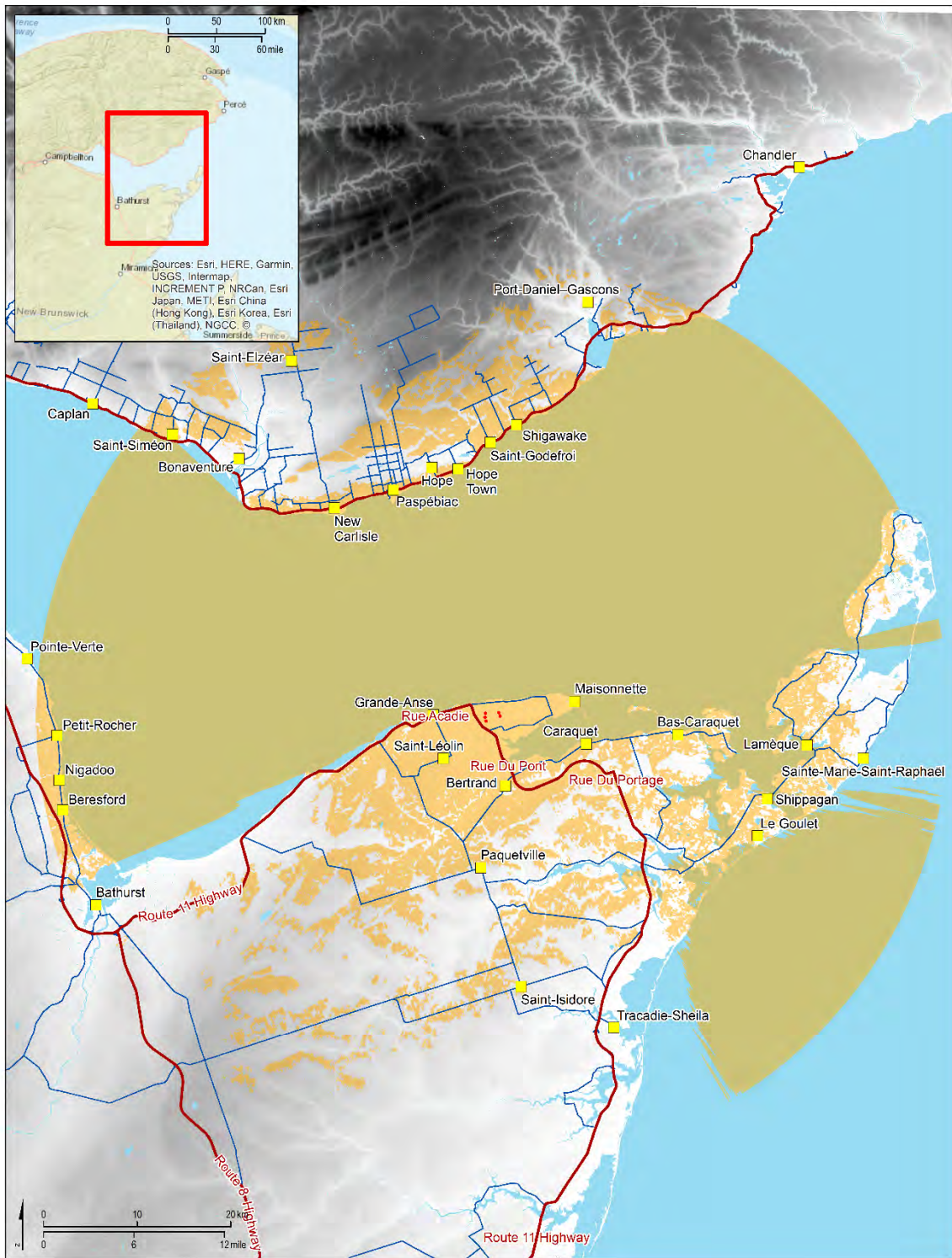
3 RESULTS

The results of the visibility analysis are shown in Appendix A. The maps show the areas from which it would be possible to see at least some portion of the WEC nacelle or blades respectively (maximum height above ground of 116 m and 179 m).

The visibility analysis results in what can be considered a “worst case” viewshed area. Practically speaking, there are several factors that were not accounted for that would limit the visibility of turbines, such as:

- Obstructions such as trees and buildings will have an impact on visibility. The use of the visibility analysis is limited in New Brunswick due to heavy tree cover. It is not possible to account for heavy tree cover analytically.
- Atmospheric, weather and lighting conditions such as clouds, low contrast lighting and haze.
- The amount of the turbine that is visible. Only part of a blade tip may be visible at some locations. It is not expected for blades to be visible over the entire 48 km calculation distance.
- Relative size of the turbine at the viewing distance. It will take a viewer longer to identify a wind turbine as the relative subtended visual angle nears the minimum angle of resolution is approached.

A ZONE OF VISUAL INFLUENCE MAPS



Chaleur Ventus Wind Power Project
 Zone of Visual Influence 5 x E126 4.0 Layout
 116 m Nacelle Visibility

- Legend**
- Populated Area
 - Turbine Locations
 - Highway
 - Road
 - 48 km Viewshed, 116 m

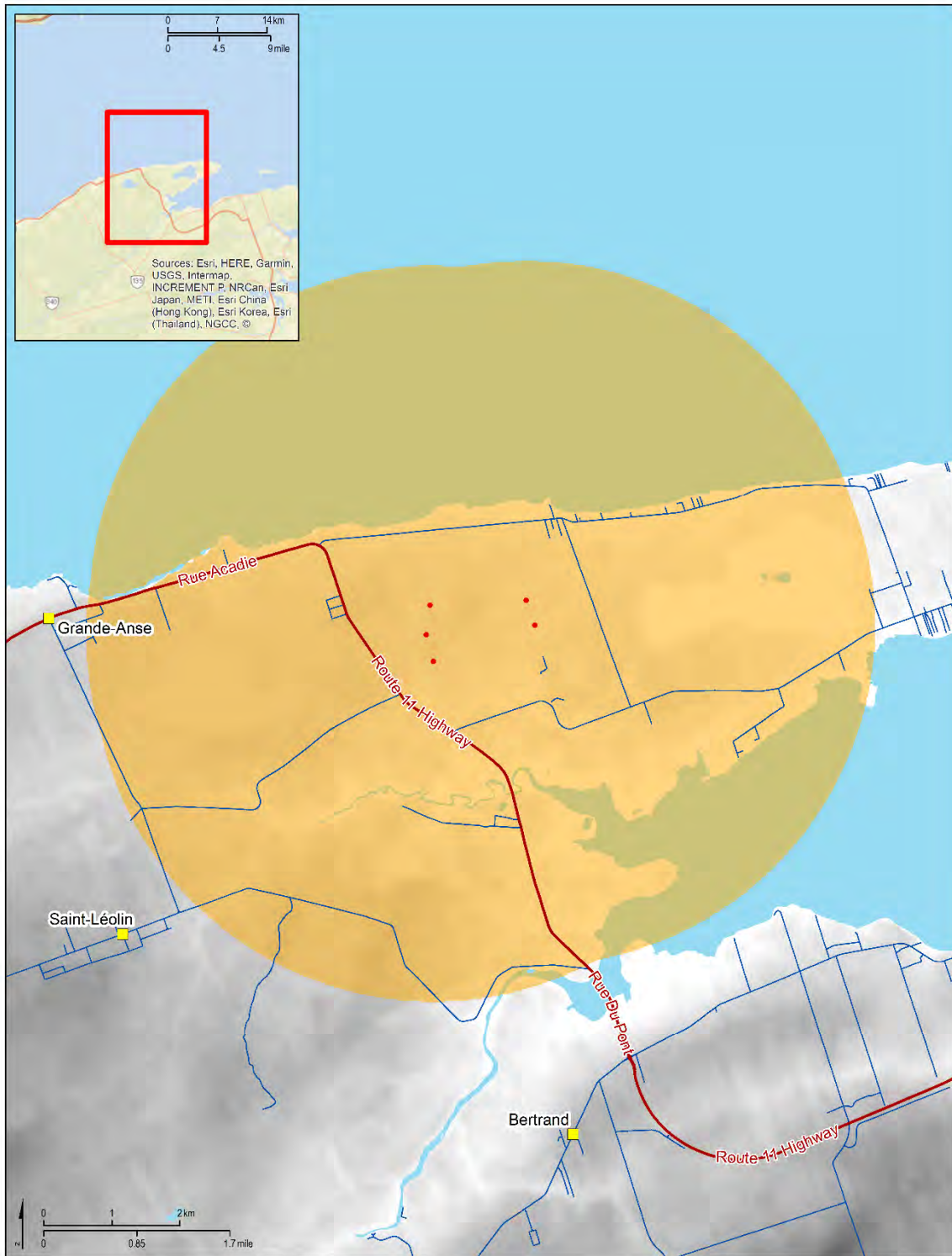
Elevation
 High : 600
 Low : 0

Version: 1
 Datum: NAD 83
 Projection: UTM Zone 20
 Scale: 1:400,000

Prepared by: WSP
 Author: A. Medd

In the preparation of this map, WSP has relied upon certain information provided by the client. While WSP has taken reasonable measures to present accurate information in the map, WSP does not warrant the reliability, accuracy, quality, currency, validity, or completeness of information found in the map. The locations shown are for informational purposes only and are not suitable for legal, surveying, or

Figure A-1 116 m Nacelle Visibility



- Legend**
- Populated Area
 - Turbine Locations
 - Highway
 - Road
 - 5 km Viewshed, 179 m

Elevation
High : 100
Low : 0

Version: 1
Datum: NAD 83
Projection: UTM Zone 20
Scale: 1:55,000

Prepared by: WSP
Author: A. Medd

Chaleur Ventus Wind Power Project
Zone of Visual Influence 5 x E126 4.0 Layout
179 m Blade Tip Visibility

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Figure A-2 179.5 m Blade Tip Visibility

MEMO

TO: Tarek Abbasi, Naveco Power
FROM: Alex Medd
SUBJECT: Chaleur Ventus Wind Energy Project Photomontages
DATE: September 25, 2019

WSP has completed the following tasks for the Chaleur Ventus Wind Energy Project photomontages:

- Site visit to capture images at six locations
- Post-processing of photos
- Stitching of the photos together to create panoramas
- Generation of photomontages for Enercon E126 EP3 turbine with a hub height of 116 metres

The photographs were taken using a Canon EOS REBEL T1i DSLR camera (4752 x 3168 resolution image) with Canon EFS 18-55 mm lens. The camera was mounted on a tripod at approximately 1.5 m above ground. The skies were cloudy on the day the photos were taken.

The photomontages were generated using WindPRO version 3.2.743. Control points were used to orient the photos (pan, tilt, and rotation angles) and to confirm the focal length and field of view. The control points used were collected during the field work and from georeferenced aerial photographs (Google Earth and Bing Maps). The turbines were rendered considering the effects of cloud cover on the light and the time of day for the shadow position and contrast.

Hugin (version 2018.0.0.5abfb4de796) was used to stitch the photomontage photos into panoramas. A combination of automated and manual masking was performed to create accurate depictions of the turbines. The resulting panoramas have a field of view of approximately 120 degrees.

For the 6 locations, maps were produced that show the before and after panorama, the location that the photos were taken, and the panorama field of view.

Please let me know if you have any questions or need any further information.

Sincerely,




Alexander Medd, EIT
Specialist, Power
Attachments



Before



After

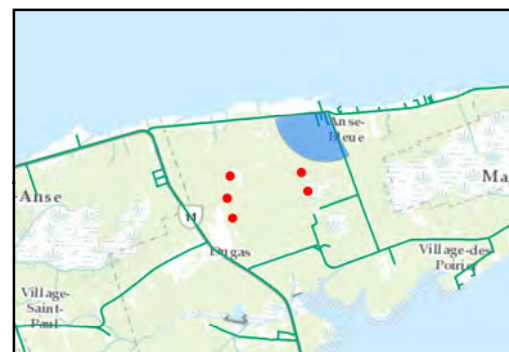
Title: Highway 303 and Chemin Downing Looking Southwest	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
 Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 116 m using 5 turbine locations.

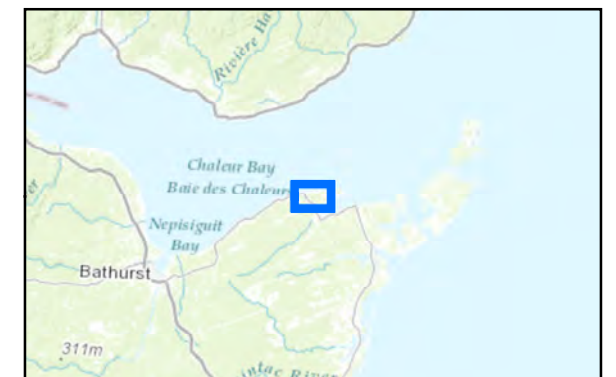
Data Sources:
 Layout developed by WSP, provided June 17, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

Prepared By: WSP Canada Inc.
Author: A. Medd
Reviewed: C. Logan
Approved: R. Istchenko

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Legend:	
	Panorama Field of View
	Turbine Locations
	Roads





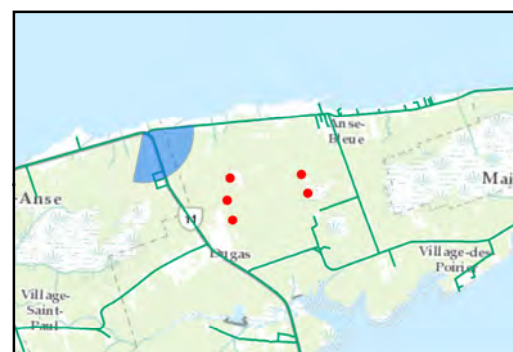
Title: Highway 11 and Highway 303 Looking South East	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E116 EP3 and with a hub height of 116 m using 6 turbine locations.

Data Sources:
Layout developed by WSP, provided June 17, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

Prepared By: WSP Canada Inc.
Author: A. Medd
Reviewed: C. Logan
Approved: R. Istchenko

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Legend:

- Panorama Field of View
- Turbine Locations
- Roads






Before



After

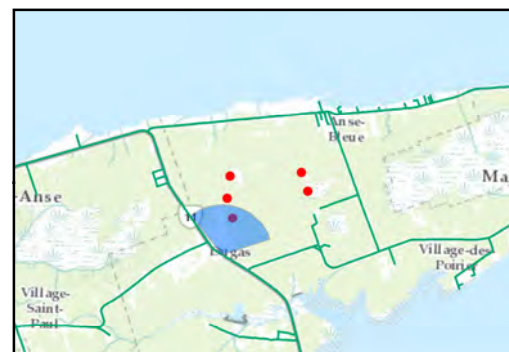
Title: Highway 11 south of Chemin Dugas Looking North East	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2




Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 116 m using 5 turbine locations.

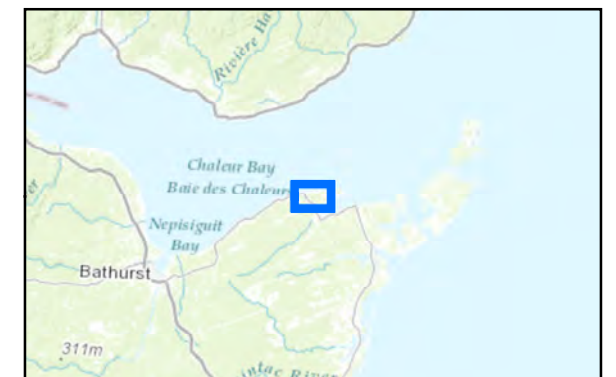
Data Sources:
Layout developed by WSP, provided August 10, 2018. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

Prepared By: WSP Canada Inc.
Author: A. Medd
Reviewed: C. Logan
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Legend:	
	Panorama Field of View
	Turbine Locations
	Roads






Before



After

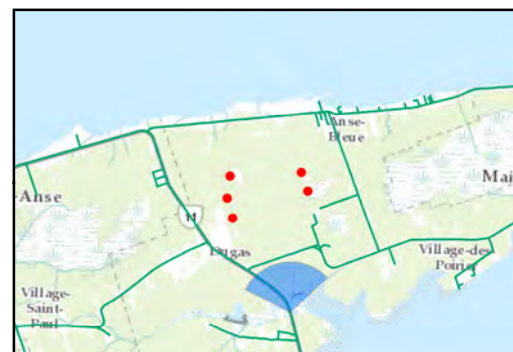
Title: Highway 11 north of Acadian Village Looking North	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
 Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 116 m using 5 turbine locations.

Data Sources:
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Legend:

- Panorama Field of View
- Turbine Locations
- Roads





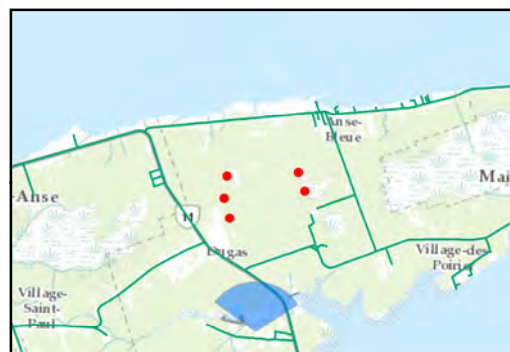
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Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 116 m using 5 turbine locations.

Data Sources:
Layout developed by WSP, provided June 16, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

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Legend:

- Photo location and Panorama Field of View
- Turbine Locations
- Road





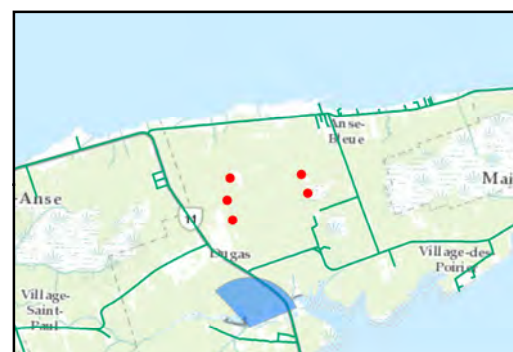
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Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 116 m using 5 turbine locations.

Data Sources:
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Legend:

- Panorama Field of View
- Turbine Locations
- Roads



CHALEUR VENTUS WIND ENERGY
PROJECT
VISUAL IMPACT ASSESSMENT FOR 132 METRE
HUB HEIGHT
CHALEUR VENTUS LIMITED PARTNERSHIP

September 2019





CHALEUR VENTUS WIND ENERGY PROJECT

VISUAL IMPACT ASSESSMENT FOR 132 METRE HUB HEIGHT

CHALEUR VENTUS LIMITED PARTNERSHIP

VERSION 1

WSP PROJECT NO.: 181-07802

DATE: SEPTEMBER 27, 2019

WSP

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PREPARED BY



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REVIEWED BY



Errol Halberg, P.Eng
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FIGURE A-2	194.5 M BLADE TIP VISIBILITY	6

APPENDICES

A	ZONE OF VISUAL INFLUENCE MAPS
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1 INTRODUCTION

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The objective of this analysis was to determine the extent of the visual influence of the wind energy converters (WECs). The results of the analysis are presented as a map that shows the extent of the visibility of the WEC blades at 195 metre (m) above ground for an Enercon E126 EP3 with a 132 m hub height.

1.1 PROJECT OVERVIEW

Chaleur Ventus Limited Partnership (CVLP) is proposing the development of the Project. The Project is located on privately owned land south of route 303 in Gloucester County, New Brunswick, and will have an aggregate electrical capacity of 20 megawatts (MW). The Project will consist of five WECs, access roads, collector system, substation, and associated temporary laydown areas required for construction. An approximate 9 kilometre (km) transmission line is proposed that runs south and southwest from the Project area to a proposed substation that will be located on Crown land approximately 2.8 km southeast of Saint-Leolin.

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2 METHODS

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In the calculation, a maximum object height of 132 m (nacelle height) was used and maximum distance was limited to 48 km. Beyond 48 km it was assumed that no portion of the turbine would be visible to the unaided eye by a casual observer without extended viewing.¹ The analysis was also completed for a 194.5 m total WEC height with a calculation distance of 5 km. A 5 km calculation distance was selected based on the 48 km visibility radius of a turbine nacelle estimated to be 10 m long. The tip of the blade was assumed to be 1 m wide which has the same subtended angle at approximately 5 km as a 10 m object at 48 km.

¹ "Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes", Sullivan et al, May 2012

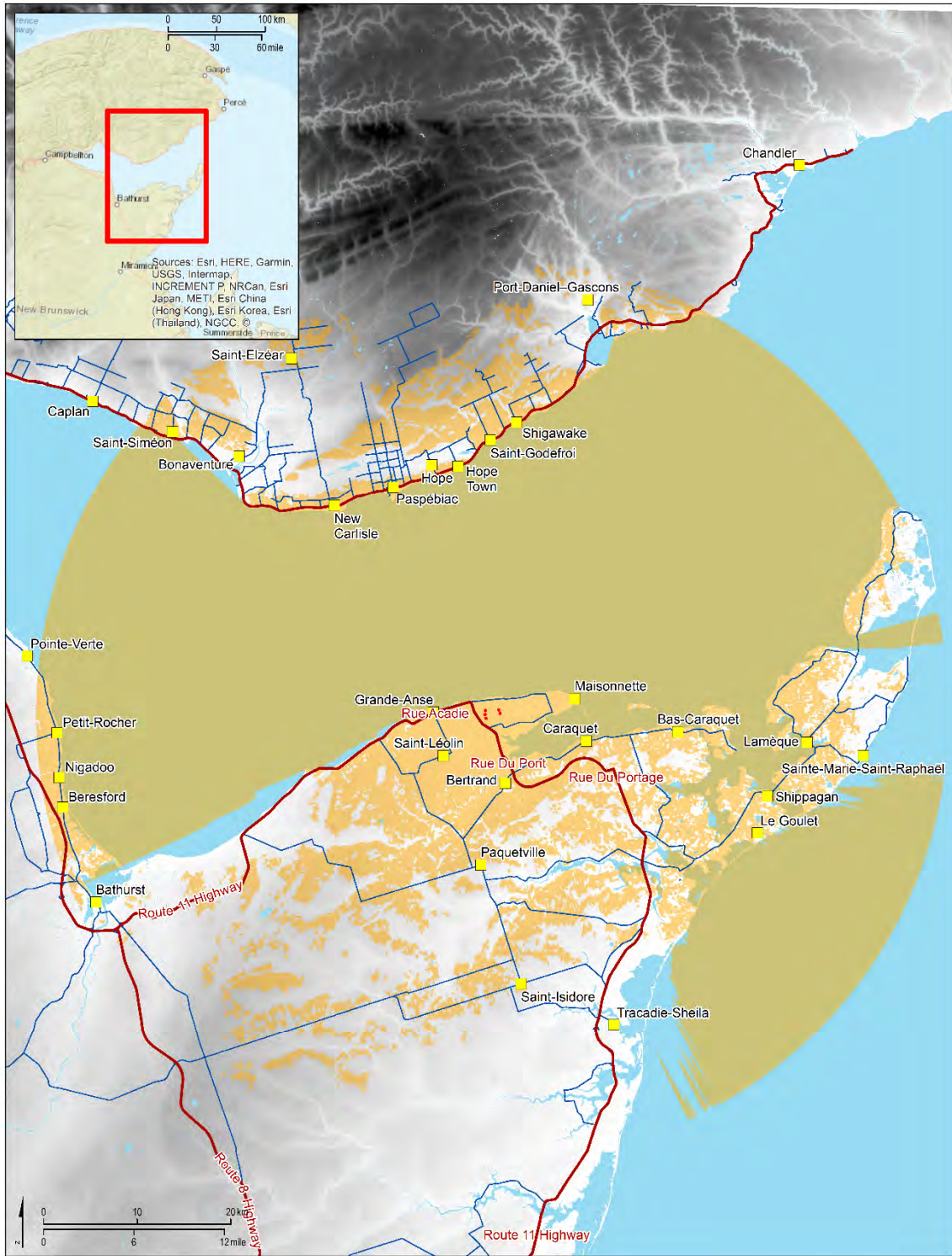
3 RESULTS

The results of the visibility analysis are shown in Appendix A. The maps show the areas from which it would be possible to see at least some portion of the WEC nacelle or blades respectively (maximum height above ground of 132 m and 195 m).

The visibility analysis results in what can be considered a “worst case” viewshed area. Practically speaking, there are several factors that were not accounted for that would limit the visibility of turbines, such as:

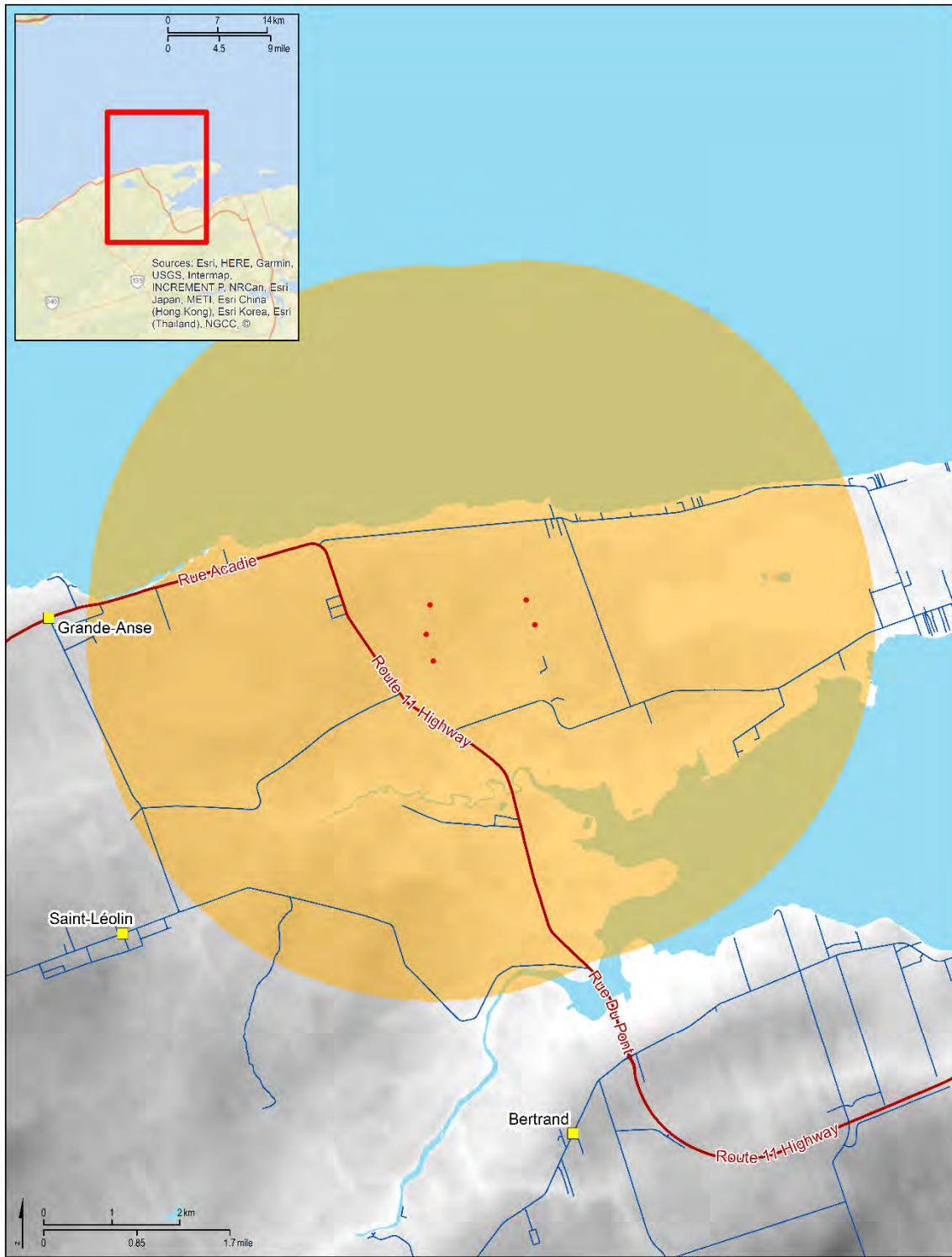
- Obstructions such as trees and buildings will have an impact on visibility. The use of the visibility analysis is limited in New Brunswick due to heavy tree cover. It is not possible to account for heavy tree cover analytically.
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- The amount of the turbine that is visible. Only part of a blade tip may be visible at some locations. It is not expected for blades to be visible over the entire 48 km calculation distance.
- Relative size of the turbine at the viewing distance. It will take a viewer longer to identify a wind turbine as the relative subtended visual angle nears the minimum angle of resolution is approached.

A ZONE OF VISUAL INFLUENCE MAPS



Chaleur Ventus Wind Power Project
Zone of Visual Influence 5 x E126 4.0 Layout
132 m Nacelle Visibility

Figure A-1 132 m Nacelle Visibility



- Legend**
- Populated Area
 - Turbine Locations
 - Highway
 - Road
 - 5 km Viewshed, 195 m

Elevation
 High : 100
 Low : 0

Version: 1
 Datum: NAD 83
 Projection: UTM Zone 20
 Scale: 1:55,000

Prepared by: WSP
 Author: A. Medd

Chaleur Ventus Wind Power Project
 Zone of Visual Influence 5 x E126 4.0 Layout
 195 m Blade Tip Visibility

In the preparation of this map, WSP has relied upon certain information provided by the client. While WSP has taken reasonable measures to present accurate information in the map, WSP does not warrant the reliability, accuracy, quality, currency, validity, or completeness of information found in the map. The locations shown are for informational purposes only and are not suitable for legal surveying or

Figure A-2 194.5 m Blade Tip Visibility

MEMO

TO: Tarek Abbasi, Naveco Power
FROM: Alex Medd
SUBJECT: Chaleur Ventus Wind Energy Project Photomontages
DATE: September 25, 2019

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- Site visit to capture images at six locations
- Post-processing of photos
- Stitching of the photos together to create panoramas
- Generation of photomontages for Enercon E126 EP3 turbine with a hub height of 132 metres

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Hugin (version 2018.0.0.5abfb4de796) was used to stitch the photomontage photos into panoramas. A combination of automated and manual masking was performed to create accurate depictions of the turbines. The resulting panoramas have a field of view of approximately 120 degrees.

For the 6 locations, maps were produced that show the before and after panorama, the location that the photos were taken, and the panorama field of view.

Please let me know if you have any questions or need any further information.

Sincerely,




Alexander Medd, EIT
Specialist, Power
Attachments



Before



After

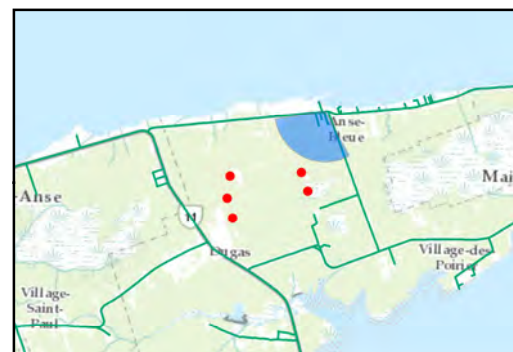
Title: Highway 303 and Chemin Downing Looking Southwest	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2




Notes:
 Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 132 m using 5 turbine locations.

Data Sources:
 Layout developed by WSP, provided June 17, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

Prepared By: WSP Canada Inc.
Author: A. Medd
Reviewed: C. Logan
Approved: R. Istchenko

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Legend:	
	Panorama Field of View
	Turbine Locations
	Roads





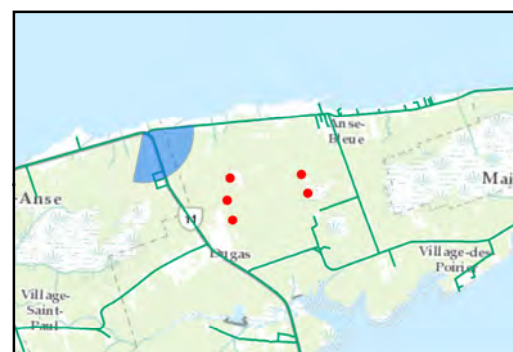
Title: Highway 11 and Highway 303 Looking South East	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 132 m using 5 turbine locations.

Data Sources:
Layout developed by WSP, provided June 17, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

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Legend:

- Panorama Field of View
- Turbine Locations
- Roads






Before



After

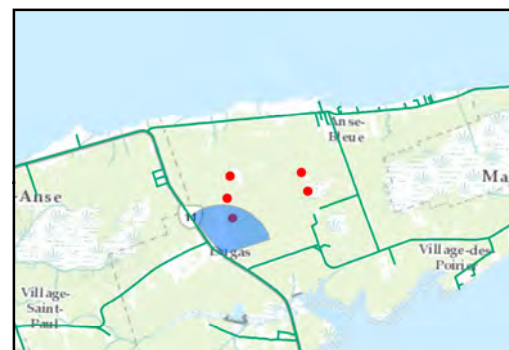
Title: Highway 11 south of Chemin Dugas Looking North East	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
 Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 132 m using 5 turbine locations.

Data Sources:
 Layout developed by WSP, provided August 10, 2018. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

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Reviewed: C. Logan
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Legend:

- Panorama Field of View
- Turbine Locations
- Roads





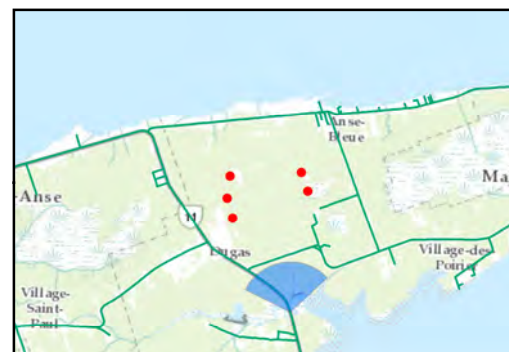
Title: Highway 11 north of Acadian Village Looking North	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-12
	Version: 2

Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 132 m using 5 turbine locations.

Data Sources:
Layout developed by WSP, provided June 17, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

Prepared By: WSP Canada Inc.
Author: A. Medd
Reviewed: C. Logan
Approved: R. Istchenko


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Legend:	
	Panorama Field of View
	Turbine Locations
	Roads





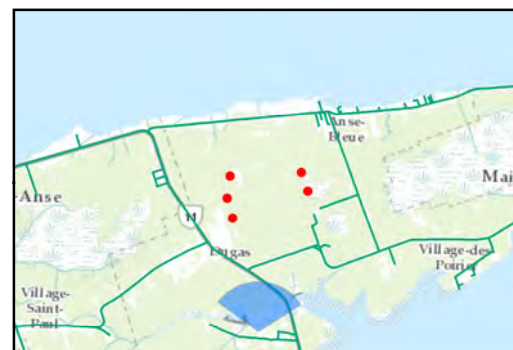
Title: Acadian Village Location 1 Looking North	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 132 m using 5 turbine locations.

Data Sources:
Layout developed by WSP, provided June 16, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

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Legend:

- Photo location and Panorama Field of View
- Turbine Locations
- Road





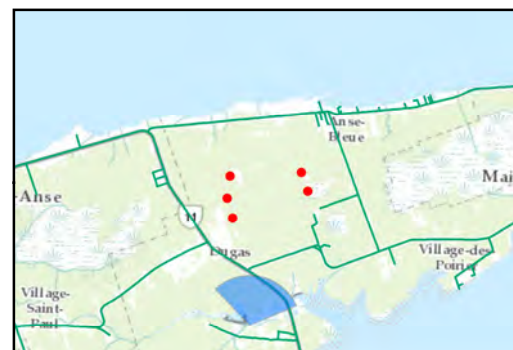
Title: Acadian Village Location 2 Looking North	
Project: Chaleur Ventus Wind Power Project	
	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2019-08-08
	Version: 2

Notes:
Photographs taken on Nov 13, 2018 with Canon EOS Rebel T1i EOS 500D DSLR camera and 35 mm lens. Photomontage simulated using Enercon E126 EP3 and with a hub height of 132 m using 5 turbine locations.

Data Sources:
Layout developed by WSP, provided June 17, 2019. Roads obtained from GeoNB May 2018, Basemaps obtained through ESRI November 2018.

Prepared By: WSP Canada Inc.
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Legend:

- Panorama Field of View
- Turbine Locations
- Roads

