



# Bitter Lake Shoreline Assessment Summary Report

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**June 2015**

**Submitted to the Bitter Lake Association by Watersheds Canada**

**Love Your Lake** is a program of Watersheds Canada and the Canadian Wildlife Federation. It is delivered in The Haliburton Highlands by The Coalition of Haliburton Property Owners Associations and its member associations.



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## Table of Contents

<b>Introduction</b> .....	<b>3</b>
<b>Bitter Lake at a Glance:</b> .....	<b>4</b>
<b>Methodology</b> .....	<b>5</b>
<b>Results</b> .....	<b>7</b>
Shoreline Classifications.....	7
<i>Stewardship Message</i> .....	8
Building Setbacks.....	8
<i>Stewardship Message</i> .....	9
Shoreline Development.....	9
<i>Stewardship Message</i> .....	10
Retaining Walls.....	11
<i>Stewardship Message</i> .....	12
Aquatic Vegetation: .....	12
<i>Stewardship Message</i> .....	13
Aquatic Substrate:.....	13
Invasive Species:.....	14
<i>Stewardship Message</i> .....	14
Wildlife Habitat:.....	14
<i>Stewardship Message</i> .....	14
Slopes .....	15
<i>Stewardship Message</i> .....	15
Lawns.....	15
<i>Stewardship Message</i> .....	16
Shoreline Buffers and Naturalization Priorities: .....	16
<i>Stewardship Message</i> .....	17
<b>Conclusions</b> .....	<b>18</b>

## Introduction

This report is a result of the assessment of the shoreline conditions conducted by Watersheds Canada and the Canadian Wildlife Federation. The Love Your Lake program is delivered in The Haliburton Highlands by The Coalition of Haliburton Property Owners Associations and its member associations.

A healthy shoreline is important to the overall health of a lake, as well as to individual shoreline property owners. A healthy shoreline is defined as one that contains a variety of native vegetation ranging from ground cover and grasses, to wildflowers, herbaceous plants, aquatic plants, shrubs, and trees. It is also important to have structural complexity, such as fallen logs and different sizes of stones and rocks, to provide habitat for wildlife. Shoreline vegetation helps maintain good water quality by reducing nutrient inputs to the lake and preventing soil erosion through root stabilization, they also provide some of the most productive and diverse wildlife habitat on the landscape. Well-vegetated shorelines also reduce impacts of flooding by providing natural barriers against moving water. A natural shoreline attracts and provides wildlife with food and habitat, which creates recreational opportunities (i.e., fishing). An abundance of wildlife living within an area is a good indicator of a healthy shoreline.

Alternatively, disturbed shorelines experience problems, such as shoreline erosion, and negatively impact the lake by contributing to poor water quality, nutrient and sediment runoff, habitat loss, and excessive weed growth. Disturbed shorelines are typically observed with areas that have been cleared of all or most vegetation, lawns that extend to the water's edge, and hardened structures, such as retaining walls, that have replaced natural vegetation.

Watersheds Canada, the Canadian Wildlife Federation, and regional partners (including Lakeland Alliance, Georgian Bay Biosphere Reserve, Coalition of Haliburton Property Owners Associations, Bonnechere River Watershed Project, Muskoka Watershed Council and City of Greater Sudbury) developed the Love Your Lake program in 2012 to promote shoreline stewardship and help shoreline property owners protect and restore their shorelines, thereby improving the health of their lake.

The Love Your Lake program is a modified and updated version of a scientific protocol developed by MAPLE (Mutual Association for the Protection of Lake Environments) in the 1980s. Watersheds Canada and other organizations in Eastern Ontario had been using a modified shoreline assessment protocol for over ten years to assess lakes in Eastern Ontario. In 2012 Watersheds Canada partnered with CWF to officially brand and broaden the program into the Love Your Lake program today.

Locally trained staff assess the health of shoreline properties on a lake using the standardized Love Your Lake Shoreline Assessment Protocol and Love Your Lake Shoreline Survey Datasheet. This data is then used to produce a personalized, report for each property owner that accurately describes existing conditions on their shoreline, suggests stewardship actions, and provides additional contacts, resources, and sources of support. This program is non-regulatory and completely voluntary. Property owners generally have a common interest to manage their properties in ways that maintain property values and lake quality and this program provides the information and support to do so.

In 2014, 71 properties were assessed totaling about 5km of shoreline on Bitter Lake. The shoreline survey included an assessment of the entire shoreline of Bitter Lake including: development, building setbacks, habitat, and identification of restoration opportunities, among other characteristics. This data can be used by the lake association and other partners to determine opportunities for restoration, education and stewardship.

This report presents the data collected from each property into a lake level summary on shoreline classifications, building setbacks, development (including structures and docks), retaining walls, erosion, aquatic cover, aquatic substrate, other shoreline observations, slope, lawns, and buffers. This report can also be used as a source of information on the current physical conditions of Bitter Lake and as a baseline to compare future surveys against.

## Bitter Lake at a Glance:

Bitter Lake is approximately 0.5km<sup>2</sup> in size, is 1.7km long and 0.6km wide. Bitter Lake has been identified as a coldwater lake, with nutrient levels that are low. The lake sits on the Canadian Shield north of Haliburton.

There is no primary inflow to Bitter Lake and there is one outflow from the lake which is a small creek. Bitter lake sits in a subwatershed of the Gull River flowing south from the Algonquin Highlands.

The majority of the land around Bitter Lake is dominated by forest, and spotted with small wetlands and beaver ponds. The lake sits in the Algonquin park ecodistrict and greater Georgian Bay ecoregion.

The Ministry of Natural Resources and Forestry has identified Bitter Lake as habitat for 5 different fish species:

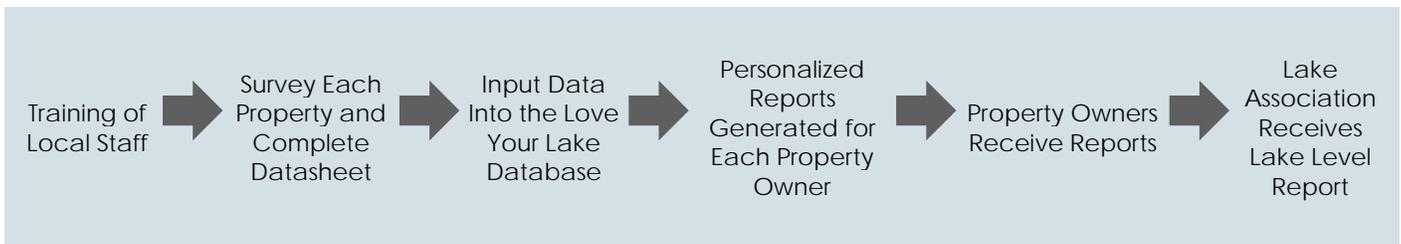
Creek Chub	Rock Bass	Yellow Perch
Golden Shiner	Lake Trout	



Bitter Lake and Surrounding Area (World Topographic Map – ESRI 2015)

## Methodology

In total, 71 shoreline properties were assessed on Bitter Lake by staff trained in using the Love Your Lake Shoreline Assessment Protocol. A datasheet was completed for each property assessed along the shoreline of the lake. This data was entered into a database to generate a personalized property report for the property landowner.



Each shoreline property included in the program was given percentage classifications in four possible classes (natural, regenerative, ornamental, and degraded), rounded to the nearest ten percent. This is based on shoreline development, retaining walls, and shoreline vegetation. The table below summarizes these classes with descriptions and photographs.

**Classification & Description**

**Photograph Example\***

**Natural** – A healthy buffer of vegetation and/or a natural shoreline of sand or exposed rock that is undisturbed and undeveloped.



**Regenerative** – Natural vegetation has been removed in the past, but is in the process of growing back towards a natural state.



**Ornamental** – All natural vegetation has been removed and replaced with mowed lawn and other non-native vegetation; structures such as docks, decks, boathouses and boat ramps are predominantly present at the shore.



**Degraded** – Natural vegetation has been lost; soil erosion, undercutting of the bank, and/or exposed roots of shrubs and trees are significant.



**\*Note:** These photographs are examples of shoreline classes, not representing any specific shoreline property on Bitter Lake. There can be a range of variation in the classifications depending on the type of shoreline.

Shoreline lengths for each property were obtained from municipal property information. For properties without this data, lengths were estimated using Geographic Information System (GIS) and a global positioning system (GPS).

The following information was produced for the entire lake:

- Building setback
- Shoreline development, by structure type
- Docks, by dock type
- Shoreline retaining walls and features
- Erosion, and if it required action
- Habitat Present
- Aquatic cover
- Aquatic substrate, by substrate type
- Other observations
- Average slopes
- Lawn presence, and lawn type
- Recommendations for each property

\*It should be noted that the total quantities and percentages calculated for various parameters in the charts and graphs may not add up to the total or 100% as often a property will either have no data or have multiple parameters on a single property.

In addition, naturalization priorities are assigned to properties using a combination of the shoreline classification data (namely the ornamental percentages) and the buffer recommendations. All of the data collected from the datasheets is used to determine naturalization priorities.

## Results

### Shoreline Classifications

It is recommended for the health of a lake to aim for a no more than 25% of the shoreline developed for access to the lake and recreational space leaving the rest natural. Beyond 25% development, critical functions of the lake that maintain its ecological integrity can begin to fail (Environment Canada, How Much Habitat is Enough? 2013) Therefore, 75% of the shoreline should be left in a natural state in order to provide maximum benefit to the health of the lake. Figure 1 shows the percentage of the entire assessed shoreline in each classification.

### Majority Property Classifications

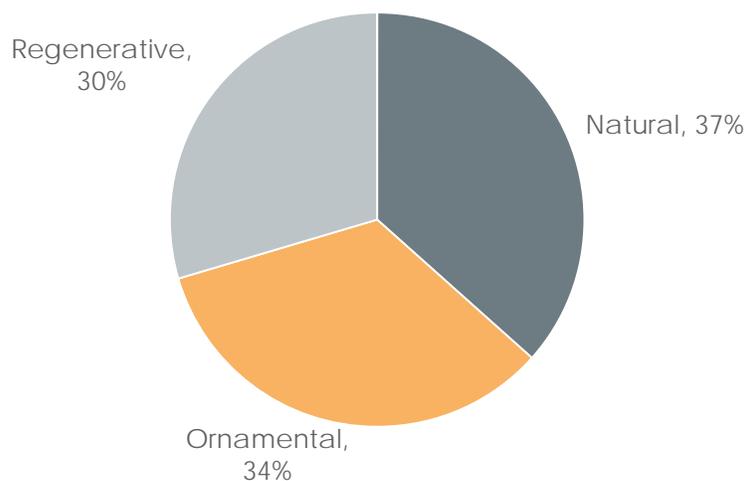


Figure 1 Property Classifications

**Stewardship Message**

On Bitter Lake, the relative majority of the shoreline (37%) is classified as natural, followed by 34% being ornamental and 30% being regenerative. It is recommended that shoreline property owners engage in naturalization projects to further decrease the ornamental percentage and increase the regenerative and natural percentages. Bitter lake, is above the recommended limit of 25% developed shoreline.

This presents an opportunity for residents of Bitter Lake to enhance the overall quality of the lake by maintaining, protecting and enhancing natural shorelines. To restore shorelines to more natural states, property owners are encouraged to take action. Regenerative properties should be encouraged to maintain their properties in a natural state.

**Building Setbacks**

On Bitter Lake, properties with various building setback ranges were observed and recorded. Shown in figure 2 is the range of building setbacks for properties on the lake. Building setbacks for shoreline developments in Ontario should be at least 30 metres from the high water mark; however, older cottage buildings were permitted closer to the high water mark. On Bitter Lake, 89% of the properties surveyed were observed to be closer than 30 metres to the shoreline. These tend to be cottages or cottages re-developed into homes that were originally built when cottage developments were permitted closer to the water’s edge. The primary problem associated with near-shore building setbacks is the limited area to buffer or filter contaminated runoff and wastewater from the main dwelling. They also disrupt the nearshore habitat corridor that many different animals use to move around the lake environment and into upland areas. While moving these buildings further back from the shoreline may not be a feasible or realistic option, naturalizing the shorelines of these properties would help address this issue.

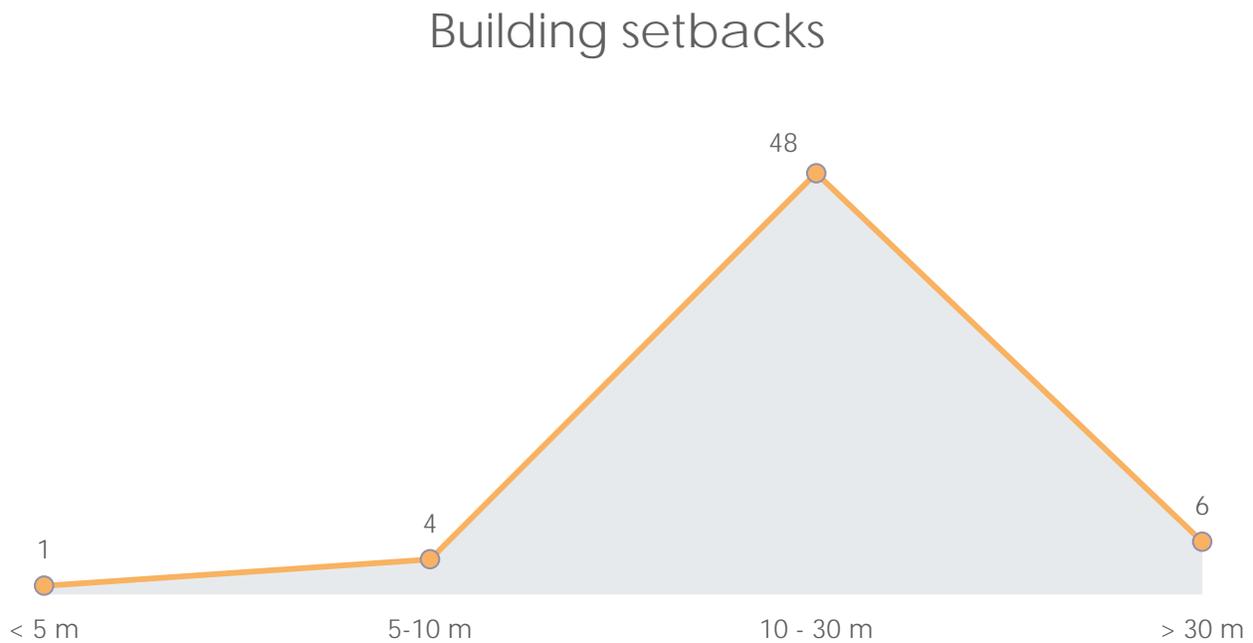


Figure 2 Building Setback Ranges

**Stewardship Message**

A potential area of concern with building setbacks is having septic systems installed close to shore. Regular inspections and maintenance of septic systems can help prevent excess nutrients from entering the lake. Nutrients entering the lake can contribute to eutrophication, resulting in increased aquatic vegetation, low oxygen levels and algal blooms. Excess nutrient loading is one of the largest threats to water quality in lakes and rivers; it is everyone’s responsibility to do something to help protect the lake.

No properties on the lake were identified with having eaves that drain into a rain barrel or with eaves that drain into a natural area. These numbers may be higher, as there were nearly 16 properties where we were unable to identify from the water where the eaves drained to. Because rain barrels are bulky to transport to a cottage area, the lake association may look into ways to make them more available to shoreline property owners. Another option is to install French drains next to cottages to encourage water to percolate into the ground instead of running directly overland into the lake.

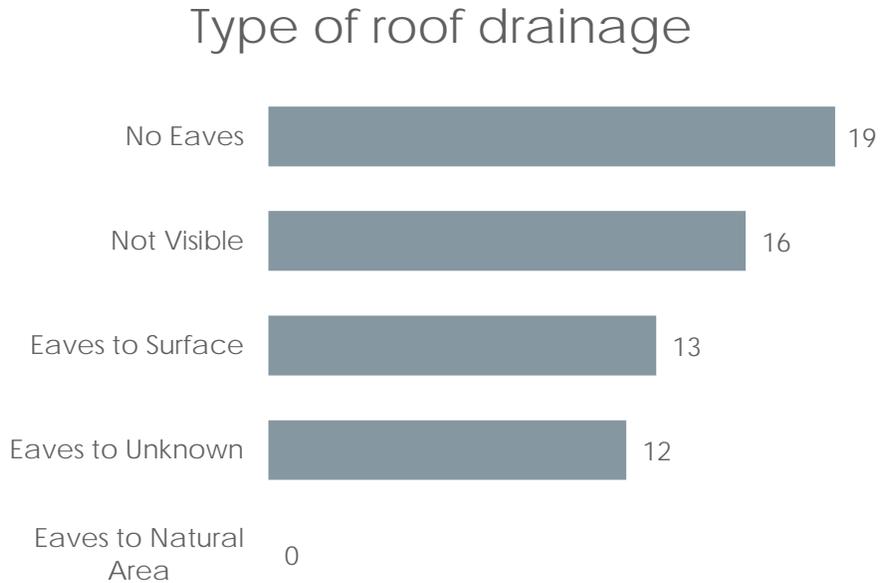


Figure 3 Roof Drainage types around lake

Naturalizing shorelines on properties with near-shore building setbacks would help reduce runoff from entering into Bitter Lake, which could help reduce potential problems such as algae blooms and loss of oxygen in the water. Property owners can also manage this problem by ensuring they have eaves troughs with downspouts directed at natural or stone catch basins or rain barrels, as well as ensuring they have a properly functioning septic to process wastewater before it enters the lake. As septic systems do very little to process nutrients, it is also important to use phosphate free products.

It is evident that policies have worked in keeping the majority of development at least 10m away from the shore. Ensuring that these policies are updated and adhered to as new cottages are developed could be an objective of the Bitter Lake Association.

## Shoreline Development

On Bitter Lake, 23% of properties with shoreline development features were observed and recorded within 3 metres of the lake. Shoreline development included the presence of man-made structures on the land or in the water within the first three metres of the shoreline. The diagrams below show the common structures present on the lake as well as the total shoreline development.

### Shoreline development

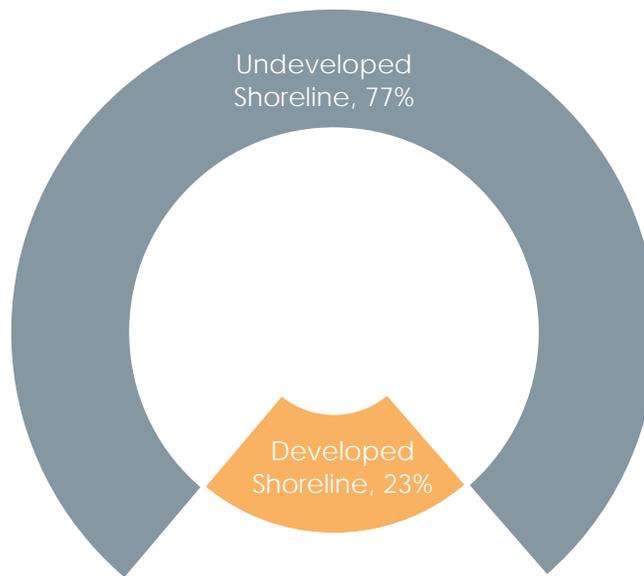


Figure 4 Shoreline Development Percentages

### *Stewardship Message*

It is recommended for the health of a lake to aim for a no more than 25% of the shoreline developed for access to the lake and recreational space leaving the rest natural. Beyond 25% development, critical functions of the lake that maintain its ecological integrity can begin to fail (Environment Canada, How Much Habitat is Enough? 2013) Therefore, 75% of the shoreline should be left in a natural state in order to provide maximum benefit to the health of the lake. Figure 1 shows the percentage of the entire assessed shoreline in each classification.

Shoreline development structures can, contribute to erosion, and can restrict wildlife access to and from land and water. Although some of these types of structures can have negative environmental impacts because they cover habitat, this can be partially mitigated by allowing vegetation to grow around the decks, boathouses, sheds, stairs, or other man-made structures.

Small floating or post non-permanent docks are the best choice of docks as they have minimal contact with the lake bottom, and sit on or out of the water, which reduces the impact they have on the surrounding environment. In the future, if shoreline property owners need to replace their old or failing permanent post,

solid, or crib docks, they could consider a non-permanent post dock or floating dock, thereby limiting impacts to fish habitat and ensuring the natural flow of water remains unrestricted.

Development along a shoreline can be done sustainably and in an environmentally sensitive fashion, as long as the structures are maintained and kept to a minimal footprint on the waterfront. Bitter Lake is just under the maximum recommendation of 25% development it will be important in the future to work towards protecting the lake against future development.

Number of structures by type

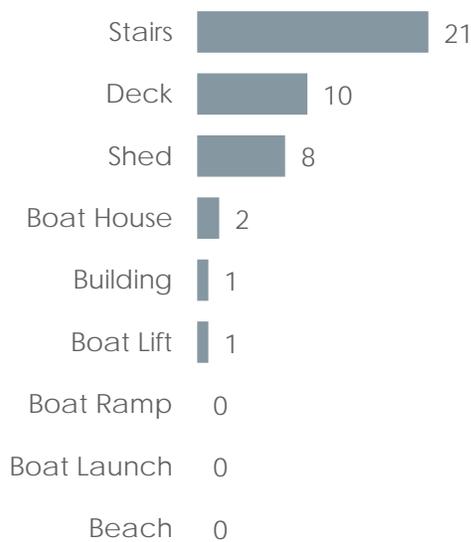


Figure 5 Structures On Lake

Types of docks

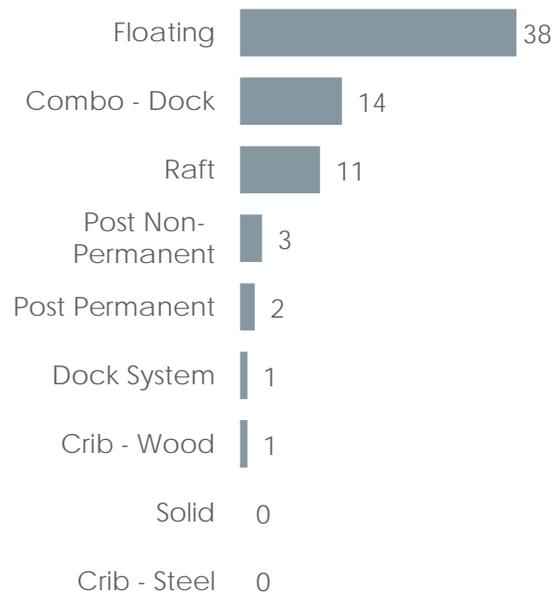


Figure 6 Docks on Lake

### Retaining Walls

On Bitter Lake, the number of properties with retaining walls was counted and summarized below. Retaining walls, most often built to protect against erosion are a common feature on many lakes. 17 properties on Bitter Lake have retaining walls on their shoreline. The types and frequency of retaining walls is below in figure 7:

**Stewardship Message**

17 properties on Bitter Lake, or 23% of properties assessed, have a retaining wall. Of the retaining walls that are present the most common choice was loose rock (15 properties or 21% of properties assessed), followed by wood (2 properties or 3% of properties assessed). While retaining walls were a common choice in the past to combat erosion, we now know about their impact to the natural environment. Waves and wakes are reflected back from flat, hard surfaces with the same force as they strike the wall. This can cause excess turbulence in the water, which scours the sediments from the lake bottom. Solid walls also eliminate shoreline habitat and act as a barrier, preventing wildlife from reaching the water. Although some retaining walls such as rip rap or loose rock have fewer impacts than other retaining walls, shoreline property owners could consider alternative erosion control methods such as planting vegetated buffers or shoreline bioengineering if they ever wish to replace their current, old, or failing retaining wall. In the meantime, maintaining vegetation around the wall and allowing new vegetation to establish and grow will help reduce runoff and provide habitat for wildlife.

**Types of Retaining Walls**



Figure 7 Retaining Walls on Lake

**Aquatic Vegetation:**

On Bitter Lake, the number of properties with aquatic cover were observed and summarized. The presence and abundance of aquatic cover can vary throughout the year. Each assessed property could have one or more types of aquatic cover. Figure number 8 shows the number of properties on Bitter Lake had aquatic cover listed by type observed along their shoreline during the time of the assessments:

**Frequency of Aquatic Vegetation types**

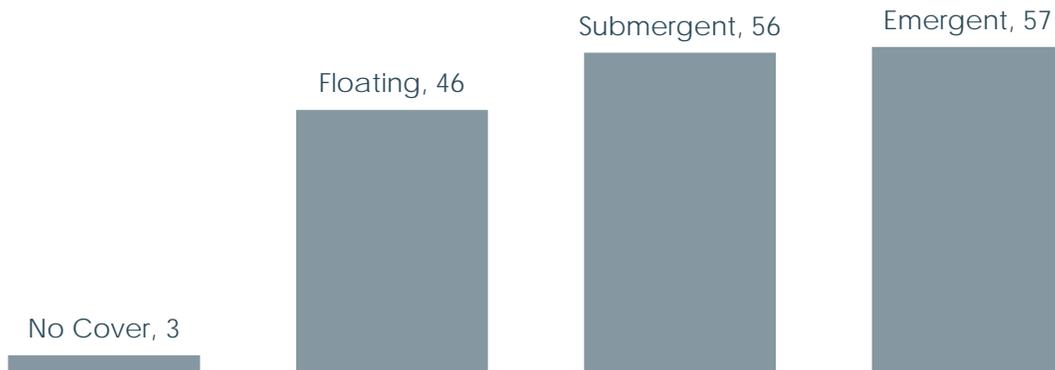


Figure 8 Aquatic Vegetation

**Stewardship Message**

4% of properties on Bitter Lake had no aquatic plants while 80% of properties had emergent vegetation which is an important source of habitat for fish, and other aquatic organisms. Floating vegetation was found less frequently on Bitter Lake but is still an important part of the aquatic ecosystem, giving habitat to birds, frogs, dragonflies, and other wildlife. Aquatic cover can create places for wildlife to lay their eggs, provide a perch for predators of fish and insects and offer cover for wildlife. Shoreline property owners that are removing aquatic vegetation from their shoreline properties may be indirectly increasing the presence of invasive aquatic species. Aquatic vegetation may be a problem if there is an overabundance of it due to high nutrient levels entering the lake through runoff. By controlling nutrients entering the lake through well vegetated buffers and other actions shoreline property owners can maintain a healthy balance of aquatic habitat, and space for recreational activities. Bitter Lake appears to be a shallow lake, so the amount of aquatic vegetation is of little surprise.

**Aquatic Substrate:**

On Bitter Lake, the aquatic substrate types were observed at each property. Figure 9 is the substrate size distribution on Bitter Lake. Aquatic substrate can be important habitat for fish and other aquatic wildlife and it is useful to document this feature to better inform future restoration projects on the lake. Bitter Lake was found to have a good variety of aquatic substrate throughout the lake for supporting aquatic biodiversity. Rubble and cobble provide great habitat for crayfish and spawning grounds for various species of fish while other environments provide excellent substrate for diverse aquatic vegetation.

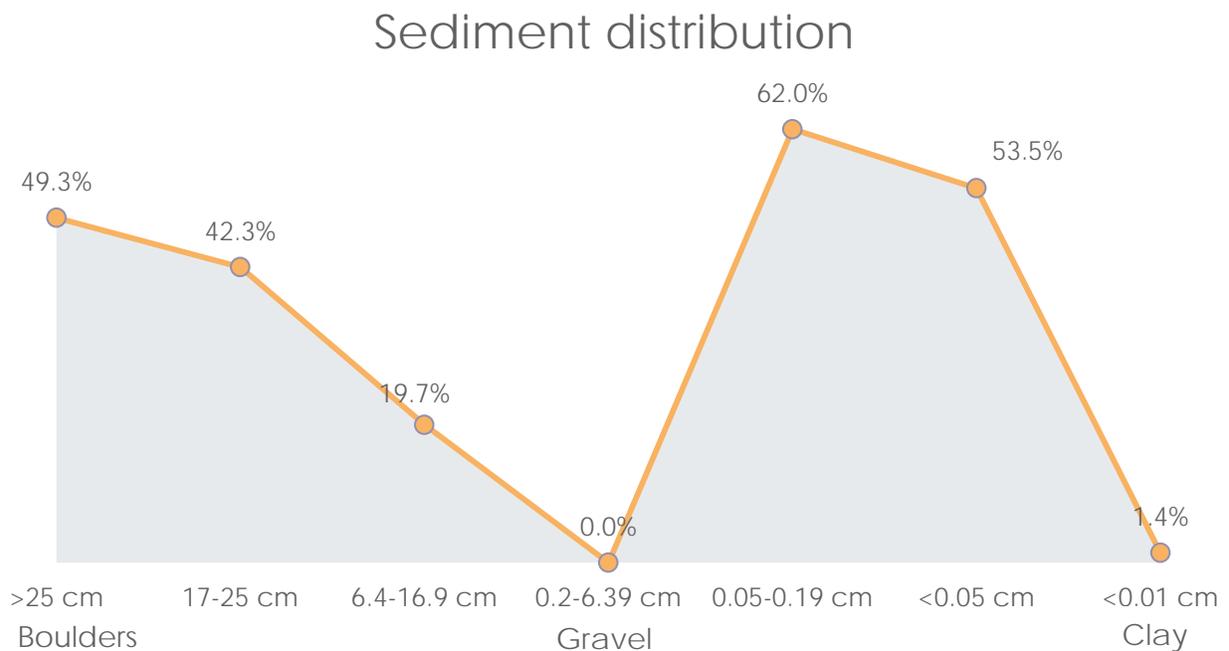


Figure 9 Sediment Distribution

## Invasive Species:

No invasive species were identified on Bitter Lake in our survey.

### *Stewardship Message*

It is important to help prevent the spread of invasive species to Bitter Lake by properly washing and drying all boats. The dumping of bait buckets into the water from other areas can spread zebra mussels and other types of invasive species. Invasive species can also be introduced through float planes, ballast water, horticultural trade, and seed mixtures. Shoreline property owners are invited to join the Invading Species Watch Program operated by Ontario Federation of Anglers and Hunters and the Ontario Ministry of Natural Resources and Forestry.

## Wildlife Habitat:

Most common types of nearshore habitat on Bitter Lake were aquatic logs, followed by terrestrial logs. Most properties on Bitter Lake had some amount of habitat present. Wildlife provides us with many enjoyable and beneficial activities from bird watching and wildlife photography to pest control, seed dispersal, nutrient cycling and pollination, to name just a few. It is important for there to be a rich and diverse range of habitats along the lakeshore to ensure a healthy lake environment. Figure 10 summarizes the lake nearshore habitat.

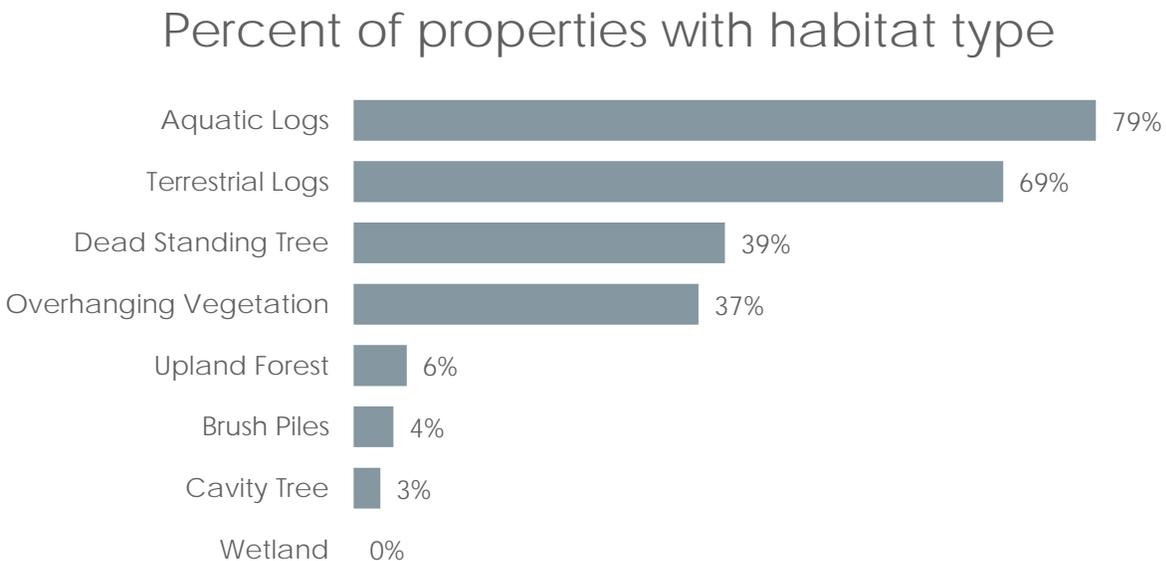


Figure 10 Habitat Present

### *Stewardship Message*

It is important to leave large trees that are dead and dying in place, as they provide important habitat for a number of different species. In Ontario, more than 50 species of birds and mammals depend on cavity trees for nesting, rearing young, roosting, feeding, storing food, escaping predators, and hibernating. Fallen logs on land provide habitat for small mammals such as moles, woodpeckers, toads and insects. As the log decomposes, reptiles and amphibians lay their eggs in the moist wood. A decaying log is also great habitat for beetles, and ants that burrow under the bark and lay eggs. In the water, logs provide important fish habitat by providing

refuge for small fish, and spaces for ambush predators such as pike to conceal themselves. By leaving dead and decaying brush and logs in place, you are helping contribute to a healthy and vibrant species community.

### Slopes

On Bitter Lake, 56 properties or 78% of properties assessed, had flat, gentle, or moderate slopes. The average slope towards the lake was observed as approximately 2:1. The steepest slope is greater than or equal to 45° while some properties had no slope or were flat.

#### Stewardship Message

The slope of shorelines influences the energy of runoff and its ability to transport sediment. Steeper shorelines often suffer greater erosion problems. While shoreline buffers of healthy trees and shrubs are important on all properties, steeper properties would yield even greater benefit from well-vegetated slopes to reduce the impacts of erosion from runoff.

### Lawns

On Bitter Lake, the number of properties with lawns, either mowed or regenerative, was observed. 35% of properties with lawns were observed to have a mowed lawn to the water’s edge. Natural ground cover and native vegetation, in comparison, slows runoff and allows filtration, removing many contaminants, pollutants, nutrients, sediment and other substances. These substances can be carried into the lake by runoff and can harm water quality and local ecological integrity. Lawn grasses also have short root systems and do not bind the soil well, which can lead to problems with erosion.

## Types of lawns on lake

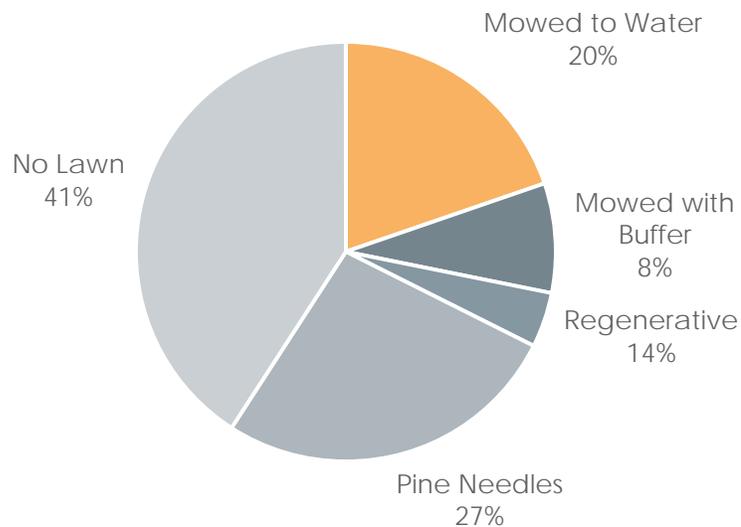


Figure 11 Lawn types

### Stewardship Message

In areas close to shore, a lawn is generally not a good choice of ground cover as 55% of precipitation runs off mowed grass directly into the lake, instead of returning to groundwater. If shoreline property owners wish to mitigate this, they could consider allowing vegetation to regenerate on its own or by actively planting native trees, shrubs, grasses, or alternative ground cover. The roots of the vegetation will grip the soil, which can help prevent erosion. Allowing mowed lawns to regenerate to a more natural state promotes water conservation and protects surface and groundwater resources. Properties with regenerative lawns are encouraged to allow this natural process to continue and to enhance regeneration by planting native shrubs and trees.

### Shoreline Buffers and Naturalization Priorities:

Arguably the most important element of a shoreline that property owners can easily influence is shoreline buffers. Buffers are an important element of natural shorelines that help filter nutrients, reduce erosion, and provide habitat. On Bitter Lake, 10% of properties have enough room between the main residence and the lake for the creation of a shoreline buffer to provide benefits to water quality and habitat. 46% of properties were noted to have great buffers as they are. In order to ensure the sustainability of a healthy lake environment it is important that natural buffers make up at least 75% of the lake shoreline, preferably as much as 80%.

There are a number of options shoreline property owners have to improve or increase the size of their buffer. Watersheds Canada and the Canadian Wildlife Federation is offering shoreline naturalizations funded through the Department of Fisheries and Oceans Canada. The data collected previous in this report was used to calculate shoreline naturalization priorities. The categories are as follows:

- Priority 1: The best candidates for naturalization efforts. These properties have more than 50% of their shoreline classified as ornamental. Additionally these properties have at least 30 metres of space between the water's edge and their main building (house/cottage). These properties are recommended to either create a buffer or expand their current buffer.
  - These shoreline property owners are encouraged to naturalize their shorelines, because their efforts would have the greatest overall impact on the health of their shoreline and the lake. They have an opportunity to plant a healthy buffer of native vegetation that could be 30 metres wide. When designing a planting plan, they can maintain room for access to the water (via raised staircases or covered, curved pathways). Lower growing vegetation can be chosen to

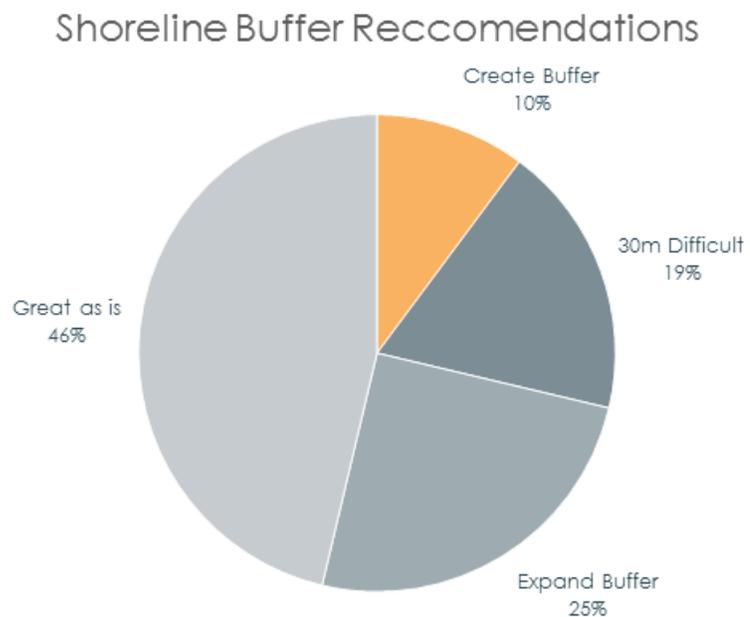


Figure 12 Buffer Recommendations

maintain views to the water, and taller vegetation can be trimmed when it grows to substantial height.

- Priority 2: The second best candidates for naturalization efforts. These properties have more than 25% of their shoreline classified as ornamental. However, some of these properties have less than 30 metres of space between the water's edge and their main building (house/cottage), which could make planting more difficult or less substantial. These properties are also recommended to either create a buffer or expand their current buffer.
  - These shoreline property owners are encouraged to plant vegetation where they can; e.g. around decks, docks, boathouses, stairs, and pathways. Although 30 metres of space between the water's edge and the main building may not be available, increasing the amount of native vegetation within the available room would still contribute to a healthier shoreline and lake.
- Priority 3: These are the third best candidates for naturalization efforts. These properties are already mostly natural or regenerative, and less than 25% ornamental. However, some of these properties have less than 30 metres of space between the water's edge and their main building (house/cottage), which could make planting more difficult or less substantial.
  - If these shoreline property owners wish to enhance their native vegetation to even further reduce their ornamental classification, their efforts would still contribute to an even healthier shoreline and lake.

### Percentage of Properties by Naturalization Priority

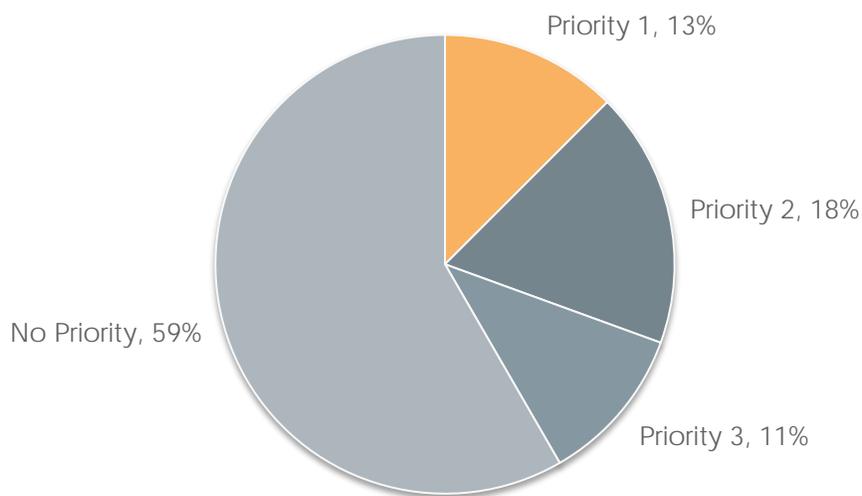


Figure 13 Naturalization Priorities

#### **Stewardship Message**

There is some potential for shoreline naturalization on Bitter Lake as greater than 13% of the properties on the lake could potentially be a candidate for naturalization based on our assessment for shoreline naturalization projects. Buffer zones are the ribbon of life, providing over 90% of aquatic and terrestrial wildlife with essential

habitat needed at some point throughout their various life stages, to mate, rear young, find food, or take shelter. Property owners who do not have 30 metres of space inland from the water's edge are encouraged to plant where they can. If support is needed in naturalization efforts, contact Coalition of Haliburton Property Owners' Associations at [www.cohpoa.org](http://www.cohpoa.org) or [www.watersheds.ca](http://www.watersheds.ca)

## Conclusions

This report is intended to be a resource for the Bitter Lake Association and community to use as a source of baseline shoreline data and to provide direction on stewardship efforts. It further encourages the Bitter Lake Association to continue their efforts to engage shoreline property owners in naturalization projects, with hopes of increasing the amount of regenerative and natural shorelines, and decreasing the percentage of ornamental shorelines. Natural shorelines are shown to contribute positively to water quality, wildlife habitat, recreational opportunities, and property values. With positive individual and community actions to protect shoreline health, all shoreline property owners, even wildlife, will benefit by enjoying a healthier lake.

Each individual property owner's shoreline report is written largely based on the majority classification of their shoreline. For ornamental properties, the reports encourage the introduction of native shoreline vegetation. For regenerative properties, the reports encourage the continued growth of existing shoreline vegetation and/or recommend increasing buffer size. For natural properties, the reports recommend to maintain the existing shoreline buffer. And for degraded properties, the reports recommend to create any type of buffer or allow native ground cover to establish itself in order to decrease overland runoff.

Ultimately, the more native shoreline vegetation a lake has, the healthier the lake system. While shoreline vegetation aids in soil stabilization, pollutant filtration, and overall lake health, it is also the best defense against most erosion problems. A good underground root network keeps soil in place, while a healthy buffer of vegetation prevents topsoil from being exposed and washed away. Shoreline vegetation nearest to and even in the water, such as aquatic and wetland plants, absorbs wave energy before it reaches the shoreline, further reducing the impact of erosion as waves, undercut and wash away the bank.

Natural buffers also provide habitat for wildlife, both aquatic and terrestrial. They improve habitat for fish by shading and cooling the water and they provide protective cover for birds, mammals and other wildlife that feed, breed and rear young near water. Local wildlife has also been known to aid natural buffer creation by spreading native plant seeds from neighboring forests (via their fur, feathers, or excrement), which also adds genetic diversity and strengthens these natural buffers.

Bitter Lake property owners are encouraged to use their shoreline handbooks as a resource to learn more about how to best protect their shoreline properties. By maintaining the natural shoreline, and with a few changes, residents of Bitter Lake can enjoy the benefits of the lake for years to come.

## Appendix:

Properties:	71	<THIS CELL CANNOT CHANGE!!			
	<b>Average</b>	<b>Presence</b>	<b>% of Total</b>		
Ornamental	39.19	62	87%		
Natural	48.08	52	73%		
Regenerative	34.67	60	85%		
Degraded	90.00	1	1%		
<b>Building Setbacks:</b>	x		<b>Retaining Walls:</b>	<b>Average</b>	
Can't See	4		Retaining Wall Length	40.0	
No Building	7				
Vacant	0		<b>Type</b>	<b>Count</b>	
Under Construction	1		Loose Rock	15	21%
< 5 m	1	2%	Wood	2	3%
5-10 m	4	7%	Steel	0	0%
10 - 30 m	48	81%	Gabion Basket	0	0%
> 30 m	6	10%	Other	0	0%
	59		Railroad Ties	0	0%
Above Recommended		90%	Treated Wood	0	0%
			Unknown	0	0%
			Other Structure	0	0%
<b>Structures:</b>	x		Armour Stone	0	0%
Boat Slip	0		Wall Failing	0	0%
Beach	0		Concrete	0	0%
Boat Launch	0		Riprap	0	0%
Boat Ramp	0			0.239437	17
Boat Lift	1		Erosion		
Building	1		<b>Type</b>	<b>Count</b>	<b>Action?</b>
Boat House	2		Surface	1	2
Shed	8		Mass Movement	1	0
Deck	10		Undercut Bank	28	0
Stairs	21		Ice Push	0	0
<b>Docks:</b>	x		<b>Aquatic Cover</b>	<b>Count</b>	<b>Percent of shorelines</b>
Unknown	0		Algae Bloom	0	0%
Cantilever	0		Removal Evidence	0	0%
Crib - Steel	0		No Cover	3	4%
Solid	0		Floating	46	65%
Crib - Wood	1		Submergent	56	79%
Dock System	1		Emergent	57	80%
Post Permanent	2				
Post Non-Permanent	3			0	0%
Raft	11			15	3%
Combo - Dock	14			39	8%
Floating	38			16	3%
				1	0%
<b># Of Slips</b>	2			56	0.120172
Natural	26	37%	<b>Average Development</b>		
Ornamental	24	34%	22.5		
Regenerative	21	30%	<b>Number Categories:</b>		54

			4	70+	0.76056338
No Building	7	7	6	40 - 60	
5-10m	4	4	49	0 - 30	
10-30m	48	48	12	NULL	
Can't See	4	4			
30+m	6	6	Priority 1	13%	
0-5m	1	1	Priority 2	18%	
Under Construction	1	1	Priority 3	11%	
Vacant	0	0	No Priority	59%	

Shoreline Development (%)	23%			
Average Shoreline Length (m)	71.1			
Total Shoreline Length (km)	5.0			
~ Developed Shoreline (km)	1.1			
x				
<b>Aquatic Substrate</b>	<b>Count</b>		<b>Recommendations:</b>	
Clay	1		Buffer	
Hardpan	1		Create Buffer	11
Bedrock	31		30m Difficult	20
Silt Clay	38		Expand Buffer	27
Boulder	35		Great as is	50
Cobble	30		Cliff	0
Rubble	14		Bedrock	12
Gravel	0		Thin Soil	11
Sand	44		Sand	2
Muck	33			
Not Visible	0		Lawn	X
			Mowed to Water	14
<b>Invasive Species</b>	<b>Count</b>		Mowed with Buffer	6
Eur. Milfoil	0		Regenerative	3
Purple Loosestrife	0		Pine Needles	19
Zebra Mussel	0		No Lawn	29
Eur. Frogbit	0		Land Use	X
Water Soldier	0		Garden	1
Fanwort	0		Few Young Trees	2
Phragmites	0		Using Boat Racks	6
No Data	71		Recommend Boat Racks	25
<b>Other Observations</b>	<b>Count</b>		<b>Pathway</b>	<b>x</b>
Commercial	0		Create Curved Path on Slope	7
Farm	0		Create Path - No Slope	4
For Sale	1		Curve & Cover Current Path	4
Island	0		Curve Path but Good Cover	0
Controlled Waterway	0		Good Curve, but Cover Path	19
			Good Curve & Covered Path	7
Slope			No Slope, but Cover Path	1
Average	3.0		No Slope & Good Cover	1
Max	5			
			Shoreline Development Chart	
			Developed Shoreline	23%

			<b>Undeveloped Shoreline</b>	77%
			<b>Redstone Lake</b>	1
<b>Classification Chart</b>				
<b>Ornamental</b>	44%	56%		
<b>Natural</b>	37%	63%		
<b>Regenerative</b>	42%	58%		

<b>Recommendations:</b>	X			<b>Sediment Distribution</b>	X	
<b>Install on Slope</b>	1			>25 cm	35	49.3%
<b>In Ground and Open</b>	0			17-25 cm	30	42.3%
<b>Raised and Closed</b>	4			6.4-16.9 cm	14	19.7%
<b>Stairs in Retaining Wall</b>	0			0.2-6.39 cm	0	0.0%
<b>In Ground and Closed</b>	12			0.05-0.19 cm	44	62.0%
<b>No Stairs Visible</b>	0			<0.05 cm	38	53.5%
<b>Stone Steps</b>	11			<0.01 cm	1	1.4%
<b>Good Raised and Open Stairs</b>	17					
<b>Drainage</b>	X					
<b>Eaves to Rain Barrel</b>	0					
<b>Eaves to Natural Area</b>	0					
<b>Eaves to Unknown</b>	12					
<b>Eaves to Surface</b>	13					
<b>Not Visible</b>	16					
<b>No Eaves</b>	19					
<b>Habitat</b>	X					
<b>Wetland</b>	0	0%				
<b>Cavity Tree</b>	2	3%				
<b>Brush Piles</b>	3	4%				
<b>Upland Forest</b>	4	6%				
<b>Overhanging Vegetation</b>	26	37%				
<b>Dead Standing Tree</b>	28	39%				
<b>Terrestrial Logs</b>	49	69%				
<b>Aquatic Logs</b>	56	79%				