CHALEUR VENTUS WIND ENERGY PROJECT

APPENDIX E - ELECTROMAGNETIC INTERFERENCE STUDY

CHALEUR VENTUS LIMITED PARTNERSHIP

October 2019

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CHALEUR VENTUS LIMITED PARTNERSHIP

DRAFT

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DATE: OCTOBER 18, 2019

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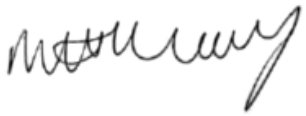

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1 INTRODUCTION

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

Wind energy converters (WECs) are large enough to potentially interfere with radio waves emitted from telecommunication, navigation, and radio detection and ranging (radar) systems. In response to the potential for interference, the Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA) has issued a set of guidelines which describe the methods for assessing electromagnetic interference caused by WECs[1]. This guideline specifies areas, or consultation zones, surrounding communication transmission systems based on system type and function. If a potential WEC location is within a consultation zone, the owner of the radio communication system should be contacted to assess how the potential interference will impact both parties.

The scope of the EMI analysis was to investigate radio frequencies registered within a Study Area extending 100 kilometres (km) from the Project's center and identify consultation zones in accordance with the RABC and CanWEA guidelines.

The location of radiocommunication stations was determined from a search of the data from the Spectrum Management System (SMS) Data which is administered by Innovation, Science and Economic Development (ISED) Canada. Appropriate consultation zones were assigned to the stations, as per the RABC/CanWEA guidelines, and then analysis was performed to identify the potentially impacted stations. Licensee information for stations of interest was retrieved from the SMS Data.

Intersections between the Project area and consultation zones was used as the basis for determining which communication systems are potentially impacted by the project.

The procedure to complete an EMI Study can be found in the Recommended Process section of the RABC/CanWEA guideline and is listed below. Step 1 has been addressed in this report. Steps 2 through 5 should be completed.

1. The wind project proponent develops a map showing the location of the proposed wind farm. The proponent obtains and provides preliminary information for the proposed project, including Project area, representative WEC characteristics, and proposed number of WECs.
2. The proponent sends notices of consultation with the proposed wind farm location and preliminary project information to all mandatory contacts operating non-disclosed systems.
3. The proponent determines whether any of the consultation zones for disclosed systems overlaps/intersects the proposed Project area as described by these Guidelines (the RABC/CanWEA guidelines).
4. In the event that the guidelines or mandatory consultation contacts indicate that a given installation is located within a consultation zone, the proponent contacts the applicable authority/owner of the disclosed or non-disclosed systems to determine if, in fact, further investigation is warranted.
5. The proponent and applicable authority/owner of the disclosed or non-disclosed systems undertake the necessary studies and identify mitigation measures to resolve the issue to the satisfaction of both parties. The wind project proponent develops a map showing the location of the proposed wind farm and all the WECs within.

[1] Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA). Technical Information and Coordination Process Between Wind Turbines and Radio communication and Radar Systems. March 4, 2010.

This report provides general information regarding the different types of radio communications, possible mechanisms of interference and identifies sources of potential radio communication conflict. Maps have been created which show all disclosed radiocommunication station locations and areas of potential interference between the proposed wind facility and radio signals (Appendix B). The radiocommunication licensees must be contacted to determine whether further interference investigation is required, particularly in cases where proposed WEC locations fall within a consultation zone. Communication tower locations, specifications, and consultation zones are presented in this report, as well as licensee contact information for each required consultation zone based on registered frequencies.

This analysis identifies consultation zones which should be incorporated into layout design. The reader is cautioned that the coordinates listed in the SMS Data can be inaccurate by up to several hundred meters; therefore, the locations of all relevant communication towers should be verified with a GPS and adjusted for each registered frequency. The SMS Data may also contain obsolete and prospective registered communication frequencies, so all potential conflicts should be verified.

The SMS Data does not list non-disclosed (protected) frequency assignments for public safety systems. These include the Federal Department of National Defence (DND), Royal Canadian Mounted Police (RCMP), Environment and Climate Change Canada (ECCC), NAV Canada, provincial and municipal police services, fire departments, and ambulance services. These entities, and ISED Canada, should be notified to address any potential radiocommunication interference issues once a turbine layout is determined.

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, collection system, substation, and associated temporary laydown areas required for construction. An approximate 9 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 metres (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 BACKGROUND

The electromagnetic interference created by a WEC can be classified in two broad categories. The first type of interference, known as obstruction, occurs when a WEC is placed between a receiver and a transmitter, creating a shadowed area where the signal is weakened or blocked. The second type of interference, known as reflection, is caused by the distortion between the raw signal and a reflection of the signal from an object. Interaction between the de-synchronised counterparts can degrade the signal. Scatter is a sub-category of reflection caused by the rotor blade movement. An example of scatter occurs when a WEC is identified as a moving object by radar systems due to the Doppler shift from the reflection of the moving rotor blades. Additionally, the orientation of the nacelle changes with wind direction and the blades pitch according to wind speed, which may cause complex interference patterns.

The specific characteristics of a WEC will influence the type and magnitude of the interference. Other factors that influence interference include blade dimension and design, tower height, diameter of the supporting tower, as well as the material used for blade and tower construction. Furthermore, WECs affect different types of signals in various ways as some telecommunication signals are more susceptible to interference than others. For example, Amplitude

Modulation (AM) radio is affected more by the presence of WECs than Frequency Modulation (FM) radio[2]. The guideline establishes a list of systems that should be investigated early in the wind farm development process including, but not limited to, the following:

- Point-to-Point Systems (Microwave Hops, Studio-to-Transmitter link, Transmitter-to-Transmitter link)
- Point-to-Multipoint Systems
- Over-the-Air Reception (Master Antenna TV, Cable TV Head Ends, Multichannel Multipoint Distribution Services Systems, VHF TV, UHF TV, Digital TV)
- Cellular Type Networks
- Satellite Systems (Direct-to-Home, Satellite Ground Stations)
- Land Mobile Networks
- Air Defence Radars, Vessel Traffic Radars and Air Traffic Control Radars
- Weather Radars

3 SUMMARY OF REGISTERED FREQUENCIES

The SMS Data contained 3,723 radiocommunication records within in the Study Area (an area extending out 100 km from the Project's center). Table 3-1 summarizes the number of station locations with consultation zones that intersect the Project Lands. Broadcast receptor conflicts is addressed in Section 6.4.

WSP has provided an interpretation of the Potential for Interference for the purpose of ranking the severity of the potential impact of WEC placement within any required consultation zone of each International Telecommunication Union (ITU) class. According to the RABC/CanWEA guidelines, all communications with potential for interference should be consulted by contacting the licensee of the communication source.

A map of the radiocommunication stations, coincident with the Project area and their associated consultation zones is shown in Appendix B.

[2] Guidelines for a Technical Engineering Report on the Environmental Impacts of Wind Turbines on Radiocommunication Services, CBC, 1400 Rene-Levesque Blvd. East, Montreal, Quebec H2L 2M2.

Table 3-1 Summary of Licensees near the Project Area

ITU CLASS[3]	NO. OF LICENSEE STATIONS IN SEARCH AREA	NO. OF LICENSEE STATIONS IN PROJECT LANDS	NO. OF LICENSEE STATIONS REQUIRING CONSULTATIONS FOR LAYOUT	STATION TYPE	FREQUENCY CATEGORY	POTENTIAL FOR INTERFERENCE[4]	CONSULTATION ZONE
AL	0	0	0	Aeronautical radio navigation land station		Moderate	1000m; up to 15 km (VOR)
AX	0	0	0	Aeronautical fixed station		N/A	
BC	0	0	0	Broadcasting station, sound	AM - TX < 3 megahertz (MHz)	N/A	5 km; up to 15 km
BC	59	3	0	Broadcasting station, sound	FM - TX > 80 MHz	Low	2000 m
BT	7	0	0	Broadcasting station, television	Television	Moderate	
EX	0	0	0	Experimental		N/A	
FA	0	0	0	Aeronautical station		Low	1000 m
FB	147	0	0	Base station	Other - TX < 890 MHz	Moderate	1000 m
FB	12	0	0	Base station	Cellular/Paging - TX > 890 MHz	Low	1000 m
FC	171	0	0	Coast station		N/A	
FL	0	0	0	Land station		N/A	
FX	1053	0	0	Fixed station	Land mobile network or low capacity station < 890 MHz	Low	1000 m
FX	304	4	0	Fixed station	Microwave TX > 890 MHz	Low	1000 m
	220	0	0	Microwave Link	Microwave TX > 890 MHz	High	Link Fresnel zone
LR	0	0	0	Radiolocation land station		Low	
ML	1964	2	0	Land mobile station		Low	
MO	0	0	0	Mobile station		Low	
NL	0	0	0	Maritime radio navigation land station		N/A	
RC	0	0	0	Non-directional radio beacon		N/A	
SM	0	0	0	Meteorological aids station	Radar	Low	
TC	5	0	0	Earth station in the fixed satellite service	Satellite	Low	
TE	0	0	0	Earth station in the satellite service– search and rescue	Satellite	N/A	
TM	1	0	0	Earth station in the meteorological-satellite service	Satellite	Low	500 m + satellite link

[3] ISED Canada. ITU Class of Station Decoded Fields, Spectrum Direct. https://spectrumdirect.ic.gc.ca/engdoc/decode/itu_cls.txt
[4] WSP has provided an interpretation of the Potential for Interference for the purpose of ranking the severity of the potential impact of turbine placement within any required consultation zone of each ITU class. According to the RABC/CanWEA guidelines, all communications with potential for interference should be consulted by contacting the licensee of the communication source.

4 NETWORKS

4.1 FIXED LINK SYSTEMS

Fixed link systems can be classified as either point-to-point or point-to-multipoint. Point-to-point telecommunication systems are used to transfer data from one point-location to another. High capacity microwave systems use radio signals in the range of 890 MHz to 40 gigahertz (GHz) to transmit data between two specific nodes in the communication network. Low capacity links use frequencies below 890 MHz Point-to-point systems may function to transport a television or radio signal prior to broadcast, telephone, or other high-volume data transfer. Television and radio networks use point-to-point systems (Studio-to-Transmitter link or Transmitter-to-Transmitter link) to send their signals over long distances prior to broadcast. Telephone and cellular phone networks also use point-to-point systems as the signal can be delivered over large distances with minimal reception loss.

Point-to-multipoint telecommunications refer to systems that provide multiple paths from a single location to multiple locations. Point-to-multipoint systems are typically used to offer cable TV (Multichannel Multipoint Distribution Services) and internet access to multiple users in sparsely populated areas, as well as data transfer from multiple sites such as oilfield or irrigation SCADA systems. This system can be treated as multiple point-to-point systems.

The rotating blades of WECs near point-to-point beam paths can either obstruct or cause a pulsed scatter of the signal. The result of either type of interference is signal degradation or signal interruption.

A wind power developer can avoid interference with microwave point-to-point systems by placing WECs outside of corridors linking the transmitter and receiver. The RABC/CanWEA guideline recommendations for point-to-point systems distinguish between two types of consultation zones:

- A 1 km consultation zone should be applied around all towers (microwave and low capacity links) and stations (receiver or transmitter) to avoid problems due to proximity of the tower.
- Line of sight consultation zones are calculated between the transmitter and the receiver for all systems above 890 MHz to avoid obstructing or scattering microwave links. This is represented by a cylinder with a width based upon three times the first Fresnel zone. The width of the Fresnel zone is proportional to the signal frequency and total link length as described in the RABC/CanWEA guidelines and is designed to avoid interference with the radio reception and thus the rotor diameter of the WEC is added to the width for avoidance.

The RABC/CanWEA guidelines do not include a recommendation to consult with the licensees of low frequency links (<890 MHz) radiocommunications as WECs generally do not cause interference with these links. They were assessed, however, and there were none in the SMS data that pass through the Project Lands.

A map of the microwave links near the Project Lands is shown in Appendix B. No microwave links pass through the Project area.

4.2 BASE STATIONS: LAND MOBILE NETWORKS AND CELLULAR TYPE NETWORKS

Land Mobile Networks and other Base Stations are used by police services, fire departments, farmers, emergency services, military and other private companies to communicate with moving units or mobile users located in an area. Cellular type networks refer to mobile telephone systems that use frequency or phase modulation similar to FM radio between 800 and 1900 MHz.

The RABC/CanWEA guidelines recommend a 1 km consultation zone around such transmission sources. This is a conservative guideline for consultation and WECs will often be able to operate much closer to these stations.

Land mobile networks operated by police services and military are not listed in the spectrum data. The RCMP and DND should be contacted directly to determine if any radiocommunication interference concerns exist.

4.3 SATELLITE SYSTEMS

Satellite systems can be found in three basic forms: large commercial satellite systems used for data transfer between ground stations and orbiting repeater stations; satellite systems used for space exploration; and ground receptor satellite dishes used for private television reception or Internet. The RABC/CanWEA guidelines describe the method for calculating a satellite system consultation zone using the transmitting frequency, antenna height, and the satellite's orientation. No satellite base stations were found with a consultation zone that intersects the Project area.

Direct-to-Home satellite broadcasting uses geostationary satellites to provide radio and television service. Users of such services are not listed in the spectrum data. However, existing regulations for setbacks from homes (for issues such as sound levels) should ensure adequate distances between Direct-to-Home users and WEC locations.

5 BROADCASTING

Broadcasting signals are used to deliver television and radio service to the general population. These signals are typically transmitted over a general area reaching up to 80 km. This category of radio transmission can be split into three basic groups: AM radio, FM radio, and television (analog and digital).

Multichannel Multipoint Distribution Services, operating at microwave frequencies, are also used for radio and television broadcasting, internet, and IP telephone service. Any stations of this type will be assigned a consultation zone similar to a television broadcasting station.

5.1 AM SIGNALS

The mechanism behind AM data transfer is modulation of the amplitude of a set frequency. This type of broadcasting system has relatively low capacity for data content. AM signals used for radio broadcasting typically operate in the frequency range of 0.525 MHz to 1.705 MHz[5]. Tall structures made of electrically conductive materials, such as WECs, can modify the radiation patterns of AM stations and may cause reception problems and interference with other stations.

5.2 FM SIGNALS

FM signals are typically used for audio broadcasting and operate in the frequency range of 87.5 to 108 MHz[5]. This technology incorporates frequency modulation of a signal to broad areas of reception. FM radio is less susceptible to interference than AM radio.

[5] < https://en.wikipedia.org/wiki/Broadcast_band >, Wikipedia, The Free Encyclopedia, Accessed December 2017.

5.3 TELEVISION

Analogue and digital television signals are located in several bands of frequencies including the range of 54 to72 MHz for channels 2 to 4, 76 to 88 MHz for channels 5 to 6, 174 to 216 MHz for channels 7 to 13, 470 to 608 MHz for channels 14 to 36 and 614 to 698 MHz for channels 38 to 51[6]. Examples of interference in television reception could include picture shadow caused by reflection from an obstacle, or picture flicker caused by the rotating blades of a WEC.

5.4 MITIGATION FOR BROADCASTING STATIONS

According to the Canadian Broadcasting Corporation (CBC) guidelines[7], a 2 km buffer is recommended around all television stations, a 2 km buffer for FM radio broadcasting transmitters, a 5 km buffer for omnidirectional AM radio broadcasting transmitters, and 15 km around directional AM radio broadcasting transmitters. Further CBC communication on Requirements for Wind Energy Projects[8] require for preliminary reporting an inventory listing FM stations within 5 km of the Project, AM stations with 15 km, and TV broadcasting stations within 100 km. Stations and buffers near the Project are shown in Appendix B. Broadcaster information for the FM stations with buffers overlapping with the Project is provided in Appendix A, though all turbines are outside the buffers of the broadcasting stations. No AM stations are near the Project. TV broadcasting stations within 100 km of the Project are listed in Appendix A.

Based on the RABC/CanWEA guidelines, a public consultation should be organised for all broadcasting receptors near the Project. The consultation zone for broadcasting receptors is based upon a 10 km buffer around each WEC for digital TV and 15 km for analog TV. All TV stations are now digital and there are no digital TV broadcasting receptors within 10 km of the Project.

Residents with a potential for interference should be notified about the potential reception interference risk in a public stakeholder meeting. This notification should provide details for a process of recording complaints of reception interference. In the case of a complaint, a third-party communications engineer can be contracted to determine the protected service contour for each station and measure the broadcasting signal to confirm affected dwellings. Mitigation methods might include the purchase of a taller reception tower for the affected residents, or providing a subscription for cable or satellite TV.

6 RADAR

The potential impacts of WECs on radar systems are difficult to assess and usually require a case-by-case analysis. Interference is heavily dependent on topography, land cover, existing obstacles and other terrain features. The RABC/CanWEA guidelines have established large consultation areas around radar facilities. Improper placement of WECs may render a radar station inoperable or severely compromised. In order to avoid such situations, a proper investigation must be performed in the planning process of a wind energy project. Under certain circumstances, even if a project is within the consultation zone of a radar station, it is possible for the interference effects to be mitigated.

[6] < http://en.wikipedia.org/wiki/North_American_broadcast_television_frequencies >, Wikipedia, The Free Encyclopedia, Accessed December 2017.
[7] Guidelines for a Technical Engineering Report on the Environmental Impacts of Wind Turbines on Radiocommunication Services, CBC, 1400 Rene-Levesque Blvd. East, Montreal, Quebec H2L 2M2. June 2008
[8] CBC/Radio-Canada Involvement and Requirements Concerning Wind Energy Projects, 1400 Rene-Levesque Blvd. East, Montreal, Quebec H2L 2M2. February 2014.

Most radar systems operate within the 1 GHz to 10 GHz frequency band[9]. These systems are used mainly for aeronautical and maritime navigation, as well as for meteorological forecasting. Radar systems involve the transmission of radio waves in a sweeping or burst pattern and an antenna that collects waves reflected (scattered) by objects in the vicinity. By filtering the scattered electromagnetic waves, the radar operator is capable of identifying the range and size of fixed objects and the direction, altitude, size, range, and speed of moving objects. Conductive objects are more likely to reflect the electromagnetic waves.

Although most radar systems are capable of filtering unwanted echoes (clutter) from fixed obstacles, the rotating blades of WECs can generate dynamic interference which is difficult to filter. The problem is amplified because the nacelle may rotate 360° based upon wind direction at hard to predict intervals.

The following section discusses three types of radar systems identified by the RABC/CanWEA guidelines which may have potential conflict with WECs.

6.1 WEATHER RADARS

ECCC operates the Canadian Weather Radar Network, which consists of 31 Doppler radar stations installed throughout the country. These radars are used for the purpose of meteorological forecasting, and also serve as a public safety tool by detecting severe weather events in advance. ECCC uses weather radar stations in order to locate and identify types of precipitation and forecast changes in position and intensity of meteorological activity. In addition, weather radar services such as hail monitoring programs are provided by private companies throughout Canada.

WECs may cause interference by either obstruction or by creating Doppler shift of the signal via reflection from their rotating blades. In addition, wake induced turbulence may be detected by these radar systems.

Weather radars use various techniques that differ from aeronautical radar systems. They are typically located in regions with a clear line-of-sight far into the horizon. Weather radar systems are often located on high topographical features, allowing far-reaching radar detection at low altitudes (negative depression angle). In contrast, aeronautical radar stations are typically focused towards flying objects above the horizon. The target detection zone of weather radar systems results in a particular sensitivity to wind power projects, especially if there is clear line of sight between the radar and the WEC.

The RABC/CanWEA guidelines have recommended that a 50 km radius consultation zone be applied around weather radar systems. ECCC has provided positions of their weather radars. Table 6-1 shows the locations and the names of the closest weather radar systems to the Project, and the approximate distance that separates them from the Study Area. No ECCC radar systems are located within the 50 km consultation zone.

Table 6-1 Environment and Climate Change Canada Radar Stations near the Project

RADAR ID	LATITUDE	LONGITUDE	DISTANCE TO PROJECT (KM)
Chipman NB	46.2299	-65.6970	180
Val d'Irene QC	48.4775	-67.5932	190

[9] Canadian Table of Frequency Allocations 9 kHz to 275 GHz (2005 Edition), Spectrum Management and Telecommunications, Industry Canada. Last amended February 2007

6.2 AIR TRAFFIC CONTROL RADARS AND CIVILIAN AIRFIELDS

Most air traffic control radars are located in the vicinity of major airports. In addition, they can be located along major aerial traffic routes distant from populated regions. Air traffic control radars can be affected by the presence of WECs obstructing their line of sight. Although they typically sweep high altitude areas, large obstacles such as WECs may be difficult to differentiate from a flying object, especially if they are placed on ridges or in clusters. In addition, the signal from a plane may be lost when passing behind a cluster of WECs. A commercial WEC is equipped with blades that are comparable in length with a medium range airliner (a Boeing 747 is 68.4 m long).

NAV Canada, a private company that provides civil air navigation services for Canada, operates all the civilian air traffic control radars. The RABC/CanWEA guidelines have recommended that an 80 km radius consultation zone be applied around NAV Canada Primary Surveillance Radars and a 10 km consultation zone around Secondary Surveillance Radars. The RABC/CanWEA guidelines have also recommended that a minimal 10 km radius consultation zone be applied around any major civilian airfield to avoid the possibility of a collision between planes and WECs. A consultation zone of 15 km should be applied to all VOR beacons.

An Aviation Constraints assessment[10] was carried out by WSP in May 2018, which identified the location of nearby aerodromes, navigation aids, radars, and airways and airspace. No airways and airspace, navigation aids, aerodromes or air traffic control radars were found that intersect with Project Lands. It was noted that NAV Canada would be expected to closely review impacts on the Runway 13 RNAV (GNSS) Approach procedure for Pokemouche aerodrome.

A map of the consultation zones of nearby stations are shown in Appendix B. Land use applications and consultation with NAV Canada are required for final layout approval.

6.3 MILITARY RADARS AND AIRPORTS

The DND operates Air Defence Radars which provide the capability for the detection of foreign aircraft. This network is comprised of radars located throughout the country. This radar network represents a portion of Canada's contribution to North American Aerospace Defense Command and is considered more sensitive than civilian airfield infrastructure. The RABC/CanWEA guidelines have recommended that a 100 km radius consultation zone be applied around DND Air Defence Radars, 80 km around Primary Surveillance Radars and 40 km for DND Precision Approach Radars. The RABC/CanWEA guidelines have also recommended that a minimal 10 km radius consultation zone be applied around any major military airfield.

As detailed in the Aviation Constraints assessment[10,] two National Defence Canadian Coastal Radar installations with coverage areas encompassing the Project area were identified. Both stations, Sydney and Barrington Nova Scotia, are over 477 km from the project and should not pose any constraints on the project, however DND should be contacted and provided with information regarding the Project to address any potential interference concerns. No identified National Defence restricted airspace areas were found in the vicinity of the Project.

[10] WSP. Anse Bleue Wind Farm Aviation Constraints. May 17, 2018.

7 CONCLUSIONS

The EMI analysis investigated radio frequencies registered within a Study Area extending 100 kilometres (km) from the Project's center. The results of the investigation into potential electromagnetic interferences at the Project have been compiled and presented in Appendix A.

A total of 3,723 records were found in the ISED SMS Data with stations located inside the Study Area. Of these, no records were found to have consultation zones that intersect with any proposed turbine locations. The consultation zones are shown on the maps found in Appendix B and tables in Appendix A.

The licensees of all possibly conflicting communication systems and broadcasters should be notified to assess interferences and mitigate concerns if required. As the coordinates for the stations in the SMS Data may be inaccurate by several hundred meters, all relevant tower locations should be verified by high resolution air photos where possible or through a site visit.

A search for line-of-sight microwave links (frequency > 890 MHz) that cross Project Lands was also conducted. No links were found that cross the Project area and no turbines are contained within a microwave link consultation zone.

There are three FM broadcasting stations near the Project area. No turbines are contained within broadcasting consultation zones.

Television reception from local broadcasters may be affected by the wind farm. The RABC/CanWEA guidelines recommend that all residents within the broadcasting consultation zone should be considered stakeholders and included in a public consultation. A method to record complaints from broadcasting receptors and a plan for mitigating problems should be established. Depending on the concerns of stakeholders, an impact study might include a field validation of reception before and after WEC installation. In the case of diminished reception due to WEC installation, the most cost-effective mitigation techniques for broadcasting reception include relocation of reception towers, purchase of a taller reception tower/antenna structures for TV/radio, or the purchase of cable/satellite TV/radio for affected receptors. Finally, mitigation methods can be applied in both the planning stages of wind power facility and after the installation of the WECs.

There are no aerodromes airways and airspace, navigation aids, aerodrome protection areas or ATC, weather or DND radars. However, NAV Canada would be expected to closely review impacts on the Runway 13 RNAV (GNSS) Approach procedure for Pokemouche aerodrome. The final layout locations must be cleared by NAV Canada.

DND, NAV Canada, Transport Canada, RCMP, ECCC, and Fisheries and Oceans Canada, Canadian Coast Guard, and local public safety agencies (provincial, regional, and local police; ambulance; and fire services) should be contacted to address any interference concerns and for the completion of land-use applications. Consultation with federal agencies including NAV Canada, Transport Canada, RCMP, ECCC, Fisheries and Oceans Canada, and Canadian Coast Guard has been initiated for the Project and no interference concerns have been raised. Documented responses are pending.

A SPECTRUM MANAGEMENT SYSTEM DATA

Appendix

Table A-1 Microwave Fixed Links with Consultation Zones Passing Through Project Lands

ORIGIN STATION CALL SIGN	ORIGIN STATION LOCATION		FREQUENCY (GHZ)	LICENSEE	ADDRESS	LICENSE #	LINK STATION	LINK STATION LOCATION	
	NAD83							NAD83	
	Latitude	Longitude					Call Sign	Latitude	Longitude
CHG278	47.730833	-65.763333	6775	BELL CANADA	200 Bouchard 5CS, Dorval QC H9S 5X5	61090045223	CHG279	47.508333	-66.413889
CHG279	47.508333	-66.413889	6435	BELL CANADA	200 Bouchard 5CS, Dorval QC H9S 5X5	61090045223	CHG278	47.730833	-65.763333
CKJ524	47.769722	-65.155833	4957.5	DEPARTMENT OF TRANSPORTATION (M)	1050 COLLEGE HILL RD, FREDERICTON NB E3B 4J8	61080004708	CKJ513	47.806389	-65.749722
CKJ513	47.806389	-65.749722	4957.5	DEPARTMENT OF TRANSPORTATION (M)	1050 COLLEGE HILL RD, FREDERICTON NB E3B 4J8	61080004708	CKJ524	47.769722	-65.155833

Table A-2 Licensees and Owners of Fixed and Base Stations (<890 MHz) with Consultation Zones Intersecting Project Lands

LICENSEE	ADDRESS	NAD 83		FREQUENCY [MHZ]	ITU CLASS	LICENSE #	CALL SIGN	CHANNEL TYPE	DATE ISSUED
		Latitude	Longitude						
R MURPHY & SON'S TRUCKING	102 GRANT ST, BELLEDUNE NB, E8G 2C9	47.666667	-65.333333	150.305	ML	65080008654		TX	2014-07-11
R MURPHY & SON'S TRUCKING	102 GRANT ST, BELLEDUNE NB, E8G 2C9	47.666667	-65.333333	150.305	ML	65080008654		RX	2014-07-11

Table A-3 Licensees and Owners of Fixed and Base Stations (>890 MHz) with Consultation Zones Intersecting Project Lands

LICENSEE	ADDRESS	NAD 83		FREQUENCY [MHZ]	ITU CLASS	LICENSE #	CALL SIGN	CHANNEL TYPE	DATE ISSUED
		Latitude	Longitude						
Rogers Communications Canada Inc.	8200 Dixie Road, Brampton ON, L6T 0C1	47.79972222	-65.13472222	6093.45	FX	61090001349	CIN995	TX	2007-10-05
Rogers Communications Canada Inc.	8200 Dixie Road, Brampton ON, L6T 0C1	47.79972222	-65.13472222	11510	FX	61090001349	CIN995	TX	2007-10-05
Rogers Communications Canada Inc.	8200 Dixie Road, Brampton ON, L6T 0C1	47.79972222	-65.13472222	6345.49	FX	61090001349	CIN995	RX	2007-10-05
Rogers Communications Canada Inc.	8200 Dixie Road, Brampton ON, L6T 0C1	47.79972222	-65.13472222	11020	FX	61090001349	CIN995	RX	2007-10-05

Appendix

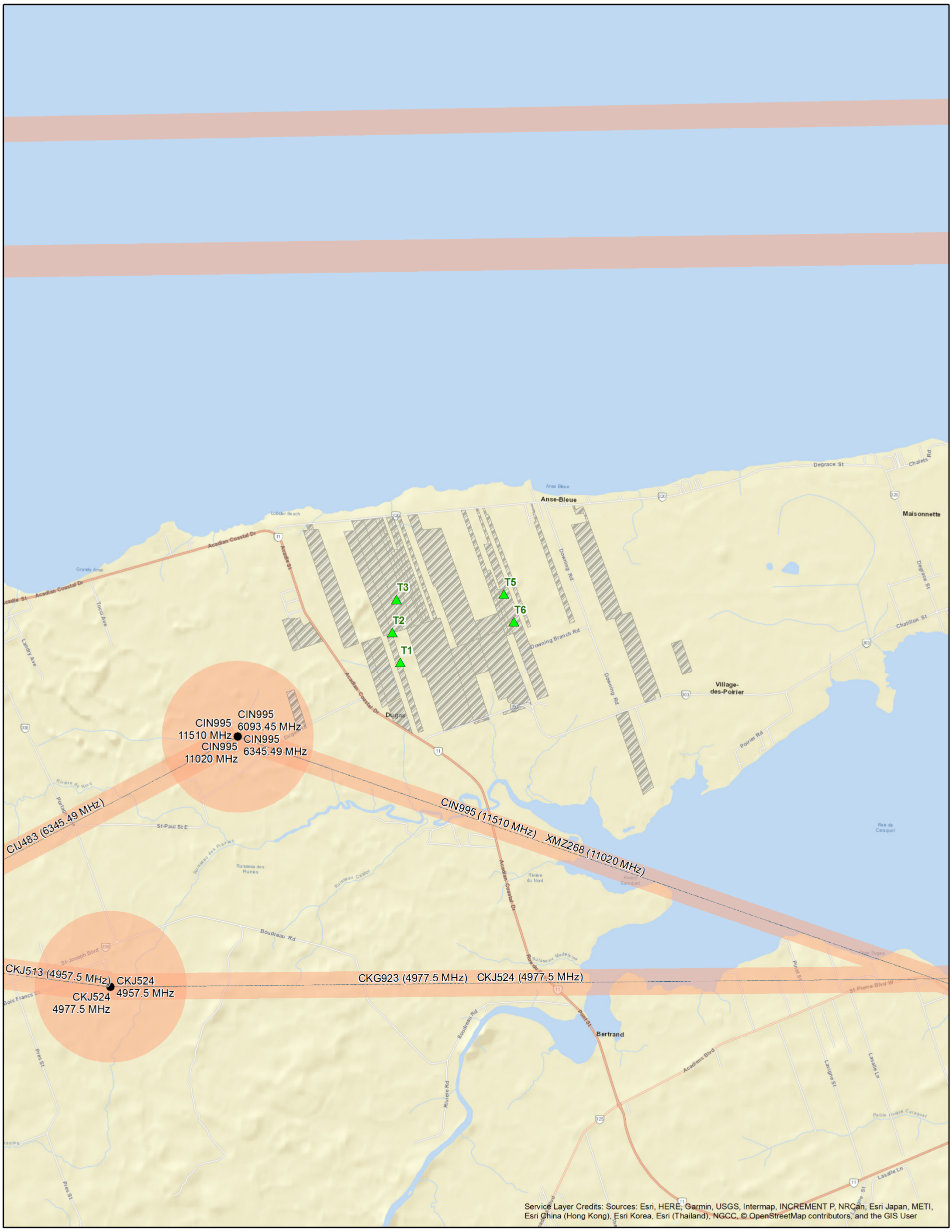
Table A-4 Licensees and Owners of Broadcasting Stations with Consultation Zones Intersecting Project Lands

LICENSEE	ADDRESS	NAD 83		FREQUENCY [MHZ]	ITU CLASS	BROADCAST TRANSMISSION TYPE	LICENSE #	CALL SIGN	CHANNEL TYPE	DATE IN SERVICE
		Latitude	Longitude							
Radio Acadie Ltd	270, Avenue Douglas, #301, Bathurst NB, E2A1M9	47.816944	-65.147222	94.1	BC	FM Radio	75000010451	CJVA-FM	TX	9/30/2016
CBC/ Radio-Canada	1400, Boul Rene-Levesque E, Montreal QC, H2L 2M2	47.816944	-65.147222	90.3	BC	FM Radio	75000009399	CBAF-FM-18	TX	5/17/2016
CBC/ Radio-Canada	1400 Boul Rene-Levesque E, Local A2-30, Montreal QC, H2L 2M2	47.816944	-65.147222	88.3	BC	FM Radio	75000009397	CBAL-FM-2	TX	5/17/2016

Table A-5 Licensees and Owners of TV Broadcasting Stations within 100 km of Project Lands

LICENSEE	ADDRESS	NAD 83		FREQUENCY [MHZ]	ITU CLASS	BROADCAST TRANSMISSION TYPE	LICENSE #	CALL SIGN	CHANNEL TYPE	DATE IN SERVICE
		Latitude	Longitude							
Societe de telediffusion du Quebec	1000, rue Fullum, Montreal QC, H2K3L7	48.527222	-64.243611	629	BT	Digital Television	75000008364	CIVK-DT-2	TX	5/27/2015
Corus Television Limited Partnership	25 Dockside Drive, Toronto ON, M5A 0B5	47.055833	-65.488889	629	BT	Digital Television	75000010098	CIHF-DT-13	TX	7/10/2015
Societe de telediffusion du Quebec	1000, rue Fullum, Montreal QC, H2K3L7	48.211389	-64.870556	581	BT	Digital Television	75000008364	CIVK-DT-1	TX	9/1/2014
CHAU-TV Communications Ltd	103 des Equipements, Riviere-du-Loup QC, G5R5W7	48.356111	-64.684167	545	BT	Digital Television	75000008213	CHAU-DT-4	TX	9/1/2014
CHAU-TV Communications Ltd	103 des Equipements, Riviere-du-Loup QC, G5R5W7	48.526667	-64.243611	201	BT	Digital Television	75000008213	CHAU-DT-5	TX	12/15/2014
CHAU-TV Communications Ltd	103 des Equipements, Riviere-du-Loup QC, G5R5W7	48.138889	-64.985278	195	BT	Digital Television	75000008213	CHAU-DT-3	TX	9/1/2014
CHAU-TV Communications Ltd	103 des Equipements, Riviere-du-Loup QC, G5R5W7	47.507500	-64.940000	189	BT	Digital Television	75000008213	CHAU-DT-10	TX	9/1/2014

B SITE MAPS



Calgary, Alberta

Title: Microwave Link and Consultation Zones

Project: Chaleur Ventus Wind Energy Project

Client: Chaleur Ventus LP

Projection: UTM Zone 12N (NAD83)
Date: August 09, 2019 **Author:** Matthew Breakey
Version: 1 **Reviewer:** Caitlin Logan

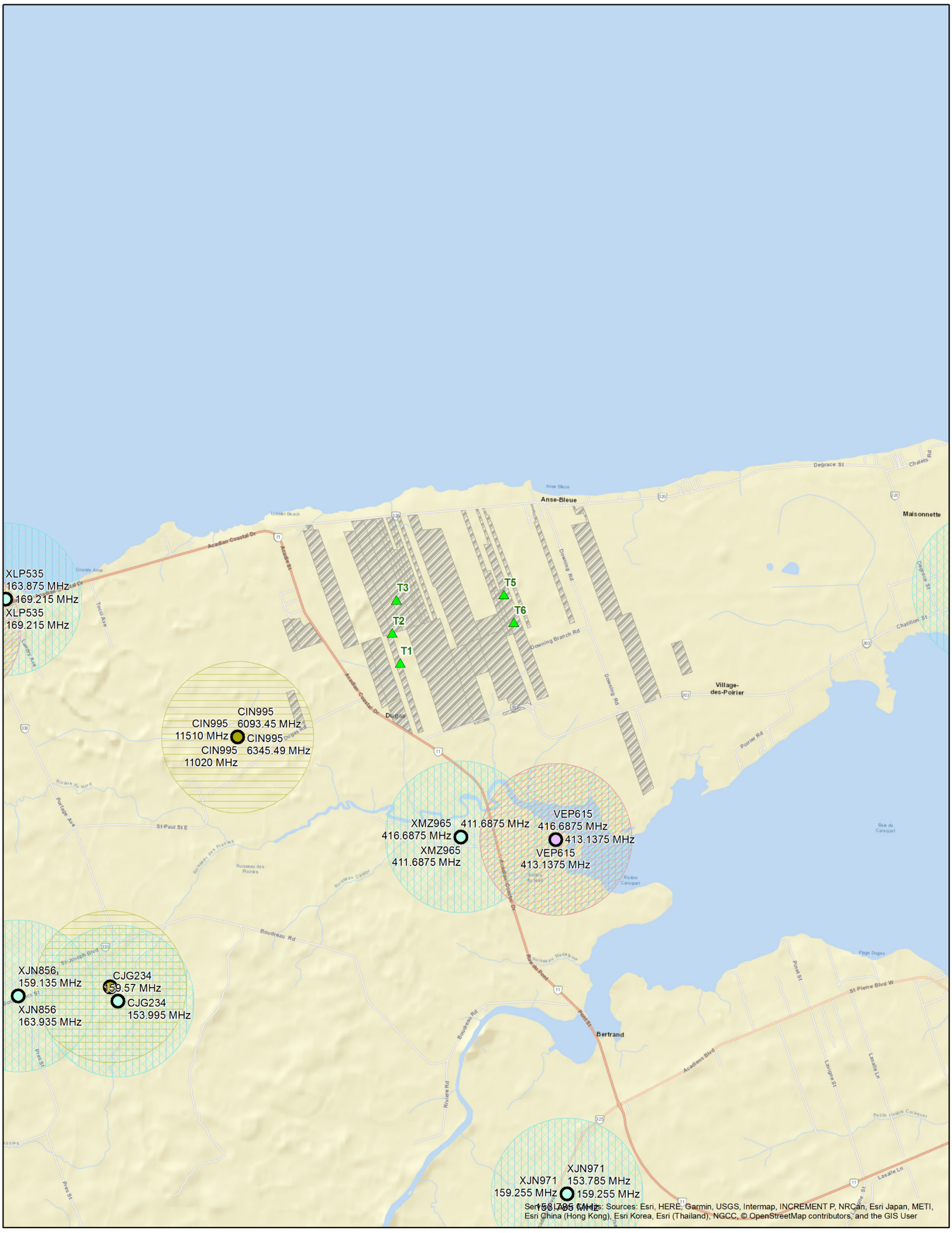
Notes: Station coordinates from SMS Data should be verfied by air photos or site visit.
Sources:
Land Stations: Canada Spectrum Management System, 2019-08.
Project Layout: Naveco, 2019-06-17.
Project Boundary: Naveco, 2018-07-18.

Legend

- WEC
- Project Boundary
- Buffer: 3 x 1st Fresnel Zone plus Rotor
- Buffer: 1000 m
- Microwave Tower
- Microwave Link

0 0.5 1 2 3 km (Scale: 1:50,000)

N



Calgary, Alberta

Title: Land Station and Consultation Zones

Project: Chaleur Ventus Wind Energy Project

Client: Chaleur Ventus LP

Projection: UTM Zone 12N (NAD83)
Date: August 09, 2019 **Author:** Matthew Breakey
Version: 1 **Reviewer:** Caitlin Logan

Notes: Station coordinates from SMS Data should be verfied by air photos or site visit.
Sources:
Land Stations: Canada Spectrum Management System, 2019-08.
Project Layout: Naveco, 2019-06-17.
Project Boundary: Naveco, 2018-07-18.

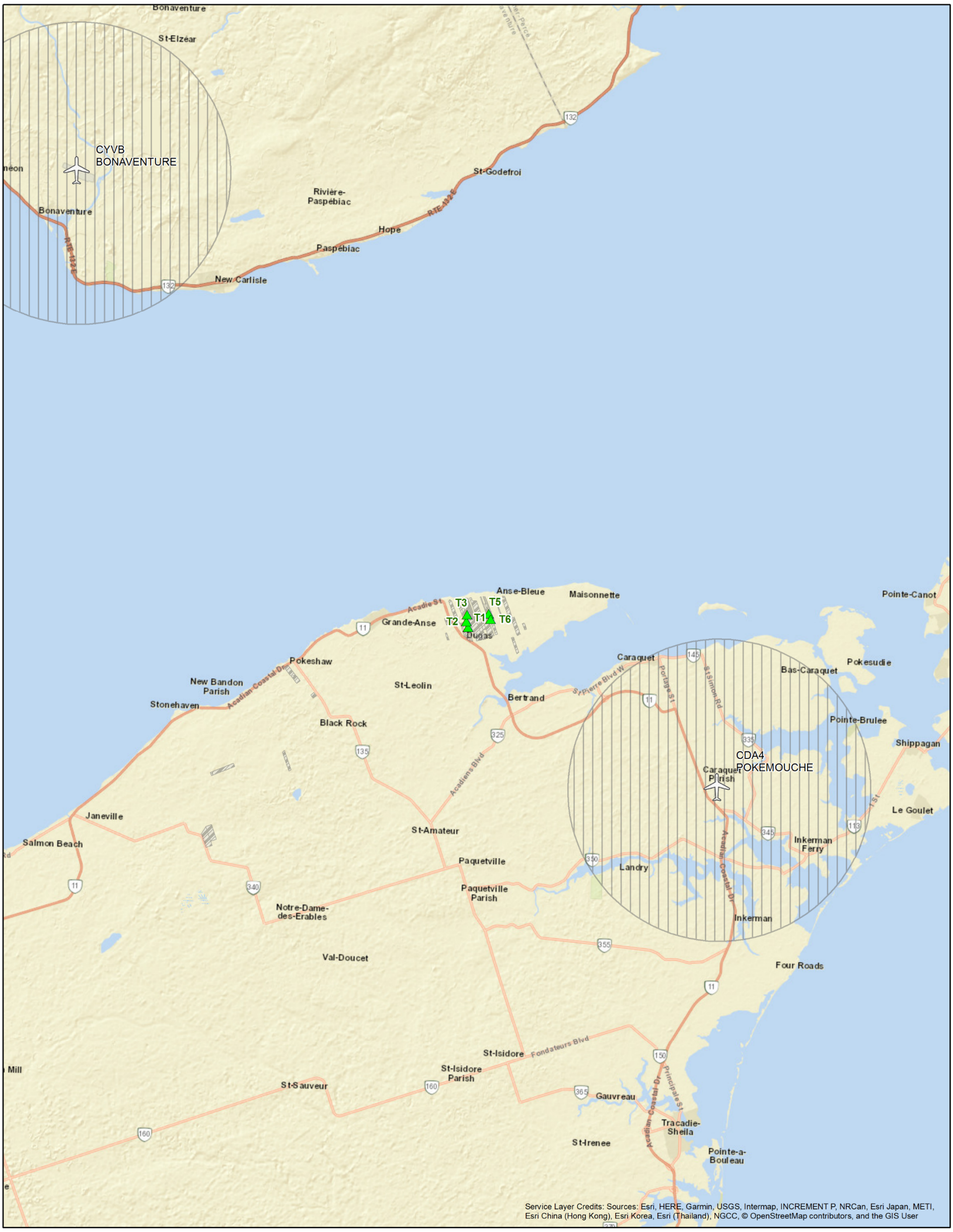
Legend

- WEC
- Project Boundary
- Buffer of Fixed Base <0.9 GHz: 1 km
- Buffer of Fixed Base >0.9 GHz: 1 km
- Buffer of Fixed Base <0.9 GHz: 1 km
- Buffer of Fixed Base >0.9 GHz: 1 km
- Buffer of Mobile Land: 1 km
- Fixed Base (>0.9 GHz)
- Base Station (>0.9 GHz)
- Base Station (<0.9 GHz)
- Fixed Station (<0.9 GHz)
- Fixed Station (>0.9 GHz)
- Land Mobile

N

(Scale: 1:50,000)

0 0.5 1 2 3 km



Calgary, Alberta

Title: Aeronautical Consultation Zones

Project: Chaleur Ventus Wind Energy Project

Client: Chaleur Ventus LP

Projection: UTM Zone 12N (NAD83)
Date: August 10, 2019 **Author:** Matthew Breakey
Version: 1 **Reviewer:** Caitlin Logan

Notes: Station coordinates from SMS Data should be verfied by air photos or site visit.

Sources:
Land Stations: Canada Spectrum Management System, 2019-08.
Project Layout: Naveco, 2019-06-17.
Project Boundary: Naveco, 2018-07-18.

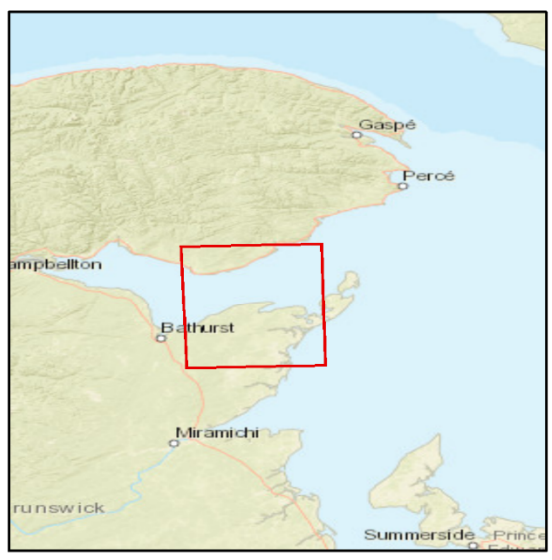
Legend

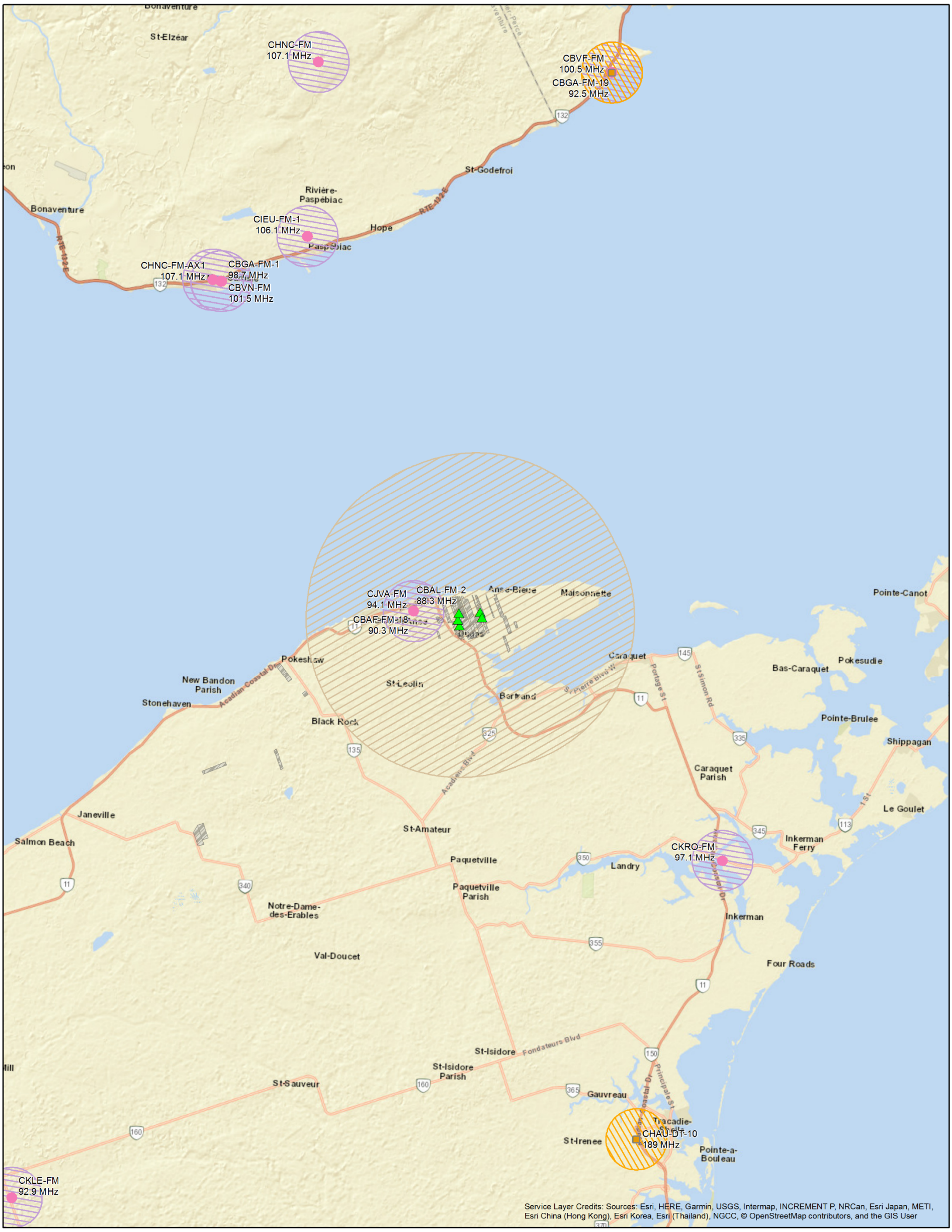
- WEC
- Project Boundary
- Certifiied Airport
- Navigation Aids
- NAV Canada Radar
- Buffer of Airport (10 km)
- Buffer of Radar (80km)

0 2.25 4.5 9 13.5 km

(Scale: 1:250,000)

N





Calgary, Alberta

Title: Broadcasting Station Buffers

Project: Chaleur Ventus Wind Energy Project

Client: Chaleur Ventus LP

Projection: UTM Zone 12N (NAD83)
Date: August 10, 2019 **Author:** Matthew Breakey
Version: 1 **Reviewer:** Caitlin Logan

Notes: Station coordinates from SMS Data should be verfied by air photos or site visit.
Sources:
Land Stations: Canada Spectrum Management System, 2019-08.
Project Layout: Naveco, 2019-06-17.
Project Boundary: Naveco, 2018-07-18.

Legend

- WEC
- Project Boundary
- Broadcast: FM
- Broadcast: Television
- Buffer of FM Station: 2 km
- Buffer of TV Station: 2 km
- Buffer of WEC Location for Digital TV Station: 10 km

0 2.25 4.5 9 13.5 km

(Scale: 1:250,000)

N