SeaChange Project: 23-02 March 2025

ShoreZone Polygon Mapping Summary Report

Cape Breton Survey Area

North Aspy River, North Harbour (ns22_sd_05771)

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1 Introduction

ShoreZone is an imaging and habitat classification system for the coastal nearshore margin including the shallow subtidal, intertidal shoreline and supratidal fringe. One objective of ShoreZone is to produce a georeferenced, searchable inventory of the physical and biological attributes of coastal habitats. ShoreZone imagery and habitat mapping attributes can provide a useful baseline from which to study change over time, while the attributes mapped (such as shoreline sediments, predicted oil residence and biotic communities) provide an important resource for scientists, managers and responders. The ShoreZone mapping system provides a decision support tool with many potential uses including community planning, facilities citing, conservation planning, research and fisheries management, emergency planning and response, search and rescue, education and habitat modeling.

The ShoreZone system was developed in the 1980s and 1990s to map coastal habitats in British Columbia and Washington State (Howes 2001; Berry *et al.* 2004). In 2001 ShoreZone was implemented in Alaska, beginning with Cook Inlet, Outer Kenai, Katmai, and portions of the Kodiak Archipelago (Harper and Morris 2004; Harper and Morris 2014). ShoreZone has since expanded to a spatially continuous database of over 124,000 km of coastal Alaska, British Columbia, New Brunswick, Nova Scotia, Washington State and Oregon (Figure 1). Figure 2 shows the extent of the shoreline mapped around the Cape Breton survey area and is the section of shoreline covered by this summary report. The most current ShoreZone protocol was updated in 2017 (Cook *et al*. 2017).

The ShoreZone imaging survey conducted around Cape Breton in September 2022 acquired aerial video and digital still images of the coast during minus tides (zero-meter tide levels and lower). The imagery and associated audio commentary were used to map the physical and biological attributes of the shoreline. The entire shoreline was mapped according to the most recent ShoreZone coastal habitat mapping protocol (Cook *et al*. 2017). In 2024/2025, the existing ShoreZone imagery and mapping, in conjunction with publicly available satellite imagery (ArcGIS Earth, ArcMap, Google Earth), was used to create intertidal and sensitive habitat polygons for the Cape Breton survey area.

The purpose of this report is to detail the polygon mapping work with summaries of the data and descriptions of the challenges involved. The length of shoreline mapped is **1,678 kilometers** in **7,440 along-shore segments** (units). In total, **7,924 intertidal polygons** (Section 2) covering a total of **1,141 ha** and **13,790 sensitive habitat polygons** (Section 3) covering **3,648 ha** were created.

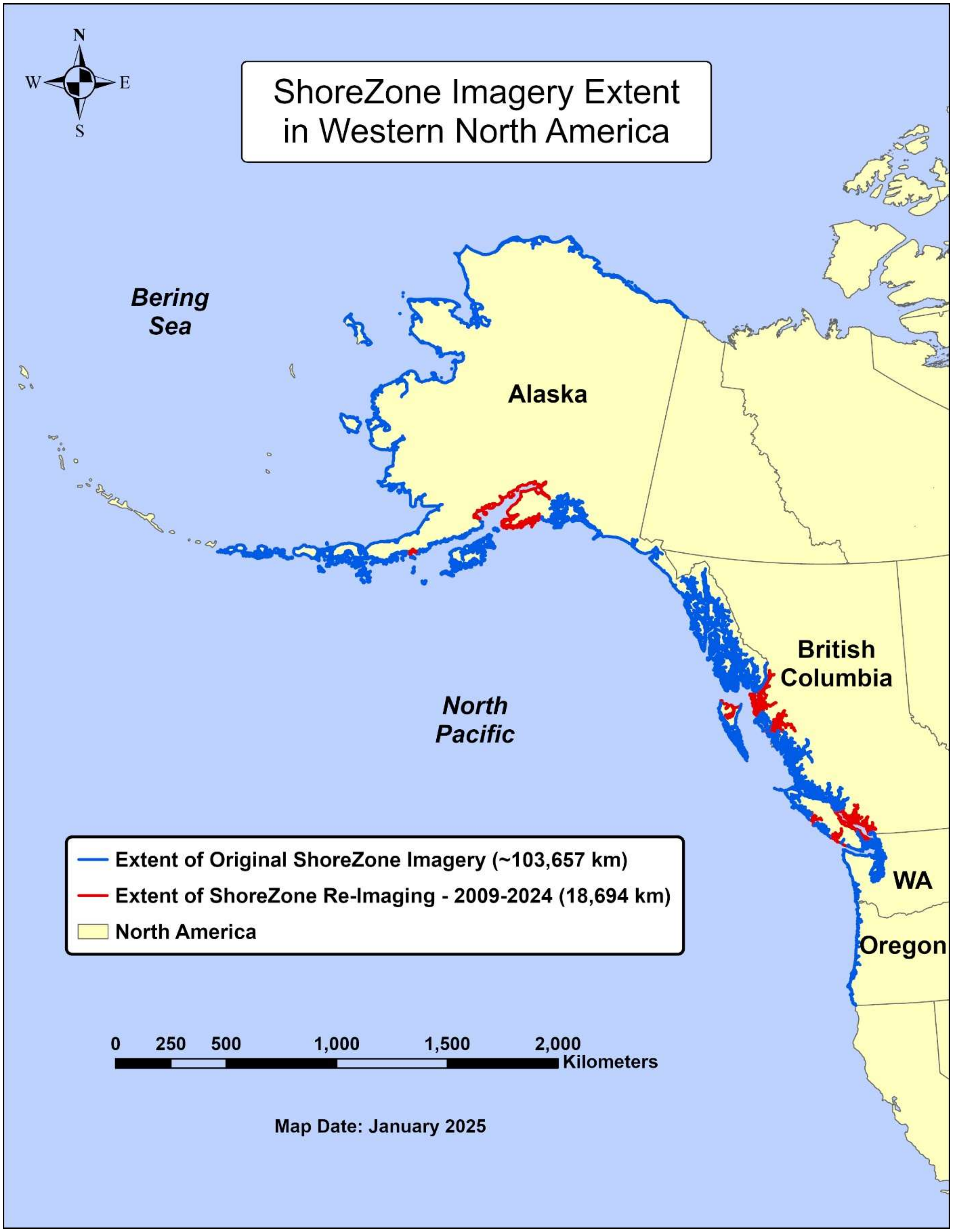

Figure 1. Extent of ShoreZone imagery and mapping in Western North America as of March 2025.

Figure 2. Extent of ShoreZone mapping for the Cape Breton survey area covered in this report.

2 Intertidal Polygon Data Summary

2.1 Methodology

ShoreZone habitat mapping uses low-altitude (100 m elevation), high resolution aerial imagery taken from helicopters to define relatively homogenous segments of shoreline, called ‘units’, based on the physical characteristics of the intertidal and supratidal zones. These units are delineated on the best available digital high-water line (HWL) which, in the case of the Cape Breton survey area, was the National_Hydro_Network shapefile. Each alongshore unit can also be divided into across-shore components where there is variation in the substrate and geomorphological forms from the top of the beach to the waterline. However, representing ShoreZone data as a one-dimensional line does not accurately display the complexity of the data that is collected. Representing the intertidal as a two-dimensional polygon is possible where there is both a digital HWL as well as a digital low water line (LWL).

Our method for creating polygons of the intertidal portion of each ShoreZone unit was to take the existing digital HWL with the existing unit segments and add the polygons to the digital HWL. We then used the ShoreZone imagery, in conjunction with the best available public satellite imagery, to define the shape of each intertidal polygon. The satellite imagery (which is orthorectified) was used as a guide to provide positional data for all boundaries but the ShoreZone imagery (which is not orthorectified) was used as the final guide as it was taken at low tide while the satellite imagery was often at mid-tide or higher.

We did encounter some challenges in the creation of the intertidal polygons, most of which centered around the accuracy of the high-water line. We made the decision to not edit the HWL unless we encountered what we considered to be an error which would significantly affect the overall size and shape of the final polygon. Figure 3 shows an example of area where the original National_Hydro_Network high water shapefile used for the linear mapping needed to be modified in order to accurately create intertidal polygons. The low water line did vary significantly from both the satellite imagery and the ShoreZone imagery along much of the coastline, so it was edited to better reflect reality.

These challenges mean that the quality of the intertidal polygons is variable from unit to unit; however, we feel confident that the general shape and size of the polygons are consistent with reality in the majority of units.

Small corrections were made to the original ShoreZone mapping attributes during the polygon creation process. These changes were noted in a small portion (<1%) of units and were made only where the polygon mapper noted a significant difference between the imagery and the existing ShoreZone mapping. The geodatabase that accompanies this report is now considered the most accurate ShoreZone data for the Cape Breton survey area and should be used to replace any previous geodatabase from that area.

Figure 3. Example of an area on Muggah Creek, Sydney, where the digital HWL was deemed to be significantly different from reality and needed to be re-digitized using the satellite and ShoreZone imagery.

2.2 Results

In total, SeaChange created **7,924** intertidal polygons at the component level. These polygons covered **1,141 ha** of the intertidal zone in the Cape Breton survey area. The final intertidal polygons add significant detail to the ShoreZone dataset and are part of the final geodatabase product for this area. These polygons represent the across-shore components and can therefore represent both unit level and component level attributes such as the Oil Residence Index (Figure 4) and the Primary Intertidal Form (Figure 5). All ShoreZone attributes are detailed in the current protocol (Cook *et al*. 2017).

Figure 4. Example of the ShoreZone Oil Resistance Index displayed as intertidal polygons in Aspy Bay.

Figure 5. Example of the ShoreZone Primary Intertidal Form displayed as intertidal polygons near Lingan Bay.

3 Sensitive Habitat Polygon Data Summary

3.1 Methodology

ShoreZone habitat mapping uses low-altitude (100 m elevation), high resolution aerial imagery taken from helicopters to classify the biological attributes in each ShoreZone unit. These attributes are called **biobands** and are defined by a typical tide height, colour and texture. For the purposes of this project, we proposed to map the biobands that we defined as 'sensitive habitats', meaning those that are productive ecosystems upon which many other species rely for food or shelter, and which may be adversely affected by pressures arising from human activities (including climate change, fisheries and development). The 3 biobands that fit these criteria and were present in the Cape Breton survey area were: **Dune Grass**, **Salt Marsh**, and **Eelgrass**. See Table 1 for the definitions of these biobands from the ShoreZone protocol and Figures 6 and 7 show photographic examples of these biobands.

Our method for creating polygons of the sensitive habitat biobands identified as part of the ShoreZone mapping of the Cape Breton survey area (SeaChange, 2025) was to take the existing high resolution ShoreZone imagery in conjunction with the best available public satellite imagery, to define the shape and position of each polygon. The satellite imagery (which is orthorectified) was used as a guide to provide positional data for all boundaries but the ShoreZone imagery (which is not orthorectified) was used as the final guide for shape and extent of the polygon. We attached the unique unit identifier(s) (PHY_IDENT) to each polygon and provided an estimate of the Density of the Indicator Species defined for each bioband within each polygon. Our Density categories were Sparse (S), Moderate (M), Dense (D), and Unknown (U) (used when the sensitive habitat was observed in the unit, but density could not be qualified). These are qualitative assessments based on classifier observations rather than quantitative assessments; however, these categories should still be useful for any calculation of biomass etc. We also added a qualitative measure of Confidence to each polygon to give the users of the data an idea of the overall accuracy of each polygon. Our Confidence categories were Low (L), Medium (M) and High (H).

Table 1. Definitions for the sensitive habitat biobands mapped as polygons in the Cape Breton survey area.

Bioband Name			Prior Code	Current Code	Zone	Typical Color	Indicator Species	Description	Biological Wave Exposure
Primary Level	Secondary Level	Tertiary Level							
Terrestrial Vegetation	Grasses	Dune Grass	GRA	**DUGR**	A	Pale blue-green	*Leymus mollis*	Found in the upper intertidal zone, tall grasses observed as clumps continuous on dunes, in logline or on beach berms. This band may be the only band present on high-energy beaches.	VP to E
Intertidal/ Subtidal Vegetation	Wetland Vegetation	Salt Marsh (BC & Washington State)	SAL	**SAMB**	A & upper B	Light, bright, or dusty green	*Sarcocornia pacifica*	Salt-tolerant herbs and grasses associated with freshwater. This band is often associated with estuaries, marshes, and lagoons although it is not uncommon as a fringing meadow in the supratidal. Used to describe a 'low marsh' in Washington State and generally lacking associated grass species in that classification. Specific to BC and Washington State.	SE to VP
Intertidal/ Subtidal Vegetation	Rooted Vegetation	Eelgrass	ZOS	**EELG**	B & C	Bright to dark green	*Zostera marina*	Commonly visible in estuaries, lagoons or channels, generally in areas with fine sediments. Eelgrass can occur in sparse patches or thick dense meadows.	VP to SP

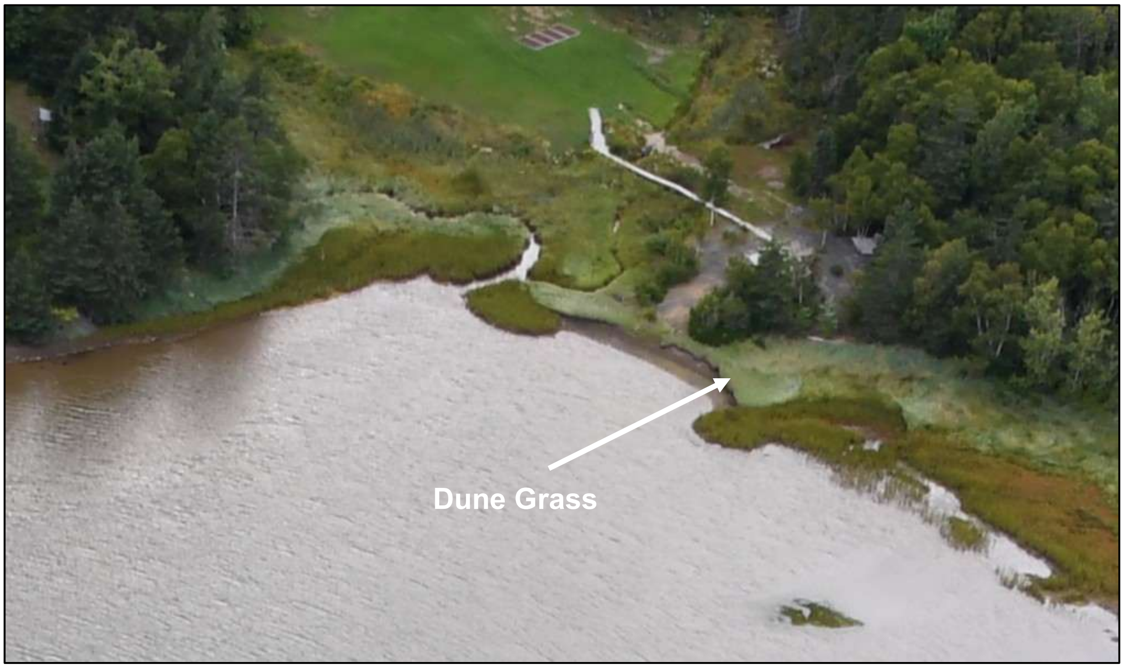

Photo ns22_sd_04414. Good example of the Dune Grass (DUGR) bioband. Little Bras d'Or Channel.
(Photo edited for emphasis and clarity)

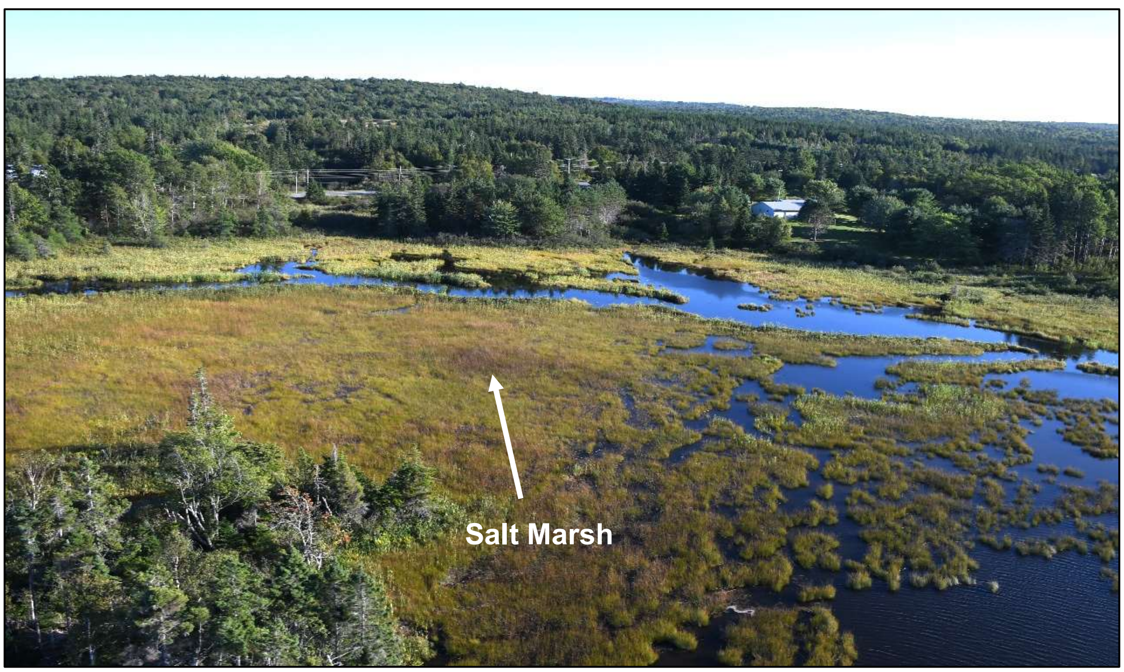

Photo ns22_sd_09662: Good example of Salt Marsh (SAMB) bioband in the supratidal/intertidal zone. East Bay, Bras d'Or Lake.
(Photo edited for emphasis and clarity)

Figure 6. Examples of the Dune Grass (top) and Salt Marsh (bottom) sensitive habitat biobands mapped as polygons in the Cape Breton survey area.

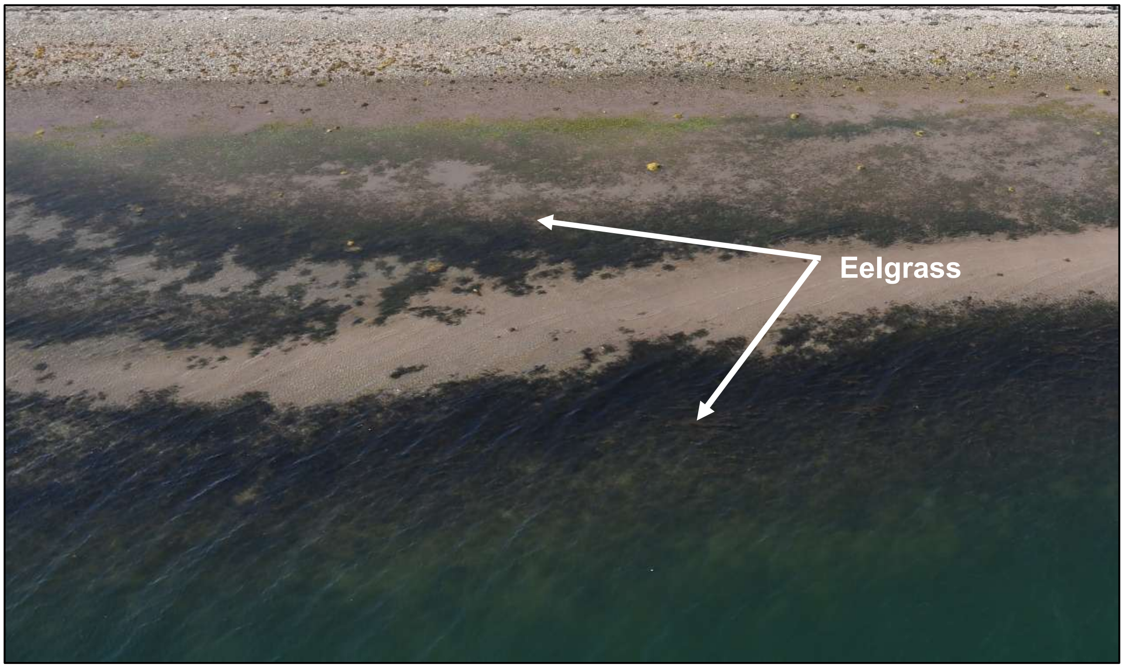

Photo ns22_sd_01504. Example of the Eelgrass (EELG) bioband in the subtidal. St. Ann's Harbour. (Photo edited for emphasis and clarity)

Figure 7. Example of the Eelgrass sensitive habitat bioband mapped as polygons in the Cape Breton survey area.

We did encounter a few challenges in the creation of the sensitive habitat polygons, some that centered around the varying resolution and quality of the ShoreZone imagery and the satellite imagery and how the two interacted. Overall, however, the satellite imagery in the Cape Breton survey area is high quality. Cloud cover and poor-quality satellite imagery can often be a challenge to see landmarks to allow for accurate location of any sensitive polygons but that was found to not be an issue in this survey area.

An example of how the satellite imagery caused challenges with polygon creation can be seen in Figure 8. Depending on how much the satellite imagery was zoomed in, a different shoreline was seen. This is likely due to two different dates of satellite imagery collected. When zoomed further out as on the top left photo, the satellite imagery matched our ShoreZone imagery (bottom photo). However, when zoomed more closely in (top right), the shoreline appeared different. This meant that the polygons in this area needed to be drawn when zoomed further out so may not be as accurately placed as is typical although still within our acceptable standards of error.

Figure 9 shows an example of a ShoreZone image of poorer quality due to the shading of the shoreline and the glare of the sun off the water. Weather conditions and the timing of the tide windows can cause challenging imaging conditions during any ShoreZone survey.

Figure 10 shows an example of a ShoreZone image where due to the angle of the helicopter flight path and the proximity of trees to the intertidal zone, the intertidal was difficult to view. This made it a challenge more specifically to observe if the Dune Grass and Salt Marsh sensitive habitats were present or absent as shown. Figure 11 shows an example of where both glare on the water and overhanging trees made it difficult to observe both the intertidal and subtidal in this area.

At times, it was a challenge to determine with confidence the depth and/or shape of the Eelgrass beds in the subtidal zone due to the beds extending beyond our imagery or the colouring of the water not allowing a clear visualization of them (Figure 12). To help guide our Eelgrass polygon shapes and sizes in the subtidal when we could not see the full extent either in our imagery or on the satellite imagery, we used a bathymetry layer (where available) and would extend the bed to a depth of approximately 5-10 metres.

Lastly, we encountered areas where biobands were overlapping each other. If it was possible, we created overlapping polygons that indicated where the separate biobands interacted; however, where it was not possible (areas where the imagery made it too time consuming or potentially inaccurate to separate the biobands) we created mixed polygons. These mixed polygons will need to be treated differently in any analyses of the data.

The challenges encountered in this project means that the quality of the sensitive habitat polygons is variable; however, we feel confident that the general shape and size of the polygons are consistent with reality in most cases. The more complex the coastline and the more complex the biology of the area, the more variable the polygons might be. The Confidence measure will be useful in allowing users to understand the accuracy of each polygon for analysis and management decisions.

Some corrections were made to the original ShoreZone mapping during the polygon creation process which changed the presence and/or abundance of biobands in some units. These changes were only made to a small portion (<1%) of units and were made only where the polygon mapper noticed a significant difference between the imagery and the existing ShoreZone mapping. This means the geodatabase that accompanies this report is now considered the most accurate ShoreZone data for the Cape Breton survey area and should be used to replace any existing geodatabase the user might have from that area.

Figure 8. Example of an area where the satellite imagery looked considerably different depending on the level of zoom used (above left is zoomed further out while above right is zoomed in) and in comparison, to the ShoreZone imagery (ns22_sd_00170, Little Pond).

Figure 9. Example of an area where the ShoreZone image (ns22_sd_00024, Spanish Bay) was of poorer quality due to the sun glare off the water.
(Photo edited for emphasis and clarity)

Figure 10. Example of an area where the ShoreZone image (ns22_sd_09596, East Bay, Bras d'Or Lake) where the trees cover most of the supratidal zone impeding observation of Salt Marsh and Dune Grass.
(Photo edited for emphasis and clarity)

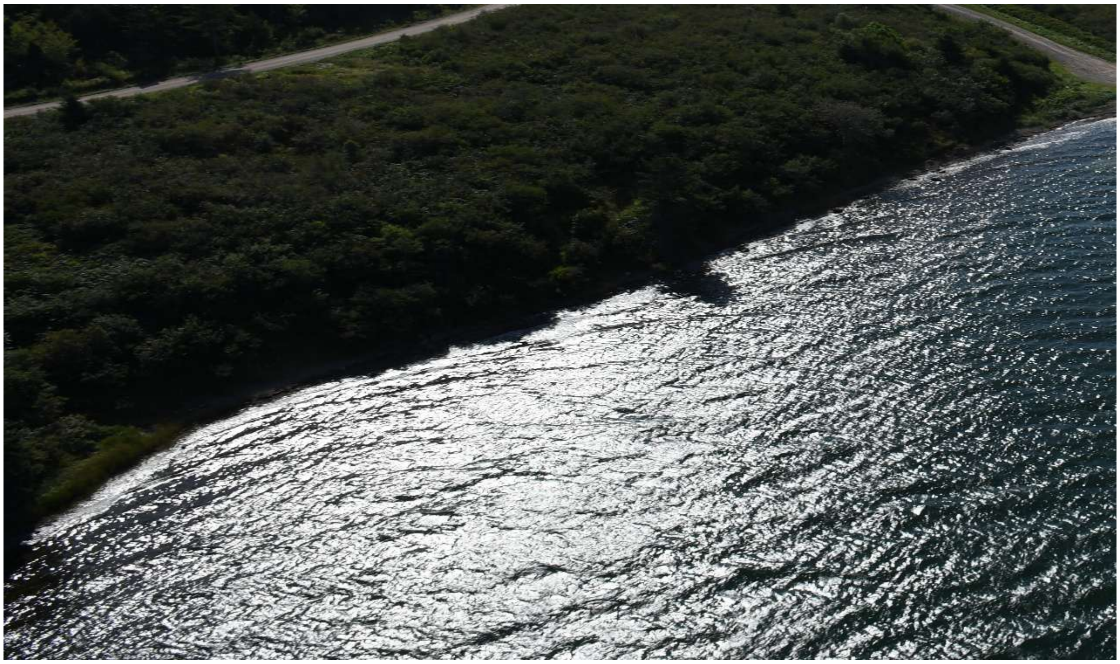

Figure 11. Example of an area where the ShoreZone image where both glare off the water and overhanging trees impede observation of the intertidal and subtidal zones (ns22_sd_11646, St. Peters Inlet)
(Photo edited for emphasis and clarity)

Figure 12. Example two areas where the subtidal limits of the Eelgrass bed could not be observed with certainty (top: ns23_sd_00583, Boularderie Island; bottom: ns22_sd_03344, Great Bras D'Or Channel)
(Photos edited for emphasis and clarity)

3.2 Results

In total, SeaChange **13,790** sensitive habitat polygons. These polygons covered **3,648 ha** of the supratidal, intertidal and subtidal zones of the Cape Breton survey area.

Each of the three biobands that the polygons represent are broken down in Table 2 by number and area of polygons of each type. Figures 13 and 14 exemplify the biobands mapped as part of this project. The final sensitive habitat polygons are part of the final geodatabase product for this area.

Table 2. Totals of sensitive habitat biobands mapped as polygons in the Cape Breton survey area.

Please note that the totals in this table will equal more than the overall total number or overall total area as there are mixed polygons that include multiple biobands.

Sensitive Habitat Bioband	Number of Polygons Created (including mixed polygons with multiple biobands)	Area of Polygons (ha) (including mixed polygons with multiple biobands)
Dune Grass	5,258	139
Salt Marsh	7,613	502
Eelgrass	2,262	3,078

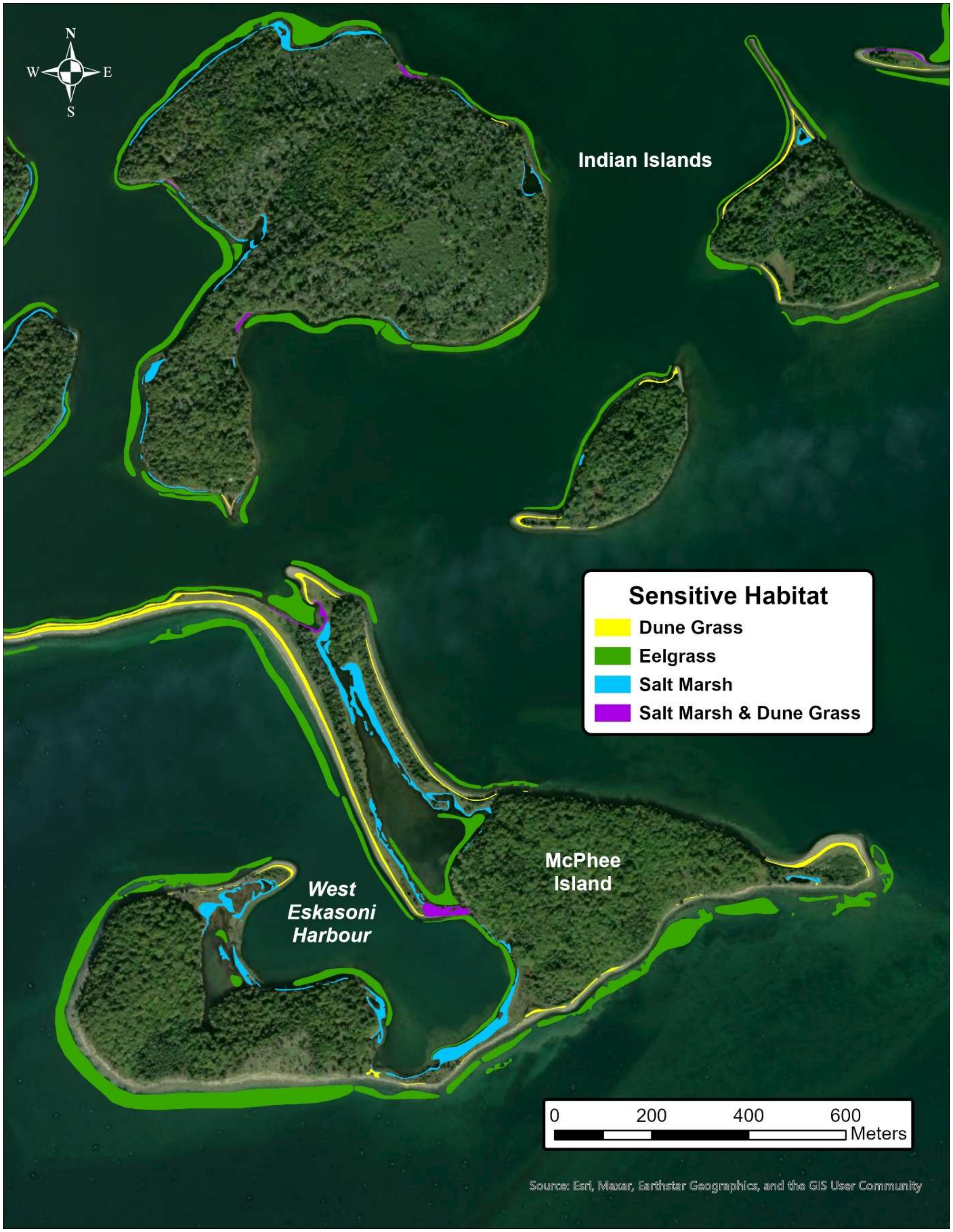

Figure 13. Example of the sensitive habitat polygons mapped around McPhee Island.

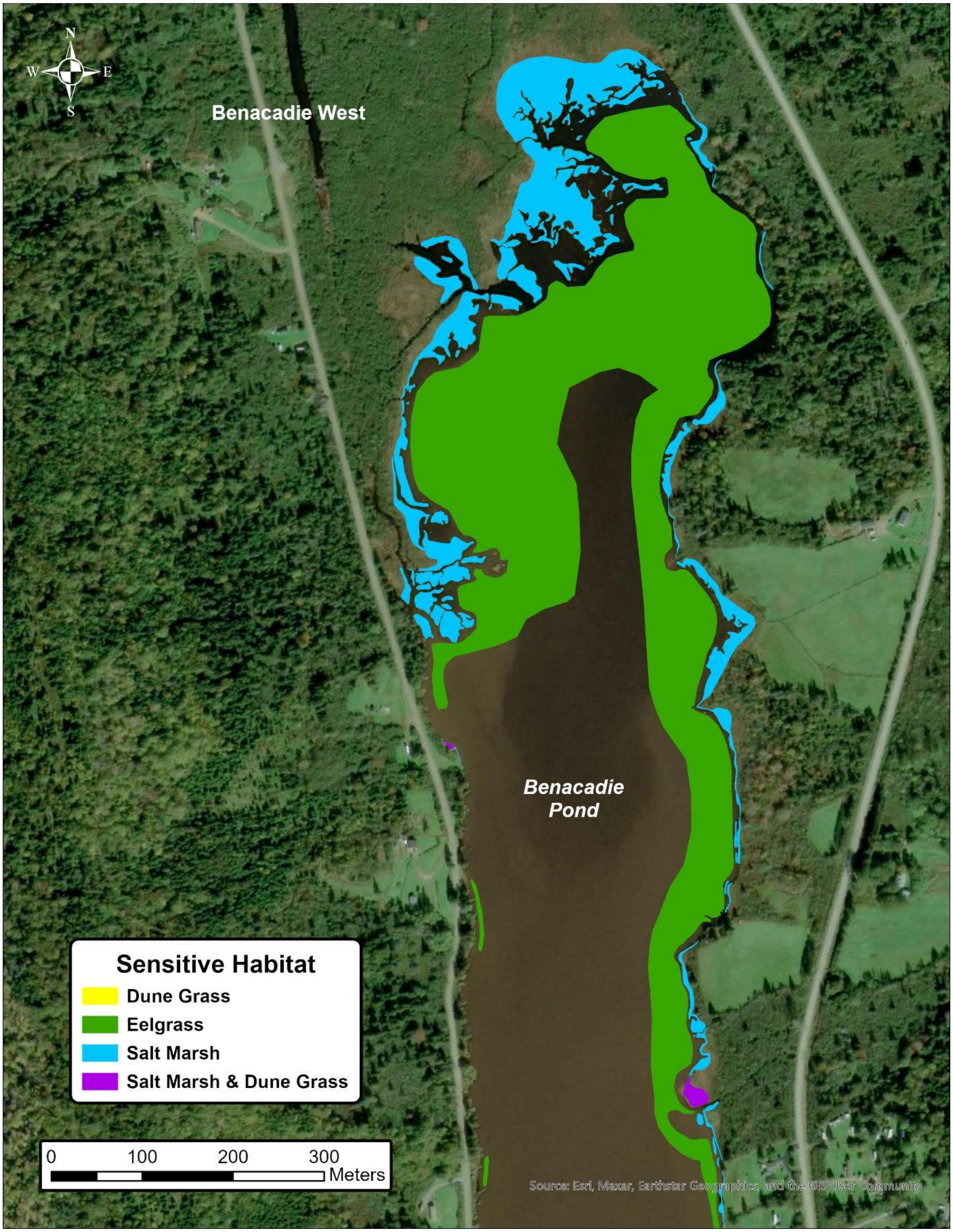

Figure 14. Example of the sensitive habitat polygons in Benacadie Pond.

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Protocols for data access and distribution are established by the program partner agencies. Please see www.ShoreZone.org for a list of partner agencies and related web sites. Imagery, reports, geodatabases and shapefiles for the ShoreZone dataset can be downloaded online at www.ShoreZone.org or through the links on that site.

Any hardcopies or published data sets utilizing ShoreZone products should clearly indicate their source. For questions regarding the protocols or information in this report, please contact SeaChange Marine Conservation Society at connect@seachangesociety.com.