

**Foreshore
Inventory &
Mapping /
Aquatic
Habitat Index**

Okanagan Lake: A Compilation of the North, South and Central Okanagan Lake



**Prepared For:
Okanagan Collaborative
Conservation Program**

**Prepared By:
ECOSCAPE ENVIRONMENTAL
CONSULTANTS LTD.**

**February 2011
File No.: 10-596**

FORESHORE INVENTORY AND MAPPING & AQUATIC HABITAT INDEX

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EXECUTIVE SUMMARY

Throughout the first years of the new millennium, the Okanagan watershed has experienced intensive development activity within most areas. As the population within the Okanagan region has grown, development has spread to more remote areas. It is becoming readily apparent that the increased development is degrading shoreline areas along the lake, which is known for its natural beauty and high recreational values. The development pressure is resulting in impacts on fish and wildlife habitat, important terrestrial communities, wetlands, and water quality. The spread of development to remote areas is the result of an increasing demand for lake side properties and year round residences with better overall servicing. For less developed areas, now is an opportune time to address lakeside development concerns to better manage future shoreline impacts.

In response to the need for better and more collaborative lake planning and management, the Okanagan Conservation Collaborative Program, with support of local, provincial, and federal governments, initiated a process to document the current condition of the foreshore and to help develop a more integrated approach to watershed management. This work was a continuation of previous projects initiated in the Central, North, and South Arms of Okanagan Lake. This report has been prepared based upon the belief that it is possible to manage this shoreline and the natural areas surrounding it in a sustainable manner.

Okanagan Lake is arguably the most important resource in the Okanagan Valley, and contributes significantly to the overall production of fish and wildlife. The lake supports populations of rainbow trout, kokanee, mountain whitefish and burbot. Okanagan Lake also contains populations of coarse fish species such as sculpins or longnose/leopard dace, which are often forage fish. Shoreline areas also provide important habitat for numerous wildlife species, including raptors (e.g., Osprey), Western Grebes, song birds, large game (e.g., deer and moose), and numerous other populations of avian and mammal fauna. Finally, the shoreline of Okanagan Lake also provides habitats that are important for rare plant species and communities. Okanagan Lake the primary source of water for agricultural purposes and human consumption for many Okanagan Communities.

Currently, many lake management projects in the province of BC follow a three step process described below. For this project, steps 1 and 2 below were completed.

1. Foreshore Inventory and Mapping (FIM) is a protocol that is used to collect baseline information regarding the current condition of a shoreline. The FIM uses a mapping based (GIS) approach to describe shorelines. These inventories provide information on shore types, substrates, land use, and habitat modifications. This new information has been combined where possible, with other mapping information such as previous fisheries inventories, recent orthophotos, and other information.
2. An Aquatic Habitat Index (AHI) is generated using the FIM data to determine the relative habitat value of the shoreline. This index follows similar methods that were developed for Shuswap Lake and is similar to other ongoing assessments along lakes in the Kootenays. The Aquatic Habitat Index uses many different factors such as biophysical criteria (e.g., shore type, substrate information, etc.) fisheries information (e.g., juvenile rearing suitability, migration and staging areas), shoreline vegetation conditions (e.g., width and type of riparian area), terrestrial ecosystem information (Sensitive Ecosystem Inventory), and modifications (e.g., docks, retaining walls, etc.) to estimate the relative habitat value of a shoreline segment. This assessment was the first known to the author to incorporate areas identified to be important terrestrial habitats. The Habitat Index classifies this information in a 5-Class system from Very

High to Very Low and describes the relative value of the different shorelines areas to one another (i.e., describes shorelines areas within Okanagan Lake to each other and not to other lakes (e.g., Shuswap or Mabel).

3. Shoreline Management Guidelines are prepared to identify the Shoreline Vulnerability or sensitivity to changes in land use or habitat modification. Shoreline Vulnerability zones are based upon the Aquatic Habitat Index described above. The Shoreline Vulnerability Zone uses a risk based approach to shoreline management, assessing the potential risks of different activities (e.g., construction of docks, groynes, marines, etc.) in the different shore segments. The Shore Line Management Guidelines document is intended to provide background information to stakeholders, proponents, and governmental agencies when land use changes or activities are proposed that could alter the shoreline thereby affecting fish or wildlife habitat.

At this time, there are numerous different shoreline policy documents that have been prepared in response to significant development pressure. At the provincial level, the Okanagan Large Lakes protocol was prepared and this document provides a framework for management of kokanee and the Western ridged mussel. Other documents include the City of Kelowna Shore Zone assessment and the Central Okanagan Lake Foreshore Plan. Currently, there is not a unified framework or policy that is being utilized by local, provincial, and federal governments in management systems.

Foreshore Inventory and Mapping

Foreshore Inventory and Mapping results (FIM) for this project included a compilation of data from the south, central, and north Okanagan. The data compilation provides valuable information regarding features, habitats, and other information for the shorelines of Okanagan Lake. A summary of the data collected indicates the following:

- The level of impact along the Okanagan Lake shoreline was determined based upon categorical descriptions of the level of disturbance observed along the lake. It is estimated that 58% of the shoreline has a high level of impact (greater than 40% disturbance) which accounts for 169 km of shoreline. Areas of moderate (between 10 to 40% disturbance) and low impact (less than 10% disturbance) account for 15% or 44 km and 25% or 72 km of the shoreline respectively. There is an estimated 3.4 km or 1.2% of shoreline that is believed to have little to no impact. Impacts along the shoreline include lakebed substrate modification, riparian vegetation removal, construction of retaining walls, docks, beach grooming, etc. In total, it is estimated that 57% or 164 km of the shore length is disturbed and 43% or 125 km is natural;
- The most predominant land use around the lake is single family areas (32%), followed by rural areas (25%). Other common land uses include natural parks (e.g., Okanagan Mountain Park), urban parks, transportation, and recreational areas;
- Wetlands and stream confluences are the most rare shore type around the lake, accounting for only 8% and 3% of the shore length respectively. The most common shore types around the lake are gravel and cliff / bluff shores accounting for 43% and 23% respectively. Gravel and cliff / bluff shores comprise 31% and 65% natural respectively;

- Aquatic vegetation occurs along 19.5% of the shoreline and is an important habitat feature for juvenile salmonids. Of this, emergent vegetation (e.g., emergent grasses, willows, or other types of vegetation inundated during high water) was the most commonly observed (e.g., emergent grasses, willows, or other areas with vegetation inundated during high water). Native beds of submergent vegetation were only documented along 2.1% of the shoreline, and areas of floating vegetation were only observed along 0.3%;
- The following summarizes habitat modifications observed:
 - Docks were the most common modification, with a total of 2,718 observed. Both pile supported and floating docks were observed. Also, numerous “dock groynes” were also observed, where lake bed substrates were piled under existing moorage structures.
 - Retaining walls were the second most predominant modification, with a total of 1,799 observed. Some retaining walls extended beyond the high water level of the lake. This construction practice is not compliant with Best Management Practices (i.e. bio-engineering practices for new walls or repairs to existing walls). Retaining walls occupied approximately 20% of the shoreline, which accounts for approximately 58 km;
 - Groynes were the next most commonly observed modification, with over 939 observed. Lakebed cobbles and boulders were most commonly used to construct groynes and it is probable that construction may have required the use of heavy equipment in some instances. The use of lakebed substrates to construct groynes has resulted in significant impacts to emergent vegetation, which is an important juvenile salmon habitat feature. Groynes along the shoreline were typically constructed to improve access and create gravel/sand beaches.
 - A total of 222 concrete boat launches and 41 marinas were observed.
 - Substrate modification was also observed along 47% of the shore length and was most commonly associated with groynes, retaining walls, transportation infrastructure (e.g., roadway fills), and sand importation to create beaches,

The findings of the FIM indicate that the shoreline areas of Okanagan Lake have been impacted by current and historic land use practices. The current trend of reliance on Best Management Practices and voluntary compliance with the regulations and guidance documents are not resulting in the required protection of important fish and wildlife habitats along the shoreline. It appears that neighbors have mimicked each others' activities and this observation has been made in many lakes that have been mapped using FIM. Finally, there were some shoreline modifications that encroached onto Crown land (i.e., below the high water level).

Given this, all agencies and stakeholders are encouraged to work with the public on better communication and education to ensure that all stakeholders are aware of the habitats present, their values, and the potential influences development activities may have upon them. Recommendations for public awareness and education to facilitate public involvement and compliance in the protection of foreshore areas are contained herein. The combination of education and cooperative enforcement will help reduce the continued losses of habitat along the shoreline and help promote stewardship of the foreshore.

Aquatic Habitat Index

The Aquatic Habitat Index (AHI) for Okanagan Lake provides valuable information regarding the estimated habitat values of different shoreline areas. The AHI is a categorical scale of relative habitat value that ranks shoreline segments in a range between Very High and Very Low (Very High, High, Moderate, Low, and Very Low). The index is relative, because it only assesses the sensitivity of one shoreline area relative to another and is not directly transferable to other lake systems. The following provides a definition for each AHI ranking:

1. Very High - Areas classified as Very High are considered integral to the maintenance of fish and wildlife species and these areas generally occur in either an important floodplain areas adjacent to a salmonid spawning, or wetland habitats. These areas should be considered the highest priority for conservation and protection.
2. High Value Habitat Areas - Areas classified as High Value are considered to be very important to the maintenance of fish and wildlife species around the lake and areas can be ranked as high for a variety of reasons. These areas should be considered a priority for maintaining current conditions and a high prioritization for conservation should be given to these areas.
3. Moderate - Areas classified as Moderate are areas that are common around the lake, and have likely experienced some habitat alteration. These areas may contain important habitat areas, such as shore spawning kokanee habitats, but these areas are generally considered more appropriate for development. Because areas of high habitat value may be present, caution should be taken when considering changes in land use to avoid unnecessary harm or degradation to existing habitat values.
4. Low - Low value habitat areas are generally highly modified. These areas have been impaired through land development activities. Development within these areas should be carried out in a similar fashion as Moderate shoreline areas. However, restoration objectives should be set higher in these areas during redevelopment.
5. Very Low - Very Low habitat areas are extremely modified segments that are not adjacent to any known important habitat characteristics.

The following summarizes the results of the AHI analysis:

- Approximately 61% of the combined shoreline is ranked as High or Very High. Many of these areas occur adjacent to critical stream floodplains, wetlands, Grebe nesting areas, along highly vegetated gravel or cobble shoreline areas, and other important natural habitats around the lake such as suitable Western Ridge Mussel habitat. The abundant high value habitat present is related to the significance and high proportion of rare communities and sensitive fish habitats in the lake.
- Approximately 28% of the shoreline was Moderate habitat value. Moderate habitat value areas are typically associated with sand or gravel shorelines that have experienced some level of habitat alteration due to previous development.
- Approximately 11% of the shoreline is ranked as Low Habitat Value. These areas occur in most intensely developed areas that are not adjacent to any known values of importance.

- The AHI found that approximately 1% of the shoreline is ranked as Very Low habitat value. These areas are mostly found along highly developed shorelines and are quite different than natural shore type conditions.
- All shoreline types are considered salmonid habitat (e.g., staging areas, rearing areas, spawning habitats, or general living). For instance, segments identified as having low juvenile habitat suitability still contribute to overall salmonid production in the lake. Further, there are some instances where high value habitats are embedded within shore line areas of moderate value (e.g., a kokanee Black Zone in a segment ranked as Moderate by the AHI) and these critical habitat areas must be considered independently of the AHI ranking because of their high value.
- The AHI highlights the importance of the connection between our diverse streamside, wetland and lakeshore habitats, and important terrestrial upland areas. Stream confluences and their adjacent features (e.g., shore marshes, large woody debris, and diverse riparian vegetation communities) are areas that tend to contain the highest fish and wildlife diversity. These areas are extremely important for maintaining viable populations, and most importantly are water quality buffers that are required to preserve source drinking waters.
- A restoration analysis was completed by removing instream features. This analysis was accomplished by removing negative habitat parameters in the index and assessing which segments increased in relative habitat value. The restoration analysis does not include assess how changes in riparian condition would improve relative habitat value, but does indicate opportunities to repair impacted instream habitats. Habitat restoration opportunities include removal of groynes, bioengineering retaining walls, planting native riparian vegetation, etc. Habitat improvements will help reverse the current trends of habitat degradation that were observed. It is recommended that habitat restoration opportunities be pursued as part of any development or redevelopment applications.

Recommendations have been presented that are intended to aid foreshore protection, guide future data management, and for future biophysical inventory works. A key recommendation is that:

- Shoreline Management Guidelines are the final step in the three step shoreline management process. This inventory and cumulative analysis of Okanagan Lake provides the framework for development of management policies that can be integrated between local, provincial, and federal governments. Shoreline Management Guidelines are currently in place for Okanagan Lake (Okanagan Large Lakes Protocol (OLLP)), but these guidelines generally only consider critical kokanee shore spawning areas, Western Ridge mussel locations, and a few other items (e.g., stream deltas and rare plants). Numerous local governments also have shoreline policies, and the OLLP and these policy documents are not integrated. Within the Shuswap system, the AHI, and layers such as those in the Okanagan Large Lakes protocols (e.g., Kokanee spawning layers) are used together to develop shoreline guidelines. The results of this assessment could be considered an important addition as a data layer to the OLLP. These guidelines can be used to develop shoreline policies and regulations that are integrated between different levels of government. Once adopted, the guidelines will assist decision makers when making land use decisions across multiple agencies. Guidelines will also streamline the permitting and regulatory processes at these different governmental levels by focusing limited resources on areas or activities that pose the greatest risks by allowing lower risk activities to proceed without the involvement of Fisheries and Oceans Canada.

The inventories and analysis completed as part of this study are expected to aid in the protection of important shoreline resources around Okanagan Lake. Although many impacts were observed along the lake shoreline, it is important to note that there are extremely important habitats present that are in good to excellent condition. The value of this work will be especially important in any shoreline land use and marine development proposals because it will help ensure appropriate management of the vast biodiversity of the Okanagan Lake shoreline.

Comparisons between 2010 and 2004 in the Central Okanagan

Foreshore Inventory and Mapping results from 2004 were compared to results from the 2010 survey. The results of this analysis indicate that change along the shoreline is potentially occurring at rates in the magnitude of 1 to 2% per year. This rate of change may not seem substantial when considered just as a percentage. However, when you consider that only 48% remained natural in 2010 (in areas surveyed in 2004 only), even the loss of 1 to 2 percent per year could mean substantial change in the next 10 to 50 years. For example, currently there is 48% of the shoreline in natural condition and if the rate of change is consistent until 2020, it is estimated the shoreline will be 39% natural. This is nearly a 5 percent decline over the next 10 years. This analysis has simplified an extremely complex system and should not be taken literally. Rather, it should be used as a guide because it provides an estimate of the approximate order of magnitude change that is occurring. The analysis found that in nearly every metric considered (e.g., slope gradient, juvenile rearing, Aquatic Habitat Index, etc.), there was a decline in shore line habitat value over time (measured as loss of percent natural shoreline).

Specific examples that are interesting to consider include the density of shoreline modifications observed between 2004 and 2010. The table highlights the densities of modifications in 2010 and the estimate of density in 2020 that were prepared using a simple best of fit line for the two data points. Again, this analysis is very simple and subject to numerous assumptions and potential sources of error and should be used as an order of magnitude interpretation tool rather than to directly predict future densities.

Table: The density of docks, groynes, boat launches, retaining walls, marinas and marine rails on Okanagan Lake in 2010 and predicted for 2020 using a simple best of fit linear line.		
Type	2010	2020
	Density (#/km)	Density (#/km)
Docks	10.27	12.0
Groynes	4.66	10.7
Boat Launch	0.72	1.1
Retaining Walls	7.76	11.2
Marinas	0.19	0.4
Marine Rails	0.61	0.9

The comparative analysis provides a clear rationale for the recommendations. The data collected corroborates concerns about shoreline condition that have been raised by citizens, politicians, and environmental practitioners. Implementation of key recommendations should occur in short order because the order of magnitude rates of change are now known and they predict that substantial and measurable change will occur in the period of one or two generations if appropriate steps are not implemented now.

Through continuing FIM and mapping efforts in the future, it will be possible to establish the effectiveness of mitigative and management steps taken. By analyzing rates of changes and relating those to implementation of policy it will be possible to identify if steps taken are effective. An integral part of this policy development will include setting clear and attainable objectives for shoreline condition. Setting of these objectives within a Shoreline Guidance Document is considered the most important next step in policy development for Okanagan Lake.

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DISCLAIMER

The results contained in this report are based upon data collected during field surveys occurring over a short durations throughout the period of one year. Biological systems respond differently both in space and time and exhibit extreme variability. For this reason, conservative assumptions have been used and these assumptions are based upon field results, previously published material on the subject, and air photo interpretation. Due to the inherent problems of brief inventories (e.g., property access, GPS/GIS accuracies, air-photo interpretation concerns, etc.), professionals should complete their own detailed assessments of shore zone areas to understand, evaluate, classify, and reach their own conclusions regarding them. Data in this assessment was not analyzed statistically and no inferences about statistical significance should be made if the word significant is used. Use of or reliance upon conclusions made in this report is the responsibility of the party using the information. Neither Ecoscape Environmental Consultants Ltd., Fisheries and Oceans Canada, project partners, nor the authors of this report, are liable for accidental mistakes, omissions, or errors made in preparation of this report because best attempts were made to verify the accuracy and completeness of data collected and presented.

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