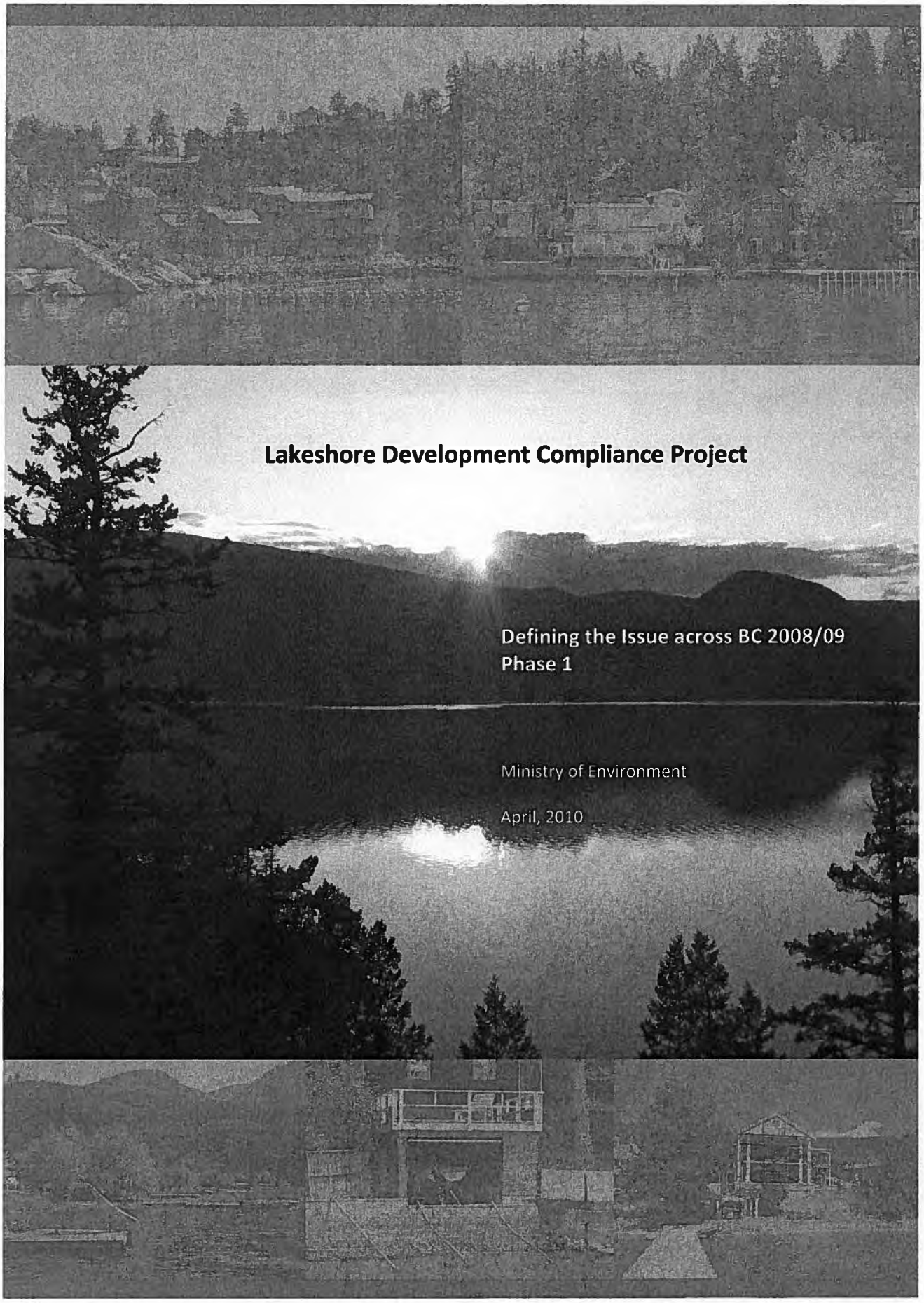


Lakeshore Development Compliance Project

Defining the Issue across BC 2008/09
Phase 1

Ministry of Environment

April, 2010

Acknowledgements

For their assistance on this project, special thanks to the provincial team (see Appendix A) and to Erica Jenkins (BCCC), Eric Heel (BCCC), Brendan Guy (BCCC), David Johner, Brent Magnan, Wesley Miles, Lisa Tedesco, Brian Robertson, Phil Epp, Kristina Robbins, Grant Furness, Susan Latimer, Brad Mason, Jillian Tamblyn, Greg Burdock, Jerry Mitchell, Bob Hamilton, Blake Dixon, Ken Cunningham, Dennis Einerson, Danny St.Hilaire, Simone Runyan, Erin Gunoff, Kyle Hawes, Jason Schleppe, Shaun Reimer, Susan Waldock, Catherina Wells, Duane Wells, Paul Askey, and to Lora Nield, Stacey Wilkerson, Edwin Hubert and Sheila Richardson for this report.

Ministry of Environment
April 2010

Background

In 2007, the Ecosystems Section of the Ministry of Environment (MOE) identified non-compliance with rules governing lakeshore development and redevelopment as one of the greatest compliance challenges facing their program. It was identified as a problem throughout the province of British Columbia (B.C.) to some degree with the most significantly impacts occurring in the southern portion of the province.

Ecosystems staff concerns not only related to the direct loss of fish and wildlife habitats such as spawning grounds and riparian vegetation but more importantly, a cumulative loss of foreshore habitats. Development along lake shorelines can reduce coarse woody debris inputs into lakes (Christensen, 1996), and can affect vegetation cover (emergent and floating vegetation) in littoral areas (Radomski, 2001), thereby impacting fish habitat. A large percentage of developments along lakeshores include over water structures. Carrasquero (2001) reports that there are three direct mechanisms of impacts associated with over water structures: littoral habitat structure changes, shading and ambient light changes, and disruption of water flow pattern and energy. Over-water structures are known to attract predatory fish such as the small and largemouth bass, shade aquatic habitat which limits the daylight available for photosynthesis (thus restructuring communities), as well as intercept gravel transport (Carrasquero, 2001). Other impacts such as increased fish predation, loss of primary productivity, disruption to fish movements, and changes in spawning gravels are also known to occur depending on the extent of the development.

There are a number of regulatory requirements governing work carried out in and around streams and lakes in B.C. These include:

- an approval or notification under the *Water Act* for works below the high water mark of a stream;
- a local government bylaw may be established to protect aquatic and riparian habitat (i.e. in some areas of the province the Riparian Areas Regulation applies which requires a Qualified Environmental Professional to certify that the development will not result in a harmful alteration of riparian fish habitat);
- a license of occupation under the *Land Act* for structures on crown land (i.e. dock);
- an authorization under the Federal *Fisheries Act* if fish habitat is at risk of being impacted.

Although lakeshore development was identified by Ecosystem staff as having a significant and increasingly negative impact to the environment, staff could only provide anecdotal evidence of non-compliance and of the resulting negative impacts to fish and their habitats.

Historically, the ministry's capacity to formally monitor or quantify the problem, let alone address it, has been inadequate.

Consequently, a provincial team was established to develop a strategy to confirm and address this perceived problem in a planned, collaborative way that is consistent across the province and sustainable for the ministry in the long term. The team included representatives from ecosystem section (MOE) across the province, Water Stewardship Division (MOE), Conservation Officer Service (MOE), Policy and Planning Branch (MOE), Local Government, Integrated Land Management Bureau, Department of Fisheries and Oceans Canada, and the BC Lake Stewardship Society. A list of team members is provided in Appendix A.

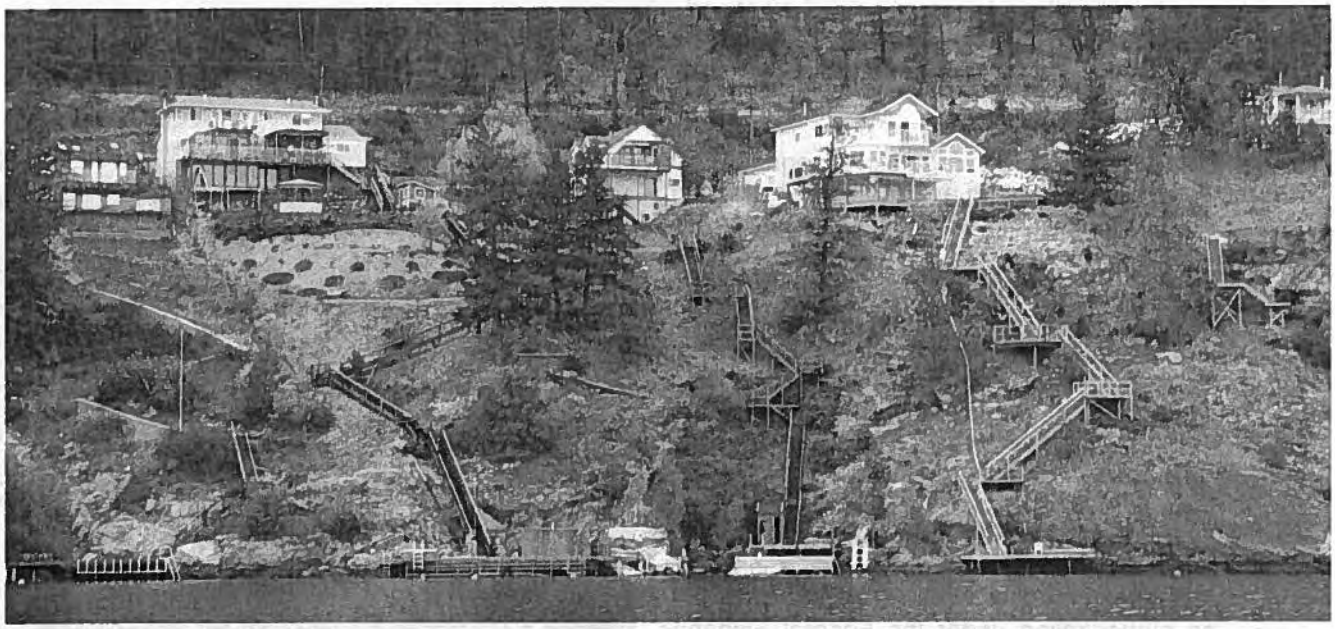
Objective

The objective of the Provincial Lakeshore Compliance project is to determine the extent and character of non-compliance along lakeshores in British Columbia (B.C.), and develop solutions to address the problems if and where they exist. The project is focused on lakefront residential developments.

Specifically, this project has two primary objectives and has been consequently broken down into two phases:

1. Phase 1 is to clearly define the problem and quantify (to the best of our ability) its extent across each participating region (i.e. is there a problem, and is it having an impact)
2. Phase 2 will focus on developing, testing and implementing tools to assist staff and partner agencies to develop strategies to address the reasons behind non-compliance over the long term.

This document is a report on Phase 1of the project which occurred in 2008.



Methodology

In early spring of 2008 the regional Ecosystem section team members were responsible for applying their local knowledge to select lakes in their area for monitoring. Selection criteria included lakes that had already experienced some development and more was expected. Provincially there was a broad range of lake sizes and levels of development chosen. Table 1 (below) depicts all the lakes selected. In total there were 32

lakes with representation from all nine of the Environmental Stewardship regions of MOE. Specific methodology and results for the 32 lakes can be found in the regional lakeshore compliance project reports (http://sharepoint.env.gov.bc.ca/ldcp/Lakeshore%20Development/Provincial%20Compliance%20Project.aspx).

Table 1 – Lakes Sampled

Region	Lake Name
Vancouver Island	Sproat
	Horne
	Kemp
	Langford
	Prospect
Lower Mainland	Sakinaw
	Ruby
Thompson	Gun
	Montana
	Pinantan
Kootenay	Moyie
	Monroe
	Rosen
	Tie
	Wasa
	Windermere
Cariboo	Dragon
	Sheridan
	Williams
Skeena	Bigelow
	Call
	Kathlyn
	Lakelse
	Round
	Seymore
	Tyhee
Omineca	Cluculz
	Fraser
Okanagan	Okanagan
	Skaha[1]
Peace	Charlie
	Swan

The baseline inventory and compliance assessments were, for the most part, conducted by a three member B.C. Conservation Corps crew (BCCC crew). The Conservation Corps was a government initiative that gave university students and recent graduates, with an interest in the environment, the kind of hands-on field experience that will make them better prospects for Ministry of Environment jobs in the future. The crew was hired and trained to ensure the data was collected in a consistent fashion across the province.

[1] Skaha Lake was done at a later date – not by the BCCC Crew.

Baseline Inventory

The baseline inventory was conducted to record the current state of selected lakeshores this will provide a regulatory benchmark and evidence for future investigations; it may also be used by partnering agencies in future decision making about development. On some lakes the baseline data was collected for the entire shoreline on other lakes, which were too large, only segments of the lakes were inventoried. Baseline inventory included video capturing of the shoreline and riparian area and GPS data collection.

Detailed technical methodologies and procedures for video and GPS data collection, data management, and quality control are provided in Sensitive Habitat Inventory and Mapping (SHIM) Procedures (Mason and Knight, 2001) and the Central Okanagan Foreshore Inventory and Mapping (FIM) Report (RDOS, 2005).

In general, the shoreline was videotaped with a digital video camera, which was stamped with the date, time and location of the property from a GPS unit. In the video the shoreline was broken into 'segments' determined by similar foreshore characteristics (i.e. segment breaks corresponded with significant changes in the appearance of the shoreline) and typically not shorter than 100 metres. Video segments were captured at a low speed (~4 knots) at approximately 60m from the shoreline, or where it was deep enough to accommodate the boat used.

The GPS data was collected for each segment. Information on shoreline morphology and habitat types were entered into a data dictionary[2], developed and used by Department of Fisheries and Oceans Canada (DFO), MOE staff, and the Regional District of the Central Okanagan (RDCO)). GPS information was recorded and a representative photograph was taken for each segment.

The information collected in each segment (~100 m) included but was not limited to:

- Shore Type
- Foreshore Modifications
- Level of Impact
- Land Use
- % Disturbance
- Riparian Type/Condition
- Substrate
- Littoral depth

Data was often collected in percentages. The percentages were estimates based on visual observations made from the boat rather than actual measurements. To view the baseline data collected, as well as the video for a lake, please contact the appropriate regional contact in Appendix A.

Compliance Assessments

The compliance assessments were done on a second pass around the lake. The intent of these assessments was to determine whether permits (primarily under the *Water Act*) had been issued for observed modifications (e.g. docks, retaining walls, beach grooming, groynes). Compliance sites were selected randomly on each lake or segment of the lake (depending on the size of the lake and time allotted). If a segment was chosen, it was an area of concern preselected by regional staff. Segments typically contained areas where new and/or redevelopment was taking place that would, under current legislation, require authorizations for modification of the foreshore. Compliance assessments were conducted on approximately 10% of the properties for most of the 32 lakes.

Due to limitations with the mapping information available, properties were selected manually using available zoning, property maps and/or orthophotos. The consistencies across regions including ensuring sites were random. Methodology for determining random varied. More details on regional methodology can be found by

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[2] *The data dictionary is a tool developed for SHIM methodology to help interpret the raw GPS data collected by Trimble Pathfinders (or similar equipment). All data needs to be data dictionary compatible so that data can be filed and interpreted in the same way.*

contacting regional staff (see Appendix A). One method of random selection was generating a list of random numbers using the statistical function in Microsoft Excel. Beginning at one point in the lake, properties were then selected in a clockwise direction. For example, if the 7th property was randomly selected, and the next number to be drawn was 3, the 3rd property clockwise from the 7th property was then chosen. On many lakes, the BCCC crew simply selected every 10th property, continuing until approximately 10% were selected from the lake or segment. Lakes with less development or lakes that had more time allocated generally had a higher percentage sample size but as each lake was reported on individually, this did not affect the results.

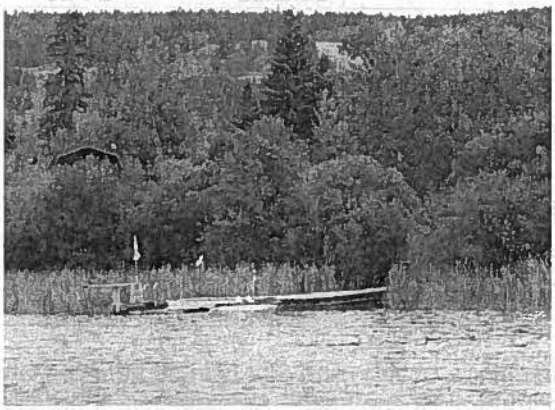
Properties selected were then identified (for the Conservation Corps) by UTM coordinates. These coordinates were then entered into the GPS and a route was planned to minimize travel time. Orthophotos of the selected properties were also included for reference of major land features from the boat. For each site, foreshore modification information was captured in the data dictionary. This included the type of modification, dimensions, materials and location relative to the high water mark. The age of the structure was also recorded as either recent or historic, with recent meaning it looked new enough to suggest it was built since permits were required. The data dictionary for the compliance assessments was developed by MOE Ecosystems staff and Regional District staff from the Central Okanagan. Photos were taken at each site of the entire property and of each individual modification.

While the objective at the outset of this exercise was to assess compliance within different types of developments (e.g. residential, industrial, commercial) by stratifying the samples, in all cases sample sizes for all but 'single family residential' were too small to report out on. As a result, only single family residential properties are included in the results.

To assess compliance on these randomly selected properties regional Ecosystems staff searched available databases and files to locate relevant authorizations. In most regions only *Water Act* files were accessible, with variability in how far back these files went. *Water Act* approvals and notifications are not currently searchable by property information, but can be queried by the source (water body), and then linked to specific properties by the civic address on the document. This required regional staff to pull all permits for a given lake, and then manually search for those that matched one of the selected properties. On large lakes where a number of permits were located, this was a very time-consuming exercise that required the assistance of administration and Water Stewardship Division staff.

Where permits for works did exist, only measurable terms and conditions were evaluated. Under Section 42(1) of the Water Regulation a Habitat Officer (appointed by the province) can place terms and conditions to ensure protection of habitat in addition to conditions of the general application. Certain conditions of the permit are time sensitive and are not measurable after development. These were not assessed with this project (i.e. timing of works and verification of erosion protection works). Conditions in the permits assessed included:

- Size of modification
- Location (below, at, or above the high watermark
- Materials used
- Alteration of sediment transport



Results

FIM baseline inventory was conducted on approximately 630km of shoreline in BC during the summer of 2008. Table 3 provides a breakdown of the kilometres of shoreline inventoried per lake and the percentage of that shoreline that has been disturbed by human influence. Compliance assessments were conducted on 574 sites on 24 lakes.

The results represent the data collected in this project. It is important to note that had different lakes or different segment of lakes been chosen results may vary.

Table 2- Kilometres of Shoreline FIM mapped by Lake and Lakes Assessed for Compliance

Region	Lake	KM of Shoreline Mapped (FIM)	% of Sampled Shoreline Disturbed	Assessed for compliance
Vancouver Island	Horne	24.52	47.4	
	Kemp	2.49	60.0	✓
	Langford	4.7	77.0	✓
	Prospect	4.97	89.2	✓
	Sproat	26.17	93.4	
Lower Mainland	Ruby	18.11	19.7	✓
	Sakinaw	36.49	44.9	✓
Thompson	Gun	15.78	97.3	✓
	Montana	7.49	9.3	✓
	Pinantan	4.97	91.0	✓
Kootenay	Moyie	36.51	54.5	
	Monroe	6.18	27.7	
	Rosen	5.44	98.1	
	Tie	10.79	55.7	
	Wasa	7.97	78.1	
	Windermere	36.3	48.6	✓
Cariboo	Dragon	16.39	43.1	✓
	Sheridan	55.3	26.9	✓
	Williams	20.3	51.0	✓
Skeena	Bigelow	1.25	4.2	✓
	Call	1.75	0	
	Kathlyn	5.28	64.2	✓
	Lakelse	26.25	69.8	✓
	Round	5.63	62.9	✓
	Seymour	4.05	26.5	✓
	Tyee	10.95	89.2	✓
Omineca	Cluculz	49.85	47.5	✓
	Fraser	65.59	56.9	✓
Okanagan	Okanagan	64.53	74.4	✓
	Skaha	Entire shoreline	100.0	✓
Peace	Charlie	38.22	36.0	✓
	Swan	15.65	22.7	✓

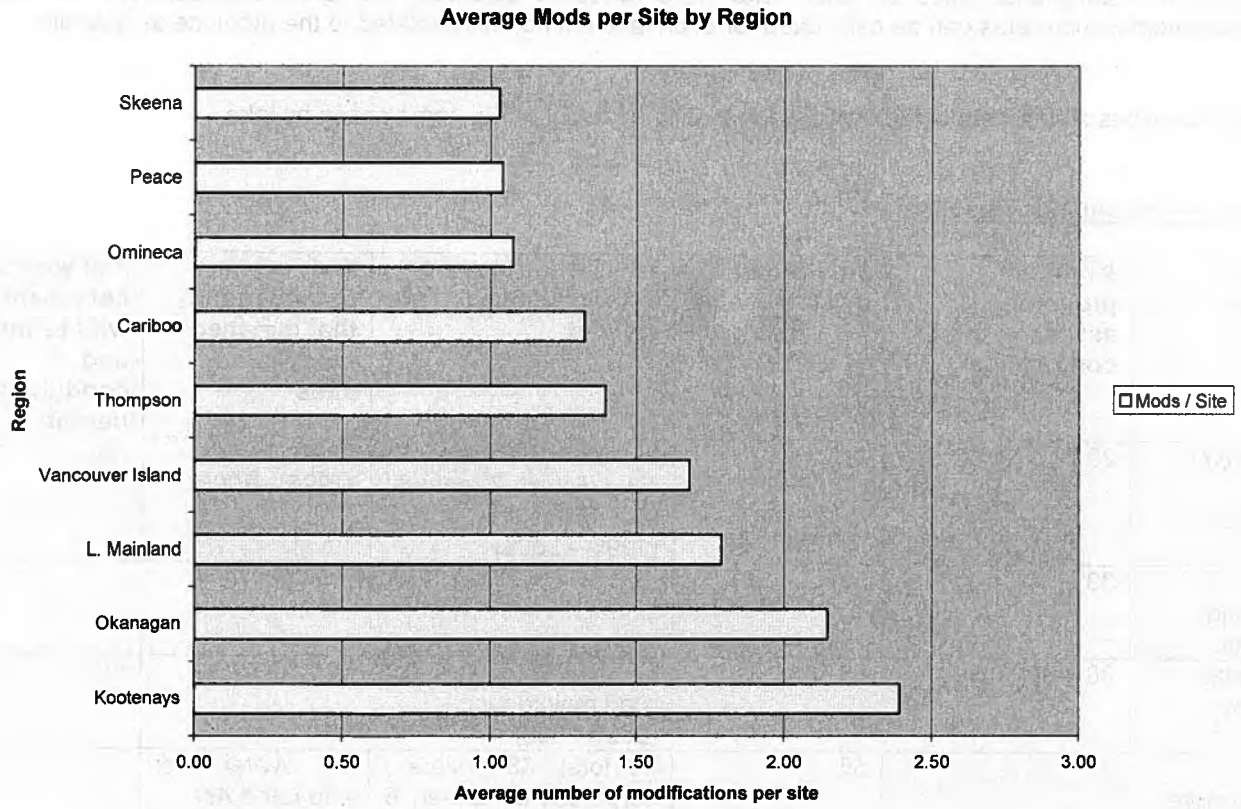
The percentage of shoreline that is in its natural state varied across the province, ranging from 100% on Call Lake to 1.9% of Rosen Lake. As expected, there is a strong correlation between the amount of development around the lake and the amount of disturbance found on the shoreline (measured by the number of modifications to the foreshore).

There were 872 modifications (docks, retaining walls, groynes, and boat launches) on the compliance sites, averaging 1.5 modifications per site. Chart 1 shows the average modification per site within each region (this chart does not include the work done by regional staff on Skaha Lake in the Okanagan Region). Kootenay Region had the most modifications per site visited; Skeena region had the fewest. The areas with the highest modifications per site again correlate with the areas of the province with the highest urban growth pressures. The majority of the modifications observed were dock structures followed closely by retaining walls.

The predominant type of modification on a lake appeared to vary with factors such as proximity to a city, type of shore, levels of erosion and possibly social norms (i.e. clusters of docks or retaining walls). For example:

- Prospect lake (Victoria), which is 89% developed has 20.2 docks and 8.3 retaining walls per kilometre (20.2) while Tyee Lake (Williams Lake) is also 89% developed but with comparatively fewer docks and retaining walls.
- 91% of Pinantan Lake (Kamloops) has been developed with only 2 retaining walls on the entire lake (but with 18.1 docks/km) likely because a significant portion of the shoreline is wetland.

Chart 1 – Average Modification per Site in each Region



Of the modifications recorded during the compliance assessments, 9% were above the high water mark (HWM), 36% were at the HWM and 55% were *below* the HWM. When docks are factored out (because it is difficult to definitively categorize them as above, at or below), 65% were situated below the HWM, where authorizations would typically be granted only under rare circumstances.

File searches in each region turned up very few permits (0 on many lakes). However, we cannot be conclusive about whether or not authorizations have been granted for observed works. As previously stated, the search in most regions included only *Water Act* files that were readily available in either electronic

databases or in paper files located on site, the earliest dating back to 1995. While active and/or recent modifications to the foreshore were easy to identify (suggesting authorizations would be located if they existed) it was difficult to determine which if any older works pre-dated the accessible files. It is possible (although unlikely) that authorizations for 'historical' modifications exist in off-site storage.

Notwithstanding this uncertainty, it appears that very few authorizations exist for the modifications observed at the compliance sites. In total, approximately 420 private property *Water Act* applications were located for all 24 lakes yet 4000+ modifications were recorded during the baseline assessment. Only a handful of these corresponded to the works observed at the 574 compliance sites. To further illustrate the disparity, 638 *Water Act* applications (of all types) were located for all of Okanagan Lake, yet 883 docks were recorded in the 64.53km segment videotaped as baseline (representing approximately 24% of the total 268.56 shoreline). None of the 638 applications were for works observed at the 35 compliance sites.

On Vancouver Island it appears that three private property *Water Act* permits have been issued since 1995, and yet there are currently 380 retaining walls and 791 docks on the lakes sampled. Skaha Lake has 14 permits for private properties and 337 modifications. Of the 14 permits on Skaha Lake 7 were for works that were observed during our assessments. The Peace region located no *Water Act* applications for works observed on the two lakes sampled and those lakes had a total of 44 retaining walls and 105 docks.

Although the compliance sites on each lake were randomly selected, the lakes themselves were not; therefore compliance rates can be calculated for each lake but not extrapolated to the province as a whole.

Table 3 provides a summary of the compliance results by region, or in some cases by lake.

Table 3 – Compliance Results

Lake or Region	**# random properties assessed for compliance**	**# recorded modifications**	**Total *Water Act* authorizations located**	**# of authorizations that matched compliance sites**	**# of works compliant with terms and conditions of permit**
Vancouver Island (3 lakes)	25	42	21 total, 3 private, 11 city / district, 7 removal of Eurasian milfoil (1995 – 2008)	0 (1995 – 2008)	n/a
Lower Mainland (2 lakes)	33	59			
Thompson (3 lakes)	38	53	17 total, 3 private, 14 road maintenance (2000-2008)	0?	n/a
Lake Windermere	23	55	44 total, 38 private / corporations / other, 6 government (2003-2008)	11 *Water Act* and *Land Act*	7
Cariboo (3 lakes)	60	78 (only 2 appeared to be 'recent' (since 2005)	18 total, 12 private, 3 city, 2 Min of Trans., 1 BC Hydro (2005 to present)	0	n/a
Omineca (2 lakes)	52	56	2 section 9's for water line work, no shoreline work	0	n/a

			(1995-2008)		
Skeena (6 lakes)	67	69	0 (year?)	0	n/a
Okanagan Lake (64.53 km segment)	35	72	638 total, 364 private, 137 city / district / parks / ministry of transportation (1997-2008)	0	n/a
Skaha Lake	194 (all properties)	337	26 total, 14 private, 12 city/ Penticton Indian Band (1997-2000)	7 *Water Act*	6
Peace (2 lakes)	49	51	0 (year?)	0	n/a

It is important to note, however, that in some regions a short term exemption for applying under the *Water Act* was applied to docks from 2000-2005. During this time Land and Water BC (LWBC) managed both the *Water Act* and *Land Act*. In order to reduce the burden of issuing two permits (*Land Act* and *Water Act*) for the same works, LWBC made a decision that docks would only require a permit under the *Land Act*. To account for this exemption on Skaha Lake, the results were recalculated excluding docks. The results did not change significantly.

As very few permits were located for the observed works, most regions were unable to answer the second part of the compliance question - whether the Terms and Conditions of permits are being followed. Only two regions were able to report on this. On Lake Windermere, of 23 properties assessed, 11 had permits under the *Water Act* and *Land Act*. Of these, four were non-compliant with the *Land Act*. In the case of Skaha Lake 194 properties were assessed, 7 had permits for works observed, and 6 of those were considered compliant with the terms and conditions.

Based on this limited sample only, it appears that if a property owner made the effort to obtain a permit, the terms and conditions associated with it were more likely adhered to than not.

Conclusion

Modifications to the foreshore and overwater structures have been shown to impact aquatic habitat. They can reduce coarse woody debris inputs, affect vegetation (riparian and aquatic), alter spawning gravels, alter water flow, alter light penetration, increase predatory fish, and disrupt fish movement. Regulations are in place to protect this critical habitat. Ministry of Environment Ecosystems staff provided anecdotal evidence that these regulations were not being followed and that this non-compliance was having a significant impact on fish and fish habitat. To quantify this perception, a selection of lakes across the province was assessed to determine the level of compliance and the extent of foreshore disturbance.

Even assuming a wide margin of error concerning the existence of *Water* Act permits and the randomness of lakes selected, the data suggests very low compliance across the province with the requirement to obtain an authorization under the *Water Act* for modifications to the lakeshore. Of the modifications that were assessed, over half were located below the HWM and therefore would most likely not have been authorized had the proponent applied for a permit. Given the knowledge that the foreshore is extremely sensitive to disturbance (RDCO 2005) we can conclude that there are significant impacts occurring in this critical zone as a result of non-authorized shoreline work.

These results will inform the Provincial Lakeshore Compliance Team as they move into Phase 2 of this project which will consider the factors that contribute to non-compliance and strategies for addressing them.

References

Cassaquero, J. 2001. Overwater structures: Freshwater issues. White Paper. Prepared for Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation.

Christensen, D. L., B. R. Herwig, D. E. Schindler and S. R. Carpenter. 1996. Impacts of lakeshore residential development on coarse woody debris in north temperate lakes. Ecological Applications. 6(4):1143-1149

Mason, B. and R. Knight, 2001. Sensitive Habitat Inventory and Mapping. Community Mapping Network. Vancouver, BC. 315pp + viii. M. Johannes, Editor.

Radomski, P. and T. J. Goeman. 2001. Consequences of human lakeshore development on emergent and floating-leaf vegetation abundance. North American Journal of Fisheries Management. 21:46-61.

Regional District of Central Okanagan (RDCO). 2005. Central Okanagan Lake Foreshore Inventory and Mapping. Planning Services Department. 91pp.

Appendix A – Provincial Team

Participants	Contact
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Ecosystems Branch	Stacey Wilkerson Edwin Hubert Megan Beveridge
Compliance Policy and Planning Branch	Sheila Richardson
Vancouver Island	Pete Law
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Thompson	Mark Phillpotts
Kootenay	Peter Holmes
Cariboo	Becky Bings
Skeena	Anne Hetherington
Omineca	Brady Nelless
Okanagan	Lora Nield
Peace	Graham Suther
Conservation Officer Service	Jim Corbett (Okanagan) Gary Van Spengen (Omineca)
Water Stewardship Division	Duane Wells (Thompson) Ken Cunningham (Okanagan) Larry Barr (Vancouver Island)
Partner Agencies (not all attended every meeting)	
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ILMB	Rick Stoudt (Southern Int.) Clint Zimmerman (Southern Int.)
Department of Fisheries and Oceans	Bob Harding, Habitat Technologist
BC Lake Stewardship Society	Carolyn Jones