Common Reed

(Phragmites australis)

&

Coastal Environments

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INTRODUCTION

PHRAGMITES & COASTAL ENVIRONMENTS

Phragmites australis, (Frag-MY-teez aus-TRA-lis) also known as Common Reed, or just simply *Phragmites*, is an invasive exotic species with origins in Europe and Asia. Thought to have first arrived in Canada through various means during the early 1800's, it has since invaded wetland habitats across eastern North America. The species was first observed in the wetlands and ditches across the St. Clair region in the late 1970's. The species is now well-established in coastal wetlands throughout the Lake Erie and Lake Huron corridor and is beginning to take root along the shores of Lake Superior. It is also present along the coastal wetlands of Lake Ontario and appears like patchwork all the way down the St. Lawrence River (*pers. comm.* Gilbert, 2012 & Lelong *et al*., 2007). In 2005, researchers at Agriculture and Agri-food Canada identified *Phragmites* as Canada's "worst" invasive plant species (Catling, 2005).

The name *Phragmites* is derived from the Greek word *phragma*, meaning fence, hedge or screen – which is a very appropriate name for~~to give to~~ this aggressive invasive species because it can grow up to five metres tall and send its roots and rhizomes even deeper into the soils. The above ground height and biomass will block sunlight while the roots and rhizomes trap water and nutrients. *Phragmites* is also an allelopathic plant that secretes toxins from its roots into the soil. These toxins destroy the structural proteins in neighbouring plants within minutes of exposure and eventually cause death. Rhizomes and roots will expand vertically and horizontally into surrounding soils and shoots become taller and more numerous each year (OMNR, 2011).

Native species have little chance against this expanding "fence" of *Phragmites*. Without sunlight, nutrients and water they cannot photosynthesize, grow and reproduce, or contend with the poisonous secretions present in the soils. Invasive *Phragmites* can thus easily out-compete neighbouring plant species and expand into a dense mono-culture stand.

Dense mono-culture stands of invasive *Phragmites* severely alter ecosystem function. Native ecosystems provide a diversity of vegetation layers and densities which appeal to a variety of species that use the habitat for breeding, nursing, foraging, and simply living. Diverse ecosystems are often overflowing with wildlife utilizing both interior and edge habitat. *Phragmites* stands do not provide such diverse functionality. Some wildlife has been observed using the edge of *Phragmites* stands including Least Bittern (*Ixobrychus exillis*), a Species at Risk in Ontario, as well as Red-winged Blackbirds (*Agelaius phoeniceus*) and Marsh Wrens (*Cistothorus palustris*), and some frogs, fish and aquatic invertebrates. It is the interior area of a well-established *Phragmites* stand where wildlife observations are rare. In situations where this invasive species has expanded across large distances, leading wetland ecologists are describing the interior area as "ecological dead zones."

Phragmites has the ability to alter hydrological cycles. Within interior wetlands *Phragmites* can transpire water at a faster rate than native vegetation and this can cause water levels to drop. In coastal areas its roots can interfere with groundwater flow. When it establishes at the mouths of rivers, streams, culverts and drain pipes it can impede stormwater flow. The thick inflexible stalks take longer to decompose than

native vegetation which slows normal nutrient cycling and traps biomass in standing dead stalks; plus these dead stalks become significant fire hazards (OMNR, 2011). *Phragmites* stands left to accumulate dead biomass year after year can potentially catch on fire and begin burning out of control. Standing *Phragmites* can pose significant threats to nearby cottages and homes, or even agricultural crops that may be growing nearby.

The cumulative impacts of *Phragmites* across the Great Lakes are a serious threat to Species at Risk. Seventy-five percent of Great Lakes coastal wetlands have already been lost to draining or dredging for development or agriculture and dune ecosystems are provincially rare (Peach, 2012). The resulting loss of habitat has caused a number of species to be listed as endangered or threatened in Ontario and/or Canada. Examples include the Dwarf Lake Iris (*Iris lacustris*), Spotted Turtle (*Clemmys guttata*), and Eastern Ribbonsnake (*Thamnophis sauritus*) as well as the Pitcher's Thistle (Cirsium pitcher) which has become isolated to a few small populations where *Phragmites* has been positively identified. These Species at Risk depend on the diminishing habitat that remains; but as this habitat becomes further degraded by the invasion of *Phragmites*, the dwindling populations of many rare species may collapse in Canada forever.

NATIVE *PHRAGMITES*

To complicate the matter even further, there is a native strand of Common Reed in Canada whose Latin name is *Phragmites australis subspp*. a*mericanus.* As the invasive strand expands it is also out-competing and displacing the native *Phragmites* which could possibly result in the native species being listed as a Species at Risk in Canada. Native *Phragmites* does not grow as tall as the invasive and will not out-compete other native vegetation. It is quite difficult to tell the two apart. Colour can help; the invasive strand is often beige or tan with blue-green leaves and dense seed heads, while the native is more often reddish-brown, with yellow-green leaves and sparser seed heads. But there have been many instances where the invasive strand appears like the native, especially along coastal shorelines and deep water systems (OMNR, 2011), such as those occurring along the shores of Lake Huron.

CLIMATE CHANGE AND *PHRAGMITES*

Low water levels are projected throughout the Great Lakes (AMEC, 2006). Low water levels could leave vast open spaces along the coast where *Phragmites* can establish. Extreme weather events are predicted to increase and the effects of high energy waves, winds and storm surges can damage coastal areas. Degraded ecosystems are less able to withstand the effects of these extreme events; *Phragmites* interrupting the sand cycle of a healthy dune leaves it little ability to form a sand bar for protection, or *Phragmites* blocking the ability of coastal wetlands to migrate lake-ward; eventually the expanding woody vegetation changes the ecosystem type completely. As climate change continues to impact and change weather patterns it is quite likely the impacts of *Phragmites* on coastal ecosystems will be magnified.

PHRAGMITES AND LAKE HURON

The Lake Huron coast is a stunning oasis of wetlands, sand and cobble beaches, marshes, and bluffs. The shoreline provides views of some of Canada's prettiest sunsets as it crosses through three eco-regions; Carolinian in the south, the Boreal forest in the north and the Great-Lakes St. Lawrence in-between. Each region is characterized by a large range of biodiversity. Rare vegetation communities, Federal and Provincial Parks, Areas of Natural and Scientific Interest (ANSIs), and Environmentally Significant Areas (ESAs) are scattered along the coast. These ecological gems are surrounded by urban communities and agriculture, bisected by roads and trails, and they are becoming heavily impacted by invasive exotic species, of which invasive *Phragmites* is causing the greatest concern.

Coastal systems are dynamic in nature and they have evolved the ability to respond to the changing conditions around them. But just like any disturbance there is often a threshold that cannot be crossed, otherwise the system is unable to absorb the impacts and readjust as necessary. Invasive *Phragmites* is a serious threat to coastal systems because the dense mono-culture stands severely disrupt natural coastal processes.

Beach-Dune Ecosystems

Phragmites invading provincially rare beach-dune ecosystems can not only reduce local biodiversity it can alter dune ecology. *Phragmites* will invade dune ecosystems by first establishing in the wet swales that occur between the lake and the dunes during low water levels. It will quickly expand along this wet swale and increase in height and density until it appears like the fence it is named for. This "fence" of *Phragmites* will interfere with the natural sand cycle that occurs between offshore sand bars and beaches. Sand is continually being eroded and deposited on shore by waves; during storms sand is taken off shore to form a sand bar. The sand bar acts as a temporary berm to protect the shore from further erosion. After the storm gentle waves will slowly bring the sand back to the beach where it will be carried by wind into the foredunes allowing them to build in height and store the sand until high water levels return. Dunes depend on this beach sand for their formation, particularly during low water levels (occurring right now across the Great Lakes), and beaches need the sand reserves held in the dunes during high lake levels and storm events (Peach, 2011). The "fence" of Phragmites will interrupt this process by blocking the inland movement of fine sand particles that deposit on the beach in front of the "fence". Some native dune species depend on sand burial as part of their ecology and will not survive if this process is altered. Much of the research on Lake Huron has confirmed that alterations to the sand cycle slowly lead to a shallow depth to the water table which in turn promotes a wet or damp beach (Peach, 2011). Wet beaches give *Phragmites* additional advantage over native dune species that prefer dryer conditions. A wet beach can attract geese and seagulls whose bodily wastes can be high in bacteria and other pathogens. If the groundwater has become contaminated by nearby sources such as leaky septic tanks it can contaminate the sandy beach. Contaminated beaches can harbour foul smells and cause extensive algae blooms.

Phragmites can also cause economic impacts. The tall and dense mono-culture stands obstruct views of the lake and block access to the shore. People using the coast for recreational activities such as angling and

hunting, kayaking or canoeing will not be able to access the shore at all. Beach goers and tourists can be deterred from wet contaminated beaches. The effects of *Phragmites* on beach-dune ecosystems can thus ripple through coastal communities and impact far more than the local wildlife.

Cobble Beaches

The story is similar for cobble beaches. *Phragmites* establishes in the wet crevices that occur between the large cobble stones. It can also establish in the wet depressions that form along the shore and have similar effects to the movement of groundwater. Dune-ecosystems are provincially rare; cobble beaches are considered *globally* rare. Species that survive in cobble beach systems can potentially become extinct if these areas are not protected and maintained. Midges, stoneflies and mayflies live in the crevices of cobble beaches. Migrating warblers and other songbirds feed on these invertebrates for high energy meals during migration (Peach, 2011). Many reptiles and amphibians use cobble beaches for basking and foraging. Tall *Phragmites* block warm UV rays from the sun and because of the thick duff layer that often accumulates, foraging for tiny insects becomes increasingly difficult. Many of the reptiles that live in Ontario are listed as either nationally or provincially endangered. If the stands of Phragmites identified within rare cobble beach areas are left uncontrolled and unmanaged, it will expand and continue to reduce the available habitat and put these species at a higher risk for extinction.

Coastal Wetlands

Coastal wetlands are different than interior wetlands because they are heavily influenced by fluctuating lake levels. Low water levels expose seed-rich lake bottoms and allow emergent, non-woody and woody plants to expand their distributions; especially in areas with gradually sloping shorelines. This periodic regeneration of shoreline vegetation is an essential component of coastal wetland ecology. *Phragmites* can aggressively establish across the exposed lake bottoms during low water years. Its aggressive and competitive characteristics will severely impede the natural expansion of native vegetation. High water years will kill woody vegetation that established during low water years, which is an important factor in maintaining open conditions. High water may have the potential to drown some Phragmites stands that occur near the shoreline, but the last high water level recorded for Lake Huron was in 1997 which was followed by a drought that lasted from 1998 to 2002. Lake levels have remained below average since and have provided ample opportunity for *Phragmites* to expand across some of the rarest and ecologically diverse coastal systems on Lake Huron (Peach, 2011).

Controlling Phragmites in Coastal Ecosystems

Much of the current knowledge for controlling *Phragmites* comes from pilot projects completed for interior wetland ecosystems. The Invasive Phragmites – Best Management Practices (BMPs) written by the Ontario Ministry of Natural Resources (OMNR) in 2011 were an attempt to amalgamate the existing knowledge and highlight the most effective control techniques. The BMPs suggest a combination of herbicide, rolling and burning is the most effective method for control, but implementing these control methods in coastal environments is rather different than for interior wetlands.

The Coastal Centre has participated in pilot programs looking at the efficacy of black plastic, herbicide injection, and cutting and mowing at various locations along the shore. Herbicide injection turned out to be the only method that seemed more effective in a dune system versus interior wetlands because the rhizomes could be reached and directly injected (*pers. comm*., Gilbert, 2012) Black plastic was inefficient along shorelines because the high winds off the lake made it hard to keep the plastic in place. Cutting and mowing coastal areas is complicated and challenging. The presence of boulders, cobbles and wet pockets are difficult to maneuver around, plus the range of slopes and the presence of native, rare vegetation can delay manual efforts. The township of Huron-Kinloss recently had good results with herbicide application along the entire 16km shoreline of beach-dune ecosystems using all-terrain vehicles and is planning to follow up with pack-back applications in the near future. But this kind of control is not easily transferable to coastal wetlands or bluff areas; mostly because of the Pesticide Act regulating overwater applications, but also because current methods involve transporting Argos and other equipment throughout the highly unpredictable conditions.

After years of pilot studies it became apparent that controlling *Phragmites* in coastal environments may require a unique approach. Since coastal ecosystems are essentially all connected to each other, *Phragmites* growing in one location, interrupting coastal processes that occur there, could potentially be causing habitat degradation in a nearby location. Little research exists to support this theory because a regional lake wide perspective of an invasion has never been produced. In order to gain an understanding of how to best control *Phragmites* in coastal ecosystems the present extent of *Phragmites* along the entire coastline is required.

The Centre has already coordinated two mapping projects, but both were isolated to small portions of the shore. In 2007 *Phragmites* was mapped along the coast from Point Clark to Southampton (Bickerton, 2007) and in 2011, 16 sand beaches were visited on Manitoulin Island of which 12 were infested with *Phragmites* (Jones, 2011). Although *Phragmites* had been positively identified in a number of locations during these mapping exercises, a complete understanding of the spatial extent of the invasion along the entire southeast coast had yet to be produced.

Purpose

1. Document *Phragmites* occurrences along the southeast shores of Lake Huron from Tobermory to Sarnia and portions of Georgian Bay to gain a more complete understanding of the state of infestation.
2. Observe hydrological and physical elements to help better understand why infestations occur where they do in a beach environment
3. Recommend priority areas for control programs that will help municipalities and community groups target key areas for control

METHODOLOGY

PHRAGMITES OCCURRENCES ALONG THE LAKE HURON COAST

Field Maps

Field maps were created using ArcEditor 9.3.1 Education Trial Version. Mr. SID 2006 imagery for Lambton County, Huron County, and Bruce County were obtained from the GIS staff at each Municipality. An Ontario Geospatial Database Exchange (OGDE) restricted access membership was obtained through the Ontario Ministry of Natural Resources (OMNR). Ontario Road Network information was downloaded and estimated routes were labeled on the map. Public Access points were obtained through the Parks and Recreation Departments for each low-tier Municipality; sometimes communicated by phone, sometimes by PDF maps or emails.

Field Work

Field work began in late October and continued through November. The exact days that were spent in each Municipality are listed in Table 1. Inverhuron Provincial Park was originally left out, but was eventually surveyed in January 2012. MacGregor Point Provincial Park staff provided best estimates of the current extent of *Phragmites* along the shoreline within the park.

TABLE 1: FIELD DAYS ARE PROVIDED BY DATE AND LOCATION

Shoreline Surveyed	Dates (2011)
Goderich	October 28
Ashfield-Colbourne-Wawanosh	October 28, October 31, November 1
Huron Kinloss	November 1
South Bruce Peninsula ****(guided by Municipal Staff)**	November 2
Kincardine	November 4, November 7
Saugeen Shores	November 8
North Bruce Peninsula ****(general advice provided by Municipal Staff)**	November 14, November 15
Central Huron	November 18
Bluewater	November 18, November 21
South Huron	November 21
Lambton Shores	November 21
Municipality of Sarnia	November 22
Plympton Wyoming	November 22, November 23, November 24
Inverhuron Provincial Park	January 5, 2012

The shoreline was reached by car and accessed most often by way of public access points. There were several occasions where access to the shore was obtained through permission from the private landowner. The shoreline was walked and binoculars were used to scan the beach. Every attempt was made to ensure the shoreline was completely covered but in many instances access was denied and the linear views from binoculars were often interrupted by the undulating shore.

When *Phragmites* was identified the coordinates were recorded using a Garmin eTrex Legend H. Photographs were taken of the stand and the general direction of the picture was recorded. Height measurements were obtained using a metre stick (x=3). Seed size was estimated using a qualitative scale of small, medium, large. Small inflorescences were tiny, scraggly and short. Medium inflorescences were longer, somewhat robust. Large inflorescences were completely robust, long and thick, and could be deeply pigmented. Density of the stand was assessed using a qualitative scale of 0 – 10. Ratings were given to the stand based on the proximity of shoots, thickness of any developing mat, and the presence of other species. Density of 0-3 indicates a sparse and thin stand that is easy to walk through because it is spread across the area and intermingled with native species. Density of 4-6 indicates the stand is thick enough to be difficult to walk through, it has begun to develop a mat, but some native species are still present. Density of 7-10 indicates the stand is too thick to walk through, the mat is thick, and there are no native species present. The size of the patch was estimated using paces and a metre stick and recorded in square meters.

Rough Data

Some places were inaccessible and exact waypoints were impossible to obtain; such as high up on the bluff or at the shoreline on the other side of a wet marsh or wetland. Sometimes the *Phragmites* would occur for kilometres along the shore and it would be senseless to walk the distance when the continuous stand could be surveyed by car. These stands were recorded as "General Observations" (G#) and were drawn on the field maps without obtaining heights, or seed sizes. When density could still be reasonably assessed a density would be assigned. Sometimes these long occurring stands would have breaks, or areas of lower densities, but the entire area would still require a control plan and thus was considered one continuous invasion and any assigned density would apply for the entire polygon. In many instances density could not be accurately determined. These polygons were given "unrecorded" densities.

Phragmites *Occurring in Roadside Ditches*

Several disturbances favour the development of large *Phragmites* colonies in roadside ditches (de-icing salt, ditch digging and agricultural inputs). These stands ~~stands that develop within roadside ditches~~ can be important vectors of dispersal for this species (Jodoin *et al.,* 2008, Brisson *et al.,* 2010). *Phragmites* occurring in roadside ditches and passed by car were marked on field maps with an "x" for the majority of the study area and later digitized as estimated polygons. In North Bruce *Phragmites* occurring in the ditches were given a more thorough assessment because only one major highway exists (Highway 6) and runs in a north-south orientation. Densities were expected to be higher in mature stands and a pattern of decreasing density would provide good evidence that the highway has acted as a corridor for dispersal in this remote area.

Municipal staff assisted with the identification of *Phragmites* throughout the Town of South Bruce Peninsula. Much of the occurring stands were in the ditches and because the car was stopped at each location a more thorough assessment of each stand was obtained.

Friends of the Penetangore Watershed Group in Kincardine provided additional waypoints for any *Phragmites* occurring in roadside ditches within the Penetangore Watershed.

Digital Mapping

Digital maps were created using the same ArcEditor 9.3.1 program. JPEGs and PDFs were exported for each map that was made. Additional layers were downloaded from the OGDE. Regional maps depict the extent of the infestation from Tobermory to Sarnia, and Municipal maps use a smaller scale so that individual waypoints could be labeled, and then matched to the photographs in the appendix.

Polygons were created using size estimates and photographs. Where the area calculated by the program was different than the area estimated in the field the calculated area was assumed to be a more accurate approximation. This survey was not tasked with obtaining an exact area measurement of the *Phragmites* stands occurring along the shore. The task was to gain an understanding of the scope of the problem. Nonetheless, the area measurements obtained from this mapping survey provide a useful approximation that can still be used to draft budgets for control measures.

Density estimates were used to categorize the polygons by colour to provide a visual illustration of density changes along the coast.

PATTERNS OF INFESTATION

In attempt to observe any apparent pattern in *Phragmites* infestations in the beach environment general locations of the identified stands were recorded. When field work was complete each *Phragmites* stand was placed in one of eight categories (Table 2). Tallies were completed to identify any patterns of occurrence along the beach environment.

TABLE 2: DESCRIBES THE CATEGORIES USED TO TALLY THE LOCATIONS WHERE *PHRAGMITES AUSTRALIS* APPEARED IN A BEACH ENVIRONMENT

Location	Description
Top of bluff	Stand is growing at top edge of the bluff
Bottom of bluff	Stand is growing at the bottom of the bluff where the bluff vegetation is met with dune vegetation or sand
Bluff	Stand is growing in the middle of the bluff; with or without native vegetation
Beach/Shoreline	Stand is growing across the sandy beach. Usually occurring within an obvious wet swale that develops between the water and the dunes.
Gully	Stand occurs at the bottom of a gully
Pipe	Stand occurs at the mouth of a black pipe
Stream/River/Pond	Stand occurs at the mouth of a stream or a large river; or occurring around a pond
Culvert	Stand occurs at the mouth of a culvert, or downstream of a culvert

Once the regional map was prepared it was reviewed with Centre Staff. The general pattern of infestation was described and the lake wide coastal processes likely influencing this pattern were identified.

IDENTIFYING PRIORITY AREAS & RECOMMENDATIONS FOR CONTROL

Areas of Natural and Scientific Interest (ANSIs) are areas of land and water that represent significant geological and biological features ~~(MNR, 2012)~~. Life science ANSIs are areas that contain examples of the natural landscapes and wildlife that occur across Ontario. Earth science ANSIs represent landscape features that have formed over billions of years and contain rare rocks and fossils. ANSI designation indicates the area is highly valued for its natural resources and should be given high priority for conservation and protection. Conservation Authorities (CAs) manage their properties mainly for the protection of the natural resources that occur there. Many of these properties are also valued for recreation and education activities and serve as isolated natural retreats for urban communities. These areas are especially important to protect from invading *Phragmites*.

Shapefiles depicting ANSIs and CAs were downloaded from the OGDE database. The CA layer was incomplete for the shoreline and did not show the CAs in the southern watersheds. These shapefiles were obtained from the individual Conservation Authorities.

Using the regional map the stands of *Phragmites* occurring in close proximity to these natural areas were identified. The closer the invasion was to these areas, the higher the priority for control.

Coastal processes identified as potential factors driving the pattern of infestation were used to further guide recommendations for the management of invasive *Phragmites* in a coastal environment.

RESULTS

REGIONAL RESULTS

MAPS

Phragmites was identified along the shoreline in each of the three Counties of Lambton, Huron and Bruce. The regional map shows the extent of *Phragmites* along the shore and in the roadside ditches (Figure 1). Figure 2 illustrates the changing densities that occur within *Phragmites* stands along the coast.

The map does not include the stands identified by Jones, 2011 on Manitoulin Island, or by Bickerton in 2007. *Phragmites* was also noted to be occurring on Cave Island (*pers. comm*., Harpur, 2010) and this is not included on these maps. Plus the invasive species is undoubtedly present throughout the interior wetlands and ditches of all three counties; but this survey focused on the shoreline and only captured stands occurring in ditches along the roads used throughout the field work.

FIGURE 1: OCCURRENCES OF *PHRAGMITES* ALONG THE SOUTH-EASTERN SHORES OF LAKE HURON

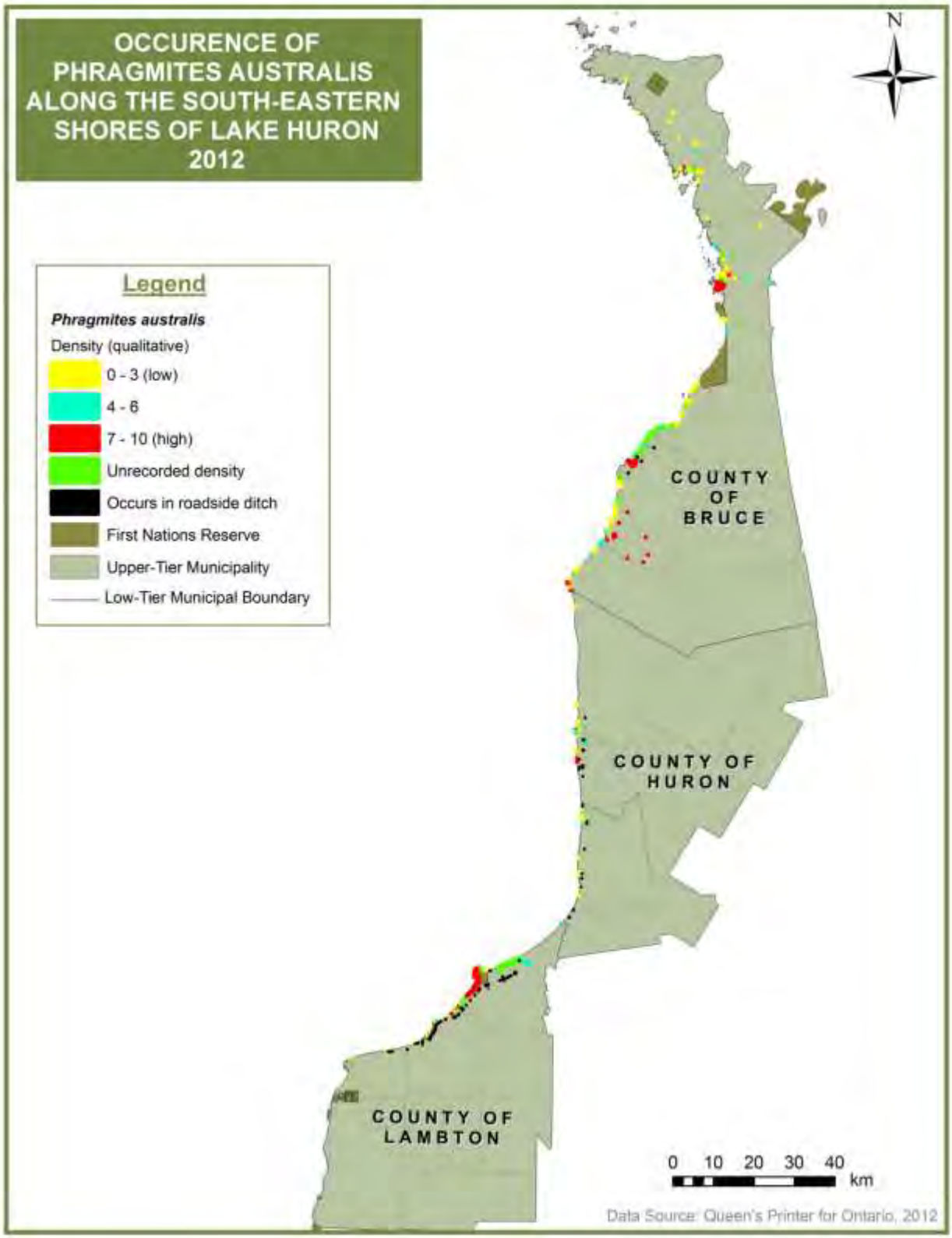


FIGURE 2: OCCURRENCES AND QUALITATIVE DENSITIES OF *PHRAGMITES* ALONG THE SOUTH-EASTERN SHORES OF LAKE HURON

COASTAL PROCESSES AND PATTERNS OF INFESTATION

Of the 276 *Phragmites* stands identified, 275 were separated into 8 categories depending on their location in the coastal zone (Table 3). One stand did not fit into any category because it was growing within the compound at the Goderich Water Treatment Plant.

TABLE 3: *PHRAGMITES* OCCURRENCES CATEGORIZED BY LOCATION

Location	Number of Occurrences
Top of bluff	3
Bottom of bluff	17
Bluff	12
Beach/Shoreline	141
Gully	3
Pipe	6
Stream/River/Pond	20
Culvert	6
Total	275

Figure 1 and 2 illustrate *Phragmites* is concentrated in three large pockets along the coast and that the highest density stands are often grouped in the same area. The shoreline ecosystems within these areas are a mix of coastal wetlands and beach-dune systems (Figure 3), which are shown in Table 3 as most often affected by *Phragmites.* This pattern of infestation can be explained through a careful analysis of all the processes involved in shaping the coast and their individual influences on the success of *Phragmites*.

Low lake levels have increased the width of coastal areas and allowed for *Phragmites* to establish along the shores. Prevailing winds and shoreline orientations, littoral cell boundaries, and the ability of the native ecosystem to compete with its aggressive invasive characteristics then combine to create the regional pattern of infestation displayed in Figure 1 and 2. Each process has a unique and varying effect because each process operates within a range of variables such as speed, diversity, age, human interference, and climate. It is impossible to identify which influences the pattern the most, or the least, it is only possible to identify the fact that they do contribute to the spread and density of *Phragmites* in coastal environments and by considering these effects the need for regional management of this infestation is increasingly vital to the health and integrity of Lake Huron's coastal ecosystems.

Lake Level Fluctuations

Water levels in the Great Lakes follow a cyclical pattern over time which implies that the recent low lake levels will eventually cycle back to higher water levels. Climate change scenarios suggest low water levels will remain, and possibly drop even further (AMEC, 2006; *pers. comm.* Geoff Peach, 2012). Where *Phragmites* is currently covering huge continuous areas the nearshore gradient is extremely low (Figure 2).

As water levels drop larger areas of the lake bed are exposed because a 1 m drop in water level can translate to hundreds of meters of added space. The dense, established stands can thus easily expand into these areas. Climate change and water levels will likely be the most influential factor in the expansion and establishment of *Phragmites* in coastal environments.

Prevailing Winds

Phragmites infestations along the coast are clustered along the portion of the shores that run perpendicular to the prevailing winds of Lake Huron which are from the west and northwest (Figure 3). The prevailing winds could be keeping the dispersal of seeds and rhizomes within close proximity to each other, or carrying seeds along the coast in a south-eastern direction where they would presumably land on structures that intersect the driving winds, such as points, or lag deposits. This could be tested with genetic analysis. Winds also drive wave energy and can create unstable and unfavourable conditions for *Phragmites* in areas of the coast that are not protected by the underlying geology of the lake. *Phragmites* seem to cluster where irregular shorelines with excessive headland-bay patterns occur. The effects of high winds on the coast demonstrate a visual correlation between the pattern of infestation and the locations that offer increased protection from prevailing winds (Figure 3).

Littoral Cells

Littoral cells are defined sections of the coast where no input or output of sediments takes place. They are self-contained coastal systems that can be managed independently of each other. Sand, and presumably seeds, roots and rhizomes of *Phragmites*, will not be transported from one cell to another. From Sarnia to McRae Point exists four separate littoral cells (Figure 3) and north of McRae Point is considered a no-drift zone where the extensive undulations of the shoreline prevent the transfer of sediments by alongshore currents. The correlation between severity of infestation and cell boundaries is quite high suggesting that once *Phragmites* establishes within the boundaries of a littoral cell, any transport of seeds and rhizomes occurring in the nearshore drift may be multiplying the infestation within each individual cell (F.J. Reinders and Associates, 1989).

- *It is worth noting that the extensive pier structure at Goderich, constructed to reduce dredging requirements in the Maitland River, has resulted in the division of an old littoral cell that once occurred from Point Clark to Grand Bend (an excellent example of how alterations in coastal systems can degrade the function of lake-wide processes).*

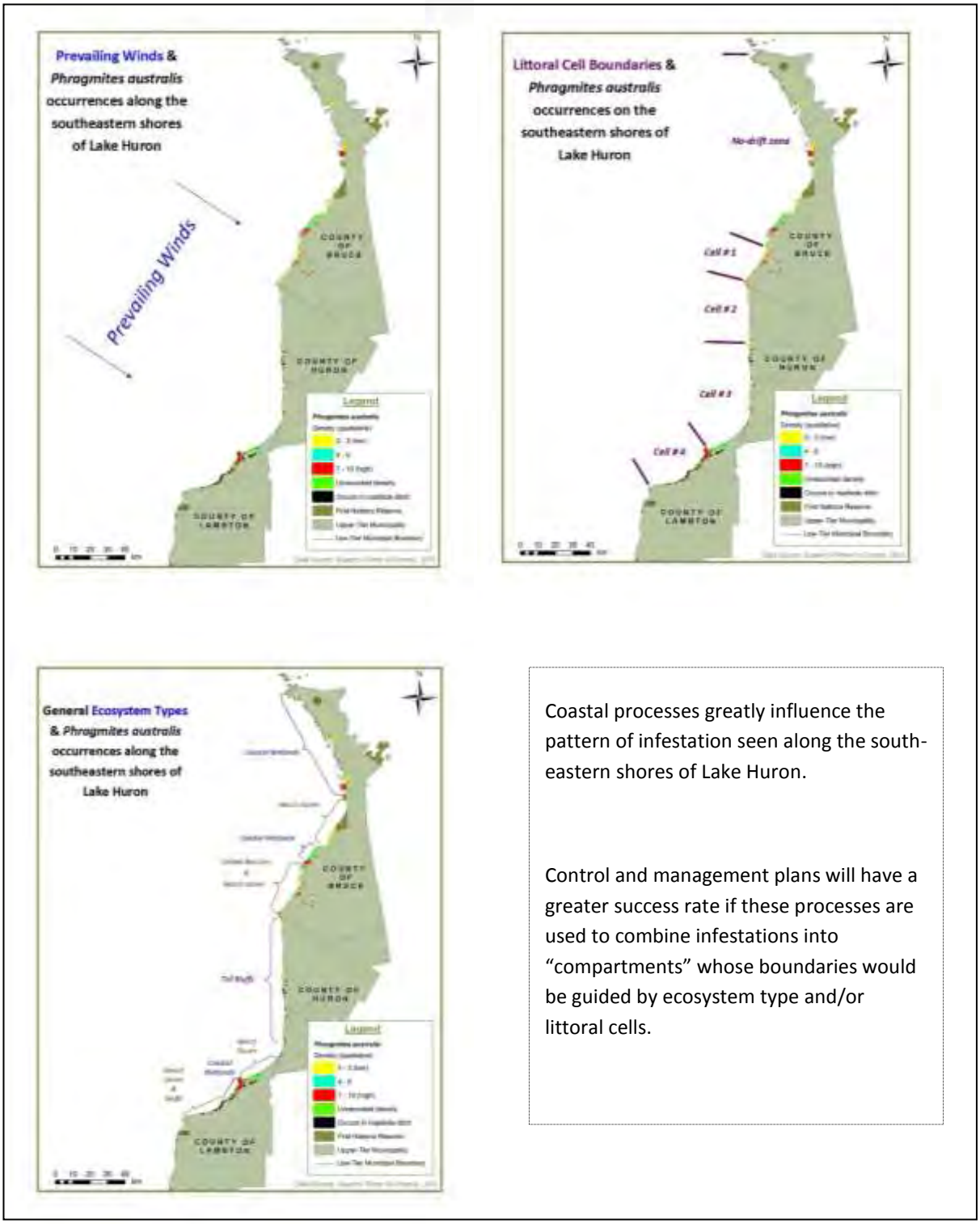
Ecosystem Types

Figure 3 provides a general illustration of ecosystem types occurring along the south-eastern shores of Lake Huron. The pattern shows thick mono-culture *Phragmites* growing in coastal wetlands and beach-dune ecosystems. But it is the dynamic coastal processes influencing the evolution of these habitats that are driving the pattern of infestation and the ecosystem types are merely resisting the expanding infestation in different ways. Winds, lake levels, littoral cells, wave energy, shoreline orientation and geology all affect

the ecosystem type that develops in response to these elements. Wetlands happen to develop in sheltered locations that provide optimal conditions for *Phragmites* which thrive and expand rapidly leaving wetland species with little chance to compete against it. Heavily degraded dune systems tend to produce wet beaches. Wind would normally blow the sand into the dunes, but where *Phragmites* has established this process is interrupted and the system is further degraded and unable to resist, or compete. Cobble ridges are moderated by high wave energy during storm events but when *Phragmites* grows within the ridge its dense biomass will attenuate incoming wave energy and interrupt this process. Bluffs carry water to the lake by way of gullies, streams, culverts and pipes – and it is no coincidence the pattern of infestation in these areas is correlated with the presence of water. Each ecosystem type will affect the expansion of *Phragmites* in a unique way; while also being uniquely vulnerable to the invasion. This degree of vulnerability combined with the preferable growing conditions for *Phragmites* produces the pattern of infestation across ecosystem types.

Phragmites in Roadside Ditches

According to the estimated densities in North Bruce it is likely that *Phragmites* identified in the area is recently established. The only high density stand occurred at the mouth of a culvert (Figure 21). The highway is probably contributing to the spread of this species, but the pattern in density does little to clearly illustrate this (Figure 2). The early detection provided by this survey is an excellent opportunity to implement a control plan before the detected stands expand and become increasingly costly to remove, especially in Stokes Bay (Figure 22).



Coastal processes greatly influence the pattern of infestation seen along the south-eastern shores of Lake Huron.

Control and management plans will have a greater success rate if these processes are used to combine infestations into "compartments" whose boundaries would be guided by ecosystem type and/or littoral cells.

FIGURE 3: COASTAL PROCESSES AND PATTERNS OF INFESTATION

PRIORITY AREAS FOR CONTROL

Table 4 lists the 65 stands that are considered high priority for immediate control. Control and management of these stands will provide the highest benefit for local biodiversity and reduce the potential for dispersal into these naturally significant areas. A detailed survey of the ANSI and CA properties is recommended as this survey did not cover the interior areas; with the exception of Port Franks Wetland and Forested Dune ANSI where a portion of the interior ponds were included.

Table 4 identifies high priority areas based on proximity to natural areas only. It does not include the highly recommended regional approach. The Coastal Centre can assist with the design of a regional approach when a management strategy is to be drafted.

One public beach in Huron County (Blacks Point) was included as a high priority but is not in close proximity to a natural area. It was included because the majority of Huron County shore is tall bluffs making this small point quite rare for the Municipality. It is the only public beach in the area and provides habitat for dune species along this portion of the shore.

The stand occurring on Rotary Beach in Goderich was also included because it is growing within meters of a dune restoration project implemented by the Coastal Centre.

The stands listed in table 4 are labeled in detailed maps prepared for each Municipality. These figures are located in section 2 of this report. Each stand comes with a photograph which can be found in the Appendix.

Control Options

An integrated pesticide approach is highly recommended in the BMPs and is a combination of manual and chemical controls. Pesticide use is regulated in Ontario by the Pesticides Act. Exemptions from the Act can be obtained through the MNR when the use of the herbicide is for the benefit of natural systems. The land owner needs to design a management strategy, apply to the MNR for a letter of opinion and hire a licensed pesticide applicator. The steps are not linear, but are all required before the recommended integrated pesticide approach can be implemented. A pesticide applicator with *Phragmites* experience is highly recommended and their knowledge can help design a long term control strategy. The written letter of opinion obtained from the MNR should provide advice on the use of pesticides near Species at Risk habitats.

The exemptions from the Pesticide Act are strictly for ecological benefits and an application seeking to restore aesthetic or cultural benefits of the lakeshore will not be considered a good reason to apply chemicals in the environment. By working cooperatively with neighbours, a broader approach can be drafted and maximum benefits to the ecology of the coast can be obtained. *Phragmites* does not respect artificial boundaries like property lines of Municipal Boundaries, and spraying herbicides is a serious commitment to make. Combining efforts to manage *Phragmites* in a larger area or ecosystem better justifies the use of herbicides.

TABLE 4: PRIORITY AREAS IDENTIFIED BY PROXIMITY TO SIGNIFICANT NATURAL AREAS

County	Municipality	Waypoint	North	East	Natural Areas
Lambton	Plympton-Wyoming	Lambton 38	4768694	405460	CJ McEwen Conservation Area
Lambton	Plympton-Wyoming	G6	general observation		CJ McEwen Conservation Area
Lambton	Plympton-Wyoming	Lambton 39	4768950	405737	CJ McEwen Conservation Area
Lambton	Plympton-Wyoming	Lambton 54	4772480	408778	High Glen Conservation Area
Lambton	Lambton Shores	Lambton 3	4786954	428346	Port Franks Wetland and Forested Dunes ANSI
Lambton	Lambton Shores	Lambton 4	4786925	426219	Port Franks Wetland and Forested Dunes ANSI
Lambton	Lambton Shores	G15-G40	general observation		Port Franks Wetland and Forested Dunes ANSI
Huron	Town of Goderich	Huron 40	4842462	441649	Rotary Beach is in close proximity to dune restoration sites
Huron	Central Huron	Huron 12	4838488	441280	Public Beach
Huron	Central Huron	Huron 13	4838650	441341	Public Beach
Huron	Central Huron	Huron 14	4838804	441435	Public Beach
Huron	Ashfield-Colborne-Wawanosh	Huron 36	4874401	441231	Eighteen Mile South Shorecliff ANSI
Huron	Ashfield-Colborne-Wawanosh	Huron 33	4850065	441585	Point Farms Provincial Park
Huron	Ashfield-Colborne-Wawanosh	Huron 34	4850423	441456	Point Farms Provincial Park
Huron	Ashfield-Colborne-Wawanosh	Huron 35	4850544	441419	Point Farms Provincial Park
Bruce	Mun. Of Kincardine	Bruce 53	4897462	451052	Brucedale Conservation Area
Bruce	Mun. Of Kincardine	Bruce 54	4897502	451059	Brucedale Conservation Area
Bruce	Mun. Of Kincardine	Bruce 67	4909255	455639	Significant Wetland, Scot Point ANSI, Conservation Areas
Bruce	Mun. Of Kincardine	Bruce 68	4911448	456007	Significant Wetland, Scot Point ANSI, Conservation Areas
Bruce	Mun. Of Kincardine	G36	general observation		Significant Wetland, Scot Point ANSI, Conservation Areas
Bruce	Saugeen Shores	Bruce 69	4914113	458239	Significant Wetland, Scot Point ANSI, Conservation Areas
Bruce	Mun. Of Kincardine	G37	general observation		Significant Wetland, Scot Point ANSI, Conservation Areas
Bruce	Saugeen Shores	McGregor1 - McGreg11	general observation		MacGregor Point Provincial Park
Bruce	Saugeen Shores	Bruce 85	4918403	463049	Inverhuron Provincial Park
Bruce	Mun. Of Kincardine	005	4904953	452496	Inverhuron Provincial Park
Bruce	Mun. Of Kincardine	006	4904970	451723	Inverhuron Provincial Park
Bruce	Mun. Of Kincardine	007	4905753	452319	Inverhuron Provincial Park
Bruce	Mun. Of Kincardine	008	4905877	452371	Inverhuron Provincial Park
Bruce	South Bruce	Bruce 21	4944852	478194	Sauble Falls ANSI
Bruce	South Bruce	G39	general observation		Sauble Falls ANSI
Bruce	South Bruce	Bruce 35	4954096	476738	Fishing Islands ANSI
Bruce	South Bruce	Bruce 34	4954530	477368	Fishing Islands ANSI
Bruce	South Bruce	Bruce 33	4955207	477913	Fishing Islands ANSI
Bruce	South Bruce	Bruce 28	4956787	479017	Grey Sauble Conservation Area
Bruce	South Bruce	Bruce 29	4956861	479004	Grey Sauble Conservation Area
Bruce	South Bruce	Bruce 30	4957174	478898	Grey Sauble Conservation Area

Bruce	South Bruce	Bruce 31	4958053	478561	Grey Sauble Conservation Area
Bruce	South Bruce	Bruce 27	4956703	479060	Grey Sauble Conservation Area
Bruce	South Bruce	Bruce 32	4956142	479144	Grey Sauble Conservation Area
Bruce	South Bruce Peninsula	087	4961109	477461	Howdenvale ANSI
Bruce	South Bruce Peninsula	086	4963179	475887	Howdenvale ANSI
Bruce	North Bruce Peninsula	060	4979215	472005	Black Creek Swamp ANSI
Bruce	North Bruce Peninsula	061	4979359	471741	Black Creek Swamp ANSI
Bruce	North Bruce Peninsula	062	4981631	472357	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	063	4981982	471724	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	064	4981552	471225	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	G40	general observation		Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	G41	general observation		Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	067	4981920	469302	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	066	4982375	469476	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	065	4982265	469521	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	068	4982744	467917	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	069	4982510	467334	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	070	4982375	467198	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	071	4981058	466133	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	072	4986240	471326	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	081	4988373	471419	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	080	4988880	470520	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	079	4990461	466604	Bruce County Forest Miller Lake Tract ANSI
Bruce	North Bruce Peninsula	078	4993948	464521	Johnston Harbour Pine Tree Point ANSI
Bruce	North Bruce Peninsula	077	4996157	465489	Johnston Harbour Pine Tree Point ANSI
Bruce	North Bruce Peninsula	076	4996198	456837	Johnston Harbour Pine Tree Point ANSI
Bruce	North Bruce Peninsula	075	5004339	453922	Singing Sands National Park
Bruce	North Bruce Peninsula	074	5004445	453987	Singing Sands National Park
Bruce	North Bruce Peninsula	073	4986240	471328	Singing Sands National Park

RECOMMENDATIONS

Take an Ecological Approach

Many of the priority areas identified by proximity to natural areas cross political boundaries. It is highly recommended that neighbouring municipalities partner together in these areas and work to control the infestation across the entire ecosystem type. This approach will reduce costs for both parties while also providing maximum benefits to the affected natural habitats.

Consider the Entire Shoreline as High Priority

In highly infested areas the question may be "where do we start?" If budgets allow, getting as much controlled early on is a positive step. If left unattended, *Phragmites* can form extensive, dense monocultures that take over native habitat, and prevent people accessing and enjoying the shore. Getting control measures implemented early, before infestations become extensive can reduce control costs. It also helps reduce further spread from blowing seeds or spreading rhizomes.

Include Public Education

Healthy ecosystems are resilient ecosystems and every single person living on the coast, in proximity to the coast, or even visitors and tourists all share responsibility for maintaining the health of the Lake Huron coast. The public can help with a control plan by staying away from invasive stands, not walking through the stands, or letting pets or children travel through the stands. These activities can carry seeds to new locations. All-terrain vehicles can also increase the spread. Mowing and cutting can open up views of the lake, but it is imperative to bag and remove the seeds and stems. It is highly recommended to instruct landowners to first obtain guidance from the BMPs before attempting to control *Phragmites*. Disturbed soils where native vegetation has been removed provide another opportunity for *Phragmites* to establish. Restoration and enhancement plantings can be effective preventative strategies in these areas.

Stormwater can provide opportunities for *Phragmites* to establish. If drain pipes are used to carry stormwater down the bluffs the discharge area is often high in nutrients and can be quite wet. These areas can be attractive to *Phragmites*. By planting this area with native woody species such as red osier dogwood, the opportunity for *Phragmites* to establish may be reduced.

Consider a Regional Approach by Identifying "Compartments" for Control

The pattern of infestation unveiled in this survey provides compelling evidence that coastal processes are greatly influencing the dispersal and occurrence of *Phragmites* in coastal environments. Taking a regional approach to the infestation may actually prove to be the most cost effective method. Design a control plan for the entire "compartment" where one ecosystem type exists or where one littoral cell occurs, will provide maximum benefits for the ecosystem and reduce the chances of recurring infestations. The costs may be substantial, but the benefits will be far greater and the interrupted coastal processes will return to normal much faster.

MUNICIPAL RESULTS

This section has been prepared to provide individual Municipalities with a clear picture of the extent of *Phragmites* within their own jurisdictions. Individual waypoints are labeled and can be matched to the photographs of each site. Recommendations are made specific for each Municipality.

Corporation of the City of Sarnia

P*hragmites* has established in three localized patches within this Municipality. The first was within Canterra Park. No *Phragmites* was identified on the 900 metre shoreline of the park, but inside the park *Phragmites* was well-established around the perimeter of a small body of water named Lake Chipicon (General Observation G1-G5). Old Lakeshore Road to the west of Cull Drain flows between the bluff and a row of manicured backyards. *Phragmites* was growing in a tiny patch at the top of the bluff (Lambton 27), where the existing vegetation had been cut or mowed and pieces of broken concrete and piles of potting soil had been dumped over the bank. The excessive mowing at this location looks to be contributing to the accumulation of surface water in small pockets on top of the bluff. Where Cull Drain passed under Lakeshore Road *Phragmites* had established on both banks north of Lakeshore Road. The third patch of *Phragmites* along the shoreline was located at Mike Weir Park at the top of the bluff in a wet depression (Lambton 28). The park looks to be regularly mowed up to the wet depression where poplars, willows, and dogwoods occurred. *Phragmites* was beginning to establish within this vegetation.

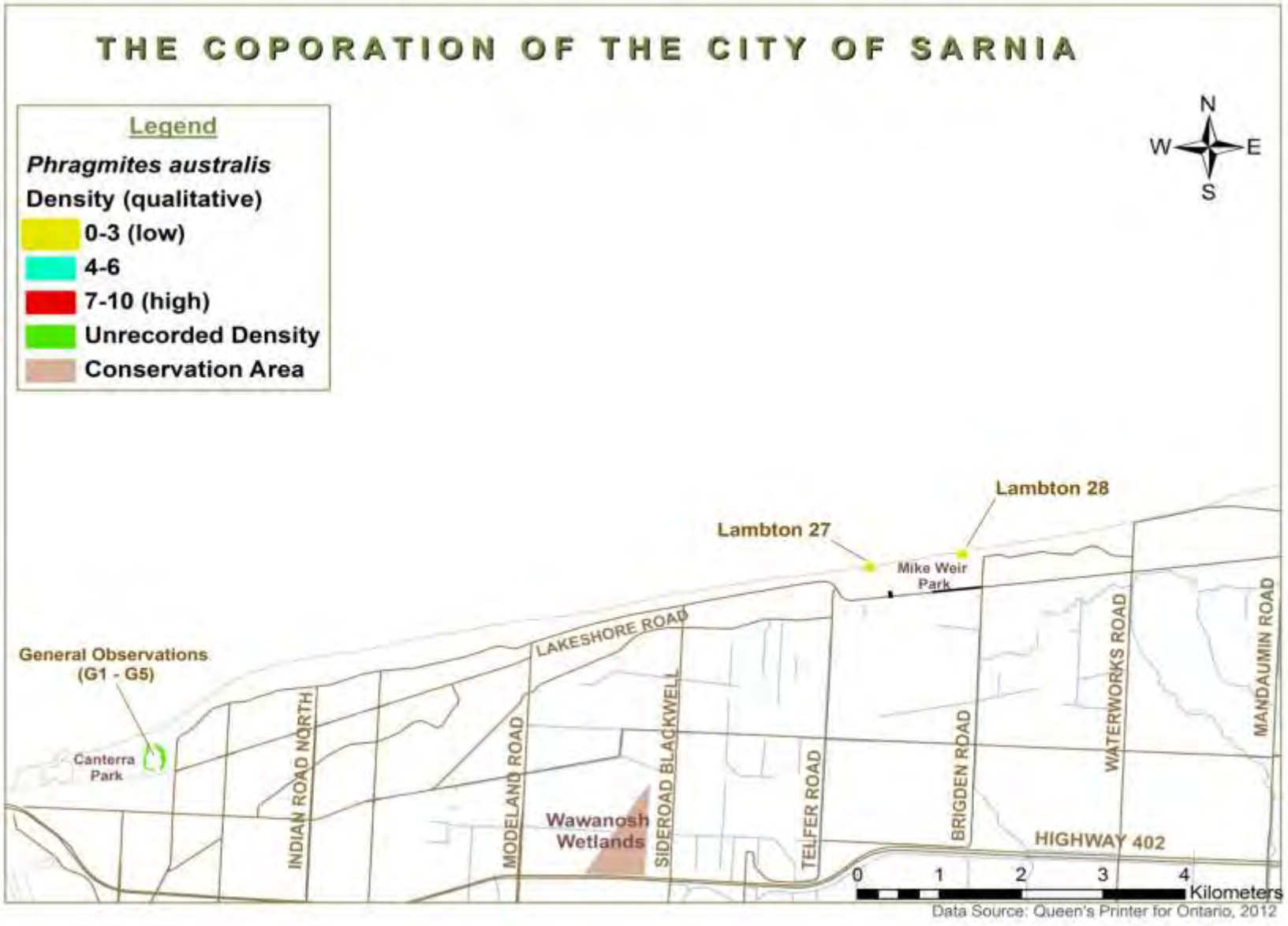


FIGURE 4: CORPORATION OF THE CITY OF SARNIA

Township of Plympton-Wyoming

Phragmites has established all along the coast of this Municipality. Patches exist at varying heights and densities, growing at the tops, bottoms, and middles of the bluffs, and are often associated with flowing water from streams, gullies, or black pipes installed to carry stormwater down the bluffs. Staircases, footpaths, and groynes are sources of disturbance and *Phragmites* is often established in their vicinity. Along Egremont Road from Mandaumin Line to Boonie Doons, only two stands of *Phragmites* were identified. Both occurred at the bottom of a bluff and both bluffs were low in vegetation, covered only with short grasses and a few shrubs. Both stands were growing between two groynes (Lambton 29, 30); one was near a gully (Lambton 30). At the end of Boonie Doon Road, the intervals between *Phragmites* stands shorten and five separate stands were identified along the beach below Ferne Avenue. Portions of the beach at Boonie Doons were littered with debris such as lawn chairs and beach toys. Two conservation areas have shoreline property in Plympton Wyoming, CJ McEwen Conservation Area and High Glen Conservation Area. *Phragmites* at CJ McEwen was lining the stream (Lambton 38, G6) and was establishing along the path down the bluff (Lambton 39). It was also established as a linear patch, west of the beach access at CJ McEwen, and growing up the slope from the beach to the very top of the bluff alongside a footpath that was well worn and carrying water down the bluff (Lambton 40). Thirteen separate stands were identified along the shore of Blue Point Bay (Detail 1): for every black pipe discharging water onto the beach (there were 4) was an established patch of *Phragmites* (Lambton 46, 48, 49 and 53), two stands were established below the bluffs at Lakeside Street (Lambton 55, 56). Fisher Beach and Hillsboro Beach each had one stand occurring at the mouths of streams (Lambton 57, Lambton 12).

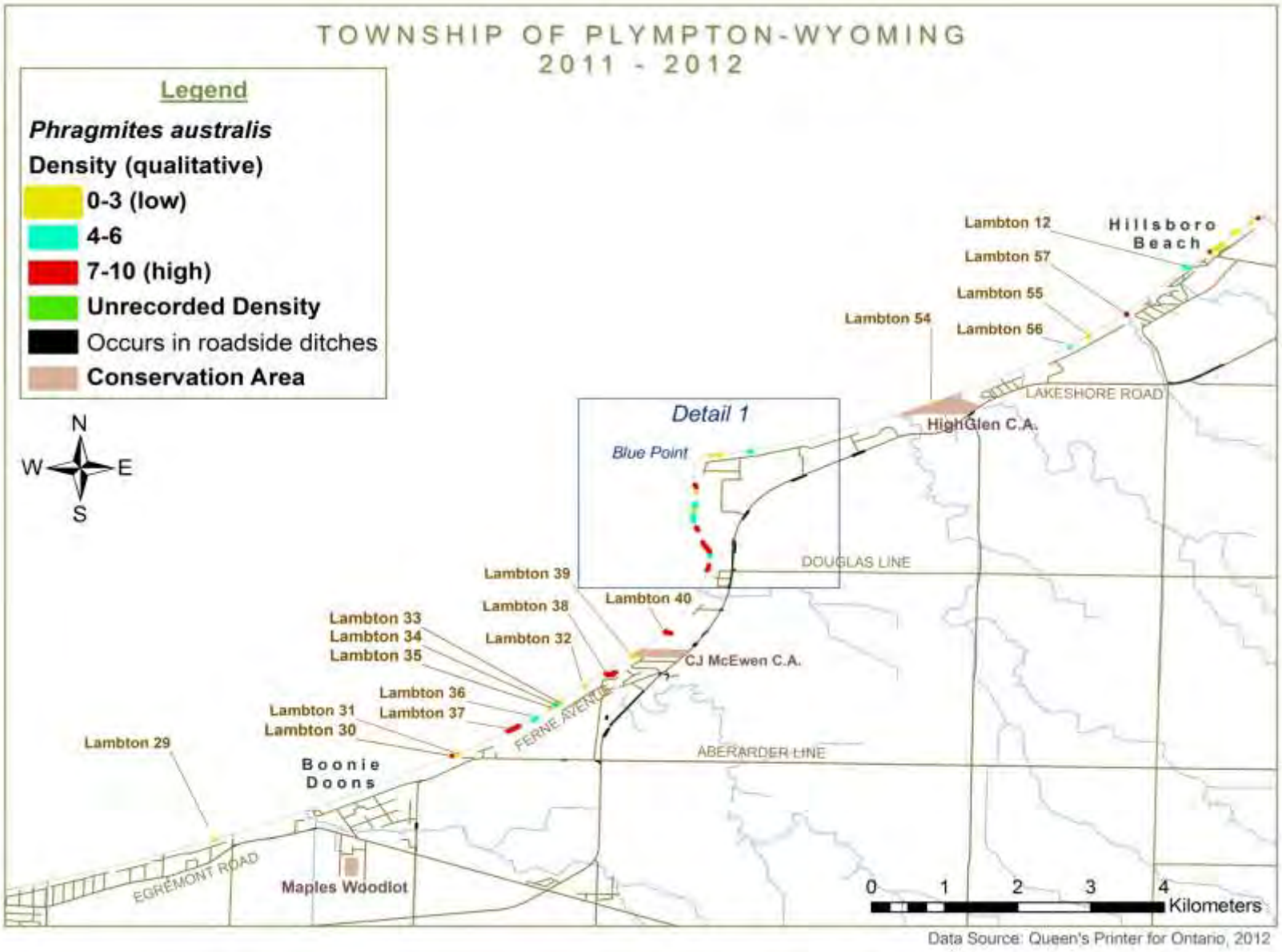


FIGURE 5: TOWNSHIP OF PLYMPTON-WYOMING

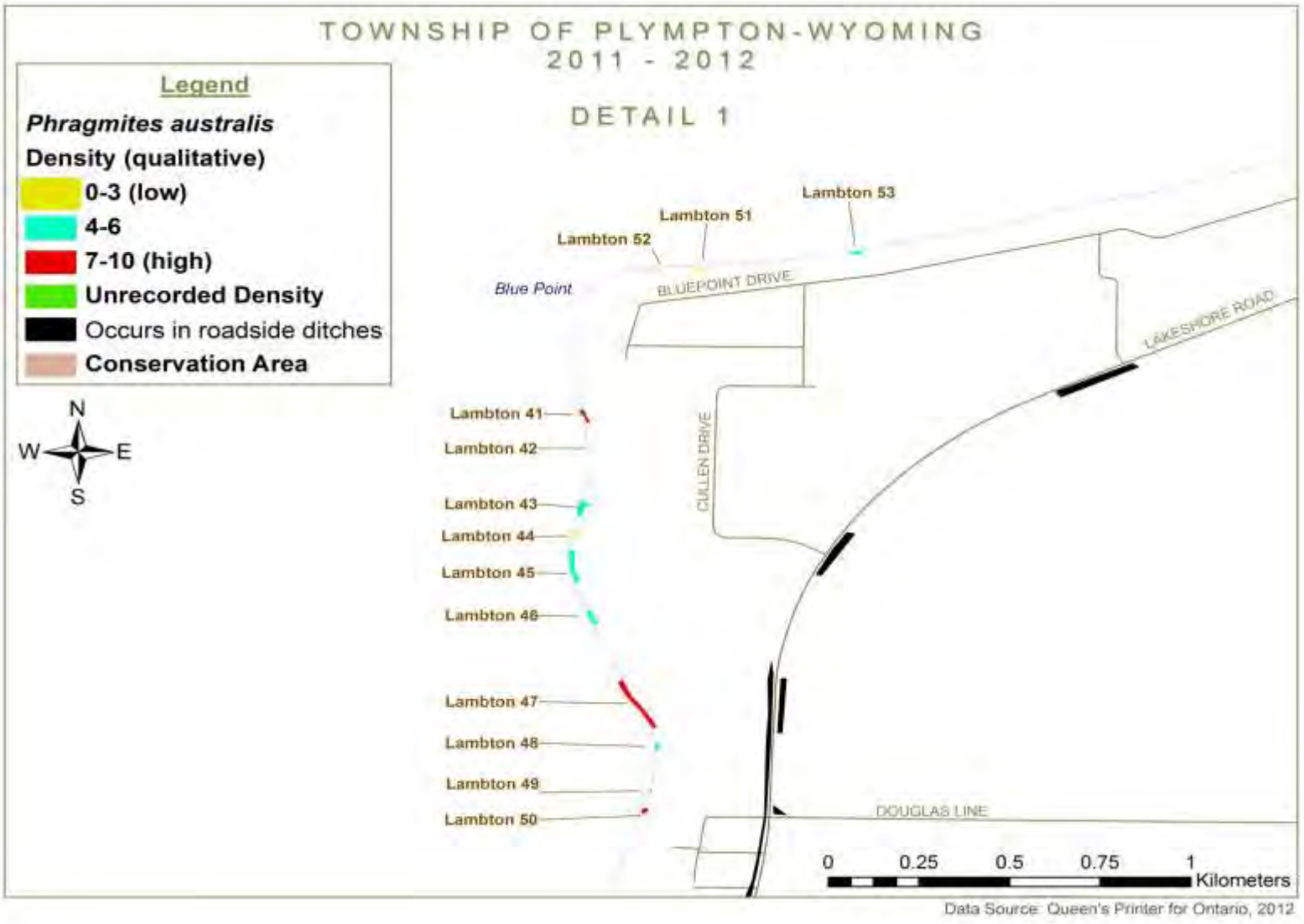


FIGURE 6: TOWNSHIP OF PLYMPTON-WYOMING, DETAIL 1

Municipality of Lambton Shores

The Town of Grand Bend had one patch of *Phragmites* established at the end of River Road (Lambton 1). Main Beach in Grand Bend was lined with linear patches of marram grasses presenting fairly healthy, vegetated dunes between the open beach and the residential properties. No *Phragmites* could be seen. The shoreline within the Pinery Provincial Park was not surveyed. (Verbal communication with Nancy Vidler, a resident in the area, indicated the park does have stands occurring within the interior but they were not included on the map.) Standing within Thedford Conservation Area on the west banks of the Ausable River *Phragmites* could be seen in patches lining both sides of the river (Lambton 2, G34). The map is actually missing several stands of *Phragmites* along the river because they were noticed at a later date. The town of Port Franks was covered in *Phragmites* (Lambton 3 &4, G15-G33, G45). Just beyond the fenced boundary between Port Franks and Stoney Point First Nations began a stand that continued for 2.6 km down the beach (G49, G50). Stoney Point was densely covered, and it also appeared in patches along the roads throughout the Reserve and was established as isolated patches along the banks of the inland ponds that were located just south of the dune systems (G52 –G56). At Ipperwash Beach, it showed up in patches between the compacted "road" and private properties, with a few patches growing directly along the waterline (Lambton 5 – 11). At Kettle Point *Phragmites* has established into a dense monoculture that extended through the coastal wetlands all the way to just north of Cedar Point Line (G11 & G10). Beyond Cedar Point Line it appeared on the beaches of West Bosanquet in various patch sizes and densities (Lambton 13-25). Of the thirteen stands identified at West Bosanquet six were associated with flowing water from streams, five were along the shoreline, and two were growing on the actual bluffs (Detail 1).

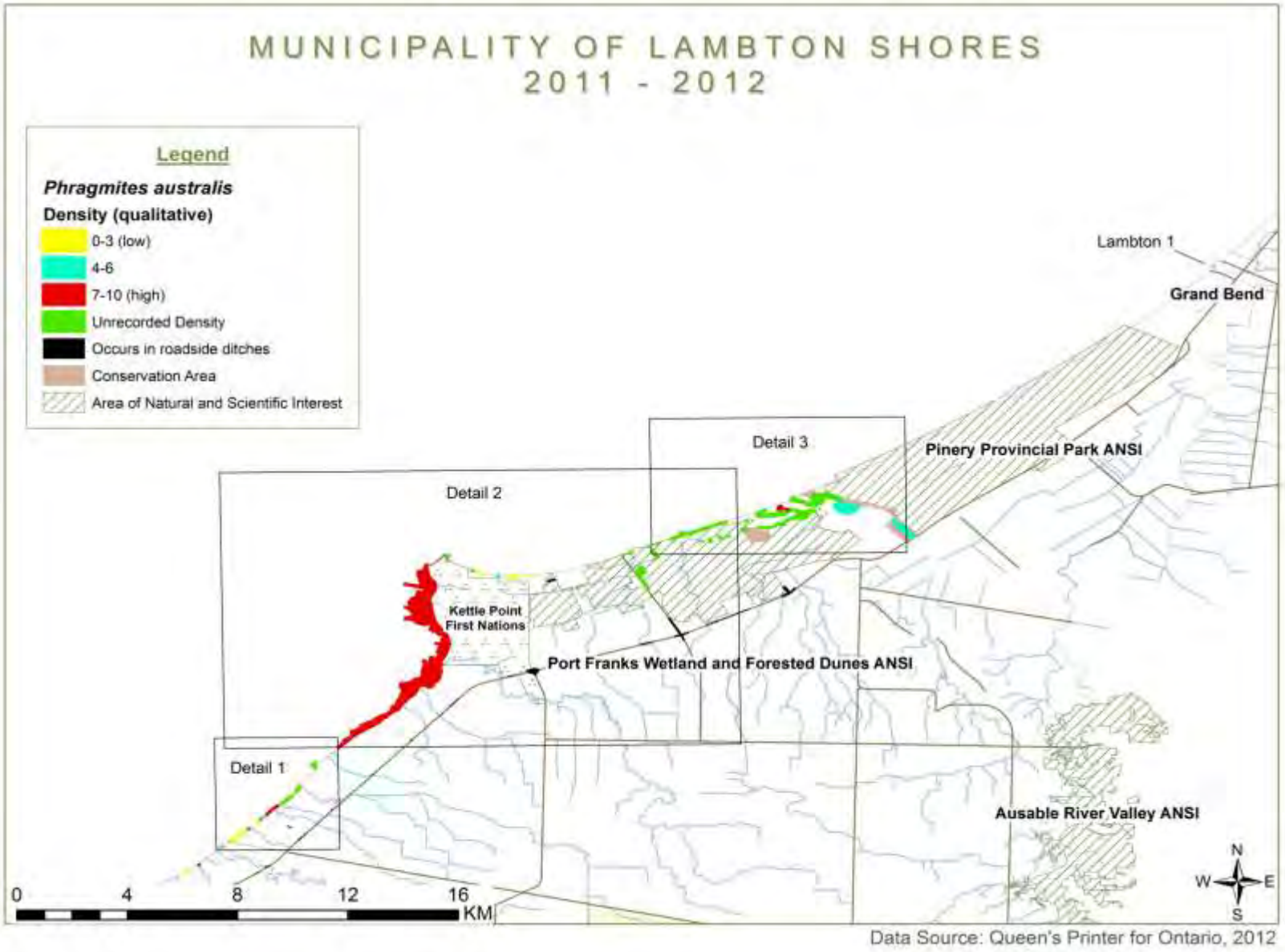


FIGURE 7: MUNICIPALITY OF LAMBTON SHORES

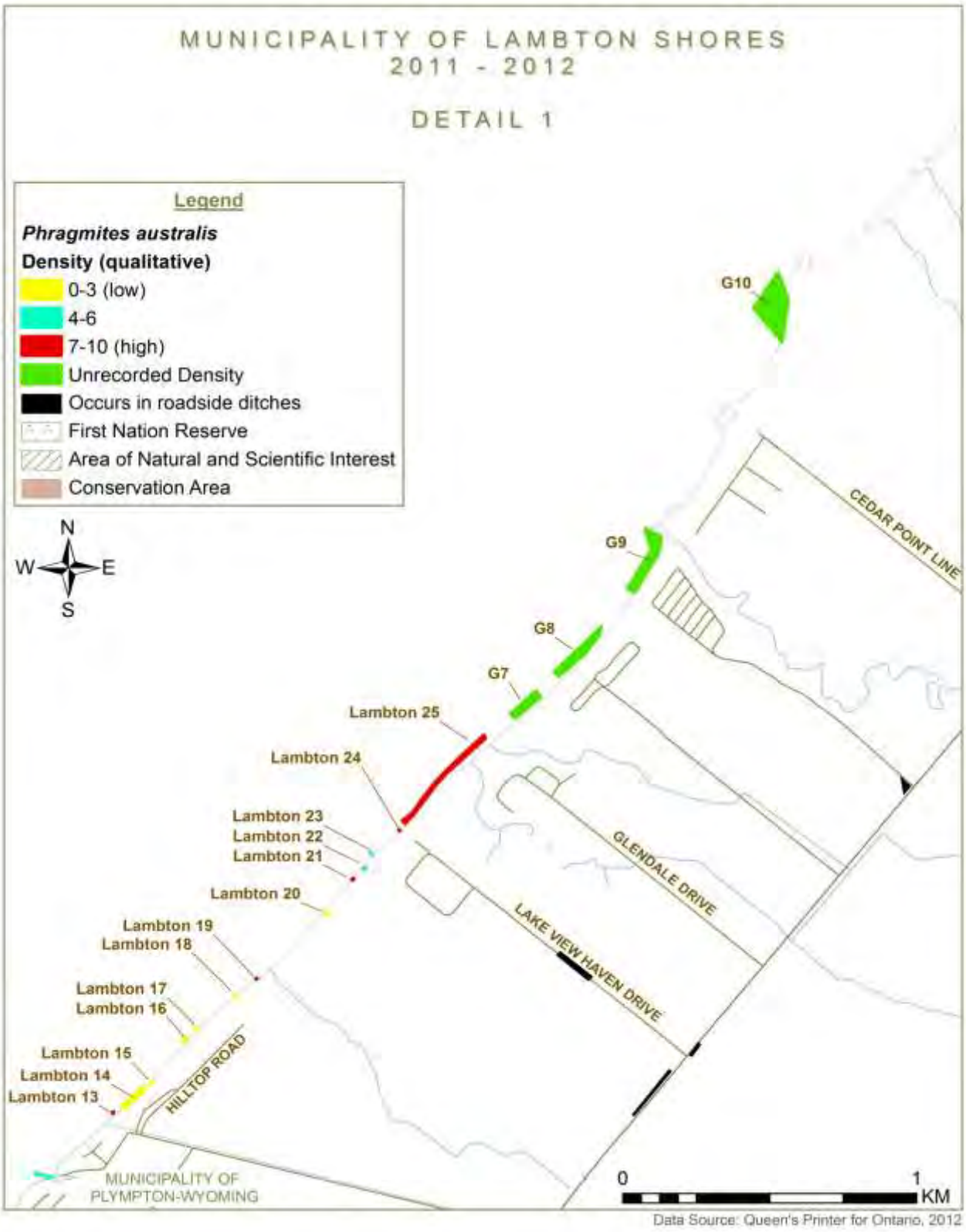


FIGURE 8: MUNICIPALITY OF LAMBTON SHORES, DETAIL 1.

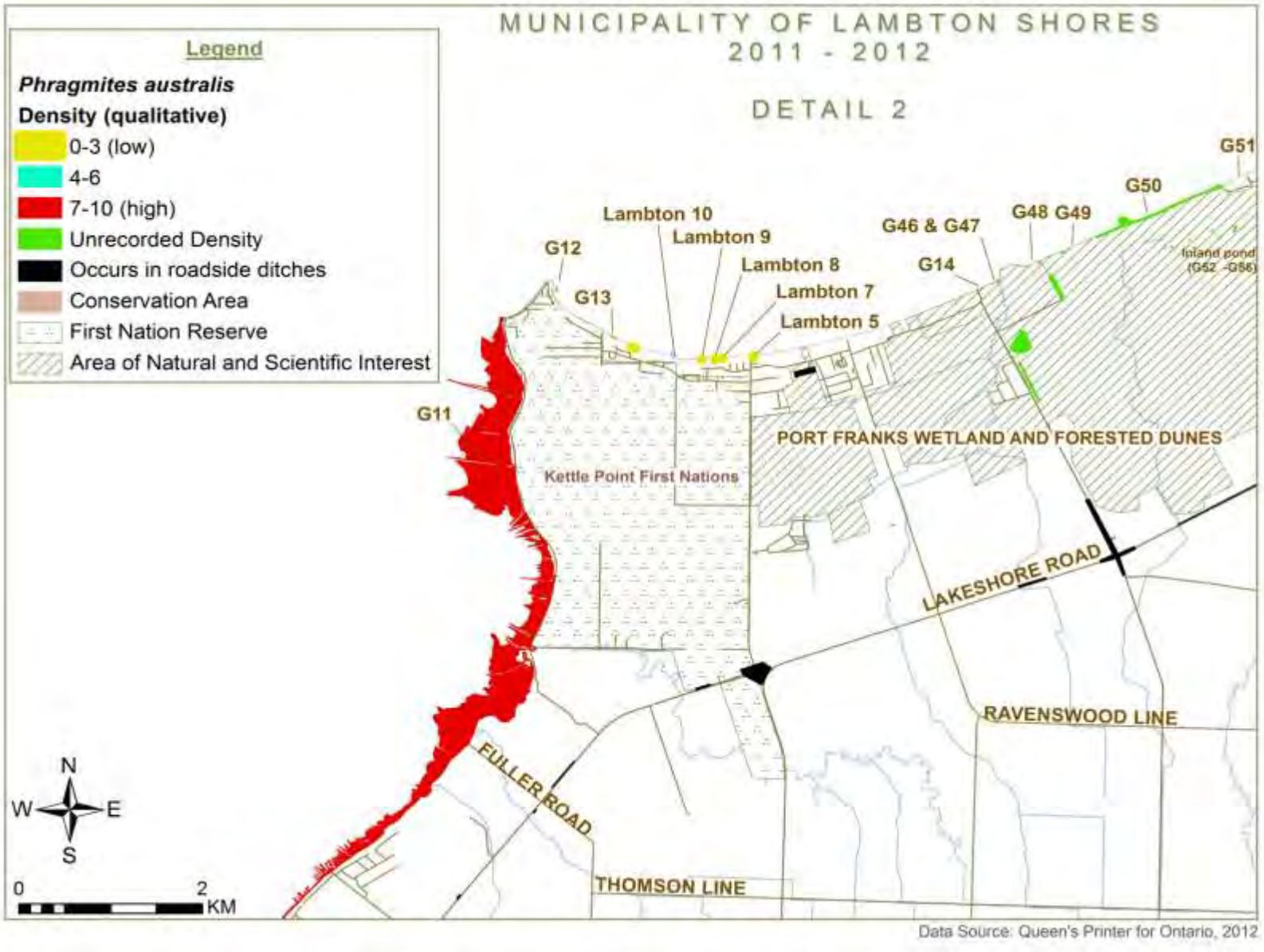


FIGURE 9: MUNICIPALITY OF LAMBTON SHORES, DETAIL 2

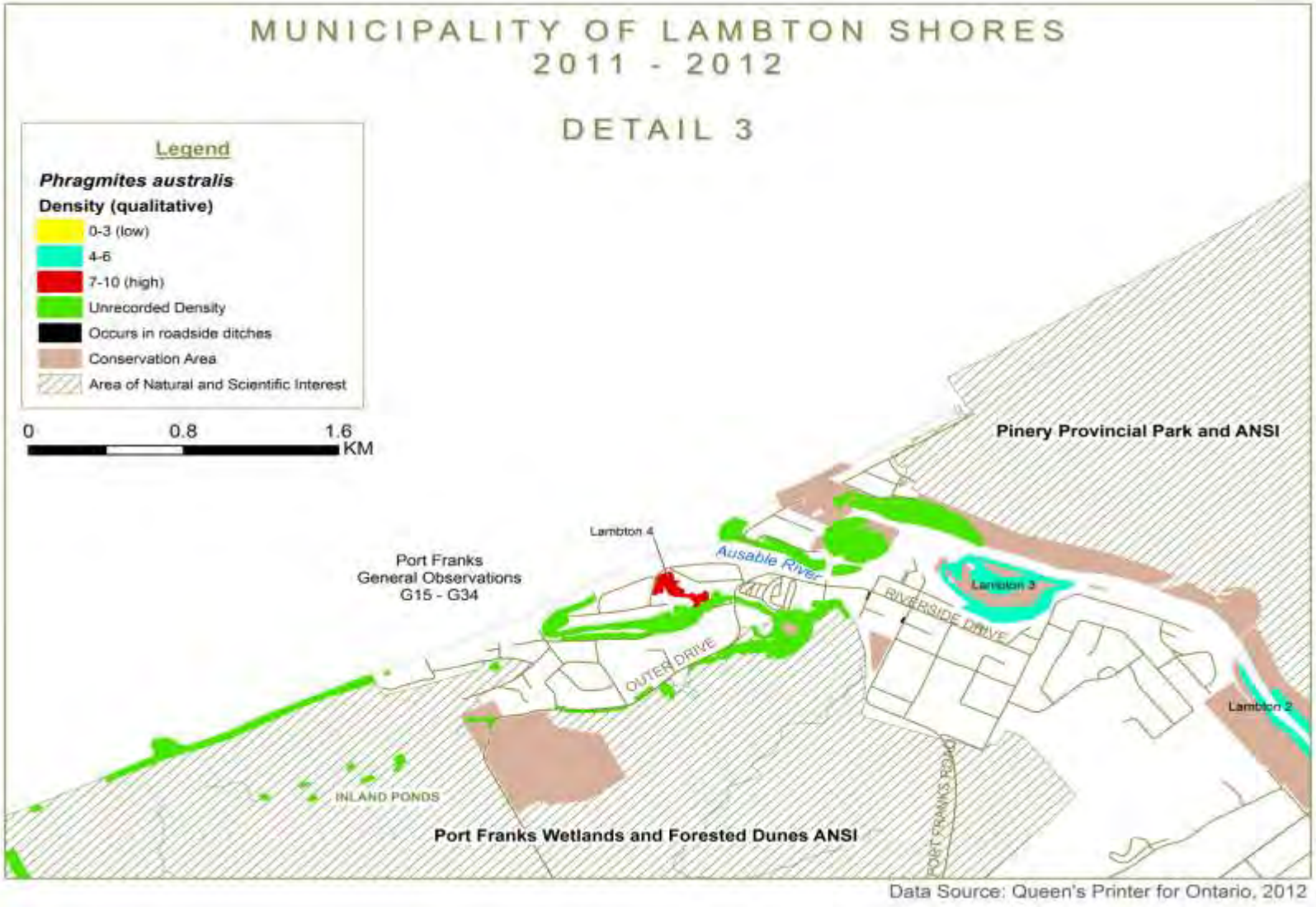


FIGURE 10: MUNICIPALITY OF LAMBTON SHORES, DETAIL 3

Municipality of South Huron

Phragmites was not identified along the shoreline of this Municipality; only one patch was seen growing in the ditch on the east side of Highway 21 between Sunnyside Road and Kingsmere Road.

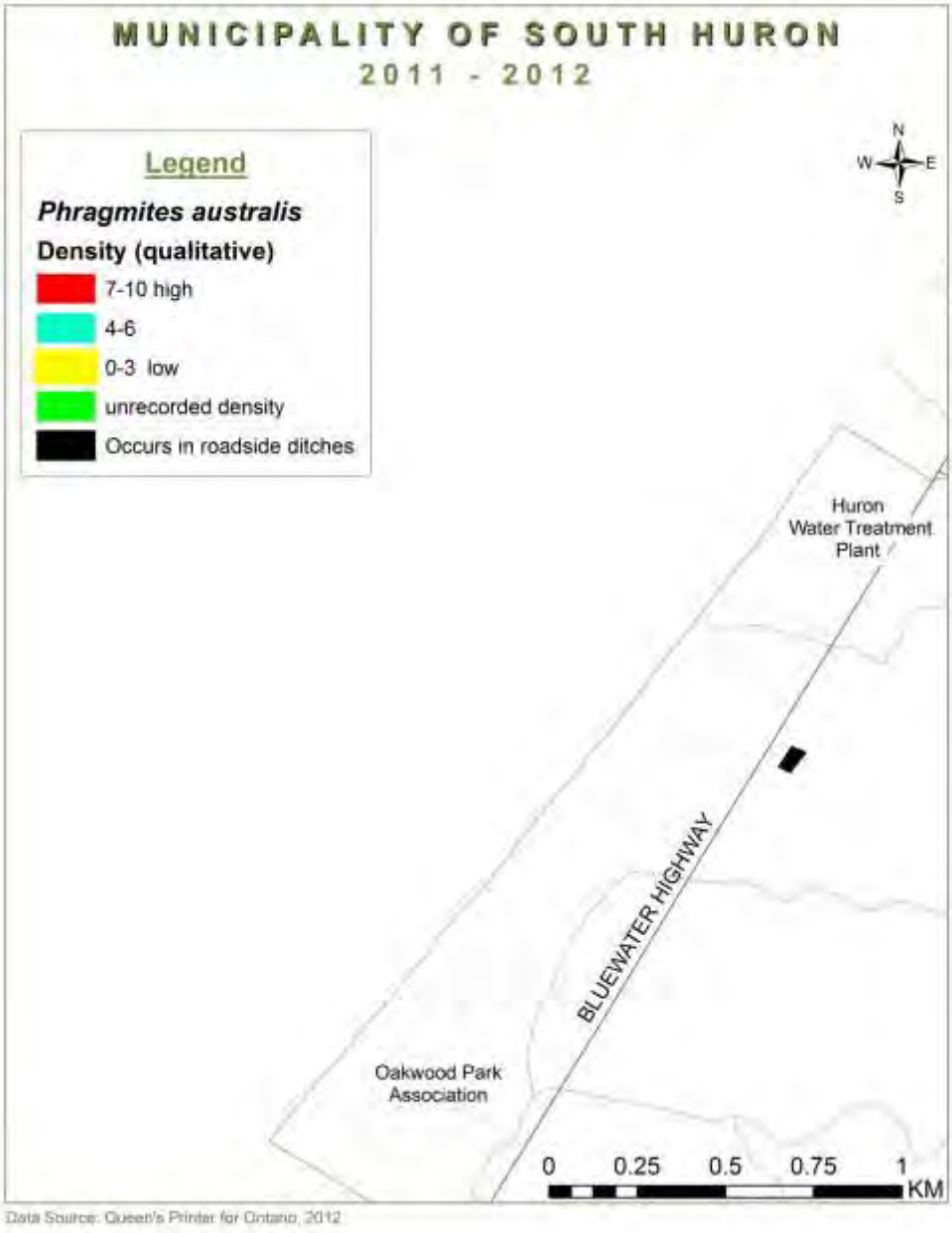
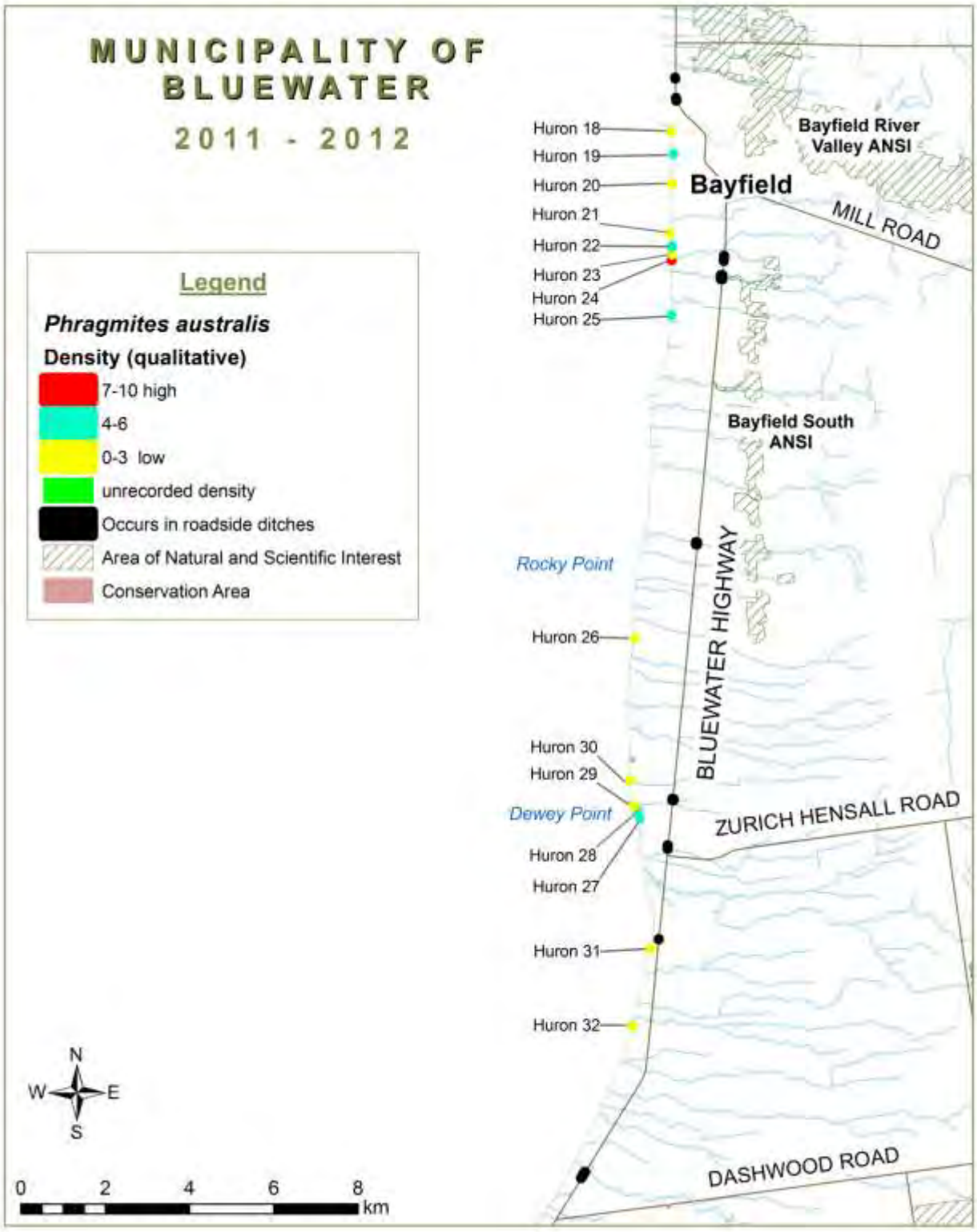


FIGURE 11: MUNICIPALITY OF SOUTH HURON

Municipality of Bluewater

Phragmites occurred in patches of varying densities and sizes along the shoreline. The large patches were in association with streams, while the tallest and densest patches occurred at the mouths of discharge pipes that ran down the bluffs. In the city of Bayfield there were three stands of *Phragmites* occurring along the shore, one at the end of Cameron Street, one at the end of Colina St., and the third occurred in the middle of the two (Huron 18-20). Four stands occurred along the shores at Wildwood (Huron 21 – 24). Two of the stands were at the mouths of streams, one at the bottom of a gully and the fourth was small and growing on the beach. At the end of Blue Bluff Road the bluffs were tall and the beaches were narrow but *Phragmites* found a way to establish as a tiny stand of only a few shoots above a gabion wall (Huron 25). South of Blue Bluff Road the bluffs remained tall and steep and the sandy beaches narrow. Groynes lined the shore at regular intervals all the way down the coast to Rocky Point where the beach widened. A small stand appeared on Crest Beach, accessible at the end of Crest Road (Huron 26). Durchame Beach, at Dewey Point, had four stands occurring along its shores, each in association with flowing water; two beside streams (Huron 30-29) and two at the mouths of discharge pipes (Huron 27-28). South of Dewey Point the bluffs were again steep and tall and the beach narrow. The last two stands identified in Bluewater were small and growing at the base of these bluffs (Huron 31-32).



Data Source: Queen's Printer for Ontario, 2012

FIGURE 12: MUNICIPALITY OF BLUEWATER

Municipality of Central Huron & the Town of Goderich

Phragmites was sparse along this portion of the shoreline, but when it did appear, it was often well-established. At the end of Union Road there were three dense mature stands associated with flowing water; two with natural streams (Huron 15, Huron 17) and one with a culvert and re-directed water (Huron 16). *Phragmites* was established at Black's Point along the southern shoreline (Huron 12) in low lying wet areas (Huron 13), and on the beach to the north of the point (Huron 14). It is quite likely that *Phragmites* will continue to expand across this point in the low lying wet areas that occur between the shoreline and the developing dunes. Black's Point is also a public beach accessible by a staircase at the end of Black's Point Road.

Private Property just south of Goderich had three large, well-established stands (Huron 48-50). This site is not on the shoreline and was visited by request of the landowner. They have attempted to repeatedly cut one stand (Huron 50), with no success at slowing its establishment.

In the city of Goderich there were three stands of *Phragmites*, none of them occurring on the actual shoreline. There was one stand at Rotary Beach growing between the parking lot and the bluff (Huron 40). The Goderich Water Treatment Plant had a well-established stand of *Phragmites* growing within the fenced compound (Huron 39). And there was a stand growing in the ditch alongside the railroad tracks on North Harbour Road (Huron 41).

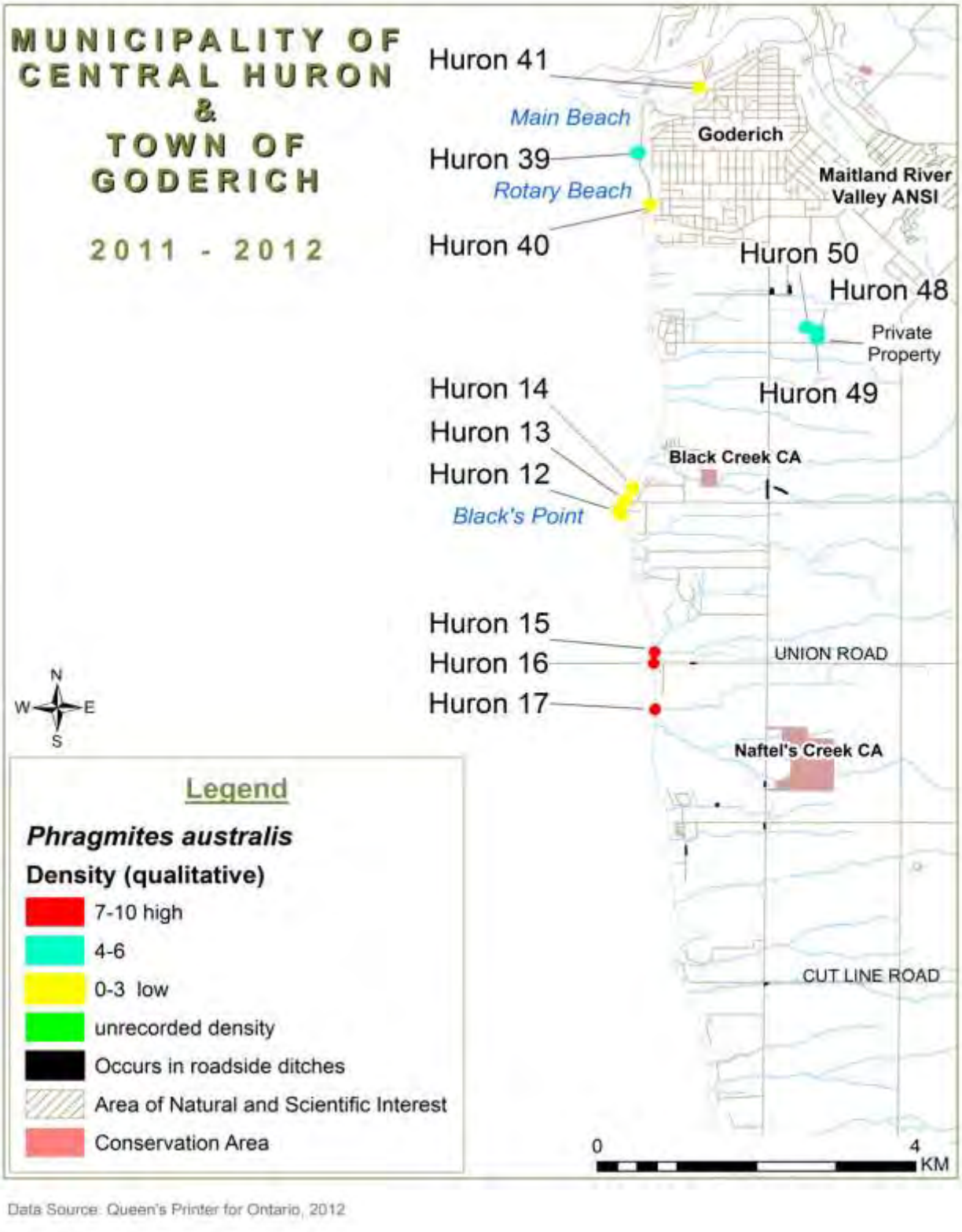


FIGURE 13: MUNICIPALITY OF CENTRAL HURON & TOWN OF GODERICH

Township of Amberley-Colborne-Wawanosh

Public access along much of the shoreline was often prohibited; if *Phragmites* occurred within the areas not fully surveyed it would likely be associated with streams, culverts, gullies, or black pipes coming down the bluffs because every identified stand was in close proximity to one of the mentioned water sources.

Phragmites appeared along the first stretch of shoreline adjacent to the Goderich Airport in no apparent pattern; growing on the beach, at the bottom of the bluffs, and on the bluffs themselves (Huron 42-46). A scan of the coast from the end of Sunset Road showed steep bluffs and a narrow beach with no evidence of *Phragmites*. The beach widened at Point Farms Provincial Park where moderately vegetated dunes occurred. Three stands of *Phragmites* were located here (Huron 33-35). Huron 33 was very tiny, composed of only a few shoots and was growing beside a small stream of flowing water. Huron 34 and 35 were sparse, low density stands that stretched across the shoreline confined to wet low lying depressions. The next public access point was in Port Albert, no *Phragmites* was found here. The mouth of Boyd Creek was accessible at the end of Zion Road. One stand of *Phragmites* was found on the south banks of Boyd Creek, another in the riparian vegetation on the north banks (Huron 36). Amberley beach was moderately affected by *Phragmites* that had established in several locations along the shoreline. According to the map all of the stands accessed at Amberley Beach Road actually occur in the Township of Huron Kinloss.

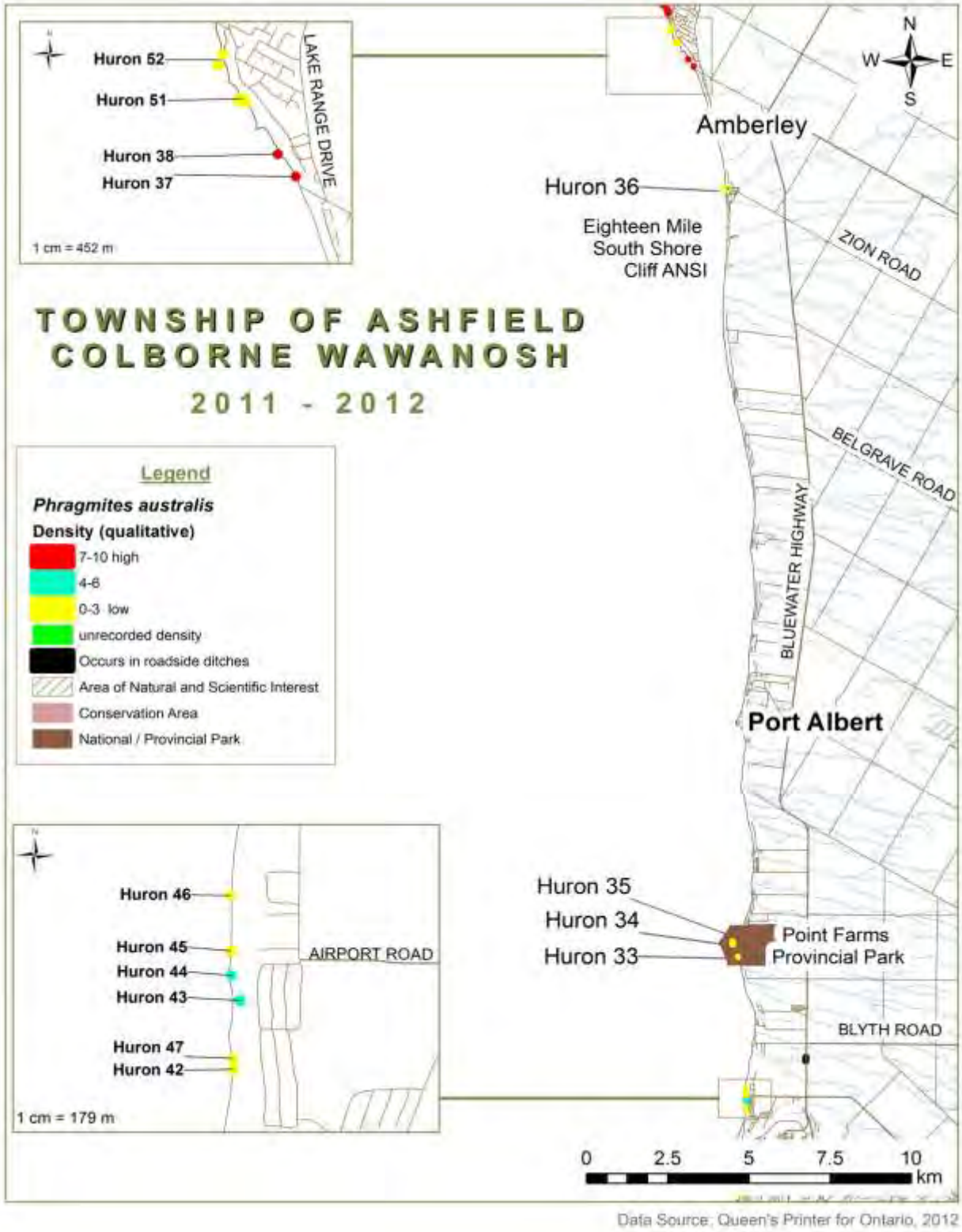


FIGURE 14: TOWNSHIP OF ASHFIELD-COLBORNE-WAWANOSH

Township of Huron-Kinloss

The first stand identified in Huron-Kinloss was established at the mouth of a culvert (Huron 37). The flow of water from this culvert meandered to the lake where a large, dense stand occurred along the shoreline (Huron 38). Just south of Point Clark the Amberley Beach dunes transitioned to an undulating shoreline of lag deposits and embayment's where several stands of *Phragmites* appeared (Huron 51, Huron 52). North of the parking lot at the Point Clark Lighthouse is Point Clark Beach, which was clear of *Phragmites*, but one small stand was identified just north of Clark Creek (Bruce 10). Lurgan Beach was accessed off of Bell Dr. *Phragmites* was growing in the wet swales, but in low density with dry and brittle shoots (Bruce 14). The stands identified at the end of Concession Road 6 were also dry and brittle (Bruce 14). The entire length of Bruce Beach south of Bruce 17 was not walked, but using binoculars no significant stands of *Phragmites* could be seen; if it was present it was short with small seed heads and was overlooked. Stands were identified near the intersection of Kennedy Road and Boiler Beach Road (Bruce 15, 16, 17), and again just south of Saratoga Road (Bruce 36). Bruce 36 extended along the shores of Boiler Beach into the Municipality of Kincardine.

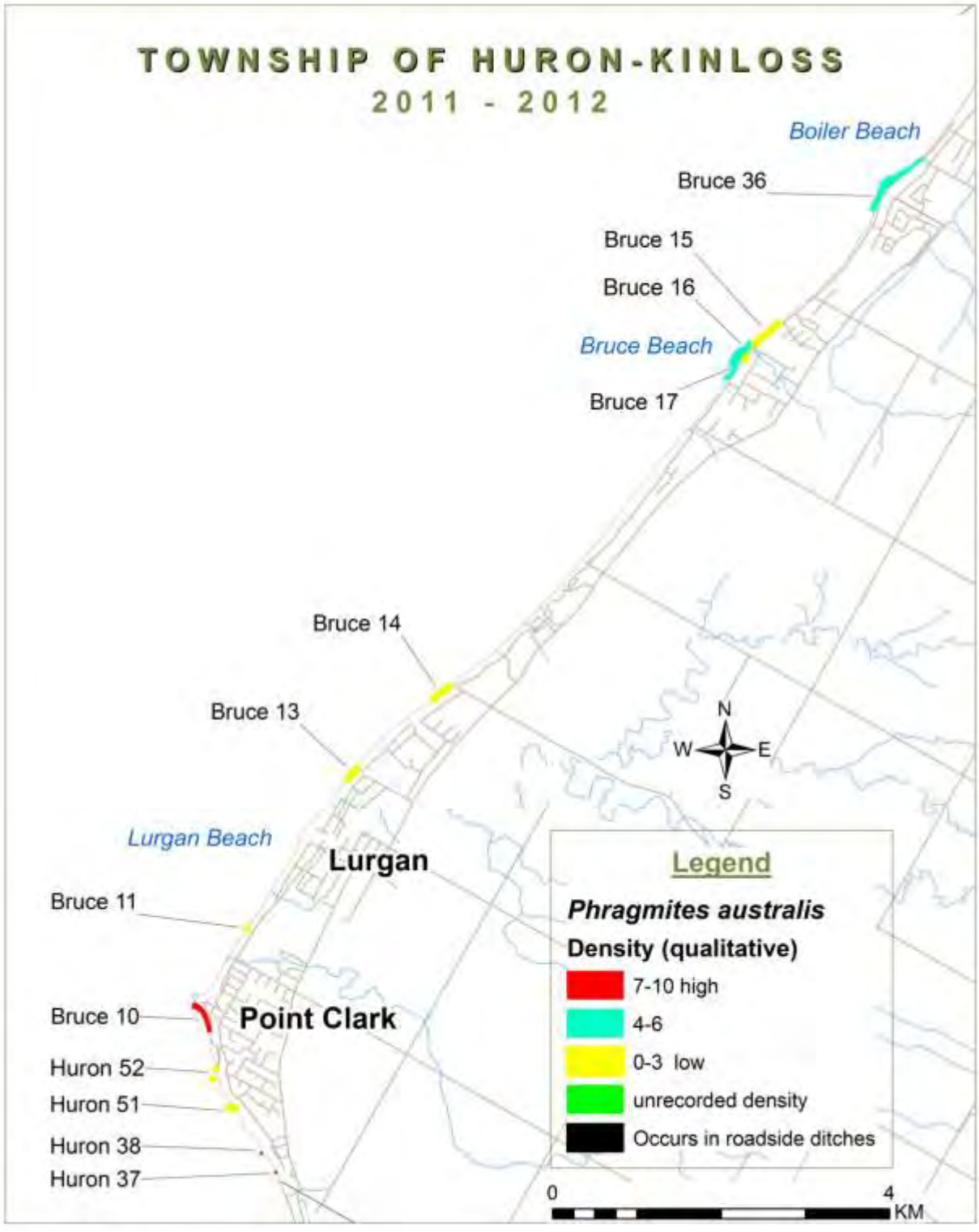


FIGURE 15: TOWNSHIP OF HURON-KINLOSS

Municipality of Kincardine

Phragmites was present in coastal wetlands and sandy and cobble beaches; but had become an extreme problem within the coastal wetlands where it was virtually continuous from Baie du Dore all the way to the north municipal boundary. This continuous stand of *Phragmites* included patches within the Scotts Point Life Science ANSI and Brucedale Conservation Area (Bruce 67, 68, 69, G36, G37). One provincially significant wetland and four provincially rare vegetation community types occur along this portion of the shore. The cobble beaches along the west shores of the Bruce Power Plant (Douglas Point) were inaccessible, but walking along the coast to the northern limits of Inverhuron Provincial Park *Phragmites* could be seen growing along the south shores (G42). Within Inverhuron Provincial Park *Phragmites* has established in the wet cobble deposits along the shoreline between the sand dunes and the waterline. Some of the stands were just establishing and had low densities across the coastal marshes (005, 006, 007), but one stand was tall and thick and well-established at the shoreline (008). South of the park boundaries the dunes have been heavily impacted by cottage developments and human interference, but no *Phragmites* was identified on the beaches. It was not until the cobble beaches between Bruce Road 15 and Concession 11 that *Phragmites* could be found (Bruce 66). Concession 11 to Lorne Beach was not walked because binoculars showed little evidence of *Phragmites*. At the northern extent of Lorne Beach *Phragmites* had established along the entire length of the beach and was growing in the wet swales (G35, G43, G44, Bruce 60-63). At the end of Parkland Road was a high energy cobble beach, where no *Phragmites* could be found. Accessing the beach from Kin-Huron Road by a public walkway that loops behind the homes, a low bluff occurred above a narrow cobble beach where one stand of *Phragmites* was identified at the mouth of a culvert (Bruce 59). North and south of Concession 7 and north of Concession 5 *Phragmites* appeared like patch work within the dunes (Bruce 56-58). One of the stands was associated with a stream (Bruce 48), while the rest occurred along the shoreline in the wet swales. South of Concession 5 was Sandpiper Point where *Phragmites* appeared as several distinct stands. It was well-established along the southern waterline within cobble deposits (Bruce 46) and appeared as short, seedless stalks across the point (Bruce 46). Slightly north of the point two stands occurred; one at the bottom of the bluff (Bruce 47), and the other at the mouth of a stream that flowed to the lake (Bruce 48). The next stands occurred along the shores adjacent to the Kincardine Golf Club, accessible by Golf Links Road. Horton Point was covered with medium density *Phragmites* (Bruce 40). North of Horton point *Phragmites* was growing in a linear stand with low density (Bruce 42, 43) which appeared to nearly connect with the next stand (Bruce 44), which was growing in the wet swales. One tiny stand occurred at the shoreline at the end of Golf Links Road (Bruce 41). Within the geographic town of Kincardine *Phragmites* appeared alongside Saugeen Street north of the pier in two distinct stands. Bruce 38 was growing at the shoreline; Bruce 39 was a tiny patch at the mouth of a stream. Station Beach had no *Phragmites* but the invasion reappeared at Goderich St. South where Boiler Beach begins, and continued to the southern boundaries of the Municipality.

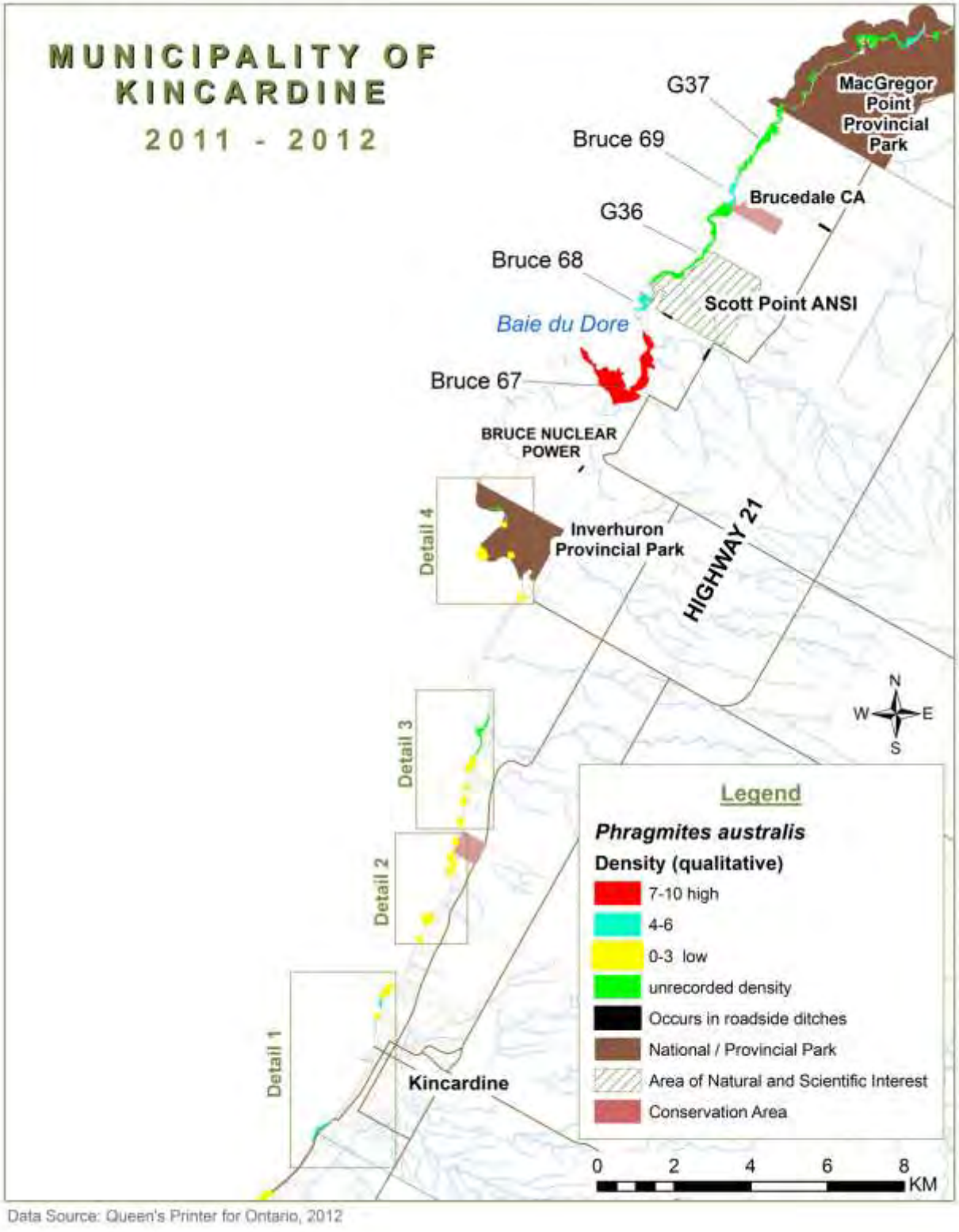


FIGURE 16: MUNICIPALITY OF KINCARDINE

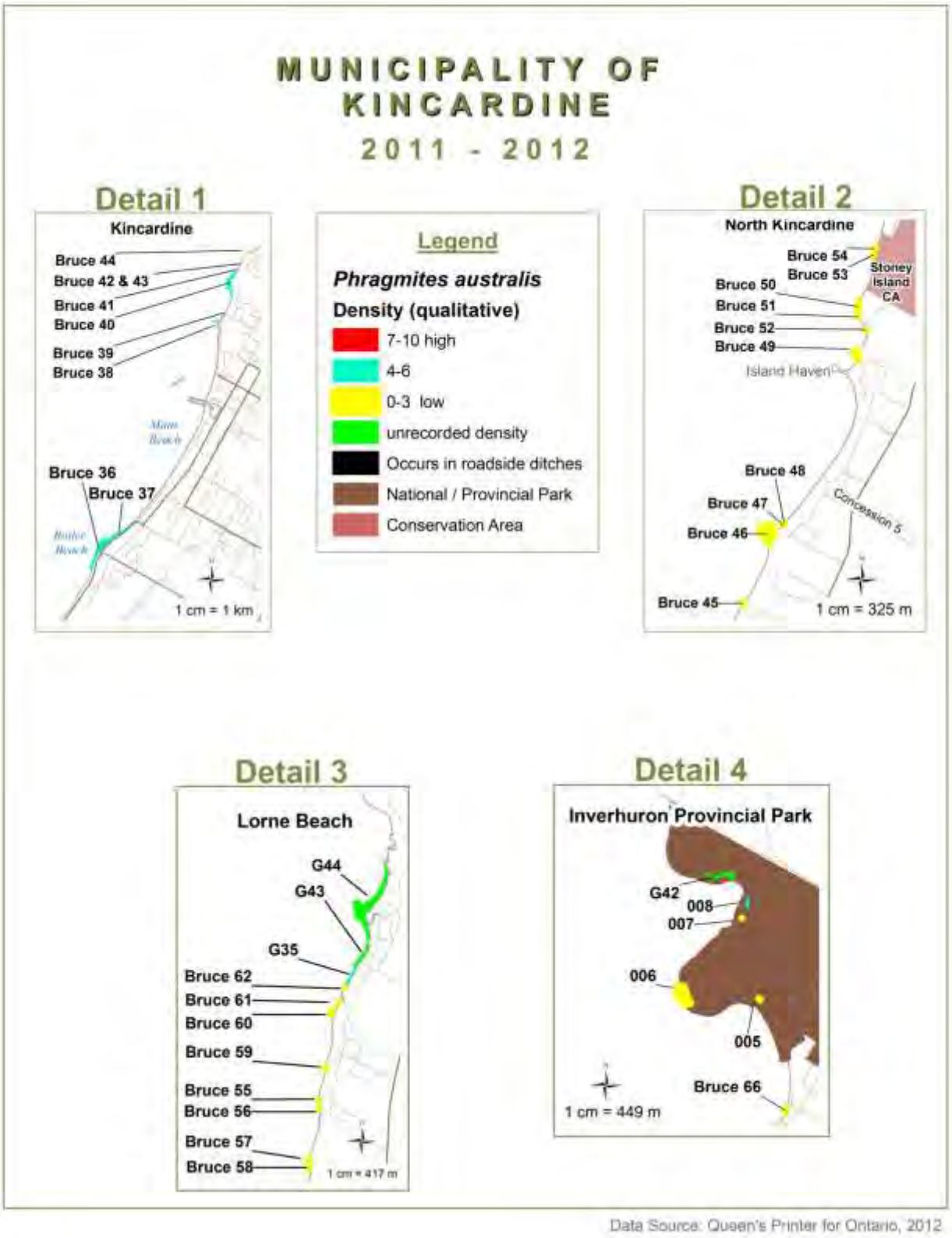


FIGURE 17: MUNICIPALITY OF KINCARDINE, DETAILED VIEWS

Town of Saugeen Shores

In the town of Southampton *Phragmites* stands were identified along North Rankin Road, north of the Saugeen River (Bruce 71-75). These stands varied in size and appeared almost like patchwork along the cobble shoreline. Where North Rankin Road turned inland a culvert carries water under the road to the lake. No *Phragmites* was growing at the mouth of the culvert, but it was establishing north of the culvert in low density. The shoreline of the Saugeen First Nations was not surveyed. South of the Saugeen River one stand of *Phragmites* was just establishing around a pocket of standing water in the coastal marshes between the houses on Front Street and the Lake (Bruce 76). The rest of the beaches of Southampton were clear of *Phragmites*, including the Chantry Dunes. The end of South Street was a public access route. *Phragmites* was establishing in the wet swales (Bruce 77). From South Street to Concession 10 *Phragmites* occurred like patchwork along the coast. It was quite sparse in Horseshoe Bay, but the stands that were there were tall, and appeared quite dense from the road. Miramichi Bay had *Phragmites* clustered around a culvert and density decreased with distance from the culvert, but appeared to cover the majority of the Bay in low density. North Shore Road follows narrowly to the shoreline between Miramichi Bay and Concession 10, leaving very little space for *Phragmites* to establish. No *Phragmites* was identified until the road veered away from the coast and one small stand was growing within the coastal wetlands (Bruce 78). Two tiny patches were growing at the outlet of a small stream just south of Bruce 78 (Bruce 79). *Phragmites* was not identified along the main beaches in Port Elgin. One tiny patch was growing at the end of Bruce Road 25 beside a gravel parking lot (Bruce 80). Water flowed perpendicular from the road to the lake at a number of locations along Saugeen Beach Road. *Phragmites* appeared as tiny stands just off the road within these ditches in two locations (Bruce 82, Bruce 83). The road bisected the natural dune systems at Edits Grove separating the fore dunes from the back dunes. *Phragmites* had established across the entire beach and fore dunes but had not crossed the road to invade the back dunes and wetland areas. At the end of Smith Line a drainage ditch and culvert system was completely surrounded by *Phragmites* which expanded into the wet coastal marshes that lined the shore (Bruce 84). MacGregor Point Provincial Park is south of Smith Line. The occurrences of *Phragmites* within the park were obtained from Park Staff (MacGregor 1 – MacGregor11). *Phragmites* was described as patches that occurred along the entire coast of the park and connected with the extensive *Phragmites* described on the coast of Northern Kincardine.

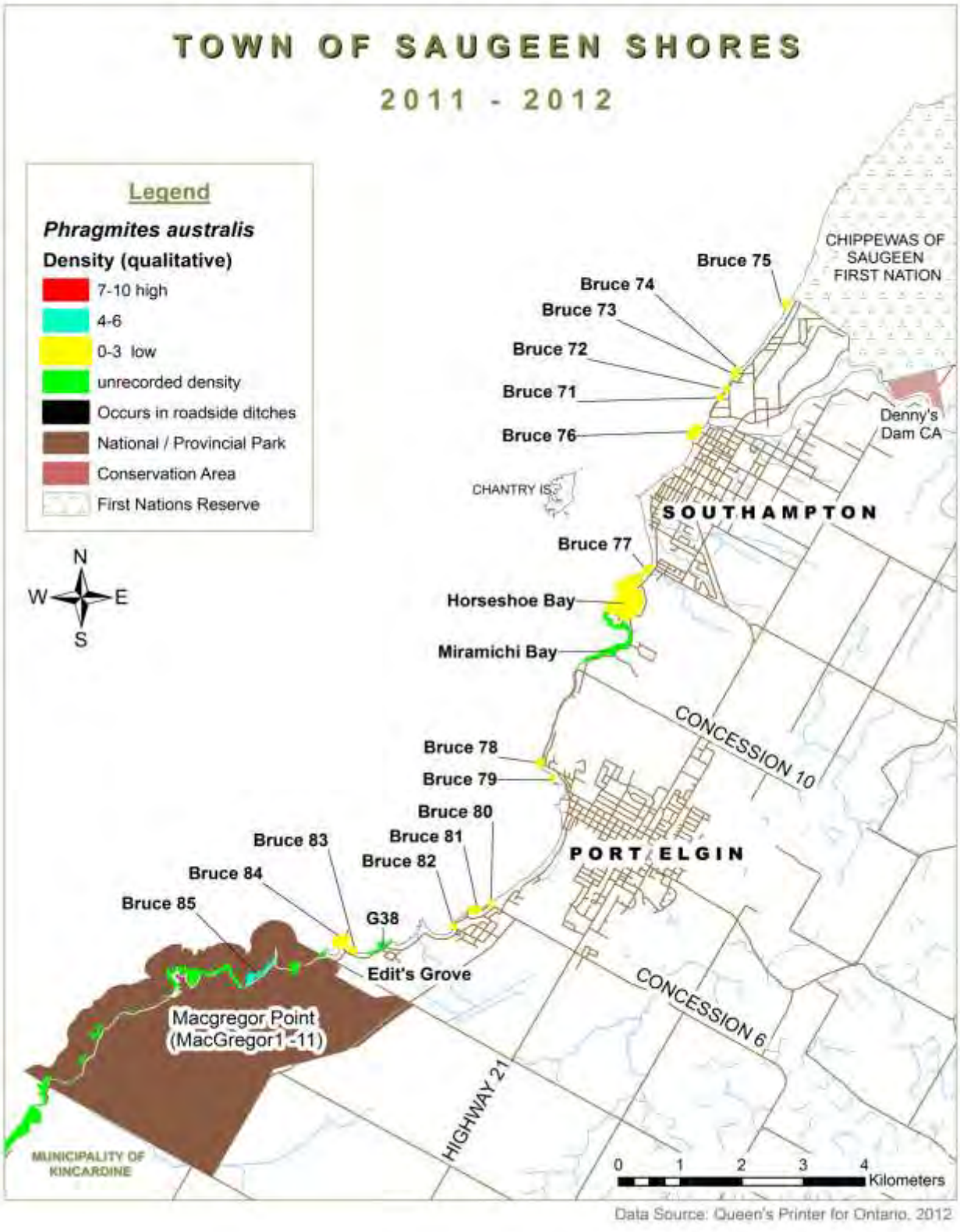


FIGURE 18: TOWN OF SAUGEEN SHORES

Town of South Bruce Peninsula

Many of the identified stands of *Phragmites* in South Bruce were growing in roadside ditches (Bruce 19, Bruce 20-24, 26-31, 083-085). These stands occurred in various lengths and heights. Some of the ditches were holding a significant amount of water (>10cm). Most of the *Phragmites* located in the ditches were clustered in the Oliphant area (Bruce 20-24, 26-31), two were located east of Sauble Beach (Bruce 19-20), and three were spread across roads in the north (083-085). Sauble Beach had *Phragmites* established along the northern extent of the beach-dune complex. It was growing alongside a storm drain outlet (Bruce 21) and was expanding to the north all the way to the mouth of the Sauble River (G39). It probably continued to appear as patches along the shoreline of Saugeen First Nations but their property was not surveyed. North of Chief's Point *Phragmites* continued for tens of thousands of square kilometres across the coastal wetlands and marshes at Oliphant (Bruce 33-35). Two stands occurred at Red Bay Park (087), and one stand occurred alongside the fishing docks in Howdenvale Bay (086). One mature stand was growing in the coastal marshes at Wiarton (Bruce 25).

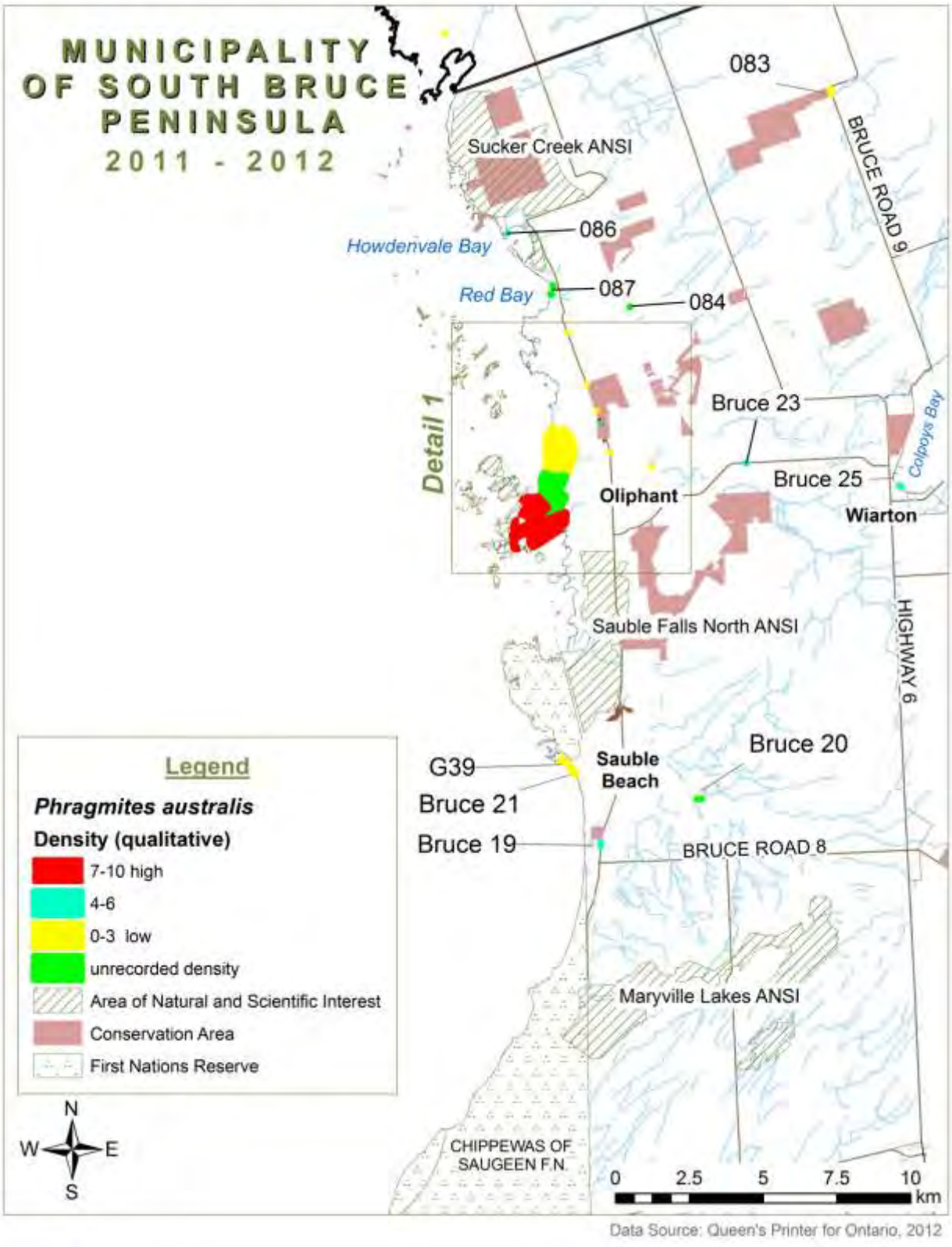


FIGURE 19: MUNICIPALITY OF SOUTH BRUCE PENINSULA

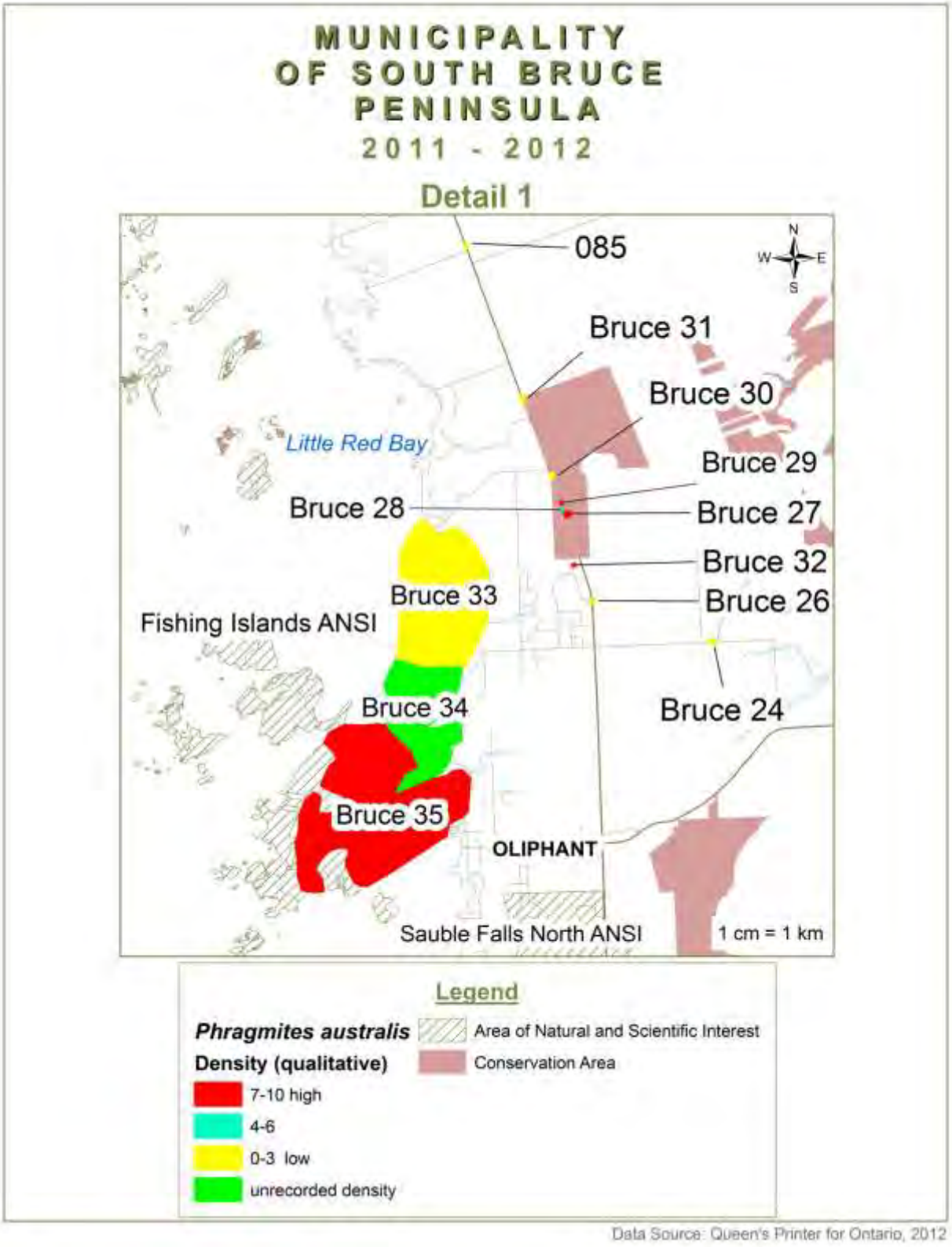


FIGURE 20: MUNICIPALITY OF SOUTH BRUCE PENINSULA, DETAIL 1

Town of North Bruce Peninsula

The Lake Huron coast was surveyed as best as possible using access points off of the available road network. Many of the identified stands were growing in roadside ditches, and the majority of these stands occurred along Highway 6 (Bruce 86, 062, 063, 071, 077-081). Myles Bay had two stands of *Phragmites*. One growing where a small stream met the lake water in a coastal wetland (060), the other at the mouth of a stream which flowed under the road in a culvert and out to the lake. This stand was quite tall and well-established (061). Black Creek Provincial Park was not surveyed. Stokes Bay was dotted with *Phragmites* around its entire perimeter, plus one patch was growing on Garden Island (G40). The fishing docks of Stokes Bay were clear of *Phragmites*, but one stand could be seen north of the docks about 50 meters from Government Dock Road (065), this stand had a low density and appeared to be just establishing. The mouth of Stokes River was surrounded by cattail marshes. Several *Phragmites* seed heads were popping up in the marsh (066). The coastal marshes off of Tamarac Road extended a few hundred metres into the Lake. One stand of *Phragmites* could be seen with binoculars growing at the waterline of the marsh (G41). Crossing the bridge to Tamarac Island, one stand of *Phragmites* was growing in the riparian vegetation below a line of cedar trees (067). Gauley's Bay had three stands of *Phragmites* along the shore and could be seen by car travelling down Gauley's Bay Road. The first stand was growing just south of a stream mouth and was the densest stand in North Bruce (068). The second was growing in the marshes near a boat launch (069) and the third was just establishing off of the road behind a line of cedars and spruces (070). Johnston's Harbour was generally clear, except for one stand establishing in the coastal marshes and wetlands (076). This stand was accessed by a foot bridge off of Pedwell Point Drive. Three stands were identified in Singing Sands National Park off of Dorcus Bay Road (073-075). Rare and endangered plant species are known to occur within this Park and the area is a Life Science ANSI. The Georgian Bay coast was surveyed by road access from Isthmus Bay to Hope Bay, but no *Phragmites* was identified.

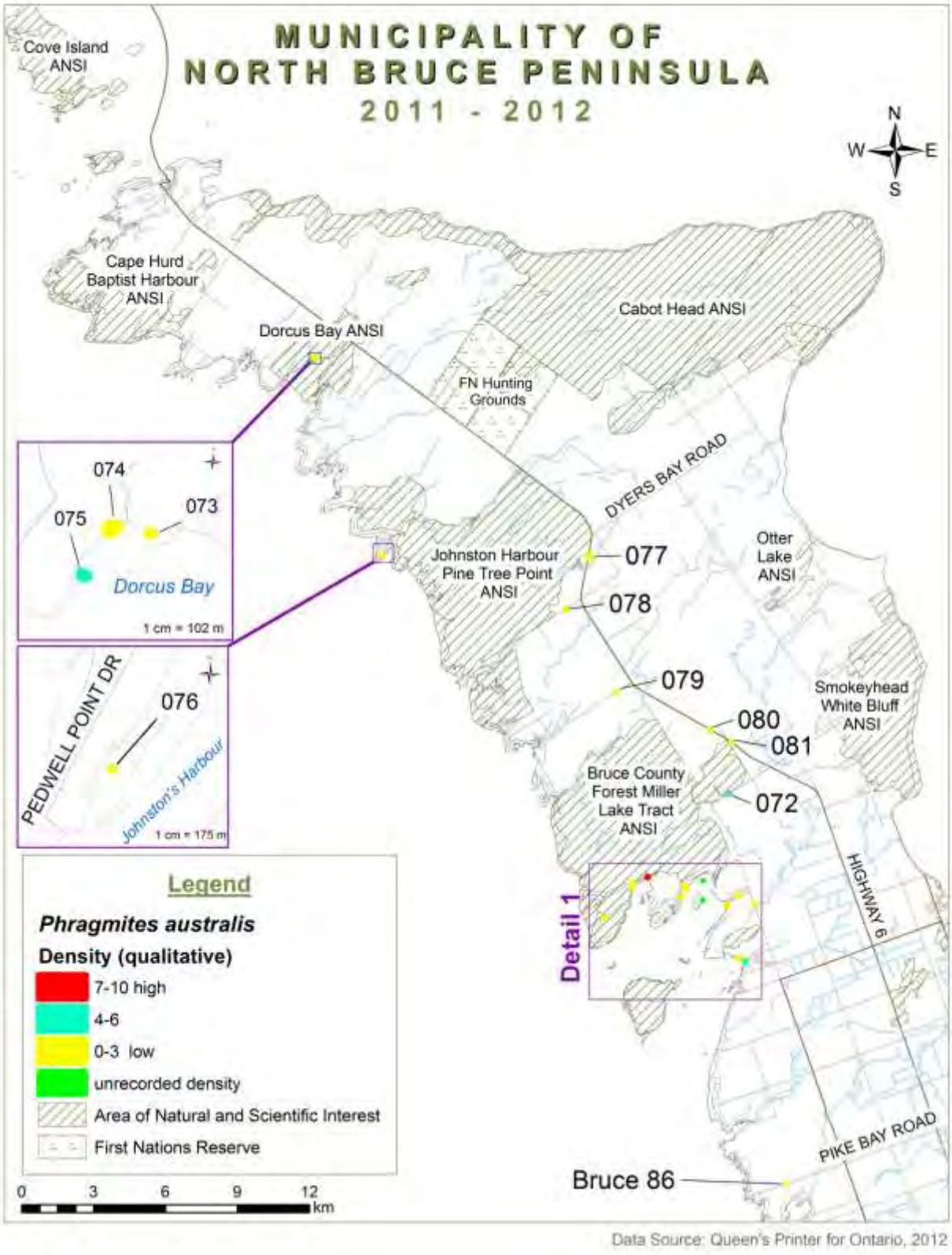


FIGURE 21: MUNICIPALITY OF NORTH BRUCE PENINSULA

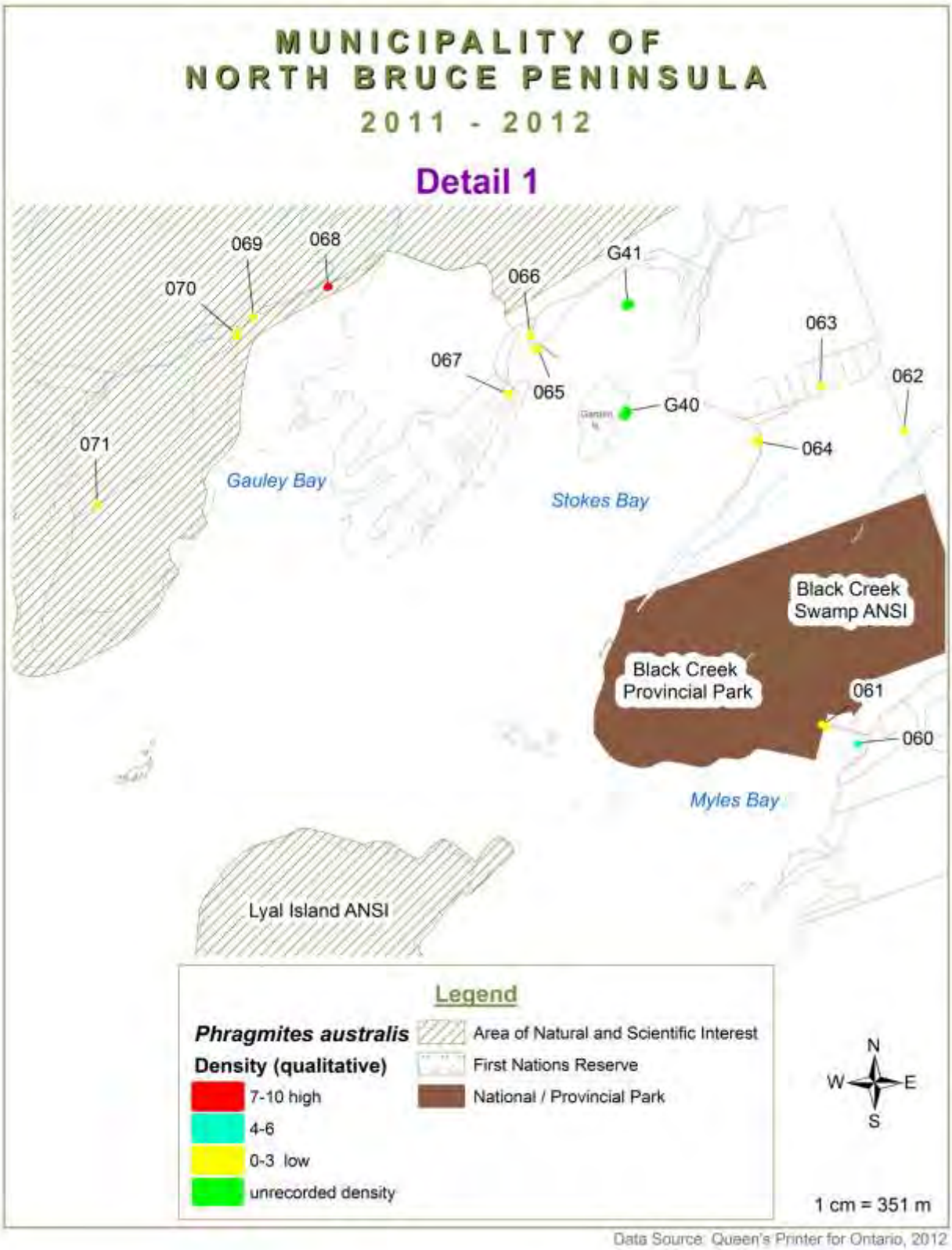


FIGURE 22: MUNICIPALITY OF NORTH BRUCE PENINSULA, DETAIL 1

CONCLUSIONS

Phragmites was documented along the entire southeastern shores of Lake Huron during the fall of 2011 and the winter of 2012. Occurring as small patches or large continuous stands, it was present in all four ecosystem types; coastal wetlands, dunes, cobble beaches, and bluffs. Estimated areas from the areas surveyed indicate a total of 1017 acres between Tobermory and Sarnia are currently affected by *Phragmites* (and this figure is likely underestimated given the length of shore that was not included in this study).

Phragmites often appeared at the mouths of streams, rivers, and the base of gullies (total of 94 acres) suggesting the invasive species may be accessing the coast by way of flowing water, travelling from inland sources. Disturbances such as discharge pipes, staircases, culverts and ATV tracks were often correlated with *Phragmites* stands. Shorelines with high bluffs were also affected by *Phragmites*, a total of 1 acre occurred in bluff locations. This was a bit unusual because of the dry conditions that are typical for bluff faces. Potential causes could be groundwater seepage or the accumulation of stormwater, in localized depressions caused by erosion or at the base of the bluff itself.

Phragmites in coastal environments can disrupt coastal processes that are required for the adaptability and long term sustainability of these dynamic and evolving ecosystems. Disrupted processes will lead to reduce ecological health. Unhealthy ecosystems offer less ecological value to wildlife, provide degraded ecological services and are less able to resist the aggressive invasive characteristics of *Phragmites*.

Dense, continuous stands of *Phragmites* were highly correlated with coastal processes such as littoral cell boundaries, shoreline orientation and lakebed geology, as well as prevailing winds. This suggests that the extent of *Phragmites* along the coast is not random; it is more likely following a pattern that is conducive to its preference for wet, low lying, protected areas. This suggests that control strategies may best follow an ecological approach, treating a regional area based on ecosystem type, or working with the prevailing winds, rather than against. It also suggests that preventative measures could be implemented that may reduce the ability of *Phragmites* to disperse into new areas. Preventative strategies may include boosting ecosystem health with native plant restorations, or reducing the occurrence of shoreline disturbances from ATVs or shoreline alterations, and stopping all unadvised mowing or cutting of native vegetation.

Summary of Recommendations

- Refer to the BMPs for small, localized stands. Contact the Coastal Centre for more information and advice regarding specific restrictions that apply to certain coastal ecosystems.
- Consider a regional, partnership approach for areas where large, continuous stretches of shoreline are impacted, especially where large stands cross political boundaries.
- Early detection, followed by early management is the best way to control this aggressive invasive species in coastal environments. In places where this report identifies many small, isolated patches, it is highly recommended they be subjected to a regional control plan before they become huge infestations that are costly to control.
- Include public education and outreach initiatives when drafting and implementing new control and management strategies.
- Work to reduce the impacts of ATVs, discharge pipes, and landscaping practices that create disturbances which contribute to the spread of invasive *Phragmites*.

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APPENDIX

WAYPOINTS & PHOTOGRAPHS

Municipality of Sarnia

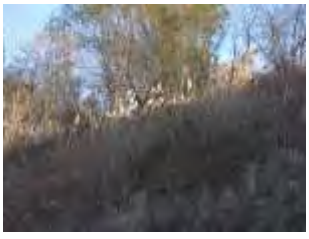
Canterra Park General Observation G1 – G5 Canterra Park pond is surrounded by well established *Phragmites*. The pond is about 500 m from the coast and is separated from the lake by a parking lot, and what is left of the natural dunes.	  West East
Old Lakeshore Road Lambton 27 One small patch of *Phragmites* is growing at the top of a steep bluff. Old Lakeshore Road runs between the top of the bluff and the backyard property lines. Someone has mowed the vegetation between the road and bluff, and dumped, what looks like potting soil, in the area.	 North West
Mike Weir Park Lambton 28 One patch of *Phragmites* is established at Mike Weir Park at the top of the bluff, surrounded by poplars and dogwoods. The bluff has a gentle slope to a sandy beach. The park is mowed up to this stand of vegetation.	 North West

Township of Plympton-Wyoming

Lambton 29 *Phragmites* is established in sand at the bottom of the bluff, between two break walls jutting out in to the lake.	 West
Lambton 30 *Phragmites* is established at the bottom of the small gully in the bluff. The path of flowing water down the bluff is obvious; water would likely pool where the *Phragmites* is growing.	 South West
Lambton 31 *Phragmites* is established in the sand at the bottom of a staircase.	 South  South
Lambton 37 Established in a long patch that starts at a discharge stream and continues west.	 South  South West
Lambton 36 Established on the bluff, a four-wheeler track runs along the bottom of the bluff between the *Phragmites* and the sandy beach.	 South  South
Lambton 35 Established at bottom of the bluff in front of a break wall, and between two groynes.	 South West

Lambton 34 One large patch growing across the bluff from the tree line at the top of the bluff, to the sand.	 South East
Lambton 33 Established as two distinct patches, growing on each side of a staircase and footpath. Area is cluttered with debris.	  South South East
Lambton 32 Established at the bottom of a well-vegetated bluff.	 South East
CJ McEwen Conservation Area Lambton 38 & G6 *Phragmites* has established on both banks of the river, and wraps around the river mouth on to the beach.	 North East
CJ McEwan Conservation Area Lambton 39 Linear patch at base of bluff beside road access to the beach. The bluff is covered in trees, but littered with garbage	 North East
Lambton 40 *Phragmites* has established on the bluff, from the beach all the way to the top. It is growing alongside an obvious footpath which becomes stairs near the top of the bluff.	  East North East

Lambton 50 *Phragmites* is established at the mouth of a creek, water flows in to the lake.	 East
Lambton 49 Established at the bottom of a staircase. Black discharge pipe runs parallel to staircase.	  South East
Lambton 48 *Phragmites* is established at the bottom of a black discharge pipe. A tiny pool of water accumulates at the mouth of the pipe. *Phragmites* spreads down the base of the bluff from this pipe.	 East
Lambton 47 Long, dense patch has established at the bottom of a staircase and along the base of a very steep bluff.	  East South East
Lambton 46 Established at the bottom of a gully where someone has poured cement armour walls, built a pump house that discharges water from a pipe. *Phragmites* grows down the beach against the bottom of the bluff, from the pump house.	  East South East
Lambton 44 Established at the base of the bluff, is heavily wind-blown, sand is quite wet.	  East South East

Lambton 43 Large patch has established at the mouth of a gully.	  East North East
Lambton 42 About 30 shoots have established along a stream that flows off the bottom of a stone footpath that follows the slope of the bluff. Allows access to the beach from the subdivision above.	 East
Lambton 41 *Phragmites* has established along the banks of a trickling stream that flows down the bluff to the beach.	  East North
Lambton 52 Established high up on the bluff.	 South
Lambton 53 Two patches about 10m apart are established near the bottom of the bluff. A significant vertical drop between the topsoil and the sand exists where a black pipe emerges.	 South East

Lambton 51 Established at the foot of a staircase. Several boulder sized rocks look to have been placed at the foot of the stairs to reinforce the bluff. An old shed and boat lay among the *Phragmites*.	 East
High Glen Conservation Area Lambton 54 Small patch has established amoung sumac and dogwoods at the top of the bluff just beyond the parking area. The patch is the right of the boat launch.	 North East
Lambton 56 Established at the base of the bluff, expanding out on to the beach.	 North East
Lambton 55 Establishing on the beach near the bottom of the bluff.	 East
Fisher Beach Lambton 57 Well-established on both banks of a high flow stream that reaches the lake.	 South East
Lambton 12 Established on the east banks of Hickory Creek.	 East

Lambton 13 Established beside flowing stream that connects to the lake. Small fish can be seen swimming in the water. The patch is dominating the west bank and extends down the beach on this side of the stream.	  South South West
Lambton 14 Long thin patch, denser at the ends, growing at the base of the bluff in the sand. Seawall runs along the base of the bluff at the east end of this patch.	 South West
Lambton 15 ~200 shoots established on top of a seawall in front of a row of cedars. Poplars are growing in the sand at the base of this seawall.	 South East
Lambton 16 Beach narrows beyond a rocky point and becomes cobble with a thick strand line. *Phragmites* is established between the bluff and the strand line, as a linear patch that runs along the bottom of the bluff.	 North East
Lambton 17 Sparse amoung a cluster of poplars and dogwoods.	 North East
Lambton 18 Spread out in tiny clusters at the base of the bluff near a tiny stream of flowing water that is running off the bluff and carving a trench in the beach.	  South East East

Lambton 19 Established on both banks of a flowing stream	 South East
Lambton 20 Established among vegetation on the bluff, ash and willow spp.	 South East
Lambton 21 Established on both banks of a flowing stream.	 South East
Lambton 22 Established along the bottom of the bluff, divided by 4-wheeler tracks that run along the beach. The *Phragmites* is denser along the shoreline.	 South West  South West
Lambton 23 Established in a linear formation from the bottom of the bluff out to the tip of a cobble point.	 West  West
Lambton 24 Established on both banks of a stream that runs off the bluff and forms a trench in the sand. Lots of garbage and debris is littering the area.	 South East

Lambton 25 Established on both banks of a very straight, 1.5m wide stream/trench carrying water from the bluff to the lake. It extends west as far as can be seen, and east as far as, what looks like Kettle Point.	 West  South East
Looking east from Lambton 25 toward Kettle Point General Observations G7-G10	 East  North  North  East (from Proof Line)
Kettle Point G11 – G13 The entire coastal wetland at Kettle Point is monoculture *Phragmites*.	 South  South  North  North
Lambton 11 Large established patch is growing between a compacted road and the backyards that line the beach.	 South West

Lambton 10 Established in two patches. One within the backyard of a house, and the other on the shoreline. The well-established road runs between the two.	 North  South West
Lambton 9 About 35 shoots growing amoung marram grasses on the beach.	 East
Lambton 8 Sparsely established amoung native dune grasses on the beach.	 East  West
Lambton 7 Established in a small patch around a snow fence, and on top of a mound of sand.	 South
Lambton 5 Establishing among native dune grasses on the beach.	 East
Port Franks (G20) Taken from corner of Outer Drive & Edward St.	 South East

Port Franks (G27 and G26) Outer Drive Bridge	 East  West
Port Franks (G31) Mouth of the Ausable River	 North West
Lambton 4 *Phragmites* is covering the entire wetland as far as the eye can see.	 West  North West  South
Port Franks (G32, G33, G34) From the Erie St. Docks Banks of Ausable River and Mosquito Island	 North East  North
Lambton 3 *Phragmites* is well-established in all the low-lying wet areas of the creek and river.	 West

Lambton 2 *Phragmites* is established all along the banks of the Ausable River.	 North
Lambton 1 One patch of *Phragmites* is established in the harbour at Grand Bend.	 North West
Stoney Point First Nations General Observations G46 to G61 *Phragmites* has established in the ditches and wetlands along the roads throughout Stoney Point. The worst and densest stands occur at the Point, and continues east all the way to the fence at Port Franks.	 East  South from point  North
G46 and G47 Established along the fore dunes and in the wet riparian vegetation along the mouth of the creek	 North toward dunes  North toward creek
G48 Establishing between the water and the campgrounds.	 South West

G49 Low density, growing in the wet swales between the foredune and the backdune	  North North East
G50 Dense and extensive from Stoney Point to the boundaries of Port Franks.	  South North East   North East North
G51 Several shoots visible by binoculars from the fence at Port Franks. *Phragmites* is just establishing on the beach.	 North East
G52 – G56 Establishing in patches across the inland ponds.	  North (G52) North East (G56)  North (G55)

Municipality of Bluewater

Huron 32 One small circular patch is growing at the base of the bluff. Hendrick St. Bisects a farm field that is ploughed to the edge of the bluff.	 North West
Huron 31 Small stand growing in the sand beside red osier dogwoods at the bottom of the bluff near a flight of stairs.	 North
Huron 27 Large and tall stand established at the mouth of a large metal pipe that runs down the bluff.	  West South East
Huron 28 Beginning to establish at the mouth of a black pipe that runs down the bluff, parallel to a staircase.	 West
Huron 29 Established on the south banks of a stream.	 South East

Huron 26 Several shoots are establishing on the bluff.	 North West
Huron 25 Established on the bluff above a gabion basket armour wall.	  North West North West
Huron 30 Established on the north banks of a stream.	 West
Huron 24 Established on the north banks of a stream.	 West
Huron 23 About 100 shoots have established across a large area on the beach.	 West
Huron 22 Large patch has established at the bottom of a gully.	 West

Huron 21 Established on the south banks of a stream.	 West
Huron 20 Established by a very small stream flowing out of a culvert and armour wall.	 West
Huron 19 Established in a stream flowing out of tiny pipe that pokes out of an armour wall.	 West
Huron 18 Small patch established on the bluff above a patch of black locust trees.	 West

Huron 17 Growing on the north banks of a stream.	 West
Huron 16 Growing on banks the north banks of a stream. There are armour walls built up on both banks from a culvert at the base of the bluff.	  West South
Huron 15 Established on the north banks of a stream.	  South West
Huron 12 Established on the south coast of Black's Point in varying densities. There is one dense patch on the southern shores, growing at the water line.	  South South East  South

Huron 13 Linear stand is growing in the low lying wet areas that carry water from the bluff to the lake.	 South
Huron 14 Walking north from Black's Point, one small stand of *Phragmites* is establishing on the beach at the base of the bluff.	 South
Private Property Huron 48 Growing around the edge of a pond.	 South
Private Property Huron 49 Established across a large meadow area that holds a significant amount of standing water during the wet season.	 South
Private Property Huron 50 Established along the banks and all over an island in the middle of a natural pond.	 North

Rotary Beach Huron 40 Established between the parking lot at Rotary Beach and the bluff.	 West
Cove Road Huron 39 Established inside the Goderich Water Treatment Plant compound.	 North East
North Harbour Road Huron 41 Established in the ditch beside the railroad tracks along North Harbour Road.	 West

Huron 42 Established at the bottom of the bluff, growing amoung willow shrubs and poplar trees.	 South East
Huron 47 Very tiny patch	No picture
Huron 43 Established several meters up the bluff.	 East
Huron 44 Established on remnant dunes occurring between the bluffs and the beach.	 East
Huron 45 Very sparse and spread out, across the beach	No picture
Huron 46 Establishing along the cobble shoreline.	 East

Point Farms Provincial Park Huron 33 Small stand growing beside a stream.	 North
Point Farms Provincial Park Huron 34 Spread out across a patch of Marram grass.	 North
Point Farms Provincial Park Huron 35 Looks like it is all standing dead.	No picture
Zion Road Huron 36 Growing at the mouth of Boyd Creek; and establishing in the riparian vegetation on the north banks of the creek.	  East East
Amberley Beach Huron 37 Established at the mouth of a culvert.	 North West
Amberley Beach Huron 38 Thick stand is growing on the shoreline; is expanding to the south on the beach.	 West

Township of Huron-Kinloss

Huron 51 North of Amberley Townline, established along the coast in patches.	  South West North West
Huron 52 Established on a tiny island not far from the mainland and along the undulating coast.	  North West South West
Point Clark Lighthouse Bruce 10 Extensive along the southern shores of the Point.	  East South East
Bruce 11 Small stand occurring within the dune vegetation.	 North East
Lurgan Beach Bruce 13 Established all along the beach among the native dune vegetation.	  North East South East

Concession 6 Bruce 14 Sparse and short, dry and brittle across beach.	 North
Bruce 18 Small stand growing in the ditch along the west side of Boiler Beach Road.	No picture
Bruce 17 Established along the entire shoreline. Some areas are thicker than others.	 North East
Bruce 16 Nearly adjacent to Bruce 17, this stand is growing on the cobble shoreline.	 South West
Kennedy Rd and Boiler Beach Road Bruce 15 *Phragmites* shoots appear all along the shoreline, short and sparse.	 South

Municipality of Kincardine

South of Saratoga Road to Goderich St. Bruce 36 & Bruce 37 Marking the beginning of the extensive stand of *Phragmites* that is established all along the shores of Boiler Beach. Density decreases at the southern end.	  North South West  North
Bruce 38 Established along the cobble shoreline along Saugeen St.	 North West
Bruce 39 Tiny stand established beside a small stream.	 West
Bruce 40 Extensive stands occurring along the shoreline. This part of the beach is adjacent to the Kincardine Golf Course properties.	  South North
Bruce 41 One tiny stand near the shoreline.	No picture

Bruce 42 & 43 Established in low density across a large area.	 North West
Bruce 44 Close to Bruce 42, could be one large stand with a higher density here.	 North East
Bruce 45 Established along the beach. Two poplars emerge from the stand.	 East
Sandpiper Point Bruce 46 *Phragmites* is covering the entire point at the end of Concession 5. The southern shores of this point is lined with cobble, Phragmites is doing well here, and growing as short, seedless stalks across the point.	 West
Bruce 47 Established on the beach at the bottom of a very short bluff/ vegetated slope.	 West

Bruce 48 Established on both sides of a small stream flowing from the bluff to the lake.	 West
Bruce 49 Tall shoots along the cobble shoreline, spreads out across the area as short shoots with low density.	 South
Bruce 50 & 51 & 52 (Joined due to proximity) Growing along the shoreline in the wet sand and cobble. Density changes across the stand.	 West
Bruce 53 – 58 Stands are periodic along the shoreline at the end of Concession 7. Large stands can be seen out at the waterline, growing in cobble and sand, travelling north and south of Concession 7	  South West North West   South West North West
Bruce 59 Public walkway from Kin-Huron Road takes you along a path behind the houses. Climb down the short bluff to a narrow beach. One patch of *Phragmites* is growing at the mouth of a culvert	No picture

Lorne Beach
Bruce 60 – 63 and G35, G43, G44

All along the shoreline of Lorne Beach *Phragmites* is established in the wet cobble/sand

Looking south shows Bruce 59, looking north shows Bruce 60 – 63, and a general observation showing *Phragmites* occurs down all the way down the shoreline as far as can be seen.


South


South West


North (zoomed)


North (zoomed)


North


North (zoomed)


North (zoomed)

Bruce 66

South of Inverhuron Provincial Park, at the end of Bruce Road 15. *Phragmites* is established in patches along the coast.


South

Inverhuron
005

Low density, growing along the cobble shore.


East


North East

Inverhuron 006 *Phragmites* patches shoot up as small patches across the entire wet meadow shoreline. Rushes, sedges, dogwoods, native grasses occur across the area. Standing pools of water are spread out across the area.	 West  North West  North  West
Inverhuron 007 Small stand growing in cobble substrate near to the water.	 North
Inverhuron 008 Thick stand is established on the cobble shoreline.	 North  West

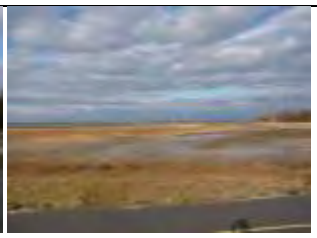
Inverhuron General Observation (G42) Looking north from waypoint 008, *Phragmites* is established along the shoreline of Inverhuron Provincial Park and the southern shores of the Bruce Power Plant property.	 North (zoomed)  North (zoomed)  North (zoomed)
Baie du Dore Bruce 67 *Phragmites* is established along the shoreline and across the coastal wetland.	 West  North West  South  South (zoomed)
Bruce 68 *Phragmites* is established along the coast at the end of Scot's Point Drive.	 West  North West  South West

G36 Continuous stand, observed by car, from Sunset Drive all the way to Concession 12.	 South West  West  West  North West  North West  Slight North West
Bruce 69 Just before Concession 12, Brucedale Conservation Area – is covered in *Phragmites*.	 West  North West
G37 From Concession 12 all the way north along Sunset Drive – solid *Phragmites*.	 West  South West

MacGregor Point Provincial Park (MacGregor 1 – 11) Bruce 85 Estimates of the infestation along the coast within the park was obtained from Parks Staff, one site was visited, Bruce 85.	No pictures
Bruce 84 At the end of Smith Line is a culvert and ditch system, built to collect rain water from the residential lots. *Phragmites* is established in the low wet areas around the culvert and out on the point along the shoreline.	 East  North East  North  North  West  North West  West (zoomed to shore)

Bruce 83 Established out at the shoreline, low densities, and no seeds.	 North
Edits Grove (G38) *Phragmites* is spreading across the entire beach front area at Edits Grove.	 South West  North  North West  North East
Bruce 82 About 50 shoots are growing off the road, water collects in the ditch, with cattails and goldenrods and flows to the water	 North
Bruce 81 Established throughout the area in patches.	 South East

Bruce 80 Small stand growing beside parking lot at the end of Bruce Rd 25.	 North East
Bruce 79 Two small patches by a stream	No picture
Bruce 78 Establishing in the coastal wetlands	 West
Miramichi Bay (General Observations - MiraBay) *Phragmites* is well established beside the culvert that comes from under the road, and spreads out in the wetlands. It is densest along the road and culvert, and thins are it spreads in to the centre of the bay.	  East North   North East West

Horseshoe Bay (General Observation - HorseBay) *Phragmites* is establishing within the wetlands as small patches located throughout the bay.	 North  West  South
Bruce 77 End of South Street. *Phragmites* is growing in the wet areas along the beach.	 West
Bruce 76 Growing in low lying wet area on the beach.	 West
Bruce 71 Two small stands along the berm (concrete blocks with some vegetation).	 South West
Bruce 72 Stemming from the concrete boulders that run between the road and the water.	 North

Bruce 73 Sparse *Phragmites*, shoots are popping up in the cobble shoreline.	 West
Bruce 74 Growing in low density along the shore.	 North
Bruce 75 Low density, stand growing out along shoreline.	 North

Town of South Bruce Peninsula

Bruce 19 Growing in the east ditch of Sauble Falls Parkway.	 North
Bruce 20 Growing in the south ditch of Spring Creek Road.	 East
Bruce 21 Stand is growing on north Sauble Beach. Location of the 2008 pilot project at Sauble Beach; injection plot. Some shoots are growing in a drainage ditch, while the rest grows on the sandy beach.	  West West
G39 Sauble Beach *Phragmites* continues all the way up to Chiefs Point, from Bruce 21. South of the Sauble River, identified as Piping Plover stations in 2008; handwick sites.	 North
Oliphant Bruce 35 Coastal meadow marshes at Oliphant have become monoculture, high density *Phragmites*.	  North West

Oliphant Bruce 34 North of Bruce 35, density decreases, but the monoculture *Phragmites* is still covering the entire coastal area.	  West North West
Oliphant Bruce 33 *Phragmites* occurs in 3 distinct patches across the northern parts of the coastal meadow marshes at Oliphant.	 North
Bruce 23 Growing in the south ditch along Bruce Road 13. Ditch (1cm of water)	 East
Bruce 24 Growing in north ditch of Spry Lake Road. Ditch (10cm water)	 West
Bruce 25 Wiarton marsh meadows. Sprayed 2011. One large stand, density decreases in the centre.	  North West
Bruce 26 Growing in east ditch of Bryant St. Ditch (no standing water)	 North

Bruce 27 Growing in east ditch along Bryant St. Extends east onto MNR property (Map layer says Conservation Authority property, Municipal Staff said MNR property).	 North
Bruce 28 Growing in east ditch along Bryant Street, north of Bruce 27. Still MNR property.	 North East
Bruce 29 Growing in east ditch of Bryant Street, north of Bruce 28. Still MNR property.	 North
Bruce 30 Small patch growing in the west ditch along Bryant St.	no picture
Bruce 31 Growing in the ditch along Bryant Street. Ditch (6cm of water)	 North
Bruce 32 Growing in the ditch at corner of Bryant Street and Hemlock Road.	 North
085 Growing in the ditch along Huron Road.	 North

084 Growing far out in the Sky Lake marshes.	 North
087 Red Bay Park. Two patches occurring along the shoreline. One at the docks, the other along the shoreline. Water: shoreline	 South
086 Growing along the shoreline at the end of Dock Rd. In a pile of wooden planks with rusty nails, cement chunks, and wire fences.	 South East
083 Three stands of *Phragmites* in the ditch of Bruce Rd. 9	 North  East  South

Bruce 86 Growing in the south ditch along Whiskey Harbour Road.	 North East
060 Tall stand of *Phragmites* established at the mouth of a creek and along the shoreline.	  South South West   South (zoomed) South(beside stand)
061 Stand of *Phragmites* is established at the mouth of a stream.	  Slightly South West West
062 Growing in a deep the east ditch along Stokes Bay Road.	 East

063 Growing along Hardwick Cove Road. Looks like an area used for dumping or turning around large vehicles. Shoots are very thick (>2cm diameter)	 North  North (panned slightly)
064 Small stand of *Phragmites* growing at the shoreline	 West (zoomed)  West
General Observation 40 (G40) Large stand of *Phragmites* was identified using binoculars. Stand is growing on the shoreline of Garden Island in Stokes Bay.	 West (zoomed)  West
General Observation 41 (G41) Stand was observed from the parking lot of Stokes Bay Park. Driveway and parking lot mowed. The area is a wet coastal marsh; P*hragmites* is established at the water's edge.	 West  West (zoomed)
067 Established on the north shores of Tamarac Island.	 South East

066 Established in a coastal marsh off of Government Dock Road. Only a few shoots have seed heads.	 West
065 Established around large cobble at the shoreline off of Government Dock Road, near the fishing docks.	 West
068 Dense stand growing at the water's edge off of Gauley's Bay Road. Tiny stream flows from the road to the lake a few meters north of the stand.	 South (zoomed)  East
069 Growing by the boat launch on Gauley's Bay Road.	 South
070 Establishing along Gauley's Bay Road in wet meadow marsh near a line of cedars and spruces	 South East
071 Handful of shoots occurring in the ditch on Gauley's Bay Road.	 North

072 Growing in the north ditch of Stokes River Road.	  South West
081 Growing in the west ditch of HWY 6	 North West
080 Growing in the ditch along HWY 6	 South West
079 Growing in the north ditch of Lindsay Road 20 beside a driveway entrance.	 North East
078 Establishing in the ditches and in the meadow areas of the radio tower.	  South
077 Laneway 6046 off of Highway 6. Three storage sheds and a paved parking lot are surrounded by.	  North East East

076 Johnston's Harbour is buffered by coastal wetlands and marshes. Someone has built a footbridge over to the island. *Phragmites* is establishing within the various native grasses and rushes.	 East  East (zoomed)  West (zoomed)
075 Singing Sands National Park, a part of Bruce Peninsula National Park/ Dorcus Bay ANSI	 West
074 Singing Sands National Park, a part of Bruce Peninsula National Park / Dorcus Bay ANSI	 North
073 Singing Sands National Park, a part of Bruce Peninsula National Park/ Dorcus Bay ANSI	 East

WAYPOINTS AND DATA

County	Municipality	Northing	Easting	Access Point	Waypoint	Height (m)	Height (m)	Height (m)	Avg. Heigh	Stnd. Dev	Seed Heads	Density	Area (m^2)	Location
Lambton	Mun. Of Sarnia	general observation		Canterra Park	G1	NOT MEASURED					MED	NO PLOTS	9588	pond
Lambton	Mun. Of Sarnia	general observation		Canterra Park	G2	NOT MEASURED					MED	NO PLOTS	2224	pond
Lambton	Mun. Of Sarnia	general observation		Canterra Park	G3	NOT MEASURED					MED	NO PLOTS	662	pond
Lambton	Mun. Of Sarnia	general observation		Canterra Park	G4	NOT MEASURED					MED	NO PLOTS	539	pond
Lambton	Mun. Of Sarnia	general observation		Canterra Park	G5	NOT MEASURED					MED	NO PLOTS	5369	pond
Lambton	Mun. Of Sarnia	4764712	394740	Old Lakeshore Road	Lambton 27	1.77	1.77	1.77	1.77	0.00	SM	1	5	top of bluff
Lambton	Mun. Of Sarnia	4764893	395873	Mike Weir Park	Lambton 28	1.77	1.54	1.62	1.64	0.12	MED	2	15	top of bluff
Lambton	Plymton-Wyoming	4766392	401505	Devonshire Road	Lambton 29	1.94	2.00	2.35	2.10	0.22	MED	1	40	bottom of bluff
Lambton	Plymton-Wyoming	4767558	403904	Windcliff Lane	Lambton 30	3.33	3.10	3.00	3.14	0.17	LRG	7	20	gully
Lambton	Plymton-Wyoming	4767569	403946	Windcliff Lane	Lambton 31	0.96	2.00	2.42	1.79	0.75	MED	2	40	bottom of bluff
Lambton	Plymton-Wyoming	4767977	404578	Boonie Doon	Lambton 37	2.57	2.25	2.00	2.27	0.29	LRG	7	1000	stream
Lambton	Plymton-Wyoming	4768071	404732	Boonie Doon	Lambton 36	2.62	2.62	2.62	2.62	0.00	MED	6	500	bluff
Lambton	Plymton-Wyoming	4768224	404893	Boonie Doon	Lambton 35	2.00	2.30	2.36	2.22	0.19	LRG	2	20	bottom of bluff
Lambton	Plymton-Wyoming	4768263	404951	Boonie Doon	Lambton 34	2.52	2.00	2.00	2.17	0.30	LRG	6	200	bottom of bluff
Lambton	Plymton-Wyoming	4768292	404993	Boonie Doon	Lambton 33	2.10	2.72	1.34	2.05	0.69	MED	3	35	bottom of bluff
Lambton	Plymton-Wyoming	4768518	405249	Boonie Doon	Lambton 32	2.10	2.50	2.30	2.30	0.20	MED	1	30	bottom of bluff
Lambton	Plymton-Wyoming	4768694	405460	CJ McEwen Conservation Area	Lambton 38	2.60	2.52	2.48	2.53	0.06	MED	7	300	river
Lambton	Plymton-Wyoming	general observation		CJ McEwen Conservation Area	G6	2.60	2.52	2.48	2.53	0.06	MED	7	30	river
Lambton	Plymton-Wyoming	4768950	405737	CJ McEwen Conservation Area	Lambton 39	1.90	1.96	1.84	1.90	0.06	SM	2	75	bluff
Lambton	Plymton-Wyoming	4769290	406062	CJ McEwen Conservation Area	Lambton 40	3.00	2.30	3.17	2.82	0.46	MED	8	250	bluff
Lambton	Plymton-Wyoming	4770164	406493	Cullen Road	Lambton 50	3.62	3.18	2.82	3.21	0.40	MED	8	75	stream
Lambton	Plymton-Wyoming	4770219	406504	Cullen Road	Lambton 49	3.39	2.40	3.42	3.07	0.58	LRG	7	15	pipe
Lambton	Plymton-Wyoming	4770356	406528	Cullen Road	Lambton 48	2.00	2.39	2.39	2.26	0.23	MED	4	75	pipe
Lambton	Plymton-Wyoming	4770553	406460	Cullen Road	Lambton 47	3.85	3.72	3.16	3.58	0.37	MED	8	1000	bottom of bluff
Lambton	Plymton-Wyoming	4770738	406382	Cullen Road	Lambton 46	2.44	2.10	2.13	2.22	0.19	LRG	7	190	pipe
Lambton	Plymton-Wyoming	4770893	406359	Cullen Road	Lambton 45	1.81	1.63	3.02	2.15	0.76	MED	4	600	bottom of bluff
Lambton	Plymton-Wyoming	4770996	406373	Cullen Road	Lambton 44	1.77	2.78	1.51	2.02	0.67	MED	2	40	bottom of bluff
Lambton	Plymton-Wyoming	4771070	406378	Cullen Road	Lambton 43	3.33	2.50	2.81	2.88	0.42	MED	5	350	gully
Lambton	Plymton-Wyoming	4771252	406394	Cullen Road	Lambton 42	2.00	2.16	1.92	2.03	0.12	NONE	0	1	bluff
Lambton	Plymton-Wyoming	4771347	406392	Cullen Road	Lambton 41	2.57	1.66	3.06	2.43	0.71	LRG	8	150	stream
Lambton	Plymton-Wyoming	4771788	406563	Cullen Road	Lambton 52	NOT MEASURED					SM	3	10	bluff
Lambton	Plymton-Wyoming	4771787	406632	Cullen Road	Lambton 51	2.78	2.68	1.98	2.48	0.44	SM	3	60	bottom of bluff
Lambton	Plymton-Wyoming	4771836	406945	Cullen Road	Lambton 53	NOT MEASURED					SM	4	100	pipe
Lambton	Plymton-Wyoming	4772480	408778	High Glen Conservation Area	Lambton 54	2.59	2.56	2.78	2.64	0.12	MED	2	4	top of bluff
Lambton	Plymton-Wyoming	4773271	410171	Lakeside Street	Lambton 56	2.89	1.96	2.91	2.59	0.54	MED	5	5	bottom of bluff
Lambton	Plymton-Wyoming	4773426	410362	Lakeside Street	Lambton 55	0.95	0.92	1.10	0.99	0.10	SM	0	125	beach
Lambton	Plymton-Wyoming	4773737	410739	Fisher Beach	Lambton 57	3.67	3.56	2.85	3.36	0.45	MED	7	40	stream
Lambton	Plymton-Wyoming	4774383	411389	Hillsboro Beach North	Lambton 12	1.58	1.00	0.96	1.18	0.35	MED	4	200	stream
Lambton	Lambton Shores	4774606	411588	Hillsboro Beach North	Lambton 13	3.00	3.15	3.11	3.09	0.08	LRG	7	35	stream
Lambton	Lambton Shores	4774676	411672	Hillsboro Beach North	Lambton 14	1.58	2.29	1.55	1.81	0.42	MED	2	1000	bottom of bluff

County	Municipality	Northing	Easting	Access Point	Waypoint	Height (m)	Height (m)	Height (m)	Avg. Heigh	Stnd . Dev	Seed Heads	Density	Area (m^2)	Location
Lambton	Lambton Shores	4774715	411716	Hillsboro Beach North	Lambton 15	2.92	2.03	2.13	2.36	0.49	MED	0	10	bluff
Lambton	Lambton Shores	4774862	411833	Hillsboro Beach North	Lambton 16	2.00	2.37	2.00	2.12	0.21	SM	3	40	bottom of bluff
Lambton	Lambton Shores	4774901	411871	Hillsboro Beach North	Lambton 17	2.00	1.39	1.20	1.53	0.42	SM	0	10	shoreline
Lambton	Lambton Shores	4775017	412007	Hillsboro Beach North	Lambton 18	2.01	1.96	2.16	2.04	0.10	MED	0	4	bottom of bluff
Lambton	Lambton Shores	4775074	412073	Hillsboro Beach North	Lambton 19	2.69	2.88	3.00	2.86	0.16	MED	7	15	stream
Lambton	Lambton Shores	4775309	412319	Hillsboro Beach North	Lambton 20	2.00	1.56	1.96	1.84	0.24	SM	0	20	bluff
Lambton	Lambton Shores	4775427	412408	Hillsboro Beach North	Lambton 21	2.34	2.62	3.00	2.65	0.33	MED	8	40	stream
Lambton	Lambton Shores	4775466	412446	Hillsboro Beach North	Lambton 22	2.00	1.96	2.00	1.99	0.02	SM	6	30	shoreline
Lambton	Lambton Shores	4775505	412479	Hillsboro Beach North	Lambton 23	2.00	2.25	2.00	2.08	0.14	MED	5	25	shoreline
Lambton	Lambton Shores	4775602	412568	Hillsboro Beach North	Lambton 24	2.59	2.00	2.96	2.52	0.48	MED	8	15	stream
Lambton	Lambton Shores	4775853	412781	Hillsboro Beach North	Lambton 25	1.52	2.00	2.13	1.88	0.32	LRG	8	4270	stream
Lambton	Lambton Shores	general observation		Hillsboro Beach North	G7	NOT MEASURED						NO PLOTS	2964	shoreline
Lambton	Lambton Shores	general observation		Hillsboro Beach North	G8	NOT MEASURED						NO PLOTS	5261	shoreline
Lambton	Lambton Shores	general observation		Hillsboro Beach North	G9	NOT MEASURED						NO PLOTS	7207	shoreline
Lambton	Lambton Shores	general observation		Hillsboro Beach North	G10	NOT MEASURED						NO PLOTS	14734	shoreline
Lambton	Lambton Shores	general observation		Proof Line & Kettle Point	G11	2.63	2.96	2.84	2.81	0.17	LRG	8	189229	shoreline
Lambton	Lambton Shores	general observation		Kettle Point	G12	NOT MEASURED						NO PLOTS	982	shoreline
Lambton	Lambton Shores	general observation		Kettle Point	G13	NOT MEASURED						NO PLOTS	1041	shoreline
Lambton	Lambton Shores	4784603	418344	Ipperwash Beach	Lambton 11	1.42	2.90	1.64	1.99	0.80	MED	2	400	beach
Lambton	Lambton Shores	4784448	418832	Ipperwash Beach	Lambton 10	2.70	2.10	1.90	2.23	0.42	MED	4	15	shoreline
Lambton	Lambton Shores	4784441	419088	Ipperwash Beach	Lambton 9	1.23	0.87	1.12	1.07	0.18	SM	0	4	beach
Lambton	Lambton Shores	4784447	419230	Ipperwash Beach	Lambton 8	1.47	1.61	1.79	1.62	0.16	MED	0	20	beach
Lambton	Lambton Shores	4784450	419310	Ipperwash Beach	Lambton 7	1.44	2.00	1.57	1.67	0.29	SM	0	3	beach
Lambton	Lambton Shores	4784481	419655	West Ipperwash Beach Road	Lambton 5	1.40	1.07	1.60	1.36	0.27	SM	1	10	shoreline
Lambton	Lambton Shores	general observation		End of Army Camp Road	G14	NOT MEASURED					LRG	NO PLOTS	75	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G46	NOT MEASURED						NO PLOTS	166	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G47	NOT MEASURED						NO PLOTS	838	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G48	NOT MEASURED						NO PLOTS	390	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G49	NOT MEASURED						NO PLOTS	709	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G50	NOT MEASURED						NO PLOTS	2025	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G51	NOT MEASURED						NO PLOTS	531	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G52	NOT MEASURED						NO PLOTS	406	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G53	NOT MEASURED						NO PLOTS	908	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G54	NOT MEASURED						NO PLOTS	493	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G55	NOT MEASURED						NO PLOTS	48261	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G56	NOT MEASURED						NO PLOTS	159	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G57	NOT MEASURED						NO PLOTS	13697	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G58	NOT MEASURED						NO PLOTS	11254	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G59	NOT MEASURED						NO PLOTS	38824	shoreline
Lambton	Lambton Shores	general observation		Stoney Point	G60	NOT MEASURED						NO PLOTS	391	shoreline

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Lambton	Lambton Shores	general observation		Stoney Point	G61	NOT MEASURED						NO PLOTS	903	shoreline
Lambton	Lambton Shores	4786954	428346	Port Franks -Dune Road	Lambton 3	3.39	3.44	3.62	3.48	0.12	LRG	5	69489	river
Lambton	Lambton Shores	4786925	426219	Port Franks - Wedd Road	Lambton 4	2.52	3.72	3.18	3.14	0.60	LRG	8	12922	river
Lambton	Lambton Shores	general observation		Port Franks	G15	NOT MEASURED						NO PLOTS	853	pond
Lambton	Lambton Shores	general observation		Port Franks	G16	NOT MEASURED						NO PLOTS	277	ditch
Lambton	Lambton Shores	general observation		Port Franks	G17	NOT MEASURED						NO PLOTS	325	ditch
Lambton	Lambton Shores	general observation		Port Franks	G18	NOT MEASURED						NO PLOTS	1931	ditch
Lambton	Lambton Shores	general observation		Port Franks	G19	NOT MEASURED						NO PLOTS	1284	ditch
Lambton	Lambton Shores	general observation		Port Franks	G20	NOT MEASURED						NO PLOTS	2526	pond
Lambton	Lambton Shores	general observation		Port Franks	G21	NOT MEASURED						NO PLOTS	15314	pond
Lambton	Lambton Shores	general observation		Port Franks	G22	NOT MEASURED						NO PLOTS	16174	river
Lambton	Lambton Shores	general observation		Port Franks	G23	NOT MEASURED						NO PLOTS	16397	river
Lambton	Lambton Shores	general observation		Port Franks	G24	NOT MEASURED						NO PLOTS	8797	river
Lambton	Lambton Shores	general observation		Port Franks	G25	NOT MEASURED						NO PLOTS	1520	river
Lambton	Lambton Shores	general observation		Port Franks	G26	NOT MEASURED						NO PLOTS	1576	river
Lambton	Lambton Shores	general observation		Port Franks	G27	NOT MEASURED						NO PLOTS	11034	river
Lambton	Lambton Shores	general observation		Port Franks	G28	NOT MEASURED						NO PLOTS	579	river
Lambton	Lambton Shores	general observation		Port Franks	G29	NOT MEASURED						NO PLOTS	42075	river
Lambton	Lambton Shores	general observation		Port Franks	G30	NOT MEASURED						NO PLOTS	8855	river
Lambton	Lambton Shores	general observation		Port Franks	G45	NOT MEASURED						NO PLOTS	2385	pond
Lambton	Lambton Shores	general observation		Port Franks	G31	NOT MEASURED						NO PLOTS	28922	river
Lambton	Lambton Shores	general observation		Port Franks	G32	NOT MEASURED						NO PLOTS	4928	river
Lambton	Lambton Shores	general observation		Port Franks	G33	NOT MEASURED						NO PLOTS	53641	river
Lambton	Lambton Shores	general observation		Port Franks	G34	NOT MEASURED						NO PLOTS	66482	river
Lambton	Lambton Shores	4785912	429679	Thedford Conservation Area	Lambton 2	1.69	2.89	1.69	2.09	0.69	LRG	5	31983	river
Lambton	Lambton Shores	4795885	437828	River Road	Lambton 1	2.72	2.85	3.10	2.89	0.19	LRG	6	20	river
Huron	Bluewater	4802888	442030	Hendrick Road	Huron 32	NOT MEASURED					MED	1	30	bottom of bluff
Huron	Bluewater	4804751	442427	Sarahas Road	Huron 31	1.77	2.00	2.10	1.96	0.17	SM	0	10	bottom of bluff
Huron	Bluewater	4807837	442179	Blue Beach Road	Huron 27	3.42	3.87	3.45	3.58	0.25	MED	5	8	pipe
Huron	Bluewater	4808007	442139	Blue Beach Road	Huron 28	2.89	3.32	2.78	3.00	0.29	MED	4	7	pipe
Huron	Bluewater	4808128	442049	Blue Beach Road	Huron 29	3.40	3.49	2.92	3.27	0.31	MED	2	20	stream
Huron	Bluewater	4808736	441951	Blue Beach Road	Huron 30	3.00	3.25	2.75	3.00	0.25	LRG	3	65	stream
Huron	Bluewater	4812117	442073	Blue Beach Road	Huron 26	2.00	2.00	2.00	2.00	0.00	NONE	0	5	bluff
Huron	Bluewater	4819783	442934	Blue Beach Road	Huron 25	2.10	2.51	2.36	2.32	0.21	SM	5	45	bluff
Huron	Bluewater	4821085	442938	Paul Bunyon Road	Huron 24	3.79	3.68	3.88	3.78	0.10	MED	8	100	stream
Huron	Bluewater	4821218	442940	Paul Bunyon Road	Huron 23	NOT MEASURED					SM	0	30	beach
Huron	Bluewater	4821420	442947	Paul Bunyon Road	Huron 22	1.74	2.38	2.54	2.22	0.42	LRG	4	45	gully
Huron	Bluewater	4822913	442948	Paul Bunyon Road	Huron 21	2.89	3.45	3.55	3.30	0.36	MED	2	40	stream
Huron	Central Huron	4822919	442942	Cameron Street	Huron 20	2.70	2.85	3.00	2.85	0.15	MED	3	40	culvert
Huron	Bluewater	4823615	442976	Colina St., Heritage Trail Stairs	Huron 19	3.47	3.47	3.47	3.47	0.00	MED	4	6	culvert

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Huron	Bluewater	4824145	442917	Colina St., Heritage Trail Stairs	Huron 18	1.50	1.30	1.13	1.31	0.19	SM	1	10	bluff
Huron	Central Huron	4835947	441714	Union Road, walk south	Huron 17	3.78	4.00	4.05	3.94	0.14	MED	8	30	stream
Huron	Central Huron	4836544	436544	Union Road-Bottom of Stairs	Huron 16	2.64	2.64	2.64	2.64	0.00	SM	8	20	culvert
Huron	Central Huron	4836691	441705	Union Road	Huron 15	3.77	3.90	3.18	3.62	0.38	LRG	7	40	stream
Huron	Central Huron	4838488	441280	Blacks Point South	Huron 12	2.68	2.68	2.68	2.68	0.00	MED	2	390	shoreline
Huron	Central Huron	4838650	441341	Blacks Point	Huron 13	2.65	2.65	2.65	2.65	0.00	SM	0	65	shoreline
Huron	Central Huron	4838804	441435	Blacks Point North	Huron 14	1.53	1.53	1.53	1.53	0.00	MED	0	20	beach
Huron	Mun. Of Goderich	4840843	443776	Chan Property	Huron 48	2.38	2.76	2.40	2.51	0.21	SM	5	55	pond
Huron	Mun. Of Goderich	4840756	443760	Chan Property	Huron 49	3.10	3.15	3.25	3.17	0.08	MED	5	888	pond
Huron	Mun. Of Goderich	4840864	443634	Chan Property	Huron 50	3.87	3.92	3.90	3.90	0.03	LRG	6	1010	pond
Huron	Mun. Of Goderich	4842462	441649	Rotary Beach	Huron 40	3.00	3.00	3.00	3.00	0.00	MED	2	15	bottom of bluff
Huron	Mun. Of Goderich	4841243	441899	Cove Road	Huron 39	2.00	2.50	3.00	2.50	0.50	MED	4	1130	n/a
Huron	Mun. Of Goderich	4843974	442270	North Harbour Road	Huron 41	2.40	2.60	2.50	2.50	0.10	SM	3	20	ditch
Huron	Ashfield-Colborne-Wawanosh	4845221	441832	Airport Road	Huron 42	2.10	2.45	2.35	2.30	0.18	SM	1	20	beach
Huron	Ashfield-Colborne-Wawanosh	4845263	441827	Airport Road	Huron 47	0.50	1.00	1.50	1.00	0.50	SM	0	2	bluff
Huron	Ashfield-Colborne-Wawanosh	4845492	441855	Airport Road	Huron 43	3.50	3.50	3.40	3.47	0.06	LRG	6	30	bluff
Huron	Ashfield-Colborne-Wawanosh	4845591	441824	Airport Road	Huron 44	3.60	3.60	3.60	3.60	0.00	SM	4	5	beach
Huron	Ashfield-Colborne-Wawanosh	4845690	441822	Airport Road	Huron 45	1.75	2.00	1.85	1.87	0.13	SM	0	20	beach
Huron	Ashfield-Colborne-Wawanosh	4845907	441822	Airport Road	Huron 46	0.50	1.00	1.50	1.00	0.50	SM	0	3	beach
Huron	Ashfield-Colborne-Wawanosh	4850065	441585	Point Farms Gate	Huron 33	0.50	1.00	1.50	1.00	0.50	SM	1	3	stream
Huron	Ashfield-Colborne-Wawanosh	4850423	441456	Point Farms Gate	Huron 34	0.50	1.00	1.50	1.00	0.50	MED	0	105	shoreline
Huron	Ashfield-Colborne-Wawanosh	4850544	441419	Point Farms Gate	Huron 35	1.74	1.74	1.74	1.74	0.00	MED	0	32	shoreline
Huron	Ashfield-Colborne-Wawanosh	4874401	441231	Zion Road	Huron 36	0.90	2.00	3.00	1.97	1.05	MED	1	180	river
Huron	Ashfield-Colborne-Wawanosh	4877961	440330	Amberley Beach Road	Huron 37	2.50	2.75	3.00	2.75	0.25	LRG	7	10	culvert
Huron	Ashfield-Colborne-Wawanosh	4877925	440348	Amberley Beach Road	Huron 38	4.10	4.10	4.10	4.10	0.00	MED	8	10	shoreline
Huron	Ashfield-Colborne-Wawanosh	4879003	439754	Amberley Beach Road	Huron 51	NOT MEASURED					MED	3	900	shoreline
Huron	Ashfield-Colborne-Wawanosh	4879357	439545	Amberley Beach Road	Huron 52	NOT MEASURED					MED	2	80	shoreline
Bruce	Huron-Kinloss	4880193	439320	Point Clark Lighthouse	Bruce 10				3.5		MED	7	9000	shoreline
Bruce	Huron-Kinloss	4881149	439886	Point Clark Lighthouse	Bruce 11				0.5-1.45		NONE	0	5	shoreline
Bruce	Huron-Kinloss	4883010	441136	Bell Dr.	Bruce 13				<1		SM	0	2000	beach
Bruce	Huron-Kinloss	4883925	442144	Concession 6	Bruce 14				<1		NONE	1	2000	beach
Bruce	Huron-Kinloss	4887937	445809	Boiler Beach Road	Bruce 18				>2m		MED	2	44	ditch
Bruce	Huron-Kinloss	4888091	445873	Boiler Beach	Bruce 17				2.5		MED	4	20 000	shoreline
Bruce	Huron-Kinloss	4888107	445864	Creek x Beach	Bruce 16				1.76		MED	5	12	shoreline
Bruce	Huron-Kinloss	4888321	446181	Kennedy Road x Boiler Beach	Bruce 15				<1		SM	0	4000	beach
Bruce	Mun. Of Kincardine	4889958	447450	Saratoga Road * Goderich St.	Bruce 36	2.93	2.87	2.96	2.92	0.05	MED	5	20000	beach
Bruce	Mun. Of Kincardine	4890127	447689	Saratoga Road * Goderich St.	Bruce 37	2.93	2.87	2.96	2.92	0.05	MED	5	7007	beach
Bruce	Mun. Of Kincardine	4892846	448961	Saugeen Street	Bruce 38	1.74	2.22	2.81	2.26	0.54	MED	6	1300	shoreline
Bruce	Mun. Of Kincardine	4892938	449016	Saugeen St. & Kingsway	Bruce 39	1.71	1.90	1.82	1.81	0.10	SM	2	10	stream
Bruce	Mun. Of Kincardine	4893370	449039	Golf Links Road	Bruce 40	2.00	1.72	2.05	1.92	0.18	SM	6	12005	shoreline

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Bruce	Mun. Of Kincardine	4893490	449173	Golf Links Road	Bruce 41	1.10	1.76	1.28	1.38	0.34	SM	3	6	shoreline
Bruce	Mun. Of Kincardine	4893539	449213	Golf Links Road	Bruce 42	0.87	1.20	0.76	0.94	0.23	NONE	1	40	beach
Bruce	Mun. Of Kincardine	4893575	449221	Golf Links Road	Bruce 43	2.00	1.94	2.00	1.98	0.03	SM	4	303	beach
Bruce	Mun. Of Kincardine	4893721	449339	Golf Links Road	Bruce 44	1.89	1.69	1.72	1.77	0.11	SM	2	1940	beach
Bruce	Mun. Of Kincardine	4894959	450115	Concession 5	Bruce 45	2.00	1.56	2.00	1.85	0.25	MED	2	120	beach
Bruce	Mun. Of Kincardine	4895469	450283	Concession 5	Bruce 46	1.57	0.50	0.72	0.93	0.57	SM	2	9050	shoreline
Bruce	Mun. Of Kincardine	4895529	450407	Concession 5	Bruce 47	2.00	1.63	1.30	1.64	0.35	MED	3	50	beach
Bruce	Mun. Of Kincardine	4895535	450408	Concession 5	Bruce 48	1.65	1.86	1.86	1.79	0.12	MED	2	50	stream
Bruce	Mun. Of Kincardine	4896710	450946	Concession 5 - walk north	Bruce 49	1.27	0.56	1.00	0.94	0.36	SM	1	1501	shoreline
Bruce	Mun. Of Kincardine	4897127	450947	Concession 5 - walk north	Bruce 50	1.21	1.67	1.50	1.46	0.23	SM	1	595	shoreline
Bruce	Mun. Of Kincardine	4897011	450939	Concession 5 - walk north	Bruce 51	1.66	1.66	1.66	1.66	0.00	NONE	2	5	shoreline
Bruce	Mun. Of Kincardine	4896924	450998	Concession 5 - walk north	Bruce 52	1.75	2.00	1.32	1.69	0.34	SM	3	20	shoreline
Bruce	Mun. Of Kincardine	4897462	451052	Concession 7 - walk south	Bruce 53	1.25	1.10	0.70	1.02	0.28	SM	1	60	shoreline
Bruce	Mun. Of Kincardine	4897502	451059	Concession 7 - walk south	Bruce 54	1.80	1.45	1.95	1.73	0.26	MED	2	95	shoreline
Bruce	Mun. Of Kincardine	4898591	451274	Concession 7 - walk north	Bruce 55	1.55	1.45	1.48	1.49	0.05	SM	1	15	shoreline
Bruce	Mun. Of Kincardine	4898514	451273	Concession 7 - walk north	Bruce 56	1.50	1.73	1.00	1.41	0.37	NONE	1	15	shoreline
Bruce	Mun. Of Kincardine	4898040	451173	Concession 7 - walk north	Bruce 57	1.39	1.22	1.56	1.39	0.17	SM	1	200	shoreline
Bruce	Mun. Of Kincardine	4897964	451187	Concession 7 -walk north	Bruce 58	1.25	1.83	1.19	1.42	0.35	NONE	1	30	shoreline
Bruce	Mun. Of Kincardine	4898894	451327	Kin-Huron Road	Bruce 59	0.90	1.47	1.51	1.29	0.34	NONE	0	80	culvert
Bruce	Mun. Of Kincardine	4899393	451384	Lorne Beach Road	Bruce 60	1.54	1.72	1.79	1.68	0.13	SM	1	130	shoreline
Bruce	Mun. Of Kincardine	4899434	451398	Lorne Beach Road	Bruce 61	0.98	1.34	1.57	1.30	0.30	SM	2	30	shoreline
Bruce	Mun. Of Kincardine	4899492	451456	Lorne Beach Road	Bruce 62	1.85	2.50	1.85	2.07	0.38	SM	0	25	shoreline
Bruce	Mun. Of Kincardine	4899641	451510	Lorne Beach Road	Bruce 63	1.00	1.38	1.28	1.22	0.20	SM	1	12	shoreline
Bruce	Mun. Of Kincardine	4899672	451520	Lorne Beach Road	Bruce 64	1.57	1.57	1.05	1.40	0.30	SM	4	6	shoreline
Bruce	Mun. Of Kincardine	4899819	451601	Lorne Beach Road	Bruce 65	2.10	3.10	2.96	2.72	0.54	MED	5	40	shoreline
Bruce	Mun. Of Kincardine	general observation		Lorne Beach Road	G43	NOT MEASURED					NONE	NO PLOTS	6186	shoreline
Bruce	Mun. Of Kincardine	general observation		Lorne Beach Road	G44	NOT MEASURED					NONE	NO PLOTS	42477	shoreline
Bruce	Mun. Of Kincardine	general observation		Lorne Beach Road	G35	2.75	2.52	3.02	2.76	0.25	MED	6	1398	shoreline
Bruce	Mun. Of Kincardine	4903854	452746	Bruce Road 15 - South	Bruce 66	1.33	2.00	1.95	1.76	0.37	LRG	3	560	shoreline
Bruce	Mun. Of Kincardine	4904953	452496	Inverhuron Provinical Park	005	1.55	1.30	1.00	1.28	0.28	SM	0	100	shoreline
Bruce	Mun. Of Kincardine	4904970	451723	Inverhuron Provinical Park	006	1.10	1.15	1.55	1.27	0.25	NONE	0	16794	shoreline
Bruce	Mun. Of Kincardine	4905753	452319	Inverhuron Provinical Park	007	1.27	1.30	1.10	1.22	0.11	SM	0	10	shoreline
Bruce	Mun. Of Kincardine	4905877	452371	Inverhuron Provinical Park	008	1.80	1.63	1.82	1.75	0.10	SM	6	2510	shoreline
Bruce	Mun. Of Kincardine	general observation		Bruce Power Plant	G42	NOT MEASURED					MED	NO PLOTS	9955	shoreline
Bruce	Mun. Of Kincardine	4909255	455639	Baie Du Dore	Bruce 67	2.82	3.00	3.10	2.97	0.14	LRG	7	922748	shoreline
Bruce	Mun. Of Kincardine	4911448	456007	Scots Point Road	Bruce 68	2.00	2.36	2.71	2.36	0.36	LRG	6	63785	shoreline
Bruce	Mun. Of Kincardine	general observation		Sunset Dr.	G36	NOT MEASURED						NO PLOTS	302388	shoreline
Bruce	Mun. Of Kincardine	general observation		Concession 10 to Concession 12	G37	NOT MEASURED					LRG	NO PLOTS	217291	shoreline
Bruce	Mun. Of Kincardine	4914113	458239	Brucedale Conservation Area	Bruce 69	1.92	2.00	2.00	1.97	0.05	LRG	6	51686	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor1	NOT MEASURED						NO PLOTS	2975	shoreline

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Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor2	NOT MEASURED						NO PLOTS	1484	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor3	NOT MEASURED						NO PLOTS	8508	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor4	NOT MEASURED						NO PLOTS	17351	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor5	NOT MEASURED						NO PLOTS	990	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor6	NOT MEASURED						NO PLOTS	2531	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor7	NOT MEASURED						NO PLOTS	1258	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor8	NOT MEASURED						NO PLOTS	1832	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGregor9	NOT MEASURED						NO PLOTS	117218	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGreg10	NOT MEASURED						NO PLOTS	20428	shoreline
Bruce	Saugeen Shores	general observation		MacGregor Point PP	McGreg11	NOT MEASURED						NO PLOTS	6043	shoreline
Bruce	Saugeen Shores	4918403	463049	McGregor Point - dayuse area	Bruce 85	2.00	2.18	2.94	2.37	0.50	MED	4	39646	shoreline
Bruce	Saugeen Shores	4918882	464318	Smith Ln	Bruce 84	1.84	1.84	1.84	1.84	0.00	MED	1	14591	shoreline
Bruce	Saugeen Shores	4918782	464530	Saugeen Beach Road	Bruce 83	NOT MEASURED					MED	1	830	shoreline
Bruce	Saugeen Shores	general observation		Eidts Grove	G38	NOT MEASURED					SM	NO PLOTS	21664	shoreline
Bruce	Saugeen Shores	4919194	466150	Saugeen Beach Road	Bruce 82	1.82	1.82	1.82	1.82	0.00	NONE	0	100	ditch
Bruce	Saugeen Shores	4919452	466487	Saugeen Beach Road	Bruce 81	0.87	0.91	1.10	0.96	0.12	NONE	0	3010	shoreline
Bruce	Saugeen Shores	4919556	466762	Bruce Road 25	Bruce 80	1.58	1.50	1.51	1.53	0.04	MED	0	40	ditch
Bruce	Saugeen Shores	4921646	467756	North Shore Road	Bruce 79	1.50	2.00	1.50	1.67	0.29	SM	1	40	stream
Bruce	Saugeen Shores	4921903	467557	North Shore Road	Bruce 78	1.55	1.40	1.45	1.47	0.08	SM	1	1255	shoreline
Bruce	Saugeen Shores	general observation		Miramichi Bay	MiraBay	NOT MEASURED						NO PLOTS	113896	culvert
Bruce	Saugeen Shores	general observation		Horseshoe Bay	HorseBay	NOT MEASURED					NONE	1	166276	shoreline
Bruce	Saugeen Shores	4925132	469309	South St.	Bruce 77	1.35	1.30	1.21	1.29	0.07	MED	1	1690	beach
Bruce	Saugeen Shores	4927368	470001	Pioneer Park	Bruce 76	1.26	1.61	0.65	1.17	0.49	SM	1	10480	beach
Bruce	Saugeen Shores	4927972	470470	South Rankin Road	Bruce 71	1.50	1.50	1.50	1.50	0.00	SM	2	130	shoreline
Bruce	Saugeen Shores	4928107	470576	South Rankin Road	Bruce 72	2.00	0.50	1.00	1.17	0.76	SM	0	50	shoreline
Bruce	Saugeen Shores	4928347	470713	South Rankin Road	Bruce 73	0.85	0.80	0.75	0.80	0.05	NONE	0	50	shoreline
Bruce	Saugeen Shores	4928436	470762	South Rankin Road	Bruce 74	0.75	0.89	0.65	0.76	0.12	NONE	0	130	shoreline
Bruce	Saugeen Shores	4929524	471516	Shore Road	Bruce 75	1.87	0.87	0.93	1.22	0.56	SM	0	1000	shoreline
Bruce	South Bruce	4942432	479037	Sauble Falls Parkway	Bruce 19				3.62		MED	6	401	ditch
Bruce	South Bruce	4944011	482376	Spring Creek Road	Bruce 20				>4		LRG	NO PLOTS	232	ditch
Bruce	South Bruce	4944852	478194	North Sauble Beach	Bruce 21				>1		SM	1	801	beach
Bruce	South Bruce	general observation		North Sauble Beach	G39				<1		SM	0	29178	beach
Bruce	South Bruce	4954096	476738	Oliphant Beach	Bruce 35				4		LRG	9	207747	shoreline
Bruce	South Bruce	4954530	477368	Oliphant Beach	Bruce 34	NOT MEASURED					LRG	NO PLOTS	794083	shoreline
Bruce	South Bruce	4955207	477913	Oliphant Beach	Bruce 33				1.5		SM	1	132699	shoreline
Bruce	South Bruce	4955397	483963	Road 13	Bruce 23				3		LRG	6	130	ditch
Bruce	South Bruce	4955279	480742	Spry Lake Road	Bruce 24				2.7		LRG	3	59	ditch
Bruce	South Bruce	4956391	489803	Wiarton	Bruce 25				2.6		LRG	6	990	shoreline
Bruce	South Bruce	4955740	479366	Bryant Road	Bruce 26				3		NONE	0	6	ditch
Bruce	South Bruce	4956703	479060	MNR Property (Brant Road)	Bruce 27				>4		SM	7	1877	ditch

County	Municipality	Northing	Easting	Access Point	Waypoint	Height (m)	Height (m)	Height (m)	Avg. Heigh	Stnd . Dev	Seed Heads	Density	Area (m^2)	Location
Bruce	South Bruce	4956787	479017	MNR Property (Brant Road)	Bruce 28				3		SM	6	33	ditch
Bruce	South Bruce	4956861	479004	MNR Property (Brant Road)	Bruce 29				>4		SM	7	35	ditch
Bruce	South Bruce	4957174	478898	Brant Road	Bruce 30				3.5		SM	1	10	ditch
Bruce	South Bruce	4958053	478561	Brant Road	Bruce 31				3		LRG	3	81	ditch
Bruce	South Bruce	4956142	479144	Corner road patches	Bruce 32				3.1		MED	7	40	ditch
Bruce	South Bruce Peninsula	4959805	477917	Huron Road	085	2.50	2.50	2.50	2.50	0.00	SM	0	10	ditch
Bruce	South Bruce Peninsula	4960583	480166	Red Bay Road	084	NOT MEASURED					MED	NO PLOTS	200	shoreline
Bruce	South Bruce Peninsula	4961109	477461	Red Bay Park	087	NOT MEASURED					MED	NO PLOTS	1740	shoreline
Bruce	South Bruce Peninsula	4963179	475887	Dock Road	086	3.10	2.10	2.98	2.73	0.55	MED	4	130	shoreline
Bruce	South Bruce Peninsula	4967912	486854	Bruce Road 9	083	2.73	2.73	2.73	2.73	0.00	SM	2	1650	ditch
Bruce	North Bruce Peninsula	4918406	463057	Whiskey Harbour Road	Bruce 86	2.35	2.45	2.57	2.46	0.11	MED	1	65	ditch
Bruce	North Bruce Peninsula	4979215	472005	Sandy Beach Road	060	2.35	2.75	2.65	2.58	0.21	LRG	5	30	shoreline
Bruce	North Bruce Peninsula	4979359	471741	Sandy Beach Road	061	1.60	1.72	1.69	1.67	0.06	SM	2	330	stream
Bruce	North Bruce Peninsula	4981631	472357	Stokes Bay Road	062	3.00	3.40	3.50	3.30	0.26	MED	1	20	ditch
Bruce	North Bruce Peninsula	4981982	471724	Hardwick Cove Road	063	3.70	4.00	3.33	3.68	0.34	LRG	2	240	ditch
Bruce	North Bruce Peninsula	4981552	471225	Hardwick Cove Road	064	1.75	1.78	1.75	1.76	0.02	SM	2	420	shoreline
Bruce	North Bruce Peninsula	general observation		Stokes Bay	G40	NOT MEASURED						NO PLOTS	1618	shoreline
Bruce	North Bruce Peninsula	general observation		Stokes Bay Park	G41	NOT MEASURED					MED	NO PLOTS	945	shoreline
Bruce	North Bruce Peninsula	4981920	469302	Tamarac Road	067	2.51	2.82	2.92	2.75	0.21	SM	1	200	shoreline
Bruce	North Bruce Peninsula	4982375	469476	Government Dock Road	066				3.00		MED	0	115	shoreline
Bruce	North Bruce Peninsula	4982265	469521	Government Dock Road	065	1.52	1.59	1.75	1.62	0.12	SM	1	340	shoreline
Bruce	North Bruce Peninsula	4982744	467917	Gauly Road	068	2.73	2.70	2.56	2.66	0.09	LRG	9	210	shoreline
Bruce	North Bruce Peninsula	4982510	467334	Gauly Road	069	1.83	1.95	1.05	1.61	0.49	SM	0	70	shoreline
Bruce	North Bruce Peninsula	4982375	467198	Gaulys Bay Road	070				2.50		NONE	0	350	shoreline
Bruce	North Bruce Peninsula	4981058	466133	Gaulys Bay Road	071	1.79	1.79	1.79	1.79	0.00	NONE	0	30	ditch
Bruce	North Bruce Peninsula	4986240	471326	Stokes River Road	072	2.00	2.82	1.95	2.26	0.49	SM	4	30	ditch
Bruce	North Bruce Peninsula	4988373	471419	Hwy 6	081	2.48	2.30	2.10	2.29	0.19	SM	1	200	ditch
Bruce	North Bruce Peninsula	4988880	470520	Hwy 6	080	2.31	2.59	2.40	2.43	0.14	SM	3	160	ditch
Bruce	North Bruce Peninsula	4990461	466604	Lindsay Road 20	079	2.44	2.47	2.45	2.45	0.02	SM	1	20	ditch
Bruce	North Bruce Peninsula	4993948	464521	Lindsay Road 30	078				0.80		NONE	0	71	ditch
Bruce	North Bruce Peninsula	4996157	465489	Hwy 6	077	2.48	2.32	1.90	2.23	0.30	MED	1	5950	ditch
Bruce	North Bruce Peninsula	4996198	456837	Pedwell Pt. Drive	076	2.00	2.25	1.95	2.07	0.16	LRG	0	150	shoreline
Bruce	North Bruce Peninsula	5004339	453922	Singing Sands National Park	075	1.89	1.43	1.85	1.72	0.25	SM	4	440	stream
Bruce	North Bruce Peninsula	5004445	453987	Singing Sands National Park	074	1.86	1.55	1.80	1.74	0.16	SM	2	760	stream
Bruce	North Bruce Peninsula	4986240	471328	Singing Sands National Park	073	0.90	1.21		0.70	0.22	NONE	0	180	shoreline