

naturescaping
LAKE SIMCOE
reflecting on the impacts of shoreline development

by kyle foch

Undergraduate Landscape Architecture Thesis

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the abstract



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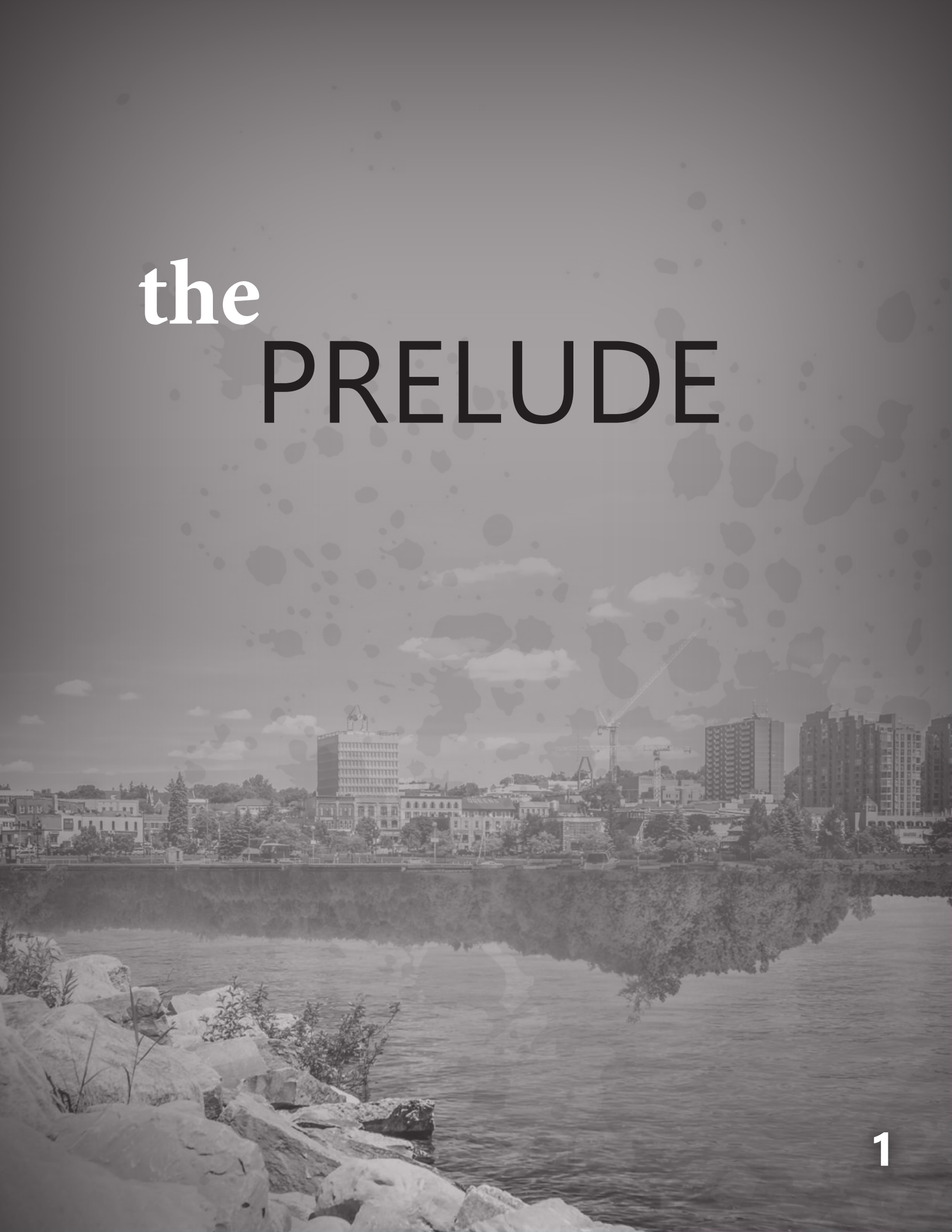
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the PRELUDE



the appreciations

Nicole Wolscht

You have taught me to enjoy the things I am passionate about rather than being lost in the chaos they may cause. I would not be where I am without your goofiness, support and love.

Kathy & Gary Foch

You gave me the opportunity to reach for the stars and taught me that I can achieve anything I set my mind to.

Daniel Foch

You pushed me over the cliff time and time again knowing my backpack had a parachute in it. I am truly a more accomplished person for it today.

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You inspired a confused high school student to leap into the field of Landscape Architecture. I have never looked back.

Andrea Graham

You had my back throughout the whole process of creating this document. I truly appreciate the help, encouragement and constructive criticism.

the abstract

Development of the Lake Simcoe shoreline is diminishing the health of aquatic and terrestrial habitats along the lakefront. Privatized development disregards the externalities and consequences it creates on the lake's ecosystem. This problem will be addressed by analyzing the deterioration of the lake, the holes in management policies and the roles that private land owners and community stakeholders have on shoreline restoration. An increase of residential, cottage, commercial and recreational development along the lakefront has weakened the shoreline's natural state through human intervention. Localized revitalization on private properties could provide a foundation for addressing this development issue at its source and may help mitigate the externalities caused by this change. When revitalization efforts are undertaken all along the lakefront in conjunction with different property owners then individual efforts are minimized while shoreline benefits are maximized.

the START

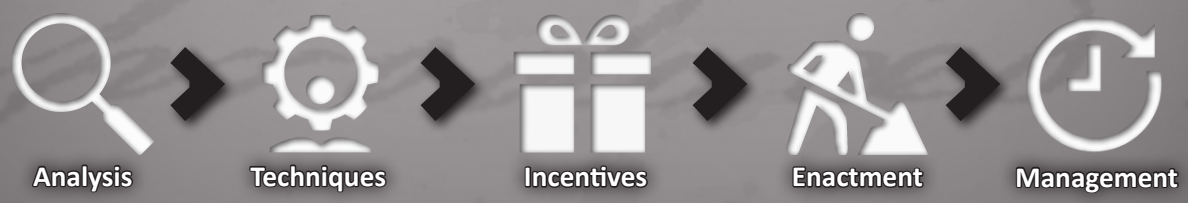


the context

Lake Simcoe is a key natural resource for the surrounding communities and plays an important role in the upkeep of ecological and communal systems for the greater watershed. The development of the waterfront has depreciated habitat and reduced the ability of the lake to provide necessary ecosystem services for wildlife and people. Humans have visibly scarred the landscape to such an extent that it is impossible for the lake to sustain itself without intervention. The government and other non-governmental organizations (NGO's) have played an important part in maintaining the lake and aiding in its restoration. However, there is a limited amount that such organizations can do without the involvement of private land owners and community stakeholders. These individuals are a major factor in the restoration and revitalization of Lake Simcoe's shoreline. If such people are willing to step in and act, then the restorative process can be more easily and effectively undertaken.

the procedure

Curing Lake Simcoe's shoreline cannot commence without an analysis and understanding of the physical, economic, social and institutional frameworks in which restoration may occur (LSEMS, 1995). The history, demographics, physiography, as well as the flora and fauna of the watershed all must be considered and respected. This knowledge will provide an appropriate context for implementing restorative processes along the shoreline. The anthropogenic development of the water's edge must also be understood. This information will provide reasoning for the revitalization of the shoreline and will set a foundation for producing mitigation and reversal techniques. Current actions must be able to integrate supplementary methods of implementation and management for waterfront restoration. Close consideration must be placed on the incentives for and enactment of revitalization undertakings as it is difficult to push such efforts onto individuals who may not care about or cannot achieve the final objectives. This document will provide all of this information and will develop strategies for the implementation and management of restoring Lake Simcoe's shoreline through localized revitalization on private lands.



the drive

I have lived on the shoreline of Lake Simcoe for my entire life. I come from the small town of Keswick located on the eastern side of Cook's Bay. My house resides directly on the water's edge which has provided me with the opportunity to observe the development that has occurred along the shoreline. I have spent most of my days next to this expanse of water and have come to appreciate that it supports immeasurable amounts of life. The lake has played a key role in the growth of my personal interests and values. It sustains the watershed's ecosystem, my community and the numerous others within its reach. I feel accountable for the lake's health because of the consumption and detriment we as humans bring to its systems. Lake Simcoe is our home. It is the livelihood for plants, animals and people that reside within its watershed. We who live along its shorelines are dependent on the lake for recreation as well as the natural resources and services which it provides. If we continue to deteriorate the lake and its systems, then we will be destroying the vary things which supports life within our communities. As a resident of the lake's shoreline, I believe that the only way to truly implement positive change is for residents like me to educate themselves and take action.

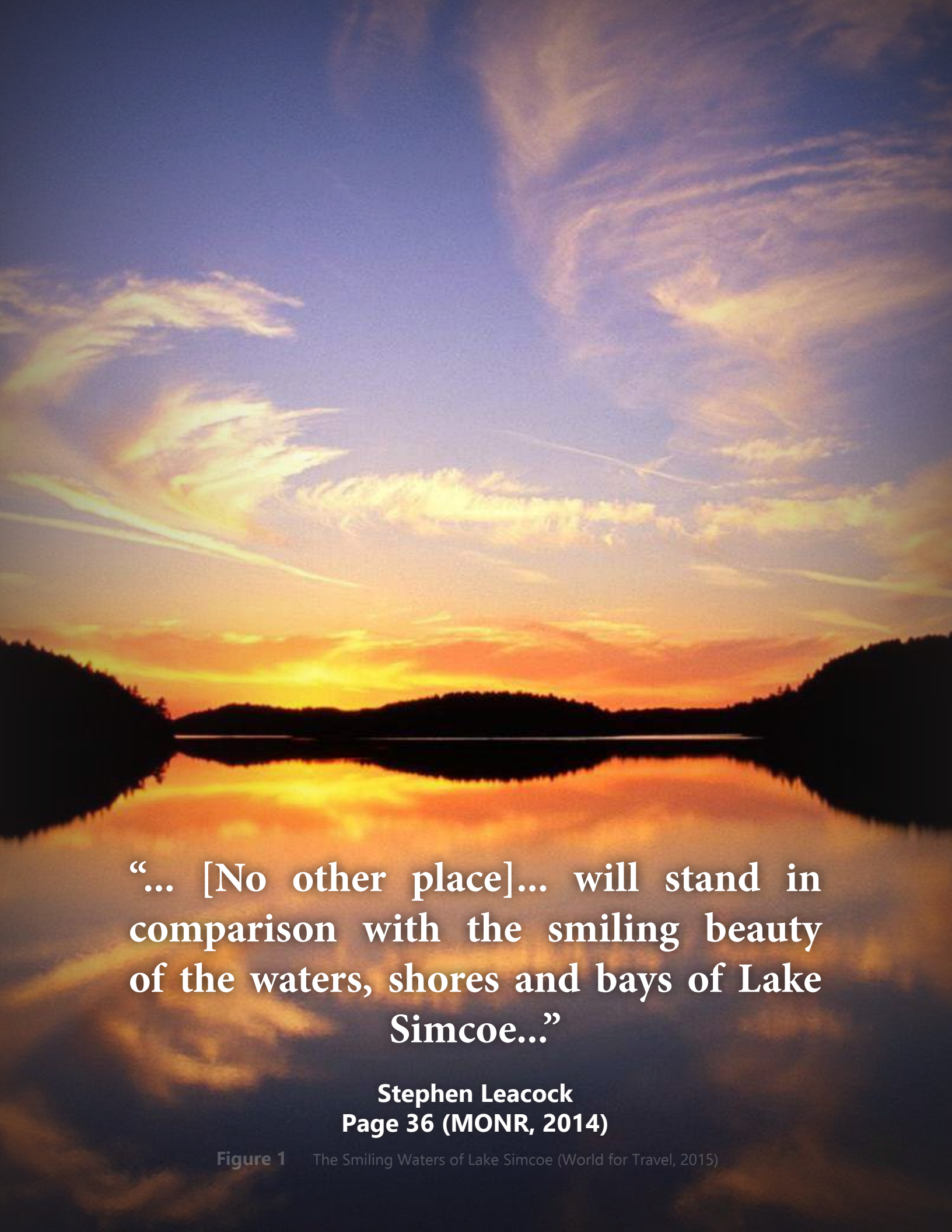


Figure 1 The Smiling Waters of Lake Simcoe (World for Travel, 2015)


the
PLACE

the location

Lake Simcoe is an inland water body located in temperate North America between Georgian Bay and Lake Ontario, roughly 50km or an hour's drive north of Toronto. The waterbody is easily accessible to more than half the population of Ontario because of its location as a central hub and its adjacency to many prominent communities (LSEMS, 1995). Ever since its formation, the Lake Simcoe watershed has acted as a unique ecosystem which sustains local biotic and abiotic features while also driving the movement of energy and nutrients throughout the landscape (LSEMS, 1995).

Lake Simcoe is centrally located within the extensive Ontario landscape and, because of its proximity to neighbouring communities, it has been misused and exploited. Callous action on the part of these adjacent settlements has led to the lake's deterioration and a decline in its structural health. To positively impact the lake and its watershed we must understand its systems and the context they have on a broader scale. The location of the lake is important in defining the part it plays within the greater natural systems of Ontario. This information will help identify features that impact the lake and in turn have consequences on the shoreline's integrity. Proximity to encroaching dangers such as pollution, urban development, natural disasters and species introduction can all greatly change the dynamics of the lake and the water's edge. The location of the lake defines its susceptibility to such dangers and drives how these impacts must be met.

Lake Simcoe, Ontario, Canada



Figure 2 Lake Simcoe Context Map (Google, n.d.)

the history

Receding glaciers carved out the lake basin and watershed more than 12,000 years ago (LSEMS, 1995). This ice pushed forwards a mixture of soil and rock which assimilated into the fields of glacial till, hilts, drumlins, eskers and moraines that make up the landscape today (LSEMS, 1995). Lake Simcoe was originally part of Lake Algonquin, but later broke off to become its own separate waterbody. These changes produced a tapestry of landscape features that provided the perfect area of settlement for predicating communities.

The watershed area has been long settled by native peoples who have lived off the lake and land. In 1615, the area was visited by Samuel de Champlain and the lake was later utilized as a trade route between Georgian Bay and Lake Ontario (Francis, 2015).

The waterbody was originally titled as Lac Aux Claies after Lieutenant-Governor John Graves Simcoe which later become known as Lake Simcoe (Francis, 2015).

According to Our Water, Our Heritage (LSEMS, 1995) throughout the nineteenth century, pilgrims found homage in this area and undertook extensive logging to develop agricultural lands. This practice stripped nearly the entire landscape of natural vegetation which deteriorated the watershed's ability to support ecosystem features and functions. This drastic agricultural implementation spurred an increase of urban growth in key market and communal centres such as Georgina, Barrie and Orillia.

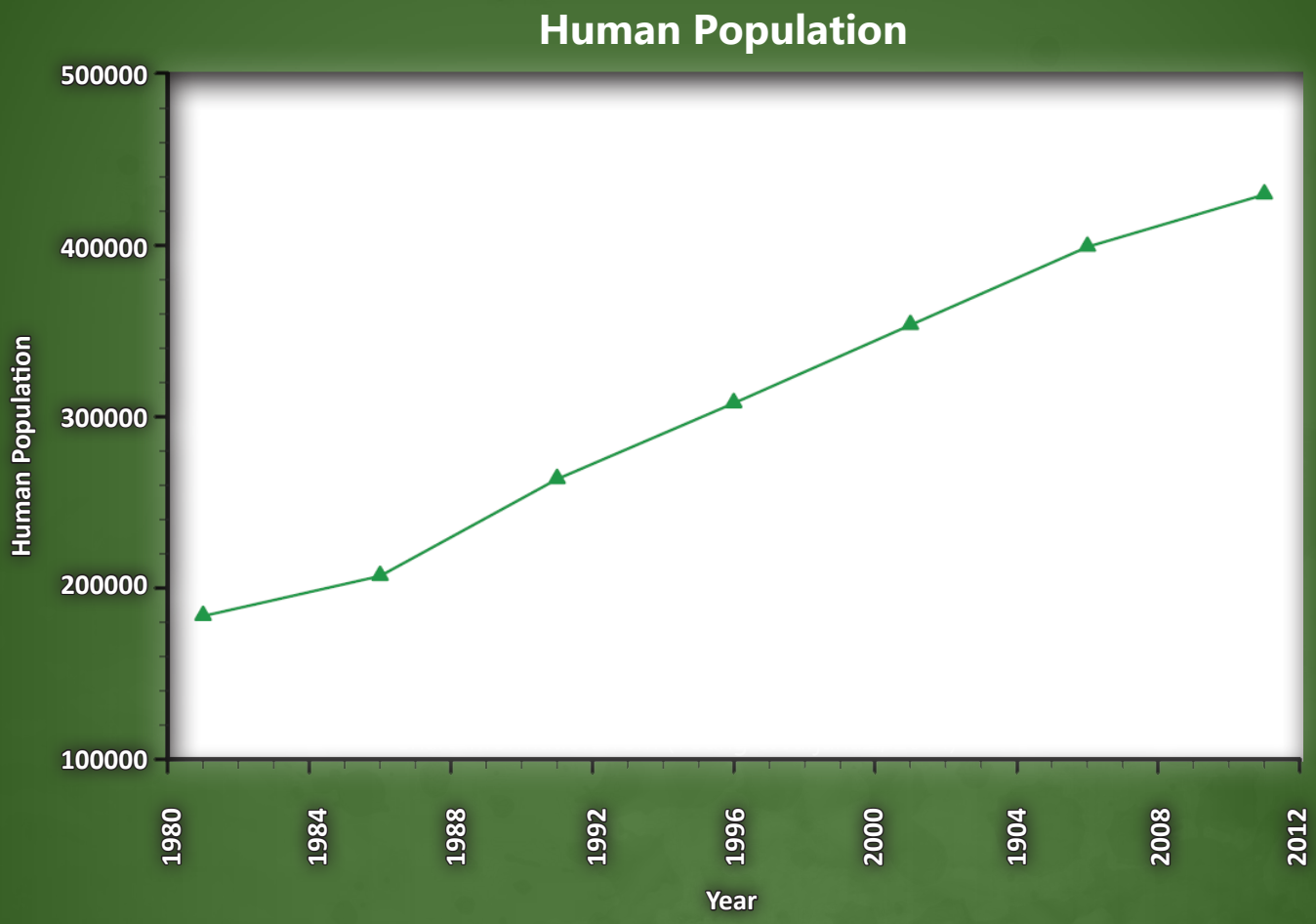


Chart information from (Young & Jarjanazi, 2014)

Over the past century, the growth of these communities has put great pressure on the lake and has drastically altered the watershed's ability to provide natural functions. The shoreline is truly representational of this degradation. It has started to deteriorate because of the increasing hostility created by urban growth and activity.

the community

The watershed hosts a population of over 435,000 people (MOECC, 2015).

Seasonal visitors come to the area to recreate and make up roughly one eight of the defined population (ECO, 2009).

The number of seasonal residents within the watershed continues to rise due an increase of Torontonians vacationing northwards and foreign home-buyers investing in the Lake Simcoe area. The watershed has seen drastic population growth over the past decade and it anticipates that there will be further expansion resultant of the Places to Grow Act and its Growth Plan for the Greater Golden Horseshoe region (ECO, 2009).

There are an estimated 12,000 cottages and 2,000 farms within the watershed which help generate hundreds of millions of dollars in revenue each year from recreational and agricultural activities (LSEMS, 2008).

Much of the recreation within the area is associated with the lake and its shoreline which provides fishing, tourism, cottage and water sport opportunities (LSRCA, 2016B). Lake Simcoe is the most prominent waterbody in all of Canada for ice fishing activity. These cultural influences greatly impact the shoreline's integrity and must be more appropriately managed.

Recreational Spending (Millions of Dollars)

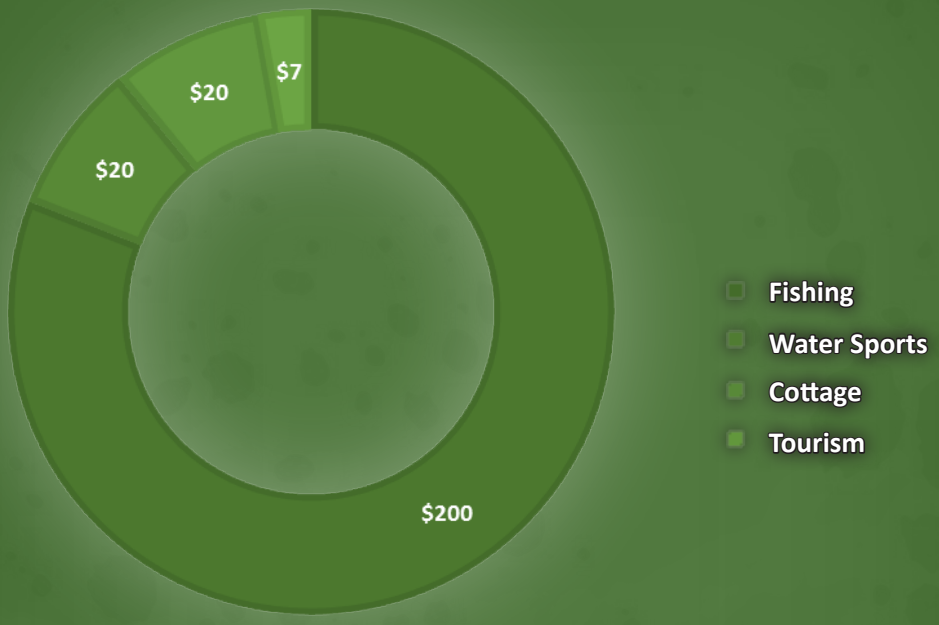


Chart information is from (LSRCA, 2016B; LSEMS, 1995)

According to Our Watershed (LSRCA, 2016B), the most notable communities within the area would include Barrie, Orillia, Keswick, Newmarket and Aurora. Numerous of these towns and cities lay directly along the shoreline and have greatly impacted the lake through their expansion practices. The watershed also hosts the York and Durham regions, as well as the Kawartha Lakes and Simcoe County. Much of the southern watershed area is governed by the Greenbelt Plan which acts as a connection to the Lake Ontario area. Lake Simcoe's watershed crosses over 23 municipal boundaries, hosts 18 sub watershed areas and contains 18 major communities.

the physiography

The Lake Simcoe watershed is composed of integrated valleylands and tablelands (LSEMS, 2008).

As described in The Naked Truth (Chabot, et al., 2006), the watershed's southern area contains deep fertile soil that is prime for agricultural activity while the north hosts thin sterile soil that rests upon a sub-surface composed of limestone, shale and granite. The Oak Ridges Moraine in the south and the Oro Moraine in the north frame the watershed and contain tributaries that flow into the lake (LSRCA, 2016B; LSEMS, 1995).

On the western side of the lake are remnants of ancient shorelines and bluffs that can be found from Orillia to Bradford. Upland areas of tilled plains litter the landscape between Barrie and Alliston (LSEMS, 1995).

Beach and boulder terraces as well as sunken peat marshlands compose much of the lowland area throughout the watershed and typically have a direct connection to the shoreline (LSEMS, 1995).

The watershed's land composition is made up of scrubland, urban space, agriculture, woodlots and wetlands (LSRCA, 2016B; Chabot, et al., 2006). There is roughly 25 hectares of bog land within the watershed and about 448 hectares of fen land (LSEMS, 2008). Such habitat comprises less than 0.2% of the total land cover and is the rarest of any type found within the Lake Simcoe basin (LSEMS, 2008). Many of these riparian wetlands reside along the shoreline and waterways that flow into the lake and have been drastically altered due to anthropogenic influences.

Land Composition
(Percentage of Total Watershed Area)

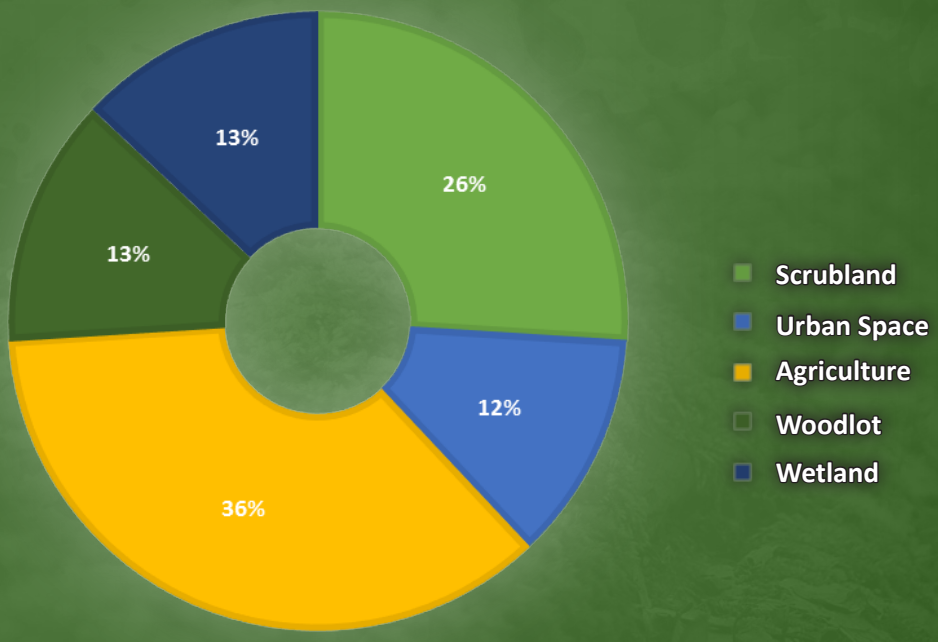
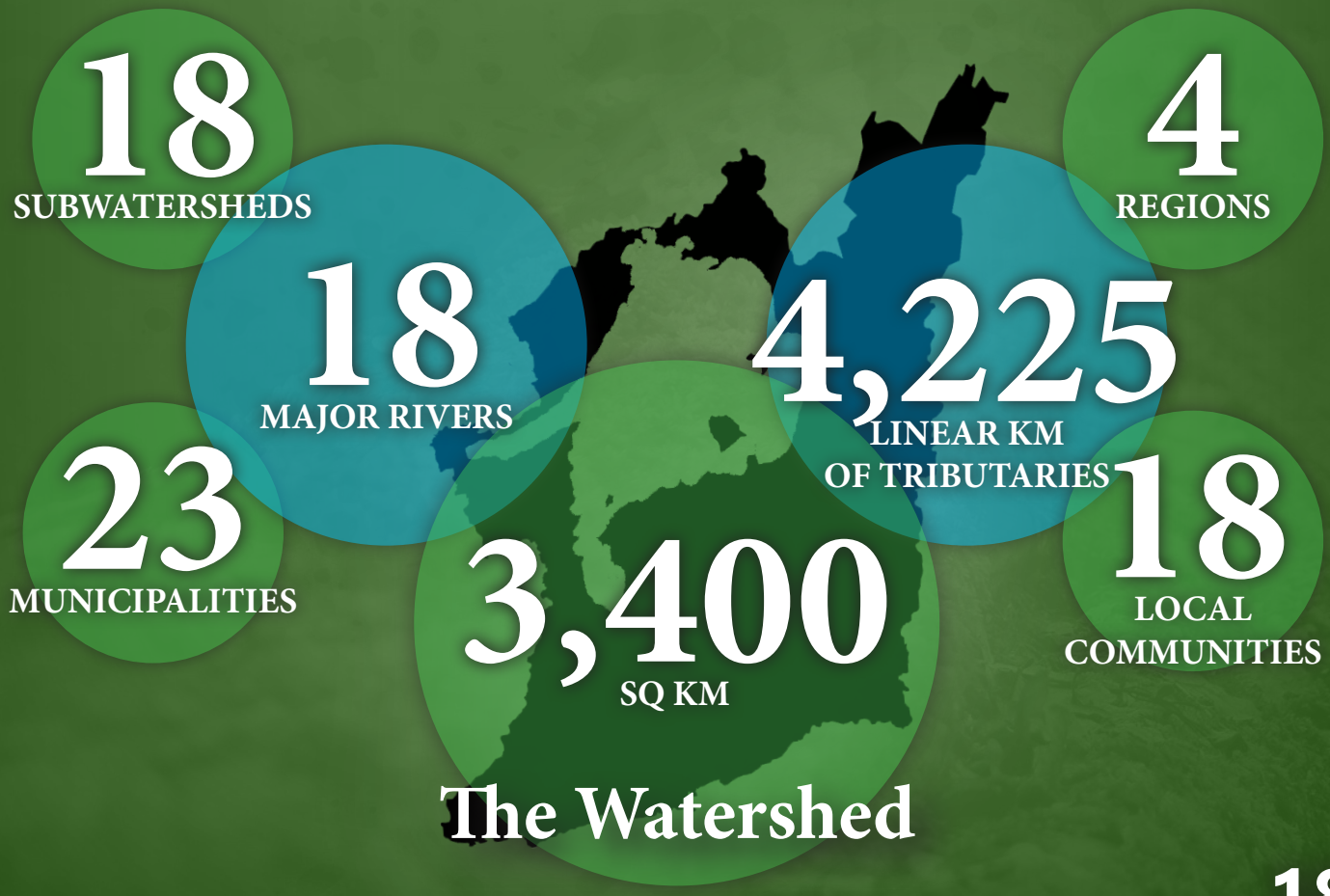


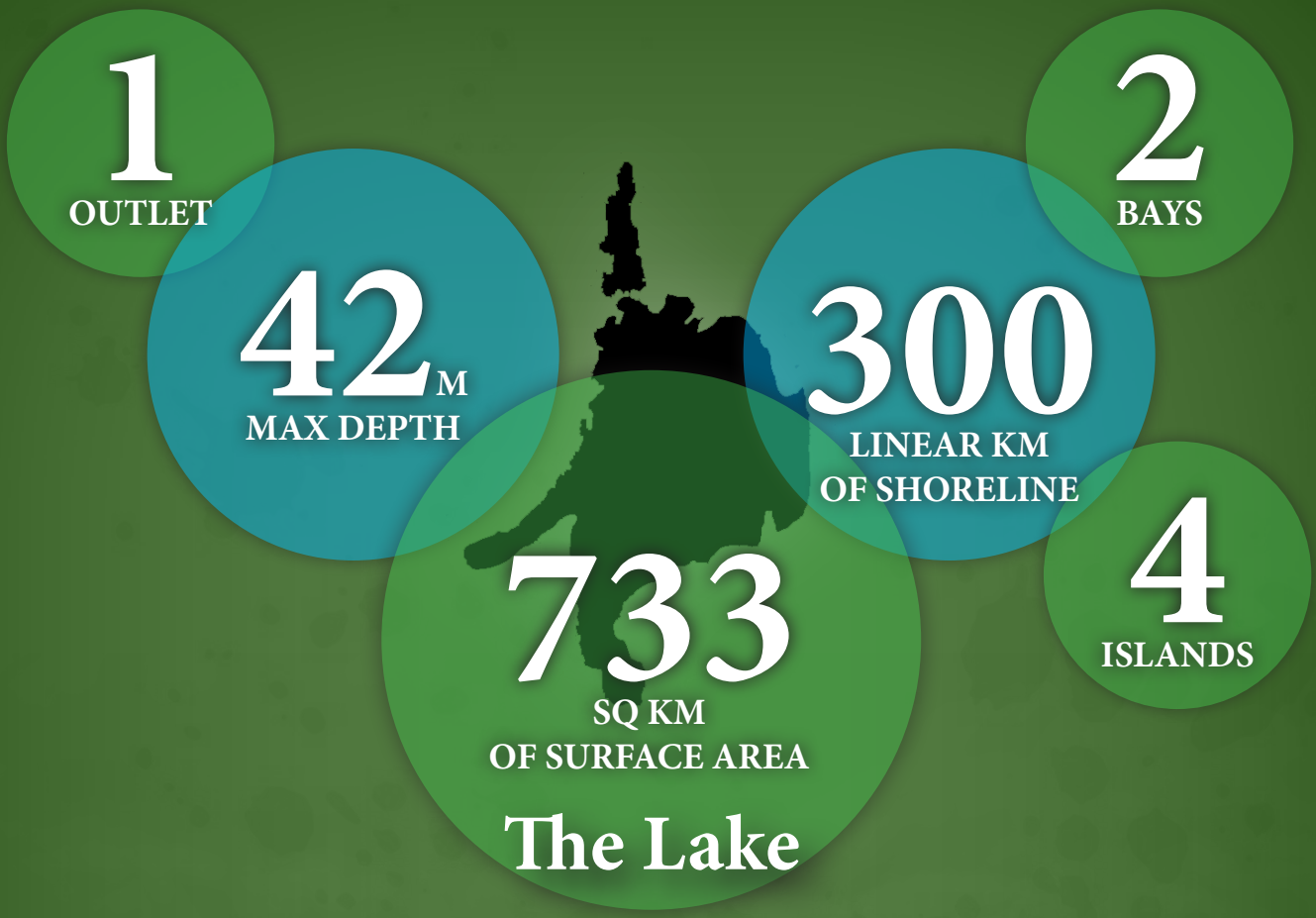
Chart information from (LSRCA, 2016B; Chabot, et al., 2006)

There are approximately 18 major rivers and 4,225 linear kilometers of tributaries, streams and creeks that feed into Lake Simcoe (MOECC, 2015; LSRCA, 2016B). The watershed if approximately 3,400 square kilometers with roughly 722 square kilometers (20% of the total area) of this being the lake (LSRCA, 2016B).

The waterbody contains two large bays and several islands in its main basin with over 300 linear kilometers of shoreline (Young & Jarjanazi, 2014). The only outlet from the lake's basin is at the north end in Atherley Narrows, near Orillia. Its deepest point is 42m below water level with a mean depth of 14m (Young & Jarjanazi, 2014).



The Watershed

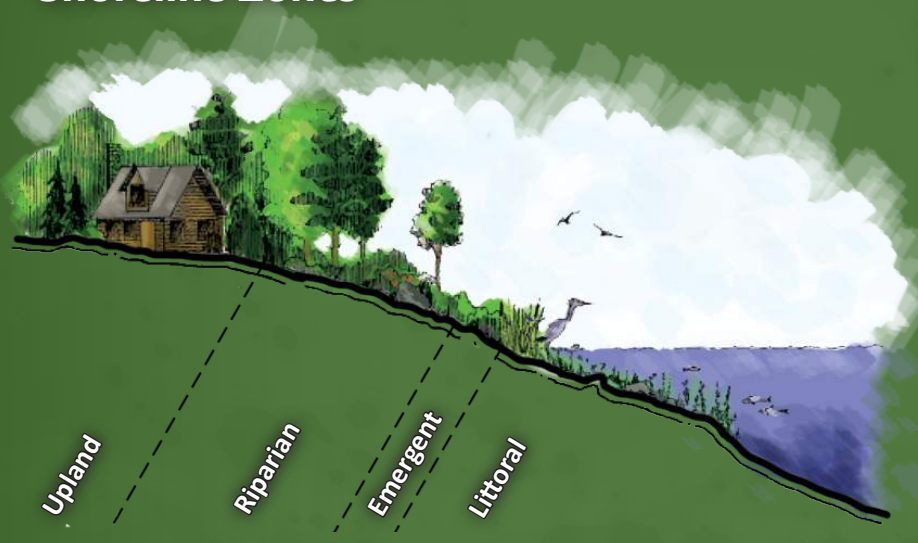


According to the LSEMS (2008), Lake Simcoe is composed of eutrophic, mesotrophic and oligotrophic areas which respectively contain high, medium and low nutrient levels. Cook's Bay is the shallowest of the areas and contains a eutrophic system. The central areas of the basin contain mesotrophic systems. Kempenfelt Bay contains a steep shoreline which drops into the deepest area of the lake. This bay acts as an oligotrophic part of the lake which supports cold water aquatic populations.

The shoreline is primarily composed of bedrock, sedimentary material, wetland/organic material and beach lands (MONR, 2014). The area where the land meets the water is a transitional zone that is integral to the success of biotic and abiotic diversity. This space is the key in manipulating the flow of energy, nutrients and matter between land and water (Lachavanne & Juge, 1997).

The different zones that along the shoreline define an imperative transitional space for flora and fauna to move from terrestrial to aquatic. Such areas interact with each other to create necessary communities that maintain the integrity of the water's edge.

Shoreline Zones



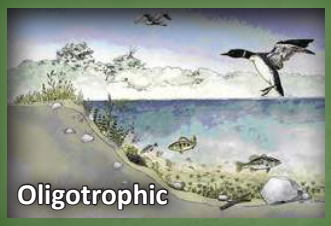
Shoreline Zone Modified Figure and Information from (LORC, 2000)

The riparian zone is the land closest to the shore which contains vegetation that prevents soil erosion, reduces runoff and provides shading, food and shelter for wildlife.

The emergent zone is the bridge between land and water which provides a transitional space for species.

The littoral area goes from land to the sunless water depths and is where most aquatic species feed, spawn and survive.

Lake Zones



Deep waters
Minimal aquatic plant growth
Low nutrient levels
Supports cold-water fish (Trout & Whitefish)
Low levels of phosphorus and chlorophyll
Minimal algae blooms



Medium water depth
Moderate plant growth
Supports a wide variety of fish (Walleye & Bass)
Moderate nutrient loads
Occasional algae bloom at the surface



Shallow waters
Abundant vegetation
Supports warm-water fish (Perch & Bass)
Susceptible to oxygen depletion
High levels of phosphorus or chlorophyll
Frequent algae blooms

Lake Zone Figures & Information from (FOCA, n.d.)

Shoreline Status

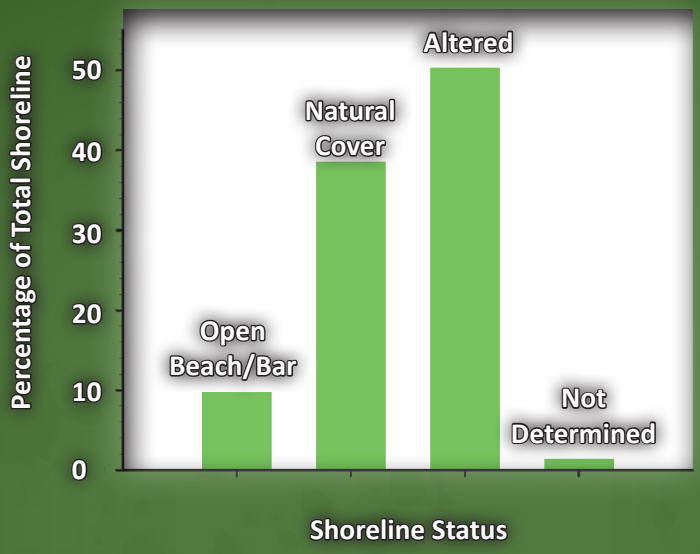
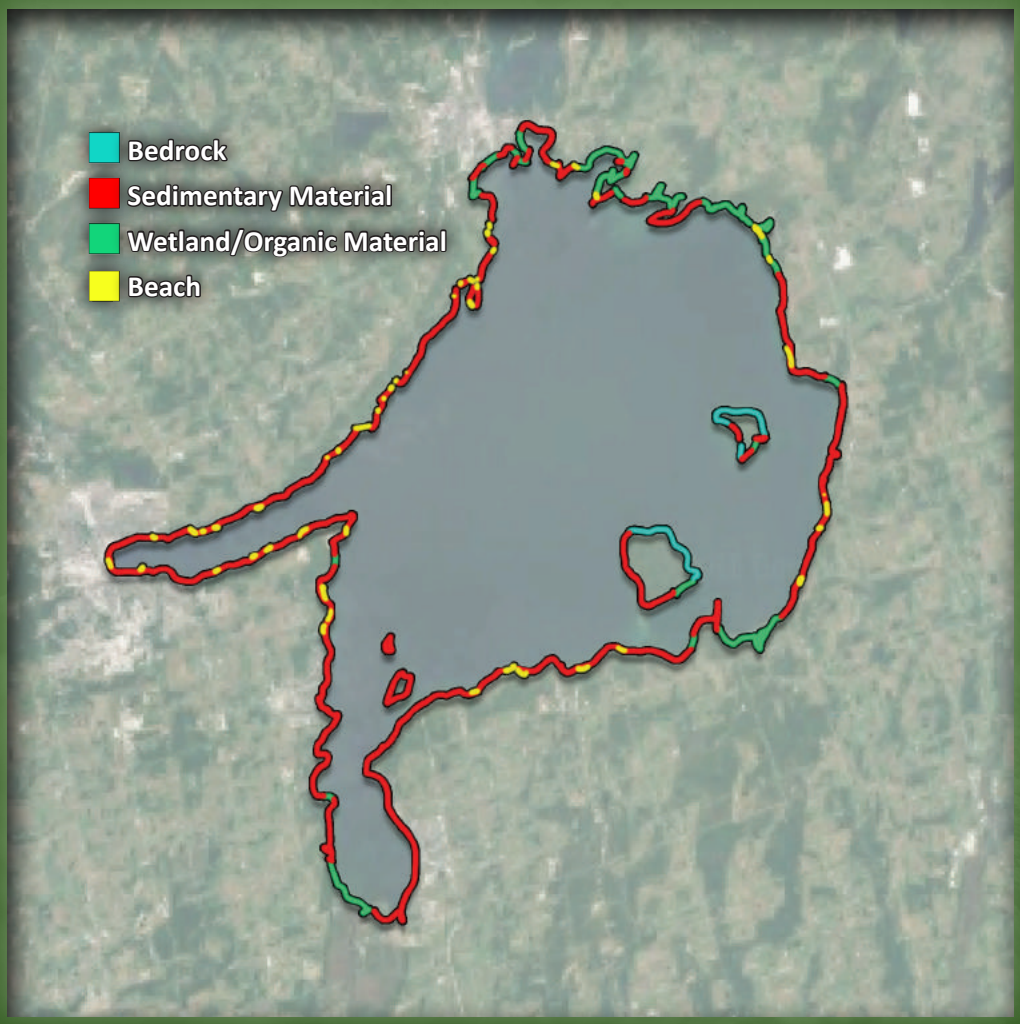


Chart information from (Young & Jarjanazi, 2014)

Shoreline Composition



Map information from (MONR, 2014)



“Shorelines are not a line, rather they are an ecotone with significant transitional dimensions along its length, towards land and in the water.”

Lake Simcoe Science Committee
Page 15 (LSSC, 2012)

Figure 6 Bunny in a Shoreline Garden (picture by Kyle Foch)

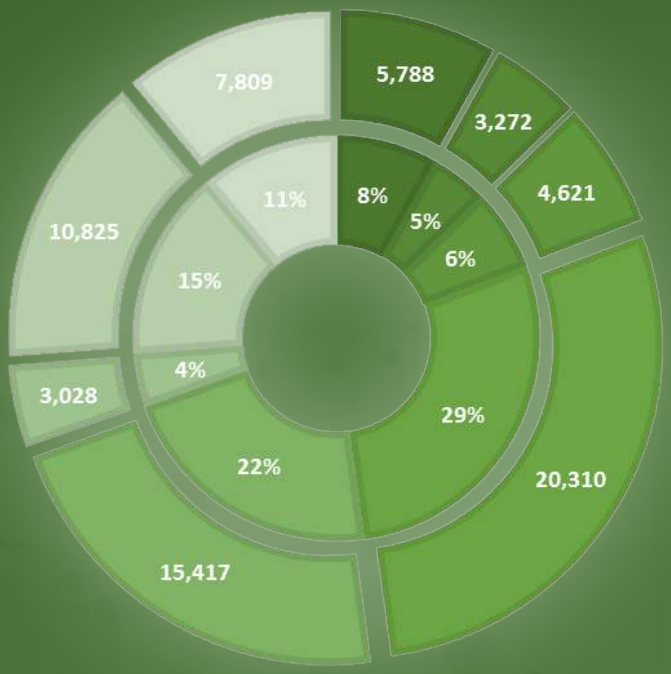
the flora & fauna

The shoreline provides a place for native vegetation to flourish, aquatic fauna to spawn and diverse habitats to develop (Chabot, et al., 2006). The flora and fauna that reside within the Lake Simcoe watershed are important to the restoration of the water's edge. To achieve effective revitalization outcomes, one must understand the context and reasoning behind shoreline restoration and how it relates to the biotic components of the landscape. A target of the biotic features must be defined and research must be undertaken to comprehend the needs of such features in the revitalization process (Young M. , 2016). This information will inform how much and what type of habitat is required for the flora and fauna along shoreline communities and will also outline the obstacles related to restorative implementation (Young M. , 2016).

The Flora Communities

According to the Basin Wide Report by LSEMS (2008), the Lake Simcoe watershed is composed of numerous vegetation communities. The most dominant of these communities include deciduous, coniferous and mixed forests as well as deciduous swamplands. Other communities that are less frequent include cultural plantations and woodlands as well as coniferous and mixed swamplands. Much of the vegetation that resides on the shoreline is composed of herbaceous species that are supported by successional woody plants. However, anthropogenic influences have depleted necessary vegetation coverage along the shoreline and throughout the greater watershed. This vegetation is essential in providing habitat for fauna and sustaining key ecological systems such as erosion control, water filtration and nutrient storage (MWC, 2013). Vegetation along the water's edge is essential in maintaining the integrity of terrestrial and aquatic interactions.

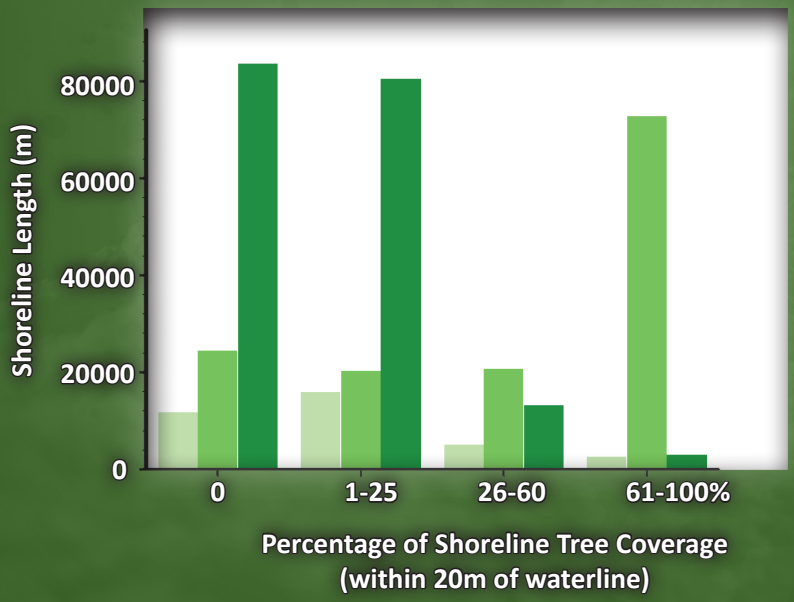
Watershed Woodlot Cover (ha)



Cultural Plantation
Cultural Woodland
Conifer Forest
Deciduous Forest
Mixed Forest
Conifer Swamp
Deciduous Swamp
Mixed Swamp

Chart information from (LSEMS, 2008)

Shoreline Woodlot Cover



Open Beach/Bar
Natural Cover
Altered

Chart information from (Young & Jarjanazi, 2014)

The Native Flora Species

Common



Indian Grass (Sorghastrum nutans)



Maple (Acer spp.)



Beech (Fagus spp.)



Willow (Salix spp.)



Dogwood (Cornus spp.)



Little Bluestem (Schizachyrium scoparium)

At Risk



Small White Lady's Slipper Orchid (Cypripedium candidum)



Blue Ash (Fraxinus quadrangulate)



Butternut (Juglans cinerea)

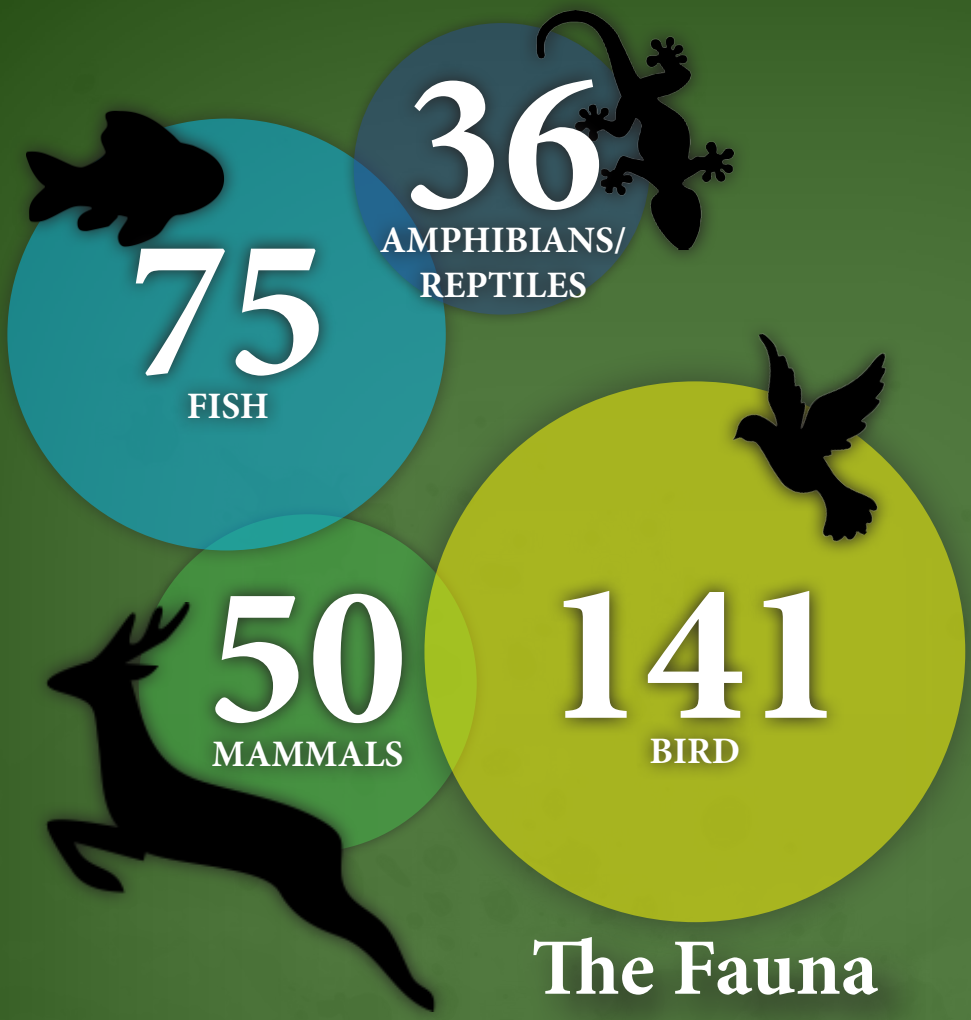
Former information is from (LSEMS, 2008)
All Figures on this page are from (MBG, n.d.) except for the Figure of the Small White Lady's Slipper Orchid which is from (MONR, 2016)

The Fauna Communities

The Lake Simcoe watershed supports numerous mammal, bird, amphibian and reptile species. Many of such animals depend on the lake and its shoreline for their livelihood. The lake itself supports a range of aquatic life including coldwater and warmwater fish, invertebrates, amphibians, reptiles, benthos and plankton (MOECC, 2008B).

There are approximately 75 fish, 50 mammal, 141 bird and 36 amphibian/reptile species in the Lake Simcoe watershed with roughly 65 of these designated as provincially rare specimens (LSEMS, 2008).

There are approximately 33 fauna species considered to be at risk within the Lake Simcoe watershed (LSRCA, 2016B). The degradation of habitat along the shoreline of Lake Simcoe has reduces that ability for many species to survive. Restoration of these degraded spaces will provide opportunity for this fauna to re-establish and sustain populations. Revitalization of the shoreline will play a key role in providing appropriate habitat and connectivity for such species throughout the terrestrial and aquatic landscape.



33
AT RISK SPECIES

65
RARE SPECIES

The Fauna

Native small fish and invertebrates can act as sensitive keystone species throughout the littoral zones of the lake. These species provide an excellent indicator of habitat availability and ecosystem health along the water's edge (Young M. , 2016). Assessing their biodiversity and species abundance will provide information on native and invasive species relationships and success rates. The following charts show the sustained populations of native species, but also indicate an increase of invaders. The latter defines fluctuations with Amphipods (Crustaceans), Chironomids (Midges or Lake Flees) and Oligochaetes (Worms) as well as the depletion of insects. This alteration of species composition may impact niche roles and the dynamic of shoreline restoration strategies.

Small Fish Biodiversity

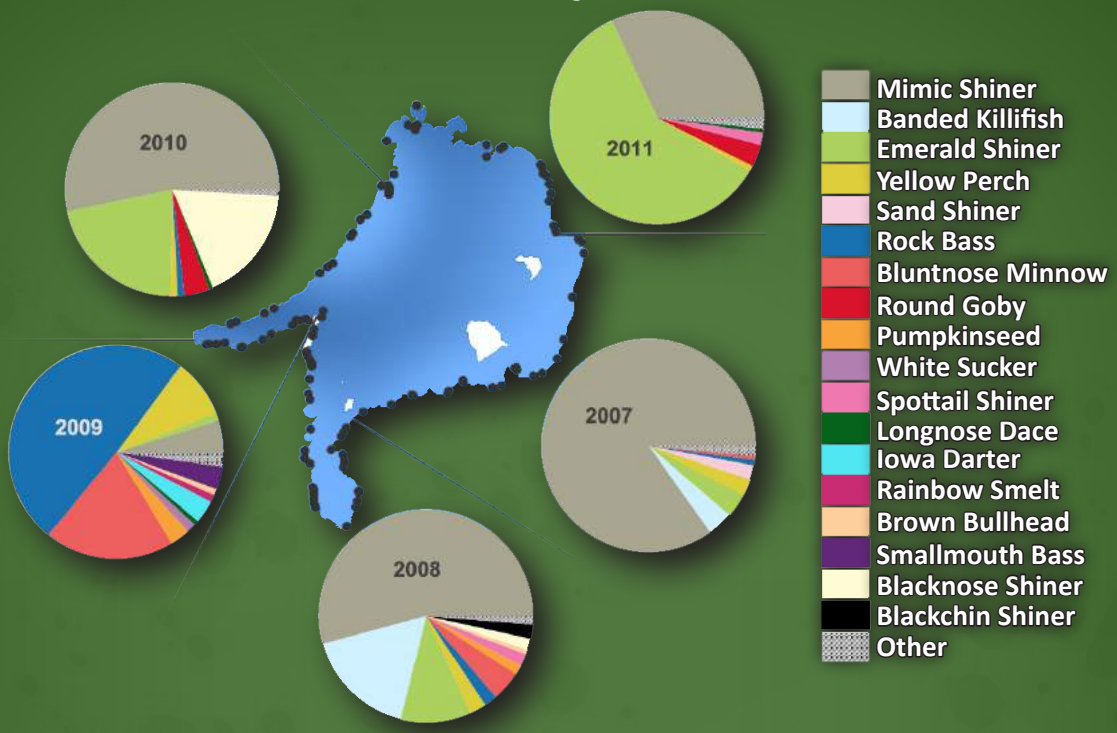


Chart information from (Young & Jarjanazi, 2014)

Shoreline Invertebrate Abundance

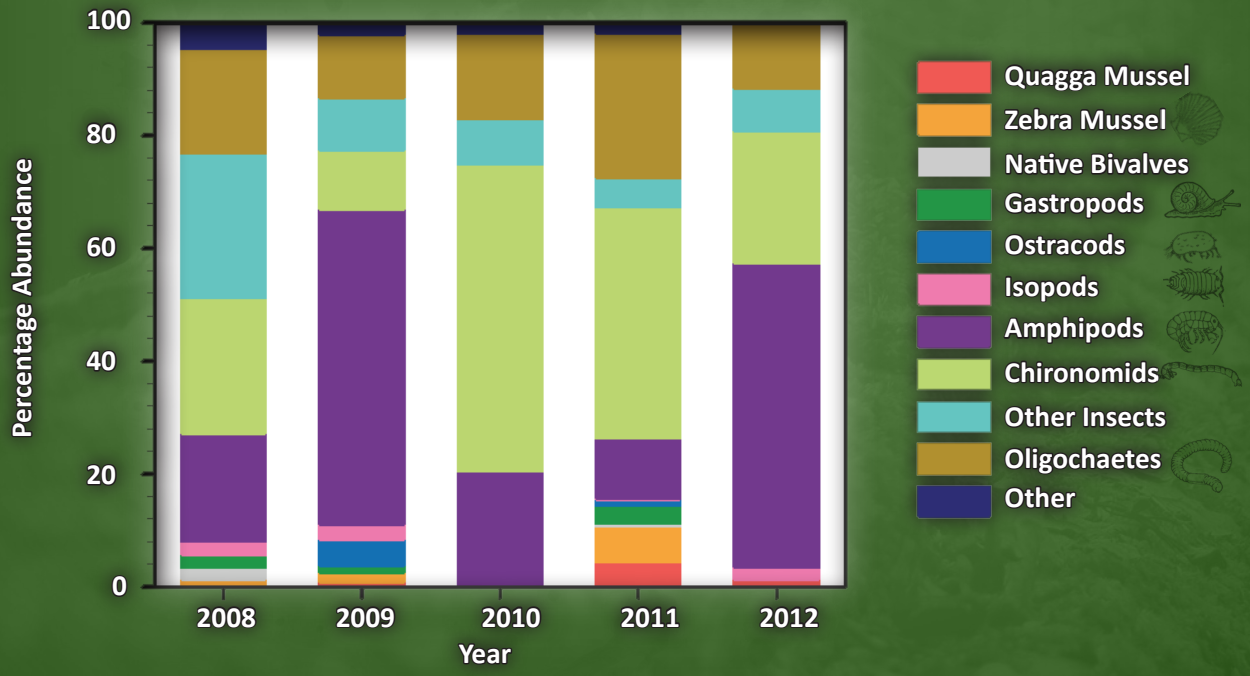


Chart information from (Young & Jarjanazi, 2014)

The Native Fauna Species



White Tailed Deer (Odocoileus virginianus)



Raccoon (Procyon lotor)



Red Squirrel (Sciurus vulgaris)



Eastern Painted Turtle (Chrysemys picta)



Gopher (Spermophilus richardsonii)



Trout (Salvelinus namaycush)



Whitefish (Coregonus clupeaformis)



Yellow Perch (Perca flavescens)



Pike (Esox Lucius)



Bass (Micropterus salmoides)



Herring (Clupea pallasii)



Walleye (Sander vitreus)

Common

All Figures of Fish on this page are from (Eakins, 2016) and all other Figures are from (Millar, n.d.)

Former information is from (Chabot, et al., 2006)

The Native Fauna Species



Jefferson Salamander (Ambystoma jeffersonianum)



Spotted Turtle (Clemmys guttata)



Northern Flying Squirrel (Glaucomys sabrinus)



Hog-nosed Snake (Hterodon nasicus)



Red Shouldered Hawk (Buteo lineatus)



King Rail (Rallus elegans)

At Risk



Lake Sturgeon (Acipenser fulvescens)



Redside Dace (Clinostomus elongates)

The Figure of the Lake Sturgeon is from (Eakins, 2016), the Red Shouldered Hawk is from (NAS, 2016), the Southern Flying Squirrel is from (Holland, 2012) and all other Figures on this page are from (MONR, 2016)

Former information is from (LSRCA, 2016; LSEMS, 2008)

The Invasive Species

According to the Lake Simcoe Basin Wide Report by LSEMS (2008) invasive non-native species threaten the integrity of biodiversity within the Lake Simcoe watershed. Alien species destroy and alter whole ecosystems by controlling habitat niches. Modification to shoreline habitat, in both terrestrial and aquatic systems, has occurred through the introduction of non-native flora and fauna. Such species can make the continued restoration and management of the shoreline difficult. These species must be considered so that mitigation techniques can be developed to reduce their impact on revitalized areas and the prosperity of shoreline systems. The following specimens are some of the flora and fauna which have been introduced into the Lake Simcoe watershed.

The Invasive Flora Species



Norway Maple (Acer platanoides)



European Buckthorn (Rhamnus cathartica)



Scots Pine (Pinus sylvestris)



Dog-strangle Vine (Vincetoxicum rossicum)



Japanese Knotweed (Polygonum cuspidatum)



Purple Loosestrife (Lythrum salicaria)



Ornamental Jewelweed (Impatiens gladulifera)



Giant Hogweed (Heracleum mantegazzianum)



Garlic Mustard (Alliaria petiolate)



Common Reed (Phragmites australis)



Eurasian Watermilfoil (Myriophyllum spicatum)



Curly-leaf Pondweed (Potamogeton crispus)

The Figure of the Curly-leaf Pondweed is from (Mixdorf, 2010), the Norway Maple and Scots Pine are from (Muma, n.d.) and all other Figures on this page are from (OFOAH, n.d.)
Former information is from (MOECC, 2016; LSEMS, 2008; MOECC, 2008)

The Invasive Fauna Species



Earthworm (Lumbricina spp.)



Emerald Ash Borer (Argrilus planipennis)



Common Carp (Cyprinus carpio)



Rainbow Smelt (Osmerus mordax)



Black Crappie (Pomoxis nigromaculatus)



Zebra Mussel (Dreissena polymorpha)



Spiny Water Flea (Bythotrephes cederstroemi)



Bluegill (Lepomis macrochirus)



Quagga Mussel (Dreissena bugensis)



Rusty Crayfish (Orconectes rusticus)



Round Goby (Neogobius melanostomus)

All Figures on this page are from (OFOAH, n.d.) except for Figures of the Black Crappie & Bluegill which are from (Eakins, 2016)
Former information is from (MOECC, 2008)

the DEVELOPMENT



the impact

Agricultural and recreational opportunity within the Lake Simcoe area has brought an increased demand for development and accessibility along the Lake Simcoe waterfront (LSEMS, 1995). With the increasing population, there has been rapid development of residences and cottages as well as commercial and recreational amenities along the shoreline. This development promotes fragmentation of habitat, loss of biodiversity and introduction of invasive species which lend to further future issues (Ontario Nature, 2014). Our pollution, contamination and general misuse of the landscape has created scars in the land which are further endorsed by physical development of the shoreline.

Our Waters, Our Heritage by the LSEMS (1995) explains that terrestrial and aquatic habitat can be drastically altered by onshore activities such as construction and agricultural practices. Development along the shoreline typically causes hardening of the water's edge. Anthropogenic infrastructure rids the waterfront of organic matter and habitat as well as the essential interstitial spaces which flora and fauna require to survive and reproduce. Expansion and intensification of agriculture and urban spaces has had considerable negative impacts on the quantity and quality of natural habitat along the shoreline (LSEMS, 2008). Development of breakwaters, docks, retaining walls and structures along the shoreline drive these negative impressions and further reduce available waterfront habitat (Chabot, et al., 2006).

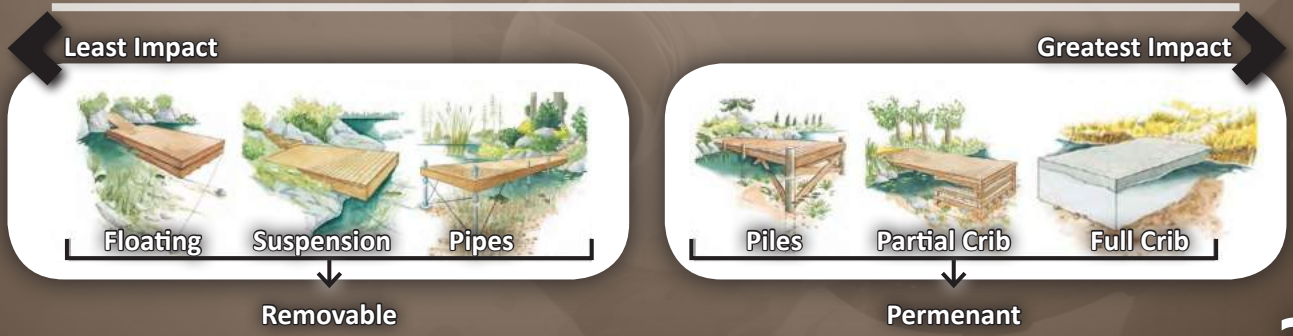
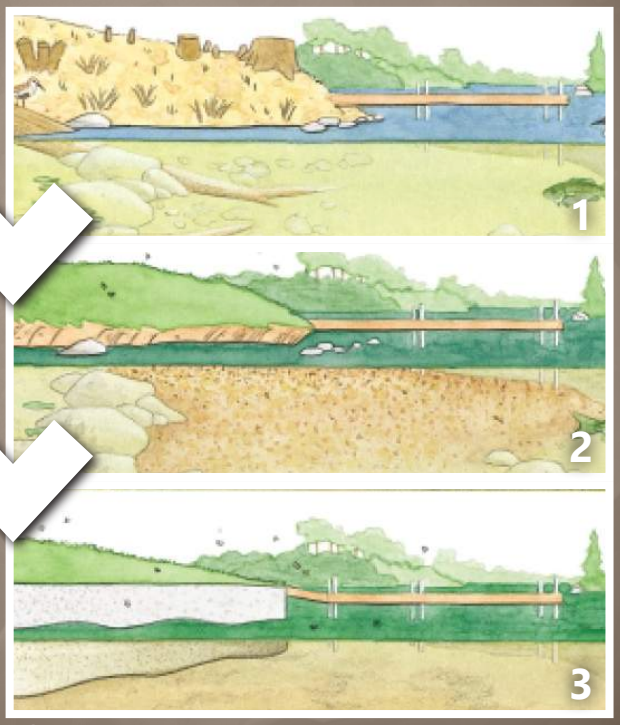


Figure 59 Shoreline Structures (MONR, 2013)

Common development undertakings and the hardening of the shoreline can cause erosion of sediment into the lake and eutrophication which unnaturally increases harmful plant production within aquatic communities (LSEMS, 2008). The movement of energy, matter and abiotic features such as water, nutrients and soils throughout the landscape can be impacted by these land use changes as well (Young M. , 2016).

Anthropogenic changes within terrestrial and littoral habitat can have negative impacts on water quality by increasing runoff of nutrients, organic matter, pollutants and sediments (Jennings & al., 1999). Simplification of the water's edge can disturb the flow of kinetic energy and promote erosion resultant of wind or wave actions (Grier, 2008).

Shoreline alteration can directly impact structural elements of the ecosystem such as density of plants in terrestrial and aquatic zones, the amount of essential complex woody debris (CWD) as well as the scale and uniformity of soil particles and substrate materials (Jennings & al., 1999; Grier, 2008; Christensen & et al., 1996).



1- Clearing of vegetation allows pollutants and runoff to reach the lake.

2- Removal of complex woody debris provides less spawning habitat and cover from predation.

3- Hardening of the shoreline simplifies necessary ecological interactions.

Figure 60 Shoreline Degredation (Ford, n.d.)

Abiotic features support ecological systems and play a key role in the sustainability of the biotic components. Without appropriate abiotic functions, positive ecosystem changes will not occur and essential support systems will not be in place for native flora and fauna to survive (Young M. , 2016). Terrestrial and aquatic species composition can alter to include less desirable biotic components that further degrade the quality of water and land which may reduce property value, increase maintenance cost and promote management strain (Dearden & Mitchell, 2016). This ecological deprivation does not maximize natural benefit for the least effort (Basterfield, 2016). Degradation of ecological systems can directly impact the quality of life had by communities that depend on the lake. Each one of us within the watershed is connected to Lake Simcoe and how we use the land is ultimately reflected by the integrity of the waterbody (Thompson & et al., 1994).

All observable anthropogenic burdens that have been forced upon the shoreline must be considered to the greatest probable extent while developing a restoration strategy. Yet, it must be emphasized that it is impossible to account for and react to every imposition humans have created across the water's edge. This is particularly true when reacting to shoreline development which is anthropogenically driven by its very nature. The latter written sections of this document will rationalize the restoration of shoreline habitat while considering developmental impacts on natural biotic and abiotic features. Other relevant factors must be considered when necessary, but it is factually impossible to contemplate all facets while justifying shoreline restoration.

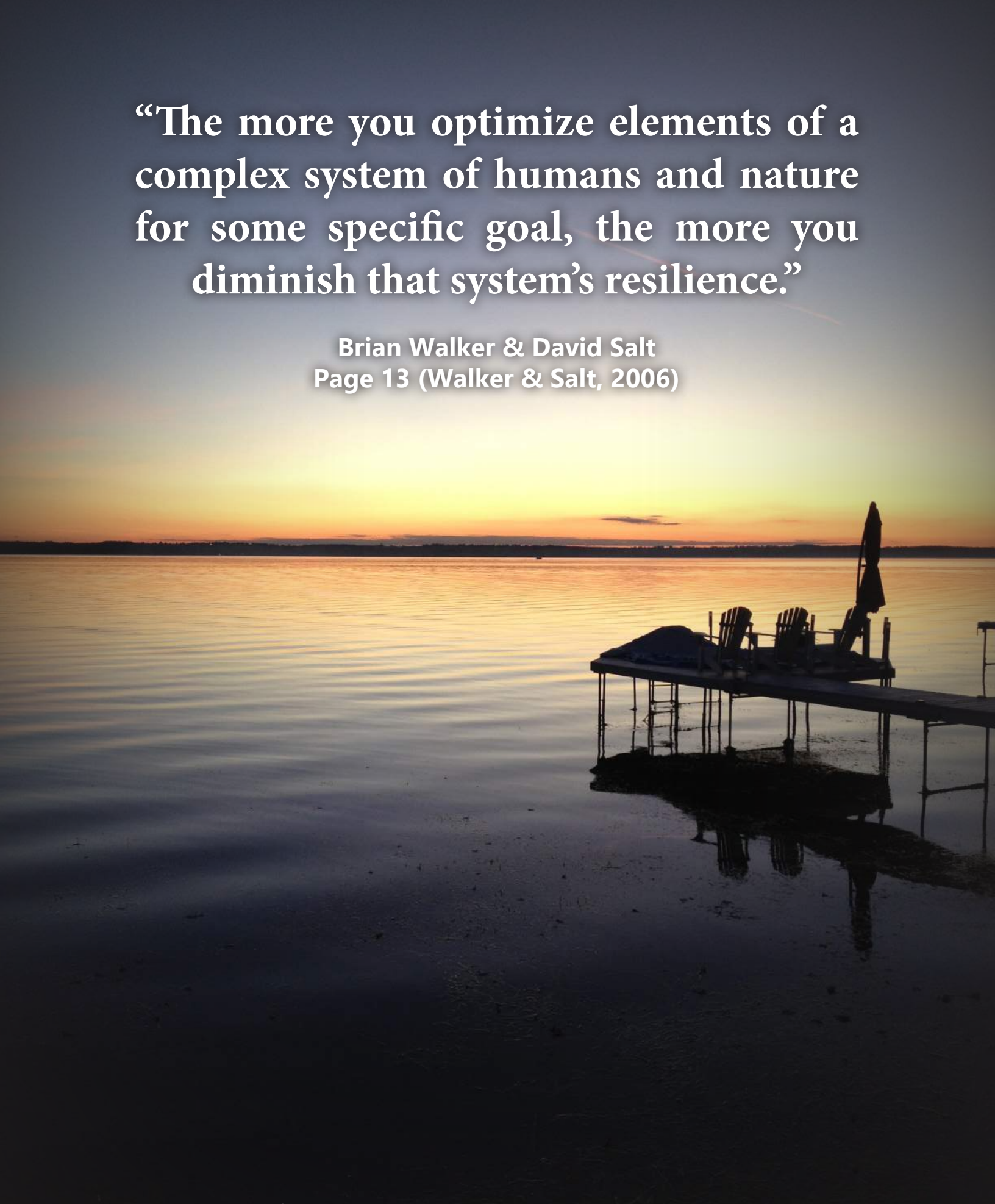


Figure 61 Touching the Shoreline (picture by Kyle Foch)

the policy

According to Mary Anne Young (2016), policy defines the laws and frameworks which guide the way our municipalities and provinces are run. It lays the ground rules for all facets of society. She argues that policy shapes the landscape by directing growth and attempting to protect natural heritage features. Such regulatory devices are important because they attempt to manage and drive growth away from the most sensitive landscape features such as places like Lake Simcoe's shoreline. Policy directs change to mitigate externalities while still allowing for expansion. It supports, protects and enhances ecological functions found within natural systems and along the waterfront.

The Lake Simcoe Basin Wide Report by the LSEMS (2008) & The Best Practices Guide to Natural Heritage Systems by Ontario Nature (2014) provide a breakdown of the enforcement tools and regulation strategies used to manage environmental impacts on the lake. Numerous provincial acts, plans, policies and legislative strategies have been developed to provide a comprehensive framework for planning within the Lake Simcoe watershed and other relevant areas. These tools will be explained within the following section in accordance with the information defined within these reports unless otherwise stated.

The Provincial Policy Statement

Established under the Planning Act

The Provincial Policy Statement (PPS) provides clear and concise rules that support the growth of areas which are reinforced by current infrastructures. This policy guides municipalities in the preparation of their Official Plans and other supplementary planning tools. Such documents define and enforce local interests, values and priorities. Natural heritage features are specifically addressed within the PPS. Such policy directly supports the protection of natural components within the Lake Simcoe watershed. This directive does not prevent municipalities from creating stricter regulation so long as it does not conflict with other legislation. The PPS influences all municipalities within the Lake Simcoe watershed and guides the impacts that these communities have on the lake. It is important to note that nothing within this policy is defined to prohibit the continued usage of lands for agricultural activity regardless of the impending impact it has on natural heritage features such as the shoreline (Young M. , 2016).

The Lake Simcoe Region Conservation Authority

Established under the Conservation Authorities Act

The Lake Simcoe Region Conservation Authority (LSRCA) provides technical information and professional guidance to support appropriate municipal planning action related to Lake Simcoe. This authority also reviews planning documents and applications for development. Regulation development controls to protect natural heritage systems is also undertaken by this organization. The LSRCA also provides investigations of the watershed to support evidence based creation of conservational, restorative, developmental and managerial natural resource practices. This organization acts as a key player in deciding land use action throughout the Lake Simcoe watershed. The LSRCA is a primary asset when looking at the restoration of the lake's shoreline. This authority may provide support through funding, information and services if localized revitalization on private property was to occur. Establishment of a shoreline restoration initiatives may be undertaken in conjunction with this organization.

Figure 62 Lake Simcoe Region Conservation Authority Crest (LSRCA, 2016)

The Lake Simcoe Protection Plan

Established under the Lake Simcoe Protection Act

The Lake Simcoe Protection Plan (MOECC, 2008B) aims to protect, improve and restore the ecological features, functions and changes that contribute to the continued health of the Lake Simcoe watershed. It further states that research must be undertaken to inform decision making processes and mitigate negative impacts on the lake and its systems. This policy aims to promote environmentally sustainable recreation, development, land usage and water usage while increasing the watershed's capacity to adapt to anthropogenic and climatic influences. The plan must work in conjunction with supplementary regulatory devices listed within this section. The LSPP takes precedent over other acts and plans if conflicts arise, unless another document provides greater protection for the ecological integrity of the lake and its components (MOECC, 2008A).

The Official Plan(s)

Established under the Planning Act

Official Plans (OP's) are a municipal level document that act as fundamental land use plans and define visions, values, goals, objectives, policies and land use designations for an area. Stakeholders play a key role in the development of this plan which is driven by a community-oriented development process. OP's and Secondary Plans within municipal boundaries set a foundation for how the community undertakes land use planning and defines the directionality of development within the municipality. Such policy impacts Lake Simcoe because of the influences it can create on a local scale. It can directly impact the lake's shoreline and connecting natural heritage features. Official Plans and Secondary Plans must work in conjunction with the PPS and any other policies which take priority unless more stringent regulation is defined.

The Oak Ridges Moraine Conservation Plan

Established under the
Oak Ridges Moraine Conservation Act

The Oak Ridges Moraine Conservation Plan (ORMCP) was developed to manage resources found within the 160 kilometre area of the moraine and its connecting features. It looks at the linkage areas, connections, buffers, setbacks, ecological health and hydrological integrity of the moraine (Young M., 2016). The municipalities within this defined area must consider the plan during the review of development applications. The protection of linkages and the core land of natural heritage features are the main objectives of this plan. It aims to achieve this by restricting land use activities within key areas. This regulatory device defines much of the development that occurs within the southern part of the Lake Simcoe watershed. It aids in the protection of greater watershed systems and supports the restoration of the natural feature that connect to the lake. The shoreline of Lake Simcoe does not fall within this geographic boundary, but is directly impacted by the changes that occur resultant of this plan. The land regulated under this plan is also designated under the Greenbelt Act and must be considered in combination with the Greenbelt Plan.

The Greenbelt Plan

Established under the Greenbelt Act

To mitigate urban sprawl and fragmentation of agricultural and ecological features, the provincial government developed the Greenbelt Plan. This regulatory device aims to protect countryside domains that act as settlement areas while also preserving agricultural and natural systems. This plan must be considered in combination with the Growth Plan which designates future growth outside of the Greenbelt area. The Greenbelt plays a major role in defining agricultural and natural land uses within the Lake Simcoe watershed. Such designations directly impact ecological systems of the lake and its surrounding landscape. This must be considered when implementing and managing the restoration of the shoreline and its systems.

The Growth Plan

Established under the Places to Grow Act

The Growth Plan for the Greater Golder Horseshoe (GGH) was produced to guide decisions regarding numerous facets of community development. Land use planning, urban form, housing, natural heritage and resource protection are just a few topics which are broached within this plan. These subjects are considered for their ability to provide economic prosperity within communities. This plan is meant to create a foundation for securing the future of the GGH through investment decisions. The actions that are driven by this plan may directly relate to the development of the Lake Simcoe shoreline. Analyzing the impacts of this development and its connection to the Growth Plan will set a foundation for counteracting detrimental undertakings.

Figure 63 Greenbelt Logo (The Friends of the Greenbelt Foundation, 2016)

Supplemental Policy

Species at Risk Act

Fisheries Act

Migratory Birds Convention Act

Endangered Species Act

Clean Water Act

Niagara Escarpment Planning and Development Act



Figure 64 Planning Documents (Ministry of Municipal Affairs, 2009)

The Implications

Policies that have been defined to protect natural areas and habitats have not been successful. There has been no development of strategies that look towards increasing natural areas within the watershed and along the shoreline (LSSC, 2012). The Shoreline Voluntary Action Program is the only device implemented that improves the water's edge. Yet, lack of shoreline regulation has led to the continued deterioration of the waterfront. The LSPP attempted to created positive change in relation to these issues, but has failed in its employment (LSSC, 2012). The lack of regulation and inappropriate development that occurs on or near the shoreline can have negative implications that risk public welfare and shoreline resources (Chabot, et al., 2006).

Many of the governmental policies that are imposed throughout the Lake Simcoe watershed are reactionary planning tools. These devices typically regulate issues on a broad scale and do not create proactive implementation strategies that are contextually appropriate (ECO, 2009). Contextually specific policy must be established to drive appropriate decisions related to development along the Lake Simcoe shoreline. The waterfront is an integral part of the whole watershed ecosystem and should be given superiority by regulating devices (LSSC, 2012).

Devices such as pollutant reduction credits and density transfer credits have both positive and negative environmental implications (Bowers, 2016). Yet, the PPS (section 2.1.9) blatantly prioritizes agriculture over natural heritage (Young M. , 2016). These are just a few examples of counterintuitive regulation that unsuitably prioritizes the environment.

These policies disregard the fact that you cannot simply replace or move ecosystem features and functions. The government has become complacent in its regulation of the environment. In their attempt to drive innovation and growth they have disregarded environmental externalities created by their policies. Regulation is only put into place as a response to these consequences and neglects to prevent issues before they start. Environmental policies are reactionary rather than proactive.

Many government policies still contain flaws in their implementation and provide opportunity for private individuals to take advantage of the system. Consequences defined by these gaps show that policies are not being enforced as strongly as intended and lack implicit prioritization of natural systems such as the shoreline. If the environment is a secondary priority, then polices are not able to represent an actual attempt at maintaining natural features solely for the value they provide.

Regulation can directly impact the protection and development of the shoreline. Gaps found within the systems have major negative implications. The shoreline's integrity can be breached when private individuals find loopholes in the regulatory system (LOTL & WEC, 2006). Furthermore, without prioritization of the environment, policy related to things such as agriculture and community growth may impose alteration unto the shoreline that may be contradictory to the very framework of environmental protection and management policy.

The positive to these issues is that the consequences created by the inappropriate prioritization of the environment and manipulation of the system helps illuminate the holes that must be mended. These very things provide a basis for positive improvement within the policy system and will develop a foundation for improving devices to protect, restore and maintain the shoreline.

the CARE



50

the education

Educating waterfront land owners, developers and local stakeholders as well as the general public about the shoreline is a key part in restoring, protecting and maintaining the water's edge. Without an informed public basis, there will be minimal implementation to positively benefit the shoreline and the lake. A knowledgeable society is a society that cares. Having a community that cares about the shoreline is fundamental to providing a healthily balanced economy and environment (LOTL & WEC, 2006). There are numerous ways to educate the public about the shoreline while also providing opportunity for involvement, economic gain, community improvement and amusement.





Curriculum

Provide local curriculum that speaks to the future generations about the shoreline and sustainability of the lake's health.



Competitions

Run competitions that will promote action, provide educational opportunity and help support funding of private projects (Slaight, 2016).



Workshops

Provide workshops that will give opportunity for hands-on experience and knowledge while producing a rhetoric throughout the community.



Groups

Utilize social & community groups to inform people in the watershed about shoreline restoration and sustainable activities (LOTL & WEC, 2006). Such groups may also provide a support system for implementation and movement of information throughout the watershed.



Events

Run events that study and celebrate the waterfront in all its forms and through all its functions (LOTL & WEC, 2006; Slaight, 2016). This will get people to physically go to the shoreline while helping them develop an appreciation for its complex functions and beauty.



Tourism

Allow for eco tourism opportunity that informs locals, developers and tourists about the shoreline and the lake while securing economic inputs produced by this market (LOTL & WEC, 2006).



Entertainment

Develop or utilize community centres and entertainment facilities (museums, arcades, theaters, parks, media centres, etc.) to teach people about the lake and its shorelines (LOTL & WEC, 2006). These facilities will encourage watershed rehabilitation and will promote the protection, restoration and maintenance of the shoreline through untraditional means while appealing to the younger generation.



Activity

Provide local activities that encourage interaction with the shoreline and education of connecting watershed components while also supporting implementation strategies that would typically lack required inputs to be undertaken.



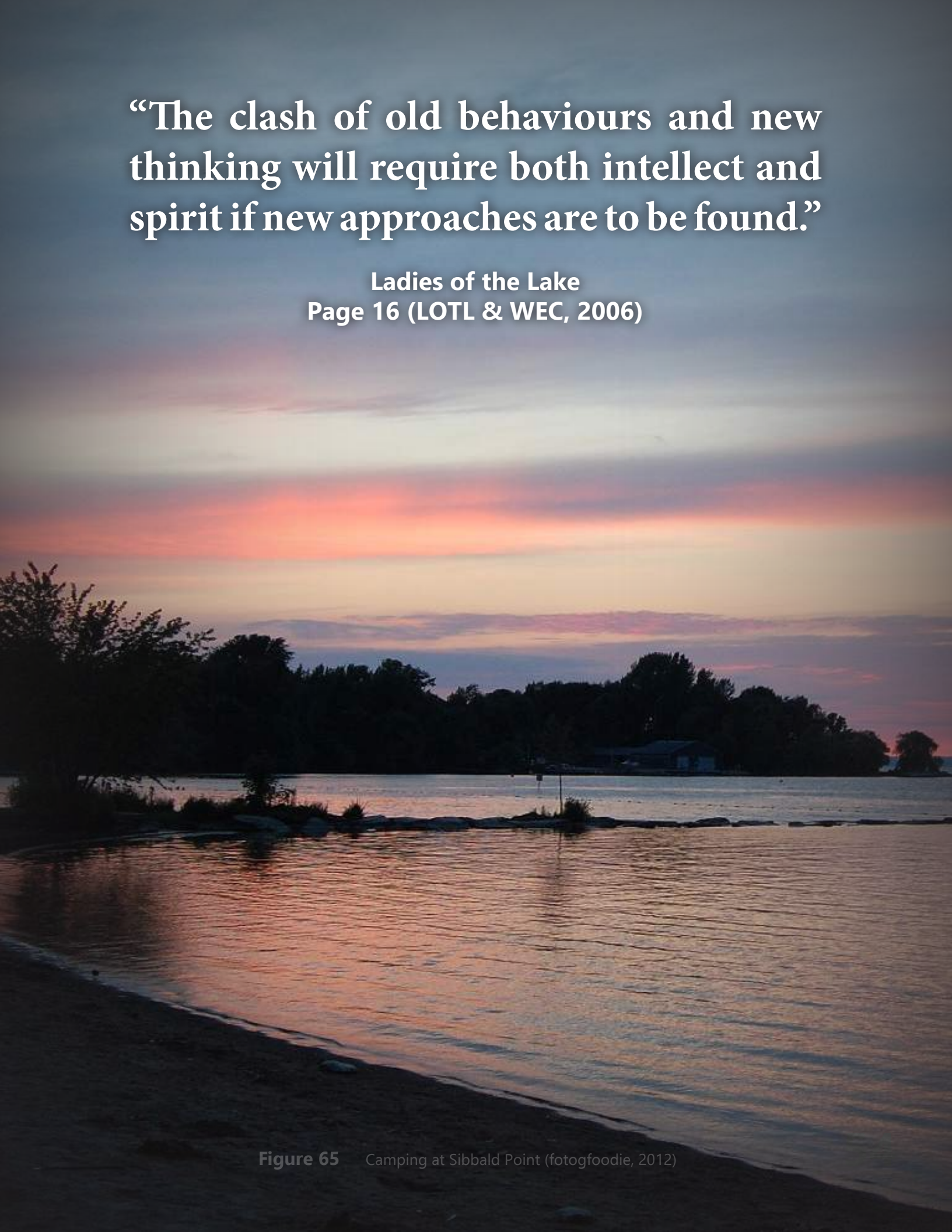
Signage

Display signage at key public location to inform people about shoreline features and functions as well as best practices for restoring and protecting the water's edge.



Literature

Distribute and produce accessible magazines, newspaper articles, brochures and social media content that informs individuals about the shoreline and action that can be taken to make it healthy again.



“The clash of old behaviours and new thinking will require both intellect and spirit if new approaches are to be found.”

Ladies of the Lake
Page 16 (LOTL & WEC, 2006)

Figure 65 Camping at Sibbald Point (fotogfoodie, 2012)

the regulation

The alteration of policy and the approvals processes for development along the edge of waterbodies has started a trend to prevent shoreline hardening (LSEMS, 2008).

Yet, there is still minimal policy that has been put into place to regulate the Lake Simcoe shoreline effectively. Shoreline regulation is become increasingly required due to the lack of voluntary action being undertaken by local waterfront residents (LSSC, 2012). Regulation is a major priority to help in the restoration of privatized shorelines and to reduce further developmental impacts.

New governance structures need to be implemented to further include citizens within the watershed community. Stakeholders must be given a greater role to play and should be involved at all levels of the restoration process. By developing and directing more effective communication strategies the public and private sectors can work as one to achieve restoration outcomes along the shoreline. Innovation, research and retention of adequate funding will help further drive these efforts (LSEMS, 2008).

Such an undertaking would provide a clear message of change for waterfront land owners and private stakeholders throughout the Lake Simcoe watershed. Accountability measures, incentives, enforcement sanctions and funding are all needed to back up more appropriate policies and legislation (LOTL & WEC, 2006).

There are numerous ways to better protect, restore and maintain the shoreline of Lake Simcoe through regulatory change. Such changes will attempt to provide more proactive policies rather than reactionary regulation tools.

Shoreline Policy

Create and continually impose regulations that improve and protect the shoreline as well as its supporting natural features (LOTL & WEC, 2006).

Vegetation Policy

Produce policy that will impose conservation and restoration of tree canopies as well as vegetation coverage along the shoreline and throughout the watershed (LOTL & WEC, 2006).

Infrastructure Policy

Develop policy that provides more opportunity for individuals to utilize green infrastructures (eg. vegetation buffer, grey water systems, shoreline adjustment, solar and wind energy) under appropriate management.

Water Policy

Create a plan & policy to replace storm water and sewage systems with ecologically appropriate alternatives while monitoring and maintaining water integrity (LOTL & WEC, 2006).

Contextual Policy

Develop policy that requires contextually specific action and implementation strategies based on appropriate temporal and special scales (Jennings & al., 1999).

Stricter Policy

More stringent policy, regulation and buildings codes must be developed to make sure new growth benefits the lake rather than impedes it (LOTL & WEC, 2006; Dearden & Mitchell, 2016).

Prioritize Policy

Ensure that the shoreline and the watershed become a higher priority in policy making and action.



Plan Expansion

The Greenbelt Plan and other conservation plans should include the shoreline and rivers that connect to the lake which will provide more public access to water and help protect natural features (LOTL & WEC, 2006).



Policy Variances

Allow for variances in policy to promote innovative shoreline development that maintains the ecological integrity of the water's edge and nurtures growth opportunities.



Fill Gaps

Take decisive action to fill gaps in policy and make sure that the system does not allow for inappropriate abuse of such flaws.



Open Opportunities

Minimize the number of barriers that prevent conservation easements, accessibility and land acquisition for ecologically positive action along the shoreline (LOTL & WEC, 2006).

the incentives

Incentives can act as an important tool to preserve natural spaces and encourage stewardship action among community members. So long as incentives are marketed effectively, they can be leverages to significantly increase productivity and feasibility while expanding the areas of restoration covered within local jurisdictions (Patterson & et al., 2014). Barriers associated with restoration undertakings must always be considered and rectified with contextually appropriate solutions. Incentives are one tool that can be used to sanction drivers and reduce the barriers associated with restoration undertakings (Patterson & et al., 2014).

Drivers & Barriers for Shoreline Restoration

	Interal Factors	External Factors
Drivers	Financial Benefits Culture, History, Norms & Learning Individual Ethics Operational Risks	Government Regulation/Policy Image, Reputation and Associated Risks Media, NGO/Interest Groups and Wider Society Insurers and Other Financial Institutions
Barriers	Lack of Finance Culture, Norms, Structure, Learning and Communication Demand on Personal and Financial Resources Lack of Knowledge or Access to Information Lack of Acceptance	Government Regulations/Policy Consumer Behaviours and Real Estate Buyers Lack of Access to Finances

Chart information from (Patterson & et al., 2014)

The Funding

Governmental and private funding is necessary to allow for restoration implementation along the shoreline of Lake Simcoe. Innovative financial strategies and mechanisms are necessary to provide the monetary backing needed for restoration along the shoreline (LSSC, 2012). Financial contributions incentivize action and support undertakings along the shoreline. Restoration is often a longer-term investment which can be encouraged by providing financial incentives to reduce initial barriers (Patterson & et al., 2014). It is important to note that financial incentives are most effective when they are simple and the benefits are swift and observable (Patterson & et al., 2014). The following are some suggestions for making ecological undertakings financially feasible for both private and public groups along the shoreline.



Grants and loans from the government or Public Private Partnerships (PPP) will directly support implementation of shoreline projects and provide significant financial contribution to drive actions.

Tax credits for conservation, restoration and management from the government will implicitly provide incentives through savings for innovative action and financial benefit (LOTL & WEC, 2006).

Philanthropy and fundraising will gather funding for both public and private undertakings which explicitly provides resources for local action.

of the shoreline and the lake will discourage such action and promote change (LOTL & WEC, 2006). These fees will also gather funding that can be put towards positive shoreline restoration strategies.

Special property tax will acquire funding which the government will use to support community action or purchase waterfront land for the sole purpose of shoreline restoration and maintenance (Patterson & et al., 2014).

Waiving fees and streamlining acceptance of environmentally beneficial projects will encourage individuals to invest in and consider restoration work while reducing costs associate with action (Patterson & et al., 2014).

The Services & Consultation

Access to information and tools is key in allowing individuals to undertaking shoreline restoration on their own property. However, such things are sometimes very difficult to attain for individuals who lack connections and education in the field of restoration. Technical advice should be given to landowners that are interested in stewardship projects as it will support engagement opportunity (Janette & et al., 2014). Providing more accessible services and consultation will make it easier for individuals and groups to create positive change along the shoreline. Provision and improvement of these services is key to providing opportunity for all individuals and groups to act. The following are some necessary changes that must be made to achieve a more accessible framework for services and consultation.

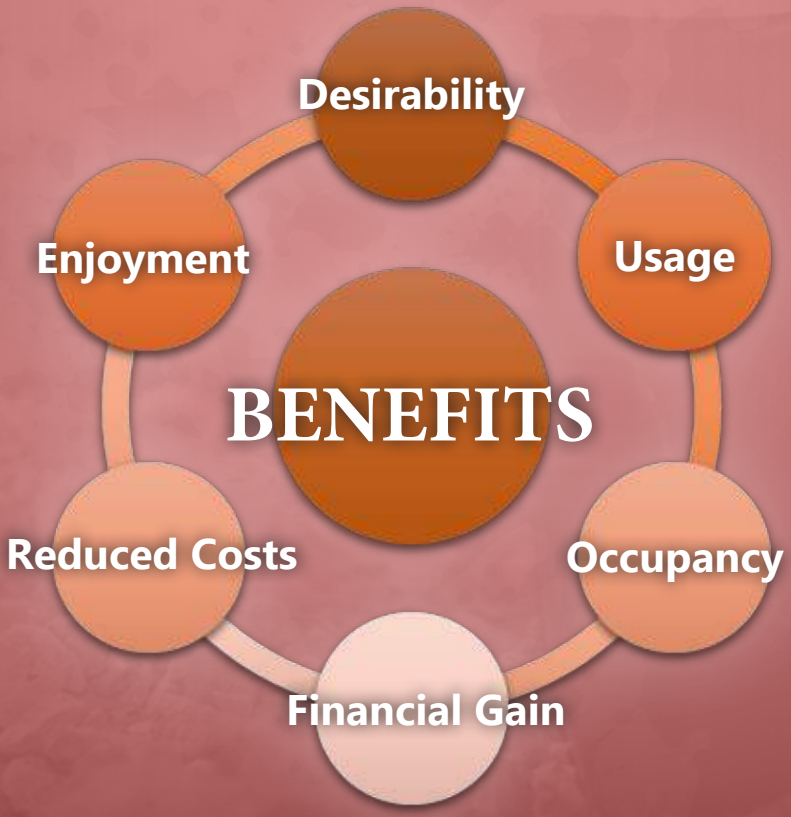
Community outreach will provide services to private individuals and groups that may otherwise have limited access to resources and information. This outreach is key to connecting with individuals that would typically not act because they lack the resources (Slaight, 2016).

Dedicated governmental sectors that are readily available to provide services and requirements would allow for monitoring and public-private interactions. NGO's throughout the community contain such resources, but few municipal divisions supply such things for individual property owners.

Stewardship programs provide technical assistance, advice and implementation solutions (LSEMS, 2008). Current programs must be enhanced by the government as they are minimally accessible and visible to the public.

The Benefits & Rewards

Producing a new economic model that highly values the lake as a key gathering node for neighbouring communities and shoreline development will positively promote growth and nurture a healthy waterfront. The balancing of economic growth and the natural environment is key to producing opportunity for individuals living within the watershed (LOTL & WEC, 2006). The government and private property owners must work in conjunction to improve shoreline settings and recompense environmental stewardship practices (Patterson & et al., 2014). It is important to recognize personal benefits and reward implementation of shoreline restoration to encourage investment in such actions (Patterson & et al., 2014). Positive shoreline undertakings by private entities would not be encouraged or even feasible otherwise. Private individuals and groups must be accountable for their ecological undertakings and allowed to reap the benefits of such action.



Retaining the integrity of the shoreline within any development reduces costs that would typically be needed to replace key ecological features and functions (Basterfield, 2016).

Ventures that provide accessibility to the lake and its shoreline while actively preserving its health can be more easily enjoyed by the end user (LOTL & WEC, 2006).

Developments that maintain the integrity of the shoreline are more desirable by the surrounding community and end users (Bowers, 2016).

Developments that provide ecologically friendly structures and landscapes (especially when classified and certified) can reap economic benefit through increased property value, rental rates, occupancy and usage (LOTL & WEC, 2006; Devine & Kok, 2015).

Eco tourism can improve the attractiveness of the shoreline and the lake while protecting its features and functions (LOTL & WEC, 2006). Development that can achieve such undertakings will be able to financially gain from site activity.



Awards pertaining to ecological action will promote environmentally positive behaviour and will encourage developers, cottagers, governments and marinas to protect, restore and maintain the waterfront (LOTL & WEC, 2006).

Classification & certification (bronze, silver, gold and platinum levels) of ecological undertakings can be ranked and will provide achievable shoreline restoration objectives for different entities with different resources.

Recognition strategies (celebration events or promotion) will encourage positive action by developers through providing them with greater visibility and free advertising related to their ecological undertakings.

the stewardship

Much of the watershed is owned by private entities which means that restoration undertakings directly depend on the actions of those who manage such private properties found along the shoreline (MOECC, 2010). Waterfront property owners will recognize and value environmental stewardship when a coherent and favourable framework for shoreline restoration is developed (Patterson & et al., 2014). People can start to become stewards of the shoreline when they utilize the provided guiding principles and techniques that are reinforced by education, regulation and incentivization. Such things support individual stewardship through behavioural and habitual changes when the development, implementation and enforcement of regulation was insufficient (MOECC, 2010).

Defining Stewardship

Voluntary process of sustained attitude and behavioural change over time

Multiple elements and activities by numerous individuals and organizations

Awareness
Education
Training
Influence
Incentives
Guidance

Creates understanding and desire to participate

+

Partnerships
Trust
Support
Effective delivery

Science-Based
Risk Assessment
Action Plans
Priority Setting

Overcomes barriers and builds skills

+

Activities
Best Management Practices
Remediation & Restoration,
(e.g. tree planting, buffers)

Beliefs
Citizen participation
Conservation Ethic
(e.g. land easements, parks)

Efforts and results cut across policy boundaries

+

Technical assistance

Incentives
Change behaviour
Make improvements
Innovate

Recognize & measure progress and success

Promotes actions that can be supported and reinforced

=

Effective and proven approach to stewardship
Ecological, economic and social benefits
Continuous improvement over time
Opportunity to align stewardship with Lake Simcoe's priorities

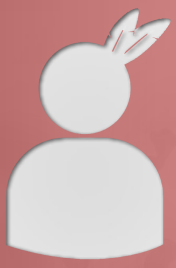
Challenge to measure stewardship's direct impact

Chart information from (MOECC, 2010)



Political Stewardship

Election campaign meetings, governmental rallies and election activities provide great opportunity for individuals to get involved, act and educate themselves or others about shoreline restoration (LOTL & WEC, 2006). Such stewardship will also provide an opportunity for subsidiarity and neoliberal policy development driven by the desire for environmental health (Dearden & Mitchell, 2016). Politically driven stewardship can help develop a strategy that will provide programming and best management practice throughout all sectors of society (MOECC, 2010). People will be able to help push decision making related to shoreline undertakings and implicitly encourage positive outcomes through their involvement.



Traditional Stewardship

The incorporation of indigenous practices and knowledge into the restoration process will allow native peoples to provide advice and become involved (LOTL & WEC, 2006). This will build community connections and will take advantage of the vast traditional knowledge indigenous people have regarding the lake and its shoreline. Providing opportunity for the native Ojibwa people to guide activities along the shoreline and help direct policy and implementation through creation of indigenous councils will allow for the most advantageous incorporation of such knowledge into restoration practices.



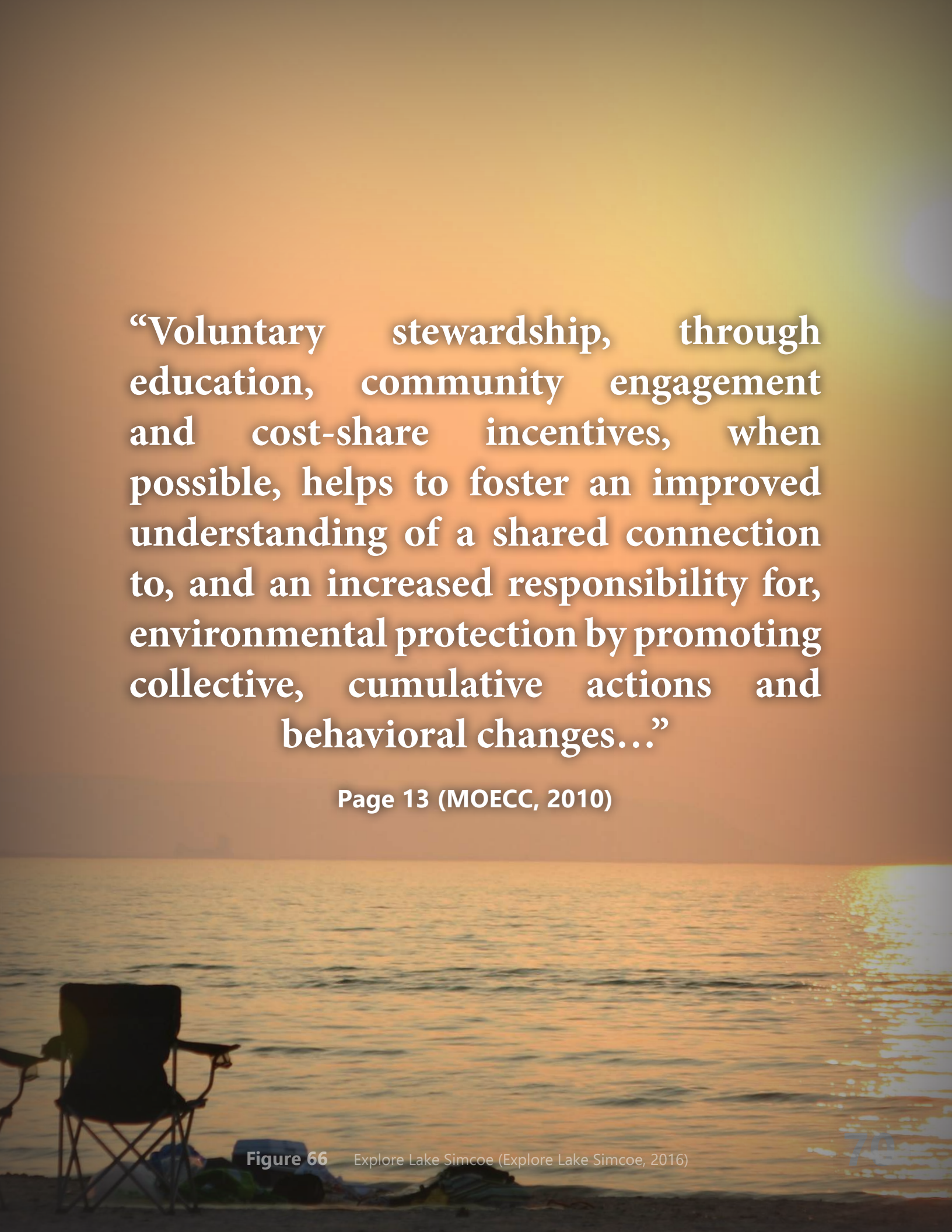
Community Stewardship

Acting as a community is an expressive and powerful way to create change. Community groups provide a wonderful opportunity to drive interest related to shoreline restoration and to show the desire of individuals to create change (Janette & et al., 2014). Grouping of individuals devoted to restoring the shoreline or contributing positively to the health of the lake is an effective way to direct influential change. These groups provide opportunity for people to get involved within the community and access a wide variety of resources and information while enjoying the presence of like-minded individuals.



Individual Stewardship

Personal funding, ethics and knowledge related to shoreline stewardship drives an individual's action to create positive change. Lending such things to the public through suggested practices can increase the desire for people to act on a personal level. Individual stewardship action is the most impactful solution to revitalizing Lake Simcoe's waterfront. The public become accountable when they have the resources required to protect the lake and maintain shoreline integrity on their private properties. The suggested strategies provide such resources throughout the community and make the public accountable for the health of the shoreline. Changing public perceptions and catalyzing further implementation will produce a ripple effect that invigorates individual stewardship (Slaight, 2016).



“Voluntary stewardship, through education, community engagement and cost-share incentives, when possible, helps to foster an improved understanding of a shared connection to, and an increased responsibility for, environmental protection by promoting collective, cumulative actions and behavioral changes…”

Page 13 (MOECC, 2010)

Figure 66 Explore Lake Simcoe (Explore Lake Simcoe, 2016)

the encouragement

Leading by example and by experience is catalytic for community involvement and encouraging individuals to act on their own properties along the shoreline (Slaight, 2016). Building a model of excellence for living in an ecologically and environmentally conscious way provides a basis for other individuals who may want to do the same thing (Chabot, et al., 2006). Action is typically initiated by public groups or large scale private stakeholders. This action sets a precedent for local private property owners to follow and can act as a resource for implementation. The following examples are sites that have been activated by the community to catalyze shoreline restoration initiatives throughout the watershed and educate people on the importance of our lake.

Clearwater Farms

Willow Beach, Georgina, Ontario

This project is undertaken by the Ontario Water Center with support by the Town of Georgina. The Clearwater Farm is a waterfront project which is implemented to set a precedent for community action, sustainable resource management and environmental education.









All Figures on this page are from (Clearwater Farms, 2016)

Pine Beach Park

Pine Beach, Georgina, Ontario

This project is undertaken through Rewilding Lake Simcoe with support from both public and private partnerships. This project entailed the rejuvenation of waterfront park land and surrounding spaces. It was designed to manage environmental, ecological and communal interests while accounting for biotic and abiotic features of the site. It stands testament as an educational tool to catalyze shoreline restoration projects throughout the community.







Top and bottom right Figures are from (DoUC, 2012)
Bottom left Figure is from (Our Lake Simcoe, 2014)

Working one-on-one with private property owners, community stakeholders and developers is an effective way to maintain a healthy waterfront and encourage restorative action (Slaight, 2016). Individuals can benefit from direct aid in their endeavours and supply resources that may have been difficult to attain otherwise. However, this process can be inefficient due to the time required for each undertaking and the persons needed for implementation (Slaight, 2016). Therefore, it is imperative to consider timelines and the importance of undertakings before providing one-on-one support. The provision of keystone projects throughout the community, such as those noted, can provide implicit encouragement if one-on-one aid cannot be attained.







Top Figure is from (DBC, 2015)
Bottom right Figure is from (ASIES, 2012)
Bottom left Figure is from (Beaton & LeGrand, 2014)


the
RESTORATION
75

the consideration

Before implementing a shoreline restoration project, individual property owners and contractors must consider factors of the work, design and maintenance. Without these considerations, there could be extreme negative consequences that may harm the lake and the water's edge. Thompson et al. (1994) denote components that should be considered before undertaking a restoration job along the shoreline.

Available Resources

Find and utilize incentive programs and attain assets to support implementation through external knowledge, financing, consultation and services. Analyze the site and nearby habitat to gather information and resources to support your shoreline project.

Causes & Nature

The type of development that has occurred or will in the future must be considered in conjunction with restoration measures to inform an appropriate solution.

Components & Adjacencies

Locate underground services such as sewer lines, electrical, wells and septic tanks on and off the site. Contact neighbours to know how this restoration may impact their properties, to see if they have similar problems and if they want to participate.

Alternatives & Measures

Reviewing the restoration alternatives and evaluating the context of the site will allow for appropriate solutions to be put into place. A target must be defined to determine requirements for biotic and abiotic features of the site.

Implementation Schedule

Some restoration practices must only be undertaken during dormancy or growth periods. A schedule of work accommodates for such requirements and keep things on track while accounting for changes.

Materials and Tools

A restoration job is an comprehensive undertaking that must bring together numerous resources. Reputable and trustworthy tool and material suppliers should be used by the land owner and their contractor. Native plant stalk and species must be attained from appropriate sources within the area to re-establish natural shoreline vegetation and prevent invasion of species.

Diversion Measures

Account for sources of runoff and drainage that must be diverted away from the shoreline restoration area to prevent damage and allow for adjustment following construction.

Access and Clean Up Costs

Consider what machinery will need access and how this will be provided. Calculate potential damage costs to develop contingency measures.

Safety Plan

Restoration work can be dangerous and requires appropriate safety gear and protection measures. Safety of the flora and fauna must also be considered to prevent the usage of harmful (eg. poisonous, flammable, corrosive, pollutant, etc.) materials or strategies.

Required Permits

Permits must be attained by the government or regulating authority to allow for undertakings along the shoreline.

Maintenance & Review

Maintain the project to provide appropriate repairs and changes. Regularly inspect the restoration site and measure for success to see if the project is truly effective (Young M. , 2016). The system must be maturing or capable of maturing and should be resistant and resilient to change (Young M. , 2016).

the techniques

Prevention of anthropogenic change is the best means to maintaining the integrity of the shoreline and any other ecological system (Young M. , 2016). Keeping the shoreline as natural as possible maintains habitat for fauna and provides key ecological functions for the lake and our land (Thompson & et al., 1994).

It is less expensive to preserve the shoreline than having to repair it due to changes we have imposed. Financial burdens can be avoided by proactively considering the impacts of anthropogenic change along the waterfront. The retention of native shoreline communities and structures is important to maintaining a healthy waterfront over the long term and preventing unnecessary costs down the road (Thompson & et al., 1994).

If change is inevitable or has already occurred, it is important for land owners to have a foundation for shoreline restoration by utilizing proven techniques. An understanding of such strategies will provide an appropriate basis for implementation and maintenance. The following techniques are intended to act as solutions that use proven restoration methods as their basis of development. These practices are recommendations of how private land owners can positively restore the shoreline's ecological and structural integrity. Yet, these are by no means the only resolutions available for such an undertaking.

Vegetative Integration

The utilization of vegetation along the shoreline helps stabilize banks, control nutrient loads, trap sediment and provide habitat for fauna all while acting as an aesthetic feature for the property (MWC, 2013; Thompson & et al., 1994). Vegetation allows for cohesiveness between aesthetics and functionality along the water's edge.

There are numerous zones that must be provided to successfully restore vegetated buffers along the shoreline. Each of these zones require planting techniques that account for their unique environmental conditions. These areas are necessary to the structure of a healthy shoreline. An attempt to attain each of these zones is necessary in producing successful project outcomes.

The following will define different planting techniques that can be utilized along the shoreline. Such techniques allow for appropriate installation and consider plant establishment, plant type and growing environment. Each strategy will be associated with the appropriate shoreline zones to denote which techniques should be utilized where.

Direct Planting

Active plants are established in managed environments and moved to site in a contained growing medium. This vegetation can be planted individually or in groups.

Bare Root Planting

Dormant plants that have been separated into individual units with their roots exposed and are planted singularly or in groups.

Seeding

Seeding (typically done as hydro seeding) is a planting means that distributes vegetation seed and mulch directly onto the ground. It is particularly effective on steep slopes.

Sprigging

(Thompson & et al., 1994)
Digging, separating and planting individual live stems that contain roots or rhizomes. These plants are installed so that the aerial sprouts are above the growing medium.

Staking

Cutting, separating and planting active vegetative stems that have been gathered from plants with stoloniferous or rhizomous habits and can regenerate from singular clippings.

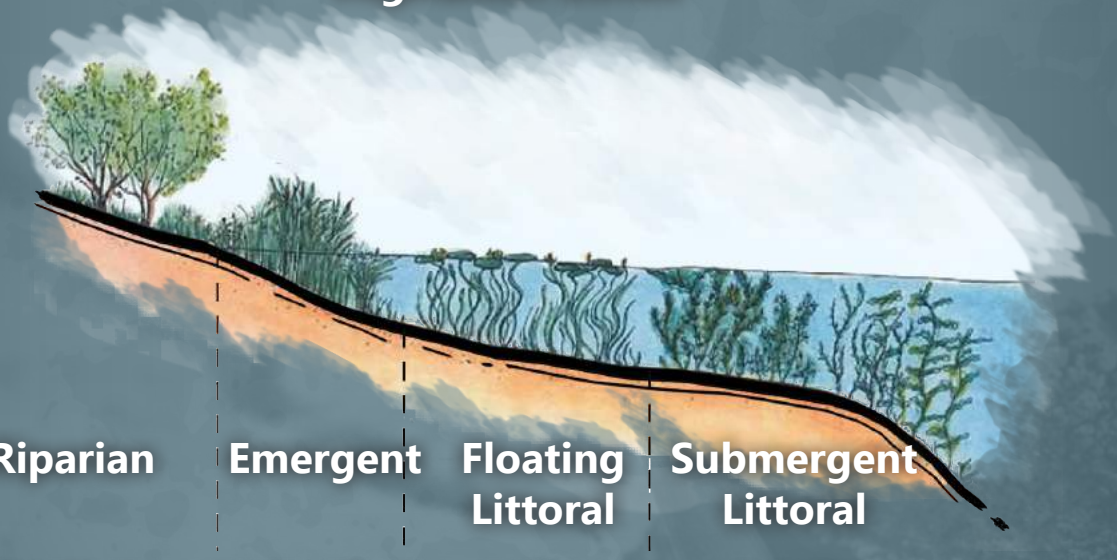
Sodding & Plugging

(Thompson & et al., 1994)
Clumps of grass and herbaceous plants are extracted and carried with their soils from an existing native site and placed on the restoration area. Plugs of individuals or plant grouping may also be extracted and planted to expose the aerial parts of the vegetation.

Rolling

(Thompson & et al., 1994)
A combination of sod, rhizomes and shoots are contained by rope nets and placed in a trench. This is an effective means for planting herbaceous and grassy vegetation.

Vegetation Zones



Riparian	Emergent	Floating Littoral	Submergent Littoral
Direct Planting	Bare Root Planting	Sprigging	Sprigging
Bare Root Planting	Sprigging	Staking	Staking
Seeding	Staking		
Staking	Rolling		
Sodding & Plugging			
Rolling			

All Figures on this page are modified from (TRCA, 2003)

Composition of planting along the shoreline can be essential to the function and aesthetic of the water's edge. It is important to utilize design techniques to achieve both desirability and functionality (Stempski, 2014). Environmental solutions must look good or society will not accept, appreciate or continue to drive them because there is a belief that they do not function if they are not beautiful (Basterfield, 2016). Yet, a redefining aesthetic can be achieved by thorough consideration during the restoration process. There are numerous landscape planting design techniques that should be utilized when restoring the shoreline to create appeal and purpose.



Repetition



Variation



Balance



Emphasis



Scale



Sequence

Repetition



The usage of similar plants within the landscape can add consistency, order and unity to the shoreline, but must be done conservatively to prevent habitat sinks (Young M. , 2016). Recurrence of appropriate vegetation can provide reliable ecological benefits over larger areas of restoration.

Variation



The usage of different species can add visual contrast and can provide special integration with other features (Stempski, 2014). This variation is beneficial for achieving specialist outcomes for more selective species.

Balance



Aligning different components by giving and taking in equal proportions is essential to sustain landscapes (Stempski, 2014). This technique is primarily used for visual appearance, but should also be considered when restoration is taking place.

Emphasis



Prominence and special attention given to vegetative components can be aesthetically positive and creates landscape icons (Stempski, 2014). Features can be emphasized to achieve specific ecological goals and provisions for fauna.

Scale

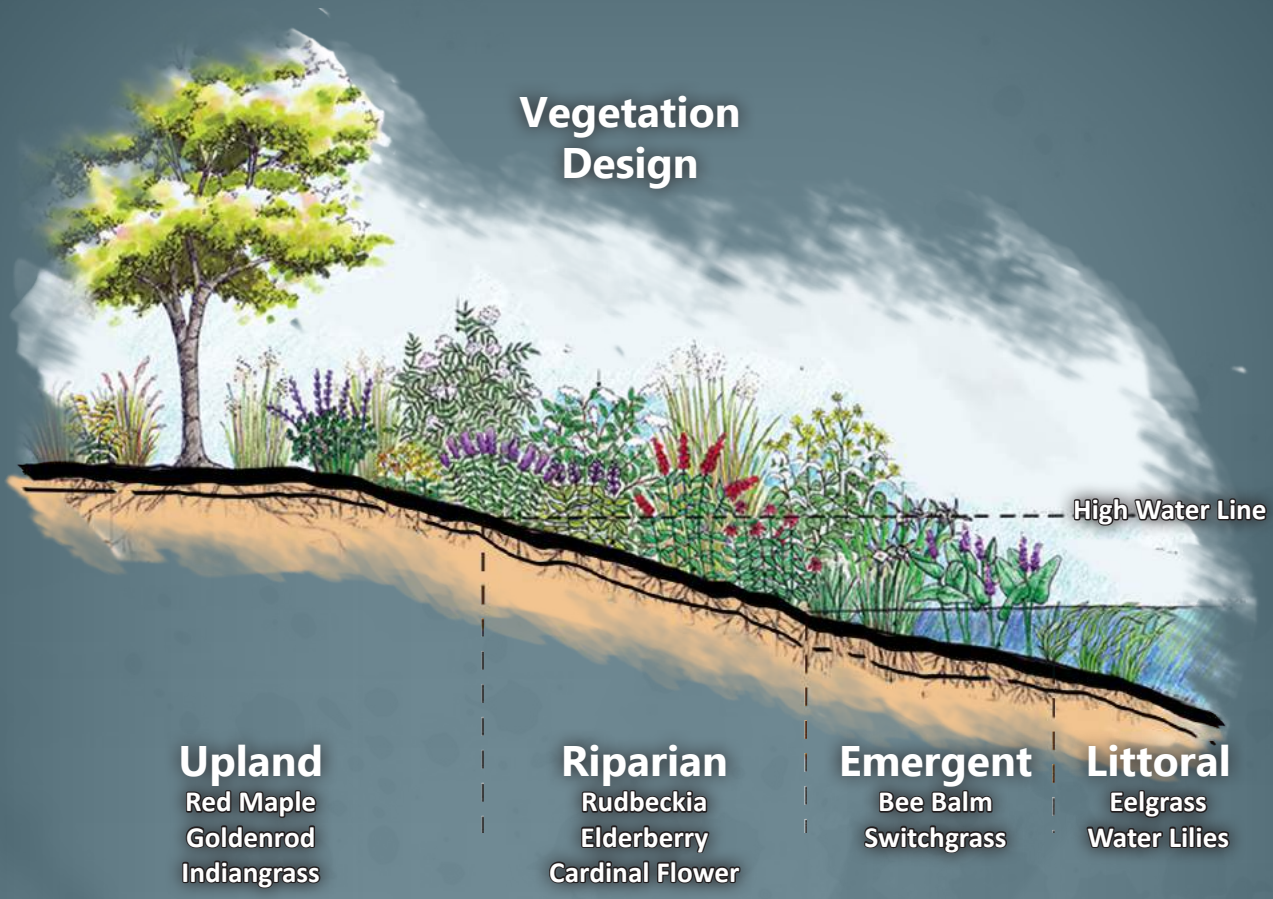


Vegetation that is appropriately sized provides visual appeal and prevents natural degradation from wind and water influences. Appropriate scale supports habitat function and structure along the water's edge while working in conjunction with anthropogenic uses.

Sequence



Appropriate arrangement of vegetation provides visual and function transition (Stempski, 2014). Grouping different plants in an appropriate manner is important to abiotic functions, variation of habitat and the integrity of transient spaces between land and water.



This graphic composition of vegetation along the lakefront utilizes the noted RVBESS principles of design. This planting provides a sense of scale and sequence which is appropriate to the conditions of the shore and balances aesthetics with functionality. The utilization of specific plant species adds both a sense of variety and repetition which could be carried throughout a larger shoreline context. Native plant compositions provide both beauty and utility of abiotic functions within the vegetative buffer along the water's edge.

All Figures on this page are modified from (Caflisch & et al., 2013)

With consideration placed on a target outcome, necessary densities of vegetative integration should be provided to achieve the desired biotic and abiotic requirements of the site. Providing the obligatory plant coverage can be achieved by utilizing design principles and implementation techniques while considering appropriate native plant species necessary for the job. Yet, the grouping, density and general width of vegetation along the shoreline will change dependent on these target outcomes. Determining the required vegetative buffer depth is essential for successful shoreline restoration. The following will breakdown the requirements for targets as define by the Shoreline Vegetative Buffers (MWC, 2013) report. These methods may need further consideration dependent of site specifics and should be appropriately integrated with other restoration techniques to achieve successful implementation and outcomes.

Aquatic Habitat

30m

Dependent on slope, soil and land use

Terrestrial Habitat

75-200m for birds and large mammals

30-100 for small mammals

Dependent on land use, frequency of property use and species requirements

Bank Stability

20-30m

Dependent on wave action, soil, water velocity and runoff rate

Contaminant Control

>30m

Dependent on soil as well as contaminant quantity and type

Nutrient Control

>30m

Dependent on soil as well as nutrient quantity and type

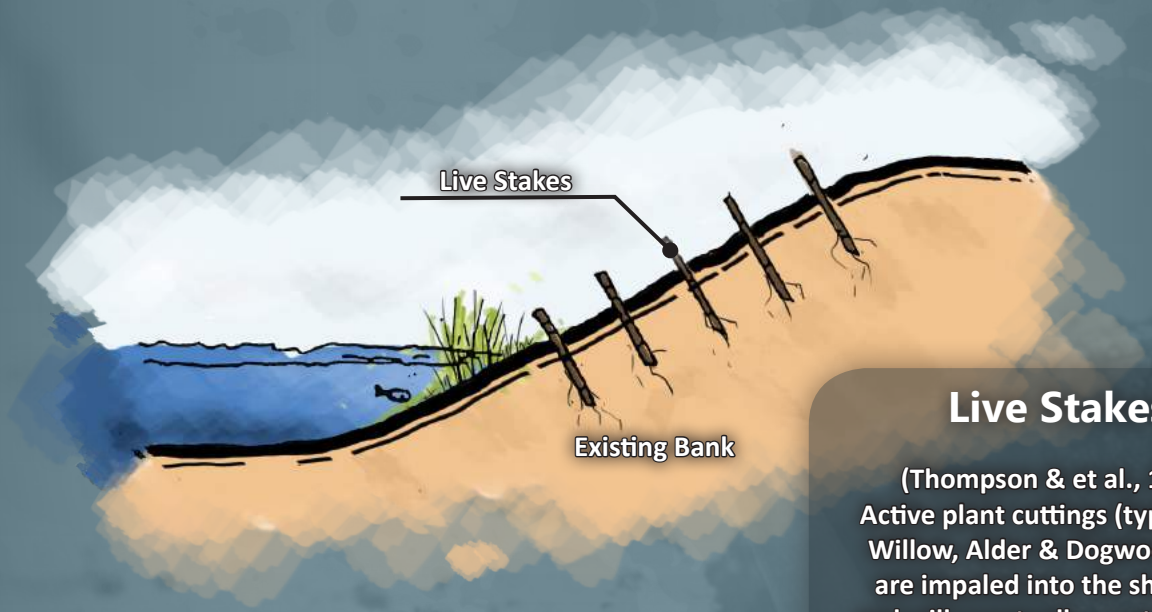
Sediment Control

Generally effective from 30-40m
3m for sand
15m for silt
122m for clay

Dependent on slope, soil, water velocity and runoff rate

Soil Bioengineering

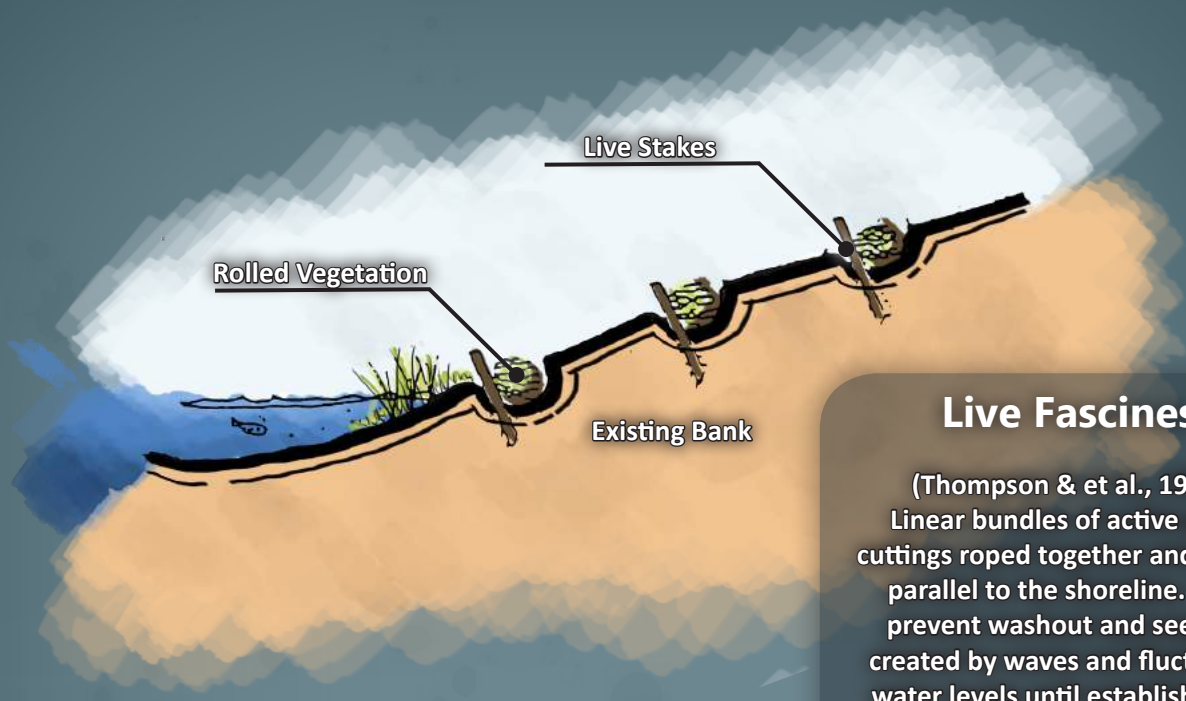
The techniques of soil bioengineering fuse planting and terra manipulation practices to achieve shoreline stabilization benefits more quickly than conventional vegetative integration (Thompson & et al., 1994). The following are some practices of soil bioengineering which can be utilized along the waterfront. Each of these methods can be used separately or in combination with each other.



Live Stakes

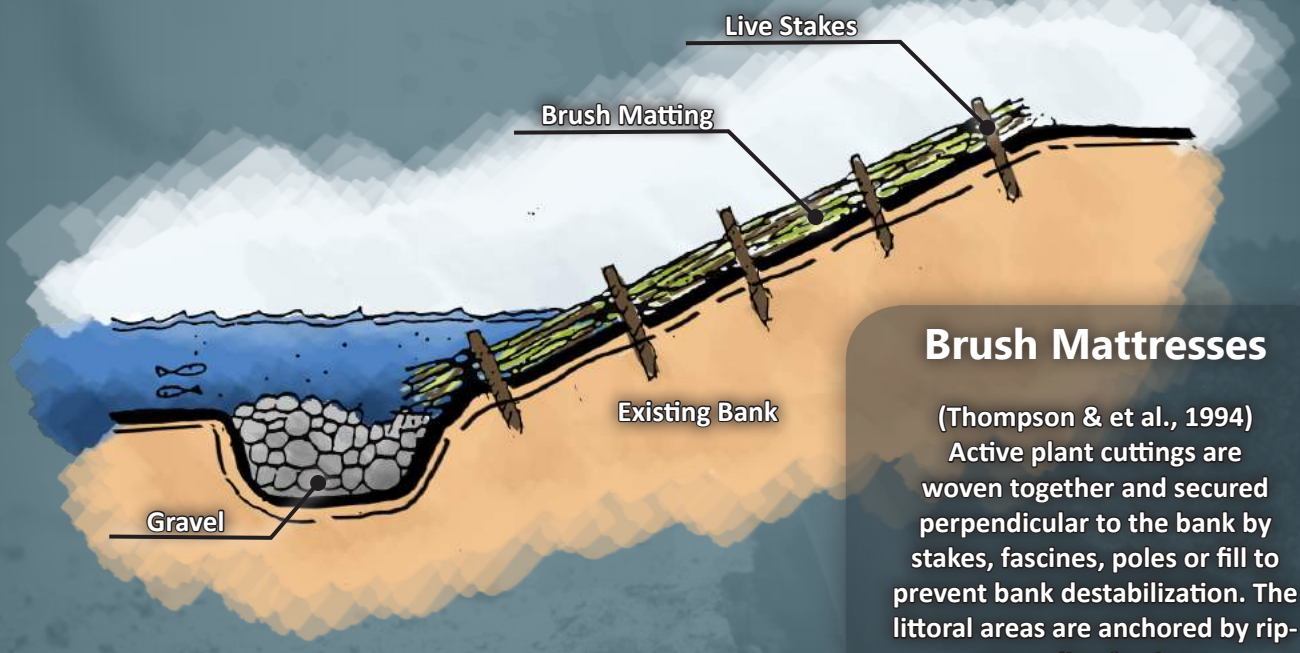
(Thompson & et al., 1994) Active plant cuttings (typically of Willow, Alder & Dogwood) that are impaled into the shoreline and will eventually create mature shrubs with stable root systems to support the bank.

All Figures on this page are modified from (Thompson & et al., 1994)



Live Fascines

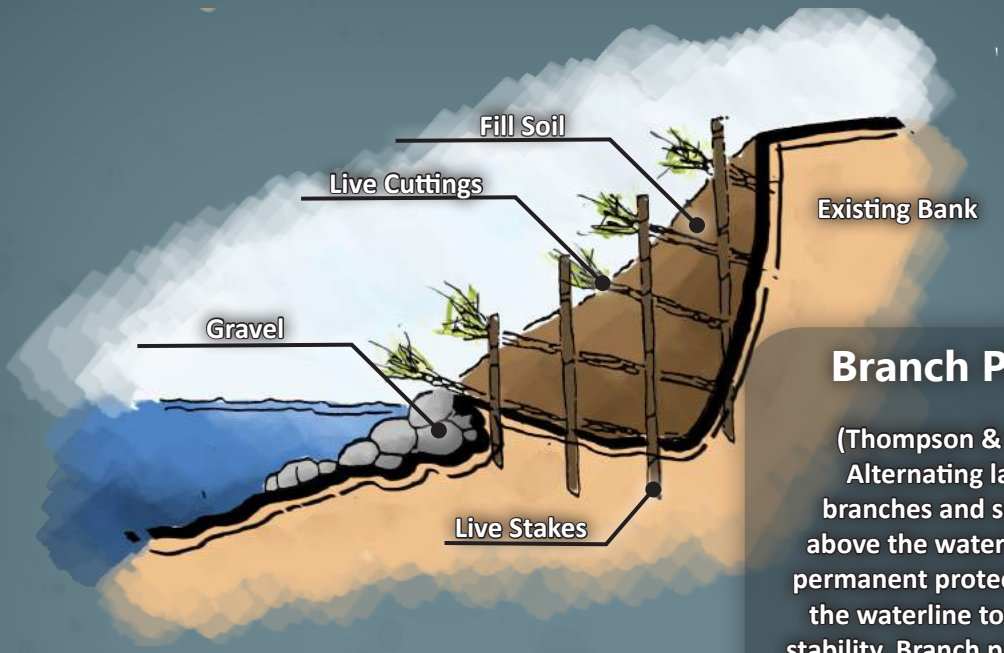
(Thompson & et al., 1994) Linear bundles of active plant cuttings roped together and skated parallel to the shoreline. They prevent washout and seepage created by waves and fluctuating water levels until establishment.



Brush Mattresses

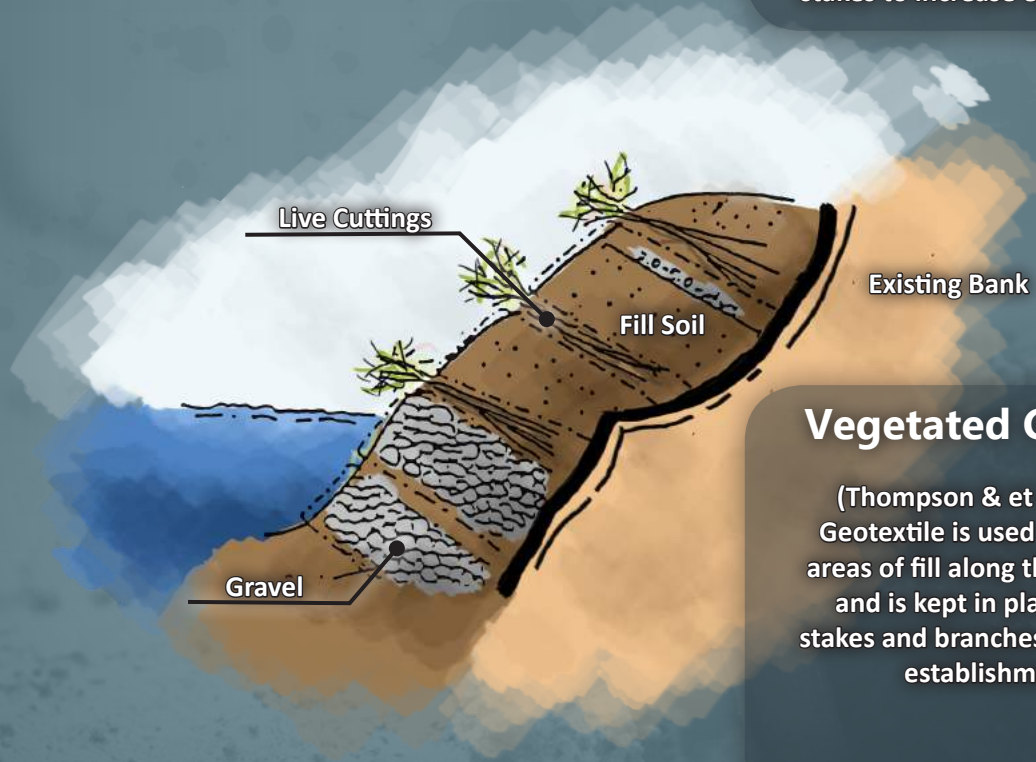
(Thompson & et al., 1994) Active plant cuttings are woven together and secured perpendicular to the bank by stakes, fascines, poles or fill to prevent bank destabilization. The littoral areas are anchored by rip-rap or live fascines.

All Figures on this page are modified from (Thompson & et al., 1994)



Branch Packings

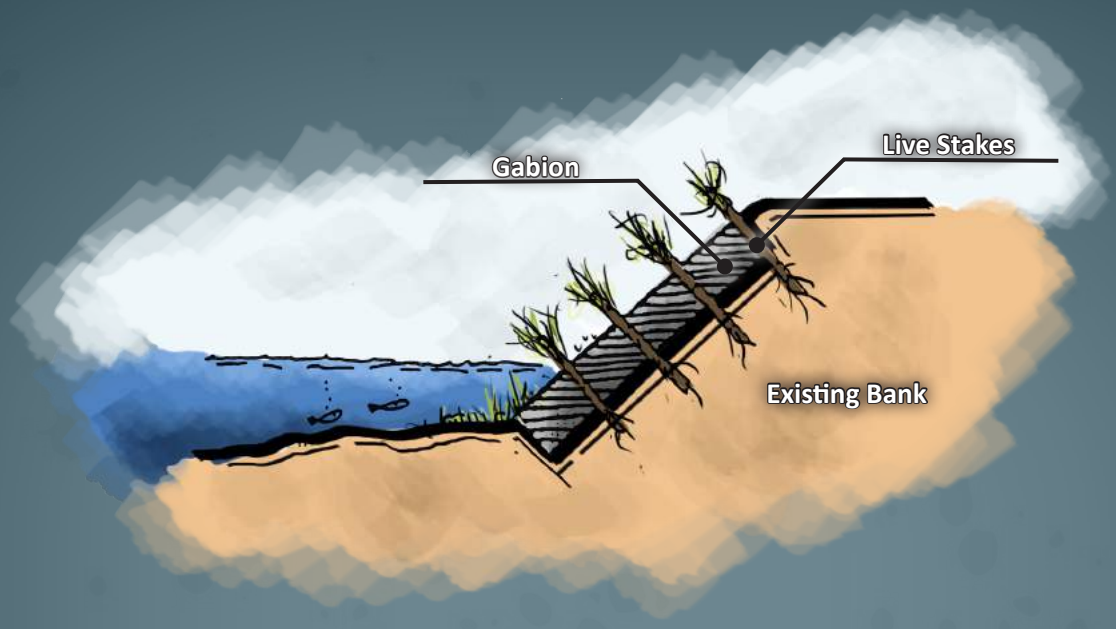
(Thompson & et al., 1994) Alternating layers of live branches and soil are placed above the waterline to provide permanent protection and below the waterline to provide initial stability. Branch packings are used to fill in washed out shoreline areas and can be implemented in conjunction with fascines and stakes to increase effectiveness.



Vegetated Geogrid

(Thompson & et al., 1994) Geotextile is used to support areas of fill along the shoreline and is kept in place by live stakes and branches to promote establishment.

All Figures on this page are modified from (Thompson & et al., 1994)



Joint Plantings

(Thompson & et al., 1994)
Rip-rap or gabions are used to support the growth of live cuttings or seedlings while act as stabilizers for backfill.

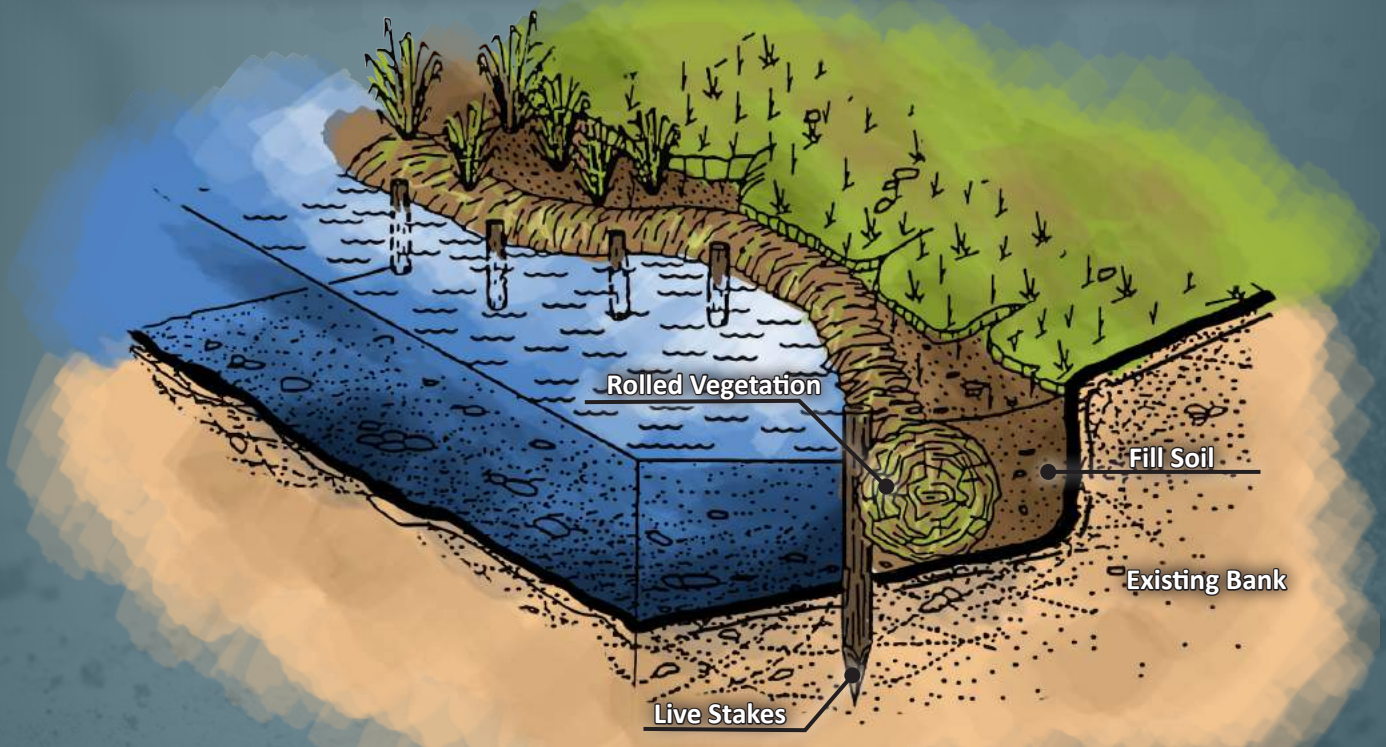


All Figures on this page are modified from (Thompson & et al., 1994)

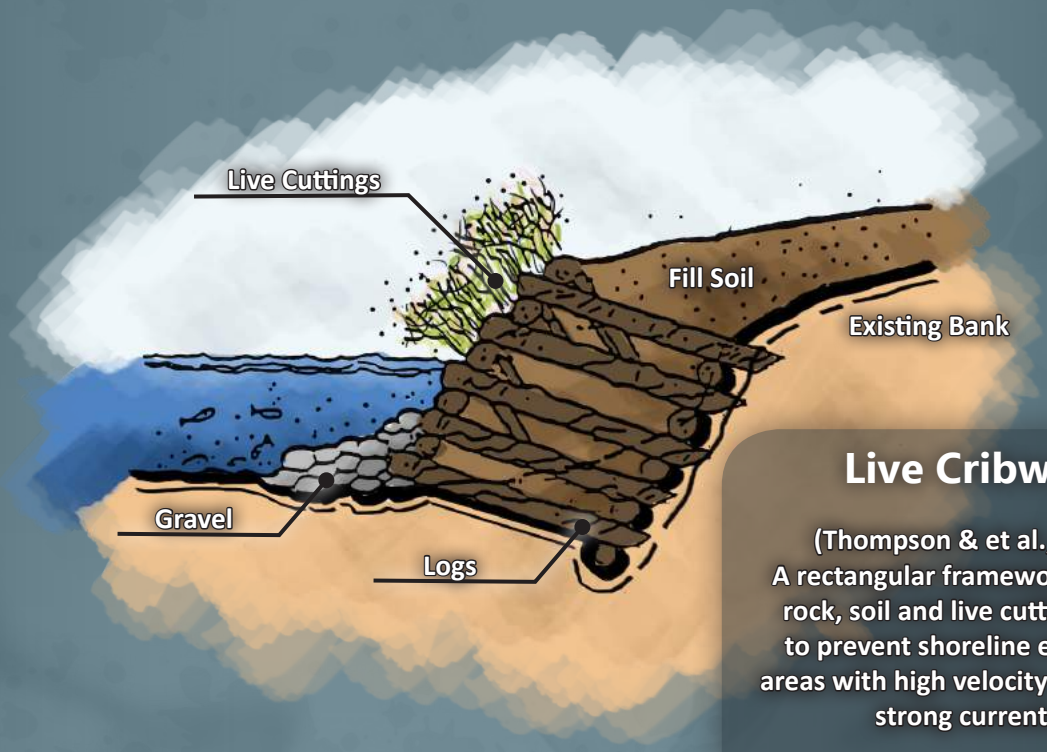


Fiber Rolls

(Thompson & et al., 1994)
A roll of live vegetative debris tied in fiber is used to retain wetland vegetation by accumulating sediment and allowing for establishment.



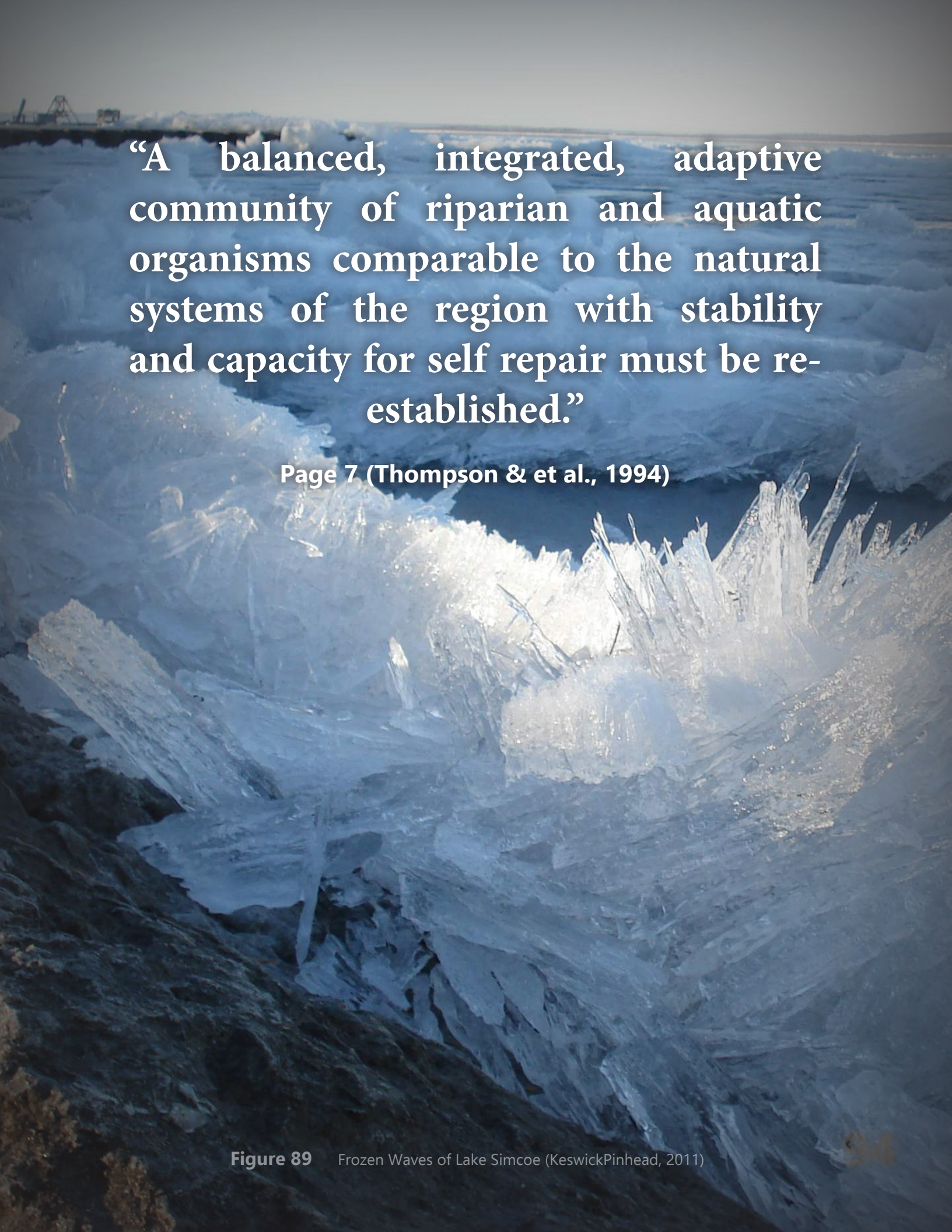
All Figures on this page are modified from (Thompson & et al., 1994)



Live Cribwall

(Thompson & et al., 1994)
A rectangular framework of logs, rock, soil and live cuttings used to prevent shoreline erosion in areas with high velocity waves and strong currents.

All Figures on this page are modified from (Thompson & et al., 1994)



“A balanced, integrated, adaptive community of riparian and aquatic organisms comparable to the natural systems of the region with stability and capacity for self repair must be re-established.”

Page 7 (Thompson & et al., 1994)

Figure 89 Frozen Waves of Lake Simcoe (KeswickPinhead, 2011)

Habitat Provision

The provision of habitat and shelter for fauna and flora along the shoreline is important to the ecological function of the water's edge. Provision of banks, lagoons, debris and void spaces created by contrasting cover within aquatic areas is important for the life cycles of fish and benthic macroinvertebrates (Thompson & et al., 1994). Habitat can be created inexpensively and effectively using material that is already present on the site or nearby. The following will define some practices for providing habitat along the waterfront with an emphasis on aquatic shelters. Each of these techniques should be utilized in conjunction with other restoration methods to provide for both terrestrial and aquatic species.

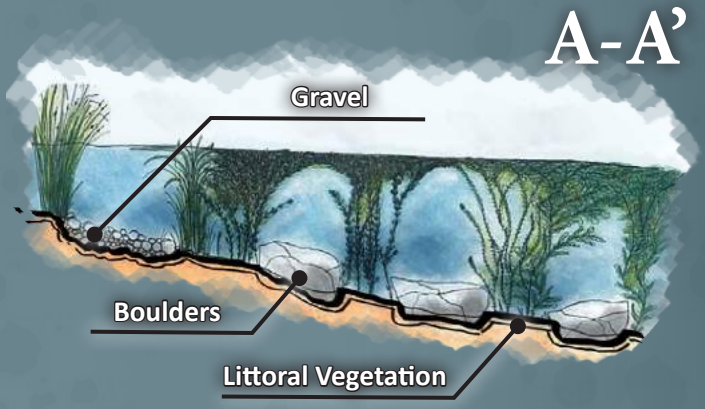
After considering specific targets, it is possible to create habitat that is essential for specialist species which may be more selective in their life cycle requirements. The improvement and delivery of these various habitats is essential in maintaining a biologically diverse waterfront and restoring the natural capital which has been lost because of waterfront development (Basterfield, 2016).

Stoned Beds

(TRCA, 2003)
Flat stones and washed gravel is installed in eutrophic littoral areas. This limits late summer growth to create uniform pockets, internal voids and pathways from deep to shallow waters. It also improves aesthetics of eutrophic lagoons.



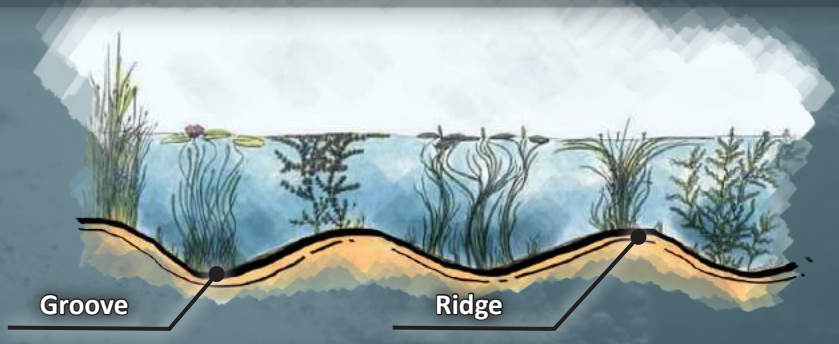
Stoned Bed
Plan



Stoned Bed
Elevation

Fluted Beds

(TRCA, 2003)
Undulation of the lake bed provides a variation in plant communities and habitat by creating pockets, ridges and groves.

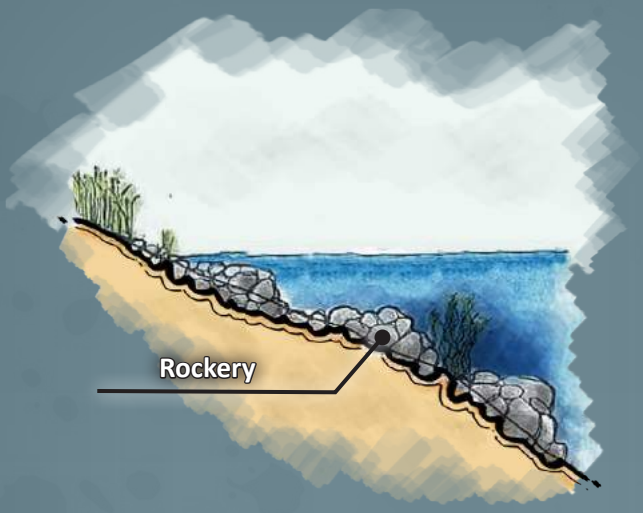


Fluted Bed
Elevation

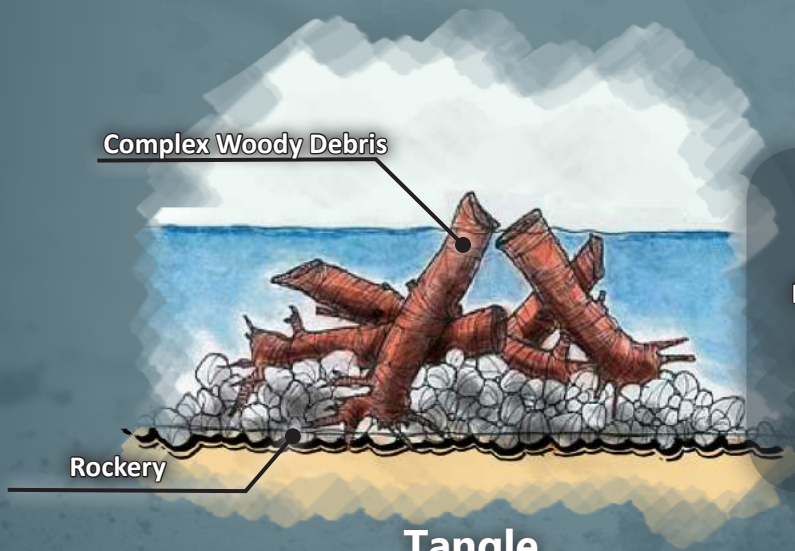
All Figures on this page are modified from (TRCA, 2003)

Stepped Shoals

(TRCA, 2003)
Armour rip-rap, boulders and gravel deposited in a tiered fashion provide uniform substrate, structural habitat and opportunity for productivity and biodiversity.



Stepped Shoal
Elevation



Tangle
Elevation

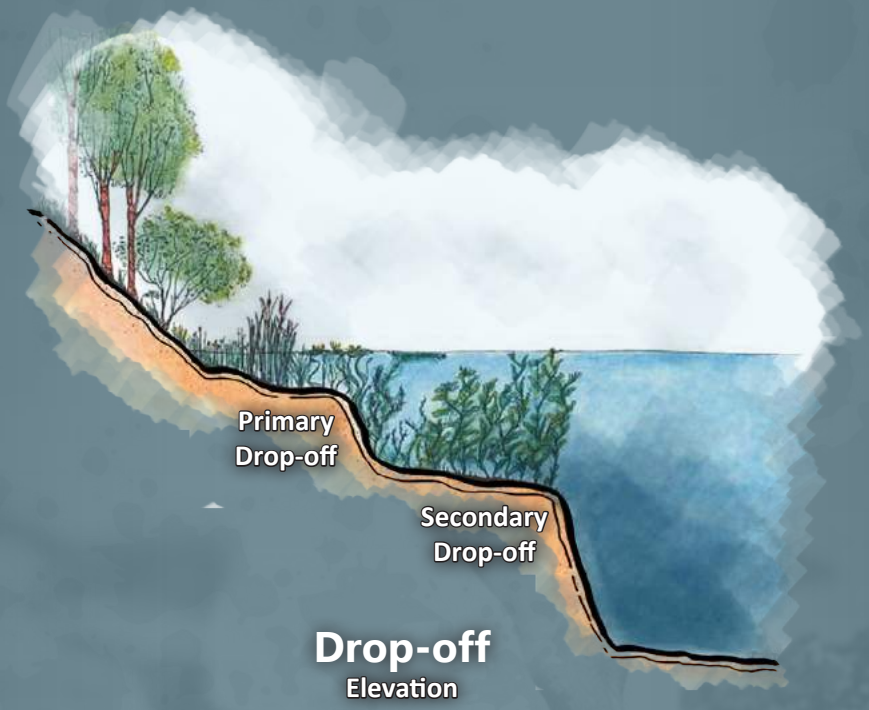
Tangles

(TRCA, 2003)
Deployment of logs and substrate materials in low fetched areas provides habitat function and wave dissipation.

All Figures on this page are modified from (TRCA, 2003)

Drop-offs

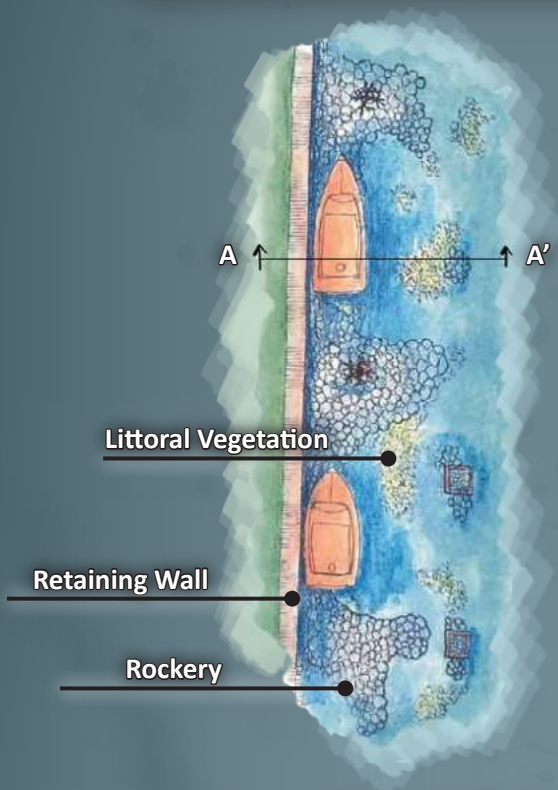
(TRCA, 2003)
The stacking of soil and stone in a manner which creates tiered drop-offs in the littoral zone provide essential features for aquatic life cycles and biodiversity. It provides both warm and cold water habitat.



All Figures on this page are modified from (TRCA, 2003)

Walls

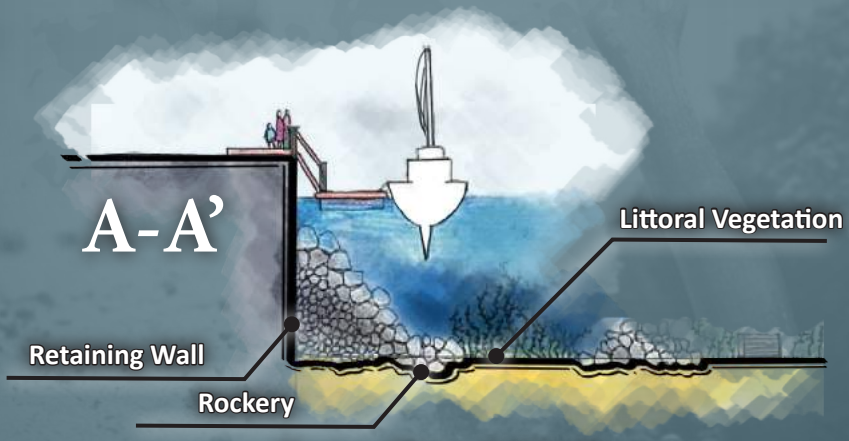
(TRCA, 2003)
The removal of break walls or the addition of structural aquatic components along existing retaining walls provide ecosystem features and habitat which originally did not exist.



Retrofitted Wall
Plan



Removed Wall
Plan

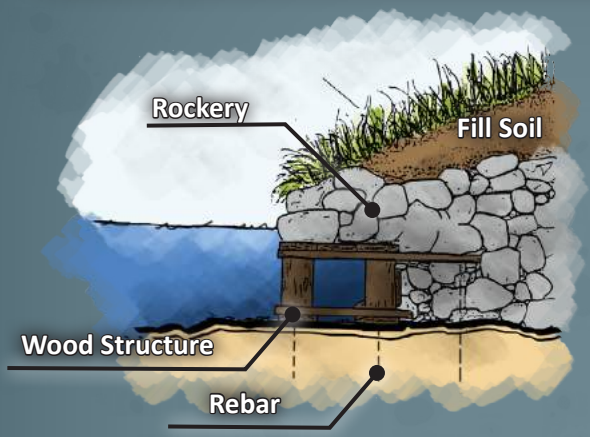


Retrofitted Wall
Elevation

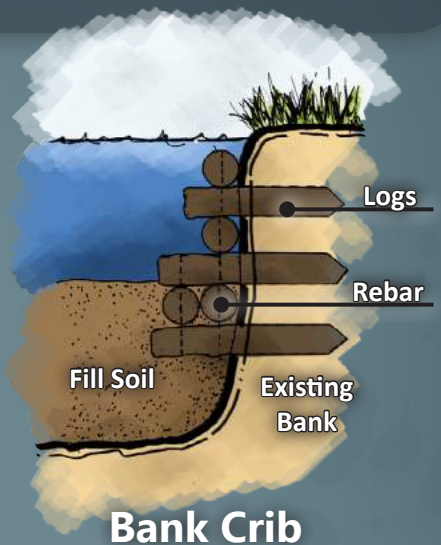
All Figures on this page are modified from (TRCA, 2003)

Lurkers & Bank Cribs

(TRCA, 2003)
Cantilevered structures of wood, stone, live vegetation and soil provide an undercut bank effect which creates cover for fish and stability for the shoreline.



Lurker
Elevation



Bank Crib
Elevation



Pile
Elevation

Piles

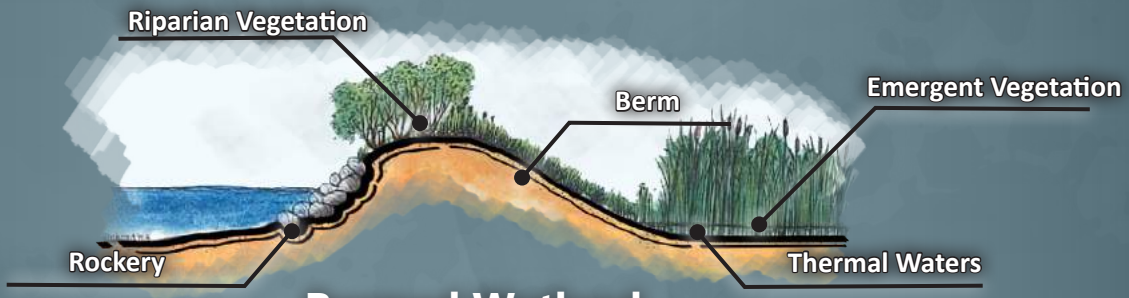
(TRCA, 2003)
Anthropogenic structures which are retrofitted with boulders, rubble, cobble, woody debris and vegetation improve vertical elements to provide habitat value.

Thermal Backwaters & Contoured Wetlands

(TRCA, 2003)
Accumulation of thermally modified water in isolated lagoons & pools produces suitable habitat for many specialist species. This technique can be highly effective when mixed with contextually appropriate upland and riparian habitat. Undulation of the emergent zone defined by lagoons, berms and waterways can create diverse habitats and allows connection to lacustrine wetlands.



Bermed Island
Elevation

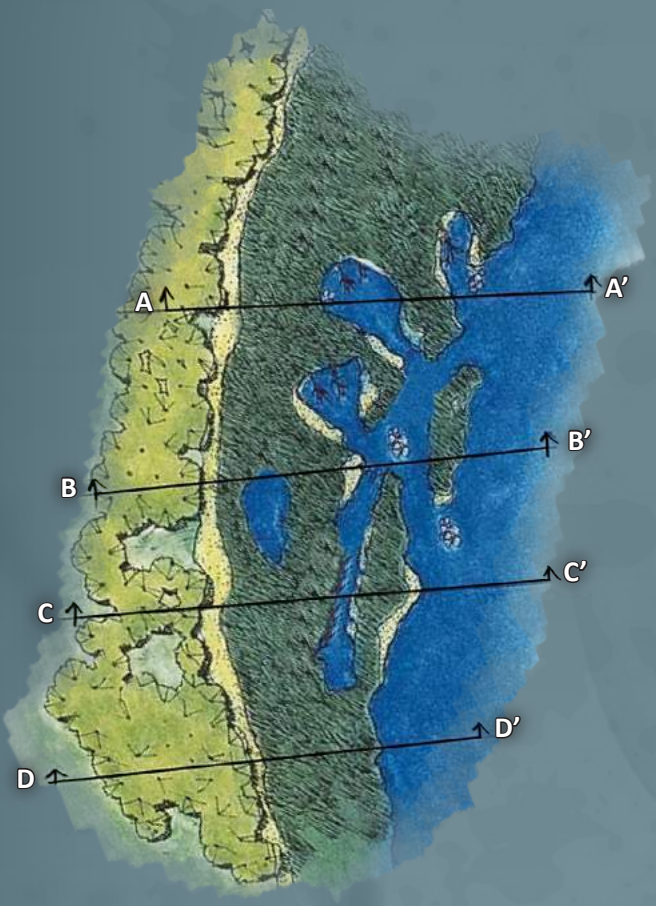


Bermed Wetland
Elevation



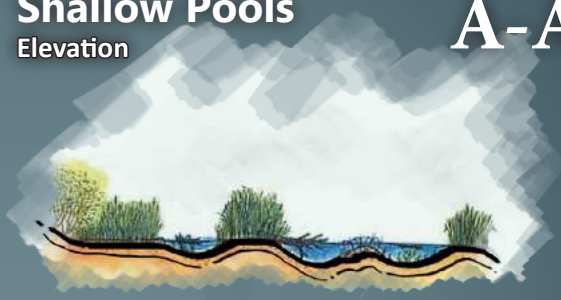
Thermal Backwaters
Elevation

All Figures on this page are modified from (TRCA, 2003)



Lacustrine Wetland & Backwaters
Plan

Shallow Pools A-A'
Elevation



Deep Pools B-B'
Elevation



Backwater Lagoons C-C'
Elevation



Emergent Stands D-D'
Elevation



All Figures on this page are modified from (TRCA, 2003)

the outcomes

The defining factors of shoreline restoration can be expansive and entail numerous different outcomes. The primary restoration objective is to revitalize the integrity of ecosystem features and functions along Lake Simcoe's waterfront. The following are listed outcomes that may be produced from rejuvenation of the water's edge. Such components are key to measuring the success of a project and providing encouragement for individual undertakings throughout the watershed. These outcomes are the true reason waterfront restoration projects are enthused.

Reinstated & Novel Ecosystems

(Young M. , 2016)
The ecological structure of the shoreline can be restored back to its original state. Yet, in the event of drastic anthropogenic change, the waterfront can be converted into a novel ecosystem that is not truly representational of its original condition, but is still valuable to the integrity of the watershed.

Habitat

(Young M. , 2016)
Flora and fauna can be restored with the reintroduction of habitat that was originally destroyed. This restoration can recreate positive connection between biotic and abiotic ecosystem features.

Matrix Coherency

(LORC, 2000)
Ecological patches and corridors for the greater watershed area can be restored and allow for natural movement of flora and fauna throughout the landscape.

Nutrient Management

(LORC, 2000)
Runoff from surrounding communities can be managed by the restored shoreline to handle inappropriate nutrient loads created by anthropogenic changes of along waterfront.

Natural Heritage

(LORC, 2000)
Natural heritage for future generations can be revitalized through the restoration of the shoreline. The natural systems of the watershed become more purposeful and preserve the integrity of human life. The systems that were once lost can now be re-found.

Water Quality

(MWC, 2013)
Filtration and management of water quality can be achieved through natural systems that provided by a restored shoreline. The integrity of the water is protected for natural and human usage.

Microclimatic Control

(LORC, 2000)
Small pockets of space along the shoreline can become more comfortable for natural and anthropogenic usage. Microclimatic areas can more appropriately support ecosystem biodiversity and allow for niches that have been all but destroyed.

Erosion Control

(MWC, 2013)
The natural management of terrestrial and aquatic geographic structures can be maintained through the recovery of the shoreline.

Flood Control

(MWC, 2013)
Fluctuation of water levels can be more easily managed due to the natural barriers provided by a restored shoreline.

Water Supply

(MWC, 2013)
The shoreline can control supplies of water through natural means and regulate levels throughout the watershed systems.

Desirable Aesthetics

(MWC, 2013)
Natural beauty can be achieved and promoted through a movement of shoreline restoration. Old habits and beliefs of beauty can make way for a more innate sense of aesthetics that is easily maintained by nature.

Property Protection

(MWC, 2013)
The integrity of private property can be kept safe as drastic anthropogenic changes are minimized and healthy natural changes are maximized. Human constructs can be protected by the natural systems restored between them and the lake.

Life Quality

(MWC, 2013)
Phycological and physiological benefits can be provided by natural systems and features. The recovery of the water's edge promotes welfare among its residents who are human and animal.

Natural Activity

Communities can interact and learn from these restored natural systems and develop a rhetoric which was formerly inaccessible.

Anthropogenic Sustainability

Human systems along the waterfront are supported by nature and can be stabilized by the restoration of the shoreline. Anthropogenic systems which require the lake to function (recreation, tourism, cottages, fishing, etc.) can sustain themselves and find comfort in shoreline health.


the
FUTURE

the accumulation

The former document has provided a basis for restoration of the Lake Simcoe shoreline in response to the negative development that has occurred within the area. Information was provided about the lake and the surrounding watershed to allow for analysis of the situation and background on the issue. Physical, historical, economic, social and institutional frameworks were reviewed and defined. Such knowledge portrays the truth behind development of the shoreline and the impact humanity has had on its biotic and abiotic systems. Methods have been defined for the care, the restoration and the future of Lake Simcoe. Reversal of anthrophonic devastation can be achieved by applying the described education, regulation, incentives and stewardship while employing physical restoration techniques along private waterfront properties. Such techniques for restoration of the shoreline should be built upon to provide appropriate future waterfront practices.

the acclimation

Stewardship, outreach and educational activity found within local communities cumulatively influences and encourages individuals to be accountable and make sustainable change along the shoreline. Action is further driven by regulation and incentivization of restoration activity. Lasting positive results will come from engaging private land owners and local stakeholders within the restoration process (MOECC, 2008B).

The considerations and techniques that have been denoted throughout this piece of literature may act as tools for positive physical change along the shoreline. Taking all the defined information and utilizing it in a responsible manner will ultimately restore Lake Simcoe's waterfront back to a healthy ecological system that can support human usage and wellbeing. We must carry these practices forward into the future to sustain the integrity of the lake and the innate beauty provided by its shorelines.

Take this document and utilize it as a toolkit. Build a foundation from these practices and define further positive actions from this point of reference. It is the individuals who live along the Lake Simcoe waterfront that will determine the fate of this wondrous natural treasure.

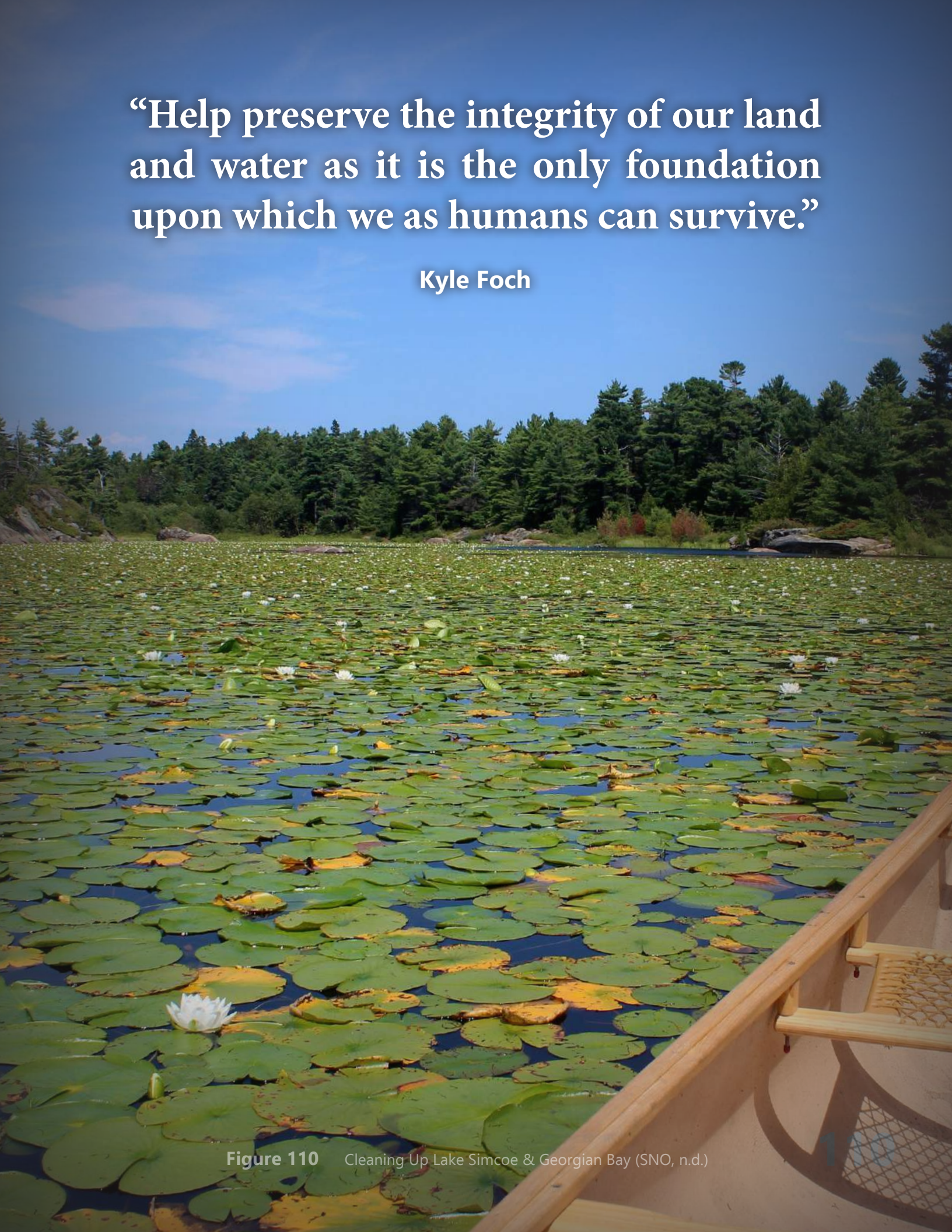
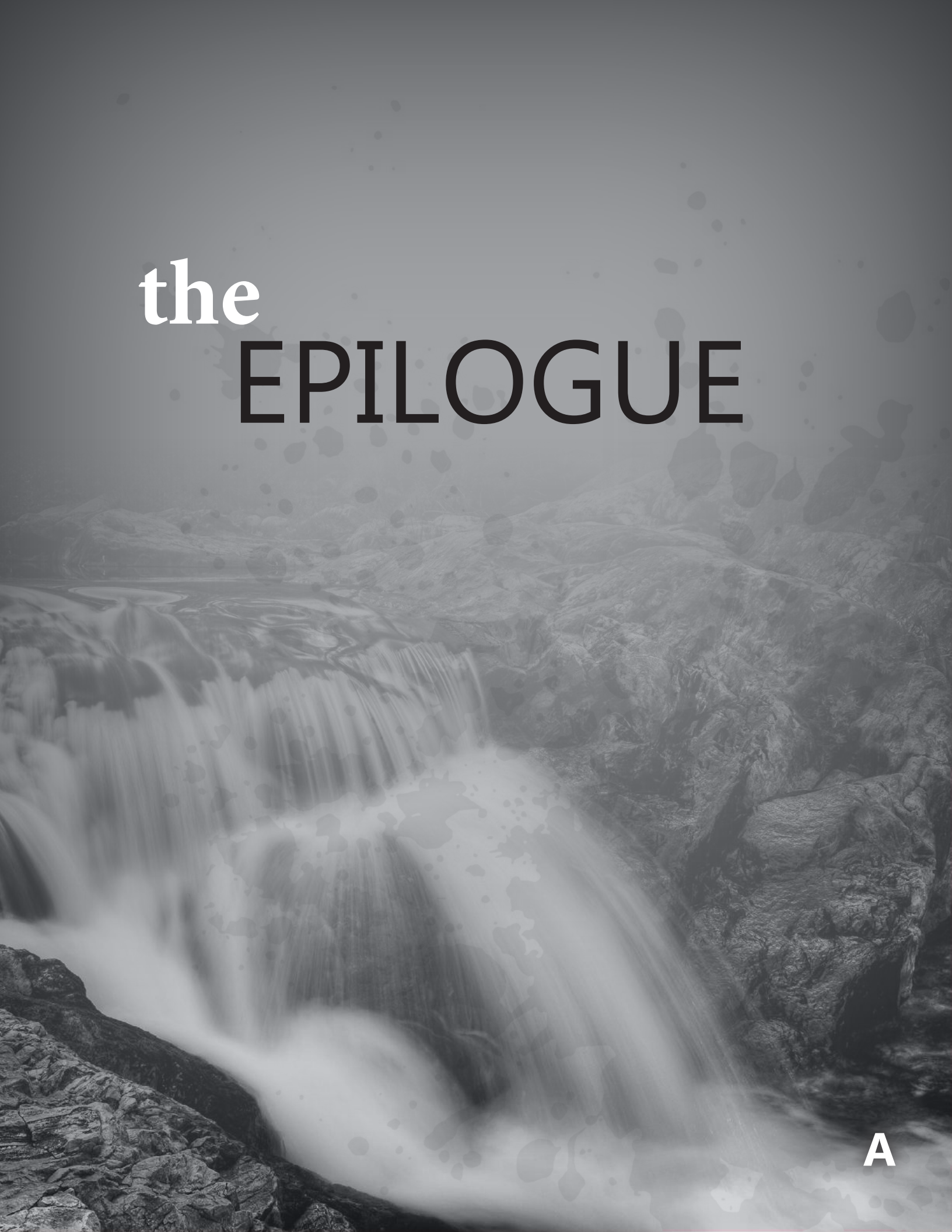


Figure 110 Cleaning Up Lake Simcoe & Georgian Bay (SNO, n.d.)



the EPILOGUE

A

the sources

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the time

Date	Task	Hours
Sept. 13	Proposal	2
Sept. 14	Proposal	2
Sept. 16	Class & Abstract	5
Sept. 22	Abstract	3
Sept. 27	Research	4
Sept. 29	Abstract & Research	4
Sept. 30	Class	2.5
Oct. 2	Breakdown & Research	5
Oct. 4	Research	3.5
Oct. 7	Class	2.5
Oct. 8	Research	5
Oct. 10	Title Page & Presentation Image	2
Oct. 11	Research	4
Oct. 12	Research	1
Oct. 14	Presentation Writing	2
Oct. 15	Title Page & Presentation Image	2
Oct. 19	Time Management & Presentation Practice	1
Oct. 20	Presentation Practice	0.5
Oct. 21	Class & Presentation	2.5
Oct. 26	Thesis Document	2.5
Oct. 27	Thesis Document	8
Oct. 28	Thesis Document	2.5
Oct. 29	Thesis Document	6
Oct. 30	Thesis Document	4
Nov. 1	Thesis Document	3.5
Nov. 2	Thesis Document	8
Nov. 4	Thesis Document	7.5
Nov. 5	Thesis Document	8
Nov. 7	Thesis Document	6
Nov. 8	Thesis Document	5
Nov. 9	Thesis Document	10
Nov. 10	Thesis Document	8.5
Nov. 12	Thesis Document	5
Nov. 13	Thesis Document	4
Nov. 14	Thesis Document	11
Nov. 15	Thesis Document	6
Nov. 16	Thesis Document	10
Nov. 17	Thesis Document Review	7
Nov. 18	Thesis Document Review	5
Nov. 19	Thesis Document Review	2.5
Nov. 21	Thesis Document Review & Time Management	3.5
	Total:	**187**

