FINAL REPORT

Cowichan Bay Float Homes and Live-aboards

Prepared for:
Cowichan Valley Regional District
Community and Regional Planning Division

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File: 1123-002.01
February 2013

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February 15, 2013
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Cowichan Valley Regional District
175 Ingram Street
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Attn: Ann Kjerulf, Senior Planner

Dear Ms. Kjerulf,

Re: Cowichan Bay Float Home Guidelines

Hemmera is pleased to provide you with this electronic copy of the Cowichan Bay Float Homes report.

We have appreciated the opportunity to work with you on this project and trust that this report meets your requirements. Please feel free to contact the undersigned by phone or email regarding any questions or further information that you may require.

Regards,
Hemmera

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1.0 INTRODUCTION

Many float homes in Cowichan Bay, British Columbia currently discharge untreated domestic sewage as both black and grey water to Cowichan Bay (verbal communication CVRD 2012). This is a concern to the Cowichan Valley Regional District (CVRD) which is updating the Cowichan Bay Official Community Plan (OCP). Cowichan Bay is located at the southeastern corner of Vancouver Island, near Duncan, British Columbia (Figure 1).

The draft OCP (2013), which includes the Cowichan Bay Area, identifies the health of the Cowichan Estuary as a primary concern due to threats to environmental quality and human health. CVRD contracted Hemmera to prepare this report to help inform development of OCP policies and corresponding land use regulations that address environmental issues related to float homes in Cowichan Bay.

The 1986 Cowichan Estuary Environmental Management Plan (CEEMP) recognizes that establishing high water quality is critical for maintaining and enhancing Cowichan estuary productivity. Cowichan Bay Village is designated as an industrial/commercial area under the CEEMP (Lambertson 1987).

Float home living is a lifestyle choice which is regaining popularity along the coast of British Columbia (Altin 1998). Although float homes are becoming more common, float home regulations vary with local government jurisdiction. In many communities, including Cowichan Bay, clear policy and regulations are needed to guide management and enforcement of float home location and domestic sewage disposal. The discharge of untreated human waste into estuaries and coastal bays is known to influence organic and pollutant loading, as well as benthic community and trophic structure (Weston 1990, Diaz 1995). The disposal of raw sewage into surface waters is adverse to human health; worldwide, research has linked recreational use of water contaminated by faecal material to health problems such as eye infections, gastrointestinal symptoms, skin irritations, respiratory illness, as well as ear, nose and throat infections (Prüss 1998, Zmirou et al. 2003, Soller et al. 2010).

Cowichan Bay float home owners' methods of domestic sewage disposal range from directly discharging untreated sewage into surrounding waters, to connection to the regional sewage treatment system via existing hook-up facilities (verbal communication CVRD 2012). To date, only two floating homes are documented as being connected to CVRD sewer facilities (verbal communication CVRD 2012).

The CVRD wishes to manage marine float home use in Cowichan Bay Village by means of an amended OCP and land use regulation in order to address potential effects to the environment, human health, public perception and infrastructure planning requirements. CVRD has initiated this project to evaluate the current status and issues associated with float home siting and usage in Cowichan Bay, the recommendations from which will be considered in the development and implementation of a

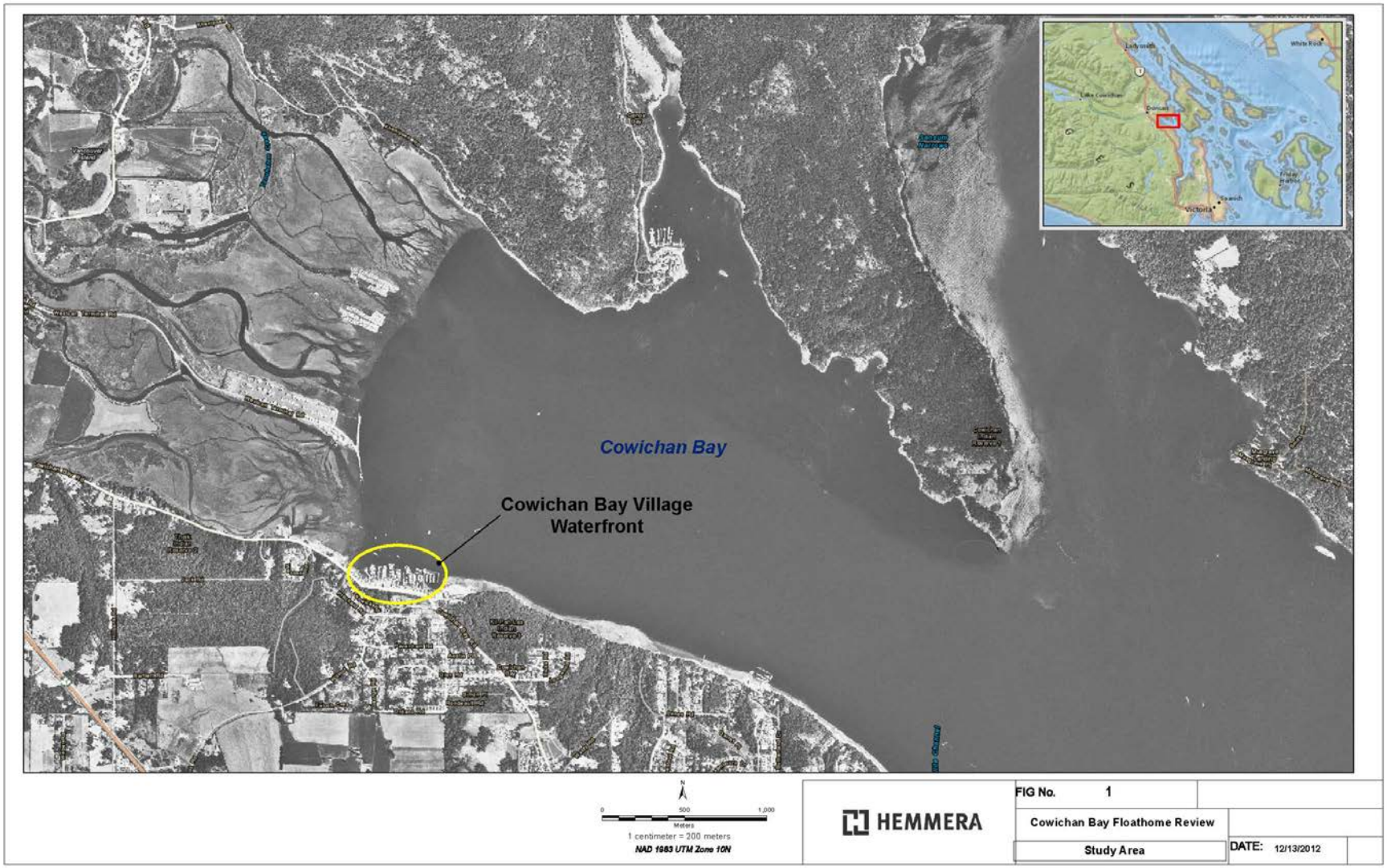
management strategy that is consistent with long term environmental protection and sustainability goals. In addition, the CVRD, Cowichan Tribes, Department of Fisheries and Oceans, Transport Canada, RCMP, Living Rivers, and BC Wildlife Federation are seeking to establish Vessel Operation Restriction Regulations (VORR) in order to designate specific areas as off-limits to motorized vessels in order to protect eelgrass habitat in Cowichan Bay (CVRD 2012).

1.1 WHAT IS A FLOAT HOME?

The province of BC defines a float home as a structure built on a flotation system and used as a residence (British Columbia Float-home Standards 1998). It is not intended for navigation or use as a navigable craft. Float homes are held to standards set by the provincial and federal governments and are regulated by local government (Greater Victoria Harbour Authority website).

Live-aboards are typically boats or small yachts (either power or sail boats) that are used as a primary residence. The sewage management issues common to float homes are also associated with live-aboards. In sections 6.0 and 7.0 of this report, water quality and sewage management issues associated with float homes and live-aboards are dealt with as one issue common to both types of infrastructure.

Figure 1 Cowichan Bay, British Columbia



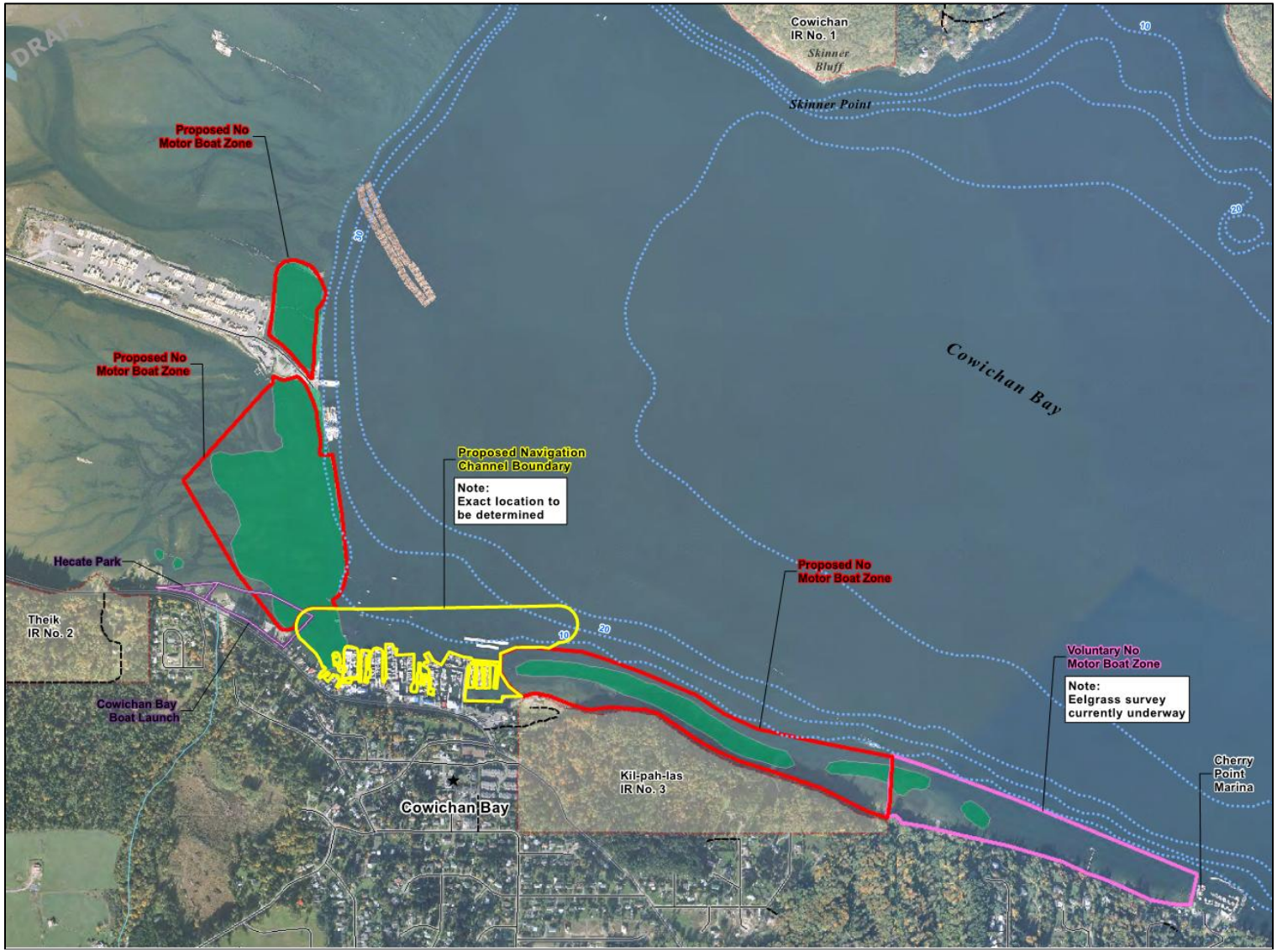
1.2 BACKGROUND

Wetland ecosystems, including estuaries, deliver a host of ecological services that are invaluable to society (Costanza et al. 1997). Estuarine ecosystems are considered among the most biologically productive areas on the planet and play an important role in shoreline erosion control; floodwater retention and control; heavy metal storage; food-web support; human recreation; water quality; and nutrient cycling. Additionally these areas provide critical habitat functions for birds, fish and other wildlife (Short et al. 2000, Meyer 2002).

The Cowichan Estuary was recently ranked as the 8th most important estuary in BC (Ducks Unlimited Canada 2008). The Cowichan River, which discharges to the estuary, is listed as a Canadian Heritage river due to its extensive lowland floodplain which is vitally important for various salmon species and up to 220 species of migrant shorebirds and waterfowl (BC Parks 2005). This designation is partially a result of the highly valued habitats of the Cowichan estuary, including: tidal marshes, mudflats, eelgrass beds, and marine riparian habitats.

A key habitat in the Cowichan Estuary is eelgrass (*Zostera marina).* Eelgrass beds are critical habitat for commercially and ecologically important organisms such as juvenile Pacific salmon and Dungeness crab (*Metacarcinus magister*) (Gunderson et al. 1990). Eelgrass beds provide refuge from predators, cover from desiccation during low tide, offer three dimensional habitat, and are an indirect and direct food source for a variety of species (Wyllie-Escheverria 2003). A map of eelgrass beds present in Cowichan Bay is shown in Figure 2 (Community Mapping Network data).

Figure 2 Eelgrass Distribution in Cowichan Bay (green polygons)



Note: From CVRD VORR study (Archipelago Marine Research Ltd. (2005) Towed underwater video survey of the physical and biological features of Cowichan Bay. Prepared for LGL Ltd, Sidney BC.

1.3 OBJECTIVES

The purpose of this project was to undertake a desk top study to assess the adverse effects of float homes and live-aboards to the environmental characteristics of Cowichan Bay and to provide recommendations for their management. This includes:

- Describing the current biophysical condition of marine foreshore habitat in the Cowichan Bay Village area;
- Evaluating the suitability of the marine foreshore area to support indigenous marine species typical of the local area;
- Recommending guidelines for float home location, operation, and sewage disposal in the village area.

2.0 METHODS

A desktop study was undertaken to gather and review both biophysical and water quality information related to the fish and wildlife habitats of the project area. An evaluation of the suitability of the marine foreshore habitats to support indigenous marine species typical of the local area was also conducted. The suitability analysis included key habitat types and the important species that rely on them and areas where native habitat has been lost due to development. Data on float home status were acquired directly from the CVRD staff. Biophysical, water quality, and float home status information was evaluated in context with existing ecosystem information available for Cowichan Bay. These data were used to assess whether adverse effects are likely to be occurring from float home usage in the area as a basis for recommendations in this report regarding float home management within Cowichan Bay.

2.1 INFORMATION SOURCES

Background information was obtained from a variety of sources, including:

- Published and unpublished government reports for the area, including previous environmental assessments;
- Published scientific reports for the area;
- Community Mapping Network;
- BC Conservation Data Centre (CDC) Species and Ecosystem Explorer;
- BC Coastal Sensitive Area mapping;
- Provincial Coastal Resource Information Management System (CRIMS database);
- Cowichan Watershed Board website (www.cowichanwatershedboard.ca);
- Provincial FishWizard;
- Freshwater Fisheries Society of BC;
- Cowichan Estuary Environmental Management Plan (CEEMP);
- iMapBC;
- British Columbia Marine Ecological Classification (BCMEC) system.

In addition, Hemmera's team members have extensive local knowledge of the local area. To supplement this local knowledge, the project team interviewed key government agency personnel that have experience in Cowichan Bay including CVRD staff and CEEMC members. Other relevant sources of information included the Seachange Conservation Society, the Cowichan Bay Nature Centre, and the Khoyatan Marine Laboratory (previously moored in Cowichan Bay).

Available habitat mapping (from the Community Mapping Network), orthophotos and bathymetric maps from the Canadian Hydrographic Service were reviewed and included in the analysis of existing marine environmental conditions in the village. Sensitive, productive, or highly valued habitat and ecosystem types were identified based on available data. Areas of low habitat value were also identified.

3.0 CURRENT FLOAT HOME STATUS AND UNDERSTANDING

3.1 FLOAT HOME INVENTORY

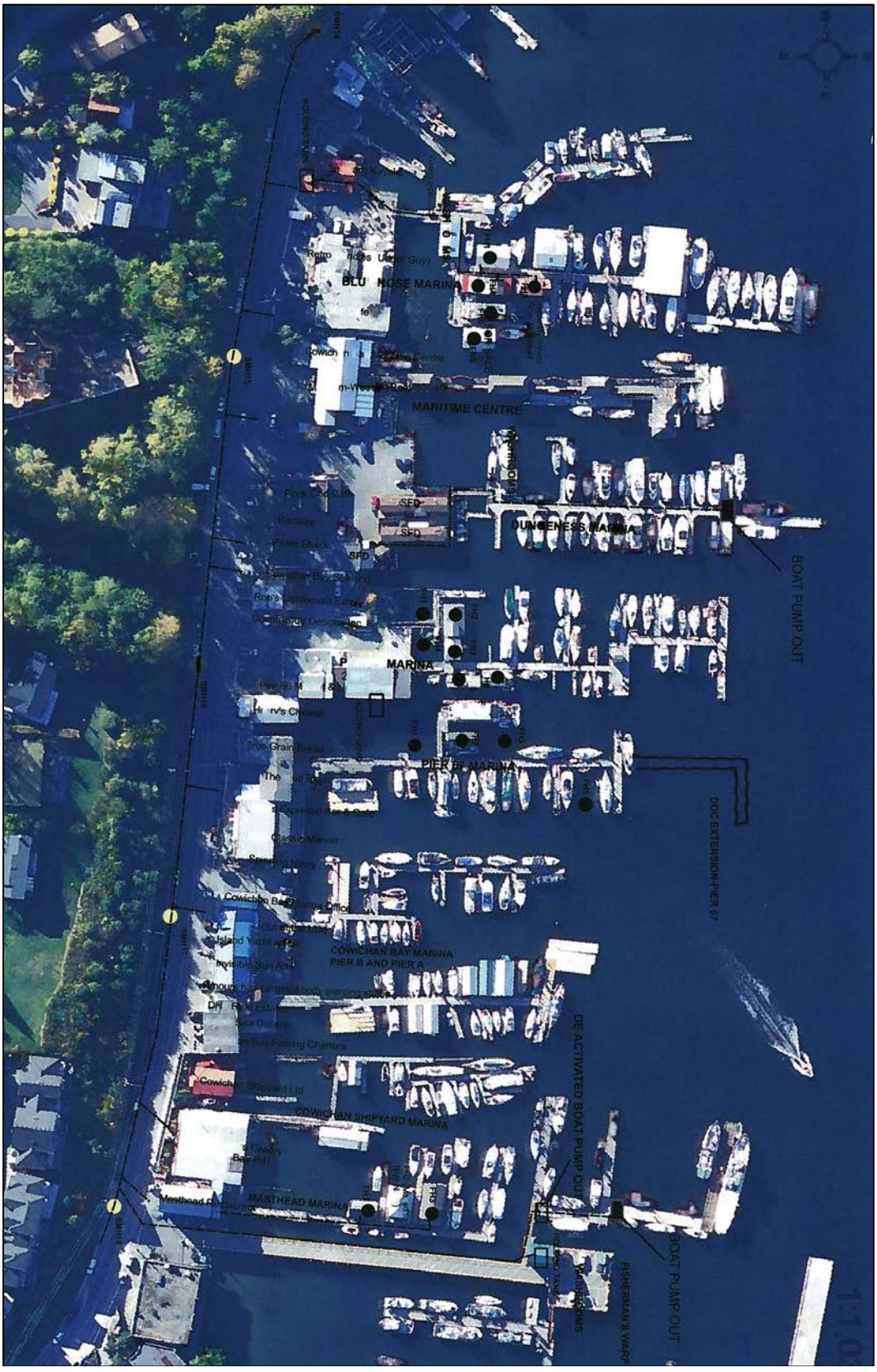
The CVRD recently conducted a float home inventory of the village (September 21, 2012 Engineering & Environmental Services Department of CVRD). Table 1 presents the inventory results and describes the moorage location, sewer units present and number of homes that have been connected to the regional sewage treatment system (more detailed information on existing float home sewage discharge is presented in Appendix A). No live-aboards have purchased or made connections. Figure 3 illustrates the location of existing float homes and live-aboards in the village area.

Table 1 Float Homes in Cowichan Bay

Marina	Sewer Units Purchased	Existing Float Homes	Float Homes Connected	Pump Outs	Comments
Ocean Suites at Cowichan Bay	0	0	0	0	• Marina used by hotel guests
Fishermen's Wharf	0	0	0	2	• One pump out is deactivated. The other collects sewage from the marina and the office
Masthead Marina	2	3	2	0	• 1 float home not connected but unoccupied
Cowichan Shipyard Marina	1	0	0	0	
Cowichan Bay Marina Pier A and B	2	0	0	0	
Pier 67 Marina (former Pier C of CB Marina)	3(3)*	5	0	0	• Docks extended into the bay to connect to Pier 66
Pier 66 Marina	0	6	0	0	• Owner willing to connect but no sewer available
Dungeness Marina	2	0	0	1	• Washroom on dock for customers • 30 pump outs per year • Upland residences present
Cowichan Bay Maritime Centre	0	0	0	0	
Bluenose Marina	0	6	3**		• Washroom for customers • 3 float homes connected to a pipe that runs to the upland – sewer hook up is unconfirmed.

Note: * Three purchased and three more requested.
** Information needs confirmation/further investigation.

Figure 3 Cowichan Bay Village Marina Area



3.2 SUMMARY OF REGULATIONS, POLICIES AND STANDARDS RELATING TO FLOAT HOMES

The British Columbia Float Home Standards (1998), as outlined by the BC Ministry of Energy and Mines, state that:

> "Float homes shall have, or be connected to, an approved sewage disposal system. Sewage disposal systems shall comply with the Sewerage System Regulation or the Municipal Sewage Regulation".

The Sewerage System Regulations (BC regulation 326/2004) under the *Public Health Act*, BC Ministry of Health) states:

> "The owner of every parcel on which a structure is constructed or located must ensure that all domestic sewage originating from the structure is discharged into a public sewer, a holding tank, or a sewerage system, and does not cause a health hazard."

However, the Sewerage System Regulations also state that "a person may discharge domestic sewage or effluent into waters if authorized under another enactment".

While they do not apply to Cowichan Bay, Bylaws and standards pertaining to Float homes have been established in a number of nearby municipalities. For example, according to the Standards for Float Homes and Live-Aboard Vessels in Victoria Harbour (Transport Canada 2001), Sewage Disposal (sections 3.2.4 and 4.3.2) requirements include:

a. Float Homes/Live-Aboard Vessels shall have an approved on-board sewage disposal system.
b. No discharge of sewage into the waters of Victoria and Esquimalt Harbours is permissible.
c. Sewage holding tanks shall comply with the Pleasure Craft Sewage Pollution Prevention Regulations.
d. Marine sanitation devices certified as Type III devices by the United States Coast Guard are acceptable.

These standards are applicable to all marinas and public port facilities in Victoria Harbour under federal jurisdiction and may be augmented by additional requirements established by the marina or port operator.

According to Bylaw numbers 3116 and 3216, contained within The Corporation of the District of North Cowichan Bylaw No. 3015 (Float Home Standards Bylaw 1999),

> "The float home must be connected to a sewage disposal system approved under applicable provincial or federal laws concerning sewage disposal (when such a system becomes available for existing float homes), or have installed a composting or Lectra/San toilet."

Furthermore, it is noted in Part 3 (Marina Standards) of Bylaw No. 3015 that the moorage site plan must include an on-site sewer system. This bylaw is consolidated under section 139 of the Community Charter and applies to all areas of land and water within the territorial area of the North Cowichan and, for certainty, extends 1000 feet beyond the foreshore high water mark.

The Crown Land Use Operational Policy, Commercial – General (Land Act, Ch. 245, R.S.B.C., 1996) indicates that for marina sites where there is a known or high risk of contamination or environmental impact due to current, past or future activities, an environmental schedule (a specific set of environmental terms and conditions) or additional insurance requirements may be warranted when processing new or replacement tenures. For circumstances where additional requirements are warranted, regional staff are to contact Crown Land Authorizations (Ministry of Forests, Lands and Natural Resource Operations), who will work with Ministry of Attorney General to prepare a customized environmental schedule.

4.0 BIOPHYSICAL CONDITIONS OF MARINE FORESHORE

Under the BC Marine Ecological Classification System, Cowichan Bay occurs within the Strait of Georgia ecosection of the Georgia Basin ecoregion, which is in the Georgia-Puget Basin ecoprovince of the broader Pacific Ecozone (BCMEC 2012). The Strait of Georgia marine ecosection is characterized by a broad, shallow basin surrounded by coastal lowlands (Georgia Depression). The coastal waters of this ecosection are largely protected, warm in summer months, and seasonally stratified, with significant freshwater input and high turbidity. Biologically this ecosection is a known nursery area for salmon and herring and possesses abundant shellfish resources.

4.1 WATERSHED CONDITIONS

The Cowichan estuary receives discharges from the Cowichan and Koksilah rivers whose watersheds encompass 939 km^2 and 302 $km^{2,}$ respectively (Westland Resource Group Inc. 2007). Both rivers are characterized by elevated winter flows, resulting from high winter precipitation, and low summer flows. Water quality within both watersheds is influenced by non-point source impacts of logging, agriculture, and urbanization (Dessouki 2010, Obee 2011). Additionally, the Cowichan watershed receives point source discharges from multiple sewerage works and the pulp and paper industry (Dessouki 2010).

4.2 MARINE CONDITIONS

A site visit was conducted of Cowichan Bay Village to confirm the current biophysical conditions of the marine foreshore and to inform the development of Best Practices for regulating float homes and live-aboards. The shoreline was traversed from the western end of the village (commencing at the boat launch) to the eastern end of the village (near the Ocean Suites hotel) and the foreshore was accessed where available. An underwater viewer was used to supplement observations from available walkways and floats.

Existing infrastructure development along the shoreline is restricting development of the marine riparian zone in the village area. The high intertidal zone has been subject to urban and commercial development near Cowichan Bay Road. This zone includes small patches of erosion protection (rip rap); pile supported residences and businesses; timber and concrete bulkheads, foreshore fill, boatways and other overwater structures. Encrusting invertebrates (barnacles; mussels) and attached algae (seaweeds) occur occasionally on these man-made structures.

Sediments throughout the intertidal zone are typified by the presence of fine sands and silts. Anthropogenic debris is common with some observed patches of wood waste.

Pilings and floats in the mid- to lower intertidal zone sustain mussels, barnacles and rockweed.

A small sand and gravel pocket beach is present fronting the Oceanfront Suites hotel. This may be suitable habitat for forage fish rearing and spawning. Whether spawning forage fish use this pocket beach needs to be confirmed in the field.

Small, remnant patches of eelgrass (*Zostera marina*) are present in the lower intertidal to shallow subtidal zone particularly towards the eastern end of the village adjacent to the Small Craft Harbour.

4.3 FISH AND WILDLIFE HABITAT SUITABILITY

Estuaries typically sustain highly productive habitat for fish and wildlife, particularly birds (Short et al. 2000, Meyer 2002). Industrial, commercial and residential developments have resulted in marked habitat losses in the estuaries of southern BC including the Cowichan estuary (Campbell Prentice & Boyd 1988). The management focus on these estuaries has typically been to preserve and enhance remaining habitats and to restore habitats that have been removed or degraded.

Highly valuable habitats typical of the Cowichan estuary include tidal marshes, mudflats, eelgrass beds, bivalve shellfish beds and marine riparian habitats. These habitats support a myriad of fish and wildlife species including, but not limited to; Pacific salmon, cutthroat trout, great blue heron, diving ducks, shorebirds and raptors (Cowichan Land Trust 2012).

Estuarine habitats are defined by a number of key physical features including, but not limited to:

- Elevation;
- Exposure;
- Substrate;
- Slope.

Under the BC MEC the Cowichan Bay benthic ecounit ID 5591 is classified by:

- Low wave exposure;
- Mud and sandy mud substrate;
- ‘Low’ seabed relief consisting of a gently undulating topography with a small elevation range;
- A 5-20% sloping nearshore seabed;
- A warm temperature range (9-15°C during summer months);
- A mean photic depth of 20 to 50 metres;
- And relatively low (<3 knot) currents (AXYS Environmental Consulting Ltd. 2001; BCMEC 2012).

The presence of vegetation and other biota is determined in part by these features. As a result of infrastructure development, species composition and distribution is often altered. For example, in the case of eelgrass (*Zostera marina*), shoot density, biomass and cover are influenced by light intensity, disturbance, and nutrient concentrations (Keddy 1987, Burdick and Short 1999). While the elevation and substrates common to Cowichan Bay are ideal for eelgrass in the absence of overwater structures and physical disturbance, eelgrass distribution is currently inhibited by existing land and water uses in the village, including areas used by float homes (Burdick and Short 1999). Based on this the same may be true for Live-aboards as well. Eelgrass has a limited elevation range in the low intertidal and shallow subtidal zone on the south coast of British Columbia. The focus of recent restoration initiatives has been to conserve this critical ecosystem within Cowichan Bay (Cowichan Land Trust, 2012).

Based on the benthic unit characteristics in Cowichan Bay village a number of habitat and species were likely abundant prior to development. Remnants of these features in areas not currently affected by development can be observed now and include:

- Marine riparian habitats;
- Clam beds;
- Eelgrass beds;
- Forage fish spawning habitats;
- Tidal marshes.

In this area the marine riparian zone, tidal marsh zone and forage fish spawning habitat zone are now occupied by Cowichan Bay Road, waterfront piling and fill-supported buildings. Given the relative permanency of these structures, the likelihood of re-establishing these habitat types significantly in the village is low.

Bivalve shellfish beds can sustain commercial and recreational fisheries and are of great importance to First Nations. Substrates present in the village may support bivalve shellfish but they are not ideal for key intertidal species such as Manila clams.

Eelgrass beds occur at lower intertidal and upper subtidal elevations. Substrates in the village are suitable for eelgrass establishment. Remnant patches of eelgrass occur in the village area where light penetration is not impaired by overwater structures such as walkways, floats and float homes.

5.0 WATER QUALITY

The Cowichan Estuary Management Plan (1987) highlights the importance of maintaining and improving the productivity of the Cowichan estuary. Water quality in Cowichan Bay is strongly influenced by watershed and marine conditions. Following is a description of the water quality in the Cowichan and Koksilah watersheds, as well as a discussion of marine bacteriological conditions.

5.1 COWICHAN AND KOKSILAH WATERSHEDS

The Cowichan and Koksilah rivers are influenced by non-point source (logging, agriculture, urban development) and point source (Duncan-North Cowichan Joint Utilities Sewage Treatment Lagoons, the Town of Lake Cowichan sewage treatment plant, and Catalyst Paper) inputs (Dessouki 2010, Obee 2011). Water quality monitoring stations are located one kilometre upstream of the Cowichan estuary in both rivers (**Figure 3**; Obee 2011).

Figure 4 Water Quality Stations on the Cowichan and Koksilah Rivers

Source: Dessouki 2010

During the past ten years, established water quality objectives (Appendix A) are often not met in regards to dissolved oxygen and bacteriological parameters (fecal coliforms, i.e. *E. coli*) and occasionally not met for turbidity and suspended solids (Obee 2011; Table 2).

The Cowichan Watershed Board (CWB) intends to address a number of negative water quality indicators in the Cowichan Watershed Partnership Project (Cowichan Watershed Board 2012). In particular, the following indicators of poor water quality are a top priority:

- General water quality issues related to adverse cumulative effects of turbidity, nutrients and bacteriological contamination - particularly in the lower Cowichan and Koksilah rivers.
- Shellfish harvesting in the Cowichan estuary has been closed since 1973 as a result of fecal contamination and given that float homes are discharging raw sewage to Cowichan Bay this activity is likely exacerbating the bacterial contamination problem in this area;
- There have been significant fish kills (juvenile salmon) in portions of the lower watershed.

As a result of population growth, sewage effluent volumes have increased at facilities discharging into the Cowichan River and disinfection processes have recently been adapted (Obee 2011). As even small concentrations of fecal coliforms can indicate an increase in pathogens that are adverse to human health, fecal indicator bacteria are commonly used to assess water quality (Soller et al. 2010). BC guidelines for fecal coliforms have been set for various human related uses (drinking water, shellfish harvesting and recreation) and are reported as the number of colony forming units (CFU) in a 100mL sample volume. Historically, the Cowichan and Koksilah rivers have exceeded a number of these guidelines (Table 2; Appendix A).

Table 2 Fecal Coliform Measurements (CFU) from Water Quality Stations on the Cowichan and Koksilah Rivers

Year	Cowichan River	Koksilah River
2000	11	19
2001	65	83
2002	174	218
2003	18	17
2004	62	138
2005	70	49
2006	35	189
2007	70	125
2008	95	n/a

Source: Dessouki 2010
Note: Shaded boxes represent values that exceed British Columbia Aquatic Life Criteria (less than or equal to 43/100 mL 90th percentile).

5.2 MARINE/ESTUARINE CONDITIONS

Fecal contamination occurs in the Cowichan estuary in part as watershed inputs, marine life and marina activities. Variability in fecal coliform levels occur throughout Cowichan Bay as a result of water flow and water circulation (higher values are noted after large storm events due to increased runoff), proximately to seal colonies, and human sewage discharges (McLaren, unpublished report 2006).

Bacteriological water quality testing has recently been completed within the Cowichan Estuary. During the de-commissioning of the Cowichan Bay sewage treatment plant in 2005, fecal coliform levels were closely monitored throughout the year, and in November 2012 the Ministry of Environment completed fecal coliform testing at numerous sites, including some within the Cowichan Bay marina area (Appendix E, Sample Location Map).

Marine bacteriological data for Cowichan Bay rarely meet established Provincial criteria in regards to fecal coliform levels (Appendix E). The British Columbia Ministry of Environment, Environmental Protection division has stated that recreational fecal coliform counts should not exceed 200 CFU, in fresh or marine waters, while aquatic life criteria are less than 43 CFU. Monitoring of CFU at Cowichan Bay was recently undertaken at four sites within the marina area (Appendix E). Recreational guidelines were not met at 3 out of 4 locations in 2012, and aquatic guidelines were not met at 4 out of 4 locations. Consequently, given the existence of multiple raw sewage discharges to the bay from float homes and live-aboards these water quality data, indicate that sewage discharges from float homes and live-aboards are likely a significant factor adversely affecting water quality at Cowichan Bay.

5.2.1 Shellfish

Fecal coliform guidelines (Appendix E) are not being met within Cowichan Bay; the Cowichan and Koksilah rivers have rarely met fecal coliform guidelines within the past 10 years and almost all marine sites exceeded guidelines in both 2005 and 2012 (Tables 2&3). A permanent sanitary closure for bivalve shellfish is in place for Cowichan Bay (DFO area 18-8). Commercial shellfish harvesting has been closed in Cowichan estuary since 1973. However, in May 2012 the Cowichan Watershed Board received $370,000 of government funding to undertake projects to help make shellfish edible (Cowichan Watershed Board 2012), with plans to re-open a fishery 2020. Reducing fecal coliform levels is paramount to re-establishing this fishery.

5.2.2 Fish

The Cowichan estuary and its associated watersheds boast an array of freshwater and anadromous fish species that support a variety of commercial, recreational, and First Nations fisheries (Appendix D). Low summer water flows within the rivers, exacerbated by poor water quality, has resulted in low dissolved oxygen conditions that threaten important salmon species (particularly Chinook salmon).

Fish that utilize the village marina area could include rearing juvenile salmon; pile and surf perch that are often associated with docks and pilings; flatfish; forage fish (Pacific sandlance and surf smelt) and other non-commercial species. Efforts to find specific published studies detailing fish use of the village area were unsuccessful.

Marinas and harbours typically suffer from poor water quality as a result of sewage, grey water, and oily bilge water. Bacteriological testing in the village area (Table X) demonstrated that E. coli, an indicator of sewage contamination, is occurring. Antifouling paints, used to treat boats, as well as wood preserved with chemicals (e.g. creosote) can also be a source of water contamination. Oil and gas pollution is usually high at marinas with fuel docks.

6.0 DISCUSSION AND CONCLUSIONS

6.1 WATER QUALITY

Water quality from the Cowichan and Koksilah rivers exceeds BC guidelines for fecal coliform concentrations and therefore freshwater inputs are very likely influencing fecal coliform levels in Cowichan Bay. Regardless, bacteriological testing of waters within Cowichan Bay, particularly in the marina area demonstrates significantly higher concentrations of fecal coliforms than found in watersheds discharging to the marine area. Consequently raw sewage discharges from float homes and live-aboard are significantly contributing to poor water quality in Cowichan Bay from a bacteriological perspective. Fecal coliforms have the potential to be pathogenic to humans but are also indicators that other pathogenic organisms may be present. Consequently, due to the tendency for shellfish to concentrate pathogenic organisms, harvesting has remained closed in Cowichan Bay resulting from high fecal coliform levels in the water. Water quality improvements can be realized, and human and environmental health improved, through programs aimed at zero waste discharge in the village. For this to happen it is desirable to manage water quality in all sources of bacterial contamination entering Cowichan Bay. An important place to start is with an equal requirement for all float homes and live-aboards to connect to the regional sewage system, for both black and grey water, given that these infrastructure units are a major contributing factor to poor water quality in Cowichan Bay.

Cowichan Tribes has keen interest in harvesting shellfish in Cowichan Bay. Consequently, improving water quality in the village, through sewage discharge regulation, would contribute to this goal. However, water quality-related closures and regulated closures due to the presence of marinas may continue to prevent harvesting of adult shellfish near the village, under the Contaminated Fisheries Regulations (DFO 1990) which state that:

> "Shellfish shall not be harvested from prohibited areas for any purpose, with the exception of harvesting for seed, spat, bait and for scientific purposes, all of which may be collected under special license.
>
> 1. The following areas shall be defined as prohibited areas:
>
> a. the area within a minimum 300 metre radius around industrial, and sanitary sewage outfalls;
>
> b. the area within a minimum 125 metre radius around marinas;
>
> c. areas where, due to the degree of contamination in the growing waters (i.e., waters having excessive concentrations of fecal material or other poisonous or deleterious substances), it may not be possible to adequately depurate or naturally purify the shellfish."

6.2 FISH HABITAT

Based on the potential of the area to support eelgrass and therefore fish habitat, it is evident that overwater structures located in areas with eelgrass capability are restricting the environment's ability to sustain that habitat. Creating the physical conditions necessary for eelgrass growth would be possible through implementation of community plans for Cowichan Bay village that are carefully focussed on managing overwater structure location to restore and sustain eelgrass habitat.

Fish and fish habitat are managed by Fisheries and Oceans Canada (DFO). A number of readily available Best Practices and Operational Statements can be used to guide works that may affect fish habitat. Periods of least risk for nearshore marine activities should be adhered to for significant construction projects. The Work Window or period of least risk, is a mitigation measure which ensure that activities take place when they have the least likelihood of affect fish during sensitive life history stages. Typical sensitive life history stages include emerging juvenile salmonids, which occupy estuaries and shallow shorelines in the spring and spawning Pacific herring, that use shallow shoreline habitats in late winter and early spring. Approved work windows for Cowichan Bay are:

- **Summer Window:** July 1 – October 1
- **Winter Window:** December 1 – February 15

The summer work window does generally not apply to estuaries. DFO should be contacted for works planned for the summer time period.

6.3 OTHER GUIDELINES

Within the United States and Canada, zoning regulations may prohibit float homes at the provincial, state or local government level. Additionally, standards are often put in place to govern siting, spacing, setbacks, densities, sewage discharge and pump-out requirements. In BC, jurisdictions such as Victoria, North Cowichan, and Vancouver have created Float home bylaws and standards to supplement the BC Float Home Standards (1998) and exercise more control over these parameters. Numerous state governments (California, Georgia, Idaho, Maryland, Washington, New York, Oregon, Florida and Washington DC) maintain policies governing the zoning of float homes and these states allow local government to exercise zoning authority most often pertaining to anchoring, mooring, sewage discharges and pump-out requirements. Commonly, many districts maintain 'no-discharge' zones within marina areas, requiring float home users to connect to sewage treatment facilities in order to legally reside at a marina. In environmentally sensitive areas, such as Chesapeake Bay, these 'no-discharge' zones may even be mandated by the state.

Many of these existing guidelines were examined to determine a “best fit” for Cowichan Bay. Not all existing guidelines are suitable for float home use or the stated goals for Cowichan Bay. Those examined and selected were adopted, modified or used as guidance for proposed Cowichan Bay recommendations.

An example of the variety of existing guidance is presented below for sewage treatment:

- **Victoria:** No sewage discharge permitted.
- **Alberni-Clayquot Regional District:** Permitted float homes must have sewage dump available.
- **Tennessee Valley Authority:** All approved non-navigable houseboats with toilets must be equipped with a properly installed and operating Marine Sanitation Device (MSD) or Sewage Holding Tank and pump-out capability
- **City of Seattle:** Municipal code on float homes doesn’t specify sewage discharge information.
- **Municipality of North Cowichan:** Float homes must be connected to approved sewage treatment system.
- **Village of Amityville, NY:** In the FH Floating Home District, all floating homes shall be provided with electricity, municipal water service and municipal sewage disposal facilities in accordance with the Suffolk County Sanitary Code.
- **Port Metro Vancouver:** Where municipal sewer is available, the municipal connection and the individual connections to each residential unit have been completed in accordance with accepted best practices.

  Where municipal sewer is not available, a Port Metro Vancouver approved sewage treatment system has been installed, capacity for connections to all residential units exist, and the system is operational.

7.0 RECOMMENDATIONS

In general, local government is responsible for serving the public interest. In Cowichan Bay, the CVRD is committed to its role in maintaining the health and safety of the public and the health of the environment. The proposed guidelines and recommendations presented in this section are intended to address water quality, human health as well as fish and wildlife habitat issues that exist as a result float home and live-aboards located in Cowichan Bay. The recommendations presented below are intended to be used as a tool guide development of a float home management strategy for Cowichan Bay Village.

The goal of these recommendations is to assist in the development of strategies to enhance ecological functions that are currently impaired, while accommodating permitted uses in a well-managed local area.

7.1 OCP POLICY RELATED RECOMMENDATIONS

- The OCP should create a zone for authorized float home use within Cowichan Bay;
- Float homes should only be authorized to occupy space in areas zoned for float homes;
- Float homes should be allowed only if they are connected to a sewage collection and disposal system or employ an alternate sewage treatment and disposal system that has been approved by the local health authority (a zero waste discharge management strategy).

7.2 RECOMMENDED STRATEGIES FOR MANAGEMENT OF FLOAT HOMES AND LIVE-ABOARDS

- The number of float homes located in Cowichan Bay at any given time should be restricted to the number of sewage hook-ups available;
- Live-aboard moorage spaces should be limited to those areas with a marina specifically identified on approved project plans for this use and the allotted area should not exceed 10 percent of overall moorage space for float homes and live-aboard vessels;
- Where possible, float homes should be sited in areas that minimize shading effects on eelgrass and other sensitive ecosystems;
- Allocate appropriately trained staff and resources to enforce provisions of the OCP and subsequent land use regulations as they pertain to float home usage in Cowichan Bay;
- Put into effect a public education program including signage and brochures informing the public as well as float home and live-aboard owners of the need to maintain environmental quality and health standards in the Bay through acceptable management of sewage discharges, including observation of a zero discharge of domestic sewage to Bay waters;
- Live-aboard units should be connected to an approved sanitary sewer or other approved upland waste disposal system with demonstrated capacity to serve the number of units proposed. All greywater must also be discharged into such a system;
- Live-aboard units should be connected to an approved potable water supply with demonstrated capacity to serve the number of units proposed;

- All construction, operation or maintenance activities in water or on intertidal areas must be timed to occur within reduced risk work windows, in order to avoid or limit adverse effects on protected species and forage fish during sensitive life history phases (e.g., reproduction, migration). Construction, operation, or maintenance activities above water or in near-shore areas should also be considered for reduced risk work windows to prevent or reduce adverse effects on terrestrial species that use the aquatic environment or where activities occur in proximity to nesting or foraging habitat.

7.3 RECOMMENDED SPACING AND SETBACKS

Spacing recommendations from existing guidelines and bylaws primarily address fire and human safety. Such recommendations include spacing between buildings (e.g. 3 m minimum), access to open water of a specific width and minimum access widths. For the purposes of this exercise, these spacing and setback considerations would be employed to address the direct and indirect effects of overwater structures on the fish and wildlife attributes of the village area.

7.4 CONCLUSIONS REGARDING EFFECTS OF OVERWATER STRUCTURES ON HABITAT

Overwater structures, such as float homes, can adversely affect estuarine habitat components including light, wave energy, substrates and water quality. Some of the effects include, but are not limited to:

- Salmon fry avoid travel under overwater structures during daylight. As they move away from the shore (further offshore), they are exposed to larger predators that typically stay in deeper waters;
- The amount of light affects salmon feeding; with less light, they eat less;
- With less light, there are fewer prey species available for salmon;
- Reductions in light affect the growth of eelgrass, benthic macro-algae and benthic microalgae which provide a myriad of habitat structures and functions;
- The presence of piles can result in changes to substrates. Pilings take up space, reducing habitat; cast shade, affecting light; catch floating debris, affecting light and habitat. Pilings also develop into a pile community, resulting in shell hash (debris from attached shellfish and barnacles that dislodge and drop to the seabed) that can alter benthic habitats;
- Invasive species have been found to settle out on, and attach to, floats and supporting structures;
- The movement of sediment along marine shorelines (littoral drift) is affected by placement of overwater structures. Changes in sediment movement limit the availability of substrate for spawning forage fish and the sand available to down-drift beaches (Hass et al. 2002).

7.4.1 Recommended Guidelines to Mitigate the Effects of Overwater Structures

Guidelines to mitigate the indirect effects of overwater structures on habitats may include:

- Plan installation and construction for periods of least risk (Summer: July 1 – October 1; Winter: December 1 – February 15);
- Use a north-south pier-dock orientation if possible;
- Place overwater structures in deep water to avoid adverse effects to eelgrass and other light sensitive habitats;

- Overwater structures should be 8 meters from native aquatic vegetation or the distance that the structure will cast shade, whichever is greater;
- The portions of piers, elevated docks, and gangways that are over the nearshore/littoral area should incorporate the use of grating, glass inserts or reflective panels to increase the penetration of light to the seafloor. All grating material should have at least 60% functional open space[1];
- Consider using artificial lighting under structures in daylight hours;
- Artificial night lighting should be minimized by focusing the light on the dock surface, and using shades that minimize illumination of the surrounding environment;
- Minimize the number of pilings;
- Use light reflective piling materials;
- Prohibit the use of skirting on overwater structures.

The direct effects of overwaters structures are related primarily to the physical grounding of the structure. Proposed recommendations include:

- Floating structures should not rest on the substrate. Overwater structures should be located in water sufficiently deep to prevent the structure from grounding at the lowest low water, and the bottom of the structure should be a minimum 2.0 metres above the level of the substrate during the lowest tides;
- New structures should be designed and located so no new bulkheads or shoreline armour is necessary.

7.5 WATER QUALITY RELATED RECOMMENDATIONS

Fecal contamination within Cowichan Bay is a concern for human health. Results of fecal coliform monitoring on the Cowichan and Koksilah rivers, which discharge into Cowichan Bay, indicate that fecal coliform measurements are high enough to warrant a closure on the shellfish fishery. Protecting Cowichan Bay from further contamination requires that all preventable sewage discharges are avoided. Besides controlling sewage discharges, additional measures can be implemented to protect the water quality of Cowichan Bay.

- No discharge of grey or blackwater should be permitted into Cowichan Bay and all float homes should be connected to the sewage collection system;
- Wood treated with toxic compounds should not be used for decking, pilings or other in-water components;
- Tires should not be used as fenders;
- Foam material should be encapsulated so it cannot break up and be released into water;
- Treated wood should be prohibited in the water;
- Materials used in the maintenance of houseboats moored at the marina should not result in contaminants or debris entering the water.

[1] "Functional open space" in this context refers to the "space" portion of the metal grating. If 60% is "open space", 40% of the grate would be comprised of metal.

7.6 BEST MANAGEMENT PRACTICES BROCHURE

The Seattle Floating Homes Association has developed a Best Management Practices brochure targeting float home tenants, managers and contractors. It is recommended that a similar brochure, focused on Cowichan Bay Village, be published with the intent of educating float home and live-aboard owners, marina owners, managers and municipal staff. An example of this brochure is presented in Appendix C.

7.7 RECOMMENDED FURTHER STUDY

7.7.1 Bathymetric Survey

Nearshore fish habitat features in the Pacific Northwest, including Cowichan Bay, are restricted to specific elevations. A detailed bathymetric survey of the village area would inform habitat suitability plans and proposed recommendations for siting of overwater structures. A detailed study of the village has likely now been conducted for some time.

7.7.2 Habitat Inventory

To fully understand the effects of float homes and other overwater structures on the Cowichan estuary ecosystem, a detailed habitat inventory should be undertaken. In particular, a detailed account of eelgrass distribution should be performed. While the BCMCA and the Community Mapping Network do provide eelgrass mapping data, these data do not clearly illustrate eelgrass distribution within the village.

The rationale for focussing on eelgrass is twofold: a) eelgrass is an important habitat type for fish and wildlife on the BC coast; and, b) with long term vision and guidance, eelgrass meadows could return to the village area.

The value of eelgrass has been outlined previously. Potential eelgrass restoration in the village area would require mitigation of shading and grounding effects through strategic walkway, float, float home and gangway placement. This would be a long term vision for restoration of this iconic habitat type.

The village has developed over time in an unregulated manner. Removal of overwater structures and grounding structures in the elevation range that would support eelgrass could be accomplished with strategic long term planning. Eelgrass beds occur at lower intertidal and upper subtidal elevations and their shoot density, biomass and cover are influenced by light intensity, disturbance and nutrient concentrations. The shoreline area with its multitude of bulkheads, erosion protection and pile supported buildings would be more difficult to change. Shellfish resources could be promoted, but regardless of the water quality of the village, *Fisheries Act* regulations prevent harvest near the myriad of docks and floats.

7.7.3 Water Quality Study

It is important to improve local water quality in Cowichan Bay Village and recommendations for float home use and siting should help improve the conditions. It is unknown however, the degree to which discharges originating in the village exacerbate contaminant levels originating from the river.

Detailed water quality information is available for both river systems that flow into Cowichan Bay. More recently (November 2012), fecal coliform has been monitored within Cowichan Bay. It would be informative to develop and implement a water quality monitoring program in the village for comparative purposes, in order to establish a baseline of fecal coliform counts for the village.

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

Report prepared by:
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Joe Truscott, R.P.Bio.
Project Director

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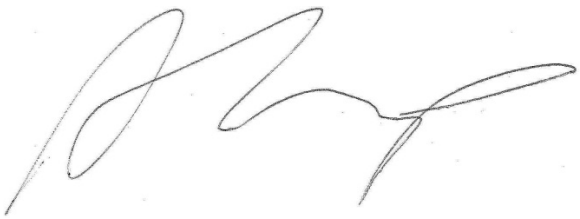

Scott Northrup, B.Sc.
Project Manager

8.0 STATEMENT OF LIMITATIONS

This report was prepared by Hemmera, for the sole benefit and exclusive use of the Cowichan Valley Regional District. The material in it reflects Hemmera's best judgment in light of the information available to it at the time of preparing this Report. Any use that a third party makes of this Report, or any reliance on or decision made based on it, is the responsibility of such third parties. Hemmera accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this Report.

Hemmera has performed the work as described above and made the findings and conclusions set out in this Report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practicing under similar conditions at the time the work was performed.

This Report represents a reasonable review of the information available to Hemmera within the established Scope, work schedule and budgetary constraints. It is possible that the levels of contamination or hazardous materials may vary across the Site, and hence currently unrecognised contamination or potentially hazardous materials may exist at the Site. No warranty, expressed or implied, is given concerning the presence or level of contamination on the Site, except as specifically noted in this Report. The conclusions and recommendations contained in this Report are based upon applicable legislation existing at the time the Report was drafted. Any changes in the legislation may alter the conclusions and/or recommendations contained in the Report. Regulatory implications discussed in this Report were based on the applicable legislation existing at the time this Report was written.

In preparing this Report, Hemmera has relied in good faith on information provided by others as noted in this Report, and has assumed that the information provided by those individuals is both factual and accurate. Hemmera accepts no responsibility for any deficiency, misstatement or inaccuracy in this Report resulting from the information provided by those individuals.

The liability of Hemmera to the CVRD shall be limited to injury or loss caused by the negligent acts of Hemmera. The total aggregate liability of Hemmera related to this agreement shall not exceed the lesser of the actual damages incurred, or the total fee of Hemmera for services rendered on this project.

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PHOTOGRAPHS

Photo 1: Cowichan Bay Village

Photo 2: View east from Boat Launch

Photo 3: Pile supported structure: Wooden Boat Society

Photo 4: Overwater structure

Photo 5: Rip rap shorline

Photo 6: Boat sheds

Photo 7: Boat sheds

Photo 8: Pile supported walkway and boatsheds

Photo 9: View east and Oceanfront Suites

Photo 10: Floating residence near government wharf

APPENDIX A

Water Quality Assessment and Objectives for the Cowichan and Koksilah Rivers (Obee 2011)

Variable	Original Objectives (1989)		Revised Objectives (2011)	
	Site	**Objective**	**Site**	**Objective**
Fecal coliforms	All but C5	≤ 10 cells/100 mL*	none	
	C5	none		
Escherichia coli	All but C5	≤ 10 cells/100 mL*	All but C5	≤ 10 CFU/100 mL*
	C5	≤ 385 cells/100 mL*	C5	≤ 77 CFU/100 mL**
enterococci	All but C5	≤ 3 cells/100 mL*	none	
	C5	≤ 100 cells/100 mL*		
Dissolved Oxygen	All (Oct to May)	≥ 11.2 mg/L	All (Oct to May)	≥ 11.2 mg/L
	All (June to Sept)	≥ 8 mg/L	All (June to Sept)	≥ 8 mg/L
Non-filterable Residue (Total Suspended Solids)	All	≤ 10 mg/L increase (when background ≤ 100 mg/L) ≤ 10% increase (when background > 100 mg/L)	All	≤ 27 mg/L (max) ≤ 7 mg/L (mean)
Turbidity	All	≤ 5 NTU increase (when background ≤ 50 NTU) ≤ 10% increase (when background > 50 NTU)	All (Oct to Apr)	≤ 5 NTU (max)
			All (May to Sept)	≤ 2 NTU (max)
Ammonia	All	see ammonia tables	All (Oct to Apr)	≤ 1.31 mg/L (mean) ≤ 6.83 mg/L (max)
			All (May to Sept)	≤ 0.49 mg/L (mean) ≤ 3.61 mg/L (max)
Total Phosphorus	none		All (May to Sept)	≤ 5 µg/L (mean) ≤ 7 µg/L (max)
Chlorophyll *a*	d/s of PE-247 and PE-1497	≤ 5.0 µg/m^2	d/s of PE-247 and PE-1497	≤ 5.0 µg/m^2
Total Copper* **	All	≤ 2 µg/L (mean) ≤ 4 µg/L (max)	All	≤ 2 µg/L (mean) ≤ 4 µg/L (max)
Total Lead* **	All	≤ 3 µg/L (mean) ≤ 8 µg/L (max)	All	≤ 4 µg/L (mean) ≤ 11 µg/L (max)
Total Zinc* **	All	≤ 30 µg/L (mean) ≤ 180 µg/L (max)	All	≤ 7.5 µg/L (mean) ≤ 33 µg/L (max)
Temperature	none		All	≤ 17 °C (weekly mean)
total chlorine residual	All	≤ 0.002 mg/L (max)	none	
copper-8-Quinolinolate	All	≤ 0.5 µg/L (max)	none	

Note: * 90th percentile
** Geometric mean
*** Original objective was set for dissolved metal.
All calculations are based on five samples in 30 days.

APPENDIX B

Cowichan Bay Float Home and Marina Sewer Service Verification (Unpublished Report by the CVRD)

COWICHAN BAY FLOAT HOME AND MARINA SEWER SERVICE VERIFICATION

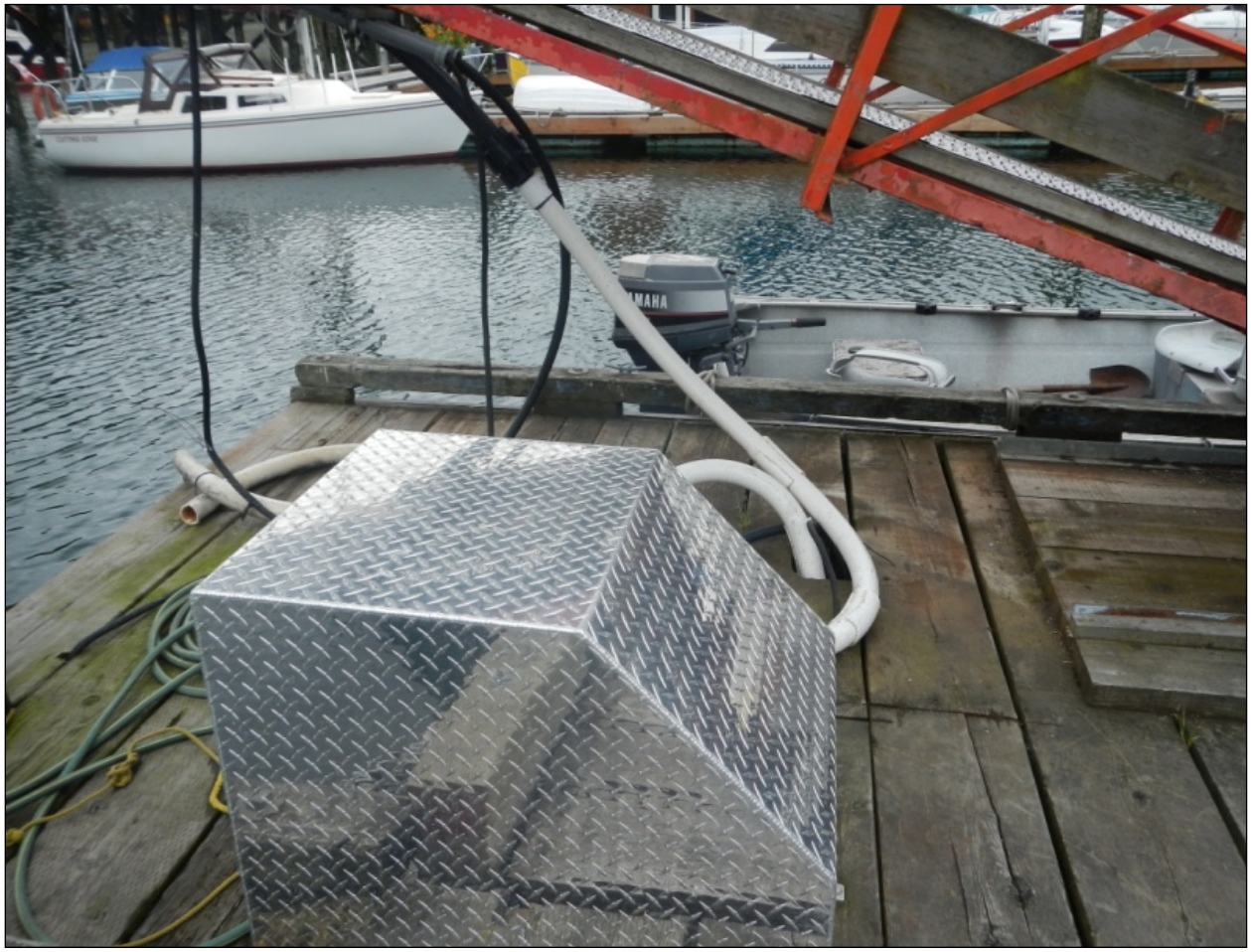
The following is a summary of a preliminary assessment conducted by CVRD Engineering staff for the Foreshore Sewage Management Systems and Float Home Sewer Service Connections of the various Marina's located within Electoral Area D, Cowichan Bay.

- It should be noted that the information below was conducted as a visual inventory and may require confirmation by notice for further inspection at owners consent.

FISHERMAN'S WHARF

- The Fisherman's Wharf Sewage Management System (SMS) consists of a recently upgraded infrastructure. Starting at the end of the North finger of the dock with a Boat Sanitation Dump.

- The sewage is transferred from the Boat Sanitation Dump through butt fused HDPE 50mm(High Density Polyethylene) pipe located just beneath the decking by the suction side of a pump located at the bottom of the ramp in a secure aluminum box.

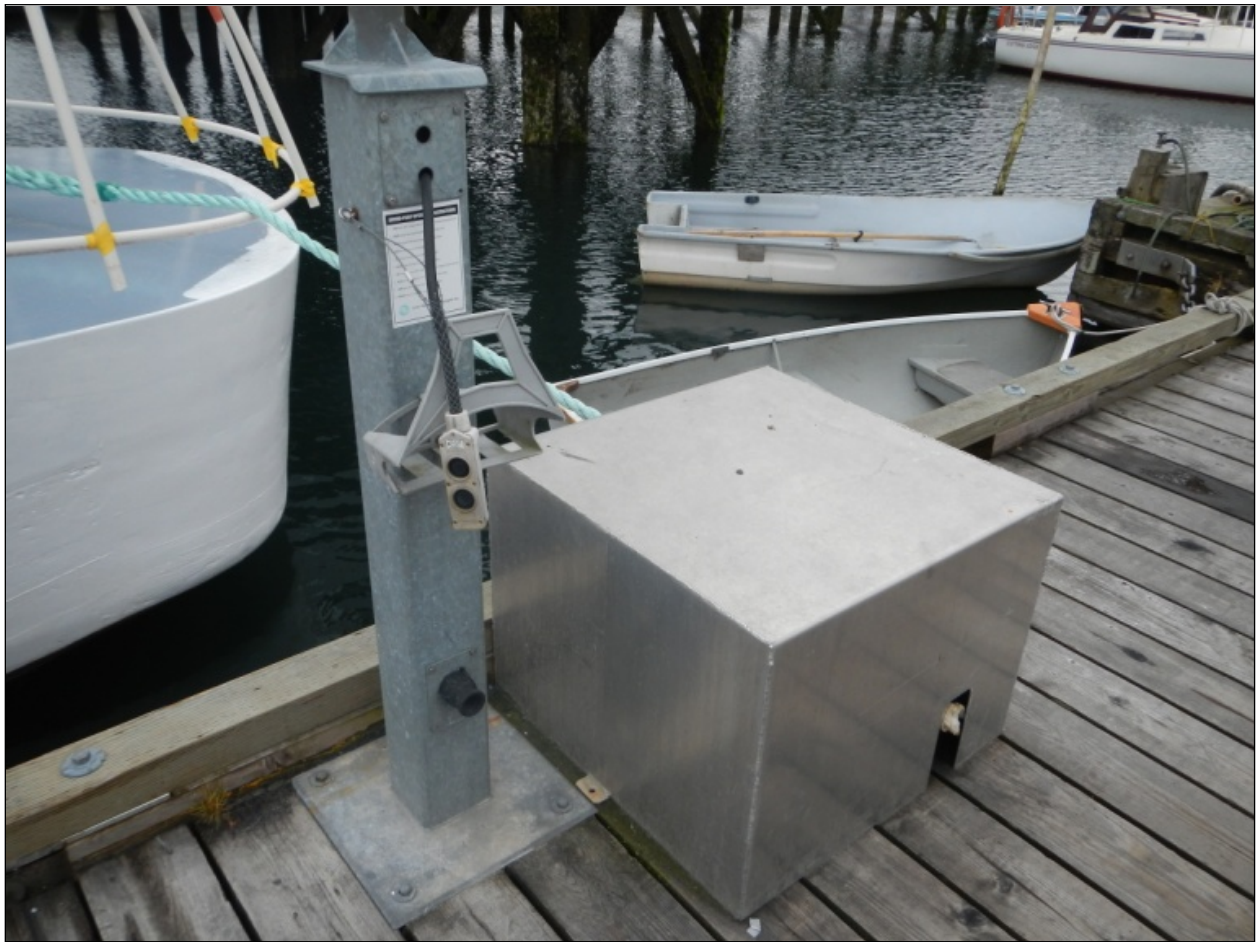


- This pump discharges the sewage through a short length of white 50mm PVC (polyvinyl Chloride) Spa Flex pipe located directly after the pump (Note Spa Flex pipe only has a working pressure rating of 65psi, and isn't commonly used on pump discharge piping) where it transitions into a 50mm HDPE pipe secured to the bottom of the ramp to the wharf at which point the 50mm HDPE wyes into a 75mm HDPE force main after passing through a 50mm PVC check valve to prevent back siphoning.

- The 75mm HDPE force main is the discharge piping from the Holding/Pump Chamber located under the Fisherman's Wharf building.

- The Holding tank seems to be constructed of Polyethylene, the 75mm sewage discharge pipe, transitioned from a short section of Spa Flex through a check valve to the HDPE Force main.

- The tank has two 50mm inlets, one on the lower left side of the tank taking the grey water and sewage from Fisherman's Wharf building, and one on the upper right side of the tank with PVC ball valve in the closed position. This inlet pipe to the tank is the discharge pipe from an abandoned Boat Sanitation Dump which is no longer physically connected to the unit.



- The 75mm HDPE Force Main from the Holding tank below the Fisherman Wharfs building is secured to the side of the wharf where it continues to the shore line, then drops below the wharf where it transitions from 75mm HDPE to 50mm then to 50mm schedule 40 PVC pipe at which point it enters into the ground.

- This service then continues to a sewer clean out located in the driveway for the wharf, at which point the flow gravities into the CVRD Sewer Infrastructure.

- Note clean out box needs to be cleared of debris to access clean out and confirm connection.

- Service connection to CVRD Sewer Main located 12.2m downstream of manhole 18.

MASTHEAD MARINA

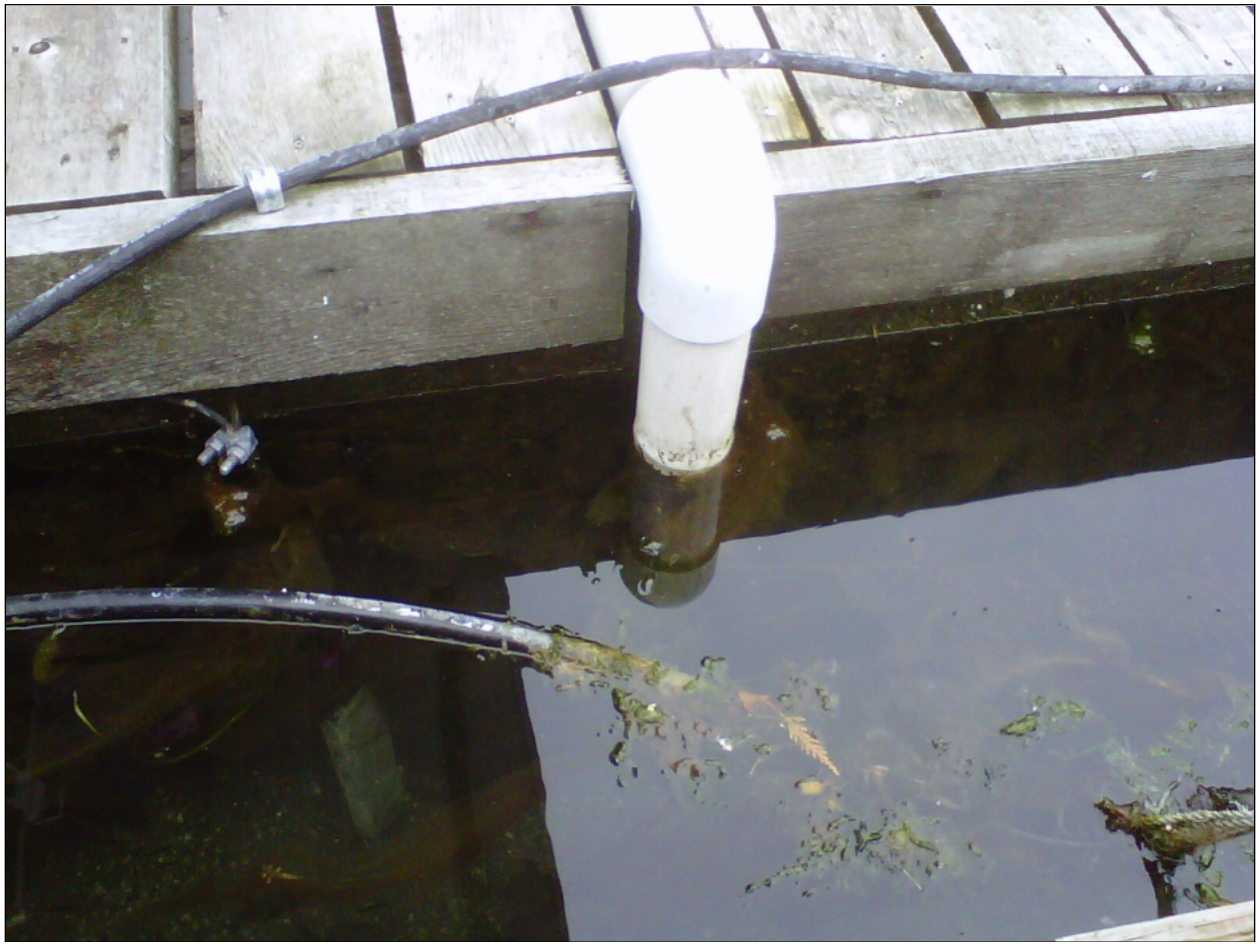
- The Mast head Marina's SMS is compiled of a variety of materials servicing two out of three float homes.

- Float home #3 is connected to the SMS via a Holding/Pump chamber located on the deck of the float home. The chamber is approximately 1.5m in length and 1m in width, unable to account for the depth we would have to approximate the volume at between 800 and 1000 litres. The chamber is attached to the force main through 50mm multipurpose PVC flex hose, then transitions to schedule 40 PVC pipe using a cam lock fitting, and using a PVC check valve before attaching to the SMS force main.

- It should be noted that multipurpose PVC flex hose has a working pressure rating of 45-25 psi depending on temperature, and has the tendency to break down under UV.

- The Holding/Pump chamber also has an overflow pipe constructed of 100mm schedule 40 PVC.

- This pipe could directly discharge influent into Cowichan Bay in the event of high level in the chamber.



- Float home #2 has no visible connection to the SMS, although there seems to be a provision for a possible future connection. We would have to assume that this home is discharging into the bay.

- Above picture is access hole to force main in the dock adjacent to float home #2

- Float home #1 is connected to the system through a section of PVC Spa Flex using cam lock fitting's transitioning into schedule 40 PVC without any sign of a check valve, leading us to assuming that there must be a Holding/Pump chamber and Check Valve assembly aboard the unit.

- It is an assumption because it is not visible and judging by the connections that the force main below the decking of the dock is 50mm schedule 40 PVC pipe, and that it transitions just before exiting the dock to 75mm clear Flex PVC with Green PVC helix, which has been wrapped in UV resistant tape.

- The force main is somewhat secured to the ramp as it transcends form the dock to the wharf.

- The force main continues along the wharf then transitions into a gravity line located under the wharf just before the Masthead Restaurant at which point it gravities into the shared sewer service line for the restaurant.

COWICHAN SHIPYARD MARINE

- Has no visible connection to its wharf system.

COWICHAN BAY MARINA PIERS A AND B

- Has no visible sewage connection to either of its wharf systems, although service for power and potable water are present.

PIER 67 MARINA

- Pier 67 currently maintains moorage for four float homes. Recent upgrades have been made to the wharf system, although without provision for a sewage management system for the homes. Again service for water and power are visible.

PEIR 66 MARINA

- Has no sewage management system, or connection to the wharf system, but has a Holding/Pump chamber servicing one of the buildings on the foreshore.

- Pier 66 provides moorage to six float homes. The only services recognized were water, power, and fuel servicing the gas bar.

DUNGENESS MARINA

- The Dungeness Marina is equipped with a boat sanitation dump located at the far end of the main wharf. The cover is secured, but it would be assumed that there would be a pump and small holding tank beneath the cover.

- The Force Main from the boat sanitation dump, although not entirely visible seems to be constructed from 50mm Spa Flex pipe along the wharf and ramp at which point it transitions to Schedule 40 PVC through a compression fitting.

- The Force Main Continues under the dock where it is believed to tie into the gravity sewer servicing a number of buildings including a restaurant before entering the CVRD sanitary sewer.

MARITIME CENTER

- The Maritime center has no visible sewage management system or connection to its wharf.

BLUENOSE MARINA

- The Bluenose marina has provided moorage for 5 float homes. There is a sewer management system in place servicing three of the float homes along with a washroom facility located on the wharf. The system seems to be generally constructed from 50mm black EPDM hose which has a working pressure of approx 60psi.

- The hose is routed through the wharf system occasionally submerged into the water

- The force main continues from the wharf up the ramp to the dock system.

- The force main was traced back to building occupied by a business, the merchant mentioned that the force main outfall went into a holding tank inside the building. Access to the tank could not be provided; it can only be assumed that the tank discharges to CVRD sewage collection system.

CONCLUSION

There are definitely some gaps creating concerns with the construction and maintenance of the sewer management systems servicing the float homes. Float home and marina approved sewage systems require good engineering practice; while many Municipalities default to the BC Float Homes Standard as their bylaw there is a multitude of Acts and Regulation that umbrella this Standard with regard to construction and maintenance.

With requirements for engineering for the construction, and a “qualified person” to oversee operation and maintenance of these systems coming from regulation of authorities having jurisdiction, little information is available on what the standard practice is for construction materials used for these systems.

Most of the systems inventoried have little consistency in the choice of materials used for construction, leaving a gap for subpar construction, installation and a potential for failure of the system.

Engineering Standards for these systems enforceable by inspection through the bylaw would dramatically reduce concern for failure of a system.

APPENDIX C

Best Practices for Floating Home Owners

(Seattle Floating Home Association)

Floating Homes Association
2329 Fairview Ave. E.
Seattle, WA 98102
206.325.1132

Take care of our lake!

A floating community can potentially contribute to water pollution with both liquid and solid wastes. To help bring the water quality and sediments of Lake Union to a cleaner level, these floating home Best Management Practices (BMPs) are recommended. Remember, under Washington State Law, Chapter 90.48.080 RCW, it is illegal to discharge or allow to be discharged any pollutant into the water. With a little forethought and common sense, we can stop pollutants from falling into Lake Union, thus creating a safer and cleaner "water yard" for outdoor recreational pleasure.

Best Practices for Floating Home Owners

Best Practices

Garbage and Recycling

1) Dispose of garbage on shore in your garbage dumpsters. Recycle paper, glass, cans in the recycle bins. Keep area around dumpsters and bins neat and debris-free.
2) Do not dispose the following in the dumpsters: paints, solvents, fuel, oil, batteries, anti-freeze, wet rags. Take these to the King County Household Hazardous Waste Station.
3) Do not dispose of any item from your floating home or dock into the water.

House, Deck and Dock Maintenance

1) When prepping the house or deck for paint, stain or varnish, tarp your work area to trap any paint chips or dust, thus preventing anything from falling into the lake.
2) Vacuum or sweep up frequently.
3) Keep the paint in small containers, bringing out only what you need.
4) Use a drip pan or tarp to mix or transfer paint or solvents. Keep the containers in a drip pan while working.
5) Paint and solvent spills need to be contained and cleaned up immediately.

Sub-Contractors

1) Inform your contractors, subcontractors, and any employees about these water quality Best Management Practices (BMPs).
2) You will be responsible for the actions of your contractors, subcontractors, and any employees regarding adherence to all water quality rules and regulations.

General Housekeeping

1) Secure all household items and outdoor furnishings located near the edge of the structures in a manner which will keep them from blowing or falling overboard into the lake.
2) Consider vacuuming decks instead of sweeping to minimize dirt from entering the lake.

Gardening

1) Tarp your work area when planting or repotting plants to avoid anything from falling into the water.
2) If using fertilizers on your plants, do not overwater so that the toxins spill over into the lake.

Boat Maintenance

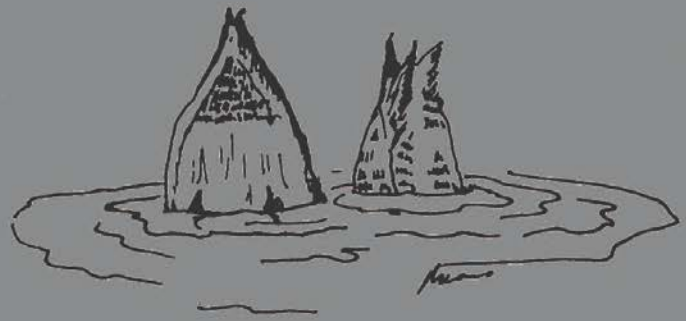
1) Engine Work
   - Use absorbent pads under engine or in bilge when changing oil.
   - Recycle waste oil and oil filters at an automotive store or at the household hazardous waste station. Recycle batteries when you buy new ones.
   - Dispose of antifreeze and transmission fluid at the household hazardous waste station.
2) Painting and Varnishing
   - Tarp the area between the boat and the floating home to trap any sanding dust or debris.
   - Vacuum and sweep up frequently. Use a sander with a collection bag.
   - Keep paint and varnish in small containers and inside a secondary drip pan.
   - Use a tarp or drip pan under your materials when mixing or transferring paint, varnish or solvents.
   - Paint, varnish and solvent spills should be treated as oil spills.
   - Do not leave any containers of fuel, oil, solvents, fluids, paint, batteries or debris of any nature on the dock or out in the open on your deck or access ramp.

Accidental Spills

1) In case of a fuel, oil, paint, solvent or dangerous material spill, STOP the source of the spill and begin to clean up immediately.
2) DO NOT pour liquid detergent onto the spill.
3) Keep absorbent pads available to throw onto the surface of the water to sop up the spill.
4) Double bag the dirty absorbent pads and dispose of them in your garbage dumpster.
5) For a large and uncontrolled spill, call the U.S. Coast Guard at 1-800-OILS-911.

Pets

1) Scoop and discard pet poop via the home sewer system or bag it and place in the garbage.



It's common sense.
Don't throw or drop
anything in the water.

APPENDIX D

Fish Species of the Cowichan Watershed

Table 1 Freshwater Fish Species Present in the Cowichan Watershed

Cowichan Basin Watershed Fish Species	Shaw Ck	Nixon Ck	Robertson R	Sutton Ck	Cowichan Lk	Cowichan R	Somenos Lk	Quamichan Lk	Koksilah R
Atlantic Salmon (*Salmo salar*)	I	I	I	I	I	I			I
Brook Trout (*Salvelinus fontinalis*)	I	I	I	I	I	I			I
Brown Catfish (*Ameiurus nebulosus*)					I	I	I	I	
Brown Trout (*Salmo trutta*)			I		I	I	I		
Brown Trout - Anadromous						I			
Bull Trout (*Salvelinus confluentus*)					●	●			
Bull Trout - Anadromous					●				
Chinook Salmon (*Oncorhynchus tshawytscha*)	●	●	●		●	●			●
Chum Salmon (*Oncorhynchus keta*)			●		●	●	●		●
Coho Salmon (*Oncorhynchus kisutch*)	●	●	●	●	●	●	●	●	●
Cutthroat Trout (*Oncorhynchus clarkii*)	●	●	●	●	●	●	●	●	●
Cutthroat Trout - Anadromous						●			●
Westslope (Yellowstone) Cutthroat Trout (*Oncorhynchus clarkii lewisi*)		SC		SC					
Dolly Varden (*Salvelinus malma*)	●	●	●	●	●	●			
Kokanee Trout (*Oncorhynchus nerka*)					●	●			
Lake Lamprey (*Lampetra macrostoma*)			T		T				
Pacific Lamprey (*Lampetra tridentate*)					●				
Western Brook Lamprey (*Lampetra richardsoni*)					●				
Lake Trout *(Salvelinus namaycush)*	●		●	●					
Prickly Sculpin (*Cottus asper*)					●	●		●	
Pumpkinseed Sunfish (*Lepomis gibbosus*)							I		
Rainbow Trout / Steelhead (*Oncorhynchus mykiss*)	●	●	●	●	●	●	●	●	●
Smallmouth Bass (*Micropterus dolomieu*)					I				
Threespine Stickleback (*Gasterosteus aculeatus*)					●	●	●	●	
Unidentifiable Trout (fry<70mm)	?		?	?		?			?
LEGEND	● = Indigenous			I = Introduced/Exotic			? = No details		
BC Conservation Status	● = Red listed			● = Blue listed			● = Yellow listed		
COSEWIC Status	T = Threatened			SC = Special Concern					

***Source:** Cowichan Watershed Board (FishWizard, Freshwater Fisheries Society of BC, gofishbc.com

APPENDIX E

Water Quality:

British Columbia Water Criteria

and Microbiological Water Quality Sampling Locations

Table A British Columbia Water Quality Criteria for Microbiological Indicators

Water Use	Escherichia coli *	Fecal Coliforms
Raw Drinking Water • no treatment	0/100 mL	0/100 mL
Aquatic Life • shellfish harvesting	Less than or equal to 14/100 mL median	Less than or equal to 14/100 mL median Less than or equal to 43/100 mL 90th percentile
Wildlife	None applicable	None applicable
Recreation • secondary contact • crustacean harvesting	Less than or equal to 385/100 mL geometric mean	None applicable
Recreation • primary contact	Less than or equal to 77/100 mL geometric mean	Less than or equal to 200/100 mL geometric mean

Notes: * E.coli is applicable to freshwater only. Fecal coliforms are applicable to fresh and salt water.

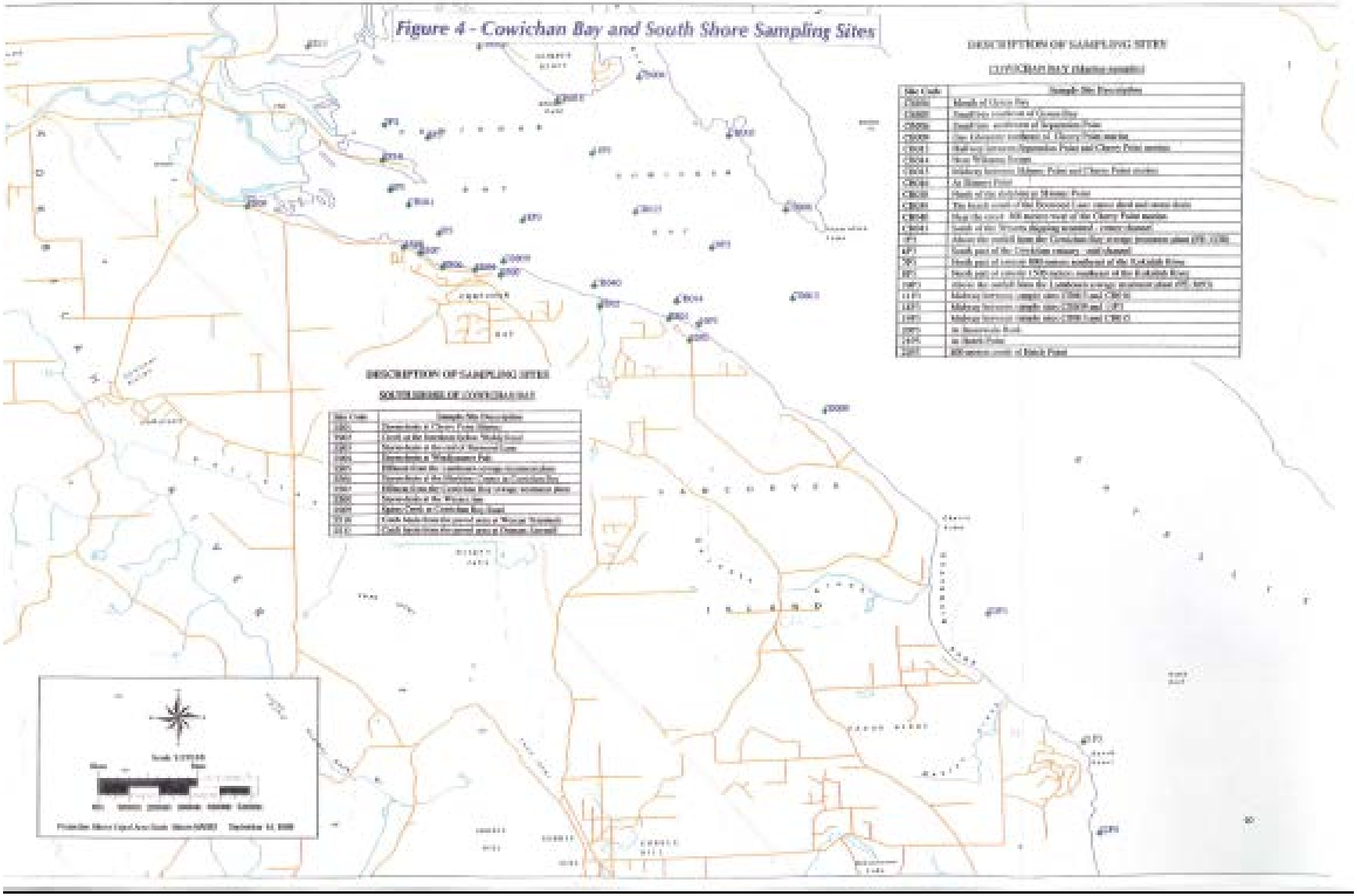


Figure 4 - Cowichan Bay and South Shore Sampling Sites
DESCRIPTION OF SAMPLING SITES
COWICHAN BAY (Marine samples)
Site Code
Sample Site Description
DESCRIPTION OF SAMPLING SITES
SOUTH SHORE OF COWICHAN BAY
Site Code
Sample Site Description


Float Home #1
Float Home #2
Float Home #3
Float Home #4
Botwood Ln