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**Baynes Sound Stewardship Initiatives
April 1, 1999- May 31, 2000**

Final Report

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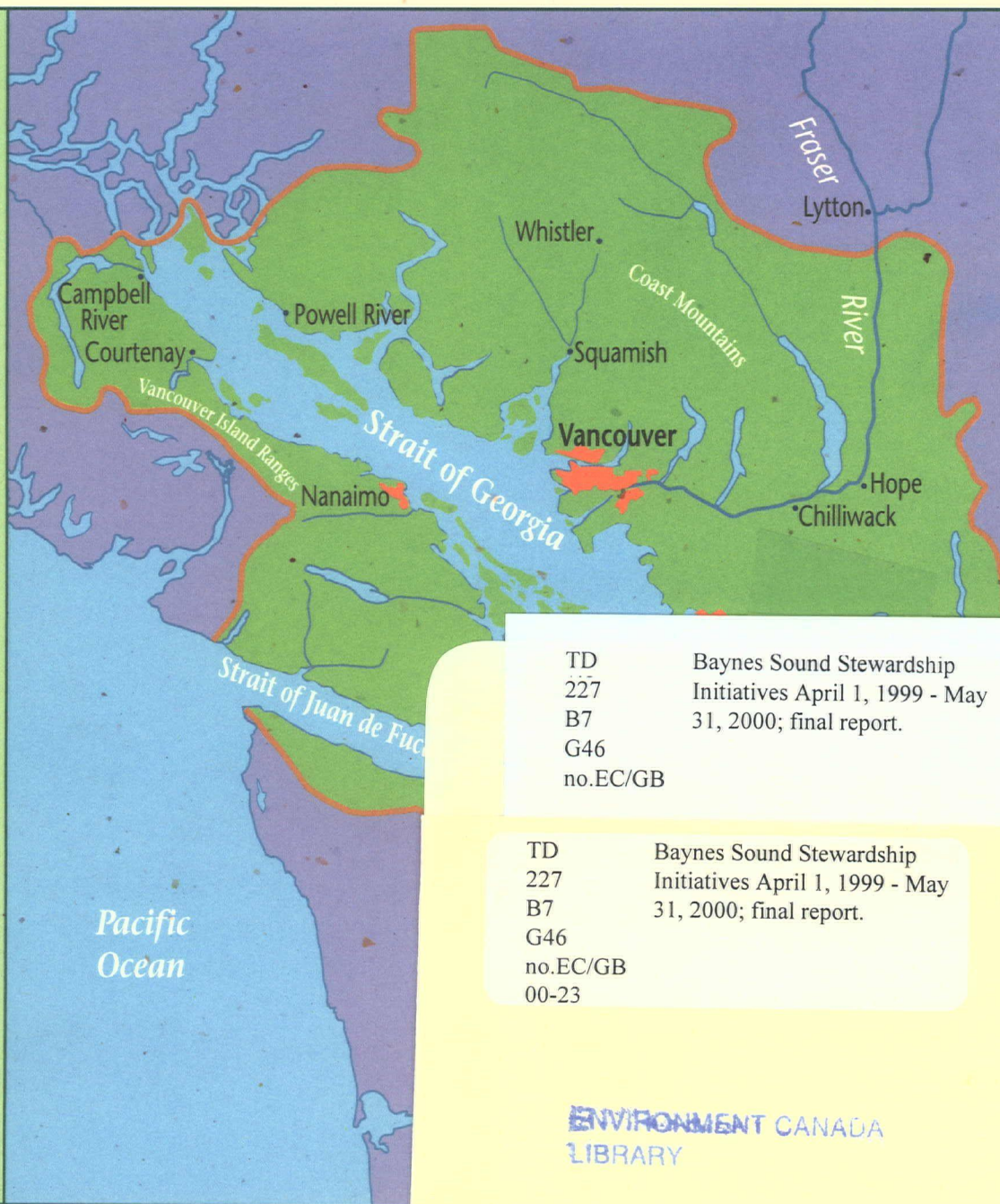


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Prepared for Environment Canada, G
Prepared by Barbara Joughin, Chris
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Baynes Sound Stewardship Initiatives
April 1, 1999 - May 31, 2000
Final Report

EC/GB-00-023

This study contributes to the Georgia Basin Ecosystem Initiative,
a partnership that provides tools, support and a framework
for action towards sustainability in the Georgia Basin.

Prepared for:

Environment Canada
Ministry of Fisheries

Prepared by:

Barbara Joughin
Chris Bruels
Odete Pinho

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Résumé

Ce rapport composite présente les résultats de trois initiatives de gérance mises en place dans la baie Baynes par la *Comox Valley Project Watershed Society* au cours de 1999 et de 2000 : le *Baynes Sound Restoration Actions Mapping Project*, le *Stormdrain Re-Monitoring Project* et le *Comox Marine Monitoring Project*.

Le *Baynes Sound Restoration Actions Mapping Project* consistait à orienter les activités correctives à l'aide du logiciel SIG Arcview. La carte et la base de données produites permettent d'accéder à l'ensemble des problèmes de pollution diffuse auxquels ont été appliquées des mesures correctives entre 1995 et 2000. Ces données seront intégrées au GIX de la baie Sound et analysées en 2001 dans le cadre du *Project Watershed's State of the Sound Program*.

Le *Stormdrain Re-Monitoring Project* et le *Comox Harbour Marine Project* font partie de plusieurs initiatives communautaires de surveillance à long terme. Ces projets ont bénéficié d'importantes contributions non financières de la part de bénévoles (qui se sont chargés de l'échantillonnage de l'eau), d'une entreprise locale, de groupes communautaires et d'un ministère provincial.

À l'aide de méthodes de surveillance mises au point en 1996, les participants du *Stormdrain Re-Monitoring Project* ont examiné les concentrations bactériennes dans les eaux usées déversées dans le nord de la baie Baynes de manière à évaluer l'évolution de la qualité de l'eau dans les canalisations testées. Les résultats de l'étude indiquent que la qualité de l'eau s'est généralement améliorée dans la ville de Courtenay comme dans celle de Comox. Les agents municipaux ont participé avec enthousiasme à ce programme de surveillance et leur participation a contribué au succès du projet et à la réduction de la concentration en colibacilles fécaux dans les eaux qui pénètrent dans la baie Baynes.

Ayant pris connaissance des résultats obtenus à l'issue du programme de surveillance des eaux usées, la ville de Comox a mis sur pied des programmes consistant à déterminer l'emplacement et l'état général de tous les raccordements de canalisations d'égout sanitaire et d'eaux pluviales. Au total, huit raccordements ont été repérés et réparés. La ville de Comox a de plus mis sur pied un plan sur cinq ans qui consistera à reconstruire la majeure partie de son système d'évacuation des eaux pluviales. Entre 1996 et 1999, la ville de Courtenay a dépensé 200 000 \$ en réparations sur les raccordements des systèmes sanitaires et pluviaux et 36 000 \$ sur le scellement des plaques d'égout sanitaire. La ville de Courtenay a prévu un budget supplémentaire pour la poursuite de ces activités en 2000.

Le *Comox Harbour Marine Monitoring Project* a permis d'accumuler des données « multisaisonnières » sur la qualité de l'eau entre mai 1995 et mai 2000. Ces données, recueillies par l'unité auxiliaire n° 60 de la Garde côtière canadienne, constituent la plus importante base de données publique sur les niveaux de colibacilles fécaux relevés dans le nord de la baie Baynes. Elles offrent également le meilleur des aperçus disponibles concernant les variations saisonnières des niveaux moyens en colibacilles dans la baie Comox Harbour. Ce projet a permis de sensibiliser les membres de la communauté qui ont pu participer directement au projet et en faire la promotion.

Les données concernant les eaux marines et les eaux pluviales montrent qu'il existe une tendance générale à la réduction des niveaux de colibacilles fécaux dans les deux cas.

Ces projets ont permis de constater que la collecte de données sur plusieurs saisons est essentielle pour l'obtention de résultats statistiquement significatifs concernant la qualité de l'eau dans la baie Baynes. Il est nécessaire de soutenir de manière continue les programmes étendus d'étude de la qualité de l'eau pour faire en sorte que des données viables d'un point de vue statistique soient disponibles pour les analyses. Pour utiliser au mieux les ressources limitées, il est cependant important d'identifier au préalable les sites de la baie Baynes qui sont les plus critiques pour la surveillance continue de la qualité de l'eau. Dans le cadre du *State of the Sound Program* (2000-2001), *Project Watershed* collaborera avec divers gouvernements et divers organismes communautaires pour établir un processus permettant d'identifier ces sites clés et pour surveiller et documenter l'état sanitaire général de la baie Baynes.

Executive Summary

This composite report presents the results of three related Baynes Sound Stewardship Initiatives delivered by the Comox Valley Project Watershed Society during 1999 and 2000 – the **Baynes Sound Restoration Actions Mapping Project**, the **Stormdrain Re-Monitoring Project**, and the **Comox Harbour Marine Monitoring Project**.

The **Baynes Sound Restoration Actions Mapping Project** located remediation activities using the Arcview GIS program. The resulting map and its supporting database list non-point source pollution problems addressed through remediation actions from 1995 to 2000. These will be integrated with the Baynes Sound GIS, and analyzed as part of Project Watershed's State of the Sound Program in 2001.

The **Stormdrain Re-Monitoring Project** and the **Comox Harbour Marine Monitoring Project** were both discrete chapters of longer term community based monitoring initiatives. These projects benefited from significant in-kind contributions from volunteer water samplers, a local business, community groups, and a provincial ministry.

Utilizing monitoring methods established in 1996, the **Stormdrain Re-Monitoring Project** examined bacterial levels in discharge waters entering northern Baynes Sound in order to compare and evaluate water quality improvements or declines in previously sampled municipal stormdrains. Study results clearly indicate general improvements in stormwater quality in both the City of Courtenay and the Town of Comox. Municipal officials have been keen participants in this monitoring program, and their involvement has contributed to the success of the project and the subsequent reduction in fecal coliform bacteria levels entering Baynes Sound.

In response to the findings of the original Stormdrain Monitoring Program, the Town of Comox initiated programs to determine both the location of all sanitary/stormdrain cross connections, and the general condition of their stormdrain system. In total, eight cross connections were located and repaired. In addition, the Town of Comox has committed to a five-year plan for the reconstruction of much of its storm system. From 1996 – 1999, the City of Courtenay expended \$200,000 on sanitary sewer/stormdrain cross connection repairs, and an additional \$36,000 on sealing sanitary sewer manhole covers. Further funds have been allocated by the City of Courtenay for these purposes for 2000.

The **Comox Harbour Marine Monitoring Project** provided multi-seasonal water quality data from May 1995 until May 2000. This data, collected by the Canadian Coast Guard Auxiliary Unit #60, is valuable as the most comprehensive public database of fecal coliform levels in north Baynes Sound. It also offers the clearest seasonal perspective on general fecal coliform levels in Comox Harbour currently available. This project provided opportunities for community education through hands-on involvement and project promotion.

A comparison of stormdrain and marine sampling datasets shows an overall trend of a reduction in median fecal coliform levels in both marine and stormdrain test results.

A key outcome of these projects is the understanding that ongoing multi-seasonal data collection is essential for a statistically significant review of water quality conditions in Baynes Sound. Ongoing support for comprehensive water quality sampling programs is required to ensure that statistically viable data is available for analysis. However, in order to make best use of limited resources, it is important to identify which sites in Baynes Sound are critical for ongoing water quality monitoring. Through the State of the Sound Program (2000-2001), Project Watershed will work collaboratively with various government and community agencies to establish a process to identify these key areas, and to monitor, review and report on the overall health of Baynes Sound.

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A special thank you to all the individuals who sampled Comox Harbour and the stormdrains, regardless of the weather or the time of day, and to the Canada Coast Guard Auxilliary #60, for the use of the "Bruce Brown II".

Thank you to the funders who made these projects possible: Bill Heath, Ministry of Fisheries, and Dave Walker, Environment Canada – Georgia Basin Ecosystem Initiative.

These projects were supported extensively with in-kind contributions. Thanks to Catherine Black and Sandy Felgenhauer, North Island Labs; to Kevin Rieburger, Ministry of Environment, Lands and Parks; and to Dave Cherry, Upper Island Health Society, for their generosity and support. A special thank you to Odete Pinho, for reviewing the data and analysing the results.

Cooperation and support from the Town of Comox and the City of Courtenay facilitated the success of the Stormdrain Re-Monitoring Project. Our appreciation is extended to Glen Westendorp, Public Works Superintendent, Town of Comox, and to Kevin Lagan, Director of Operational Services, City of Courtenay.

The Baynes Sound Stewardship Action Group supports and guides Baynes Sound stewardship projects that address water quality in Baynes Sound. Thank you for the ongoing support to Bill Heath, Ministry of Fisheries; Richard Drake, Comox Valley CARE; Cathy Slater, BC Shellfish Growers Association; Mac Fraser, Village of Cumberland Manager of Operations; Bert Kooi, Environment Canada; and Dave Cherry, Environmental Health.

A special thank you to Chris Bruels, Project Watershed.

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1. Introduction

In 1994 almost 25% of the shellfish growing leases in Baynes Sound were closed due to fecal coliform contamination. Since that water quality “wake up call”, several citizens groups, government agencies, the shellfish industry, and individuals have worked together through the Baynes Sound Stewardship Action Group (BSSAG) to identify pollution sources and undertake actions to reduce non-point source pollution.

Through BSSAG and its associated members (including Project Watershed), Baynes Sound Stewardship Initiatives are identified and developed as a means of measuring and reducing non-point source pollution in Baynes Sound. The members of BSSAG provide guidance and advice to Project Watershed for the Baynes Sound Stewardship Initiative (BSSI) projects we develop and deliver. Project Watershed continues to be the delivering agency for many of these projects.

In 1999, with funding support from the Ministry of Fisheries and Environment Canada – Georgia Basin Ecosystem Initiative, and in-kind support from the BC Ministry of the Environment, the Upper Island Central Coast Community Health Services Society, North Island Labs, and community volunteers, Project Watershed completed the following three Baynes Sound Stewardship projects:

- **Baynes Sound Restoration Actions Mapping Project**
- **Stormdrain Re-Monitoring Project**
- **Comox Harbour Marine Monitoring Project.**

The **Baynes Sound Restoration Actions Mapping Project** produced an ArcView (GIS) map of water quality improvement actions. The map is supported by an Access database, listing non-point source pollution problems addressed through remediation actions from 1995 – 1999.

The **Stormdrain Re-Monitoring Project** utilized a team of 24 community volunteers to test water quality in 39 municipal stormdrains and 5 rural drainage ditches to evaluate the effectiveness of repairs made following identification of the original contaminated “hot spots” between 1995 and 1998.

In 1999/2000, the **Comox Harbour Marine Monitoring Project** gathered marine water quality data from six Environment Canada sampling sites in Comox Harbour to supplement data from the Stormdrain Re-Monitoring Project, and to indicate how water quality conditions in Baynes Sound might have been affected by repaired stormdrains. This sampling program also contributed to the collection of multi-seasonal water quality data. In addition, the 1999/2000 project adhered to the original purposes of using a water quality sampling program in Comox Harbour to develop a scientific baseline of the Harbour’s condition, and to increase public awareness of water quality issues in the Comox Valley.

2. Background

Baynes Sound is one of BC's prime commercial shellfish growing areas, and is fished commercially for herring and shrimp. It is also a popular recreational boater destination. However, the local shellfish industry has been directly impacted by fecal coliform bacterial contamination, and shellfish growing area closures and restrictions are an ongoing concern to industry, government, and community groups.

Commercial shellfish farming represents a positive prospect for economic diversification in resource-dependent coastal Baynes Sound communities. The nature of shellfish farming is such that regional economic impacts are very high, and the local shellfish industry is mainly small business operations that are located in the small, coastal communities of the region. Today, approximately 500 jobs (permanent, part-time and seasonal) are directly related to the Baynes Sound shellfish industry. However, declining water quality has severely impacted on the production of shellfish in the region. Because shellfish accumulate bacterial pollutants in their tissues through environmental exposure, human health can be placed at risk in conditions of poor water quality. In 1994, a closure of 23 % of the shellfish harvesting area was imposed on Baynes Sound due to high fecal coliform levels, and the area continues to be closely monitored by Environment Canada.

Continued urban and rural development in the watersheds feeding into Baynes Sound impact on water quality, and on the shellfish industry that is supported by these waters. Baynes Sound receives non-point source pollution from many different sources, including agricultural and business run-off, stormdrain/sewer cross connections, and fecal coliform contamination from boaters and failing rural septic systems. High levels of fecal coliform contamination in marine systems create complex and diverse health concerns for the species inhabiting and using these systems.

Baynes Sound is a potential "no discharge zone" under the Canada Shipping Act. Once it is designated as a sensitive waterway with legislated protection, boaters will not be able to discharge sewage into the Sound. Baynes Sound has also been nominated as an Important Bird Area, and as a Provincial Wildlife Management Area.

3. Sponsoring Organization

The Comox Valley Project Watershed Society (Project Watershed) was established in 1993 to promote community stewardship of Comox Valley watersheds through information, education, and action. Over the past seven years, we have built numerous partnerships among community organizations, citizens, industry and all levels of government.

Project Watershed's major program areas include the Baynes Sound Stewardship Program, the Watershed Inventory and Mapping Program, the Sensitive Habitat Stewardship Program, volunteer coordination, and the development of a centre for community stewardship resources.

Project Watershed has a long-term vision of developing a strong, active community stewardship ethic to improve water quality and ecosystem integrity within the Comox Valley. Based on this vision, we have completed several Baynes Sound remediation projects, sponsored by Environment Canada Eco-Action 2000, Ministry of Fisheries, Georgia Basin Ecosystem Initiatives, and a host of other partners.

During the past five years, these remediation projects have been focused on four primary inputs of fecal coliform contamination to Baynes Sound: failing septic systems, agricultural inputs, boater waste, and faulty stormwater drains. Additional projects involved the business community in a survey on the use and disposal of toxic substances, and the construction of a pilot biofiltration wetland.

In addition to directly addressing water quality issues in Baynes Sound, community involvement projects about Baynes Sound non-point source pollution sources have provided the opportunity for citizens, government agencies and shellfish growers to work together to improve water quality. The motivation of community members to volunteer on projects related to Baynes Sound is high. Hundreds of citizen volunteers have participated in recent stewardship programs.

4. Bacteriological Pollution

Fecal coliform is a bacteria found in the intestines of warm-blooded animals. They can also be found in the waste material, or feces, excreted from the intestinal tract. When fecal coliform bacteria are present in high numbers in a water sample, it likely means that the water has recently received fecal matter. These sources could be from wastewater discharges, animal wastes or failing septic fields. Although fecal coliform are not necessarily agents of disease, they may indicate the presence of disease carrying organisms, which live in the same environment as the fecal coliform bacteria. Once fecal coliform has made its way into a water system, its survival is usually only 72 hours in fresh water and 48 hours in salt water; however this is largely dependent on other factors such as salinity, water temperature, sunlight and nutrients. This means that if water samples show consistently high counts of fecal coliform, then the input into the system is constant.

“Storm events” are heavy sustained rainfalls produced by cold fronts passing through a wide geographic area. When intentional urban stormdrain testing is done during storm events (as was done in the 1996 survey only), it is possible to identify the impact that dilution has on fecal coliform counts originating from sewage cross connections or originating from surface runoff.

In rural areas, most surface pollutants enter waterways near the beginning of a storm event, when pollutants, such as bacteria, are dissolved into solution and are moved through erosion. Increases in pollution levels are most evident during the heavy “first flush” rains typically in September or October. This is when the accumulation of land-based pollutants is mobilized after dry summer weather. Pollution levels are also higher in rural areas when rainfall levels increase and water tables are high. This is a time when on-site septic systems will more readily malfunction and show evidence of problems.

Fecal coliform concentrations are reported in units of the most probable number (MPN) of bacteria colonies per 100 ml of sample water (# MPN/ 100 ml) for marine water samples and in colony forming units per 100 ml for fresh water samples (# CFU/ 100 ml).

Fecal coliform bacteria numbers that indicate problems:

Fecal Count	Consequence
Greater than 0 fecals (MPN/ 100 ml)	Water not fit for drinking
Median greater than 14 MPN or that more than 10% samples is >43 MPN	Area closed to shellfish harvest, however relaying and/or depuration is permitted
Average greater than 200 MPN/ 100 ml or that more than 10% samples is >400 MPN	Area closed for swimming
Average greater than 88 MPN or that more than 10% samples is >260 MPN	Area prohibited for all shellfish harvesting, including relaying and/or depuration

5. Project Description

In March 1999, the BC Ministry of Fisheries contributed funds to the Comox Valley Project Watershed Society to support water quality stewardship work in Baynes Sound, specifically for:

- i) Baynes Sound water quality database analysis by GIS mapping and presentation methods to identify data trends and further delineate point and non-point pollution sources. (**Baynes Sound Restoration Actions Mapping Project**);
- ii) Coordination and technical analysis of water quality monitoring in the foreshore area of Baynes Sound in order to evaluate recent remediation efforts and to identify other pollution sources (**Stormdrain Re-Monitoring Project**).

In November 1999, the original objectives of the Agreement were expanded to include the following:

- iii) Provide comparative marine data from consecutive winter seasons in Comox Harbour, and provide corroborative marine water quality test results from Comox Harbour with concurrent monitoring data from storm drains in Comox, Courtenay, and Royston. Test results may identify new or ongoing "hotspots" of bacterial contamination, as well as how water quality conditions in northern Baynes Sound have been affected by recent stormdrain repairs in urban areas. (**Comox Harbour Marine Monitoring Project**).

In December, 1999, Environment Canada – Georgia Basin Ecosystem Initiative contributed funds to Project Watershed for the **Comox Harbour Marine Monitoring Project**. These funds were to be used to continue to identify the degree, the extent and the sources of contamination to Comox Harbour, as well as to identify how to mitigate and remediate these sources so as to upgrade the prohibited/closed status of the shellfish growing waters in this area.

5.i BAYNES SOUND RESTORATION ACTIONS MAPPING PROJECT:

a) Objectives

- Compile Baynes Sound remediation data;
- Produce a map showing Baynes Sound remediation efforts for the May 1999 Environment Canada review of shellfish harvesting classifications in Baynes Sound.

b) Results

The Baynes Sound Restoration Actions Mapping Project defined and located water quality improvement actions on an ArcView map (1:50,000 scale). The map (Appendix 1) shows 56 restoration activities, including:

- Agricultural fencing improvements
- Septic system repairs and alterations
- Sewage cross connection repairs
- Riparian zone planting and rehabilitation
- Livestock management
- Holding tank installations

c) Summary

Restoration actions have been documented in an ArcView GIS mapping program. It was produced to provide easy reference for shellfish control agencies when considering where water quality improvements might be expected in specific growing areas. However, to date there have been no changes made to shellfish growing area classifications that can be linked directly with the restoration actions that are indicated on the map.

The Baynes Sound Restoration Actions Map and its supporting database will be integrated with the GIS mapping work that will be undertaken during the State of the Sound Program, Phase 1 – Information Collection and Data Management. Further analysis of this work will be performed in the State of the Sound Program, Phase 2 – Data Analysis and Interpretation.

The State of the Sound Program (2000 – 2001) will establish a comprehensive and standardized process to monitor and report on the ongoing state of Baynes Sound environmental health and water quality. This will be accomplished through the creation of an accessible information system for managing and reporting Baynes Sound remediation project data and information. It will also be accomplished through the development of clearly defined, valid, and standardized processes and procedures to gather, record, maintain and retrieve data in both database (spreadsheet) and GIS (mapping) formats. The State of the Sound reporting process will further serve as the basis for a powerful community education tool that will be used to increase public awareness and help prepare individual communities to move toward local waste management program planning and implementation.

The State of the Sound Program will be delivered in three linked phases that will lay the foundation for a long-term, ongoing State of the Sound monitoring and reporting process.

5.ii) STORMDRAIN RE-MONITORING PROJECT:

a) Objectives

Both nationally and in Baynes Sound, stormwater remains one of the most poorly managed sources of pollution. The 1999/2000 Stormdrain Re-Monitoring Project was designed to monitor bacteriological pollution discharges entering the northern part of Baynes Sound via storm drains and ditches in the Town of Comox, the City of Courtenay, and the Regional District of Comox Strathcona, Area A – Royston, and Area B – Queen's Ditch. (Please refer to Appendix 3 for stormdrain maps).

The 1999/2000 community-gathered data would be used for comparison and evaluation of water quality improvements or declines that may have occurred since 1996 in previously sampled municipal stormdrains.

Between 1996 to 1998, Project Watershed's "Hot Spots" stormwater monitoring program collected a total of 433 fecal samples from 55 storm drain discharges in the region. Of the 55 drains monitored, a total of 13 discharges were found to pose a high or medium human or shellfish contamination risk.

In response to these findings, the City of Courtenay repaired a total of 48 faulty sanitary sewers that were cross connected into storm drains from 1996 – 1999. During this time, the City of Courtenay also repaired 26 stormdrains that were cross connected into the city sanitary sewer system. The Town of Comox corrected 8 sanitary sewer into stormdrain cross connections between 1996-97. Both the City of Courtenay and the Town of Comox committed significant budget allocations and equipment purchases to accurately track and repair cross connection problems.

b) Results

In the Stormdrain Re-Monitoring Project, between September 7, 1999 until March 23, 2000, 24 trained community volunteers monitored 44 stormdrains in Courtenay, Comox, and Regional District Area A (Royston) and Area B (Queen's Ditch). Once a month, water samples taken from each site were tested for fecal coliform levels, pH, temperature, and conductivity. Visual observations were collected at all sites. In total, 256 samples were collected and tested from September 1999 to March 2000, and results were used to evaluate the progress resulting from municipal efforts to improve water quality.

Fecal coliform samples were collected in sterile "Whirl-Pak" bags or sterile plastic containers and taken directly from the storm drain stream (never at the base or pool of the drain). Other water quality parameters were tested in the field using portable instruments and kits (i.e. Hach kits). Fecal coliform sample results were tested locally by North Island Labs, as an in-kind contribution from the BC Ministry of Environment, Lands and Parks - Environmental and Resource Management. Results were also obtained through the Upper Island/Central Coast Community Health Services Society and tested in Vancouver.

Stormwater Quality in the Comox Valley – Results of Stormdrain Monitoring Programs from 1996 – 2000

Summary results tables were prepared for the City of Courtenay, Town of Comox, Royston and the Regional District Area B to summarize the human health and shellfish risk rankings at each site for 1995-1998 as compared to 1999-2000. The site rankings are designated based on the criteria outlined in the "Priority Human and Shellfish Contamination Rating System" (Table 1). The median count, maximum count and total number of samples collected are also presented in each table to show the comparison in fecal coliform counts between the monitoring periods.

Priority Human and Shellfish Contamination Rating System

*note: The following stormwater contamination rating system was developed through a wide literature review, and final ranking numbers were chosen by the Baynes Sound Round Table Monitoring Committee in 1996. Levels were chosen to account for dilution, and the risk of human or shellfish contact, and are in line with levels used by the Capital Regional District's rating system. This rating system has been used as the basis for comparing the data from the earlier monitoring project to data from the most recent project. Local municipal engineers have been encouraged to review the standards employed in this rating system standard, and ongoing discussion will address any concerns about the high levels represented in this system. *

The evaluation of stormwater discharges in this report incorporates a general public concern for human and shellfish health risks in the assessment of publicly monitored stormwater discharges. This rating system includes the following parameters:

- fecal coliform concentration;
- shellfish industry use of the shoreline adjacent to the discharge and;
- public use of the shoreline adjacent to the discharge.

The results collected through this program are ranked into high, medium or low priorities to guide remediative or corrective measures based on the following bacteriological criteria:

HIGH Priority Contamination Risk

1) A site which is located in a high use area where direct human contact is likely. This includes readily accessible discharges into swimming beaches, in neighborhood parks, playing fields and in or near dense housing and where fecal coliform counts were found to exceed 3000 CFU in more than 50% of the sampling events.

or

A site in which direct human contact is unlikely and fecal counts exceed 5000 CFU in more than 50% of sampling events.

2) A site that is discharging directly onto shellfish harvest sites where fecal coliform counts exceed 260 CFU in more than 50% of the sampling events.

or

A site discharging indirectly onto shellfish harvest areas with counts exceeding 1000 CFU in more than 50% of sampling events

MEDIUM Priority Contamination Risk

1) A site discharging into areas where human contact is likely and counts are greater than 200 CFU in more than 50% of sampling events.

or

A site that is not likely to have direct human contact (such as discharges onto farm land and inaccessible stream reaches), however, fecal coliform counts exceed 3000 CFU in more than 50% of the sampling events.

2) A site that is discharging directly onto shellfish harvest sites with fecal coliform counts exceeding 88 CFU in more than 50% of the sampling events.

LOW Priority Contamination Risk

1) A site where human contact is likely and with fecal coliform counts less than 200 CFU in more than 50% of the sampling events.

or

A site that is not likely to have human contact with counts less than 3000 CFU more than 50% of sampling events.

2) A site discharging directly onto a shellfish harvest site with fecal coliform counts less than 88 CFU in more than 50% of the sampling events.

or

A site in a location that will not likely impact shellfish health.

NO Contamination Risk

A site free of fecal coliforms.

Table 1: Priority Human and Shellfish Contamination Rating System

	Contact	High	Medium	Low
Human Use	Direct	>3000 CFU/100 ml In > 50% samples	>200 CFU/ 100 ml In > 50% samples	<200 CFU/ 100 ml In > 50% samples
Human Use	Indirect	>5000 CFU/100 ml In > 50% samples	>3000 CFU/100 ml In > 50% samples	<3000 CFU/ 100 ml In > 50% samples
Shellfish Use	Direct	>260 CFU/100 ml In > 50% samples	>88 CFU/ 100 ml In > 50% samples	<88 CFU/ 100 ml In > 50% samples
Shellfish Use	Indirect	>1000 CFU/100 ml In > 50% samples	--	--

The legend for the summary results tables is as follows:

Legend - ☐ Low Risk ☐ Medium Risk ☒ High Risk (for Human or Shellfish)

- Dash - Insufficient Data (less than 5 samples collected during monitoring period)

Blank Box – No data collected at the site during the monitoring period

CITY OF COURTENAY

Since 1996, the City of Courtenay has corrected a total of 74 sanitary sewer / storm drain cross connections. These repairs included both sewer pipes connected to stormdrain pipes, and stormwater infiltration of the sanitary sewer system. Of the 10 monitored drains with sewer cross connections, 5 indicated an improvement in water quality (improved ranking), 3 maintained the same ranking and there was insufficient data at two of the sites to indicate what change resulted (Table 2).

The study results indicate general improvements in urban stormwater quality in the City of Courtenay storm drains. In Courtenay, the human health and shellfish risk rankings at the monitoring sites either improved (at 5 of the 16 sites with both data periods) or remained the same (at 11 of the 16 sites). Improvements in health or shellfish rankings were only observed at sites where cross connection repairs occurred. However, there was also a general improvement observed in water quality. The medians and maximum fecal coliform counts decreased at the majority of sites (15 of the 16 sites with both data periods), indicating a general decrease in fecal coliform levels between the two periods. Although water quality appears to have improved, evidence of problems such as the presence of toilet paper, oils on the water surface, odors of gray water or volatile organic compounds still occur at some sites.

TOWN OF COMOX

The Town of Comox corrected a total of 8 sanitary sewer into stormdrain cross connections in 1997, and continues to "smoke test" drains to identify possible cross connections, particularly in new development areas¹. Although the exact locations for all of sanitary sewer cross connections in the Town of Comox are not known, the Town of Comox is committed to upgrading their storm drain system and addressing infiltration to both their sanitary and storm systems. In November 1996, at least one cross connection was repaired which discharged into Indian (or Carthew) Creek (Site 233). Results show that water quality has improved in the Creek between the two monitoring periods of this study (Table 3).

In Comox, the human health and shellfish risk rankings at the monitoring sites either improved (at 4 of the 10 sites with both data periods) or remained the same (at 6 of the 10 sites). The study results indicate general improvements in urban stormwater quality in the Town of Comox storm drains. The median fecal coliform counts decreased at the majority of sites (9 of the 10 sites with both data periods), indicating a general decrease in fecal coliform levels between the two study periods. The maximum fecal coliform counts also decreased at the majority of sites (7 of the 10 sites), reinforcing a general decrease in fecal coliform levels between the two study periods. Although water quality appears to have improved, evidence of problems such as the presence of oils on the water surface, odors of gray water or algal mats still occur at some sites.

¹ Fred Parkin, Town of Comox, pers.com., February 1998

Table 2: City of Courtenay Contamination Ranking of Storm Drain Effluents

Site/ Map	Site Description	Human Risk		Shellfish Risk		Median		Maximum		Total Samples	
		96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00
286 ²	Mid Airstrip Drain in Airfield Park	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1755	1500	3.3M	14.2K	18	7
466 ³	End of Nim Nim Place west of School Playfield	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1365	505	3750	2070	8	
283-2 ⁴	Larger Mansfield Drain on Right side	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	620	30	10K	125	11	7
463	Corner of McLaughlin & Centennial Drive	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1060	46	9170	306	8	7
601	Piercy Creek at the end of Willemar Ave	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>	-	1180	615	6570	1020	19	2
472	Behind 1267 Williams Road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2700	6	24K	179	9	7
477	10 th Street East across from Hobson Park	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	201	45	2970	840	9	7
496	Parking lot before Fish & Game Club on Rod & Gun Rd	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	43	7	9350	280	7	5
491	Culvert at Morrison Ck. under 1 st St bridge @ Willemar Rd	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	260	10	8000	460	7	7
284 ⁵	Drain at South end of Courtenay Airfield	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	38	40	7300	810	19	7
283-1 ⁶	Smaller Mansfield drain on left side	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	22	4400	52	8	7
490	Behind 5 Rod & Gun Road at Puntledge River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	100	44	1600	1110	8	7
473	Behind fence at 1003 Williams Road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	283	204	2400	3550	8	7
475	769 Chaster Road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	83	32	1840	1900	9	7
481	Muir Road at Southwest side of playground	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	162	44	1080	490	5	7
476	Back Road at 6 th Street East	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	34	51	840	394	7	7
462	Tunner and Back Road at corner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	410	14	1060	152	5	7

² Site 286 - 1999/2000 field observations indicate the presence of toilet paper and gray water odors.

³ Site 466 - 1999/2000 field observations indicate water surges at this site.

⁴ Site 283-2 - 1999/2000 field observations indicate the presence of oil on the surface, gray water and volatile organic compound odors.

⁵ Site 284 - 1999/2000 field observations indicate the presence of oil on the surface.

⁶ Site 283-1 - 1999/2000 field observations indicate the presence of oil on the surface and gray water odors.

Site/ Map	Site Description	Human Risk		Shellfish Risk		Median		Maximum		Total Samples	
		96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00
479	Drain Opposite 1180 Braidwood Ave	<input type="checkbox"/>		<input type="checkbox"/>		265		1550		7	0
461	Culvert South of Parking lot-Mex and Superstore		<input type="checkbox"/>		<input type="checkbox"/>		334		2100	0	7
600	Culvert at Base of 12-2040 20 th Street trailer park	-	<input type="checkbox"/>	-	<input type="checkbox"/>	185	20	360	41	2	5
470	Drain opposite 1880 Back Road	<input type="checkbox"/>		<input type="checkbox"/>		1		80		7	0
497	Left of 184A Archery Cres. Off 1 st Avenue	-	<input type="checkbox"/>	-	<input type="checkbox"/>	716	2	1410	26	2	5
492	Steel culvert at Morrison Creek on 1 st Street	-	<input type="checkbox"/>	-	<input type="checkbox"/>	1	2	1	13	2	7
468	Ditch at North end of Western Road	-	<input type="checkbox"/>	-	<input type="checkbox"/>	2050	5	2300	2200	4	6
467	Ditch at Corner of Dingwall Road and Northland Rd.	-	<input type="checkbox"/>	-	<input type="checkbox"/>	1200	34	1600	230	3	7
480 ⁷	Muir Road and McLaughlin	-	<input type="checkbox"/>	-	<input type="checkbox"/>	107	64	1320	1230	4	7
505	Courtenay River Drain at 5 th Street Bridge	-		-		1		27		3	0
505-A	Courtenay River Drain at base of Central Builders	-		-		19		26		2	0
506	Courtenay River Drain under 17 th Street Bridge	-		-		0		0		2	0
464	200 Back Road PVC drain parking lot	-		-		70		170		3	0
465	200 Back Road Steel Culver parking lot	-		-		565		1600		4	0
474	765 Williams Road	-		-		185		720		4	0
471	Drain .3km east of 1880 Back Rd at reflective posts	-		-		1		38		3	0
469	East of 1547 Dingwall, North side of road		-		-		52		870	0	3
601-1	Willemar Ave - concrete arch post 1999 construction		-		-		325		650	0	2
601-2	Willemar Ave - Blue plastic culvert		<input checked="" type="checkbox"/>		<input type="checkbox"/>		226		1010	0	5

Legend - ☐ Low Risk ☒ Medium Risk ☐ High Risk

- Insufficient Data (less than 5 samples)

Blank Box – No data collected

⁷ Site 480 -1999/2000 field observations indicate the presence of oils on water surface.

Table 3: Town of Comox Contamination Ranking of Storm Drain Effluents

Site/ Map	Site Description	Human Risk		Shellfish Risk		Median		Maximum		Total Samples	
		96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00
196 ^a	2 nd of two drains at base of Filberg Lodge	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1001	11	23K	300	19	7
194	Golf Course Creek at Jane Street	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	251	48	5580	250	12	7
233 ^a	Indian Creek or Carthew Creek	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	325	28	14K	360	10	7
195	1 st of two drains at base of Filberg Lodge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	99	8	4001	60K	19	7
222	Drain Below Pioneer Cemetery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20	20	350	48	11	5
229	Metal culvert under Ellis Street Lookout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	52	9	2200	1610	14	7
231	North of Edgewater Parking Lot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	55	16	470	1680	13	7
223	Drain at base of Manor Drive by cemetery stones	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	22	145	830	10	5
225	Comox shoreline at base of Grey House	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	44	9	610	40	10	5
226	Carthew Street storm drain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	49	54	182	707	5	7
192	Storm Drain at Black Fin Pub	<input type="checkbox"/>	-	<input type="checkbox"/>	-	30	81	6320	156	20	2
193	Drain at base of Pump Station on Jane Place	<input type="checkbox"/>	-	<input type="checkbox"/>	-	30	16	390	17	12	2
406	Waterfall culvert North of Balmoral at Brooklyn Creek	<input type="checkbox"/>		<input type="checkbox"/>		30		640	0	10	0
404	PVC Drain on North side of Balmoral Rd Brooklyn Ck	<input type="checkbox"/>		<input type="checkbox"/>		12		790	0	8	0
194.6	Drain at bridge on Golf Course Creek	-		-		190		271	0	2	0
194.5	Drain at North end of Golf Course Creek	-		-		36		84	0	3	0

Legend - ☐ Low Risk ☐ Medium Risk ☒ High Risk
 - Insufficient Data (less than 5 samples) Blank Box – No data collected

^a Site 196 -1999/2000 field observations indicate the presence of gray water odors and thick algal mats.

^a Site 233 -1999/2000 field observations indicate the presence of oils on water surface.

REGIONAL DISTRICT OF COMOX STRATHCONA - ROYSTON & AREA B

Monitoring ditch runoff in Royston and in Area B, which are rural and agricultural areas with on-site sewage disposal systems, provides vastly different information than monitoring storm drains in the urban areas of Courtenay and Comox, which are on municipal sanitary sewer systems. In this area, contamination is likely from septic system failures and agricultural inputs. Heavy rainfalls here can wash agricultural pollutants into the ditches and streams, particularly during the "first flush" rains of the year (usually in September or October). During the winter, septic systems that are not working well will more readily malfunction and have problems when water tables are high and the soils are saturated.













"The septic fields used in the rural waterfront areas of Baynes Sound are considered the most probable source of fecal contamination to the Sound, and certainly the source which has the greatest potential to increase and significantly impact the shellfish culture industry in the area."¹⁰ In the summer of 1996 proper septic care and maintenance education campaign workshops and pump-outs occurred in Royston and throughout Area A and B. In Royston, this campaign resulted in nine septic inspections and on-site septic system pumpouts. Fourteen on-site septic systems were inspected and pumped out in the Kilmarnock area, just south of Royston. Additional pumpouts occurred in the area, however exact figures are not known as records were not kept by septic maintenance companies after the project.

Monitoring in Royston indicated that there was an increase in fecal coliform levels (median and maximum count) at one of the two sites monitored during both data collection periods. The water quality ranking at site 365 (Base of 3855 Marine Drive) deteriorated to a medium health risk and a high shellfish risk (from a low health risk and medium shellfish risk) (see Table 4). Site 364 (Marine Drive at Grieg Road) maintained its low human and shellfish risk ranking. The median and maximum fecal counts did however, indicate a general improvement in water quality.

Results of monitoring in Area B at the Queen's Ditch and at Lazo marsh, collected insufficient fecal coliform samples for analysis of these sites. The monitoring at these locations was intended to track more general water quality conditions at these sites (i.e. dissolved oxygen, pH, conductivity). Please refer to the appendix of results for this information.

¹⁰ ESSA Technologies Ltd. 1996. Non-point Source Pollution in British Columbia: An Assessment of Environmental Impacts. BC Ministry of Environment, Lands and Parks. Page 103

Table 4: Royston Contamination Ranking of Ditch Water Quality

Site/ Map	Site Description	Human Risk		Shellfish Risk		Median		Maximum		Total Samples	
		96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00
365	Base of 3855 Marine Drive					127	280	8720	20K	10	7
342	Marine Drive South side Warren Road ditch					830		9230		6	0
364	Marine Drive at Grieg Road					71	61	11K	135	10	5
361	Roy Creek						81		7460	0	7
362	Marine Drive North on Forde Road Ditch	-		-		580		3460		3	0
363	Marine Drive South on Forde Road Ditch	-		-		1025		1950		2	0
341	Marine Drive North on Warren Road Ditch	-		-		0		0		4	0







Legend -  Low Risk  Medium Risk  High Risk
 - Insufficient Data (less than 5 samples) Blank Box – No data collected

Table 5: Regional District Area B - Contamination Ranking of Storm Drain Effluents

Site/ Map	Site Description	Human Risk		Shellfish Risk		Median		Maximum		Total Samples	
		96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00	96-98	99-00
620	Queen's Ditch at Point Lazo boat Launch	-	-	-	-	343	230	480	360	3	2
460	Drain entering Lazo marsh at Lazo Rd.		-		-		53		100	0	2

Legend -  Low Risk  Medium Risk  High Risk
 - Insufficient Data (less than 5 samples) Blank Box – No data collected

c) Summary

Samples were collected from municipal stormdrains and rural ditches between 1995 to 1998 as part of a multi-seasonal monitoring program where both dry (spring/summer) and wet (fall/winter) conditions are present. The 1999 to 2000 (comparison) monitoring program collected data during the wet weather period only (September 1999 to March 2000). This seasonally wet period captures data during a time when the heavy rainfall dependent "first flush" pollution events can occur, and also throughout the winter months when the water flows and possible dilution of contaminants are at their peak.

Despite this disparity in seasonal sampling times, the study results generally indicate improvements in urban stormwater quality in both the City of Courtenay and the Town of Comox storm drains in 1999 - 2000. In Courtenay and Comox, the human health and shellfish risk rankings at the monitoring sites either improved (at 35% of sites) or remained the same (at 65% of sites). The medians and maximum fecal coliform counts also decreased at the majority of sites, indicating a general improvement in water quality.

However, this does not mean that the work to repair sanitary sewer cross connections or to address other pollutants (i.e. chemical pollutants) entering municipal storm drains is over. Although sites may have lower fecal coliform counts, evidence of problems such as the presence of toilet paper, oils on the water surface, odors of gray water or volatile organic compounds still occur at some sites. Ongoing assessment and review of individual sites summarized in this report will determine the impact of sanitary sewer cross connection repairs to date, as well as identify future actions that could be taken to improve water quality.

This monitoring program also investigated water quality in rural ditches of Royston and in the Regional District of Area B. Monitoring in Royston indicated that there was an increase in fecal coliform levels (median and maximum count) at one of the two sites monitored. The water quality ranking at site 365 (Base of 3855 Marine Drive) deteriorated to a medium health risk and a high shellfish risk (from a low health risk and medium shellfish risk).

5.iii) COMOX HARBOUR MARINE MONITORING PROJECT:

From the 1930's until 1963, Comox Harbour was the major shellfish growing area in British Columbia. Japanese vessels full of oyster seed would arrive at the harbour to distribute seed stock over the 400 ha (960 acres) of excellent growing waters. After 1963, Comox Harbour was closed for direct shellfish harvesting due to bacteriological contamination, although stock could be relayed to other locations for cleansing before sale. Today, this closure status still exists, with harvesting allowed for depuration and relay only. Shellfish leases in the harbour are currently held by Strait Oyster Company, Raincoast Sea Farms and Baynes Sound Oyster Company.

a) Objectives

Historically, the objectives of early Comox Harbour marine monitoring programs, the "Identification of Fecal Bacterial Contamination Sources" (1995), and the "Identification of Shellfish Contamination Sources in Northern Baynes Sound" (1996), were to:

- Provide a continuous source of water quality sample results in the North Baynes Sound region, to develop a scientific baseline of Comox Harbour water quality;
- Analyse water samples from marine and freshwater inputs to aid in the identification of sources of contamination in Baynes Sound;
- Increase public awareness of water quality issues in the Comox Valley.

These objectives were intended to help meet a long term goal to upgrade classification of closed or restricted shellfish harvesting areas in Comox Harbour to allow direct harvesting, and to prevent any further shellfish harvesting closures in Comox Harbour.

The objectives of the 1999 / 2000 Comox Harbour Marine Monitoring Project were to:

- Provide comparative data from two consecutive winter seasons;
- Add corroborative marine water quality test results from Comox Harbour to concurrent monitoring data from storm drains in Comox, Courtenay, and Royston.

Data would be used to help determine the cumulative effectiveness of Baynes Sound remediation work, and to identify what additional remediation work is needed.

b) Results

During the 1999 / 2000 Comox Harbour Marine Monitoring Project, volunteers from the Canada Coast Guard Auxiliary Unit #60 sampled 6 Environment Canada sample sites every two weeks from January 6, 2000 to May 18, 2000. During this time, a total of 54 samples were tested at North Island Labs for fecal coliform levels.

Different volunteers from the 30-member Coast Guard Auxiliary formed the bi-weekly sampling crews, using their new Search and Rescue boat, the Bruce Brown II, to access the marine sample sites. Participation in the sampling program has provided the members of Unit #60 with the opportunity to support local clean water actions, and has provided them with valuable regular crew training time. These volunteers have made a tremendous contribution to this program – their work has made the collection of the samples possible.

For the 1999 / 2000 sampling program, project funding was provided by Community Futures Development Strathcona from May until November 1999, and by Environment Canada (GBEI) and the Ministry of Fisheries from January until May 2000. The data gathered during this period of time has been incorporated into a larger body of data (collected since May 1995), and has been included in the following analyses.

Monitoring Methods:

Canadian Coast Guard Auxiliary volunteers were trained in the field on proper aseptic sampling techniques. Data was collected on field survey forms, and the presence of possible contamination sources, such as vessels, birds or animals, was noted. "Grab samples" were collected in sterile "Whirl-Pak" bags or with sterile 100ml plastic bottles at an approximate depth of 15 cm (6 inches). All samples were collected at scheduled two week intervals during the ebb tide, approximately two hours after the high tide, when fresh and salt water mixing is at its peak. On the ebb, the surface current is flowing southward out of Comox Harbour and is accelerated by the runoff waters coming from the Courtenay River. According to Environment Canada monitoring staff, this is the optimal monitoring period for collecting samples, which measure land based pollution runoff.

From January 2000 until the end of May 2000, all marine samples were tested by North Island Laboratories in Courtenay. From 1995 to 1999, the majority of fecal coliform samples were processed according to Canadian Shellfish Sanitation Program criteria by North Island Laboratories in Courtenay, within 6 hours of marine sample collection. Seven sets of marine samples from 1995 – 1999 were processed by the Ministry of Health Laboratories in Vancouver within 24 hours of sample collection. As a result of the delayed sample processing, the following seven sets of samples did not meet Environment Canada Shellfish Sanitation Program criteria: June 6 1996, June 20 1996, July 16 1996, August 2 1996, August 19 1996, November 26 1996, and August 21 1997.

Monitoring Locations:

The six marine station locations in this study are those used by the Environment Canada Shellfish Sanitation Program, with the exception of site 20.5. Stations 11, 14, and 18 are located in active shellfish harvesting areas, where relaying and/or depuration is permitted. Station 20.5 and 25 are located in areas designated as prohibited for shellfish harvesting. Station 55, located on the south end of Goose Spit, is also closed for shellfish harvesting, however there are no leases currently held in this location.

Table 6 Marine Monitoring Locations

Station #	Site Location Description	Shellfish Classification
NBS 11	Comox Harbour between BS009 and cautionary spar	Closed/ relaying permitted
NBS 14	Harbour off flashing beacon	Closed/ relaying permitted
NBS 18	Comox Harbour between marina and southwest wharf	Closed/ relaying permitted
NBS 20.5	Comox Harbour at inner Goose Spit Bay	All harvesting prohibited due to bacteriological contamination
NBS 25	Comox Harbour at north arm of Gartley Point	All harvesting prohibited due to bacteriological contamination
NBS 55	Comox Harbour at Goose Spit off cement bunker	Closed/ relaying permitted, no shellfish leases in area

Comox Harbour Water Quality Monitoring **Marine Monitoring Results from 1995 – 2000**

Under the criteria of the Canadian Shellfish Sanitation Program, areas are closed for shellfish harvesting if the median fecal coliform level is greater than 14 MPN/100ml or the percentage of samples exceeding 43 MPN/100 ml is greater than 10%. Areas are prohibited for shellfish harvesting if the mean exceeds 88 MPN/100 ml or the percentage of samples exceeding 260 MPN/100 ml is greater than 10%. This ranking system is followed in the analysis of water quality data in this report.

Comox Harbour marine sampling programs have occurred as follows:

- May 31, 1995 – November 26, 1996
- February 10, 1997 – October 20, 1997
- November 23, 1998 – November 8, 1999
- January 6, 2000 – May 18, 2000.

The Comox Harbour bi-monthly monitoring program collected a total of 445 samples over a 48 month period from May 31, 1995 to May 18, 2000. Data is missing for 11 months from December 1997 to October 1998, and there is no funding to continue monitoring beyond May 2000.

Table 7. Summary of Samples Collected Per Year

Year	Total # of Samples	Average # Samples Collected at each Station per Year	Seasonal Sampling Notes
1995	65	14	Samples collected from May to December
1996	97	18	Samples collected from January to November
1997	102	17	Samples collected from February to October
1998	18	3	Samples collected for two months only – Nov & Dec
1999	109	18	Samples collected from January to November
2000	54	9	Samples collected for 5 months – Jan to May
TOTAL	445*		

note: Analyses were performed on data from samples gathered until March 3, 2000. Four additional samples from each site from March 3 – May 18, 2000 are not part of the results displayed in Table 8 - "Comox Harbour Marine Station Summary Report", Figures 1 - "Comox Harbour Marine Station Water Quality Report", Figure 2 - "Frequency of Samples Exceeding 43MPN/100ml", Figure 3 - "Seasonal Changes in Precipitation", and Figures 4 through 9 - "Median Fecal Coliform Levels."

These results are presented as raw data in Appendix 6.

Comox Harbour Marine Station Water Quality Report

May 1995 to May 2000 (bimonthly monitoring results)

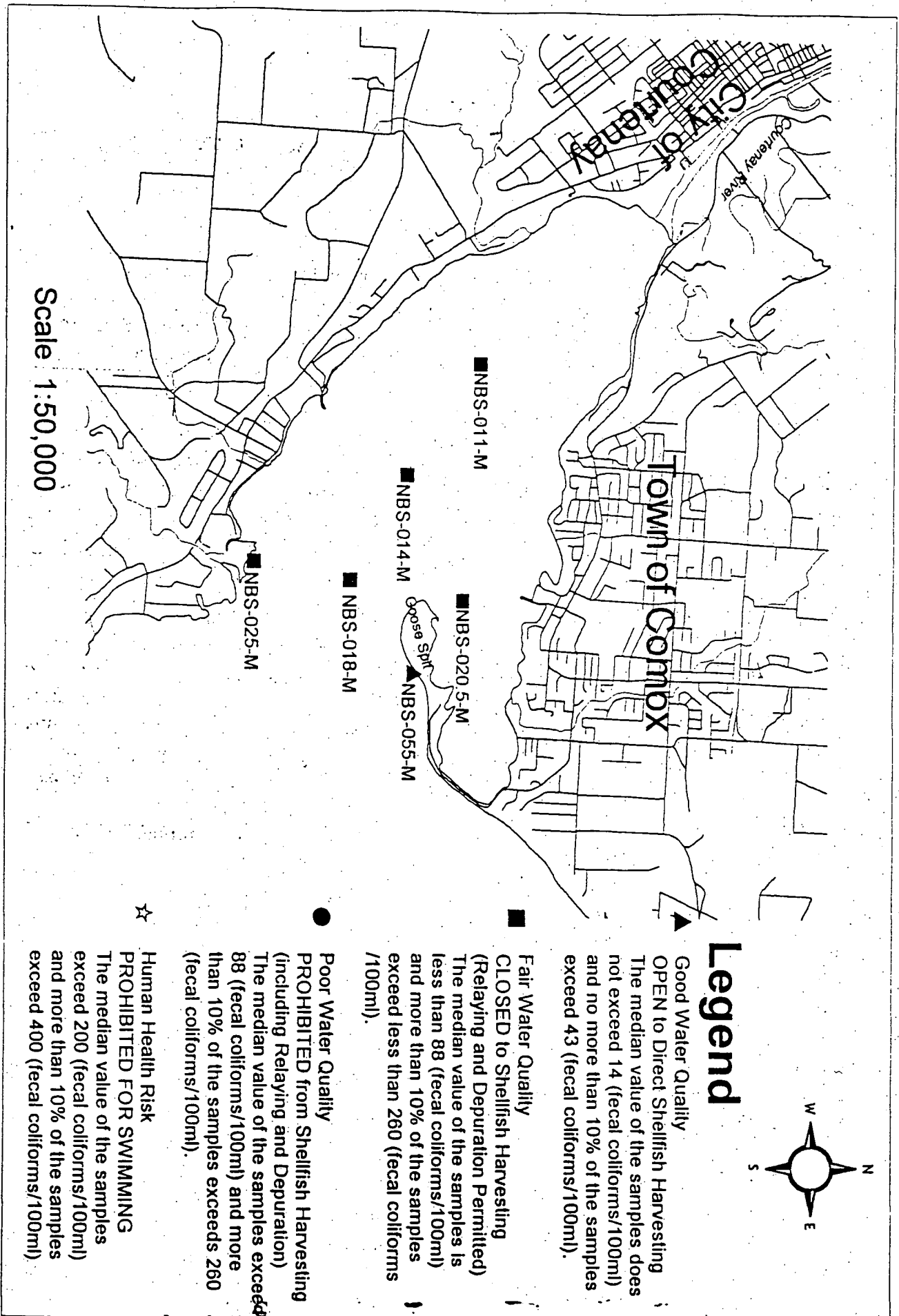


Figure 1 Comox Harbour Marine Station Water Quality Report

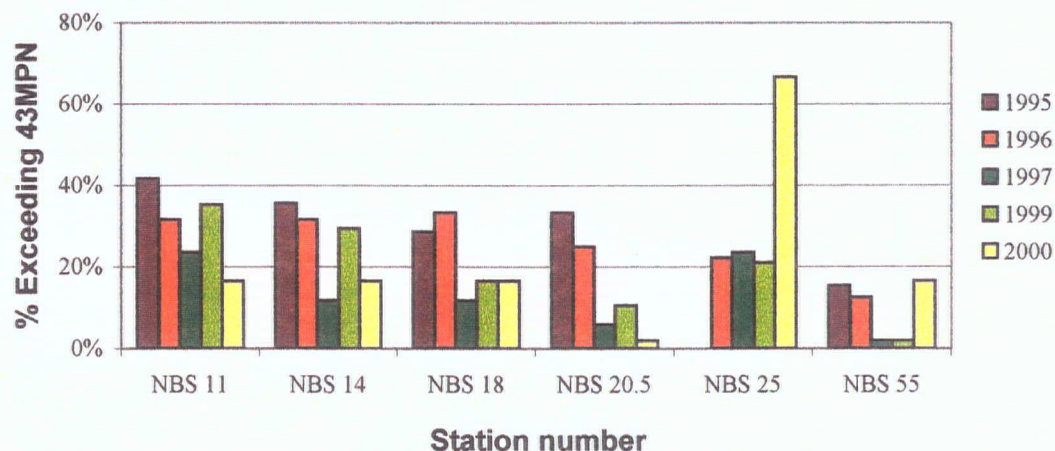
Results (illustrated in Table 8) indicate that the water quality is highest outside of the Comox Harbour (NBS 55), where the water exchange is greatest. At NBS 55, only 7% of samples exceed 43 MPN/100 ml. Water quality is lowest at the site closest to the Courtenay River (NBS 11, where 30% of samples exceed 43 MPN/100ml). At this site there is little water exchange and non point source pollution from urban runoff, stormwater and agricultural runoff may be found in greater concentrations here. Figure 1 summarizes the ranked water quality status at each station as it relates to the Canadian Shellfish Sanitation Program Guidelines.

Table 8 Comox Harbour Marine Station Summary Report *

Station	Total #	#>43 MPN	%>43 MPN	%>260 MPN	Min.	Max.	Median	Average	Std. Dev.
NBS 11	74	22	30%	5%	2	1600	20	89	225
NBS 14	76	20	26%	3%	2	1600	23	65	192
NBS 18	76	17	22%	3%	2	540	8	37	79
NBS 20.5	73	14	19%	5%	2	1600	11	65	208
NBS 25	54	15	28%	4%	2	920	24	55	131
NBS 55	74	5	7%	0%	2	170	5	16	31

Table 8 and Figure 1 illustrate that sites NBS 11, 14, 18, 20.5 and 25 have “fair” water quality. These sites have median values less than 88 MPN/100 ml, and no more than 10% of the samples exceed 260 MPN/100 ml. This area appears to have water quality that supports its existing closed status, with relaying and depuration permitted. Site NBS 55 is the only site with “good” water quality, where the median value for the samples does not exceed 14 MPN/100 ml and no more than 10% of the samples exceed 43 MPN/100 ml. This area appears to have water quality that is sufficiently clean to permit shellfish harvesting.

Figure 2 Frequency of Samples Exceeding 43MPN/100ml by year



Note: No samples were collected at NBS 25 in 1995. Data for 1998 is insufficient and is not shown. Data for 2000 is from January to March 2000 only and can not be considered representative of the multi-seasonal average shown in other years.

Figure 2 summarizes each site by year to illustrate the frequency of sampling results that exceeds 43 MPN/100ml. The data presented here shows a great deal of variability between years. A regression analysis was performed on the fecal coliform data, and the results indicated that there are no statistically significant trends at any of the sites.

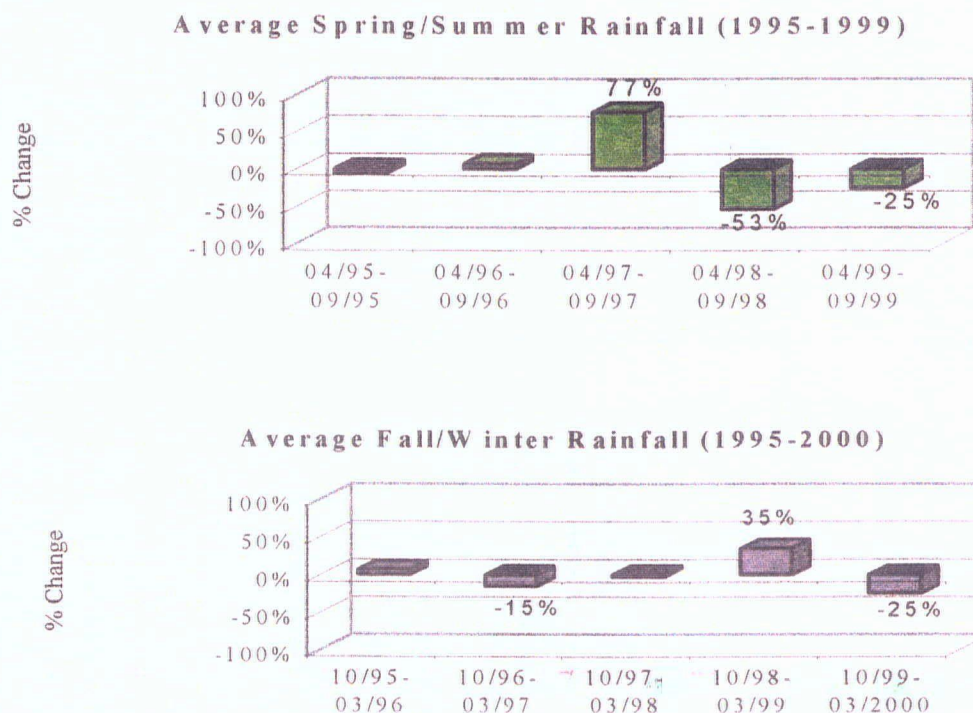
Due to the variable nature of fecal coliform data and the relatively short time period of this study, this report can only represent this water quality data through simple descriptive statistics. With a decade or more of consistent data, the parametric statistical significance tests of regression analysis (analysis of covariance) and Student's T-tests can be applied to indicate changes in water quality over time and the differences between sites. This longer time frame is needed to determine any statistically meaningful changes in water quality in the Comox Harbour.

PRECIPITATION DATA:

Precipitation is an important factor related to surface water quality. Higher pollution readings are experienced during the high rainfall seasons of fall and winter, when the movement of easily dissolved and eroded materials are readily transported.

The marine water quality data is analyzed here in relation to the daily precipitation totals (rain and snow), collected by Environment Canada's Atmospheric Environment Branch at its location on Point Lazo near the Comox Harbour. The percentage change in rainfall, illustrated in Figure 3, represents the comparison of total rainfall for each seasonal year, relative to the five year average. Figure 3 illustrates the seasonal precipitation to indicate if it was a relatively "wet" or "dry" season (15% greater or less than the five year seasonal average).

Figure 3 Seasonal Changes in Precipitation (1995-2000)



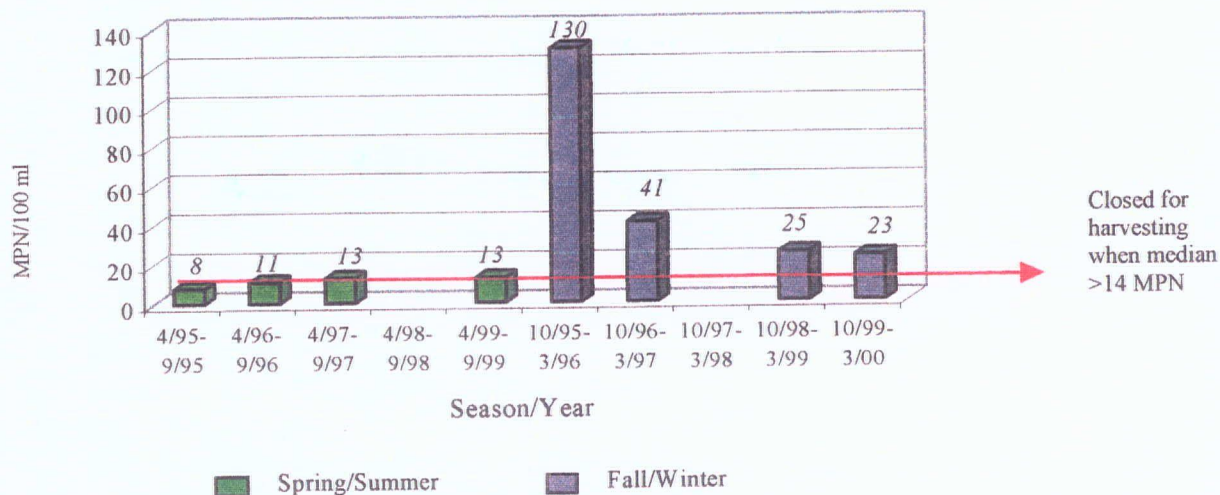
All six monitoring stations experienced the lowest median fecal coliform levels during the spring/summer seasons, when precipitation levels were also lowest. Sites 11, 18, and 55 consistently indicated median fecal coliform levels of less than 14 MPN during entire spring/summer monitoring seasons. In the fall/winter months, most sites indicated fecal coliform levels that exceeded the median of 14 MPN. Site 55, located outside of the harbour, where water quality is highest, indicated only one season and year (the fall/winter 1995) where median fecal coliform levels exceeded 14 MPN (with a seasonal median of 30 MPN/100ml).

Generally, the highest median fecal coliform season and year in the Comox Harbour was the fall/winter of 1995/96, during a relatively average seasonal rainfall period (Figure 5). Sites 11, 14, 18 and 55 experienced their highest fecal coliform levels, with median counts of 130 MPN, 49 MPN, 49 MPN and 30 MPN/100ml, at each site respectively during the fall and winter of 1995/96.

RESULTS BY SITE:

Site 11, located closest to the mouth of the Courtenay River, showed the highest median fecal coliform level of all sites during the fall / winter season of 1995, during an average rainfall season. This site consistently indicated median fecal coliform levels of less than 14 MPN during spring / summer monitoring seasons.

Figure 4 Site 11 – Median Fecal Coliform Levels (MPN/100ml)



Site 14, located in the middle of Comox Harbour, experienced the least amount of seasonal variability, with median fecal coliform levels exceeding 14 MPN in 3 of the 4 spring/summer years and all four of the fall/winter monitoring years. Changes in rainfall between seasons appear to have no influence on water quality at this site. During the “wettest” spring/summer season (77% above average), the site had the lowest fecal coliform median level of 13 MPN. During a relatively “wet” 1998/1999 fall/winter (35% above average), this site maintained a relatively consistent median fecal coliform level of 23 MPN/100ml.

Figure 5 Site 14 – Median Fecal Coliform Levels (MPN/100ml)

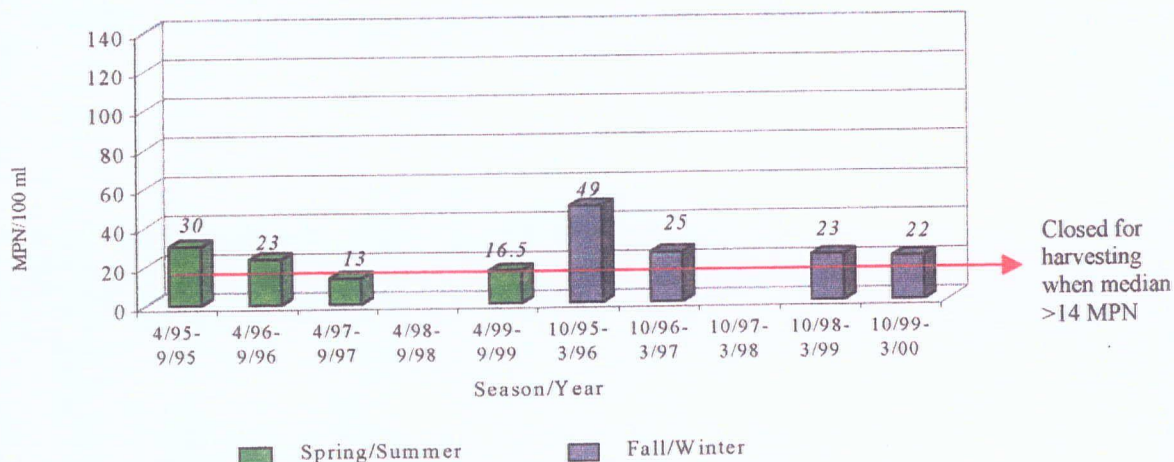


Figure 6 Site 18 - Median Fecal Coliform Levels (MPN/100ml)

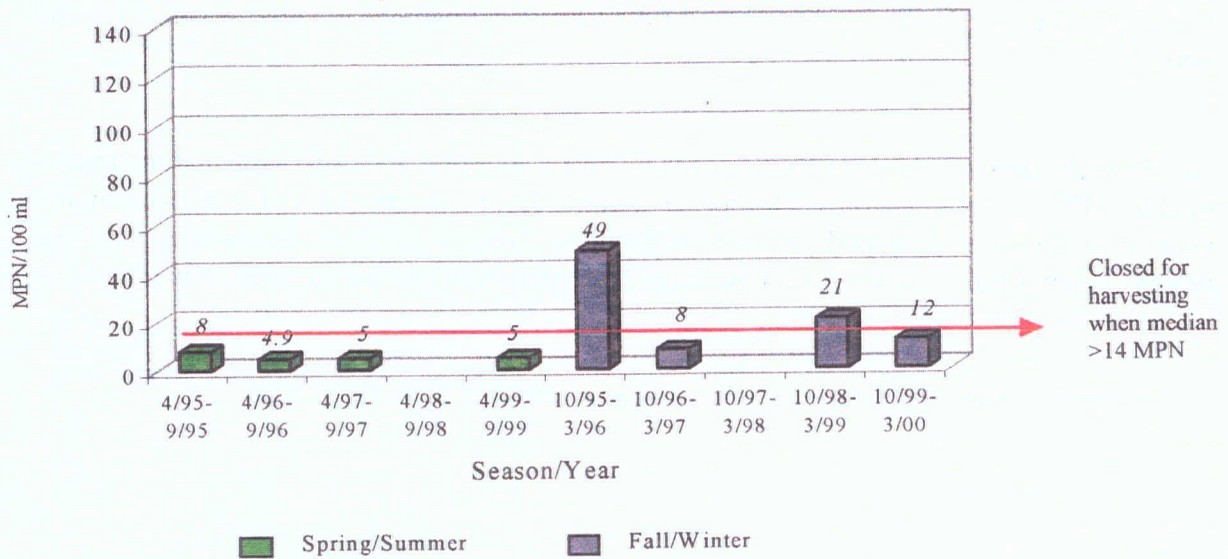
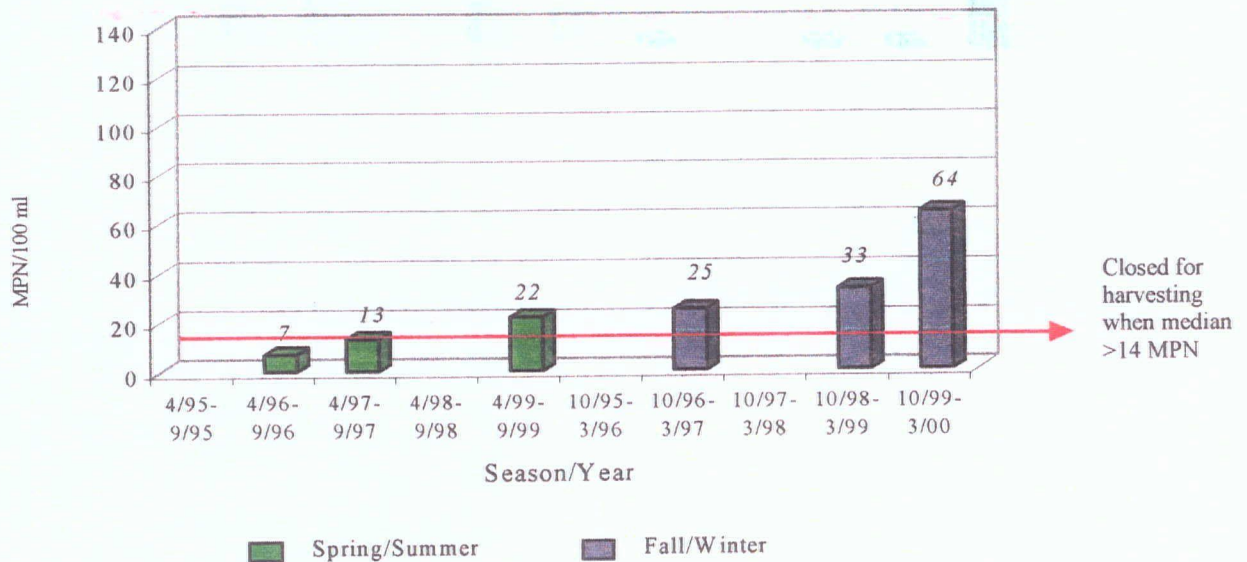


Figure 7 Site 25 - Median Fecal Coliform Levels



Site 18, indicates median fecal coliform counts with less than 14 MPN in most monitoring years and seasons. The two high fecal coliform count years were the fall/winter of 1995/96 (an average rainfall season) and fall/winter of 1998/99 (35% greater than average rainfall season), with 49 and 21 MPN/100 ml respectively.

Site 25, is the only site that indicates an increasing trend in median fecal coliform levels. The three monitoring seasons and years indicate a rise in coliform levels, with the highest level to date experienced in the fall/winter of 1999/2000 (which had a 25% less than average rainfall season).

Site 20.5 is the only site that experienced its highest median fecal coliform count during the lower rainfall spring/summer season. The highest median fecal coliform level of 30 MPN/100 ml was experienced in the spring summer of 1995 (during a relatively average seasonal rainfall period).

Site 55 is the only site located outside of the Comox Harbour. This site indicated the lowest median MPN levels of all sites. The spring/summer fecal coliform levels for the four monitoring years were consistently a median less than 5 MPN/100ml. The fall/winter seasons, also had relatively low fecal coliform levels, with the highest year being the fall/winter of 1995 (a relatively average rainfall year).

Figure 8 Site 20.5 - Median Fecal Coliform Levels (MPN/100ml)

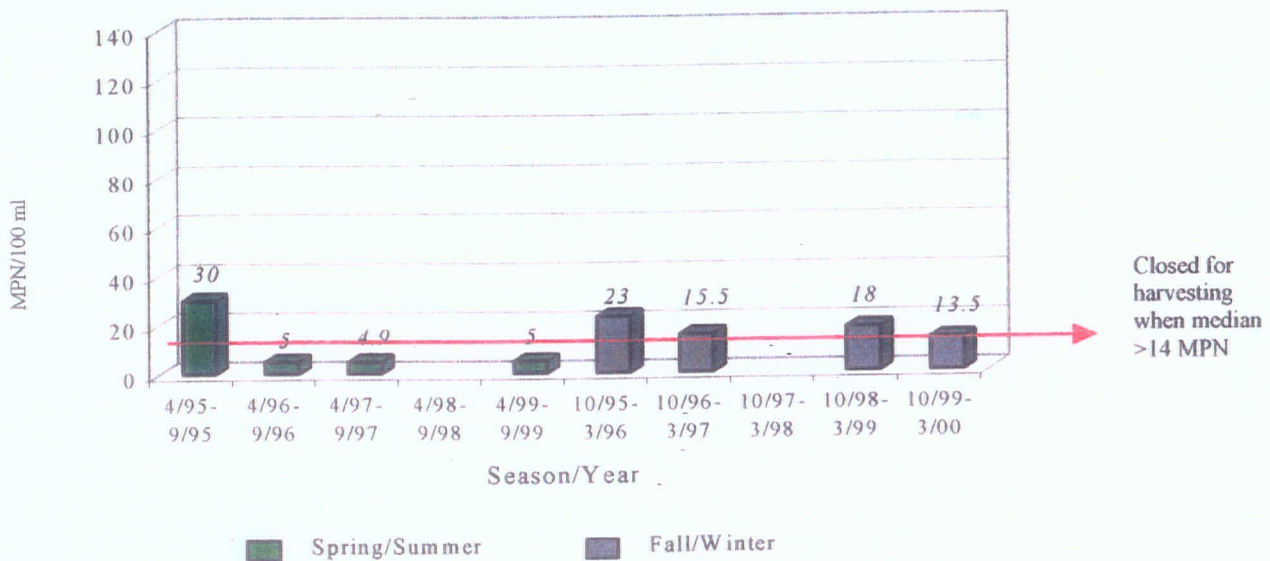
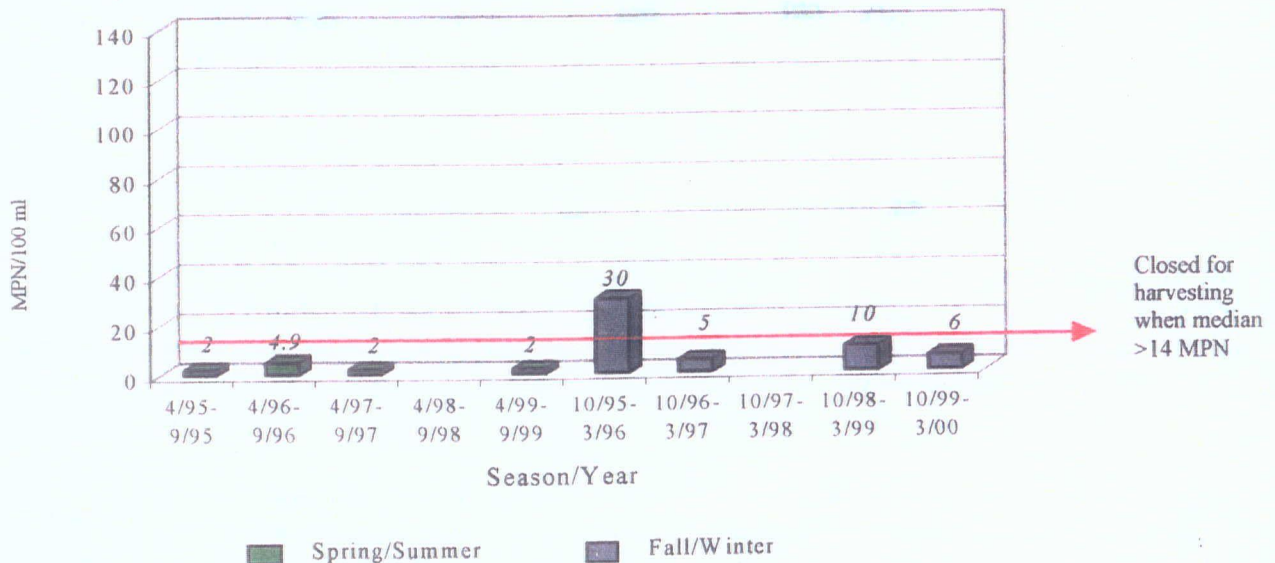


Figure 9 Site 55 - Median Fecal Coliform Levels (MPN/100ml)



CONCLUSIONS:

The water quality monitoring data collected at six sites in the Comox Harbour from May 1995-March 2000 indicate that the area is currently suitable for shellfish harvesting for purposes of relay or depuration, within its current closed status. However, Environment Canada has indicated that it will not open shellfish growing leases in Comox Harbour for direct harvesting at this time, due to its proximity to urban areas.

Test results show that fecal coliform levels are lower outside the Harbour, where water exchange is greatest. Fecal levels are more elevated at the sites closest to the Courtenay River, where there is little water exchange and where non-point source pollution from urban runoff, stormwater, boating and agricultural runoff would be most concentrated.

Generally, the highest median fecal coliform season and year in the Comox Harbour was the fall/winter of 1995/96, during a relatively average seasonal rainfall period. Only one site indicated an increasing trend in fecal coliform levels from the time sampling began until 2000. Site 25, located at the north arm of Gartley Point, was monitored over three years, with each consecutive year indicating an increasing median MPN level (indicating declining water quality).

A regression analysis was performed on the data and the results indicated that there are no statistically significant trends at any of the sites.

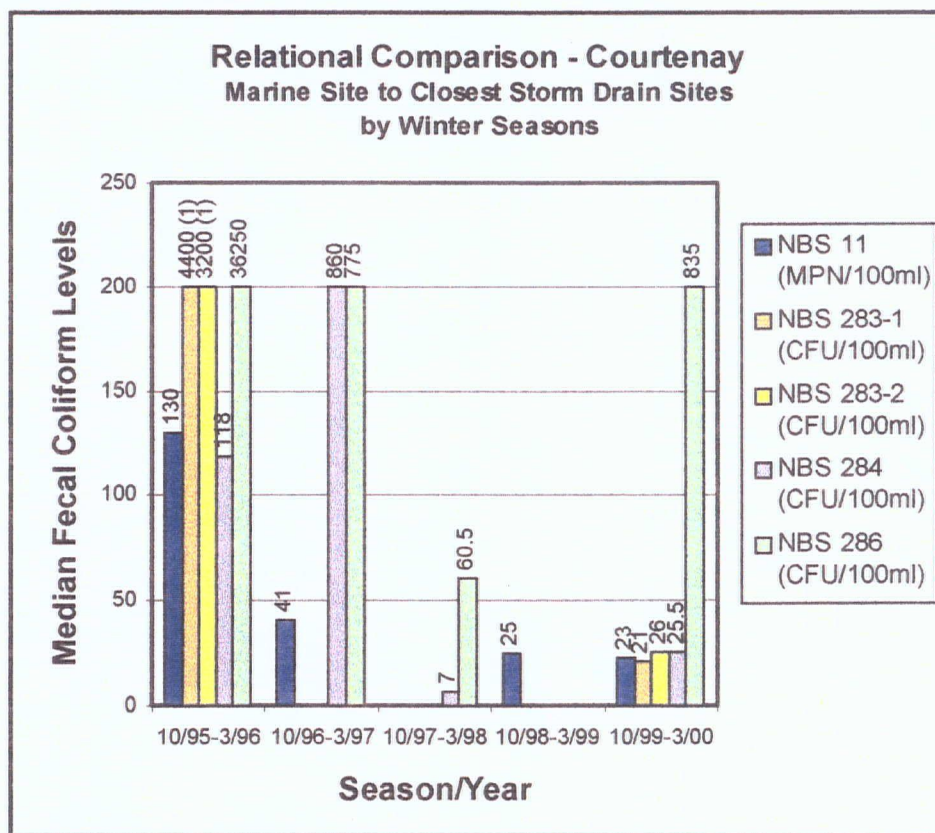
Comox Harbour Water Quality Monitoring

Relational Comparison of Marine and Stormdrain Results, 1995 - 2000

The following charts compare median fecal coliform results for winter seasons through the entire sampling period 1995-2000. A marine sampling site in both Courtenay and Comox was chosen for its proximity to possible municipal impact. Once the marine sites were identified, storm drain sites closest to the marine sites were chosen.

Because marine water quality testing uses the Most Probable Number (MPN)/100 ml method, and the storm drains water quality testing uses the fresh water test Colony Forming Units (CFU)/100 ml method, the values shown for each site are not directly comparable. Rather, the chart displays the overall trends of stormdrain and marine samples in the overall sampling period.

Figure 10 Relational Comparison – Courtenay

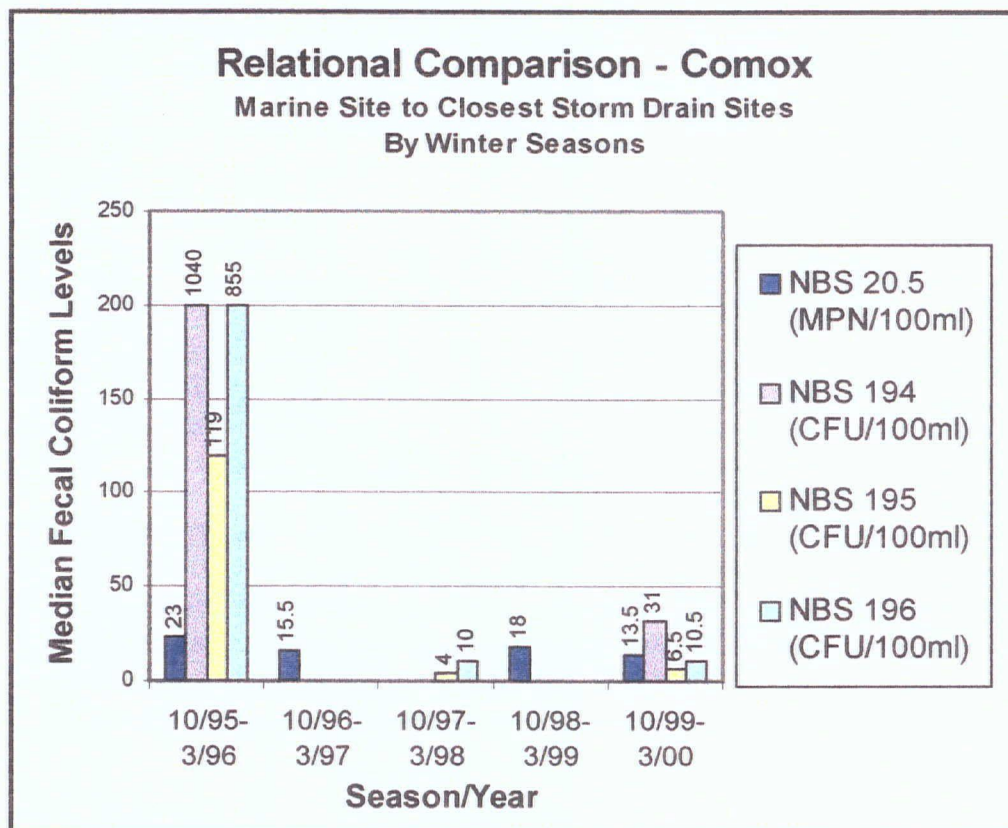


Note 1: Fecal coliform results from one sampling only

In the graph “Relational Comparison – Courtenay”, the overall pattern of the median fecal coliform counts shows a general decrease of fecal coliform levels in the marine and storm data collected during the test period, with somewhat erratic results appearing in storm drains NBS 284 and NBS 286.

The graph “Relational Comparison – Comox” shows a similar pattern of the highest median fecal coliform counts occurring during the winter of 1995/1996 in both the marine and storm drain data.

Figure 11 Relational Comparison – Comox



Two factors limited the direct comparison of results gathered from freshwater stormdrains in Courtenay, Comox and Royston with marine water quality test results from Comox Harbour. One limiting factor was the use of different testing units for fresh water and marine sampling. This made the numbers themselves not directly comparable. Another limiting factor was the absence of coordinated sampling times for marine and stormdrain sites. With the short life span of fecal coliform in salt water, results from different test dates were not directly comparable.

Although dissimilar measurement methods and sampling dates made direct comparison of marine and stormdrain tests impossible, these graphic displays of relational results indicate similar patterns of generally decreasing levels of fecal coliform levels in both marine and stormdrain samples.

c) Summary

Marine monitoring in Comox Harbour has provided multi-seasonal water quality data from Comox Harbour since May 1995. Due to the variability of hydrologic, meteorological and land management influences, and the relatively short time period of this study, this sampling program provides only general information on fecal coliform levels in Comox Harbour. It also provided a valuable community education component, opportunities for hands-on involvement in stewardship activities, and public awareness about water quality issues created through media coverage and promotion of the program in the community at large.

A key outcome of this project has been the understanding that ongoing multi-seasonal data collection is critical for statistically significant review of water quality conditions in Baynes Sound. Analysis that is statistically meaningful can only be performed on data gathered consistently over a long period of time. Ongoing funding for a comprehensive water quality sampling program in Comox Harbour would provide the means for long term data collection and review.

Although consistent sampling over a 10 – 20 year period would provide sufficient data for statistically significant analysis, this volunteer collected data is valuable as the most comprehensive public database of fecal coliform levels in north Baynes Sound. While Environment Canada's water quality testing program uses 5 consecutive samples tested annually to determine the status of the area's shellfish growing leases, the data compiled by Project Watershed, although insufficient for statistically valid analysis, offers the clearest seasonal perspective on general fecal coliform levels in Comox Harbour currently available.

Data from different winter seasonal periods (1995/96 and 1996/97; 1998/99 and 1999/2000) indicate that for all sites except Site 25, median fecal coliform levels were lower in 1996/97 (15% below average rainfall); than in 1995/96 (average rainfall). Site 25 sample results were not included for 1995/96. Further, median fecal coliform levels were lower for all sites except Site 25 in 1999/00 (35% above average rainfall) than in 1998/99, during a fall/winter season with 25% below average rainfall levels. Site 25 is the only site whose results indicate an increasing trend in median fecal levels.

A comparison of stormdrain and marine sampling datasets shows overall trends of the median counts for winter seasons. A general decrease is evident for most sites in both stormdrain and marine fecal coliform counts over the five year period. The decrease in the stormdrain results are considered to be due primarily to remediation work undertaken by the City of Courtenay and the Town of Comox in their stormdrain and sanitary sewer systems. The influences resulting in the decrease of the marine sampling are more varied, especially the sites impacted by upstream activity on the Courtenay River.

5. Financial Report

BC Ministry of Fisheries

The BC Ministry of Fisheries, Sustainable Economic Development Branch, contributed a grant of \$14,000 to the Comox Valley Project Watershed Society to support water quality stewardship work in Baynes Sound. Under the terms of the original Contribution Agreement, the monies were to be spent as follows:

- Coordination and technical analysis of water quality monitoring in the foreshore area of Baynes Sound in order to evaluate recent remediation efforts and to identify other pollution sources (**Stormdrain Re-Monitoring Project**) - \$5000;
- Baynes Sound water quality database analysis by GIS mapping and presentation methods to identify data trends and further delineate point and non-point pollution sources. (**Baynes Sound Restoration Actions Mapping Project**) - \$9000.

In November 1999, the original Contribution Agreement between Project Watershed and the Ministry of Fisheries was revised to allow reallocation of funds from the Baynes Sound Restoration Actions Mapping Project to the Stormdrain Re-Monitoring Project, and to the **Comox Harbour Marine Monitoring Project**, which was added at that time. At the same time, the term for the use of the funds was extended from December 1999 to March 31, 2000 to include the Comox Harbour Marine Monitoring Project.

Environment Canada – Georgia Basin Ecosystem Initiative

In December 1999, Environment Canada – Georgia Basin Ecosystem Initiative contributed \$1800 toward the implementation of the **Comox Harbour Marine Monitoring Project**.

In-Kind and Community Contributions:

Almost 46% of the total project budget was provided through in-kind and community contributions. Thanks are extended to North Island Labs, the BC Ministry of Environment, Lands and Parks, and the Upper Island Health Unit for providing support for testing water quality samples in the **Stormdrain Re-Monitoring Project**, to Odete-Pinho for her contribution to the final reports, to all the stormdrain sampling volunteers, and to the Canada Coast Guard Auxiliary #60 for the use of the "Bruce Brown II" and its crew.

The following spreadsheet shows the amended allocations and total project budgets, including contributions from the Ministry of Fisheries, Environment Canada – Georgia Basin Ecosystem Initiative, and in-kind contributions.

The project variance of \$62.05 has been balanced by a contribution from Project Watershed.

Final Financial Statement:

	TOTAL	BC MinFish	EC - GBEI	In-Kind		
REVENUES						
Mapping	\$6,250.00	6,250.00				
Stormdrains	\$19,366.25	6,750.00		12616.25		
Comox Harbour Marine	\$3,540.00	1,000.00	1800.00	740.00		
Community In-kind	\$0.00					
Total Contributions	\$29,156.25	14,000.00	1,800.00	13,356.25		
EXPENDITURES						
Mapping						
Wages / Benefits	2,149.27	2,149.27				
Contractors	2,463.40	2,463.40				
Rent	350.00	350.00				
Telephone	50.00	50.00				
Administration	889.00	889.00				
	5901.67	5901.67	0	0		
Stormdrain						
Wages / Benefits	8,549.12	4,180.12		4369.00	* note 1	
Contractors	2,189.00	1,589.00		600.00	O. Pinho	
Materials & Supplies	7,510.11	362.86		7147.25	* note 2	
Equipment	657.73	157.73		500.00	P W	
Travel	134.30	134.30				
Rent	200.00	200.00				
Telephone	25.00	25.00				
Administration	511.00	511.00				
	19,776.26	7,160.01	0.00	12,616.25		
Comox Hrbr Marine						
Wages / Benefits	1,212.81	315.19	897.62			
Contractors	360.00			360.00		
Materials & Supplies	1,162.56	685.38	477.18			
Equipment	380.00			380.00		
Travel	175.00		175.00			
Administration	250.00		250.00			
	3,540.37	1,000.57	1,799.80	740.00		
Total Cash Expenditures	15,862.05	14,062.25	1,799.80	13,356.25		
In-Kind Contributions	13,356.25					
Total Project Expenses	\$29,218.30					
Variance	-\$62.05					
Note 1	sampling volunteers		25 vltrs x 14 hrs x \$10	3500.00		
	UICC consultation		4 hrs @ \$35/hr	140.00		
	North Island Labs		14.6 hr @ \$50/hr	729.00	4369.00	
Note 2	North Island Labs		lab fees	1,137.50		
	UICC		lab fees	2025.00		
	MELP		lab fees	3984.75	7147.25	

Appendices

1. Baynes Sound Restoration Actions Map and Table
2. Stormdrain Sampling Volunteers
3. Stormdrain Sample Site Maps
4. Stormdrain Water Sample Data – July 1995 to March 2000
5. Stormdrain Water Sample Form
6. Comox Harbour Marine Sampling Volunteers
7. Comox Harbour Marine Water Sample Data – May 1995 to May 2000
8. Comox Harbour Water Sample Form

Appendix 1

Baynes Sound Restoration Actions Map and Table

PROJECT WATERSHED

Comox Valley Project Watershed Society
Box 3007
Courtenay, BC V9N 5N3
Phone: (250) 339-1619 Fax: 339-9619
watrshed@mars.ark.com

June 27, 1999

Please find attached a Draft map and table of "Baynes Sound Restoration Actions for 1995-1998". The purpose of this map is to show water quality improvement actions on an ArcView map (1:50,000 scale). This past month, Environment Canada has been in the Baynes Sound collecting water quality samples for a review of shellfish harvesting classifications. This map shows restoration activities (such as agricultural fencing improvements, septic system repairs / alterations, and sewage cross connection repairs etc.) which may have created improvements in water quality that can lead to shellfish reclassifications (ie. reopening existing closed, or conditionally closed, shellfish harvesting areas).

This map represents the enormous amount of energy that has been directed to improving water quality in the region. Thank-you for your contributions to creating a healthy and clean Baynes Sound.

In the table there is a need to define the difference between the terms septic 'alteration' and septic 'repair'. A septic 'repair' is undertaken to repair a malfunctioning on site sewage disposal system. A septic 'alteration' is undertaken to alter an existing sewage disposal system. The system is reviewed by the Health Services Society at that time for any malfunction and any new work on the sewage disposal system is brought to today's standards.

If you wish to get more specific facts on the remediation actions referred to in the table, I have listed the sources of information here (alphabetically). The 53 sewage cross connection repairs undertaken by the City of Courtenay are listed in reports managed by Dennis Hendersen at the City Public Works Department or by Kevin Lagan, the City engineer. Janine Stacey at Fanny Bay Oysters compiled a list of 32 remediation activities. The report is titled "Baynes Sound Section C Pollution Abatement and Remediation" which lists regional influences and site by site remediations. Dave Cherry, Environmental Health Officer at the Health Services Society compiled a list of 120 septic repairs and alterations in the Baynes Sound Region from 1996 to 1999. The information on the Lone Pine Farm was provided by Bill Health at the Ministry of Fisheries. Biologist, Vance Liponski reported on the water quality improvements of Mac's Oyster Company. The manager of Maple Guard Resort, Jenny, reported on their switch to exclusive pump and haul. Fanny Bay Oysters report titled "Baynes Sound Section C Pollution Abatement and Remediation", reported on the water quality improvements at the Manson's, Ministry of Forests, Omega Salmon Farm, Pacific Reef Oysters, Pepperland Resort, Polden's and the Rosewall Log Sort. Project Watershed's livestock fencing and revegetation activities are documented in the following two reports: "The Baynes Sound Hot Spots Remediation Project Agricultural Component Report April-October 1997" and "Comox Valley Agricultural Program 1998 Final Report". The Town of Comox contact for information on sewage cross connection repairs is Glen Westenthorp. Finally, Keith Reid, with the Deep Bay Harbour Authority, reported on the pumpout facility planned for December 1999.

If you find any errors in this map and table or if you wish to add additional information please do not hesitate to contact me at 339-1619. Thank you for your assistance.

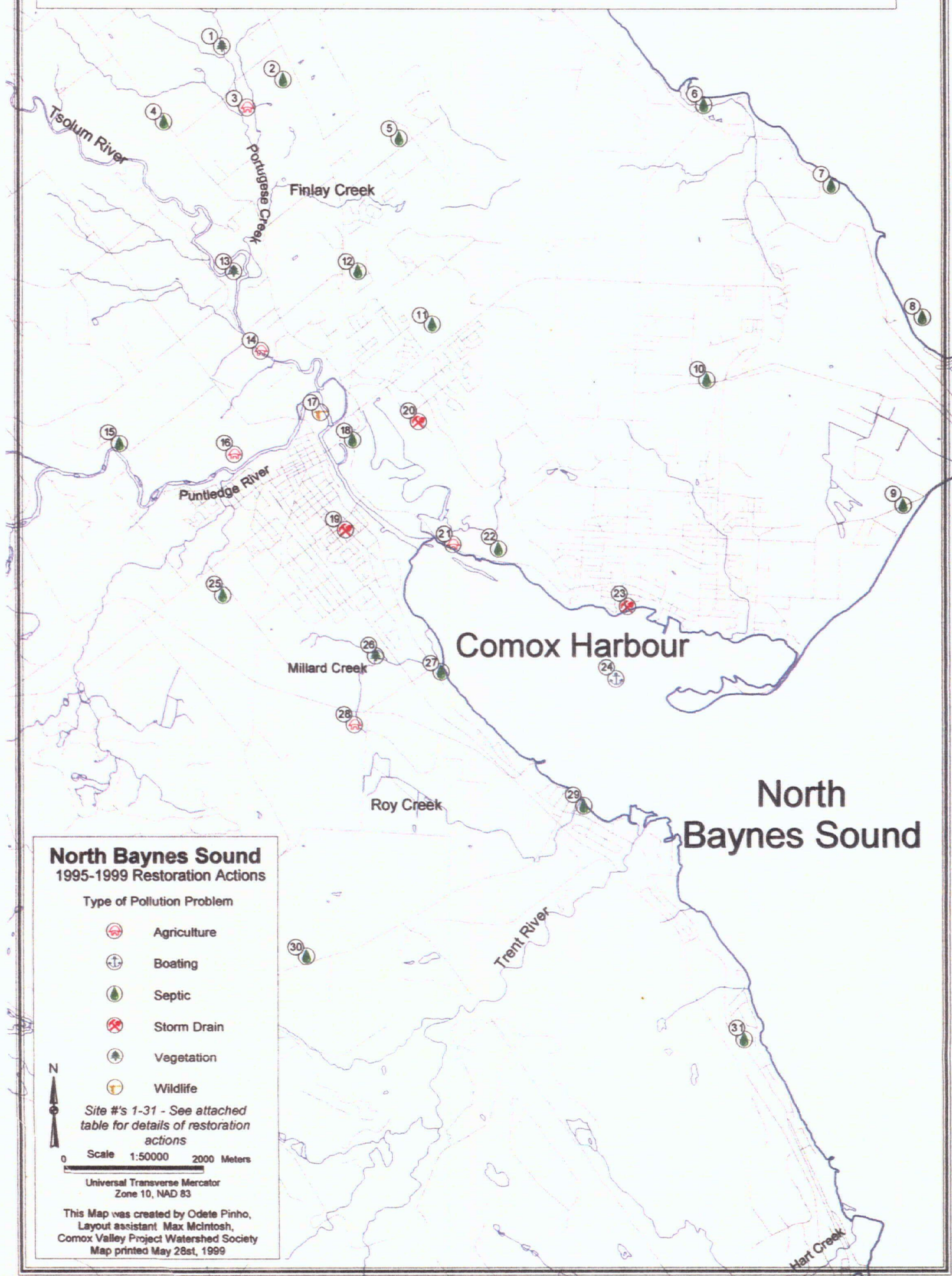
Sincerely, Odete Pinho



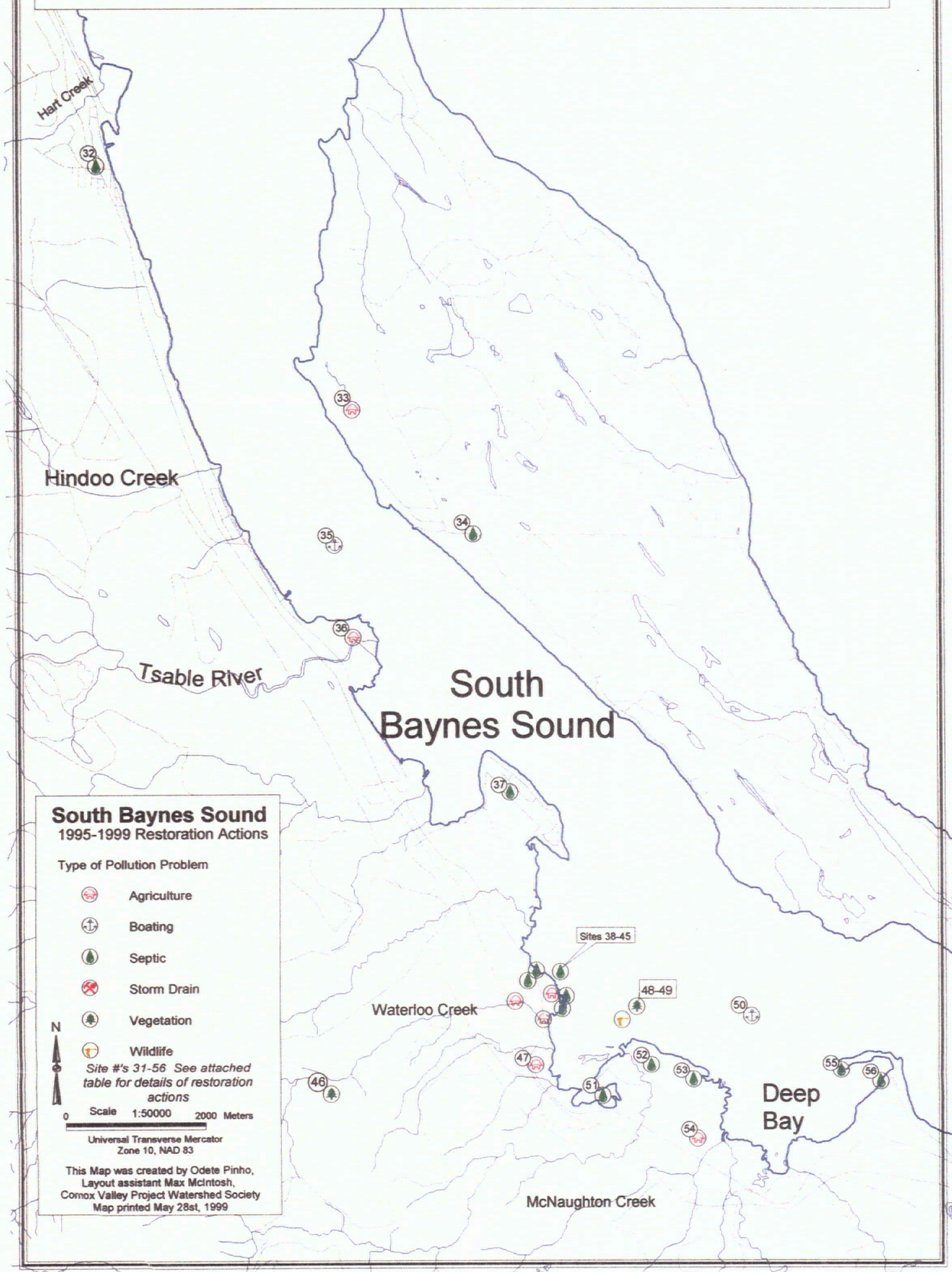
Baynes Sound Restoration Actions 1995-1999

SITE	TYPE	Remediation Action Undertaken	POLLUTION PROBLEM	SOURCE OF INFORMATION	DATE	LOCATION OF ACTION	WATERSHED
1	Vegetation	2058 trees planted	riparian filter & protection	Project Watershed	1997-98	various - see reports	Portuguese & Finlay Creeks
2	Septic	2 septic systems altered	see definition of alteration	Health Services Society	1996-1999	Nlh, Island Hwy Sunnydale area	Portuguese & Finlay Creeks
3	Agriculture	7335 feet of fencing & 1 bridge	118 cattle, 9 horses access	Project Watershed	1997-98	various - see reports	Portuguese & Finlay Creeks
4	Septic	7 septic repairs & 10 alterations	see definition of repair & alteration	Health Services Society	1996-1999	Headquarters Road area	Tsolum River & Portuguese Ck
5	Septic	1 septic system repair	see definition of repair	Health Services Society	1996-1999	Huband Road	Finlay Creek
6	Septic	4 septic repairs & 2 alterations	see definition of repair & alteration	Health Services Society	1996-1999	Little River/ Ferry Terminal	Little River
7	Septic	3 septic repairs & 4 alterations	see definition of repair & alteration	Health Services Society	1996-1999	Kin Beach	Kin Beach
8	Septic	1 septic repair & 1 alteration	see definition of repair & alteration	Health Services Society	1996-1999	Kye Bay Road	Kye Bay
9	Septic	6 septic repairs & 5 alterations	see definition of repair & alteration	Health Services Society	1996-1999	Yates Rd, Curtis Rd, Andrew	Pl. Holmes
10	Septic	1 septic repair & 2 alterations	see definition of repair & alteration	Health Services Society	1996-1999	Daye Rd, Hudson Rd	Brooklyn Creek
11	Septic	2 septic repairs	see definition of repair	Health Services Society	1996-1999	Ryan Rd	Comox Estuary
12	Septic	5 septic repairs	see definition of repair	Health Services Society	1996-1999	N Island Hwy	Comox Estuary
13	Vegetation	772 trees	riparian filter / protection	Project Watershed	1997-98	various - see reports	Tsolum River & Tributaries
14	Agriculture	8174 feet of fencing & 1 manure pile	26 horses 165 cattle 200 chickens	Project Watershed	1997-98	various - see reports	Tsolum River & Tributaries
15	Septic	3 septic alterations	see definition of alteration	Health Services Society	1996-1999	Plateau Rd	Puntledge River
16	Agriculture	2000 feet of fencing	350 cows fenced- river access	Project Watershed	1998	various - see reports	Puntledge River
17	Wildlife	50 seals culled	wildlife source of fecal	Fisheries and Oceans Canada	1998	Puntledge/Courtenay River	Puntledge River
18	Septic	1 septic repair	see definition of repair	Health Services Society	1996-1999	Comox Road	Courtenay River
19	Storm Drain	25 sewage connections fixed	cross-connected drains	City of Courtenay	1996-1998	various - see reports	West Courtenay -various
20	Storm Drain	28 sewage connections fixed	cross-connected drains	City of Courtenay	1996-1998	various - see reports	East Courtenay - various
21	Agriculture	1700 feet fencing + 170 trees	50 cattle fenced+ riparian vegetation	Project Watershed	1998	2750 Comox Road	Comox estuary
22	Septic	3 septic alterations	see definition of alteration	Health Services Society	1996-1998	Comox & Cummings Rd	Comox estuary
23	Storm Drain	7 sewage connections fixed	cross-connected drains	Town of Comox	1996	various harbour discharges	Comox estuary
24	Boating	herring fishery restructure	now fishers out <48hrs pre-opening	Fisheries and Oceans Canada	1997-98	Baynes Sound various	Baynes Sound
25	Septic	1 septic repair & 6 alterations	see definition of repair & alteration	Health Services Society	1996-1998	Alden, Maiden, Lake Trail	Piercy Ck and Morrison Ck
26	Vegetation	3280 trees and shrubs	riparian filter and cover	Project Watershed	1998	various - see reports	Roy & Millard Creeks
27	Septic	3 septic system repairs	see definition of repair	Health Services Society	1996-1998	Fraser and Sandpiper Rd	Millard Creek
28	Agriculture	1330 feet of fencing	50 cattle & horses fenced	Project Watershed	1998	various - see reports	Roy & Millard Creeks
29	Septic	8 septic repairs & 2 alterations	see definition of repair & alteration	Health Services Society	1996-1998	Royson Rd, Ross, Island Hwy	Oceanfront and Roy Ck
30	Septic	1 septic system alteration	see definition of alteration	Health Services Society	1996-1998	Cumberland Rd	Trent River
31	Septic	2 septic repairs & 2 alterations	see definition of repair & alteration	Health Services Society	1996-1998	Kilmarock, Arran, Montrose	Oceanfront, Kilmarock area
32	Septic	2 septic system repairs	see definition of repair	Health Services Society	1996-1998	Tappin Rd, McLeod Rd	Oceanfront Union Bay
33	Agriculture	livestock relocated from forestore	see definition of repair & alteration	Lone Pine Farm	1996	Northwest Rd, Denman Is	Oceanfront Denman Island
34	Septic	6 septic repairs & 2 alterations	see definition of repair & alteration	Health Services Society	1996-1998	Central, Lacon, Northwest R.	Oceanfront Denman Island
35	Boating	holding tank but effluent still discharged	ferry discharges raw sewage	BC Ferries	1997	ferry crossing Baynes Sound	Baynes Sound
36	Agriculture	relocating cattle & fencing	20 cattle at foreshore	Mac's Oyster Co.	1995	7162 S. Island Hwy.	Tsable River & foreshore
37	Septic	2 septic repairs & 6 alterations	see definition of repair & alteration	Health Services Society	1996-1998	Ships Pt, Tozer, Cougar S	Oceanfront Ships Point
38	Septic	decommissioned failing septic	closed campground etc at site	Pacific Reef Oysters	1993	S. Island Hwy.	Fanny Bay oceanfront
39	Septic	relocated pigs/geese 900 ft away	7 pigs +5 geese fenced	Fanny Bay Oysters	1996	8271 S. Island Hwy.	Waterloo Ck / Oceanfront
40	Septic	septic upgrade	2 new holding tanks	Fanny Bay Oysters	1996	8260 S. Island Hwy.	Baynes Sound
41	Agriculture	manure pile removed	no more livestock	Fanny Bay Oysters	1998	8259 S. Island Hwy.	Baynes Sound
42	Septic	septic upgrade	increased holding capacity	Fanny Bay Oysters	1996	8233 S. Island Hwy.	Baynes Sound
43	Agriculture	no livestock now	approx. 20 chickens	Podens	1996	8331 S. Island Hwy.	at railway cross-Waterloo Ck
44	Agriculture	20x40 feet manure pad	manure for organic farm	Project Watershed	1998	8329 S. Island Hwy.	Fanny Bay oceanfront/Waterloo
45	Septic	septic upgrade	2 new holding tanks	Pepperland Resort	1995	8256 S. Island Hwy	Baynes Sound
46	Vegetation	replanted clearcut	1000 acre clear cut in 1990	Ministry of Forests	1992-93	Mud Bay uplands	Waterloo Creek
47	Agriculture	removed chickens	approx. 30 chickens	Mason's	1997	8230 S. Island Hwy.	Baynes Sound
48	Vegetation	paved dryland sort	reduced debris / wood waste	Rosewall Log Sort	1995	8392 S. Island Hwy.	Mud Bay
49	Wildlife	increased log sorting operations	no logboom space for sealions	Fisheries and Oceans Canada	1996	8392 S. Island Hwy.	Mud Bay
50	Boating	herring fishery restructure	now fishers out <48hrs pre-opening	Fisheries and Oceans Canada	1997-98	Baynes Sound	Baynes Sound
51	Septic	septic tank and field replaced	failing septic field	Fanny Bay Oysters	1995	Curran Road	Slough at Mud Bay
52	Septic	modified discharging of waters	flooded septic fields	Omega Salmon	1993	8470 Berray Rd, Fanny B.	Rosewall Creek
53	Septic	1 septic system alteration	see definition of repair & alteration	Health Services Society	1997	Berray Rd	Oceanfront Mud Bay
54	Agriculture	1800 feet of fencing	25 cattle fenced	Project Watershed	1997	8901 S. Island Hwy.	McLaughlin Creek
55	Septic	pumpout facility & bathrooms	lack of facilities for locals	Harbour Authority	for Dec 99	Deep Bay	Deep Bay
56	Septic	exclusively pump and haul	1000 gallon failing septic	Maple Guard Resort	1995	Deep Bay	Deep Bay

Baynes Sound Restoration Actions 1995-1999



Baynes Sound Restoration Actions 1995-1999



Appendix 2

Stormdrain Sampling Volunteers

Storm Drain Water Quality Monitoring Volunteer List

The following citizens volunteered to collect the samples and data that facilitated the monitoring of the stormdrains in Courtenay, Comox, Royston and Area B in the Regional District of Comox-Strathcona. These dedicated volunteers ventured out regardless of the weather, once a month for seven months September 1999 through March 2000.

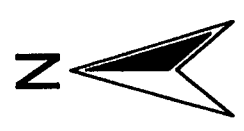
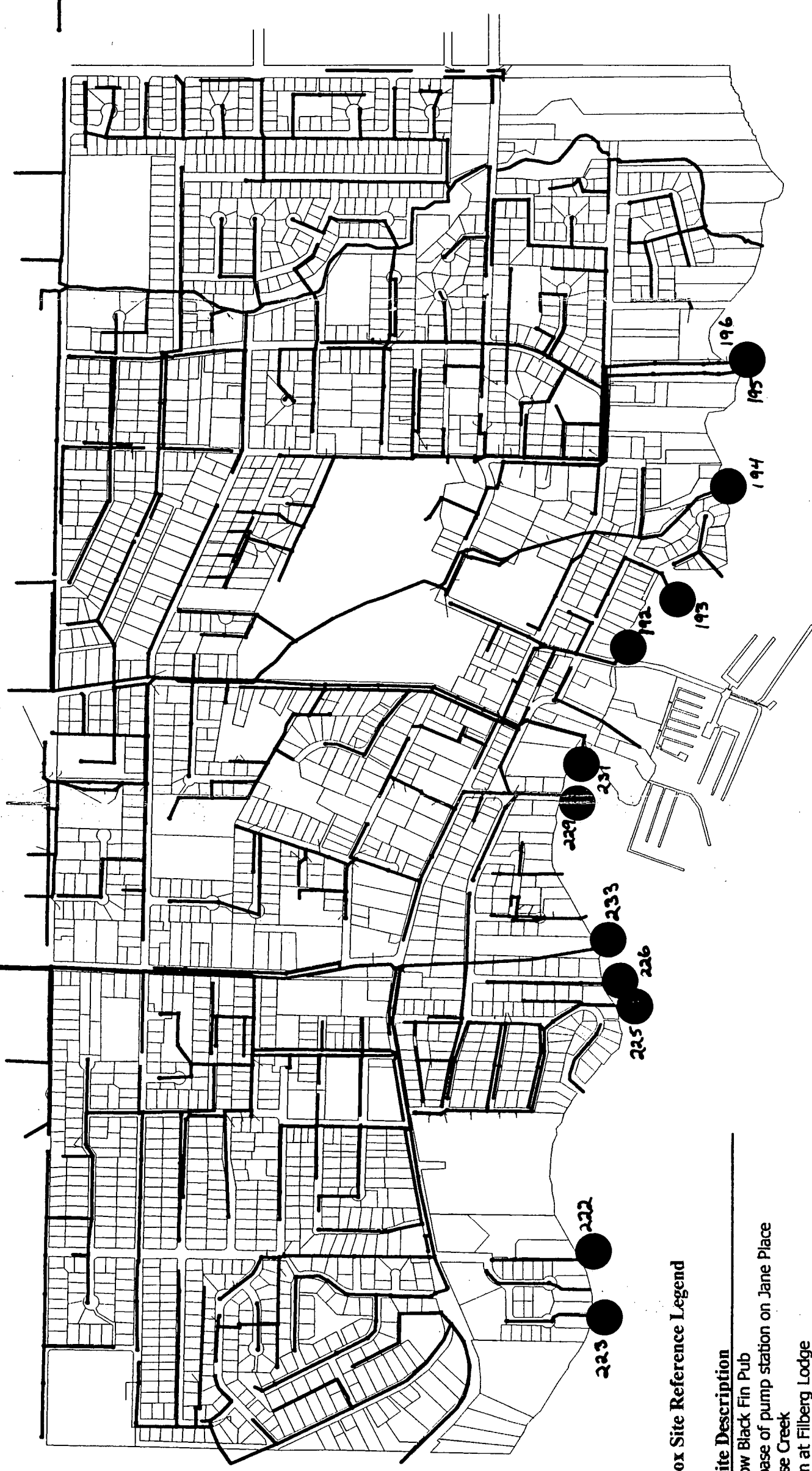
Danielle Bilodeau
Stephanie Caspersen
Grant Compton
Joan Compton
Derek Harris
Joan Harris
Mary Harris
Bill Heath
Valerie Heath
Andy Hyland
Hans Kroemer
Alexis Masterton
Cam Masterton
Wendy Masterton
Heather Mathers
Brenda Norris
Myra Page
Terry Papiernik
Kathy Penner
Russ Petersen
Dave Radford
Heidi Tobiassen
Allison Tremain
Harry Wright

Coordination of the volunteers was done by Chris Bruels of Project Watershed.

Appendix 3

Stormdrain Sample Site Maps

South Comox Storm Drain System, March 1, 2000



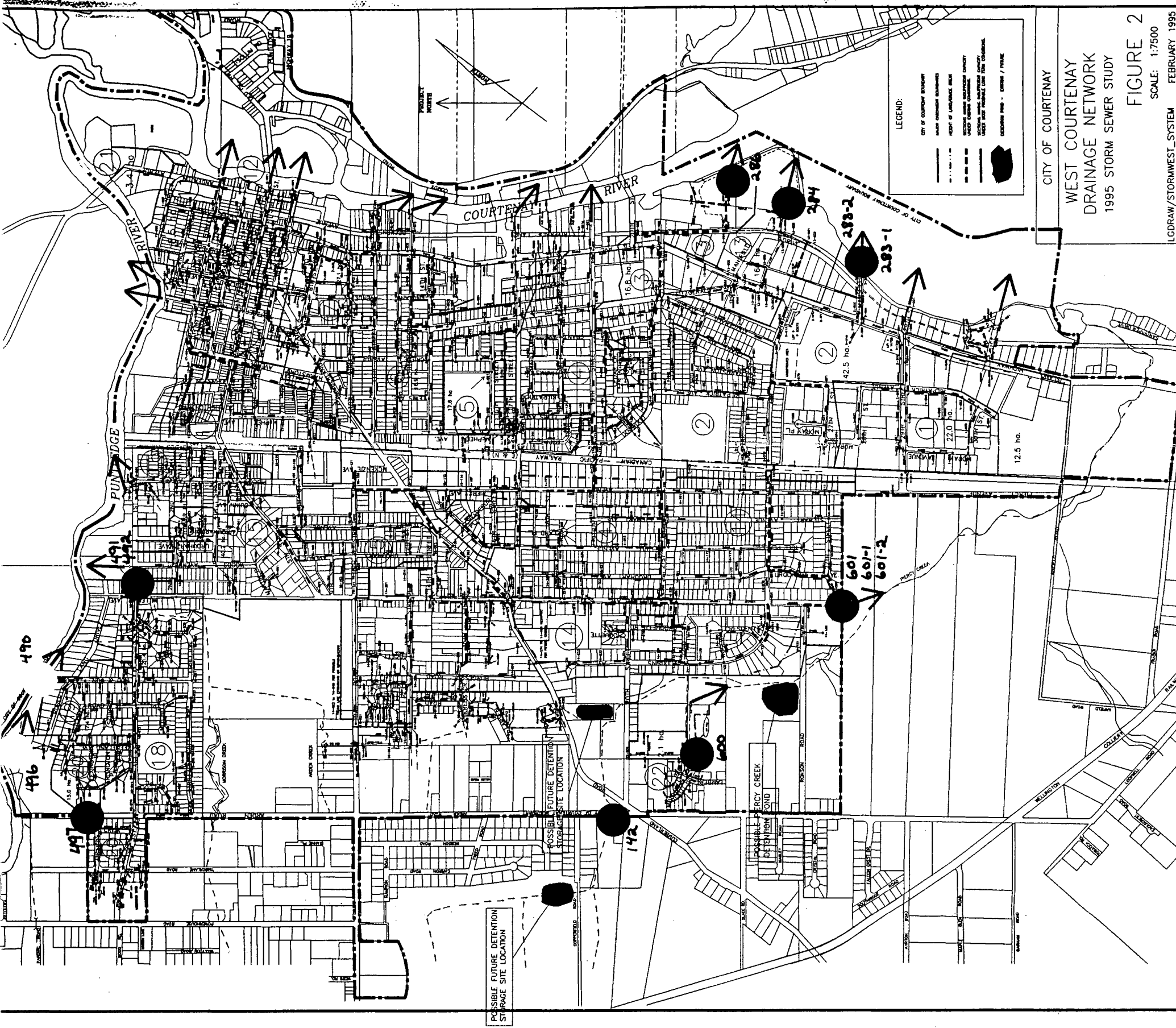
Map B - Town of Comox Site Reference Legend

Site No.	Site Description
NBS 192	Drain below Black Fin Pub
NBS 193	Drain at base of pump station on Jane Place
NBS 194	Golf Course Creek
NBS 195	West drain at Filberg Lodge
NBS 196	East drain at Filberg Lodge
NBS 222	Drain below Pioneer Cemetery
NBS 223	Drain at base of Manor Drive by cemetery stones
NBS 225	Shoreline at base of grey house with Canada flag
NBS 226	Carthew Street Storm Drain
NBS 229	Metal culvert under Ellis Street lookout
NBS 231	Comox Harbour concrete drain north of Edgewater Parking lot
NBS 233	Indian or Carthew Creek



Map C - City of Courtenay Site Reference Legend

Site No.	Site Description
NBS 142	Piercy Ck. At Arden and Cumberland Rd.
NBS 283-1	Mansfield Dr. smaller drain on left side
NBS 283-2	Mansfield Dr. parking lot larger drain on right side
NBS 284	Drain at south end of Airfield
NBS 286	Drain a mid Airfield
NBS 490	Behind 5 Rod and Gun Rd. at Puntledge River
NBS 491	PVC culvert at Morrison Ck under 1 st & Willemar
NBS 492	Steel culvert at Morrison Ck under 1 st St & Willemar
NBS 496	Parking lot at Bear James Park
NBS 497	Behind of 184A Archery Cres.
NBS 600	Culvert at 16-2040 trailer park on 20 th St.
NBS 601	Piercy Ck. At culvert south end Willemar Av
NBS 601-1	South End of Willemar Ave-concrete arch
NBS 601-2	South End of Willemar Ave-blue plastic culvert



Site No.	Site Description
1	1.1
2	2.1
3	3.1
4	4.1
5	5.1
6	6.1
7	7.1
8	8.1
9	9.1
10	10.1
11	11.1
12	12.1
13	13.1
14	14.1
15	15.1
16	16.1
17	17.1
18	18.1
19	19.1
20	20.1
21	21.1
22	22.1
23	23.1
24	24.1
25	25.1
26	26.1
27	27.1
28	28.1
29	29.1
30	30.1
31	31.1
32	32.1
33	33.1
34	34.1
35	35.1
36	36.1
37	37.1
38	38.1
39	39.1
40	40.1
41	41.1
42	42.1
43	43.1
44	44.1
45	45.1
46	46.1
47	47.1
48	48.1
49	49.1
50	50.1
51	51.1
52	52.1
53	53.1
54	54.1
55	55.1
56	56.1
57	57.1
58	58.1
59	59.1
60	60.1
61	61.1
62	62.1
63	63.1
64	64.1
65	65.1
66	66.1
67	67.1
68	68.1
69	69.1
70	70.1
71	71.1
72	72.1
73	73.1
74	74.1
75	75.1
76	76.1
77	77.1
78	78.1
79	79.1
80	80.1
81	81.1
82	82.1
83	83.1
84	84.1
85	85.1
86	86.1
87	87.1
88	88.1
89	89.1
90	90.1
91	91.1
92	92.1
93	93.1
94	94.1
95	95.1
96	96.1
97	97.1
98	98.1
99	99.1
100	100.1

Map D - City of Courtenay Site Reference Legend



FIGURE 3

SCALE: 1:7500

REMSD: 00/01/26

CITY OF COURTENAY

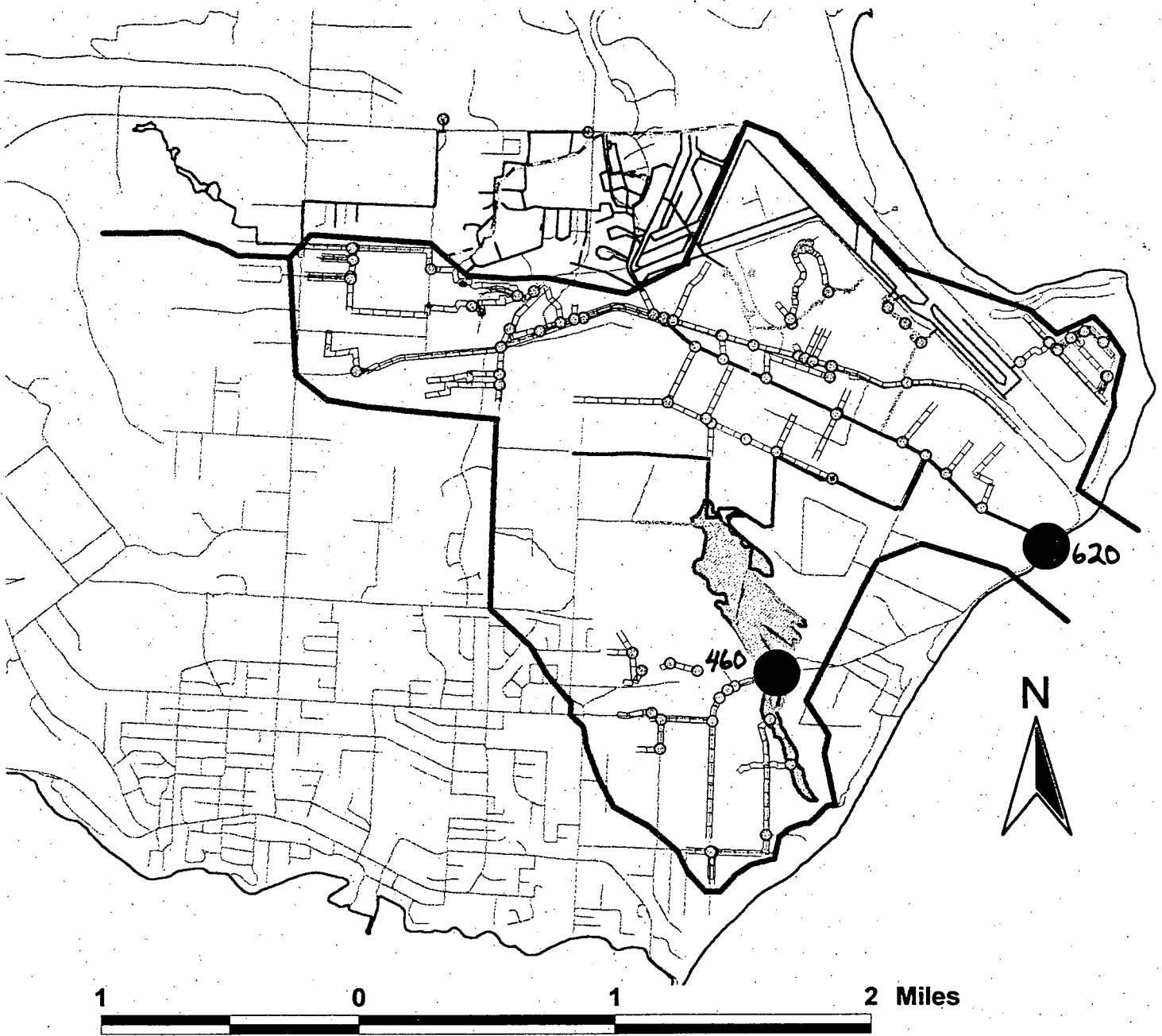
~~EAST COURTENAY
DRAINAGE NETWORK~~

1995 STORM SEWER STUDY

FIGURE 3

SCALE: 1:7500

Regional District Area B



Map E - Lazo/Point Holmes Site Reference Legend

<u>Site No.</u>	<u>Site Descriptions</u>
NBS 460	Storm drain entering Lazo Marsh on Lazo Road
NBS 620	Queen's Ditch at Point Lazo Boat Launch

Appendix 4

Stormdrain Water Sample Data – July 1995 to March 2000

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-142-FW

Piercy Ck. @ Arden & Cumberland Rd.

14-May-95				7.05		
18-Jun-95				7		
16-Jul-95						
20-Aug-95	220					
19-Sep-95	157					
21-Oct-95				7.3	0	
19-Nov-95						
27-Feb-96				7.1	0	
01-Dec-96				7.1	0	
15-Nov-99	71			6.9	104	
13-Dec-99	130			7.1	98	
10-Jan-00	40			6.9	100	
14-Feb-00	36			6.8	40	
12-Mar-00	1			6	15	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-192-FW

Area E - Comox Harbour east - storm drain below Black Fin Pub

10-Jul-95	1020					odor
25-Jul-95	990					debris, odor, dead crabs
23-Oct-95	6320					odours
20-Nov-95	6					
23-Nov-95	1082					debris
21-Dec-95	1					debris, odours
23-Jan-96	540					debris, odours
20-Feb-96	9					debris
19-Mar-96	4					debris
10-May-96	27			7.7	345	debris, algae
14-May-96	99.9	<100				algal blooms
14-Jun-96	820			7.5	395	styrofoam nuts, debris
12-Jul-96	12			7.6	100	debris log jam
09-Aug-96			DRY Site			
13-Sep-96	2310			6.7	250	odours
11-Oct-96	33			7.8	41	debris log jam
07-Nov-96	1040		storm event	6.4	120	grey turbid water
22-Nov-96	2			7.3	420	organic debris, litter
02-Feb-98	13			7.2	332	clear
16-Feb-98	19			7.2	231	clear
02-Nov-98	14			7.3	228	clear
24-Nov-99	156			6.5	560	
22-Dec-99	5			6.8	220	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-193-FW

Storm drain at base of Pump station on Jane Place -low tide shoreline access

23-Nov-95	216					debris
21-Dec-95	30					
23-Jan-96	223					debris, odours
20-Feb-96	6					oil on surface/debris
19-Mar-96	0.9	<1				foam/ab.color
10-May-96	10			6.9		oil/debris
14-May-96	99.9	<100				rust colour, oil, algae
14-Jun-96		unknown		7	483	oil/debris/odors
12-Jul-96	6			7.3	100	oil/ yard debris/odours
09-Aug-96		DRY Site				
13-Sep-96	390			6.5	220	odors/org. debris
11-Oct-96		nple,garden debris co				
22-Nov-96		no sample, debris bloc				grease, gasoline odours
24-Nov-99	15			6	700	
22-Dec-99	17			6.7	620	

NBS-194-FW

Area E - Comox Harbour east - small stream @ the end of Jane St.

10-Jul-95	450					
25-Jul-95	1330					algae blooms
23-Aug-95	330					algae blooms, dead crabs
24-Sep-95	30					algal blooms
23-Oct-95	5570					algae, bubbles
23-Nov-95	1040					algae
21-Dec-95	172					algae
23-Jan-96	3100					
21-Feb-96	45					algae
02-Feb-98	46			7.2	367	clear
16-Feb-98	29			7.2	204	clear
02-Nov-98	101			7.2	204	clear
08-Sep-99	250			7.3	317	algae, birds/animals
05-Oct-99	197			7.4	233	algae
23-Nov-99	14			7.3	250	algae
16-Dec-99	7			7.4	309	
26-Jan-00	53			6.9	70	birds/animals, algae
28-Feb-00	5			7.4	240	
21-Mar-00	48			7.4	216	

Storm Drains Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Fecals/100ml</u>	<u>Comments</u>	<u>pH</u>	<u>Conductivity</u>	<u>Comments/ Indicators</u>
NBS-195-FW	Area E - Comox Harbour east - 1st of 2 storm drains @ the bottom of Filberg Park -shorelin					
	10-Jul-95	1350				cutverts
	25-Jul-95	920				algae,odor,foam
	23-Aug-95	4001	>4000			algae bloom
	23-Oct-95	860				debris
	23-Nov-95	236				foam/alga
	21-Dec-95	2				algae on rocks
	23-Jan-96	590				
	21-Feb-96	0.9	<1			bubbles/ a little algae
	19-Mar-96	1				algae
	05-May-96	1		7.5		debris,algae,birds
	14-May-96	99.9	<100			lg patches of algae @flow
	28-May-96	140				algae, foamy mats on wtr
	21-Jun-96	23		7.7	252	odors, foam, algae
	10-Jul-96	90		7.5	230	bubbles, oil scum , algae
	14-Aug-96	466		7.3	245	algae, debris
	07-Nov-96	720	storm event	6.6	120	algae on rocks, grey wate
	02-Feb-98	2		7.1	278	clear
	11-Feb-98	4		7.3	406	clear
	16-Feb-98	5		7.1	204	clear
	08-Sep-99	20		7.5	280	odours
	05-Oct-99	59700		7.3	274	algae,abnormal color
	23-Nov-99	8		7.2	219	algae, bubbles
	16-Dec-99	55		7.2	296	odours,algae
	26-Jan-00	5		7	60	odours,algae, birds
	28-Feb-00	4		7.3	210	
	21-Mar-00	1		7.1	216	

Storm Drains Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Fecals/100ml</u>	<u>Comments</u>	<u>pH</u>	<u>Conductivity</u>	<u>Comments/ Indicators</u>
NBS-196-FW	Area E - Comox Harbour east - 2nd of 2 storm drains @ the bottom of Filberg Park - shoreli					
	25-Jul-95	10600				algae,odor,foam
	23-Aug-95	10001	>10000			algae growth
	24-Sep-95	23001	>23000			algal blooms
	23-Oct-95	15001	>15000			foam, murky
	23-Nov-95	650				foam/algae
	21-Dec-95	960				debris, algae
	23-Jan-96	850				
	21-Feb-96	860				bubbles/debris/algae
	19-Mar-96	500				bubbles/algae
	05-May-96	440		7.3		bubbls,debris,alg,foam,bi
	14-May-96	5800				algae along flow
	28-May-96	1001	>1000			algae
	21-Jun-96	4810		7.4	261	scum layer,algae, birds
	10-Jul-96	3380		7.2	230	bubbles, algae, birds aro
	14-Aug-96	3090		7	245	algae, debris,
	07-Nov-96	10800	storm event	5.9	110	algae on rocks
	02-Feb-98	11		7.3	379	clear
	11-Feb-98	9		7.1	795	clear
	16-Feb-98	10		7.1	310	clear
	08-Sep-99	300		7.4	235	bubbles, algae
	05-Oct-99	6		7.4	480	algae
	23-Nov-99	10		7.3	280	algae, dead fish
	16-Dec-99	9		7.1	208	odours,algae
	26-Jan-00	25		7.3	170	birds/animals, algae
	28-Feb-00	11		7.2	210	
	21-Mar-00	17		7.2	269	

Storm Drains Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Fecals/100ml</u>	<u>Comments</u>	<u>pH</u>	<u>Conductivity</u>	<u>Comments/ Indicators</u>
NBS-222-FW						
Area F - Comox Shoreline below Pioneer Cemetery- low tide shoreline access						
	18-Oct-95	20				algae out on beach
	20-Dec-95	7				
	24-Jan-96	13				
	07-May-96	9		7.3	301	erosion, debris, algae
	11-Jun-96	290		7.6	408	erosion, debris, algae
	10-Jul-96	120		7.5	400	erosion, debris, algae, bir
	13-Aug-96	350		7.3	36	cloudy water, algae, debr
	19-Sep-96	170		7.5	340	cloudy water, algae, debr
	10-Oct-96	130		7.3	36	debris
	15-Nov-96	11		7.8	285	algae, dead fish, erosion
	02-Feb-98	10		7.5	240	clear
	21-Oct-99	48		7.1	320	
	30-Nov-99	16		7.6	200	erosion
	20-Dec-99	24		7.5	220	birds/animals, fishkills, d
	11-Jan-00	10		7.5	260	
	28-Feb-00	99.9	<100	7.5	260	debris, birds
NBS-223-FW						
Area F - Comox shoreline @ cemetery stones base of Manor Drive -low tide shoreline access						
	18-Oct-95	13				algae
	20-Dec-95	5				
	24-Jan-96	34				odours
	07-May-96	1		7.5	352	erosion, debris, algae
	11-Jun-96	145		7.2	419	debris, algae
	10-Jul-96	1		7.2	450	erosion, debris, algae
	13-Aug-96	1		7.2		algae, debris
	19-Sep-96	0.9	<1	7.05	420	algae, erosion, debris
	10-Oct-96	0.9	<1	7.2	44	algae, cloudy water, eros
	15-Nov-96	1		7.1	455	algae, dead fish, erosion
	21-Oct-99	1.9	<2	7.2	330	
	30-Nov-99	22		7.5	200	
	20-Dec-99	8		7.6	240	debris
	11-Jan-00	830		7.6	310	
	28-Feb-00	99.9	<100	7.6	287	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-225-FW

Area F- Comox Shoreline at base of grey house (base of Canada Flag) -low tide shoreline a

20-Nov-95	6					
20-Dec-95	37					
24-Jan-96	4					
19-Feb-96	33					
12-May-96	6			7.5	219	
17-May-96		<5 greases				
09-Jun-96	51			7.25	185	debris
28-Jun-96		<5 greases				
14-Jul-96	147				225	algal mats
11-Aug-96	610			7.7	226	algal mat 10mx2m
18-Oct-96	383					
12-Nov-96	80			6.95	174	organic debris
23-Nov-99	40			7.2	194	
22-Dec-99	2			7.2	180	
12-Jan-00	10			7.2	910	
24-Feb-00	9				180	
23-Mar-00	0.9	<1		7.2	190	

NBS-226-FW

Area F - Comox Harbour west - Carthew Steet storm drain

20-Dec-95	49					
24-Jan-96	182					
19-Feb-96	4					debris/odours/dead bird
12-May-96	5			7.3	198	debris/odors/algae/oil
17-May-96		<5 greases				
28-Jun-96		<5 greases				
14-Jul-96						debris,algae
11-Aug-96		no flow				
17-Oct-96	120			7.2	160	clear water
13-Sep-99	70			7.2	193	algae
19-Oct-99	707			7.4	220	algae
23-Nov-99	690			7.3	268	
22-Dec-99	9			7.3	220	
12-Jan-00	54			7.2	205	
24-Feb-00	12				190	
23-Mar-00	7			7.3	228	odours

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
NBS-229-FW	Area F - Comox Harbour west - metal culvert under Elfst Street stairs lookout					
	15-Aug-95	21				
	18-Oct-95	67				none
	20-Nov-95	38				
	20-Dec-95	24				
	24-Jan-96	9				
	19-Feb-96	130				bubbles
	06-May-96	17		7.6		
	14-May-96	2000	MOH lab			foam 2cm, algae, grey wat
	03-Jun-96	233		7.25	239	
	08-Jul-96	780		7.4	22	
	12-Aug-96	5		7.6	262	foam
	17-Oct-96	800		6.9	100	brown cloudy water
	07-Nov-96	2200	storm event	6.7	160	brown turbid wat, odours
	19-Nov-96	4		7.2	220	
	09-Sep-99	9	<10	7.1	703	
	06-Oct-99	9	<10	7	604	
	09-Nov-99	1050		6.7	155	
	08-Dec-99	1610		6.7	100	
	26-Jan-00	0.9	<1	7	100	
	09-Feb-00	0.9	<1	7	40	
	08-Mar-00	0.9	<1	7.1	106	

Storm Drains Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Fecals/100ml</u>	<u>Comments</u>	<u>pH</u>	<u>Conductivity</u>	<u>Comments/ Indicators</u>
NBS-231-FW	Area F - Comox Harbour west - concrete storm drain @ edge of Edgewater Pub parking lot					
	15-Aug-95					
	18-Oct-95	66				foam, brown/white
	20-Nov-95	21				
	20-Dec-95	12				
	24-Jan-96	14				
	19-Feb-96	79				bubbles
	06-May-96	8		7.5		
	14-May-96	99	<100			foam
	03-Jun-96	29		7.2	233	bubbles, debris, brwncoatn
	08-Jul-96	55		7.7	24	
	12-Aug-96	209		8.2	265	
	17-Oct-96	290		7.2	150	murky brown water
	07-Nov-96	470	storm event	6.5	140	algae, VOCs odour, grey wat
	19-Nov-96	1		7.2	220	
	09-Sep-99	16		7.4	221	
	06-Oct-99	9	<10	7.4	250	
	09-Nov-99	990		6.8	150	
	08-Dec-99	1680		6.8	103	
	26-Jan-00	25		7	9	
	09-Feb-00	10		7	40	
	08-Mar-00	4		7.1	211	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-233-FW

Area F - Comox Harbour west - Carthew Creek

15-Aug-95	540					algae
18-Oct-95	14000					none
20-Nov-95	130					
20-Dec-95	920					
19-Feb-96	350					bubbles
09-Jun-96	224					organic debris
14-Jul-96	220			7.75	234	algae,
11-Aug-96	1000			8.3	243	organic debris
17-Oct-96	300			7.6	225	turbid water
12-Nov-96	440			7.05	162	debris
20-Nov-96		e x-cut'n repaired Wal				
11-Feb-98	5			7.1	181	clear
16-Feb-98	274			7.4	170	clear
13-Sep-99	360			7.5	223	algae
19-Oct-99	79			7.4	210	algae, oily surface
23-Nov-99	185			7.6	193	
22-Dec-99	15			7.5	180	algae
12-Jan-00	28			7.3		
24-Feb-00	4				180	algae
23-Mar-00	5			7.3	176	oil on surface

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-283-1

Smaller Mansfield Storm Drain on left side - access via parking lot - low tide access

20-Jul-95			Sewage x-crit'n repair			
06-Nov-95	4400					
14-May-96	999.9	<1000				grease and thick film,
28-May-96	99.9	<100				VOC odors, algae
30-May-96	0.9	<1		7.2	309	algae
27-Jun-96	5			7.2	336	algae, debris
25-Jul-96	3			7.35	340	more algae, debris,
29-Aug-96	3			7.35	351	oils, algae, bubbles
26-Sep-96	1			7.3	335	litter in water
09-Sep-99	30			7.4	280	algae
06-Oct-99	20			7.4	300	algae
25-Nov-99	52			6.9	238	odours, bubbles
23-Dec-99	4			6.8	240	odours, oil slick
24-Jan-00	22			6.3	40	odours, oil on surface
23-Feb-00	18			6.9	25	oil on surface, green scum
22-Mar-00	27			6.9	253	

NBS-283-2

Larger Mansfield Drive Storm Drain on Right side - access via parking lot - low tide access

20-Jul-95			Sewage x-crit'n repair			
06-Nov-95	3200					
14-May-96	10000					oils/grease film in water
28-May-96	3710					VOC odors, algae
30-May-96	1310			7.4	220	algae
27-Jun-96	6000			7.3	240	
25-Jul-96	50			7.35	220	more algae norm, debris
29-Aug-96	445			7.4	265	oils, bubbles, algae
26-Sep-96	620			7.35	260	litter in water
02-Feb-98	497			7	234	clear
16-Feb-98	80			6.9	168	clear
02-Jun-98	169			7	186	clear
09-Sep-99	60			7.4	200	algae
06-Oct-99	9	<10		7.4	240	algae
25-Nov-99	106			7	178	bubbles, odors
23-Dec-99	15			7.2	180	odours, oil slick
24-Jan-00	22			6.8	30	odours, oil slick
23-Feb-00	30			7	20	oil on surface, green scum
22-Mar-00	125			7.2	180	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-284-FW	Culvert @ south end of air field- access via low tide walk along outer Airstrip fence					
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13-Jul-95	38					oil, algae
11-Oct-95	7300					oil, algae, water murky
21-Nov-95	6					algae
19-Dec-95	5					bubbles, odours, algae
05-Feb-96	230					
01-Apr-96	1					algae, foam
22-May-96	59			7	248	algae
28-May-96	99.9	<100				algae
26-Jun-96	9			7.15	267	algae on rocks & pipe
06-Aug-96	18			7.15	460	algae
30-Aug-96	1601	>1600		6.8	510	algae,org.debris,9cm silt
01-Oct-96	1			7.09	1174	6cm silt with rusty sed.
21-Oct-96	1600	storm event		6.3	45	grey turbid water
05-Nov-96	1			7	342	silt 13 cm depth in drain
07-Nov-96	860	storm event		5.9	80	cig.butts,oil film,gases
27-Nov-96	1601	>1600		6.79	225	sewer odour, oil, murky
02-Feb-98	13			6.9	322	clear
16-Feb-98	1			6.9	251	clear
02-Nov-98	43			6.9	268	clear
09-Sep-99	50			7.1	130	algae
06-Oct-99	810			7.2	140	algae, birds
25-Nov-99	9			6.8	250	birds/animals (#)
23-Dec-99	3			6.9	260	algae(brown)
24-Jan-00	40			6.8	60	
23-Feb-00	45			6.7	60	abnormal colour,oil
22-Mar-00	11			6.9	230	oil on surface

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-286-FW

Storm Drain Mid Airstrip

11-Oct-95	22200					algae
21-Nov-95	50300					algae
19-Dec-95	60700					bubbles, odours, toilet
05-Feb-96	6800					toilet paper shreds
01-Apr-96	236000					toilet paper, algae, bubbl
22-May-96	4600			6.85	125	algae, grey soapy colour
28-May-96	3300000	MOH lab estimate				algae on rocks
10-Jun-96		ewage x-cnt'ns repair				
26-Jun-96	1170			7.2	236	algae on rocks
06-Aug-96	190			7.45	240	algae
30-Aug-96	1910			6.92	100	algae, 3 cm silt, cig but
01-Oct-96	5400			7.4	283	cig butts, wrappers, bones
21-Oct-96	350	storm event		6.4	60	grey turbid water
05-Nov-96	44			7.15	286	cut channel heavy flow
07-Nov-96	775	storm event		6	105	smell VOCs, oil film, algae
27-Nov-96	1600			6.95	215	murky, oil, algae, birds
02-Feb-98	71			6.9	256	clear
16-Feb-98	50			7	193	clear
02-Nov-98	48			7	240	clear
09-Sep-99	14200			7.2	140	algae, odors
06-Oct-99	170			6.9	190	algae, birds
25-Nov-99	83			6.9	217	birds/animals (#)
23-Dec-99	122			7	200	odours, birds
24-Jan-00	1500			6.9	60	toilet paper
23-Feb-00	2060			6.9	30	algae, debris, TP
22-Mar-00	3001	>3000		6.9	68	

NBS-361-FW

Roy Creek at Marine Drive bridge

07-Sep-99	7460			7.3	370	algae
07-Oct-99	770			7.1	382	algae
24-Nov-99	170			7	990	
22-Dec-99	16			7	107	foam
25-Jan-00	81			7	131	
24-Feb-00	56			7	110	debris
28-Mar-00	52			7.1	237	birds/animals (#)

Storm Drains Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Fecals/100ml</u>	<u>Comments</u>	<u>pH</u>	<u>Conductivity</u>	<u>Comments/ Indicators</u>
NBS-364-FW	Marine Drive at Base of Greig Road					
	24-Jan-96	540				
	05-Jun-96	281		7.1	120	algae
	30-Jun-96	50		7.2	128	algae, debris
	07-Aug-96		Dry site			
	04-Sep-96	11000	MOH estimated	7	209	abn. turbid wat., foam 1c
	02-Oct-96	70		7.3	110	green & brown algae, debris
	21-Oct-96	250	storm event	6.7	70	grey water smell
	07-Nov-96	49	clear	5.4	370	clear
	02-Feb-98	29		6.9	115	clear
	06-Feb-98	35		6.9	114	clear
	16-Feb-98	72		6.9	112	clear
	24-Nov-99	61		6.9	110	
	22-Dec-99	129		6.9	123	
	25-Jan-00	49		7	490	
	24-Feb-00	49		7	100	
	28-Mar-00	135		7	220	
NBS-365-FW	3855 Marine Drive					
	05-Jun-96	91		7.2	150	
	30-Jun-96	34		7.3	160	foam, algae
	07-Aug-96	122		7.4	180	
	04-Sep-96	580		7.2	179	
	02-Oct-96	340		7.5	185	algae, bubbles, erosion
	21-Oct-96	8720	storm event	6.8	105	
	07-Nov-96	550	storm event	6.2	185	brown water
	02-Feb-98	18		6.9	142	clear
	06-Feb-98	103		6.9	141	clear
	16-Feb-98	132		6.9	133	clear
	07-Sep-99	19700		7.2	172	algae
	07-Oct-99	5582		7.1	192	foam
	24-Nov-99	280		6.9	148	odours
	22-Dec-99	44		6.9	151	
	25-Jan-00	730		6.9	259	
	24-Feb-00	51		7	120	
	28-Mar-00	171		7.1	280	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-460-FW

Storm Drain entering Lazo Marsh on Lazo Road.

03-May-96				7.2		
05-May-96				6.4	116	turbid water
07-Jun-96				7.4	242	algae, 500 fry, tea color
04-Jul-96				7.4	300	sticklebacks observed
10-Sep-96			9mg Dis. Oxygen	7.5	300	
27-Sep-96				7.8	319	algae 1x1m
18-Oct-96			12mg/L Dis. Oxygen	7.25	260	sand sediments
26-Nov-96				6.9	185	algae, bubbles
20-Sep-99				7	410	algae, abnormal color
22-Nov-99	5			7.1	140	foam
20-Mar-00	99.9	<100		7	123	foam

NBS-461-FW

Culvert mid way between the Mex and Superstore, South of parking lot

19-Sep-99	49			7.5	200	algae, foam
19-Oct-99	73			7.6	210	algae
16-Nov-99	2100			7.1	150	odours, fish
14-Dec-99	1830			6.9	100	abnormal colour
18-Jan-00	334			7.2	240	birds/animals (#)
15-Feb-00	670			7.3		odours, foam
07-Mar-00	77			7.3	192	odours, bubbles

NBS-462-FW

Tunner and Back Road at corner

11-Jun-96	540			7.2	273	
16-Jul-96	405	Deterg. 0-0.1		7.3	240	stagnant odours, algae
19-Aug-96	410			7.3	250	algae bloom
10-Oct-96	1060			7.2	250	algae bloom
25-Nov-96	280				400	
19-Sep-99	88			7.4	269	debris
17-Oct-99	14			7.2	220	debris
14-Nov-99	152			7	185	debris
19-Dec-99	11			7.2	250	debris
23-Jan-00	5			7.2		debris
13-Feb-00	14			7.2	210	debris
13-Mar-00	39			7.1	228	debris

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-463-FW		access at Corner of McLaughlin Drive and Centennial Drive				
	11-Jun-96	520		6.7	249	debris, tiny worms
	16-Jul-96	6990		7.5	322	litter plastic and organi
	19-Aug-96	8650		7.5	260	litter, grey water smell
	10-Oct-96	9170		7.5	260	oil, litter, chironomids
	25-Nov-96	1600			245	litter
	02-Feb-98	130		7.2	130	clear
	16-Feb-98	79		7.1	124	clear
	02-Jun-98	32		7.1	133	clear
	19-Sep-99	306		7.4	322	oil on surface
	17-Oct-99	150		7.1	230	debris
	14-Nov-99	181		7.1	145	foam
	19-Dec-99	6		7.1	143	foam
	23-Jan-00	14		7.1		debris
	13-Feb-00	42		6.9		debris, foam
	13-Mar-00	46		7.1	173	debris

NBS-466-FW		End of Nim Nim Place along west edge of school playing field				
	07-Jun-96	401		7.4	226	litter, debris
	24-Jul-96	3750		7.4	200	litter, brown film on wat
	09-Aug-96	670		7.3	200	litter, brown film on top
	10-Oct-96	560		7.3	210	smell of kreosote, litter
	25-Nov-96	1600			170	shredded paper in water
	02-Feb-98	1964	>1963	6.8	197	smell of VOC's
	16-Feb-98	1130		6.9	186	smell of VOC's
	02-Jun-98	23001	>23000	6.9	215	grey water smell, colour
	15-Sep-99	410		7.5	229	oil on surface, odors
	13-Oct-99	190		7.3	180	debris
	17-Nov-99	2070	estimate	7	181	oil on surface, brown scum
	15-Dec-99	400		6.5	160	debris
	12-Jan-00		overgrowth	7.3	220	serge of water
	07-Feb-00	1250		6.9	200	
	06-Mar-00	600		6.9	209	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-467-FW

Ditch @ corner of Dingwall Road and Northland Road

24-Jun-96			ical bacteria overc	42	42	brown turbid water
26-Jul-96	500			7.2	300	
12-Nov-96	1200			7.1	170	
25-Nov-96	1600				180	clear
21-Sep-99	38			7.6	150	erosion
19-Oct-99	230			7.5	220	algae
16-Nov-99	160			7.1	160	algae
14-Dec-99	150			6.6	150	
18-Jan-00	94			7	290	
15-Feb-00	50			7.2		
07-Mar-00	76			7.1	185	

NBS-468-FW

Ditch @ North end of Western Road

24-Jun-96	1800			6.5	69	debris
26-Jul-96	182			7.2	280	debris
12-Nov-96	2300			7.1	200	
25-Nov-96	1601	>1600			240	debris
21-Sep-99	410			7.2	250	birds/animals (#)
19-Oct-99				7.2	230	algae
16-Nov-99	22			6.3	160	birds/animals (#)
14-Dec-99	6			6.2	140	
18-Jan-00	4			6.4	300	
15-Feb-00	1.9	<2		6.5		
07-Mar-00	1.9	<2		6.5	212	

NBS-469-FW

East side of 1547 Dingwall, north side of the road

18-Jan-00	870			7	160	
15-Feb-00	52			6.7		debris
07-Mar-00	16			7.2	185	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
NBS-472-FW						
Culvert at the end of Quail place behind 1267 Williams Road.						
	23-May-96	73		7.3	251	food,paper,oil,bubbl,foam
	11-Sep-96		not processed		360	toilet paper, veg. peels
	30-Sep-96	6050			298	scats visible, bubbles,
	10-Oct-96	2800		7.3	280	5 tampons, smell grey wat
	17-Oct-96	2700		6.9	95	toilet paper shreds
	30-Oct-96	24000		7	372	toilet paper, debris,odor
	29-Nov-96	149		7	340	odors, oil on surface
	02-Feb-98	8		7.1	236	clear
	16-Feb-98	2		7	229	clear
	02-Jun-98	7		7.1	241	clear
	14-Sep-99	9	<10	6.9	215	
	12-Oct-99	179		6.9	100	foam, debris
	18-Nov-99	6		7.1	264	foam
	09-Dec-99	9		7	211	
	12-Jan-00	4		7.2	240	foam
	15-Feb-00	1		7.3	253	bubbles
	15-Mar-00	1		7.1	300	bubbles
NBS-473-FW						
Culvert at Back Road and 10th Street East behind 1003 Williams Road						
	23-May-96	2400		7.15	275	
	24-Jun-96	31		7.2	239	
	29-Jul-96	430		7.1	210	bubbles
	06-Aug-96		<5 mg/l greases			
	26-Aug-96	301	>300	7.1	250	
	03-Sep-96		< 5mg/l greases			
	11-Sep-96		not processed		274	brown scum film, fish
	30-Sep-96	24			283	scum film on surface
	10-Oct-96	28		7.3	238	fish
	30-Oct-96	770			307	paint scrapings, 1" fish
	29-Nov-96	283		7	300	debris
	14-Sep-99	3550		6.9	200	foam, small fish(alive)
	12-Oct-99	580		6.9	110	foam
	18-Nov-99	204		7.1	252	bubbles,fish/worms
	09-Dec-99	13		7	219	bubbles
	12-Jan-00	59		7.2	257	foam
	15-Feb-00	1440		7.2	263	foam
	15-Mar-00	0.9	<1	7.2	320	foam

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-475-FW

769 Chaster Road

29-May-96	99			7	114	algae
25-Jun-96	1840			7	88	foam
31-Jul-96	240			7.2	110	
27-Aug-96	1290			7.3	105	
24-Sep-96	4			7.2	210	
30-Oct-96	2			7.2	142	bubbles
27-Nov-96	50			6.7	160	
16-Feb-98	30			6.9	170	t.paper
02-Jun-98	83			6.9	245	t.paper, feces, rice, soa
22-Sep-99	27			7.3	180	
12-Oct-99	24			7.2	233	
18-Nov-99	18			7.2	180	
09-Dec-99	34			7.2	150	
18-Jan-00	142			7.3	200	
08-Feb-00	1900			7.1		
07-Mar-00	32			7.2	190	

NBS-476-FW

Back Road @ 6 Street East culvert entering stream

01-Apr-96		sewage x-cnt'n repairs				
29-May-96	117			7.3	243	t.paper,abnormicolor,foam
25-Jun-96	34			7.2	248	t. paper
31-Jul-96	550			7.4	230	t.paper
27-Aug-96	840			7.2	206	
24-Sep-96	0.9	<1		7.4	220	t.paper, bubbles
30-Oct-96	12			7.2	248	t.paper, foam
27-Nov-96	30			6.8	220	toilet paper
22-Sep-99	51			7.2	200	
12-Oct-99	44			7.1	235	
18-Nov-99	16			7.2	175	
09-Dec-99	33			7	165	
18-Jan-00	162			7.3	250	
08-Feb-00	394			7.1		
02-Mar-00	54			7.2	191	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-477-FW

10 Street East across Hobson Park

17-Apr-96			wage x-repair on Hob			
29-May-96	2970			7.4	238	
25-Jun-96	1960			7	239	
31-Jul-96	190			7.3	220	clear water
27-Aug-96	201	>200		7.1	236	clear water
24-Sep-96	40			7.4	230	
30-Oct-96	2500			7.3	234	clear
27-Nov-96	1600			7	210	bubbles
16-Feb-98	130			7.1	185	clear
02-Jun-98	46			7.1	186	clear
22-Sep-99	530			7.3	200	
12-Oct-99	45			7.2	243	
18-Nov-99	10			7.2	180	
09-Dec-99	34			7.3	165	
18-Jan-00	309			7.1	250	
08-Feb-00	840			7		
07-Mar-00	33			7.2	189	

NBS-480-FW

Muir Road and McLaughlin

09-May-96	3			6.6	193	oils, algae, litter,
13-Jun-96	121			6.8	200	algae, dead worms, bl.fil
11-Jul-96	92			6.8	200	oil, debris, >50% algae,
08-Aug-96	1320			6.7	177.5	fishkills, oil, algae
25-Nov-96		no flow				brown sludge scum layer
15-Sep-99	1230			7	196	oil on surface, debris
13-Oct-99	550			6.9	180	foam
17-Nov-99	13			7	200	algae(brown)
15-Dec-99	64			6.7	120	oil on surface,algae
12-Jan-00	1.9	<2		6.9	2.8	algae (red)
07-Feb-00	26			6.7	200	algae, oil on surface
06-Mar-00	99.9	<100		6.7	194	algae(brown / green)

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-481-FW

Muir Road at South-west corner of playground

09-May-96	12			7.3	147	dead worms
13-Jun-96	162			7.4	199	foam, debris, odors, bubb
11-Jul-96	1080			7.3	200	white soapy bubbles
08-Aug-96	10			7.7	222	bubble bath foam, pinky w
25-Nov-96	170				125	surging, discoloured
15-Sep-99	12			7.6	235	oil on surface, algae
13-Oct-99	490			7.6	170	
17-Nov-99	2			7.1	175	bubbles
15-Dec-99	140			6.9	80	abnormal colour
12-Jan-00	3			7.1	260	bubbles
07-Feb-00	44			7	200	bubbles
06-Mar-00	99.9	<100		7	121	bubbles

NBS-490-FW

Behind 5 Rod & Gun Road @ Puntledge River

28-May-96	99.9	<100		6.3	78	algae, moss
25-Jun-96	6			7.3		rust stains on bank & outle
30-Jul-96	6			6.4	100	algae, smell grey water
27-Aug-96	240			6.25	84.2	algae, grey wat. odours,
09-Sep-96	99.9	<100				
11-Oct-96	0.9	<1		6	80	odour grey water
07-Nov-96	680	storm event		5.5	680	paper shreds, rusty water
25-Nov-96	1600				100	clear
15-Sep-99	26			6.5	100	
13-Oct-99	1110			6.9	110	
17-Nov-99	122			6.5	100	
15-Dec-99	140			6.3	74	
12-Jan-00	44			6.5	160	
16-Feb-00	12	estimated		6.7	200	
16-Mar-00	6			6.5	117	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
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NBS-491-FW

PVC culvert discharging in Morrison Creek under 1st St.

28-May-96	32			7.2	192	debris, rust staining
25-Jun-96	90			6.5		algae, slight urine smell
30-Jul-96	260			7.2	200	rust staining
27-Aug-96	260			7.3	205	rust staining bank & pipe
05-Sep-96	8000	storm event		6.9	783	rust water with suds
10-Oct-96	3150			7.2	220	rust coloured water
07-Nov-96	1360	storm event		6.1	120	
15-Sep-99	460			7.2	200	
13-Oct-99	78			6.9	216	odours(fish)
17-Nov-99	10			6.5	170	
15-Dec-99	70			6.3	119	
12-Jan-00	2			6.5		
16-Feb-00	1.9	<2		7.1	200	
15-Mar-00	4			7	201	foam

NBS-492-FW

Steel culvert discharging in Morrison Creek under 1st St.

10-Oct-96	0.9	<1		6.7	150	
07-Nov-96	0.9	<1 CFU storm event		5	150	clear
15-Sep-99	1.9	<2		6.2	120	
13-Oct-99	13			6.5	150	odours(fish)
17-Nov-99	1.9	<2		6.5	120	
15-Dec-99	5			6.3	119	
12-Jan-00	8			6.5	120	
16-Feb-00	1.9	<2		6.5	200	
15-Mar-00	1.9	<2		6.5	136	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
NBS-496-FW Before Fish and Game Club @ parking lot on Rod & Gun Road						
	08-Jul-96	43		7.15	207	algae, odours, bubbles
	17-Jul-96	49		7.15	198	algae, odours, surface bubble
	12-Aug-96	5		7.15	238	odours, algae, oil, foam
	05-Sep-96	100				
	10-Oct-96	37		7	250	algae, brown scum film
	07-Nov-96	9350		6.85	100	cig. butts, brown wat., foam
	25-Nov-96	30			130	grey water odour, turbid
	21-Sep-99	280		7.4	200	bubbles
	26-Oct-99	12		7.3	210	bubbles, debris
	16-Nov-99	1.9	<2	6.8	176	bubbles
	14-Dec-99	7		6.8	120	bubbles
	08-Mar-00	1.9	<2	7	210	odours
NBS-497-FW Culvert Left of 184A Archery Cres. off 1st Ave. discharging into Puntledge						
	07-Nov-96	1410	storm event	6.5	20	odours
	25-Nov-96	22			100	litter
	21-Sep-99	2		7.3	198	debris
	26-Oct-99	1.9	<2	7.4	197	debris
	16-Nov-99	4		6.7	180	bubbles
	14-Dec-99	26		6.7	110	debris
	08-Mar-00	1.9	<2	6.9	240	debris
NBS-600-FW Culvert at base of 16-2040 trailer park on 20th Street.						
	15-May-96	9		6.7	160	looks clean
	12-Jun-96	360		6.5	178	oil on surface
	17-Jul-96		no flow			
	17-Oct-96		vert submerged under			
	15-Nov-99	39		6.3	550	
	13-Dec-99	0.9	<1	6	102	
	10-Jan-00	20		6.3	130	
	14-Feb-00	3		6.7	40	
	12-Mar-00	41		7.2	100	debris
NBS-601-1-FW South end of Willemar Ave. (after 1999 construction) arch concrete culvert						
	14-Feb-00	0.9	<1	7.1	30	
	12-Mar-00	650		6.8	35	abnormal colour

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
NBS-601-2-FW						
	South end of Willamar Ave, blue plastic culvert					
	18-Oct-99	470		7.5	200	
	15-Nov-99	1010		6.8	887	
	10-Jan-00	106		7.1	140	
	14-Feb-00	35		7.1	300	
	12-Mar-00	226		6.9	300	
NBS-601-FW						
	Piercy Ck. @ Culvert at the south end of Willemar Avenue (former site 151)					
	20-Aug-95	760				
	19-Sep-95	4000				
	21-Oct-95	9				
	19-Nov-95			6.7		
	27-Feb-96			6.9	0	
	15-May-96	1180		7.1	214	algae, odor
	12-Jun-96	2100		7.2	241	algae, odors, bilge smell
	02-Jul-96		<5 greases oils			abnormal colour -blue gre
	17-Jul-96	4400		7.1	200	odors,algae,debris, litte
	15-Sep-96	6400		6.9	100	milky grey colour, smell
	17-Oct-96	500		6.3	62	milky grey dark water
	07-Nov-96	1630	storm event	5.6	165	grey water, algae on rock
	20-Nov-96	950				
	05-Dec-96	300		6.8	170	
	15-Dec-96	2070		6.7	150	
	17-Dec-96	6570		6.9	200	
	07-Jan-97	1580			170	
	15-Jan-97	1030		7	200	
	21-Feb-97	202		7.1	195	
	17-Apr-97	510		7.1	180	debris, algae
	16-Feb-98	9	<10	6.9	170	clear
	02-Jun-98	1680		6.8	186	grey water smell, VOC's
	13-Sep-99	210		7.5	247	debris
	13-Dec-99	1020		6.9	151	

Storm Drains Report

Results from 1995 to 2000

Station Number	Date	Fecals/100ml	Comments	pH	Conductivity	Comments/ Indicators
----------------	------	--------------	----------	----	--------------	----------------------

NBS-620-FW

Queen's Ditch at Point Lazo Boat Launch

17-Jun-96	173			6.95	258	algae, abnorm. colour
15-Jul-96	343			7.1	300	algae, odors, abnorm. colour
19-Aug-96	480			7.4	333	ab. colour, litter, odour
20-Sep-99				7.1	200	algae
22-Nov-99	360			6.7	230	abnormal colour
20-Mar-00	99.9	<100		6.7	204	abnormal colour

Appendix 5

Stormdrain Water Sample Form

STORM DRAIN MONITORING LOG

(FILL IN ONE LOG FOR EACH STORM DRAIN)

General Information

Page # _____ of # _____

Date: yr _____ mo _____ dy _____

Time:

Storm drain number: _____ start _____ finish _____

Weather Conditions

Air Temperature _____ °C

Weather (check one) clear ☐ snow ☐ overcast ☐ fog ☐
 drizzle ☐ downpour ☐ partly cloudy ☐

Number of days with similar weather _____ days

Rainfall in previous 24 hours (check) _____ none _____ light _____ heavy

Site Observations

Water speed: fast ☐ moderate ☐ slow ☐

Water depth: _____ meters

Indicators: (circle any that apply)

fishkills dead crabs oil on surface debris foam algae
 erosion bubbles abnormal colour odors birds/animals
 toilet paper

OTHER: (concerns/observations)

Storm Drain Testing Results (test water directly at outflow point)

Water Temperature _____ °C

Fecal Coliform Taken _____ YES _____ NO

Greases and Oils Taken _____ YES _____ NO

Conductivity Taken _____ YES _____ NO

RESULTS
Office use

Cond. result _____ us.

pH - circle or write in

6.0 6.3 6.5 6.7 6.8 6.9 7.0 7.1 7.2 7.3 7.5 7.6

← acidic neutral alkaline →

Comments: _____

Detergents (ppm) 0 to 1.3

STORM DRAIN MONITORING LOG

(FILL IN ONE LOG FOR EACH STORM DRAIN)

General Information

Page # _____ of # _____

Date: yr _____ mo _____ dy _____

Time: _____

Storm drain number: _____

start

finish

Weather Conditions

Air Temperature _____ °C

Weather (check one)

clear ☐

drizzle ☐

snow ☐

downpour ☐

overcast ☐

partly cloudy ☐

fog ☐

Number of days with similar weather _____ days

Rainfall in previous 24 hours (check) _____ none _____ light _____ heavy

Site Observations

Water speed: fast ☐

moderate ☐

slow ☐

Water depth: _____

meters

Indicators: (circle any that apply)

fishkills

dead crabs

oil on surface

debris

foam

algae

erosion

bubbles

abnormal colour

odors

birds/animals

toilet paper

OTHER: (concerns/observations)

Storm Drain Testing Results (test water directly at outflow point)

Water Temperature _____ °C

Fecal Coliform Taken _____

YES

NO

Greases and Oils Taken _____

YES

NO

Conductivity Taken _____

YES

NO

RESULTS

Office use

Cond. result _____ μS

pH - circle or write in

6.0

6.3

6.5

6.7

6.8

6.9

7.0

7.1

7.2

7.3

7.5

7.6



acidic

neutral

alkaline



Comments: _____

Detergents (ppm)

0

to

1.3

Appendix 6

Comox Harbour Marine Sampling Volunteers

Comox Harbour Marine Monitoring Volunteers

The monitoring of the water quality in the Comox Harbour has been facilitated through the Canadian Coast Guard Auxiliary Unit #60 volunteers. This organization has contributed its regular on-call volunteers to staff their boat, the 'Bruce Brown II', for the biweekly sample gathering trip. The following list of volunteers participating in this project have assumed different tasks, including acquiring the supplies from the laboratory, taking the samples of the water and temperature, recording the observations, delivering the samples and data sheets to the lab, and commanding the boat.

Coxswains

Bob	Bouck
Garry	Brown
Brian	Cameron
Curt	Hansen
Derek	Harris
Matt	Jansen
Kevin	O'Brien
Stefan	Pletscher
Ted	Wallis

Volunteers

Jeff	Balchin
Ron	Anderson
Kieth	Begg
Roger	Casson
Mel	Clisby
Paul	Dickie
Gerry	Dyck
Mike	Ellis
Dennis	Flint
Mike	Geneau
Paul	Giles
Frank	Heeley
Brian	Johns
Larry	Johnson
Jerry	Lucas
Jim	Mackie
Fred	Maniak
Sam	Manson
Hugh	McKinnon
Jamesalan	Munro
Bill	Murray
Ted	Newell
Gord	Olsen
George	Penfold
James	Volkers
Roger	Wishart
Brad	Wood

Appendix 7

Comox Harbour Marine Water Sample Data – May 1995 to May 2000

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
NBS-011-M					
	31-May-95	10:10	8	13.5	
	14-Jun-95	8:59	23	12	
	29-Jun-95	9:30	13	20	
	14-Jul-95	9:05	2	16	8 boats
	11-Aug-95	8:00	33	16	4 boats
	30-Aug-95	11:30	4	19	3 seals
	12-Sep-95	9:40	30	18	birds and seals
	24-Sep-95	8:45	2	16	birds
	09-Oct-95	10:00	130	13	3 bird flying over
	23-Oct-95	8:28	50	20	
	08-Nov-95	9:35	350	0	
	22-Nov-95	13:05	220	8	
	07-Dec-95	9:05	540	6	Birds everywhere
	09-Jan-96	10:20	170	7	
	22-Jan-96	9:22	13	5	
	06-Feb-96	9:05	1600	6	
	21-Feb-96	9:10	33	6	
	07-Mar-96	9:05	13	6	100 herring boats in Comox Bay
	21-Mar-96	8:45	4	6	
	09-Apr-96	10:38	33	8	
	24-Apr-96	11:00	240	8	
	08-May-96	9:35	11	10	
	21-May-96	8:50	13	10	6 flying birds
	04-Jun-96	9:14	5	13	
	20-Jun-96	9:00	5		
	04-Jul-96	9:20	4.9	16	2 eagles, 2 seals
	18-Jul-96	9:15	5	15	2 birds above, 1 sealion
	02-Aug-96	9:00	10		
	19-Aug-96	10:30	35	17	
	16-Sep-96	9:40	240	15	
	28-Oct-96	9:00	79	10	
	26-Nov-96	9:45	920	8	
	10-Feb-97	9:00	7	6	
	10-Mar-97	9:00	49		~ 200 birds on shore at all sites
	27-Mar-97	9:00	8	6	
	10-Apr-97	10:38	5	10	
	28-Apr-97	10:05	13	9	large number of ducks off Comox Hill
	12-May-97		5		
	27-May-97	9:30	11	14	20 birds on shore, 10 flying over
	09-Jun-97	9:08	23	14	

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
	23-Jun-97	9:00	79	14	50 birds on water
	11-Aug-97	9:05	11		20 birds flying and 20 on shore
	21-Aug-97	9:20	40	18	4 birds flying over
	05-Sep-97	9:25	220	16	
	06-Oct-97		5		
	20-Oct-97	11:10	23	9	100 flying and 3 birds on shore
	23-Nov-98	11:10	33	8	many ducks on water
	07-Dec-98	11:15	49	7	15 flying birds, 4 seals
	21-Dec-98	10:00	17	1	1 bird flying, 3 on shore
	04-Jan-99	10:00	13	6	0 birds flying, 0 on shore
	18-Jan-99	9:50	33		24 birds flying
	29-Jan-99	8:36	79	4	20 birds flying, 37 onshore
	15-Feb-99	8:23	17	5	0 birds flying, 0 onshore
	01-Mar-99	8:10	240	5.5	2 birds flying, 10 onshore
	15-Mar-99	9:05	5	4.5	0 birds flying, 12 on shore
	31-Mar-99	7:45	1.9		0 birds flying, 0 onshore
	14-May-99	7:33	6	10	0 birds flying, 0 onshore
	27-May-99	8:40	17	10	
	07-Jun-99	13:10	8	12	6 birds flying, 50 onshore
	28-Jun-99	7:15		12	
	14-Jul-99	7:16	70	13	2 birds flying
	29-Jul-99	7:34	49	18	20 on water
	11-Aug-99	7:28	13	19	
	27-Aug-99	7:23	1.9	19	3 flying, 5 on water
	10-Sep-99	7:12	13	13.5	
	27-Sep-99	8:05		12	
	26-Oct-99	9:05	130	10	50+ birds flying
	08-Nov-99	8:11	49	9	50 Birds on shore
	22-Dec-99	8:02		9	10-20 birds flying
	06-Jan-00	8:40	49	6	
	20-Jan-00	8:35	22	5	
	03-Feb-00	7:40	13	5	10 birds flying
	18-Feb-00	7:42	8	6	10 birds flying, 20 birds on water, 2 birds
	03-Mar-00	7:13	23	6	10 birds flying
	13-Mar-00	12:11	23	8	
	04-Apr-00	7:11	2	9	1 bird flying, 1 seal
	19-Apr-00	7:33	4	10	5 birds flying, 5 birds on water
	18-May-00	8:12	1.9	13.5	1 seal

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
NBS-014-M					
	31-May-95	10:10	4	13.5	
	14-Jun-95	9:11	17	12	
	29-Jun-95	8:44	33	19	
	14-Jul-95	9:17	33	16	
	28-Jul-95	8:10	30	16	
	11-Aug-95	8:00	33	16	
	30-Aug-95	11:35	70	18	
	12-Sep-95	9:50	23	18	birds and seals
	24-Sep-95	8:52	23	15	birds and seals
	09-Oct-95	10:10	90	12	12 bird flying 12 on shore
	23-Oct-95	8:35	23	20	
	08-Nov-95	9:40	170		
	29-Nov-95	13:10	500	9	
	07-Dec-95	9:10	130	6	Birds everywhere
	08-Jan-96	10:30	30	7	
	22-Jan-96	9:30	23	5	
	06-Feb-96	9:10	49	5	
	21-Feb-96	9:15	17	5	
	07-Mar-96	9:10	49	6	100 herring boats in Comox Bay
	21-Mar-96	8:55	2	6	
	09-Apr-96	10:47	23	8	
	24-Apr-96	11:05	79	8	
	08-May-96	9:40	8	10	
	21-May-96	9:55	13	10	6 flying birds
	04-Jun-96	9:22	30	10	
	24-Jun-96	9:00	5		
	04-Jul-96	9:30	5	16	1 gull
	18-Jul-96	8:50	5	12	3 flying birds, 10 on shore
	02-Aug-96	9:00	105		
	19-Aug-96	10:35	30	16	1 seal
	16-Sep-96	9:55	220	14	
	28-Oct-96	9:10	170	8	
	26-Nov-96	9:10	33	8	
	10-Feb-97	9:00	33	6	
	10-Mar-97	9:00	17		~ 200 birds on shore at all sites
	27-Mar-97	9:35	7	7	
	10-Apr-97	10:30	1.9	9	
	28-Apr-97	10:10	8	9	
	12-May-97		13		
	27-May-97	9:40	2	14	5 flying birds

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
	09-Jun-97	9:05	22	13	
	23-Jun-97	9:05	31	14	10 birds on water
	11-Aug-97	9:10	2		20 on shore and 20 flying birds
	21-Aug-97	9:15	75	18	
	05-Sep-97	9:35	33	17	
	06-Oct-97		33		
	20-Oct-97	11:15	9	10	20 birds flying over
	23-Nov-98	11:20	13	8	many ducks on water
	07-Dec-98	11:25	170	7	
	21-Dec-98	10:23	4	2	30 bird flying, 60 on shore
	04-Jan-99	10:05	8	6	0 birds flying, 0 on shore
	18-Jan-99	9:55	49		6 birds flying
	29-Jan-99	8:45	170	5	0 birds flying, 0 onshore
	15-Feb-99	8:30	33	5	0 birds flying, 0 onshore
	01-Mar-99	8:15	79	5.5	5 birds flying, 10 onshore
	15-Mar-99	9:10	4	6	1 birds flying, 0 on shore
	31-Mar-99	7:46	8		0 birds flying, 0 onshore
	14-May-99	7:33	8	10	10 birds onshore
	27-May-99	8:45	31	10	
	07-Jun-99	13:17	7	13	
	28-Jun-99	7:22		12	2 flocks flying
	14-Jul-99	7:06	49	14	20 birds flying, 4 on shore
	29-Jul-99	7:40	7	19	
	11-Aug-99	7:38	22	19	
	27-Aug-99	7:28	22	19	3 in water
	10-Sep-99	7:16	11	13.5	
	27-Sep-99	8:10		11	3 birds flying, 20 on shore
	26-Oct-99	9:10	22	9	20+ birds flying, 20+ birds on shore
	08-Nov-99	8:18	110	8	20 birds flying, 50 on shore
	22-Dec-99	8:07		9	50+ birds flying
	06-Jan-00	8:48	1600	5	15 birds flying, 10 on water, 10 on shore
	20-Jan-00	8:40	22	5	
	03-Feb-00	7:46	5	5	30 birds flying
	18-Feb-00	7:48	2	6	15 Birds flying, 50 birds on water, 2 birds
	03-Mar-00	7:22	33	7	2 birds flying
	13-Mar-00	12:16	5	7	20 birds on water
	04-Apr-00	7:16	5	9	1 bird flying
	19-Apr-00	7:37	13	11	2 birds flying, 1 bird on water
	18-May-00	8:18	1.9	14	2 birds flying, 150 on shore

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
NBS-018-M					
	31-May-95	10:10	4	13.5	
	14-Jun-95	9:15	11	13	
	29-Jun-95	8:49	8	19	
	14-Jul-95	9:21	2	15	
	28-Jul-95	8:20	13	15	
	11-Aug-95	8:00	49	16	
	30-Aug-95	11:50	2	18	10 birds flying
	12-Sep-95	10:00	4	18	birds and seals
	24-Sep-95	9:00	8	15	birds
	09-Oct-95	10:15	8	12	
	23-Oct-95	8:40	50	18	
	08-Nov-95	9:50	130		
	29-Nov-95	13:15	300	9	
	07-Dec-95	9:15	49	6	Birds everywhere
	08-Jan-96	10:35	50	6	
	22-Jan-96	9:40	11	5	
	06-Feb-96	9:20	170	5	
	21-Feb-96	9:20	46	5	
	07-Mar-96	9:20	11	6	
	21-Mar-96	9:00	1.9	5	
	09-Apr-96	10:54	8	9	
	24-Apr-96	11:17	540	9	
	08-May-96	9:45	4	10	
	21-May-96	9:00	4	10	10 flying birds
	04-Jun-96	9:28	60	13	2 sea lions, 2 flying birds
	20-Jun-96	9:00	4.9		
	04-Jul-96	9:40	5	15	many ducks on water
	18-Jul-96	9:00	25	14	10 birds flying, 200 + onshore
	02-Aug-96	9:00	4.9		
	19-Aug-96	11:00	4.9	16	
	16-Sep-96	10:33	1.9	15	
	28-Oct-96	9:20	110	10	
	10-Feb-97	9:00	7	6	
	10-Mar-97	9:20	17		~ 200 birds on shore at all sites
	27-Mar-97	9:55	8	8	
	10-Apr-97	10:50	2	9	
	28-Apr-97	10:25	5	9	
	12-May-97		2		
	27-May-97	9:45	4	14	
	09-Jun-97	9:30	5	14	

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
	23-Jun-97	9:21	79	14	8 birds on water
	11-Aug-97	9:20	5		
	21-Aug-97	9:28	10	18	
	05-Sep-97	9:45	8	15	
	06-Oct-97		17		
	20-Oct-97	11:20	1.9	11	20 birds flying
	23-Nov-98	11:38	33	8	many ducks on water
	07-Dec-98	11:35	170	9	5 birds flying
	21-Dec-98	10:32	9	1	4bird flying, 20 on shore
	04-Jan-99	10:08	1.9	6	100 ducks on water
	18-Jan-99	10:16	130		0 birds flying
	29-Jan-99	8:49	170	5	50 on water, 10 birds flying, 15 onshore
	15-Feb-99	8:40	7	6.5	60 birds flying, 50 onshore
	01-Mar-99	8:20	49	5	5birds flying, 15 onshore
	15-Mar-99	9:15	1.9	5	200 birds flying,
	31-Mar-99	8:05	7		0 birds flying, 0 onshore
	14-May-99	7:44	2	11	
	27-May-99	8:48	5	11	2 birds flying, 200 inwater
	07-Jun-99	13:22	1.9	13.5	10 birds flying, 400 onwater
	28-Jun-99	7:30	13	12	20 birds flying
	14-Jul-99	7:25	1.9	15	6 birds flying, 20 on shore
	29-Jul-99	7:45	1.9	18	80 birds on water
	11-Aug-99	8:06	8	19	
	27-Aug-99	7:35	13	19	2 birds flying, 5 on water
	10-Sep-99	7:19	5	13.5	1bird flying, 200+ on water
	27-Sep-99	8:15		12	
	26-Oct-99	9:14	1.9	11	15+ birds flying
	08-Nov-99	8:35	33	9	30 birds on shore
	22-Dec-99	7:35		9	
	06-Jan-00	9:27	70	8	10 birds flying
	20-Jan-00	8:45	13	6	15 birds flying, 15 on water, 4 on shore
	03-Feb-00		11	6	10 birds flying
	18-Feb-00	8:03	4	7	4 birds flying, 5 birds on water
	03-Mar-00	7:35	17	8	4 birds flying, 4 birds on water
	13-Mar-00	12:31	2	8	
	04-Apr-00	7:20	1.9	9	3 birds flying, 20 on water
	19-Apr-00	7:53	17	9.5	5 birds flying, 5 on water
	18-May-00	8:38	7	12.5	

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
<u>NBS-020.5-M</u>					
	29-Jun-95	9:35	7	21	
	14-Jul-95	9:40	33	15	
	28-Jul-95	8:35	30	15	
	11-Aug-95	8:00	540	15	
	30-Aug-95	12:10	2	18	
	12-Sep-95	10:10	23	16	seals
	24-Sep-95	9:10	240	15	seals
	09-Oct-95	10:20	8	12	4 bird flying 4 on shore / 15 seals
	23-Oct-95	8:50	23	18	
	08-Nov-95	9:20	1600	0	> 1600 MPN
	29-Nov-95	13:25	280	9	
	07-Dec-95	9:00	13	6	Birds everywhere
	08-Jan-96	10:45	240	6	
	22-Jan-96	9:49	23	5	
	21-Mar-96	9:15	1.9	6	
	09-Apr-96	11:00	1.9	10	
	24-Apr-96	11:25	540	9	
	08-May-96	9:55	13	11	4 seals
	21-May-96	9:05	2	10	1 seal 4 flying birds
	04-Jun-96	9:36	70	13	2 sea lions, 15 flying 6 onshore birds
	20-Jun-96	9:00	4.9		
	04-Jul-96	9:55	5	16	5 eagles, 1 gull 1 heron
	18-Jul-96	9:10	4.9	12	100 flying birds, 1 sealion
	02-Aug-96	9:00	4.9		
	19-Aug-96	11:05	5	16	
	16-Sep-96	10:40	5	15	60 birds on shore, 5 flying, 2 seals
	28-Oct-96	9:40	130	10	
	26-Nov-96	9:25	33	8	3 seals
	10-Feb-97	9:15	11	6	
	10-Mar-97	9:30	14		~ 200 birds on shore at all sites
	27-Mar-97	10:00	1.9	8	
	10-Apr-97	11:13	1.9	9	
	28-Apr-97	10:30	2	10	
	12-May-97		5		
	27-May-97	9:55	13	14	
	09-Jun-97	9:28	1.9	14	200 birds on shore
	23-Jun-97	9:25	23	14	8 flying and 12 birds on water
	11-Aug-97	9:45	2		
	21-Aug-97	9:32	4.9	19	6 sailboats anchored, 2 birds on shore
	05-Sep-97	9:55	7	15	

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
	06-Oct-97		17		
	20-Oct-97	11:30	8	10	80 birds flying
	23-Nov-98	11:41	130	8	many ducks on water
	07-Dec-98	11:45	11	8	50-100 birds on water
	21-Dec-98	10:50	13	2	10 bird flying
	04-Jan-99	10:32	6	5	100 ducks on water
	18-Jan-99	10:22	130		150birds flying
	29-Jan-99	9:12	23	5	50+ on water, 10 birds flying
	15-Feb-99	8:48	23	6	100 birds flying, 30 onshore
	01-Mar-99	8:25	33	5	10 birds flying, 50 onshore
	15-Mar-99	9:18	2	6	1 birds flying, 500 on shore
	31-Mar-99	8:10	2		10 birds flying, 50 onshore
	14-May-99	8:08	8	10	5 birds flying 20 onshore
	27-May-99	9:10	2	12	10 birds flying, 50 inwater
	07-Jun-99	13:46	1.9	14	1 birds flying, 5onshore
	28-Jun-99	7:35	5	12	
	14-Jul-99	7:50	13	16	10 birds on shore
	29-Jul-99	8:05	5	20	
	11-Aug-99	8:12	33	19	
	27-Aug-99	7:55	49	19	
	10-Sep-99	7:27	5	13.5	
	27-Sep-99	8:40	5	12	30 birds flying, 20 birds on shore
	26-Oct-99	9:34	13	16	
	08-Nov-99	8:24	17	9	10 birds flying, 200 birds on shore
	22-Dec-99	7:40		8.5	200+birds on water
	06-Jan-00	9:13	14	7	100 birds on water
	20-Jan-00	8:50	17	5	50 birds on water, 10 on shore
	03-Feb-00	8:19	33	5	5 birds flying, 5 birds on water
	18-Feb-00	8:10	8	5	10 birds flying, 50 birds on water, 40 bird
	03-Mar-00	7:45	11	8	20 birds flying, 10 birds on water, 10 bird
	13-Mar-00	12:35	1.9	8	30 birds on water, 50 birds on shore
	04-Apr-00	7:39	2	10	5 birds flying, 10 on water, 10 on shore
	19-Apr-00		1.9	10	20 birds flying, over 25 on water, over 25
	18-May-00	8:46	2	12	30 seals on log boom

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
NBS-025-M					
	04-Jun-96	9:50	35	12	5 flying birds
	20-Jun-96	9:00	4.9		
	04-Jul-96	9:10	5	15	
	18-Jul-96	9:45	10	12	2 birds flying, 6 onshore, 1 sealion
	02-Aug-96	9:00	55		
	19-Aug-96	10:45	4.9	15	3 flying birds
	16-Sep-96	10:25	7	15	
	28-Oct-96	9:35	920	10	
	26-Nov-96	9:35	33	8	
	10-Feb-97	9:20	13	6	
	10-Mar-97	9:45	33		~ 200 birds on shore at all sites
	27-Mar-97	9:42	5	8	
	10-Apr-97	10:42	1.9	9	
	28-Apr-97	10:15	8	9	
	12-May-97		22		
	27-May-97	10:10	13	14	
	09-Jun-97	9:15	7	14	4 seals
	24-Jun-97	9:10	110	16	6 flying and 8 birds on water
	11-Aug-97	9:45	8		
	21-Aug-97	9:47	20	18	3 birds flying, 4 on shore
	05-Sep-97	10:07	79	15	
	06-Oct-97		79		
	20-Oct-97	11:40	13	10	
	23-Nov-98	11:25	33	8	many ducks on water
	07-Dec-98	11:55	130	8	100 floating birds
	21-Dec-98	10:45	8	2	5 bird flying, 2 on shore
	04-Jan-99	10:15	33	5	150 ducks on water
	18-Jan-99	10:02	49		0 birds flying
	29-Jan-99	9:02	33	6	0 birds flying, 0 onshore
	15-Feb-99	8:56	33	6	0 birds flying, 0 onshore
	01-Mar-99	8:30	33	4.5	0 birds flying, 0 onshore
	15-Mar-99	9:21	25	5	50 birds flying
	31-Mar-99	7:54	33		30 birdson water, 100 onshore
	14-May-99	8:00	11	10	20 birds flying 25 onshore
	27-May-99	9:05	2	12	
	07-Jun-99	13:28	2	14	
	28-Jun-99	7:46	22	12	
	14-Jul-99	7:34	79	15	4 birds flying, 15 on shore
	29-Jul-99	7:50	33	18	50 birds on water, 10 on shore
	11-Aug-99	7:45	33	19	25 birds on shore

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
	27-Aug-99	7:39	22	19	1 bird flying, 10 in water
	10-Sep-99	7:23	49	13.5	5 birds flying
	27-Sep-99	9:30	2	12	100's birds flying, 100's birds on shore
	26-Oct-99	9:19	22	11	
	08-Nov-99	8:43	350	9	300 birds on shore
	22-Dec-99	8:18		10	100+ birds in water
	06-Jan-00	8:54	79	10	30 birds flying
	20-Jan-00	8:55	79	4	
	03-Feb-00	7:56	130	5	50 birds on water
	18-Feb-00	7:55	5	5	20 birds flying, 40 birds on water, 100 bir
	03-Mar-00	7:25	49	7	5 birds flying, 5 birds on water, 10 birds
	13-Mar-00	12:22	2	9	
	04-Apr-00	7:25	2	7	Over 50 Birds Flying, over 70 birds on w
	19-Apr-00	7:43	2	11	10 birds flying, 20 on water, over 50 on s
	18-May-00	8:25	5	13	16 birds on water, 30 on shore

Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
NBS-055-M					
	31-May-95	10:10	50	13.5	
	14-Jun-95	9:25	8	12	
	29-Jun-95	8:00	2	18	
	14-Jul-95	9:30	1.9	14	
	28-Jul-95	8:30	2	15	
	11-Aug-95	8:00	13	15	
	30-Aug-95	12:00	2	19	
	12-Sep-95	10:05	4	15	birds
	24-Sep-95	9:05	1.9	15	birds
	09-Oct-95	10:30	2	11.5	6 bird flying 8 on shore
	08-Nov-95	10:00	170	0	
	29-Nov-95	13:20	7	10	
	07-Dec-95	9:20	2	6	Birds everywhere
	08-Jan-96	10:40	30	7	
	06-Feb-96	9:25	110	5	
	21-Feb-96	9:25	33	5	
	07-Mar-96	9:25	33	6	
	21-Mar-96	9:10	4	6	
	09-Apr-96	11:05	13	10	
	24-Apr-96	11:18	170	10	
	08-May-96	10:05	2	11	500 flying bird
	21-May-96	9:10	4	10	2 flying birds
	04-Jun-96	9:41	30	12	4 flying birds
	20-Jun-96	9:00	4.9		
	04-Jul-96	9:45	4.9	16	
	18-Jul-96	9:05	4.9	14	12 onshore birds, 1 sealion
	02-Aug-96	9:00	4.9		
	19-Aug-96	10:55	4.9	16	
	28-Oct-96	9:25	5	10	
	10-Feb-97	9:30	13	6	
	10-Mar-97	9:40	4		~ 200 birds on shore at all sites
	27-Mar-97	9:50	1.9	8	
	10-Apr-97	10:56	1.9	9	
	28-Apr-97	10:20	5	10	
	12-May-97		2		
	27-May-97	10:00	1.9	14	200 flying 30 on shore birds
	09-Jun-97	9:20	1.9	13	
	23-Jun-97	9:17	7	16	12 birds on water
	11-Aug-97	9:35	1.9		
	21-Aug-97	9:42	35	17	5 birds on shore, 3 flying over

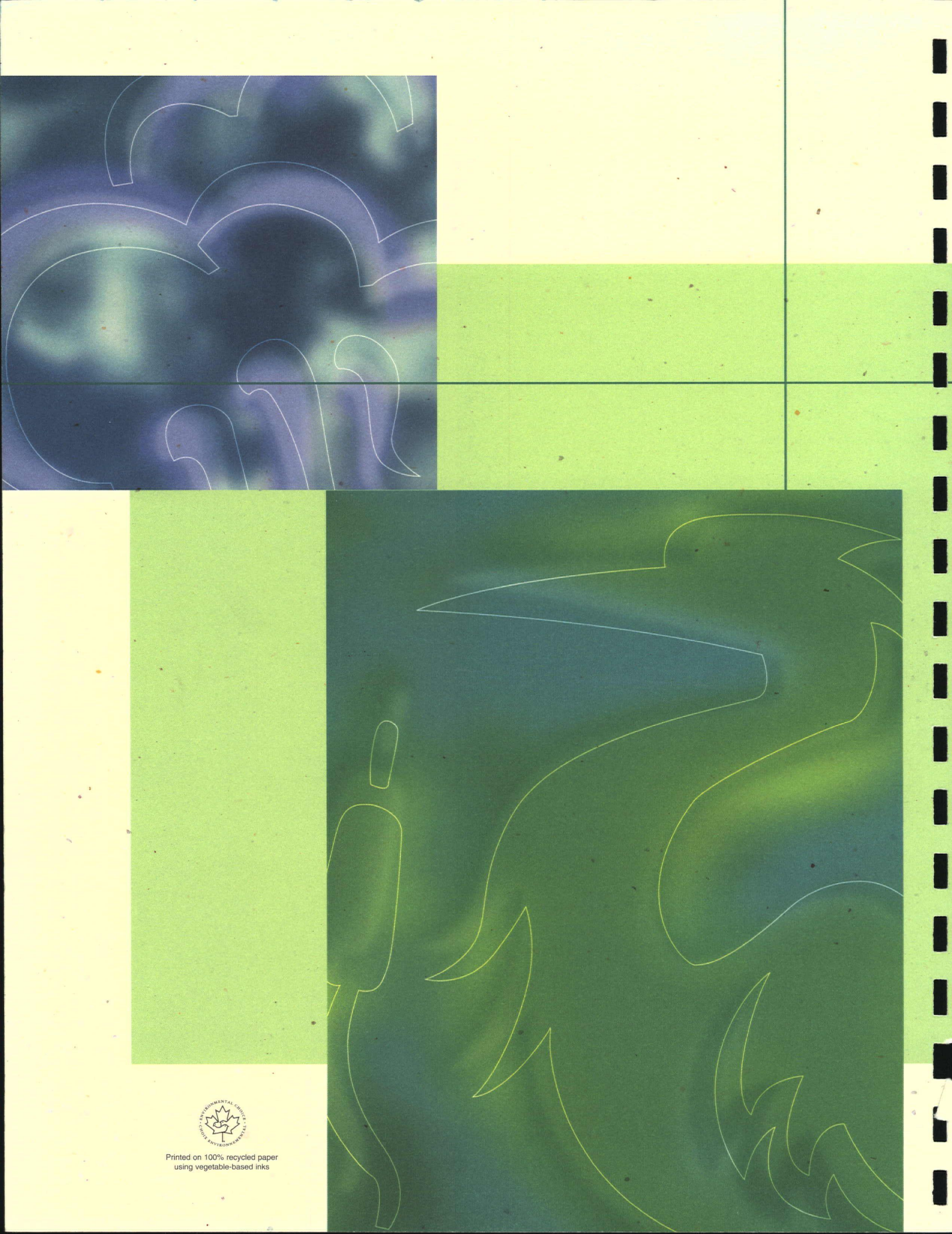
Comox Harbour Marine Report

Results from 1995 to 2000

<u>Station Number</u>	<u>Date</u>	<u>Time</u>	<u>MPN/100 ml</u>	<u>Water Temp.</u>	<u>Comments</u>
	05-Sep-97	10:00	7	15	
	06-Oct-97		2		
	20-Oct-97	11:35	17	10	50 birds flying over
	23-Nov-98	11:30	7	8	
	07-Dec-98	12:10	46	8	200 floating birds
	21-Dec-98	10:36	33	6	24 bird flying, 15 on shore
	04-Jan-99	10:20	5	7	100 ducks on water
	18-Jan-99	10:08	17		100 birds flying
	29-Jan-99	8:50	13	6	50birds flying, 50 on water
	15-Feb-99	9:02	5	6.5	0 birds flying, 0 onshore
	01-Mar-99	8:35	33	6	10 birds flying, 50 onshore
	15-Mar-99	9:30	7	5	10 birds flying, 200 on shore
	31-Mar-99	8:00	1.9		50 birds onwater, 100 onshore
	14-May-99	7:49	1.9	11	50 birds flying 10 onshore
	27-May-99	8:55	5	14	10 birds flying, 50 onshore
	07-Jun-99	13:36	1.9	14	
	28-Jun-99	7:42	33	12	20 birds flying
	14-Jul-99	7:41	2	16	2 birds flying
	29-Jul-99	7:55	13	19	2 birds on water
	11-Aug-99	7:52	11	19	
	27-Aug-99	7:44	1.9	19	4 Birds Flying, 2 on water
	10-Sep-99	7:28	1.9	13.5	6 birds flying, 5 on water
	27-Sep-99	8:25	2	12	100's birds flying, 100's birds on shore
	26-Oct-99	9:25	1.9	15	
	08-Nov-99	8:30	5	10	10 birds flying, 50 birds on shore
	22-Dec-99	8:26		10	100+ birds in water
	06-Jan-00	9:03	33	9	50 birds flying
	20-Jan-00	9:00	5	7	10 birds flying, 100 on water
	03-Feb-00	8:30	5	7	10 birds flying, 10 birds on water
	18-Feb-00	7:58	17	7	75 birds flying, 200 birds on water, 50 bir
	03-Mar-00	7:30	13	8	10 birds flying
	13-Mar-00	12:26	7	8	
	04-Apr-00	7:31	1.9	9	Over 60 birds flying, 20 birds on water
	19-Apr-00	7:49	1.9	11.5	Over 50 birds flying, over 50 birds on wat
	18-May-00	8:30	1.9	13	2 birds flying, 10 on water, 6 on shore,

Appendix 8

Comox Harbour Water Sample Form



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