FRASER POLLUTION ABATEMENT OFFICE

Progress Report 1992 - 93

CANADA'S GREEN PLAN
LE PLAN VERT DU CANADA

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FRASER POLLUTION ABATEMENT OFFICE

1992 - 93 Progress Report

By

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EXECUTIVE SUMMARY

The Fraser River Action Plan (FRAP), an initiative of Canada's Green Plan, was announced in June 1991. One of the three primary objectives of FRAP is to clean up pollution in the Fraser River Basin. This objective depends on pollution abatement. The Fraser Pollution Abatement Office (FPAO) of the Fraser River Action Plan was established in 1991 with the responsibility to identify and reduce pollutants entering the Fraser River Basin.

The FPAO has now completed its first full year of operation. This progress report will summarize the strategic approach, outline the main program areas, and profile the accomplishments of each of the projects undertaken by the Fraser Pollution Abatement Office in this first year (1992/93). The Introduction provides background on the role of FPAO within the larger framework of the Fraser River Action Plan and the Green Plan.

Numerous government and nongovernment agencies, research institutes, First Nations groups, and industry associations — not to mention the general public — are concerned with the environmental quality and sustainable development of the Fraser River Basin. Pollution, habitat destruction, and urban development have already put the river under stress. As the population continues to grow, demands on the river and competition for resource use are increasing, resulting in conflict and the potential for environmental damage.

But the Fraser can be protected and the trend to environmental degradation reversed. Because of the wide range of government jurisdictions and regulatory agencies, the tremendous financial costs involved, and the increased need for integrated management, numerous partnerships and cooperative working arrangements have been set up by FPAO to help achieve its goals.

FPAO's strategy focuses on a variety of domestic and industrial point and non-point sources of contamination of the Fraser River Basin. These have been organized into six main program areas: Industrial Discharges, Municipal Discharges/Urban Runoff, Agricultural Runoff, Groundwater Contamination, Contaminated Waste, and Airborne Contaminants.

Within each of these areas, contaminant sources must first be catalogued and characterized. In addition, methods for organizing and using large volumes and multiple sources of data need to be formulated. Developing inventory databases and digitized maps, guidelines, site-specific impact assessments, design manuals, codes of practice, industry training courses, and workshops are all part of the range of projects of the FPAO.

Approximately 30 projects, several within each program area, were carried out during 1992/93. Most of these were performed at some level of partnership with other agencies and organizations. All of them contribute to the achievement of FPAO goals. Many of these projects required one or more years of continuing activity and may still be in operation.

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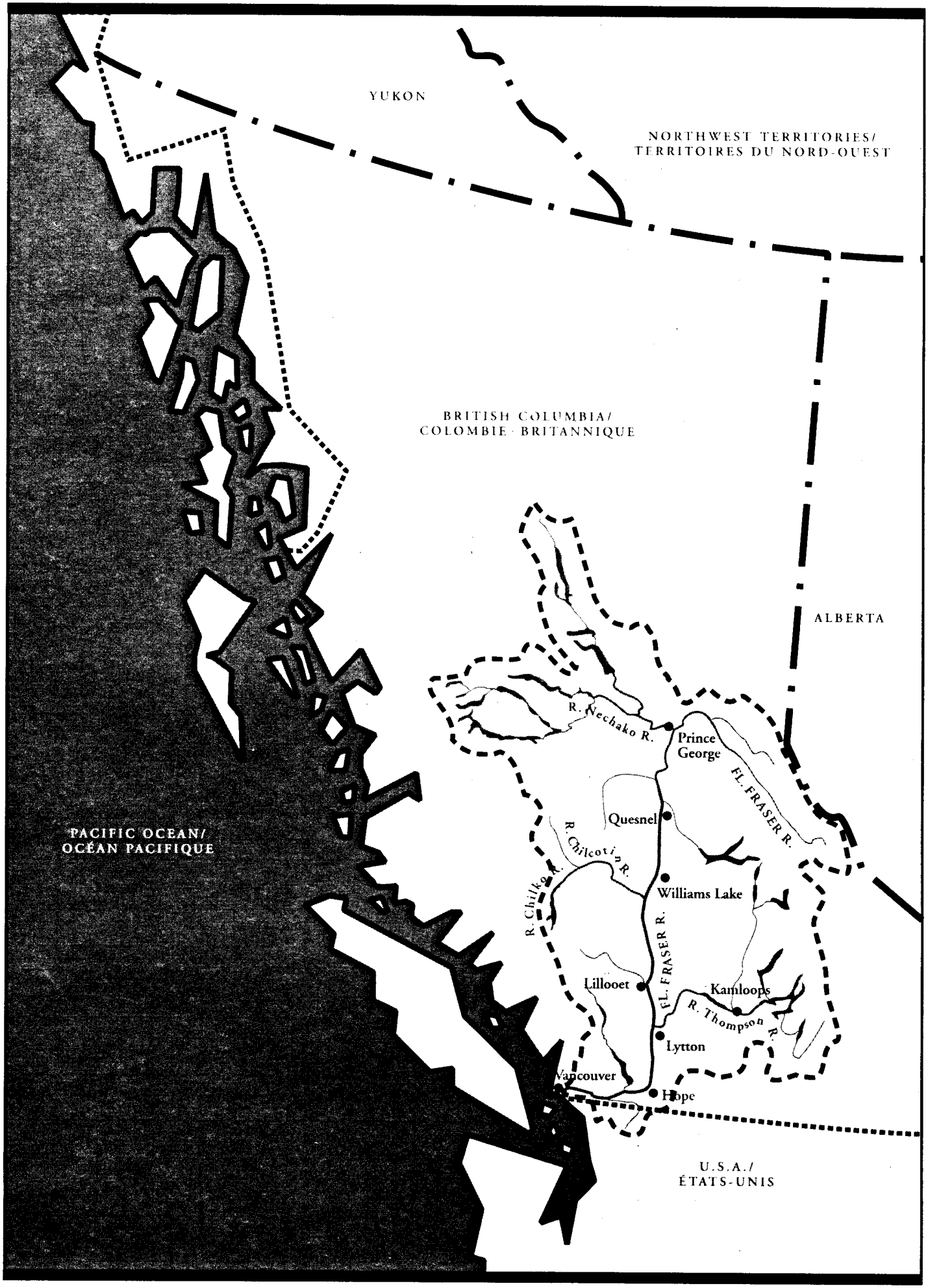
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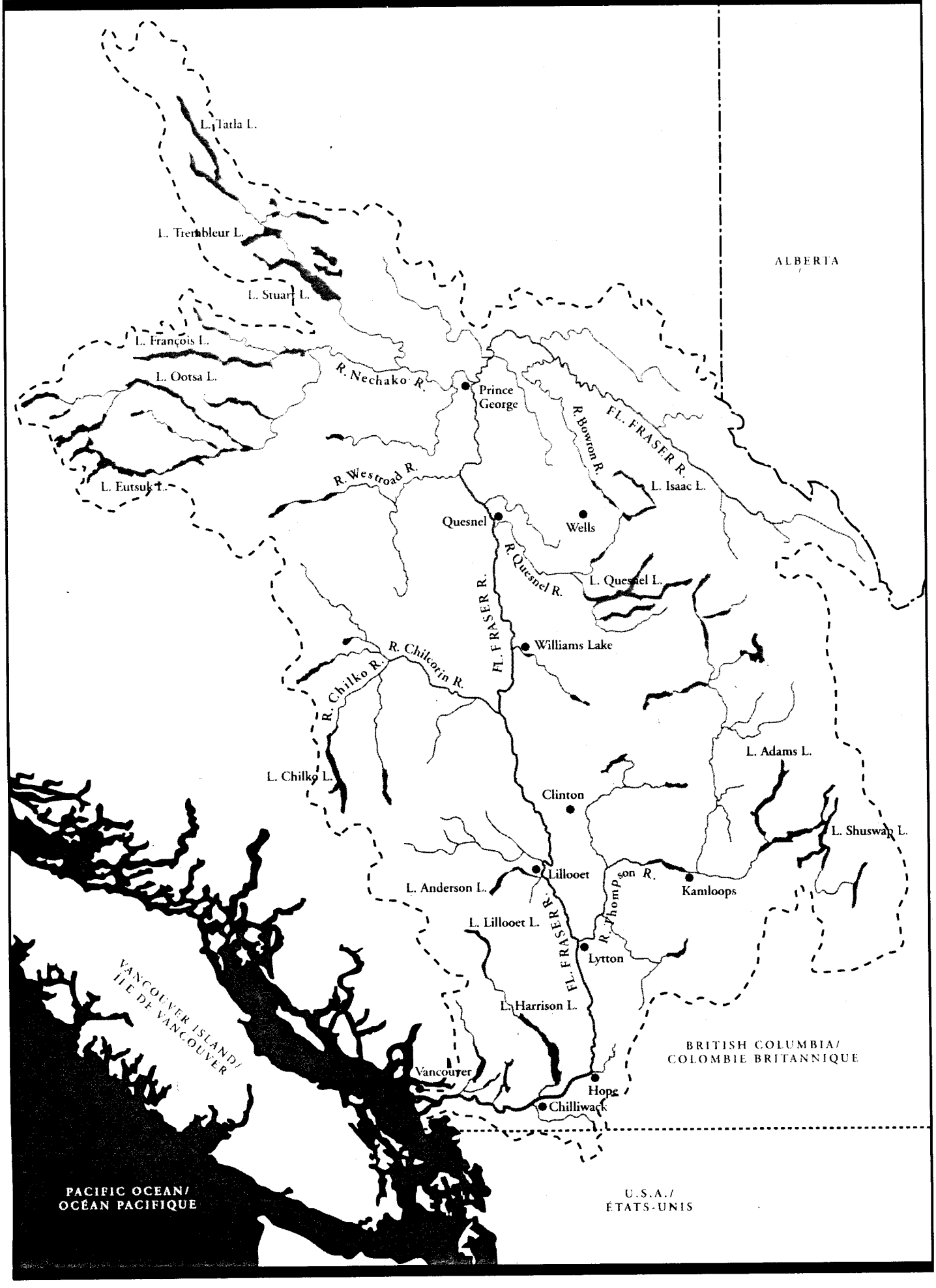
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1.0 INTRODUCTION

1.1 The Fraser River Basin

The Fraser River runs 1,375 km from its headwaters in Mt. Robson Provincial Park to its massive delta at the Strait of Georgia. The Fraser Basin covers 25% of British Columbia, taking in the watersheds of dozens of tributaries, including the Nechako, Bowron, Chilcotin, and Thompson rivers. It is the fifth largest river basin in Canada and contains a diversity of landscapes, ranging from alpine wilderness to plateaus and canyons, rolling uplands, wetlands, and estuaries.

All but one of BC's 14 biogeoclimatic zones are represented in the Fraser River Basin. This mosaic provides habitats for a tremendous diversity of plant and animal species. Magnificent wildflower meadows, grasslands, and forests can all be found in the Fraser Basin. It is home to wolves, bears, mountain goats, bighorn sheep, caribou, moose, and countless small mammals; reptiles and amphibians (important environmental quality indicator species); and provides critical nesting, feeding, and staging habitats for hundreds of thousands of migratory birds and waterfowl.

Nearly two million people - over 60% of BC's population - live, work, and play in this vast and diverse region. The cultural history of many of the province's peoples can be traced throughout the Fraser River system, from the earliest activities of First Nations peoples through European contact, the fur trade, overland trails, gold rushes, and eventual multicultural settlement. The Fraser River has been a vital transportation link for trade and exploration, and remains a focus for human settlement and industrial growth.

The Fraser River system produces more salmon than any other river system in the world. It provides over 65% of the province's sockeye, 60% of the pink, and 16% of the chinook salmon catches, and gives an average return of about $300 million from the combined commercial, recreational, and aboriginal food catches.

The Basin supports 48% of BC's commercial forest area, 60% of its metal mining operations, and nearly 45% of the province's precious farmland. Tourism and outdoor recreation are also significant contributors to the economy in the Fraser Basin.

The waters of the river connect the land to the air, plants, animals, and people; the river supports the ecosystems of the Fraser Basin. But the same water also transports environmental contaminants within this ecosystem. Over 50% of industrial discharge volumes in the Basin come from pulp mills in its northern interior, and about 95% of municipal waste discharge volumes come from the cities and towns in its lower reaches.

It is evident that environmental integrity of the Fraser River Basin must be protected and improved in order to sustain its immense importance to the people of British Columbia.

1.2 The Green Plan And The Fraser River Action Plan

In summer 1990, Canadians across the country participated in public meetings to voice their concerns and suggestions for cleaning up and protecting the environment. Canada's Green Plan was developed in response to the ideas expressed at those meetings. In recognition of its tremendous environmental and economic importance, clean-up and sustainable management of the Fraser River Basin was targeted as a priority. The resulting six-year, $100 million Fraser River Action Plan (FRAP), one of over 100 programs contained in the Green Plan, is the largest single Green Plan initiative in British Columbia.

The mission of FRAP is to clean up pollution, restore the productivity of the natural environment of the Fraser River Basin, and implement a management program to ensure its long-term sustainability.

This is a huge responsibility. The government of Canada is working together with the government of British Columbia, First Nations, communities, industry, and other stakeholder groups along the Fraser River in its efforts to clean up pollution and achieve environmental and socioeconomic sustainability in the Fraser Basin.

FRAP is administered jointly by the Department of Environment (DOE) and the Department of Fisheries and Oceans (DFO). Environment Canada's approach is to lead (carry a project or study through to completion on its own), participate (where partnerships are essential to the completion of a project or where DOE doesn't have the primary mandate), and support (where DOE's role is to provide financial or limited technical input) studies and projects that will help accomplish the goals of the Fraser River Action Plan.

A key component of FRAP, operated by Environment Canada, is pollution abatement. The pollution abatement component is charged with the tasks of identifying contaminants entering the waters of the Fraser River Basin, and preventing and cleaning up point and non-point sources of pollution. Of FRAP's total funds, $6.5 million over six years is directly allocated for pollution abatement.

1.3 Fraser Pollution Abatement Office

Key objectives of the Fraser River Action Plan are to arrest and reverse pollution of the Fraser Basin, and to reduce the discharge of persistent toxic substances into the river. A primary component of these objectives is pollution abatement. In 1991, the Fraser Pollution Abatement Office (FPAO) was established specifically to coordinate activities toward identifying, preventing, and cleaning up pollution in the Fraser River Basin.

The goal of FPAO is to ensure healthy ecosystems in the Fraser River Basin by working with others to identify contaminants and to prevent and clean up point and non-point sources of pollution.

Specific pollution abatement targets are to:

- reduce by 30% the total discharge of environmentally disruptive effluents entering the waters of the Basin by 1997
- significantly reduce the release of persistent toxic substances entering the waters of the Basin by the year 2000

Persistent toxic substances are defined by the Priority Substances List (PSL) and Toxic Substances List (TSL) of the Canadian Environmental Protection Act.

The chief federal legislation from which FRAP and FPAO have their mandate to act are the Canadian Environmental Protection Act and the Fisheries Act. Both of these are sufficiently broad-based to enable a wide range of actions. FPAO's success in achieving its goals will also depend in large part on voluntary pollution prevention measures by communities and industries in the Basin.

1.4 FPAO Strategic Approach

The work of the Fraser Pollution Abatement Office is complex. To achieve its goals, FPAO has developed a multilateral and cooperative strategy to identify and reduce or eliminate contaminants entering the Fraser River Basin in six main program areas: Industrial Discharges, Municipal Discharges/Urban Runoff, Agricultural Runoff, Groundwater Contamination, Contaminated Waste, and Airborne Contaminants.

The strategic approach includes:

- inventories of point and non-point sources of pollution
- wastewater characterization and pollutant loading evaluations
- site-specific environmental impact assessments
- identification of control technologies and cost-effectiveness
- reviews of technology and best management practices (BMP)

- prioritization of discharges for abatement
- support for industry and public education programs
- development of specific partnerships based on problem, expertise required, and mandates
- development of codes of practice for voluntary pollution prevention
- regulatory instrument compliance reviews
- promotion of economic and non-economic incentives, such as user-pay systems, deposits/refunds, government procurement policies, environmental citizenship, and alternative uses of waste
- implementation of detailed abatement plans in consultation with other government agencies and dischargers, and in accordance with the polluter-pays principle

This strategic approach enabled FPAO to initiate, support, or participate in a wide range of projects during 1992/93.

1.5 Partnerships

The costs associated with pollution abatement are enormous. The chief means by which FPAO can significantly reduce costs is by entering into partnerships.

FPAO's roles include leading, participating, and supporting a wide array of projects with the primary objective of pollution abatement in the Fraser River Basin. Building on existing programs in partnership with other government and industry organizations can accelerate or expand the levels of accomplishment and save financial resources by avoiding duplication of effort.

One of the foremost partnerships is between the Department of Environment and the Department of Fisheries and Oceans, each of which is responsible for half of FRAP core funding ($50 million DOE, $50 million DFO). While each department focuses on its own areas of expertise and responsibility, their activities are coordinated by a senior level joint committee. A number of working groups, technical committees, and scientific advisors cooperate in a formal and informal way to share knowledge and resources.

FPAO also initiates new projects in partnership with other federal government departments and initiatives, notably Agriculture, Health and Welfare, Indian And Northern Development (DIAND), Geological Survey of Canada (GSC), Atmos- pheric Environment Service (AES), and Fraser River Estuary Management Plan (FREMP).

Provincial government ministries and agencies, particularly branches of BC Environment, namely, Environmental Protection and Pesticide Management; and the ministries of Agriculture, Fisheries and Food, and Health, have been active partners with FPAO to achieve both federal and provincial goals for pollution abatement and waste management in the Fraser River Basin.

FPAO also works in collaboration with municipal and regional governments, industry associations, and research institutes.

Some of FPAO's current partners include Greater Vancouver Regional District (GVRD), Municipality of Surrey, City of Prince George, Fraser Valley Health Unit, BC Federation of Agriculture, Greenhouse Growers Association, Nursery Growers Association, Mushroom and Berry Producers Association, BC Water & Waste Association, and National Water Research Institute.

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2.0 THE PROJECTS

2.1 Highlights Of 1992/93 Project Year

The Fraser Pollution Abatement Office lead, participated in, or supported upwards of 30 projects for the 1992/93 fiscal year. Some of these were completed by April 1993, but many require additional time to complete or are ongoing monitoring programs.

A large number of projects addressed the lack of data - and a database for the entire Fraser Basin - on the locations and types of discharge sites and wastewater characterization and loadings. Characterization means a detailed analysis for chemical and biological variables. Loading is a mathematical term (concentration x flow = mass) that essentially means the amount of a substance being discharged to a receiving environment.

The design of sampling techniques and field protocols is a critical area. Uniform, valid, and consistently utilized techniques are required if the data collected is to have any degree of comparability. Some projects addressed this need.

Inventories and characterizations of point and non-point sources of pollution have also been a focus of FPAO during 1992/93. These included:

- industrial discharges
- municipal discharges, including combined sewer overflows (CSOs) and urban runoff
- agricultural runoff
- groundwater mapping and determination of contaminant loading in confined and unconfined aquifers

Point source discharges are those that enter the receiving environment from a single, distinct point, such as a pipe. They are concentrated points where samples can be taken directly from the discharge under study. Examples of point source discharges include sewage treatment plants and industrial wastewater discharge systems.

Non-point source discharges are dispersed over a large area where there is widespread opportunity for contaminants to enter the receiving environment. They may be accumulated discharges that result from a number of individual sources. Examples include agricultural runoff, urban runoff, combined sewage overflows during storm events, or areas affected by airborne contaminants.

Among the other pollution abatement projects completed in 1992/93 are a survey of an abandoned mine to evaluate effects on the aquatic ecosystem, development of a database for effluent monitoring, support for an Integrated Pest Management certification program, and the design of a toxic air emissions inventory.

The Contaminated Sites program was active in forming a partnership with BC Environment to set up a computerized inventory of contaminated sites that will help plan future remediation.

Pollution prevention and treatment depends on sharing knowledge and technological innovation. Technology transfer is an important component of FPAO's activities and there are aspects of it in most of the current projects.

The following project profiles give more detailed information on the activities of the Fraser Pollution Abatement Office for 1992/93.

2.2 Project Profiles

In the following profiles, information is provided on funding, partnerships, and FPAO contact. In many cases, in-kind funding has been provided, particularly by BC provincial ministries, which have expended considerable staff time, expertise, and facilities, and given other kinds of support, including datasharing and file searches.

In other cases, industry groups or producers' associations have participated in a project, often by producing initial surveys or final reports.

These profiles give details about each of the projects conducted in 1992/93. Projects completed in the start-up year (1991/92) are not covered in this report.

FPAO staff and DOE advisory contact information is provided in section 4.0.

2.2.1 Effluent Point Source Inventory and Database for the Fraser River Basin and Fraser Point Source Inventory Users' Manual

Performed by: UBC Westwater Research Centre

Funding by: FPAO $48.5 K

In Kind: Department of Indian And Northern Development (DIAND); BC Environment: Environmental Protection Division, Water Quality Branch, Laboratory Services and Systems Management Branch provided staff time and expertise, and retrieval and clarification of digital data.

FPAO Contact: Lisa Walls

In order to design a cost-effective strategy for wastewater discharge characterization and control in the Fraser River Basin, the number, locations, and types of sources need to be identified. This project began by identifying the need for a georeferenced inventory of industrial and municipal point sources of wastewater discharges and a PC-based system to maintain, examine, and report the information collected in the inventory.

The project's two primary objectives were:

1. to conduct an inventory of industrial and municipal point sources of wastewater discharges in the Fraser River Basin, including basic administrative, geographic, and regulatory data on each source, and

2. to design a PC database system to maintain, examine, and report the information collected in the inventory.

Data was collected from BC Waste Management permits (using BC Environment's WASTE data management system) and site visits to BC Environment regional offices. Data on federal non-permitted installations was obtained from FFEAD, the Federal Facilities Environmental Activities Database of Environment Canada. FFEAD data was supplemented with site information for federal facilities obtained from Environment Canada files, DIAND, federal institutions, and Transport Canada.

The ability to transfer data from one database type to another was an important criteria of this project in order to maximize information exchange and avoid duplication of effort. The database model was, therefore, designed to conform to the Spatial Archive and Interchange Format (SAIF) developed by BC Environment. The resulting program is called the Fraser Point Source Inventory, or FR_PSI.

As of April 1993, the FR_PSI contained records for 456 sites, including maximum allowable discharge limits. Data summaries

were comprised by sub-basin, region, key parameters, and major industry groups.

The information contained in the resulting database represents an effort to collect, compile, and summarize the data available from many sources on point-source wastewater discharges in the Fraser Basin, but it has limitations.

Non-point sources and sources that discharge to municipal storm sewer or sewage interceptors were not included in this project.

Reports from the database should be cautiously interpreted. The FR_PSI does not include monitoring data. Other limitations and caveats also apply, such as inconsistent or missing data, and discharge values that may differ from what is listed on the wastewater discharge permit.

Recommendations to make the database system more inclusive and accurate include:

- using BC TRIM 1:20 000 digital maps to provide more accurate location information
- standardizing the language and format of BC waste management permits
- updating FR_PSI at least every six months
- inclusion of a number of missing small federal facilities and Indian Reserves

Verification and beta-testing (field trials) of the FR_PSI are currently underway. This feedback is expected to identify any necessary improvements to the software and corrections to the data.

The project also resulted in the production of a User's Manual for the FR_PSI.

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2.2.2 Preliminary Report On The Effects Of Abandoned Mine Tailings At Wells, B.C. On The Aquatic Ecosystem Of Jack Of Clubs Lake

Performed by: Lakes Research Branch, National Water Research Institute

Funding by: FPAO $10 K; NWRI $35 K

In Kind: BC Environment staff in Williams Lake and Prince George provided support to the field work; Geological Survey of Canada provided polarography, on-site chemical analysis, and field sampling.

FPAO Contacts: Lisa Walls and George Derksen

This study is part of a project on assessment of effects of mining activities on aquatic ecosystems. Like every other industry, mining generates waste products, such as tailings and waste rock. These frequently contain some naturally occurring and potentially toxic elements, either from the metal ore, or from substances, such as mercury and cyanide, introduced during the various stages of extraction.

Potential environmental risks associated with abandoned tailings deposits are a concern of the local community, but there was limited information on the effects of the old mine on adjacent aquatic ecosystems. This data is essential to identify pollution sources and assess their effects on the ecosystems of the Fraser Basin.

The purposes of this study were

- to determine the effects of the abandoned tailings on the biota in Jack of Clubs Lake and on adjacent land at Wells, BC
- to determine the distribution of major and trace elements in the different environmental compartments (water, suspended and bottom sediments, interstitial water of sediments and biota)
- to examine the transport of major and trace elements from the tailings into the Fraser River system

Water, vegetation, and invertebrate samples were collected from various types of sites in the lake, at the tailings on the northeast side, and from several sites in and near the Willow River and adjacent streams. Bowron Lake, in nearby Bowron Lake Provincial Park, was assumed pristine and used as a control or reference site for the study.

Concentrations of 43 major and trace elements were determined from the samples, and ten soluble and particulate nutrients were analyzed. Benthic community structure and microbial activity were evaluated.

While concentrations of metals, iron oxides, and sulphides were greater nearest the tailings and in adjacent bottom sediments, as were conditions of low pH, the gradients levelled out. It is assumed that the bottom sediments act as a sink, rather than a source for many of these substances. Elevated concentrations of some were observed in the vegetation and invertebrates collected from the tailings.

The bioavailability of certain trace elements in sediments increases towards the tailings. There was evidence that they inhibit a variety of microbial activities, including enzyme functions, carbon dioxide production, humification of organic matter, and denitrification, but the causes are not yet known.

On preliminary examination, the benthic community data did not demonstrate any major effect from the mine tailings. There was some indication of reduced overall numbers at one station, and the bivalves may be particularly sensitive. There were low numbers and sporadic distribution of oligochaetes. Effects are assumed to be localized, but without reference data from other similar lakes, it is difficult to know what type of community to expect.

A number of additional investigations need to be carried out in order to more accurately interpret the results of this study, particularly a survey of similar, noncontaminated lakes.

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2.2.3 Chemistry And Toxicity Of Three Wastewaters

Prepared by: Environmental Management Associates and Hydroqual Laboratories Ltd.

Funding by: FPAO $9 K

FPAO Contact: Lisa Walls

This project provided interpretation of a pilot wastewater characterization study carried out in April and May 1992 as part of initial steps to develop a toxicity testing program tailored to the Fraser River Basin and to assign priorities for abatement.

Data was analyzed for three representative effluent types sampled in 1992:

1. primary treated domestic sewage from Greater Vancouver wastewater treatment plant (Annacis Island)
2. final effluent from a bleached kraft pulp mill (Northwood Pulp & Timber at Prince George)
3. urban runoff from a Vancouver storm sewer

While there were some problems with large numbers of variable data from the different labs, making interpretation of chemical profiles problematic, the following general results were tabulated.

Annacis Island effluent contained high concentrations of suspended solids, ammonia, nitrogen, and the metals aluminum, copper, and zinc. It was also high in oil and grease. The effluent was not being chlorinated at the time samples were taken, but some less toxic forms of dioxin

and furan compounds (not 2,3,7,8 congeners) were detected. Acutely toxic effects were exhibited in tests with rainbow trout and *Daphnia magna*.

Northwood's effluent contained suspended solids, resin acids, dissolved salts, nitrogen, phosphorus, aluminum, and zinc. Low concentrations of chlorinated organic compounds were identified, but AOX concentration was high. It was slightly toxic to trout at full strength, inhibited reproduction in some microorganisms, and repressed algal growth.

The storm sewer water was relatively low in dissolved salts, but contained significant concentrations of the metals aluminum, copper, zinc, and nickel. There were also traces of 2,4-D detected from use on lawns and gardens, and small amounts of dioxins and furans. This effluent showed no acute toxicity.

All three effluents exhibited some degree of genotoxicity. Of the three, the pulp mill effluent stood out in genotoxicity and algal growth repression.

Toxicity bioassays can only measure the potential for harm because of the differences between laboratory and field conditions, and because it is impossible to test every organism in the ecosystem. In addition, conditions in the river (hardness, temperature, turbidity, etc.) can modify lab results. However, experience has shown that contaminants sufficient to produce toxic responses in lab tests may lead to loss of species in nature and a disruption of normal ecosystem function. The magnitude of effects is also dependent on the strength of the toxicity, its persistence, and the volume of effluent relative to the flow of the river.

Outcomes of this project included recommendations for a broader range of sampling measurements (ion balance, dissolved oxygen), and further algal toxicity testing of Fraser Basin pulp mill effluents.

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2.2.4 Evaluation Of The PEEP* Index And Recommended Toxicity Tests For The Fraser River Basin

Prepared by: Environmental Management Associates and Hydroqual Laboratories Ltd.

Funding by: FPAO $10 K

FPAO Contact: Lisa Walls

This project was undertaken, along with the previous one, as part of the plan to develop a reliable toxicity testing program to rank and compare waste discharges in the Fraser Basin, and to monitor the progress of pollution abatement measures.

The PEEP index was initially developed for testing and ranking effluents in the St. Lawrence River Basin.

PEEP uses results from four small-volume bioassays, selected to incorporate a range of trophic levels and a variety of acute and chronic endpoints.

One of the purposes of this project was to examine the environmental relevance and applicability of the PEEP index to the Fraser River Basin. This evaluation was done using the results of a project that characterized three representative wastewater samples (primary treated municipal wastewater from Annacis Island, secondary treatment, bleached kraft pulp mill effluent, and runoff from a Vancouver storm sewer).

The second purpose of this project was to recommend a test or array of tests best suited to assaying toxicity of wastewater discharges entering the Fraser River Basin.

As initially formulated, the PEEP index in its present form was judged unsuitable for the Fraser River system because it underemphasizes acute lethal toxicity and strongly weights toward a screening test of genotoxicity.

The recommended toxicity test program must be applicable to all kinds of effluent discharges found in the Basin. It must provide results that are quantitative and reproducible so that it can track changes in toxicity of effluents and monitor the success of abatement techniques.

This report includes a set of guidelines for standardized methods of sample collection and storage, quality control, and testing of toxicity.

*PEEP = Potential Ecotoxic Effects Probe

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2.2.5 Recommended Guidelines For Wastewater Characterization In The Fraser River Basin. Volume I, Development Document and Volume II, Draft Methods Manual

Prepared by: Norecol Environmental Consultants Ltd.; chapter on toxicity testing prepared by Environmental Management Associates and Hydroqual Laboratories Ltd.

Funding by: FPAO $38 K

FPAO Contact: Lisa Walls

This project was carried out to strengthen the scientific basis of FPAO's strategy to characterize contaminant sources and determine loadings of specific contaminants to the Fraser River Basin.

The study focused on "end of pipe" measurements on stationary source effluent discharges to surface water courses and to ground, including process and cooling water discharges. Storm water is included if it discharges directly to the receiving environment through a pipe or ditch (point source) and does not discharge to the municipal storm, sanitary, or combined sewer (CSO) systems.

It is envisioned that many wastewater characterizations will be conducted throughout the Fraser Basin by various government agencies, Crown corporations, First Nations, industries, consultants, and other stakeholders. In order to ensure comparability of data generated at different sites and by different agencies, a consistent set of field sampling protocols and analytical procedures must be established.

This project describes the parameters to be measured, the protocols for field sampling, and the preferred analytical methods to be used in the quantitative assessment of wastewater discharges in the Fraser Basin.

The report generated by this project is in two volumes. Volume I defines the parameters to be measured in the wastewater characterization program and explains the rationale for parameter selection. Volume II outlines sampling and analytical protocols.

More specifically, Volume I, the Development Document, identifies core parameters to be measured at all sites and source-specific parameters to be monitored at specific industrial, agricultural, or urban (sewage treatment plant) sites. Developing the parameters list involved:

1. development of an initial list of parameters to be evaluated

2. evaluation of the parameters with emphasis on tentatively selecting those persistent and/or toxic substances that could have significant impacts on aquatic organisms

3. final parameter selection based on probable presence in Fraser Basin effluents

and the ability to obtain accurate, routine analytical results

The selection process resulted in the identification of nine core and 35 industry-specific parameters or parameter groups.

The industry-specific parameters included a variety of parameters that have been identified in sediments and fish tissues in the Fraser Basin: chlorophenols, chlorinated dioxins and furans, polycyclic aromatic hydrocarbons (PAHs), and several metals. These parameters also include chlorinated and non-chlorinated organic compounds selected from CEPA's PSL. These substances are potentially of concern because of their toxicity or because they have been found in the tissues of aquatic organisms from other basins.

Volume I identifies industry-specific parameters for ten industry groups. It also recommends development of, or testing to confirm the validity of, analytical methods for parameters potentially of concern but for which reliable methods do not exist or have only recently been developed.

Volume II is a guideline document, developed to provide consistent protocols for field sampling and analytical methods used for FPAO's wastewater characterization program.

This guideline document outlines:

- guidelines on field sampling procedures for chemical characterization, including sample collection, preservation, processing, and transportation
- methods of measuring effluent flow rate
- field quality assurance measures
- preferred and alternate methods for chemical analyses
- data reporting specifications
- collection, analysis, and reporting requirements for effluent toxicity tests

By following these procedures, different individuals and agencies can generate reliable and comparable data on contaminant concentrations and loadings, and effluent toxicity.

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2.2.6 Fraser River Basin Pulp Mill Database Project

Prepared by: David Skippon, Co-op Student, Kwantlen College

Funding by: FPAO $6 K; data provided by Fraser Basin pulp mills

FPAO Contact: Lisa Walls

As part of its wastewater characterization program, FPAO has established a database of pulp mill effluent compliance monitoring data from five pulp mills in the Fraser Basin. This database contains information on a range of daily and monthly measurements, including biochemical oxygen demand (BOD), total suspended solids, acute toxicity, adsorbable organic halides (AOX), dioxins, furans, and nutrients.

The primary objective of this project was to assemble all the effluent monitoring data available from these five pulp mills, using 1990 as a baseline year, and transfer that data from paper copy reports into the federal government Envirodat database

The five pulp mills in this study were:

- Northwood Pulp & Timber Ltd in Prince George; bleached kraft
- Prince George Pulp & Paper Mills in Prince George; bleached kraft
- Cariboo Pulp & Paper in Quesnel; bleached kraft
- Quesnel River Pulp Company in Quesnel; thermal/mechanical
- Weyerhaeuser Canada in Kamloops; bleached kraft

Envirodat is a national Environment Canada database, residing on VAX Oracle. It contains information such as the

geographic locations of the sampling sites, sampling dates and times, method of analysis and test results for water quality, effluent, sediment, and biota analysis data. The Fraser Pollution Abatement database is set up as a regional module of the national Envirodat system.

While the Fraser River Basin Pulp Mill Effluent Database project was completed in April 1993, ongoing updates are required. This database will become an important part of the data now being gathered on the Fraser Basin and will be a valuable tool for resource managers and researchers. It will contribute to future management decisions for the Fraser River Basin.

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2.2.7 Effluent Characterization Study: Fraser River Estuary Management Program (FREMP)

Performed by: Technology Resource Inc. and McLeay Associates Ltd., with chemical analysis by Analytical Services Ltd. and biological tests by BC Research Corp.

Funded by: FPAO $40 K and Environment Canada, Environmental Quality Division $150 K

In Kind: The project was coordinated by the Water Quality/Waste Management Committee of the Fraser River Estuary Management Program (FREMP).

FPAO Contact: Lisa Walls

This was an effluent characterization project for industries that discharge into the Fraser River Estuary. Eleven industries participated: Domtar, Fraser Wharves, Hilinex Packaging, International Forest Products (IFP) - Hammond Cedar and Fraser Mills divisions, Lafarge Canada, MacMillan Bloedel (New Westminster), Scott Paper, Tilbury Cement, Tree Island Steel, and Westshore Terminals. Assessments showed that most discharges were under permit by BC Environment, and six of these permits were up to date.

This project is part of a three-year monitoring cycle to generate environmental trend data on the fate and effects of contaminants in the Fraser River Estuary. The data will be used as a basis for establishing priorities for the subsequent monitoring of contaminants and toxicity in water, sediments, and biota, and to recommend priorities for pollution abatement. The study covers three components of effluent characterization: chemistry, toxicity, and bio-uptake, as well as assessments of the operations at the eleven participating industries.

Three samples were collected at each of 17 discharge locations in the eleven industrial sites. All samples were analyzed for a wide range of chemical parameters and subjected to acute and chronic toxicity tests, as well as tests for muscle bio-uptake of heavy metals, PAHs, and chlorinated phenolic compounds.

Results indicated general compliance with permitted discharge limits, but some excursions were noted. Operational assessments indicated that reported discharge flow rates do not necessarily reflect actual rates. As well, a number of Waste Management Permits were out of date.

Each of the ten effluents sampled showed chronic toxicity to *Ceriodaphnia dubia*, possibly because of one or more effects of heavy metals (these showed high concentrations in some samples). Future chemical characterizations should focus on heavy metal concentrations. Resin and fatty acids, total suspended solids, and specific PAHs

were also detected, and one effluent exhibited an adverse pH.

Varying degrees of chronic and acute toxicity were exhibited. Of the samples tested, 37% failed the acute lethality test for *Daphnia magna*, and 10% demonstratrd acute lethality to rainbow trout. For the effluent samples studied, the chronic toxicity test using *Ceriodaphnia dubia* was consistently and appreciably more sensitive than the acute lethality tests.

For all primary effluents studied, the extent of accumulation of any contaminants in fish muscle tissue was only at trace amounts or was non-detectable. Recommendations were made for future bio-uptake studies.

In general, final recommendations were made to use lower limits of detection for all the components (chemistry, toxicity, bio-uptake) looked at in this study. As well, more information needs to be compiled in order that a more rigorous interpretation of data and comprehensive appraisals of potential effects of a particular discharge on the receiving environment can be made.

Ω

2.2.8 Initial Dilution Zone Impact Assessment: Fraser River Estuary Management Program

Co-funding by: FRAP (Environmental Quality component) $80 K

In Kind: Study managed by FPAO and supported by FREMP

FPAO Contact: Lisa Walls

The initial dilution zone (IDZ) monitoring program is a preliminary study to document impacts of wastewater discharges on the receiving environment in a zone 100 m on either side of an outfall. The study consisted of sampling receiving water and sediments within the IDZs of those industries in the Fraser River Estuary sampled in the previous study.

Field measurements included general physico-chemical parameters (pH, temperature, dissolved oxygen, salinity) and toxicity. As well, sediment samples were collected at three sites at each industry. All samples were analyzed for particle size, total organic carbon, and total metals. Sediments from selected sites were also analyzed for chlorophenols and PAHs. All sediments were tested for toxicity using at least two standard tests.

This IDZ study showed some site-specific industrial impacts, including locations with elevated levels of metals, pentachlorophenol, and PAHs in sediments, some chronic toxicity in the receiving water at one site, and some sediment toxicity at three sites.

Ω

2.2.9 Wood Preservation Industrial Stormwater Discharges - Lower Fraser Basin

Performed by: Envirochem Services Inc.

Co-funded by: FPAO $35 K and Environment Canada, Commercial Chemicals Branch $11.4 K

DOE Contact: Doug Wilson

The wood preservation industry in British Columbia uses approximately 4 500 metric tonnes of wood preservation chemicals annually to protect wood products from attack by fungi, insects, and marine borers. Predominant chemicals used include creosote, pentachlorophenol (PCP), and aqueous formulations of arsenic, copper, and chromium or ammonia.

These chemicals are washed off the wood in storage by rain and enter the Fraser River drainage in various ways as contaminated stormwater runoff. Roofing and paving of process areas reduces contaminated runoff to some degree, but little can be done about runoff from treated-wood storage yards.

This contaminated stormwater runoff has been identified by Environment Canada as a liquid process emission requiring control. Characterizations have been performed on the various leachates from chromated copper arsenate; all are toxic to fish. As well, stormwater discharges from wood preservation plants have been shown to be acutely toxic to fish.

The chemical concentrations in leachates from ammoniacal copper arsenate, pentachlorophenol, and creosote-treated pilings, timbers, railway ties, and the resulting contaminated stormwater concentrations, have not been characterized.

This project focused on characterizing these chemical leachates and on determining the acute fish toxicity, particularly to salmonid species, of selected leachate samples. The information can be used to:

1. identify the need to develop remedial actions at Fraser River wood preservative plant storage yards

2. provide information to BC Environment for the possible development of appropriate stormwater discharge levels in a Wood Preservation Chemical Waste Control Regulation under the BC Waste Manage- ment Act

3. provide information to Agriculture Canada for re-evaluation of its wood preservation chemicals schedule

Ω

2.2.10 A Comprehensive Survey Of Pesticide Use In BC: 1991

Prepared by: Norecol Environmental Consultants Ltd.

Funded by: FPAO $20 K and BC Environment (Pesticide Management Branch) $40 K

DOE Contact: Doug Wilson

BC Environment's Pesticide Management Program (PMP) has established the objectives of reducing reliance on pesticide use throughout the province by 25% (by the year 2001) and promoting integrated pest management (*IPM). Since pesticides eventually make their way into various components of the ecosystem, by reducing their use, these objectives address the overall goal of pollution abatement.

To estimate the current level of pesticide use and to identify changes in use, periodic surveys are necessary. This survey is based

on data from 1991 sales records. Its major objectives were:

- to establish a database and levels of pesticide use (to be updated on a periodic basis for the identification of trends)
- to identify the major uses of specific pesticides, which may help to identify those that should be reduced through legislation or the promotion of IPM methods.

The survey included use of commercial, domestic, and agricultural pesticides, and anti-sapstain, wood preservative, and slimicide chemicals. Exempted (as defined by BC Pesticide Control Act) pesticides were excluded, with the exception of flea control products sold by veterinarians. Pesticides sold in supermarkets and pharmacies, such as moth balls and aerosols, were also not included in the data because this wide distribution method precludes the gathering of accurate data.

The survey showed that over 5 million kg of pesticides were purchased or used by British Columbians in 1991. Wood preservative and anti-sapstain chemicals accounted for over 78% of this amount, and agricultural pesticides accounted for nearly 14%. Total pesticide use included 274 active ingredients.

The evaluation of data quality identified numerous errors in the annual summary data submitted by pesticide vendors and pest control service licensees. Recommendations for future surveys include suggestions for improving the accuracy of reporting sales and use summaries, and ways to increase awareness of survey objectives to promote cooperation and improve reporting accuracy, such as a media campaign or meetings with vendors, users, and industry representatives.

*IPM: Integrated Pest Management is an ecologically integrated approach to the control of pest populations (including insects), destructive invertebrates (notably nematodes), and disease organisms. There are also IPM programs for the control of weeds. Some IPM techniques (including the use of pesticides) are: crop rotation, use of biological pesticides, release of sterile mates, growing insect-resistant varieties, and the use of pheromone and other traps.

Ω

2.2.11 Ready-Mix Concrete Industry Environmental Code Of Practice (1993 Update)

Performed by: Envirochem Special Projects Inc.

Funded by: FPAO $5 K and Industrial Programs Division (DOE) $5 K and technical support

In Kind: Technical support provided by the BC Ready-Mix Concrete Association

DOE Contact: David Poon

This project produced a technical recommendations document (TRD) that outlines recommended operational practices for waste management in the ready-mix concrete industry. It will help to indicate the expected quality of discharges that may result from following the recommendations. It can be used by operators as a benchmark for new facilities or the upgrading of existing ones. These recommendations generally represent good industrial practices that are realistic and economically achievable.

The activities of the ready-mix concrete industry may occur at or near sensitive fisheries streams, groundwaters for irrigation or potable water supplies, marine

waters, or in other environmentally sensitive areas.

Process effluents or contaminated storm-water runoff have the potential to be discharged into environments that have significant resource value. This TRD will provide guidance to permanent and portable ready-mix concrete facility operators so that conflicts with other resource stakeholders are minimized.

The project, which was 50% funded by FPAO, builds on earlier work originally begun to assist the industry to take advantage of new technologies (*Overview of the Ready-Mix Concrete Industry in British Columbia, Water and Waste Management Practices* [June 1988] and *Recommended Waste Management Practices for the Ready-Mix Concrete Industry in British Columbia* [1990]).

The purposes of this project were:

- to outline recommended operational practices that will minimize the impact of ready-mix facilities on the receiving environment
- to determine how much of the industry has had time to learn about the Code of Practice
- to determine which management methods may be necessary to increase industry acceptance of the Code
- to continue to inform the industry about recent technology, including recycling and other environmental protection practices
- to encourage the industry to develop self-monitoring activities and perform environmental practice audits
- to provide uniform guidance to the BC Ministry of Environment as it formulates and administers Waste Management Permits for ready-mix concrete facilities

The recommendations are supported by facility operators, industry associations, admixture chemical suppliers, and regulatory agency personnel. Broad industry acceptance and performance of these practices will help to improve the quality of the Fraser River Basin.

Ω

2.2.12 Urban Runoff Quantification And Contaminants Loading In The Fraser Basin And Burrard Inlet

Performed by: Stanley Associates Engineering Ltd, December 1992

Funded by: FPAO $40 K

FPAO Contact: Alain David

This study was a planning-level assessment of surface water contaminant loadings to the Fraser Basin and Burrard Inlet from selected urban runoff sources. Runoff volumes and selected contaminant loadings were quantified on a mean monthly basis for each chosen municipality, grouped for each hydrographic region, and combined to present mean monthly and mean annual loadings to both the Fraser River and Burrard Inlet.

Twenty-five municipalities in the basin with a population in excess of 5,000, from Prince George to Delta but mostly of the lower mainland, were selected for consideration; combined, they represent approximately 91% of the total basin population and provide a representative indication of urban runoff contaminant loadings.

This study investigated loadings of 20 contaminants to the Fraser Basin and Burrard Inlet. Several of these parameters were anticipated to be found at background concentrations in undeveloped watersheds; it was difficult to quantify the parameters because of widespread variation. Thus, for various naturally occurring parameters, such as suspended solids, nutrients (nitrates and

nitrites, ammonia, etc.), metals, BOD, and COD, the total loading should not be considered entirely produced from urban development.

Parameters such as polycyclic aromatic hydrocarbons, oil and grease, phenols, and pesticides can be wholly attributed to anthropogenic sources; sources of fecal coliforms include animals and agricultural operations.

Some of the conditions affecting runoff included snowmelt, rainfall, temperature, topography, and human development and activities.

Contaminant loadings were based on typical urban runoff concentrations reported in the literature; no site-specific field sampling was conducted during this project. The contaminant loading values presented should not be considered as absolute values of anticipated loadings, but rather as a range of projected values, useful for future planning and investigation. For each contaminant in each municipality a low, typical, and high estimate of loading was provided.

Ω

2.2.13 Combined Sewer Overflow Inventory (Fraser River Basin And Burrard Inlet)

Prepared by: UMA Engineering Ltd.

Funded by: FPAO $14 K, with in-kind staff assistance from the City of Vancouver, GVRD, and City of New Westminster

FPAO Contact: Alain David

The objective of this project was to conduct an inventory of all combined sewer overflow (CSO) discharges to the Fraser River Basin, including Burrard Inlet and its tributaries. CSO discharges are point sources of pollution.

Data for the inventory came from existing information on the sites, their structures, overflow volumes, frequencies, quality, contributing industries, and the receiving environments. No field survey work was required.

A survey of British Columbia and Yukon sewage collection systems for municipalities with populations greater than 10,000 had already been conducted, therefore, this inventory was only concerned with municipalities located within or discharging to the Fraser Basin or Burrard Inlet with populations less than 10,000.

No CSO structures were located in the study area outside of the lower mainland. Within this region, however, 53 combined sewer outfalls were found: 5 in Burnaby, 13 in New Westminster, and 35 in Vancouver.

The purpose of the inventory questionnaire was two-fold:

- to determine whether wastewater collection in each jurisdiction consisted of entirely separate storm and sanitary sewage systems (or whether the collection systems were combined)
- where appropriate, to confirm to which watercourse the CSO was being discharged

The nature of the discharge of a particular outfall or its receiving environment was determined, but no detailed characterizations of CSO discharges were undertaken. Notwithstanding, there were a limited number of reports that provided estimates of CSO discharge quality and quantity, based on typical values found through literature review, monitoring data from sewage treatment plants, and/or simulation. Data on industrial and commercial

discharges to the wastewater collection systems of Burnaby, New Westminster, and Vancouver were obtained from waste discharge permits.

The 53 CSOs surveyed currently discharge untreated CSO to Burrard Inlet, including False Creek and English Bay, the Brunette River, and the North Arm of the Fraser River.

Ω

2.2.14 Sampling Procedures And Protocols For Combined Sewer Overflows And Urban Runoff

Prepared by: Novatec Consultants Inc., UMA Engineering Ltd., W20 Inc.

Funded by: FPAO $48 K

FPAO Contacts: Alain David and George Derksen

The Greater Vancouver Sewerage and Drainage District (GVS&DD) discharges into the Lower Fraser Basin and Burrard Inlet over 700,000 m^3/yr of liquids, made up of 50% urban stormwater runoff (UR), 41% wastewater, and 9% combined sewer overflow (CSO). While UR and CSO represent about 60% of the discharge volume to this environment, very little is known of the wastewater contaminant characteristics or environmental impacts of either source on the Fraser River.

The purpose of this project was to describe a recommended approach to characterize CSO and UR discharges to determine their potential for pollution loading to the environment.

The report is a guidance document for investigation and assessment of UR and CSO discharges into the Fraser River Basin. Its overall purpose was to provide agencies with procedural documentation to plan and implement monitoring programs for these two types of wastewater discharges.

Ω

2.2.15 Sewer Use Control Study (For Fraser Basin And Burrard Inlet)

Performed by: UMA Engineering Ltd.

Funded by: FPAO $22 K

FPAO Contact: Alain David

Municipal sewerage systems discharging to the Fraser River Basin collect and treat the domestic flow of over 80% of the Basin's population; a further approximately 13% of industrial wastewater is discharged to the Vancouver municipal system.

These municipal wastewater discharges have been found to contain an array of potentially toxic compounds, such as ammonia, cyanide, chlorine, anionic surfactants, heavy metals, organic materials, phenols, and sulphides. A large portion of these contaminants are likely of industrial or commercial origin.

Aside from contamination of the aquatic habitat, numerous other problems are attributable to these discharges, such as interference with treatment plant operations, corrosion of piping and equipment in sewer lines and treatment plants, possible explosions or fires in sewer systems, and potential danger for sewerage system workers from poisonous gases, burns, or skin irritations. A comprehensive, uniformly applied sewer use control program could reduce the occurrence of these problems.

This project was an initial step in the development of a sewer use control program for British Columbia. It involved three main areas of study:

1. an inventory of the sewer use bylaws of municipalities in the Fraser River and Burrard Inlet drainage basins to determine the state of wastewater regulation for the region (A number of federal and provincial Acts also regulate the manufacture, use, and sale of a range of chemicals [commonly found in wastewaters] used by commercial and industrial groups.)

2. a review of US and Ontario industrial wastewater pre-treatment and sewer use control programs to provide recommendations for a suitable program for BC

3. a discussion of wastewater minimization opportunities for industries and commercial enterprises

The goals of a sewer use program are the protection of receiving water quality, the sewerage system, worker and public health and safety, and air and sludge quality. Reporting requirements (by industrial and commercial users), compliance monitoring, and enforcement are critical components of an effective sewer use program.

To achieve these goals, source control of wastewater is an essential consideration because it allows chemical-specific abatement techniques to be used and it reduces the potential for toxics release to the environment through sewer and treatment plant outfalls.

Although most of the municipalities in the study area have some restrictions on the discharge of wastewater to the sewerage system, the bylaws have, for the most part, been ineffective because of inadequate enforcement and/or incomplete coverage of potentially deleterious substances.

A recommendation of this project is that a comprehensive, uniformly applied sewer use control program be developed for British Columbia. The reviews of US and Ontario programs indicated that they would provide valuable guidance in the development of a program for BC.

A final recommendation discussed avoiding the generation of large quantities of wastewater in the first place as the best approach to achieve reduction of contaminant loadings in the Fraser River Basin. Education and assistance given to industry for waste minimization opportunities and techniques would play an integral role.

Ω

2.2.16 Municipal Effluent Toxicity Study/Cold-Climate Sewage Lagoons

Funded by: FPAO and BC Environment, Environmental Protection Branch

Performed by: BC Environment, Environmental Protection Branch, Prince George

FPAO Contact: Alain David

This project looked at characterization of wastewater discharges into the northern portion of the Fraser River Basin. It consisted of a review of municipal effluent toxicity and treatment in cold-climate sewage lagoons. Locations in the northern interior of British Columbia (Prince George, Vanderhoof, McBride, Fort St. James, Fraser Lake) were studied.

Toxicity bioassays and other tests were performed to determine the quality of municipal effluents. The following initial results and recommendations were recorded:

- A dependable correlation may exist between rainbow trout toxicity and Microtox for municipal lagoons.
- There appears to be a direct relationship between toxicity and H_2S concentration at two study lagoons; further investigation is required.
- Nitrification is limited in all study lagoons.
- Ammonia is clearly responsible for only a few of the noted lagoon toxicities.
- Lab-induced toxicities causes ammonia to appear more a culprit than it may actually be because of a rise in pH during the test.
- Ammonia may actually be toxic at lower concentrations than the main literature suggests.
- Other agents may be responsible for the noted toxicities at [Fort St. James] and McBride.
- Consideration should be given to running municipal toxicities under appropriate temperature and pH controls.
- Additional research is required to determine the rate of ammonia nitrification expected in standard bioassay tests.

Ω

2.2.17 Characterization Of The Clark Drive CSO Effluent

Funded by: FPAO $19 K and in-kind staff time and equipment; GVRD financial and in-kind contributions

Performed by: FPAO and GVRD

FPAO Contact: Alain David

This project was a characterization study of the Clark Drive outfall in the City of Vancouver, which discharges directly into Burrard Inlet. Of the 53 combined sewer overflows (CSO) in the Greater Vancouver region, which discharge a total annual volume of 36 million m^3 into the receiving waters of the Lower Fraser River and Burrard Inlet, the Clark Drive CSO is the largest single outfall location in the region. It accounts for about 60% of the total annual CSO discharge volume and discharges at a frequency of about 140 events annually.

Environment Canada has extensively studied the receiving environment in the proximity of the Clark Drive CSO and has found high levels of contamination.

Specific objectives of this project were:

- to characterize the Clark Drive discharge during winter flow conditions to give an

indication of the types and concentrations of contaminants found in GVRD CSO discharges

- to identify contaminants within the Clark Drive CSO discharge that would be appropriate for initial dilution zone (IDZ) and receiving water assessment studies

Combined sewer wastewater collection systems convey both domestic wastes and rainfall runoff in the same pipe. During dry weather, all sanitary sewage is received at wastewater treatment plants. During wet weather (storm events), runoff flows can result in system capacity being exceeded. The excess flows, which are mixed sewage and stormwater runoff, are directed to receiving waters by relief systems to prevent flooding. These CSOs are point sources of wastewater discharges. Very few characterization studies of CSO discharges have been performed throughout the Fraser River Basin and Burrard Inlet.

CSO characterization studies are an important first step in environmental assessment of discharges because the data collected could be used to focus future receiving environment impact assessments. This proposed study gives a first indication of the types of contaminants, their concentrations, and variability between winter storm events for the Clark Drive CSO.

Sampling was done of both wastewater and sediments. Parameters monitored included flow rates, metals, toxic organics, bacteriologicals, dioxins and furans, and Microtox toxicity.

Ω

2.2.18 Evaluation Of A Wet Pond As A Best Management Practice For Stormwater Treatment

Prepared by: GVRD, Liquid Waste Management Planning Branch

Funded by: FPAO $13 K, plus in-kind contributions; District of Surrey and GVRD, both cash and in-kind contributions and use of equipment

FPAO Contact: Alain David

As part of FPAO's goal of reducing contaminant loading in the Fraser River Basin, municipal wastewaters, such as urban stormwater runoff (UR), require characterization and determination of best management practices (BMP). One such BMP is the use of wet ponds. From information about contaminant removal efficiencies for wet ponds, based on field studies in other regions of North America, it is believed that wet ponds can significantly reduce contaminants originating from UR.

The primary objective of this project was to evaluate the practicality of wet ponds as a treatment best management practice in reducing the quantity of pollutants entering receiving waters.

Secondary objectives included the collection of more information on the contaminant loads typically carried by stormwater runoff from urbanized areas of Greater Vancouver.

There are no wet pond field studies from the Greater Vancouver area that can be used to better quantify the expected removal efficiencies, or to refine design criteria for wet ponds. A goal of this project was to fill this data gap by evaluating the treatment efficiency of a wet pond in the Fraser Glenn area of Surrey.

This wet pond was best suited to study because it has a single inflow and single outflow. Discharge from this pond drains into the Serpentine River which discharges to Boundary Bay. Information gathered in this project is directly applicable to present and future efforts to control the impacts of UR on the Fraser River Basin.

Ω

2.2.19 Fraser/Thompson Rivers Bleached Kraft Mill Monitoring, Suspended Solids And Biosolids Characterization

Performed by: Environment Canada, Pollution Abatement Branch

Funded by: FPAO $11,000

FPAO Contact: George Derksen

The five bleached kraft pulp mill complexes on the Fraser River drainage are currently making changes in their bleaching processes in a program to reduce chlorinated organic compounds (adsorbable organic halogen, dioxins and furans) from their effluents. All have secondary effluent treatment. This secondary effluent contains suspended solids composed primarily of organic biosolids, to which dioxins and other organochlorines bind.

As the pulp and paper industry incorporates changes to reduce contaminants, environmental effects monitoring programs have been conducted to assess the condition of aquatic communities, the bioaccumulation of chlorinated organic compounds in fish, and the concentration of specific chlorinated compounds in bottom sediments.

In this project, a continuation of an earlier DOE program, suspended river solids (largely silts and clays) and biosolids (bacterial cultures that accumulate in wastewater treatment systems) were characterized. These are a critical component of wastewater and receiving environment characterizations for a number of reasons:

1. Suspended solids are an important transport mechanism for certain chlorinated organic compounds which, due to their hydrophobic properties, bind with the clay/silt particles. These don't settle out as rapidly as heavier particles, so they are transported further down the river, ending up accumulating at the mouth of the Fraser and in Georgia Strait.

2. Biosolids also attract chlorinated organics. These accumulate in bottom sediments, enter the food chain, and become an important pathway for the accumulation of contaminants in aquatic ecosystems.

This characterization project can be used as a means of assessing chlorine reduction programs in pulp mills.

Other objectives of this project were to determine if a seasonal pattern in suspended solids contaminant levels exists (e.g., during spring freshet).

As noted elsewhere in this progress report, there is limited data on wastewater characterization and contaminant loading throughout the Fraser River Basin; this project will add to the growing database.

Ω

2.2.20 Agricultural Waste Management In The Fraser Valley (Vol. I)

Prepared by: CH2M Hill Engineering Ltd.

Funded by: FPAO $25 K and BC Environment $75 K

In Kind: BC Ministry of Agriculture, Fisheries & Food and BC Federation of Agriculture

FPAO Contact: George Derksen

This project was largely an inventory of manure generation in the Fraser Valley and a search for methods to manage runoff into the Fraser River Basin.

Agricultural waste discharges, particularly in intensive farming areas, can contribute extensively to contaminant loading in watersheds. In the Fraser Valley of south-western British Columbia, the issue is compounded because of increased urbanization, groundwater nitrate concerns, changes in agricultural intensity, and the increased concern about pollution in the Fraser River Basin.

In July 1992, BC Environment initiated a program to evaluate the treatment and disposal of agricultural waste in the Fraser Valley. This initiative fell within the objectives and strategic approach of FPAO. The initial approach included an inventory of waste sources from animal production. The Ministry of Agriculture and producer groups (including dairy, swine, and poultry) provided data on manure production and current waste management activities. Site visits were made to some of the larger operations to verify data.

The scope of the study was expanded to attempt to quantify the runoff produced by agricultural operations in two of the 20 identified waste inventory zones. Direct survey data about crop production, actual manure application rates, actual fertilizer application rates, and fertilizer chemical analysis by crop and livestock type, and geographic area were limited.

The scope of the study changed, resulting in a re-evaluation of the need to develop a waste treatment system conceptual design. Instead, effort went into finding more specific land use information and developing an agricultural waste management plan.

Ω

2.2.21 Environmental Guidelines For Greenhouse Growers In British Columbia And Environmental Guidelines For The Nursery Industry In British Columbia

Prepared by: BC Federation of Agriculture member organizations: Greenhouse Guidelines by Nahanni Horticultural Services and Zbeetnoff Consulting; Nursery Guidelines by Pacific Resource Consultants

Funded by: FPAO $15 K

In Kind: Project management and report production by BC Ministry of Agriculture, Fisheries & Food and by BC Federation of Agriculture and producer groups

FPAO Contact: George Derksen

These projects entailed developing environmental guidelines for the greenhouse and nursery industries. The guidelines provide specific details on how to conform to the provincial Code of Agricultural Practice for Waste

Management. The long term existence of the various agricultural industries in British Columbia depends upon the use of environmentally sound practices.

These two guidelines books review and present a thorough range of information for their respective industries. They describe management options for today's producers that provide them with a sound understanding of environmentally sustainable practices.

Each book gives information on the federal, provincial, and local legislation and bylaws affecting their operations. Each also discusses the regulations accompanying the legislation.

Sources of pollutants, their impacts on air, soil, water, and surrounding communities are discussed. Site selection and planning, soils, water management, pest management, fertilizer use and management, waste management, storage of supplies, pesticide use and handling, and recycling and composting options are presented in a clear, understandable fashion. There are sections on Best Management Practices and other environmental considerations, such as air emissions, noise and vibration, and light glare. Each also has a useful glossary of terms.

Ω

2.2.22 Reduction Of Chemical Pesticide Use In Agriculture Through An Integrated Pest Management (IPM) Program- A Business Plan For An IPM Certification Program

Prepared by: Zbeetnoff Consulting

Funded by: FPAO $10 K

In Kind: BC Federation of Agriculture

FPAO Contact: George Derksen

Integrated pest management (IPM) is an ecologically integrated approach to the control of pest populations, in this case, mostly insects, destructive invertebrates (notably nematodes), and disease organisms. There are also IPM programs for the control of weeds.

All available techniques, including pesticides, crop rotation, destruction of crop residues, biological pesticides (usually predators or pathogens of specific pests), release of sterile mates, pheromone and other traps, growing insect-resistant varieties, strategic use of planting and harvesting dates, and others are consolidated in a unified program to avoid economic damage and adverse effects on human health and the environment.

Use of IPM can greatly reduce the amount of contaminants entering the environment. To this end, the BC Federation of Agriculture, with the support of the FPAO, desires to promote an increase in the use of IPM by implementing programs for training and certifying farmers and commercial users of federally restricted pesticides.

This project focused on devising a business plan for an IPM certification program. The agriculture industry in BC has identified key objectives to implement IPM. This project consisted of detailing functional and structural approaches and options to achieving these objectives.

The following components of the business plan have been completed:

- Consumer Education (Marketing Plan)
- Grower Knowledge (Education and Awareness Plan)
- Personnel Development (Education and Training Plan)
- IPM Database (Information Plan)
- Research (Research Plan)
- Professional Services (Certification Plan)
- Regulation (Regulatory Plan)
- Budgetary (Funding Plan)

Ω

2.2.23 CASI* Collections Over Lower Fraser River and Burrard Inlet (New Remote Sensing Tools For Ecologists)

Prepared by: GA Borstad Associates Ltd.

Funded by: FPAO $15 K (1st year) and by DFO; a federal Environmental Innovation Program Project

Partners: Canada Centre for Remote Sensing, Canadian Space Agency, Supply and Services Canada

FPAO Contact: George Derksen

***CASI:** Compact Airborne Spectrographic Imager

The application of remote sensing technology for aquatic ecosystems management has tremendous potential for detailed analysis. It is an efficient, accurate data collection procedure. The demand for accurate and relatively inexpensive digital information has increased dramatically since GIS has been adopted by resource management agencies and private companies.

The focus for this project was to further refine the methods for airborne digital image capture and analysis for aquatic resource management. This would be accomplished by integrating the CASI spectral sensor with roll/pitch/yaw measurement systems and Global Positioning Systems (GPS).

One component of this project targeted specific sites in the Fraser River Basin and Burrard Inlet for data collection and analysis. Specific areas of interest for this study included nearshore zones adjacent to rivers and streams. These edges are transitional areas that provide a diverse range of habitats and generally provide critical spawning and nursery habitats for many species of fish, birds, and mammals.

The four main goals of this study were:

- to provide baseline data on the extent and distribution of nearshore aquatic and terrestrial habitats
- to produce habitat maps that can be classified and incorporated into habitat management plans
- to demonstrate the utility of remote sensing, image analysis, computer modelling, and geographic information systems for habitat assessment and resource management
- to streamline methods of collecting remote sensing data and the production of accurate digital databases

Some test sites within the Lower Fraser River Basin and near Prince George have been flown over in this two-year project.

The project includes a study of the multi-spectral and thermal characteristics of discharges from municipal and industrial sources. The changing horizontal patterns through time of effluents near the surface can be mapped accurately with CASI and may be a valuable assessment tool in conjunction with data collected by more traditional effluent dispersion techniques.

While a flight in conjunction with a proposed dye study at the Annacis Island sewage discharge did not occur this year, flights were made at the time of a dye study at the Scott Paper mill in New Westminster. Extensive and detailed transects of dye concentrations were collected with an *in situ* fluorometer. To this quality data, CASI will be able to contribute a series of comprehensive and synoptic maps of horizontal dye patterns. The horizontal maps may improve the accuracy of dispersion modelling.

Subtle changes in water colour may reveal lost or hidden discharges in the Fraser River Basin and Burrard Inlet. Locating and monitoring these outfalls is an important part of environmental management. CASI is a logical instrument to explore this application.

On the first flight, CASI collections were made in the Maple Ridge to Mission area of the river edge habitat. As well, observations were collected in Burrard Inlet that contain several interesting scenes of value to environmental managers and ecologists.

On the second flight, the Scott Paper mill dye study was covered 16 times and the other target sites were covered eight times. An interesting preliminary result from the Annacis Island discharge was observed at low slack water, when the outfalls were observed to be boiling to the surface and the plume could be defined without dye enhancement. At slack water, the dye plume from the Scott mill was also apparently rising directly to the surface.

The data has yet to be interpreted and a final report has not been prepared.

Ω

2.2.24 BC Federation of Agriculture Producer Group Peer Advisors Training Manuals and Complaint Tracking System

Prepared by: BC Federation of Agriculture (BCFA)

Funded by: FPAO $28 K

In Kind: BC Ministry of Agriculture, Fisheries & Food (BCMAFF) and BC Federation of Agriculture

FPAO Contact: George Derksen

The BC Federation of Agriculture formed the Agricultural Environmental Protection Council (AEPC) to allow peer producers the opportunity to educate a solution to environmental problems for individual farms and ranches prior to regulatory agencies forcing farmers to adopt corrective measures. It is the AEPC's goal to maintain high environmental standards on BC's farms and ranches through education and a responsible approach to pollution prevention.

Agricultural pollution occurs generally as a non-point pollution source as runoff from manure or rotting feed, pesticide and herbicide use and handling, improper disposal of waste oil and hydraulic fluids, and direct contamination of ditches or other waterways by stock. As well, plant and animal disease organisms may be transported from one area to another by machinery, animals, or through watercourses.

The BCFA has developed a custom database on a Macintosh LCIII computer with Hypercard software to help keep track of environmental complaints. Complaints received as of 30 June 1991 are being entered into the system. Eventually, it will be possible to generate summaries based on several categories, e.g., geographical region and type of operation.

This project provided support and expertise for the development of a peer advisor training program and the production of a series of peer advisor training manuals.

These manuals give thorough information on the background of the AEPC, the peer advisors program, procedural guidelines for peer inspection teams, BCMAFF support programs, reference materials, and a list of contact people. Sample and actual inspection forms are included.

As well, copies of the Environmental Guidelines for Dairy, Poultry, and Beef Producers are provided. Environmental Guidelines for Hog Producers, the Nursery/ Greenhouse Trade and Berry Producers are in the process of being written. These include information on the Agricultural Waste Control Regulations, Code of Agricultural Practice for Waste Management, and other environmental considerations.

This type of cooperative, peer-oriented program will likely prove most effective as a pollution prevention approach to addressing environmental concerns in the agriculture community of BC.

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2.2.25 (Draft) Review of Groundwater Mapping and Assessment in British Columbia (and) (Draft) Criteria and Guidelines for Groundwater Mapping and Assessment in BC

Prepared by: Piteau Associates Engineering Ltd. and Turner Groundwater Consultants for the Resources Inventory Committee Earth Sciences Task Force

Funded by: FPAO $30 K

FPAO Contact: Bert Kooi

As part of FPAO's mandates to identify sources of contaminants and to develop and implement suitable control measures, this project seeks to contribute to the development of a uniform methodology to integrate, interpret, and present groundwater quality and associated hydrogeological data.

About 25% of BC's population depends on groundwater for water supply. The largest use (55%) is by industry, followed by agriculture (20%), municipalities (18%), and rural domestic (7%). Certain areas of the province are entirely dependent on groundwater.

Various types of data are needed to manage and protect groundwater resources, such as the location, quality, and extent of an aquifer, or its interaction with surface water, chemical trends, and vulnerability to contamination. One good source of this kind of information can come from drillers' records. Other sources can come from soils maps, geochemical data, bedrock geology mapping, and hydrometric information.

The overall objectives of this study were to:

- evaluate the application of knowledge of groundwater mapping and assessment in the context of integrated resource management and land use planning
- provide procedures and recommendations for the collection, synthesis, analysis, and presentation of groundwater-related data for use in environmental and land use management and planning

Specific objectives were to:

- achieve a consensus on a minimum set of data elements to facilitate the collection and sharing of groundwater data with interested agencies
- identify implementation issues that should be resolved to encourage the collection of a minimum set of data elements on groundwater
- prepare a realistic and functional procedures manual outlining the minimum recommended standards for groundwater mapping in British Columbia to be used in the development, use, management, and protection of the groundwater resource

The following tasks were completed:

- carried out a survey of the concerns of those who use groundwater data
- identified existing sources of groundwater related data and evaluated current data and mapping methods
- organized and participated in a workshop to determine user needs
- prepared a comprehensive procedures manual on minimum standards and levels of expertise required to carry out groundwater mapping, and the quantity and quality of its occurrence and distribution

The results of this project are presented in two volumes, listed above. Vol. 2, Criteria & Guidelines for Groundwater Mapping and Assessment, explained the physical characteristics of groundwater and the principles of its formation, such as the hydrologic cycle, recharge and discharge of aquifers, saturated and unsaturated zones, water table, infiltration, etc., and gave a description of a groundwater map.

Stakeholder groups identified a need for increased public awareness of groundwater resources and how to manage and protect them. In order to do this, high quality data and mapping information is required. Maps must be continually updated in order to remain useful.

Specific recommendations by the project team include the establishment of a minimum set of data elements for sharing information, establishment of a centralized source of groundwater information, computerization of groundwater data, and outreach programs to promote groundwater education.

It was acknowledged that protection of groundwater resources will further the goals of FPAO by promoting environmentally sound practices for groundwater use and management.

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2.2.26 Assessment of Distribution Sources and Natural Remediation of Nitrates in the Abbotsford Aquifer Using Stable Isotope Techniques

Performed by: National Hydrology Research Institute

Funded by: FPAO $25 K and BC Environment $50 K

FPAO Contact: Bert Kooi

This project began in 1992 and is continuing, so this profile represents a progress report. No interpretation of data collected has been made; this will form part of the final report due at the end of fiscal 1993.

The purpose of this project is to distinguish between various nitrate sources detectable in the Abbotsford aquifer. These include septic seepage and runoff from manure and fertilizers. This project also seeks to develop methods to distinguish contaminant sources in aquifers in general.

Information has been gathered from 63 wells, most near the Abbotsford Airport. Groundwater samples have been taken, including at locations of piezometers, from

single wells, and from water bodies. The project scientist now has data on new wells and has analysed for nitrates and nitrate isotopes, sulphates, chlorides, and isotopes of water.

Up to 50 more samples will be collected from domestic and municipal wells, and soil samples from selected contaminated and uncontaminated sites.

BC Health is also conducting studies in this area, so researchers will likely supplement data from those studies.

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2.2.27 Sewage Disposal System Report - BC Ministry of Health

Performed by: Dayton & Knight Ltd. Consulting Engineers and Piteau & Associates

Funded by: FPAO $25 K and BC Ministry of Health $50 K

FPAO Contact: Bert Kooi

This project relates to the Ministry of Health's (MOH) concern with existing on-site sewage disposal practices in the Fraser Valley. The concern comes from two sources: the first being the number of failures of on-site disposal systems being observed; the second being the advancing universal knowledge on the topic which suggests that many existing practices are generally inadequate to develop sewage disposals systems that function adequately for an acceptable length of time.

The area under study is bounded on the west by the Pitt River/Fraser River, on the east by the town of Hope, on the south by the Canada/US border, and on the north to the developed areas north of the Fraser River.

The primary objective of the project was to review current on-site sewage disposal system practices in the Fraser Valley and make recommendations for improvement.

MOH considers an on-site sewage disposal system failure to have occurred when the effluent moves directly to the ground surface with minimal treatment, when sewage odours are detected, or when flows within the household plumbing system are sluggish. Failures are generally recognized on a complaint basis only. Failures by transmission of inadequately treated effluent to groundwater typically is undiscovered.

Health hazards due to septic system failures include potential microbial, viral, and nitrate contamination of groundwater, any of which can have serious health consequences given the number of groundwater wells used as drinking water sources in the Fraser Valley. The MOH has justifiable concerns about the potential for insufficient primary health care performance of on-site sewage disposal systems.

There are various designs of on-site sewage treatment systems that are appropriate for a given site. The performances of ten drainfields were monitored. Several others were visited by the consultants to evaluate failure modes and site-specific problems.

This project has provided an overview of on-site sewage disposal practices and land development in the Fraser Valley. It recommends on-site sewage disposal systems and the range of variations required or allowable given local conditions, so that once installed, the system will not require any more maintenance than the currently approved conventional and mound systems.

This project's report also makes specific recommendations about design, construction, inspection, and maintenance to ensure

that the on-site sewage disposal system operates as intended.

As part of FPAO's contribution to the Fraser Valley Sewage Disposal Project, an evaluation of the impact of septic effluent on unconfined permeable aquifers, with relatively shallow water tables, was carried out. The principle objectives of this study were to measure distance of travel of coliform bacteria, nitrates, and possibly other pathogens at a selected site in the Fraser Lowland.

The study site was selected on the basis of it being representative of many areas in the Valley that have a high potential for contaminating groundwater. After drilling the boreholes and installing monitoring devices in each, water samples were collected and submitted to laboratories for chemical and biological analyses.

Interpretation of the resultant data confirmed that the water in the area has a low total dissolved solids content and was slightly acidic to neutral. Except for a few samples abstracted from the monitoring wells located 3m down gradient of the drainfield, all groundwater samples met Canadian Drinking Water Standards (CDWS).

The only parameter that did not meet CDWS in all samples was nitrate. Results showed there is a recognizable plume of nitrate in the groundwater extending as far as the property boundary. This plume tends to sink below the water table as it migrates northwards. Fecal coliform data has not yet been assembled, but higher counts are expected in autumn because of seasonal rainfalls.

There is limited information on groundwater quality in the Lower Fraser Valley. Only a small part of it has been compiled in a manner that can be interpreted for usefulness of locating potential sources of contamination and aquifer type. Projects of this sort will help to increase that base of knowledge.

This project came up with a considerable number of recommendations for the design, construction, operation and maintenance, inspection and monitoring, and future research on on-site sewage disposal systems, tailored for use in the Lower Fraser Valley.

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2.2.28 Development of Design Basis for An Inventory of Sources and Emissions of Toxic Air Contaminants for BC

Performed by: B.H. Levelton & Associates Ltd.

Funded by: FPAO $30 K and by BC Environment and GVRD

DOE Contact: Ed Wituschek

Atmospheric contamination deposition is one of the sources of toxic contamination in the Fraser River Basin. As one of the main program areas of the Fraser Pollution Abatement Office, an inventory of sources and emissions of toxic air contaminants will be conducted.

The inventory will provide information about emission types, volumes, and distribution and, as a result, will also enable future toxic emission studies to be identified and prioritized, and assist public information needs.

Emissions inventories for common air pollutants (CO_x, NO_x, particulate, SO_x, and VOC) have been and continue to be produced on both a national and provincial basis and the relevant estimating techniques continue to be refined and improved. However, for several reasons, emissions

inventories for non-common or toxic air pollutants have not been done. While this project didn't set out to give or rationalize these reasons, one of its objectives was to remedy the situation.

The essential scope and purpose of this project was to evaluate and recommend a database design, develop the recommended software program, prepare a list of toxic air contaminants, and prepare a file of toxic contaminant emission factors for each source category based on a literature search.

The intended use of the results from the BC toxics inventory in atmospheric dispersion and deposition modelling requires a system capable of giving good spatial and temporal resolution to the emissions, as well as making use of the best available data for emissions identification and quantification.

Potential uses of air toxics emission inventories include:

- to identify sources and general emission strengths, patterns, and trends
- to store data from related toxic emissions programs (such as permit/compliance data, public information needs, and emergency response/toxic hotspots programs)
- to focus subsequent inventory work
- to ensure optimum siting of ambient air monitors
- to provide input to dispersion models
- to identify multiple source and multiple pollutants problem areas
- to develop control strategies and regulations

In order to meet these requirements, the overall approach was to design the database to parallel the BC common pollutants Emissions Inventory System (EIS) and Environment Canada's Residual Discharge Information System (RDIS).

The data system for producing this inventory is named TOXS and has a number of features that give it a high degree of flexibility and ease of use. Its limitations include use of US measurement terms instead of metric. This project recommended continuing general simplification and refinement of the program. A full description of file structures and system design is given in the operating manual.

While the inventory developed from the recommended design will specialize in industries and geographical conditions in British Columbia in order to have a narrow focus for characterization, it is intended that the inventory system should be capable of use anywhere in Canada.

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3.0 HOW 1992/93 FPAO PROJECTS HELP ACHIEVE KEY OBJECTIVES OF THE GREEN PLAN AND THE FRASER RIVER ACTION PLAN

In order to achieve the objectives of the Fraser River Action Plan, a clear strategic approach to achieve pollution abatement is required.

First and foremost is the need to identify sources of pollution entering the Fraser River Basin. A significant number of projects have addressed this, but many more are still required. These may be point or non-point sources related to a wide variety of industrial, municipal/urban, domestic, agricultural, airborne, groundwater, and contaminated sites activities or causes.

Once these have been identified and inventoried, information needs to be entered into a user-friendly computer database program. Some projects dealt specifically with this requirement.

The next critical phase is the characterization and quantification of the effluents and contaminants entering the Basin. This information also needs to go into the database.

Eventually, all this data will be linked in one GIS to present basin-wide information in a concise form.

A major contribution to reducing pollution in the Fraser Basin is the development of codes of practise and guidelines for a number of industries. Protection of the environment is more easily achieved through the cooperative efforts of government and industry working together, using the information gained from characterization studies and surveys of control technologies to develop industry-wide policies and procedures that can control pollution at the source.

All these activities help FPAO achieve its objectives and enable planning to proceed in a manner that will allow for sustainable land and resource use decisions for the Fraser River Basin.

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4.0 FPAO LOCATION AND PERSONNEL

Fraser Pollution Abatement Office, Environment Canada 224 West Esplanade, North Vancouver, BC V7M 3H7		
Name	**Program**	**Phone/Fax**
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Bert Kooi, Biologist	Industrial, Groundwater	666-2790/7294

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Name	**Program**	**Phone/Fax**
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Ed Wituschek, P.Eng	Toxic Air Contaminants	666-2815/6800
Hugh Liebscher, Hydrogeologist	Groundwater	666-0807/6713
Bob Shepherd, P.Eng	Contaminated Sites	666-3055/7294
Doug Wilson, Chemist	Advisory	666-3197/6800
Dr. David Poon, Engineer	Advisory	666-2862/7294

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5.0 FPAO PROJECTS PLANNED FOR 1993/94

The product forecast for FPAO for 1993/94 has been completed. Due to fiscal restraint and budget cutbacks, increased emphasis has been placed on co-funding with other entities, whether government agencies, industry associations, research institutions, or non-profit organizations.

Upcoming projects have been tailored to meet realigned goals and objectives.

Forecasted Projects for Fraser Pollution Abatement Office for 1993/94

Month	Projects
June 1993	• Sponsorship to the BC Water and Waste Association Conference
September	• Costs associated with implementing Codes of Practice for one sector (in association with Planning)
October	• Link (industrial) pollution point source inventory database to MapInfo desktop mapping software
November	• Baseline pollutant loadings from pulp mills - Report on compilation of existing data • Sponsorship to the Geological Association of Canada seminar on environmental applications of industrial minerals • Technical report releases and a series of pollution abatement workshops • Computer bulletin board to supply and access report texts • Inventory of high risk sites with potential for impact on unconfined aquifers and surface water
December	• Development of portable field laboratory to measure site-specific effects of industrial and municipal discharges on salmon - initial design • Agriculture environmental guidelines and training for mushroom and berry producers • Manure stockpile inventory (GIS) for assessment of compliance with guidelines - Report on development
1994 January	• Code of Practice for fish processing based on best available technology • Manure production database (GIS) - Report on development • Preliminary hydrogeological assessments at priority sites
February *(continued)*	• Acid mine drainage (AMD) pollution prevention project to develop standard reference material for AMD prediction - Progress Report

Forecasted Projects for FPAO for 1993/94

Month	Projects
February *continued*	• Agricultural issues and abatement strategies for areas outside the lower Fraser • Characterize (industrial) effluents at five priority sites • Inventory of federal sources of persistent toxic substances • Impact zone definition (municipal and CSOs) • Inventory (GIS) of urban runoff discharges in the FREMP area, including abatement prioritization - Report • Snow dumping site alternatives and disposal recommendations (Prince George) - Report • Farm pesticide inventory (GIS) • Development of Agricultural Waste Management - Environmental Protection Manual • Integrated Pest Management program demonstration (of benefits to farmers) workshop for producers of small fruits, greenhouse growers, and vegetables • Groundwater pollution remediation options, regulatory deficiencies and regulatory development - Progress Report • Airborne contaminants data system (GIS) and toxics emission inventory
March	• Code of Practice for priority industrial sector based on best available technology • Toxicant control in industrial waste sludges (pilot project) - Progress Report • Municipal discharge and combined sewer overflow (CSO) characterization, inventory, and loading - Reports on characterization and CSO loading • Codes of Practice for stormwater management at industrial sites • Baseline pollutant loadings from 2 industrial sectors • Develop BCWWA training packages for municipal wastewater treatment plant operators • Technology to reduce contamination from urban runoff - Report on technology demonstration • Innovative agricultural practices to minimize chemical use and optimize reuse - annual reports on multi-year projects • Groundwater protection strategy - Scoping Report • Prince George sewage dispersion/dilution study • Pilot scale optimization of nutrient removal from sewage • Pilot scale assessment of sewage treatment processes in cold climate (Prince George)

6.0 REFERENCES

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