Ministry of Environment Annual Report 1980/81

Province of British Columbia
Ministry of Environment

Honourable Stephen Rogers,
Minister

B. E. Marr,
Deputy Minister

VICTORIA, BRITISH COLUMBIA

Activities of all branches are covered for the period January 1, 1980 to March 31, 1981.

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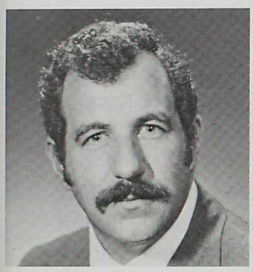
To the Honourable Henry P. Bell-Irving, D.S.O., O.B.E., E.D.,
Lieutenant-Governor of
the Province of British Columbia

MAY IT PLEASE YOUR HONOUR:

Herewith I beg respectfully to submit the Annual Report of the British Columbia Ministry of Environment for the period January 1, 1980 to December 31, 1981.

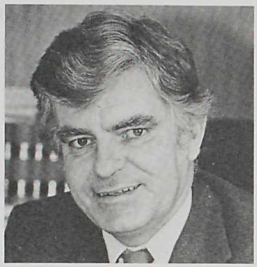


Stephen Rogers,
Minister of Environment

The Honourable Stephen Rogers,
Minister of Environment

SIR:

I have the honour to submit the Annual Report of the British Columbia Ministry of Environment for the fifteen months ended March 31, 1981.



B. E. Marr,
Deputy Minister

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Foreword

This report differs from past annual reports, since it reports from the start of a calendar year rather than the traditional fiscal year. For most branches of the Ministry this means that this edition covers the 15 months period between January 1, 1980 and March 31, 1981.

The organizational structure of the Ministry changed during 1980 with the realignment of programs and responsibilities. Some of these changes are reflected in the contents of this report, with emphasis being placed on the regional structure of the Ministry. This is the first report that gives extensive coverage to regional activities.

inistry of Environment

MINISTER
C.S. Rogers

DEPUTY MINISTER
B.E. Marr

Administration Assistant
B. Bolton

Information Services Br.
R.L. Cameron

ENVIRONMENTAL MANAGEMENT DIV.
Assistant Deputy Minister:
A. Murray

- **FISH & WILDLIFE BR.** **Dir:** D.J. Robinson
- **MARINE RESOURCES BR.** **Dir:** T.G. Halsey
- **WASTE MANAGEMENT BR.** **Dir:** R.H. Ferguson
- **WATER MANAGEMENT BR.** **Dir:** H.D. DeBeck
- **PESTICIDE CONTROL BR.** **Dir:** R.W. Kobylnyk

ENVIRONMENTAL SERVICES DIV.
Assistant Deputy Minister:
G.E. Simmons

- **INVENTORY & ENGINEERING BR.** **Dir:** P.M. Brady
- **SURVEYS & MAPPING BR.** **Dir:** E.R. McMinn
- **ENVIRONMENTAL LAB** **Dir:** A.J. Lynch
- **PROVINCIAL EMERGENCY PROGRAM** **Dir:** R.E. Neale

REGIONAL OPERATIONS DIV.
Assistant Deputy Minister:
E.D. Anthony

- **CONSERVATION OFFICER SERVICE** **Chief Conservation Off:** R.L. Aldrich
- **VANCOUVER ISLAND REGION** **Reg. Dir:** J.C. Lyons
- **LOWER MAINLAND REGION** **Reg. Dir:** D.R. Hehn
- **THOMPSON-NICOLA REG. & CARIBOO REG.** **Reg. Dir:** W.A. Kastelen
- **KOOTENAY REGION** **Reg. Dir:** D.G. McDonald
- **SKEENA REGION** **Reg. Dir:** D.E. Smuin
- **OMINECA-PEACE REGION** **Reg. Dir:** A.B. Mitchell
- **OKANAGAN REGION** **Reg. Dir:** T.H. Oxland

ADMINISTRATION DIVISION
Executive Director:
J.R. Marshall

- **PERSONNEL SERVICES BR.** **Dir:** R.C. Webber
- **FINANCIAL SERVICES BR.** **Dir:** K.R. MacKay
- **COMPUTING SERVICES BR.** **Dir.** M.F. Rose

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...ctive of the Ministry of Environment ...e that people, fish and wildlife have ...ronment in which to live, work and ...he province of British Columbia.

...by this mandate, the Ministry must ...balance between the need to safeguard the quality of air, water, land, flora and fauna and the social and economic needs of people.

To better meet this responsibility the Ministry of Environment is presently undergoing a major reorganization that is designed to introduce a common planning and management base for all ministry programs. This will require rewriting legislation, realigning programs and regionalizing much of the decision making process.

This organization chart reflects the Ministry's structure as of August. 1980.

Dir. = Director
Reg. = Regional
Div. = Division
Br. = Branch

Office of the Deputy Minister

At the beginning of each reporting period, the Ministry sets a number of goals and objectives we hope to achieve during the year. While many programs are continuing, we made significant progress in the past fifteen months in managing and protecting the Province's natural environment.

As you can see in the text of this report, the work in which the Ministry is engaged is as varied and diversified as the Province. Our programs reflect the increasing demands being placed on the environment from the social and economic communities.

During this reporting period, the Ministry identified 12 major programs to which present and future energies and resources will be directed. We established a new Assessment and Planning Division to ensure that proper planning is an integral part of our management strategy. Major changes were made to legislation under which the Ministry operates, and a new *Ministry of Environment Act* was introduced. Successful negotiations were completed with management plans for the Cowichan, Squamish, Nanaimo and Fraser River Estuaries.

A water management strategy was developed to deal with water quality and quantity in the Nicola watershed. During the year there was an urgent need for staff to assess the impact of the Northeast Coal Development and the Site C hydro electric project. In 1980, we launched a major investigation of pollution violators in the Fraser River estuary that resulted in a number of successful prosecutions.

The Ministry established the new Habitat Conservation Fund for acquiring, protecting and enhancing key fish and wildlife habitat areas, and 16 new wildlife species plans were issued. We introduced a new commercial fisheries aquaculture policy and established assistance for British Columbia's oyster growing industry.

A special hazardous waste management committee was established to solve the growing problem of dangerous material disposal. We placed greater emphasis on the recovery of resources in our waste management program. Oil recycling incentives were introduced on Vancouver Island and the Lower Mainland and a quarantine program was initiated to check the spread of Eurasian water milfoil.

Decentralization of services to eight regions was well advanced and staff were consolidated in headquarters, Prince George and Nanaimo. Construction started on new regional headquarters in Smithers, Penticton and Kamloops.

When you consider that these and many other difficult programs were completed in the midst of a major Ministry reorganization, we can truly appreciate the dedication of managers, professionals, technicians and support staff of the Ministry of Environment.

Information Services Branch

Introduction

1980 saw the consolidation of information and education staff of the Ministry into a single Information Services Branch, and the organization of the staff in a way most suitable for meeting the demands of a new and broader Ministry information program. The new structure created a service unit to provide basic communication skills across all programs, and a program development unit consisting of information officers, assigned to various Ministry management programs. Staffing for these divisions was still being completed at year end.

The major activities of this period were split between the development of overall Ministry information programs and procedures, with numerous trial projects, and the maintenance of continuing communications services including media relations, educational program publications, audio-visual and displays. By the end of the year a Ministry theme was established and several projects were begun to introduce the concept of "Environment — it's your home". These included a poster series, Ministry directory, office entry and decor items and television spots. This theme will be developed further, and used as a vehicle for other Ministry program messages in the activities of the next year.

Continuing information services activities including the following:

Media Relations

A total of 153 news releases, information bulletins, press advisories and other public notifications were issued, with an average distribution of 700 to 800 per item. This included several joint Federal-Provincial news releases.

The Ministry's "Oil Save" program was the subject of a special series of releases backed up by advertising with selected media where the program was being initiated — on Vancouver Island from Victoria to Nanaimo, and in Vancouver City, North and West Vancouver, and Burnaby.

The Branch initiated the use of "Information Bulletins" rather than "News Releases", to distinguish genuine "news" items from more general information such as the release of reports and the updating of hunting and fishing regulations. In addition, the Ministry's mailing list was maintained and updated.

The Ministry's clipping service was produced regularly and distributed to the heads of Ministry divisions and branches, and to regional offices. Many clippings from the Province's weekly and community papers, which were not included in the primary clipping service, were sorted and distributed to the appropriate parties within the Ministry.

Publications

In addition to a considerable amount of publication preparation and production work undertaken on behalf of other Ministry programs, several projects were begun to improve public understanding of overall Ministry concerns following reorganization. These included a review of Ministry programs in the form of a colour booklet, a series of colour posters dealing with environment which is representative of different parts of the Province, and a series of inexpensive fact sheets with environmental problems as their focus. The quarterly *Wildlife Review* and the staff newspaper *Environment News* continued to be issued regularly. *Wildlife Review* and the Ministry's wildlife poster series were honoured with awards from the Association for Conservation Information in the categories of magazine editing and

special publications respectively. Other highlights of the year included:

(1) publication of a full-colour booklet, *The Fraser River,* dealing with the Ministry's approach to environmental problems affecting the river,

(2) a major document describing new Provincial policy for commercial fisheries and mariculture,

(3) assistance to the Fish and Wildlife Branch in developing literature dealing with new management policies for moose in the Omineca Region, as well as public information material intended to alert the public to the problem of coarse fish introductions to interior lakes, and

(4) planning for a major illustrated book on the British Columbia environment, to be co-published with the private sector in 1982.

Audio-Visual

Photographic assignments included major coverage in the Omenica-Peace, Skeena and Kootenay Regions in response to demands for illustrated material required for publications, slide shows and the new environment poster series. The photographer was seconded for a number of special assignments including the cabinet tour of Vancouver Island and B.C. Place features.

Special photographic coverage was completed for the Fraser River brochure, the Provincial Emergency program's mock airport disaster, and the introduction of the Conservation Officer Service uniforms.

Displays

More than 300,000 visitors viewed the Ministry's shopping mall display which included live animals, fish, movies and features on waste, water and fish and wildlife. The display was exhibited in most major malls in the Lower Mainland and on Vancouver Island. It was alternated with a second display on the Salmonid Enhancement Program carried out in conjunction with the Federal Ministry of Fisheries and Oceans. In addition, a display was entered in the Sportsman Show in Vancouver and a special "milfoil" exhibit was constructed and displayed in major malls throughout the Province.

The Kootenay Hatchery display was refurbished and a feature photographic display was distributed to all regional headquarters.

More than 1,000 signs were constructed. New exterior signs were introduced for most Victoria offices.

Education

The Ministry's ENCORE environmental educational program was recommended as prescribed material for use in British Columbia schools. Also, the Ministry of Education officially endorsed the use of the environmental education handbook as supplementary material for ecology units in the elementary science program.

This is the first time that an environmental-oriented education program, developed by a resource Ministry, has been proposed as prescribed material for use in British Columbia schools. This means that the material must be used in the school science program.

A number of workshops were held for school personnel to encourage integration of environmental studies into the school curriculum.

There has been a very positive response from the school system for more environmentally-oriented material. As a result there is greater emphasis being placed on introducing new materials and lesson plans for such resources as water, waste, and other resource management objectives.

Library

Library holdings in Victoria of the Fish and Wildlife Branch, the Marine Resources Branch, and the Information

and Education Branch, formerly housed with the Ministry of Recreation and Conservation, were amalgamated with holdings of the Waste Management Branch and Water Resources Services libraries of the Ministry of Environment. A central library to house the amalgamated holdings of these agencies was created in Victoria in the fall of 1980. This library will continue to monitor the uncentralized holdings of the Assessment and Planning Division and Environmental Services Division. The library will also monitor the holdings of the regional offices of all the agencies of the Ministry.

Demands for the library services of the Ministry have increased substantially; queries from all areas of the world are multiplying, and so are the numbers of students and the public who use the ministerial library. In the coming year the library will endeavour to expand its service to these patrons, as well as to the Ministry's staff throughout British Columbia. Expanded service includes proposals for central administration, periodic publication of a computer-based catalogue, and the introduction of a service to generate current bibliographies in a wide range of special fields, using commercial sources of information stored on computers.

Conservation Outdoor Recreation Education Program (CORE)

The responsibility for the administration of the CORE program was transferred from the Fish and Wildlife Branch to the Information Services Branch. The transfer initiated a general review of the program, and results indicated a need for new lesson plans, a new instructors manual, improved visual aids and a streamlining of administrative procedures. The Ministry of Education agreed to provide professional assistance in the development of new lesson plans, and a new instructors manual, including a review of all present teaching aids. New comprehensive liability insurance coverage was instituted for all instructors in the Province.

There was an increased interest in the CORE program with a total of 9,892 students enrolled between January 1, 1980 and December 31, 1980. There were 7,928 graduates with 1,450 failures and 629 who failed to complete the course.

Registered volunteer instructors totalled 879 but only 362 were classified as active.

See Table 10.1, Page 138, for further details.

ADMINISTRATION DIVISION

Financial Services Branch
Personnel Services Branch
Computing Services Branch
Central Services Unit

The Division is responsible for personnel, finance, space, communications, computing services, mail, courier services, and general administrative support for the Ministry.

Major developments in the reporting period include: approval of seven new regional offices, and consolidation of operations involving 700 staff in Victoria; a Ministry Personnel Classification Committee and a new Safety and Training Unit; approval of a new autocartographic system; a Central Services Unit responsible for space, communications, vehicles and insurance.

Financial Services Branch

The Financial Services Branch is responsible for the development and implementation of Ministry programs for control of assets, budgetary planning and expenditure. Programs also include accounting for revenue and operating costs in accordance with Ministry and Government policies, and advice to Ministry officials on budgetary and financial matters.

A major development during this reporting period was the decentralization of some accounting responsibilities to branches and regions. This process will continue through the 1982 fiscal year. New financial reporting systems were introduced, as well as a proposed property control system.

A new Distributed Finanacial Management system will result in the introduction of bi-weekly pay, and the integration of the Personnel Management System and Leave Management System.

Personnel Services Branch

This Branch is responsible for personnel administrative services and systems provided to managers and employees of the Ministry. Services include recruitment, selection, salary administration, classification, organizational analysis, contract administration, collective bargaining, employee relations, staff development, safety and manpower planning.

The Branch opened an office in Kamloops this year, and established a Staff Development and Safety Section. Our first regional office was opened in Kamloops in February, 1980.

Other new projects include preliminary studies for the delegation of recruitment and selection from the Public Service Commission and a new payroll/personnel records system.

Recruitment, selection, classification and organizational analysis continue at a high level. There was also increased union action relating to staff transfers. The Ministry Classification Committee, initiated last year, has been well accepted within the Ministry and by the central agencies.

Computing Services Branch

The Computing Services Branch is a liaison between Ministry staff and B.C. Systems Corporation. The Branch is responsible for Ministry systems, changes to systems and co-ordination of data processing.

The Branch is coordinating a project to provide the technology and procedures necessary for Surveys and Mapping Branch to distribute digital and paper maps on request. The Assessment and Planning Division is supported with thematic map production and preparations for the new *Land Use Planning Act*.

Central Services Unit

Central Services meets the Ministry's requirements for office, storage and equipment space by negotiation with the British Columbia Buildings Corporation. Associated services such as building security, janitorial service, parking, furniture systems, office moves, telephone systems, photo-copying and mail delivery, vehicles and insurance, are also administered by this office.

The largest single project undertaken was the consolidation of almost 700 of the Ministry's Victoria staff into one area.

ASSESSMENT AND PLANNING DIVISION

Planning Branch
Assessment Branch
Terrestrial Studies Branch
Aquatic Studies Branch
Air Studies Branch

The Assessment and Planning Division was created to provide a focus for a new range of Ministry-wide assessment and planning objectives. In April 1980, five branches were established: Assessment, Planning, Air Studies, Aquatic Studies, and Terrestrial Studies, supported by an Administrative unit.

After dissolution of the Environment and Land Use Committee Secretariat, the Division became responsible for coordinating projects under the E.L.U.C. Development Guidelines, specifically for Linear Developments.

At the year end, the Divison has continued to implement its objectives and to play its role in the Ministry through the Air, Terrestrial Environmental, and Coastal and Estuary Management Programs.

Planning Branch

The Branch prepared plans for all environmental resources (air, water, water quality, fisheries, wildlife and marine resources) at the sub-regional level. The first plans were for the Nicola and Williston basins, and for the south-east Kootenays.

Operational fisheries plans were produced for the Arrow Reservoir, Kootenay Lake and the Peace River, a wildlife plan for the Arrow basin and a water management plan for Nicola Lake and the Coquitlam River.

The Economics Section advised the Water Comptroller and the Director of the Fish and Wildlife Branch on compensation for fish and wildife losses associated with the Revelstoke hydro project, the Arrow Reservoir and the proposed Site C project.

Branch Responsibilities and Accomplishments

Plans developed by this Branch will examine the supply-demand relationships for all environmental resources now, and over the next 20 years, for approximately 40 planning areas in the Province. The aim is to develope consistent policies involving water-related resources (water quality, water quantity and fisheries) and the terrestrial resources Ministry programs can be avoided and the Ministry's concerns can be better understood.

Specific resource management measures (e.g. water storage for irrigation, wildlife management areas, fishery enhancement works) are developed by operation planners, but are prescribed in the strategic plan.

Strategic Planning

Strategic environmental management plans were initiated in the Nicola basin, the Elk/Flathead Planning Unit, the Williston basin, the Peace basin and the Upper Columbia Planning Unit.

(i) Nicola Planning Unit

Water and related resource management in the Nicola basin were subjects of an initial study in 1979/80 to develop a hydrologic model to assist water management. The Planning Branch, in conjunction with the Regional Office of the Ministry in Kamloops, assumed direction of the study in August, 1980. The Branch completed an initial analysis of current supply and demands for water quantity, sport fisheries and wildlife. Because there is a shortage of water in the basin, work has begun to improve the regulation of Nicola Lake to increase water supplies for fisheries (salmon and steelhead) and irrigation. A Nicola Valley Working Committee was established, with representatives from various public interests in water management and Government agency staff, to advise the Ministry.

(ii) Elk/Flathead Planning Unit (S.E. Coal Block)

This program arose from the Coal Guidelines Process as a plan for fish, wildlife and outdoor recreation resources. The objective is to measure impact assessment and develop impact management programs associated with the five coal projects currently planned for the region. After the dissolution of the E.L.U.C. Secretariat, this project was transferred to the Planning Branch, and expanded into a comprehensive environmental management plan. Terms of reference are currently being prepared to add water allocation, water quality, and air quality to the plan.

Data collection and analysis of the fish, wildlife and outdoor recreation sections are nearly complete. A major component of the study has been a survey of public attitudes towards all aspects of outdoor recreation. The results of the survey will help resource managers to set environmental management

objectives which have public support. The management plan should be complete by mid-1981.

(iii) Upper Columbia Planning Unit

An environmental resource management plan for the Columbia-Windermere Land Use Study has recently been introduced. Background data relating to fish, wildlife and water resources are currently being collected.

(iv) Peace River Planning Unit

The urgent need to assess the impact of Northeast Coal Development and the Site C Hydro-electric project, and to develop comprehensive impact management programs, makes the Peace River Planning Unit one of major importance in the Province.

A strategic plan for fisheries management on the Peace River, with and without the proposed Site C dam, has been completed by the Fish and Wildlife Branch and work has commenced on a plan for wildlife resources. Initial discussions have taken place to prepare terms of reference for the north-east Coal Block section of the Peace Planning Unit.

(v) Williston Basin

An analysis of the resource management opportunities in and around Williston Reservoir was originally initiated in 1974/75 by B.C. Hydro and a number of Government agencies. The Planning Branch has developed this into a strategic plan for water, fisheries, wildlife, recreation and forestry management in the area.

Operational Planning

(i) Nicola Lake

Storage on Nicola Lake was the first project to be undertaken based on the Nicola strategic plan. There is sufficient hydrological information available on Nicola Lake inflow to be reasonably certain of filling the amount of storage to be developed. It is probable that more storage control on the mainstem will simplify tributary storage development and management in the future.

During 1980, work on the project included field surveys of the lake outlet. Aerial colour photographs were taken of the area from Nicola Lake to Spence's Bridge to determine how much land is currently irrigated by the Nicola river. Field investigations continued under the Salmonid Enhancement Program to estimate fisheries resource maintenance flow desired for the Nicola River for this particular storage project, and elsewhere in the Nicola Basin. A preliminary engineering feasibility report was completed on rebuilding the outlet of Nicola Lake.

(ii) Coquitlam River

During 1980, the Ministry of Environment chaired an Implementation Committee to act as a forum for information sharing, encouragement and assistance in the implementation of the 1978 Coquitlam River study recommendations.

Staff of the Planning Branch participated in the Coquitlam Area Mountain Study, undertaken to ensure integrated planning and management of these public lands.

(iii) Arrow Reservoir Fisheries and Wildlife Management Plans

In 1967, the Keenleyside dam raised the level of the Arrow Lakes approximately 13 m. (40 feet) flooding over 110 sq. km of Class 1 winter range for mule and white-tail deer, and around 30 per cent of accessible spawning areas for kokanee, Dolly Varden and rainbow trout. The Water Licence for the project stipulated that management measures should be undertaken at B.C. Hydro's expense. Because a program to resettle former waterfront owners along the reservoir was not approved by Environment and Land Use Committee until 1980, the Planning Branch, in

conjunction with the Fish and Wildlife Branch, did not complete management plans for fish and wildlife until spring of 1981. Several measures have been proposed, including the Inonoaklin Fishway, to increase current levels of production.

(iv) Kootenay Lake Fishery Plan

The closure of the West Arm of Kootenay Lake for kokanee fishing in 1980 reduced sport catches by one-third of the 1975 total. Angling for trophy-sized rainbow trout in the North Arm of the lake is also on the decline. A fishery management plan for the entire lake has been drafted which would re-establish the kokanee fishery in the West Arm by the construction of a spawning channel at Redfish Creek, which could also be used to enhance rainbow trout stocks. Kokanee and rainbow trout production would also be helped in the North Arm by improvements to the Meadow Creek spawning channel and by increasing spawning habitat for trophy-sized rainbow trout on the Lardeau River. The plan has been approved in principle by the Kootenay Region Fish and Wildlife Branch and will shortly be implemented under the Conservation Trust Fund.

Economic Studies

The Economics Section of the Planning Branch provides economic policies for analysing the Ministry's major programs and negotiates claims for compensation.

(i) Compensation

During 1980/81, the Planning Branch assisted with claims for compensation such as the Revelstoke hydro-electric project, the Keenleyside dam on the Arrow Lakes and the proposed Peace Site C hydro dam.

By the end of the year, a draft agreement had been negotiated with B.C. Hydro to provide almost $6 million for compensation programs on the Revelstoke project.

(ii) Economic Policy Analyses

The Planning Branch assisted the Marine Resources Branch with preparation of a paper on *Provincial Commercial Fisheries/Aquaculture Policy,* which was subsequently adopted by Cabinet. A report was also commissioned on the *Economic and Resource Management Aspects for the Commercial Use of Fish and Wildlife Resources in British Columbia* for the Fish and Wildlife Branch.

During the year, the Branch undertook a number of site surveys to estimate recreational values of steelhead in conjunction with the Federal-Provincial Salmonid Enhancement Program, and also completed an overall assessment of the economic effects of salmon enhancement on steelhead stocks.

Assessment Branch

The Assessment Branch directs the management and protection of environmental resources by developing appropriate surveillance activities and guidelines.

Evaluation Section

The Evaluation Section is responsible for evaluating developments affecting the environment. This work includes environmental problem analysis, representation on Provincial, Federal/Provincial and other steering committees associated with major developments.

Guidelines and Review Section

Work completed includes coordinating reviews of environmental impact

statements submitted by developers under the E.L.U.C. Guidelines for Coal, Metal and Linear developments, representing the Ministry on the Steering Committees for Coal and Metal Mines.

Accomplishments

Preliminary assessments were conducted of natural gas pipeline routes from the Mainland to Vancouver Island; coal liquification plant at Hat Creek; fixed transportation link from the Mainland to Vancouver Island; coal shipping terminal at Boat Harbour, Vancouver Island.

Regulated projects considered were: alternative LNG Terminal proposals; petrochemical plant proposals; offshore oil exploration proposals; foothills (North B.C.) Gas Pipeline; foothills (South B.C.) Gas Pipeline Surveillance; Site C Hydro-electric development; oil tanker traffic and related terminal proposals; CNR Twin Tracking proposal.

The Section became responsible for supervising restricted development in the Garibaldi slide hazard area.

Other activities included: O/C 908-77 Fraser Delta Environmental Assessment Dredgate Deposition/Marsh Transplant Experiment at Steveston North Jetty; Geotechnical (Pit Test) Studies, Roberts Bank; Vancouver Island Natural Gas Pipeline Proposal; O/C 3339-78 Cowichan Estuary Environmental Assessment Dolphin replacement and landfill in Doman Industries mill pond; maintenance dredging of MacMillan Bloedel's log sort facility; replacement of B.C. Forest Products log dump retaining crib; dyke repairs to Blackley's Farm.

Environmental regulation of major Federal projects included: Fraser River Training Works: panel awaiting Environment Impact Assessment of revised proposal; Vancouver International Airport: Roberts Bank Coal Port Expansion.

Ministry planning studies included: Thompson River Basin Pre-planning Study, Squamish Estuary Management Planning Study, Fraser River Estuary Study. The Branch became responsible for future direction and coordination of the Ministry's Coastal and Estuary Management program in early 1981.

The Field Coordinator on the Alaska Gas Pipeline Southeastern Pre-Build was to be responsible for surveillance during construction and clean-up.

Procedures and policies were developed for environmental control of construction of the Pacific Northern Gas Kitimat to Terrace natural gas pipeline.

Ministry review of numerous Coal and Metal mine developments was coordinated including the Quintette (Dennison Mines) property in the Northeast Coal area and the Quinsam (Weldwood) mine near Campbell River.

The risk to the killer whale population of Robson Bight was evaluated as a result of proposed logging activities in the Tsitka watershed.

Terrestrial Studies Branch

The Terrestrial Studies Branch is responsible for Terrestrial Environmental management program and the Coastal and Estuary management program. The Branch provides information on the soils, surficial geology, vegetation and wildlife biophysical habitats; serves as a central repository for Province-wide information on soils, vegetation and terrain; and provides drafting, graphics, distribution and autocartographic services for the Assessment and Planning Division.

Two major programs were initiated: the Terrestrial Environmental management program, and the Coastal and Estuary Environmental management program.

Accomplishments

Major accomplishments include:

Terrestrial Environmental Management Program:

(a) soils, terrain, agriculture capability and forest capability maps of the upper Coldwater River for a watershed planning study for the Water Investigations Branch;
(b) soils, terrain, geologic and erosion hazard maps of the watersheds of the Stein and Cummins rivers, for the Ministry of Forests.
(c) assessing the suitability of soil and terrain for urban development (Brandywine Creek) (for Assessment Branch, Ministry of Environment).
(d) detailed terrain maps and assessment of the River Delta's suitability as a port facility;
(e) broad scale soils, terrain, vegetation and wildlife habitat information in the Cry Lake area in northern British Columbia for wildlife management and linear development;
(f) mapping of soils, terrain, erosion potential and stream characteristics for the Coldstream and Vaseaux watersheds for the Okanagan Basin Implementation Board;
(g) evaluating the soils in the vicinity of Vernon for their suitability for spray irrigation of waste water;
(h) providing soil capability for agriculture and soil moisture information to the Ministry of Agriculture and Food for their Agricultural Land Reserve Program.
(i) resource analyses of the Graystokes area east of Kelowna for use by the Graystokes Public Advisory Task Group;
(j) inventory and analyses of the Cascade Wilderness Study area's soil resources;
(k) soil and laboratory computer data file;
(l) wildlife ecological mapping for the East Kootenay area, the Pine-Moberly area and the Burns Lake area.
(m) completed 40,595 chemical and physical analyses of soil, surficial material and vegetation samples. (*See* Tables 1 and 2 on pages 118 & 120 for summary of laboratory services provided in 1980/81.)
(n) Publications during 1980/81 included:
Describing Ecosystems in the Field.
Terrain Capability for Residential Settlements.
Soil Resources of the Lardeau Map Area.
Soils of the Pemberton Valley.
Soils of the Langley-Vancouver Map Area, Volume 1.
Illustrated Keys to the Gymnosperms.
Illustrated Keys to Some Common Grass Genera.

Coastal and Estuary Environmental Management Program:

(a) continuation of the coastal waterfowl inventory, and the estuarine waterfowl habitat assessment in cooperation with *Ducks Unlimited;*
(b) participation in the Fraser River Estuary Task Force.

Aquatic Studies Branch

The Aquatic Studies Branch is a technical support agency. It is the Ministry's central source of information in the fields of aquatic biology, limnology, oceanography, water quality engineering and other aquatic sciences.

Environmental Services

(a) *Saltspring Island Small Lake Study* — A report on the water quality and domestic suitability of Ford Lake, Bullocks Lake, Blackburn Lake, and Lake Stowell was completed in 1980.

(b) *Dutch Lake* — A study of water quality was initiated at the request of Thompson-Nicola Regional District. Sampling was completed in 1980, and the report will be finished in 1981.

(c) *Shawnigan Lake Study* — The quality of water in Shawnigan Lake will be studied, as well as its nutrient loading, in order to assist the Cowichan Valley Regional District with lake-shore planning.

(d) *Waste Management Branch* — Reviews were carried out on sludge disposal to land, and land disposal of sewage as an option for Saltspring Island (Ganges). Assistance was given in preparing guidelines to design settling ponds for sediment control in mining. Pollution control facilities and the water equality monitoring program for the Line Creek Coal Project were assessed.

(e) *Consulting for Regional Districts* — Use of soils information and investigations in lakeshore management was reviewed for the Fraser-Fort George Regional District.

(f) *Consulting for the Petroleum Resources Branch* — Disposal of wastes from the petroleum industry in the Peace River-Fort St. John area.

Environmental Management

A storm water outfall in the Vancouver region will be monitored to discover the amount of contaminants originating in storm water from a residential area. The monitoring will last until October, 1981, and may be expanded to other outfalls. Heavy metals and toxic organics will be measured which may be accumulating in fish from the Fraser River. During 1980, fish of several species were obtained from all parts of the river, between the source and the estuary. Results of the analyses should be available in 1981.

Watershed Management

Activities for the year are summarized in Table 9.1 page 134.

Aquatic Plant Management

This program concentrated on control of the nuisance aquatic weed, Eurasian water milfoil (*Myriophyllum spicatum* L.). Cost-shared cosmetic control of this plant in four Okanagan Valley mainstem lakes was implemented in cooperation with the Okanagan Basin Water Board. Diver-operated dredges worked under a similar arrangement with local agencies in Cultus Lake in the Lower Mainland Region. Intensive integrated control was implemented by the Province in Kalamalka and Wood Lakes.

Quarantine and surveillance activities were combined in 1980 to improve technical knowledge about the spread of Eurasian water milfoil by boaters and to secure public cooperation. Research continued on control technologies, including potential biological control of Eurasian water milfoil. Table 2 contains detailed information.

Stream and Lake Inventory and Aquatic Data Base

During 1980/81, work continued on stream inventory programs in the Queen Charlotte Islands (South Moresby Island), the Saanich Peninsula, Saltspring Island, the Lillooet River, the Sooke River, the Columbia mainstem, the East Kootenays (Windy and Cummings Creeks) and the upper Dean River.

Fifteen stream systems of varying sizes were surveyed for fish species distribution, delineation of areas sensitive to habitat manipulations and basic interpretations of habitat quality.

A data base was formed of aquatic resources of the East Kootenay's and upper Dean River system.

There was consultation with the Province of Quebec and the Yukon in ecological survey design and with the U.S. Forest Service on the impact of forest harvesting on fish habitats in western North America.

Research

A study was carried out on the impact on water quality of explosives (ammonium nitrate) used in coal mining.

Aquatic plants were documented throughout the Province. A 600-page illustrated manual was published describing most aspects of aquatic plants in British Columbia, including their distribution and ecology. An aquatic plant herbarium was maintained and specimens identified for other agencies.

Environmental Impact and Miscellaneous Work

A paper entitled, *Agricultural Runoff and Water Pollution* was prepared and presented at the annual meeting of the Canadian Water Resources Association, Kelowna, British Columbia, June 1980. The paper has been submitted for publication in the Journal of that Association.

Manuals were published describing aquatic system inventory procedures, data entry procedures, the hierarchical watershed coding system for British Columbia, together with a glossary of aquatic survey terminology. Work began on lake inventory procedures and various mapping methods.

The Alcan Pipeline Project, continued with a detailed study of proposed stream crossing sites along the length of the pipeline from the Yukon to the Alberta borders.

Air Studies Branch

An acid rain program was initiated for the coastal area. Nine sampling stations have been established to monitor precipitation chemistry from individual storms; Environment Canada is cooperating in analysis of the data. All acid rain programs in the four western provinces are now being coordinated through a joint committee.

A lichen monitoring project was established near Chetwynd to correlate sulpher dioxide concentrations with lichen growth.

Six hundred and seventy Provincial climate stations were operated in British Columbia, reducing to 208 during the year; half are operated by cooperating agencies.

Publications during 1980/81 included: (a) *Climate of British Columbia — 1977*, (b) *Saanich Peninsula Spring-Time Freeze Risk* by R. R. H. Chilton, (c) *An Analysis of Solar Radiation Data for British Columbia* by Dr. J. E. Hay.

The Branch has four components: Air Engineering Unit, Meteorology Unit, Climatology unit, and Data Processing Unit.

ENVIRONMENTAL MANAGEMENT DIVISION

Fish and Wildlife Branch
Marine Resources Branch
Water Management Branch
Pesticide Control Branch
Waste Management Branch

Fish and Wildlife Branch

The Wildlife Program

Wildlife management programs cover inventory and management of wildlife populations, maintaining or enhancing habitat, and setting seasonal regulations to control hunter and trapper harvests.

Administration

Gross revenue from the sale of hunting and angling licences and all other services totalled $6,830,845; an increase of $188,892 or 3 per cent from fiscal year 1979/80, mostly as a consequence of greater activity by hunters and anglers, both resident and non-resident.

Expenditures, exclusive of accommodation costs, utilities, and statistical services, are expected to total $11,814,117 for fish and wildlife programs; $130,971 by Creston Wildlife Management Authority; $348,482 in mitigation funds for fish and wildlife habitat affected by B.C. Hydro development; and $2,000,000 in the Salmonid Enhancement Program.

Guided hunting generated approximately $1.7 million in direct revenue to the Province. Guide Outfitters provided big game guiding services to 4,150 hunters, of whom 3,916 were non-residents from 16 foreign countries. Guided hunters harvested 3,648 game animals (the number of each species harvested in each Region is shown in Table 6.5).

Active Guide Outfitters numbered 274 (out of 308 licences held), and there were 855 active Assistant Guides (1,108 licences).

Bird Management

Peale's peregrine falcons were surveyed on the Queen Charlotte Islands in 1980 as part of the five year North American Peregrine Falcon Survey. Territorial pairs increased more than 30 per cent from the survey in 1975. The breeding population is estimated to be at least 76 pairs.

For the first time a systematic survey was made of breeding bald eagles on the coast of British Columbia. The survey was made in conjunction with the U.S. Fish and Wildlife Service and was based on 61 plots, of 64 square miles each. The estimated breeding bald eagle population on the British Columbia coast is $9,080 \pm 22$ per cent birds.

Endangered Species

The Ministry continued to work with Federal and Provincial counterparts to implement the Convention on International Trade in Endangered Species of Wild Flora and Fauna.

With the Federation of B.C. Naturalists and Douglas College, the Ministry co-sponsored a successful symposium on threatened species and habitats in British Columbia and the Yukon.

Wildlife Research and Technical Services

A five year, $1.3 million co-operative research program was begun to study the effects of intensive forest management practices on wildlife in second growth forests on Vancouver Island.

Roosevelt elk and black-tailed deer are the key species in the study, but the implications for other wildlife will also be examined. Costs are being shared equally between the Ministry of Environment and the Ministry of Forests. The forest industry and public conservation groups are also participating.

The impact of wolves on caribou calf survival was studied for a fourth year. In the first three years of the experiment wolves were removed from an area and response of the caribou was compared with caribou response in a comparable area where wolves had been left

undisturbed. In the fourth year no wolves were removed, and the emphasis was turned toward monitoring the wolves and caribou in both areas. It appears that removal of wolves may have led to a small increase in the survival of calves. Another year of monitoring is planned.

Caribou habitat in both study areas has been mapped in cooperation with the Terrestrial Studies Branch, to identify key features associated with specific kinds of habitat used by caribou.

The Branch completed a fourth year of a bighorn sheep productivity project to examine behaviour, nutrition, range and genetics and their influence on reproduction and growth in bighorns. A band of 20 to 30 sheep in a 100 acre enclosure near Penticton is being studied, in a cooperative venture between the Ministry, the University of British Columbia, and the Okanagan Game Farm.

Information on the growth, horn development, condition and reproduction of the sheep, and changes in vegetation, are being recorded in the first phase of the study. Results so far show that the sheep feed on herbs and shrubs much more than previously believed, and that the diversity and nutritive content of their forage is more important than the amount.

A one-year survey of public attitudes toward wildlife and wildlife issues was undertaken.

The Ministry assisted with funds for other studies, as follows: response of elk and vegetation in north-eastern British Columbia to 'prescribed fire' (controlled burning of the range); status of the white pelican, an endangered species in British Columbia; assessment of public attitudes toward wolf control (in cooperation with Simon Fraser University).

The Wildlife Research Section examined specimens of wildlife for parasites and disease, 'aging' teeth were collected for compulsory inspection as part of their Regional service.

Game Checks, Compulsory Inspection and Hunter Questionnaires

Game checks at the Cache Creek checking station (in its 35th consecutive year of operation), were made by 15,000 hunters, who reported a harvest of over 28,500 animals.

The Fish and Wildlife Branch instituted a Province-wide compulsory inspection system for grizzly bear, cougar and mountain sheep in 1975. These animals which are killed during a regular hunting season, or under circumstances provided by authority of the *Wildlife Act*, must be taken to an official of the Branch for inspection and measurement. Mountain goat and caribou were added to the list of designated species in 1976 and 1978.

The number of compulsory inspections completed by Branch staff has grown from 700 in 1975 to some 2,100 in 1980.

More than 100,000 questionnaires were mailed to residents who purchased hunting licences in 1980. According to responses, approximately 40 to 50 thousand big game animals were harvested during 1.25 million recreational hunting days.

Big Game (Ungulates)

Elk populations appear to be increasing in most areas of the Province.

A trial intensive management program was initiated in heavily hunted moose areas to preserve a greater proportion of mature breeders and increase the percentage of the non-breeders harvest. There is some evidence that because of heavy hunter take of bull moose in past years, there are too few mature bulls to breed all the cows during the main breeding period.

The number of "limited entry" hunts was increased from 28 to 37, and the number of licences made available, from 1,807 to 2,981.

During the year a small group of woodland bison moved up the Liard River to Fort Nelson from Nahanni Butte

in the Northwest Territories, where they had been released by the Canadian Wildlife Service. The 'rare and endangered' animals were subsequently transferred away from the community to a more remote area southwest of Fort Nelson.

Wild Fur Management

Wild caught fur taken in the 1979/80 trapping season brought $4.1 million into the rural economy of British Columbia. (*See* Table 6.6).

In 1980 Trapper Education courses, mandatory for new trappers in British Columbia, were offered throughout the Province. The Ministry established an annual grant of $8,000 to help defray costs incurred by the British Columbia Trappers' Association. A total of 480 students completed the course in 1980 (Table 6.7).

The Ministry assisted several trap inventors through the $100,000 Humane Trapping Fund.

Problem Wildlife Management

There were more complaints in 1980 of deer, elk and waterfowl damage to pastures, orchards, crops and stored products.

Attacks by bears, including one fatal incident and nine maulings, caused concern for public safety. As most bear problems are related to garbage disposal, steps are being taken to improve waste management in chronic problem areas.

Livestock losses to wolves declined in 1980, although the problem remains serious. During the winter, shooting from helicopters was an effective means of removing some problem wolves. But the primary method of control is site-baiting, particularly in the summer period. A permit to use the poison 1080 for this purpose was issued to the Fish and Wildlife Branch in 1980, with a maximum of 250 individual baits to be placed per year within the Province.

Public Conservation Assistance Fund

The $50,000 Public Conservation Assistance Fund supported fifteen conservation projects which may not have been possible without assistance. One half the total cost of a project may be covered out of the Fund, with the project volunteers supplying materials, equipment, labour or additional financing.

Some projects undertaken in 1980/81 involved: a re-introduction of sandhill cranes; wildlife range improvement; steelhead and rainbow trout stream enhancements; construction of a nature park; winter feeding of wild sheep, deer, and birds; construction of holding facilities for injured wildlife; preservation of the Vancouver Island marmot; protection of ecological reserves; collecting steelhead broodstock; stream cleanup; tagging rainbow trout; fry feeding in the San Juan River.

Land Management

Habitat Conservation Fund

The Habitat Conservation Fund was created to acquire and develop key fish and wildlife habitat in the Province. Revenue for the fund will be generated from surcharges in primary hunting, fishing, trapping and guiding licences, and from grants, gifts, donations and bequests.

A sum of $1.26 million was granted from the Crown Land Fund.

Use of Prescribed Fire

A draft protocol agreement with the Ministry of Forests was developed to facilitate the use of prescribed fire in wildlife management.

Site Management

The Fish and Wildlife Branch manages land consigned to the Ministry from the National Second Century Fund of British

Columbia The following sites were consigned in 1980/81:

(a) Willow Creek (Campbell River) — 80 acres acquired to protect and enhance a highly productive cutthroat and coho stream;
(b) Stellako River — 59 acres at the mouth of the Stellako River on François Lake, important to a continuing fisheries and conservation project;
(c) Walter Clough (near Slocan City) — 150 acres of waterfowl habitat donated by Mr. Innes Lorne Cooper of Victoria, now named the Walter Clough Wildlife Area, in memory of an early pioneer in the area;
(d) RCMP Flats (north of Radium Hot Springs) — 584 acres, including valley bottom habitat important for waterfowl nesting and staging, and an upland winter range for ungulates, principally elk;
(e) Owen Lake (south of Houston) — 128 acres adjacent to Owen Lake, part of an intensive moose management program planned for the Nadina Valley.

The Fisheries Program

The number of participants in non-tidal sport fishing continued to increase in 1980/81. Approximately 340,000 licensed resident anglers spent 4.6 million days fishing. There were approximately 110,000 non-resident anglers who spent an estimated 570,000 days sport fishing. The total annual catch was approximately 8 million fish, or close to 1.5 fish per angler day, with rainbow trout and kokanee the most commonly caught species. The total catch has remained at approximately 8 million fish for the last 20 years, despite the increasing number of anglers.

During the 1980/81 season residents and non-residents together spent approximately 140 million dollars on freshwater angling.

In order to maintain and enhance freshwater fishing in British Columbia the Fisheries Management Section carries out fish habitat assessment and improvement, research, and fish culture activities throughout the Province with the cooperation of regional fisheries biologists. Additional responsibilities include the Fisheries Program, development of freshwater sport fishing regulations, regulation of commercial fish farms, and coordination of the Federal-Provincial Salmonid Enhancement Program.

Steelhead Harvest Analysis

The 1979/80 analysis is based on returns from 7,565 steelhead anglers or 30 per cent of the 25,095 licensees. From these returns it is noted that an estimated 14,755 licensees spent 135,000 days fishing for steelhead in British Columbia. An estimated 6,384 anglers were successful, catching a total of 39,500 steelhead. Approximately 12,663 were kept, while the remainder were caught and released. Comparison of these results with the five previous years is found in Table 6.8.

Fish Habitat Improvement

Major programs such as the Salmonid Enhancement Program, Okanagan Basin Implementation and the Public Conservation Assistance Fund, have improved debris clearance, obstruction removal, stream diversion, lake aeration, chemical lake rehabilitation, spawning and rearing habitat renovation and creation, fish passage construction and fish food transplants.

In 1980/81 the Fish Habitat Improvement Section was involved in ten inland fisheries projects throughout the Province, as follows: Small lake tributary enhancement investigations (Carp, Hicks, Alta, Weaver, Kawkawa, Buntzen Lakes); Spawning channel maintenance (Ruby Lake); Flood control impact assessment (Mission Creek); Wild Rainbow trout recruitment monitoring (Mission Creek); B.C. Hydro

Mitigation/Compensation Surveys (Jordan River).

Weaver and Hicks Lakes, outlet spawning gravel will be renovated and increased and fish passage (i.e., access to lakes) improved through fishway construction in 1981/82. At Carp Lake regional managers were concerned that rainbow trout were being harvested in excess of their natural recruitment or replacement. Angling regulations have been introduced which are designed to protect and maintain spawning stock. At Ruby Lake the annual scarification (cleaning) of an outlet-spawning channel resulted in increased production of coastal cutthroat trout and improved catch of these fish in the lake fishery.

In 1980/81 the Section was involved in 16 projects with funds provided by the Salmonid Enhancement Program, as follows: Enhancement assessment (Nicola, Little Chilcotin/Elkin, Camera, Salloomt, Kispiox, Morice and Kloiya Rivers); Enhancement assessment/ implementation (Lower Mainland Sea-Run Cutthroat); Fry stocking evaluation (Bonaparte, Silverhope Rivers); Highway/industrial impact assessment (Coquihalla, Coldwater Rivers); Pre- and post-flood evaluation (Salmon River — Langley); Instream improvement (Springer Creek); Applied enhancement research (Colquitz Creek); Evaluation of steelhead survival over winter (Deadman River).

A number of these projects will continue in 1981/82. For example, in the Lower Mainland, boulders will be placed in two streams to improve rearing habitat for juvenile sea-run cutthroat trout. In Silverhope Creek and the Coquihalla, Bonaparte and Salloomt Rivers, steelhead fry stocking programs recommended by the Section will continue. In Colquitz Creek, the Provincial Capital Commission has provided funds for a combined linear park and stream restoration project which will include stream enhancement structures for increasing coho salmon and sea-run cutthroat production.

In 1980/81 the Fish and Wildlife Branch, in cooperation with Federal Fisheries and Oceans, produced a Stream Enhancement Guide with support from the Federal-Provincial Salmonid Enhancement Program. This guide can be used by fisheries agency field staff as well as the public.

Fisheries Research

Research indicates that by genetic manipulation or by sterilization, (diverting energy to growth rather than production of sexual products), growth of trophy rainbow trout of 2–4 kg should be achieved easily and inexpensively.

In the Okanagan-Kamloops area most small lakes are extremely rich in nutrients. In some cases this characteristic results in low dissolved oxygen levels and consequent winterkill of fish. Experimental aeration of Yellow Lake near Penticton has resulted in a trout population per unit of area five times greater than in comparable lakes nearby.

In the Lower Mainland the first experimental sea-run cutthroat rearing program has resulted in a catch of 2,000 fish in the Chilliwack area.

Fish Culture

During the year 6.4 million hatchery fish were liberated in 607 lakes and seven streams; approximately 5.1 million rainbow trout were planted in 483 lakes; 82 lakes received brook trout, and 250,000 kokanee eggs went into the Arrow Lakes area. Steelhead fry totalling 119,500 were released to four rivers; 52,633 steelhead smolts were planted in five rivers; and 61,691 sea-run cutthroat were also released. (*See* Tables 6.9 and 6.10.)

For the second year, 17,000 brown trout fry were released into tributaries of the Cowichan and Adam-Eve Rivers. Other projects included: cooperation with B.C. Hydro and Power Authority in the construction of a small hatchery at Peace Canyon to compensate for the Site

1 Dam; significant returns of anadromous cutthroat to sport fisheries and spawning grounds on Vancouver Island resulting from the first year's release of hatchery fish; approximately one-half of the summer run steelhead returning to the Coquihalla River were of hatchery origin; Loon Creek Hatchery expansion was completed, enabling the first steelhead smolts and chinook fry to be released in April and May of 1981; 2,206 juvenile and adult fish were examined clinically for the detection, diagnosis and prevention of disease.

Salmonid Enhancement Program — 1980

The Federal-Provincial Salmonid Enhancement Program is designed to double the catch of salmon, steelhead and sea-run cutthroat in the next twenty years. This development program is to be completed in two phases. Phase I will continue until 1983/84 followed by the final Phase II.

The Province agreed to support Phase II with funds at the proportionate level agreed to for Phase I.

Careful and restrictive management of salmonid stocks in the Province continues, since they have declined to historic low levels.

Opportunities for enhancement of natural systems were evaluated on the Nicola, Chilcotin, Bella Coola, Kispiox, Morice, Kloiya, Lillooet, Nahatlatch, Stein, Texas, Seton and Bridge Rivers.

Log and debris barriers were removed from four high-quality tributaries of the Salmon River on Vancouver Island. In addition, several large boulders were added to Springer Creek, providing habitat for several hundreds of steelhead and coho smolt. In the Lower Mainland, cutthroat rearing areas were improved in tributaries of the Serpentine, Nicomekl, and de Boville Slough. On the Thompson, removal of an obstruction on Criss Creek gave steelhead access to an additional 17 km of spawning and rearing habitat. Spawning areas were also constructed in Criss Creek and Shaken Creek, a tributary of the Nicola system.

Smolts released from Provincial hatchery facilities number 32,000 cutthroat and 73,000 steelhead. Fingerling releases in the fall provided an additional 15,000 cutthroat and 120,000 steelhead. Also, in 1980 the first production scale rearing facility was constructed and operated on Cowichan Lake. High summer temperatures resulted in substantial losses (65 per cent), but fall and winter survival and growth was excellent. Alterations to the Loon Creek hatchery near Clinton were completed, and the facility went into production.

Regional staff intensified the collecting of wild stock steelhead for Federal hatchery facilities. Approximate production of smolts was 220,000, though many fish were undersize.

Programs for colonizing unused habitat should be given high priority, because pilot plants of fry have shown such programs to be economical and to encourage survival.

The first returns of adult steelhead were observed in some rivers.

The development of a sea-run cutthroat program continued, and good fisheries for sea-run cutthroat have developed on the Hope-Camp Slough, the Gorge Waterway, Fulford Harbour and the Oyster River.

Inland Fisheries Enhancement Projects

Hatheume Lake rehabilitation project (Region 3); Hatheume Lake was chemically treated to remove the increasing population of sculpins which was causing the decline of rainbow trout and threatening to colonize nearby lakes.

Gardom Lake (Region 3) aeration project; air pumps were installed to circulate air to the bottom of the lake and increase oxygen levels during the winter. This will prevent winterkill of fish due to low oxygen levels caused by the cover of ice and algae decomposition, and will increase the level of sport fish production.

Nechako River sturgeon study (Region 7); sturgeon have been tagged with radio transmitters and their movements have been followed. This study has been made in collaboration with New Caledonia College.

Yellow Lake aeration project (Region 8); aeration of Yellow Lake to prevent winterkill of trout has created a fishery of 11,000 angler days per year, where previously there was no fishery.

Arctic grayling transplants (Region 7); arctic grayling have been stocked upstream of impassable barriers in rivers in the area of the northeast coal block. British Petroleum collaborated in this project.

Okanagan Lake enhancement (Region 8); 20,000 one year old rainbow trout were released into Okanagan Lake. The hatchery fish made up 25 per cent of the catch of one year rainbow trout. 100,000 kokanee were also released into Okanagan Lake.

Skaha Lake Hatchery (Region 8); construction of this hatchery is complete. It will be used to rear kokanee for release when the plankton crop is at its maximum, thus reducing the cost of rearing, and increasing the survival of the released kokanee.

Habitat Protection

A compensation package for losses stemming from Revelstoke Dam was completed during the year, and a position paper on the effects of the proposed Peace River Site C dam was developed.

Emphasis is placed on the low flow problems in the Nechako and the Kemano completion proposal by Alcan, the Coquihalla highway projects, coal projects in the northeast and southeast, the Alaska Highway Gas Pipeline, and the proposal for a wilderness area on South Moresby Island.

Work has been started on a special study to assess the effects of soil erosion on forest and stream productivity in the Queen Charlotte Islands. The $800,000 study is a joint project of the Federal Department of Fisheries and Oceans and the Provincial Ministries of Environment and Forests.

Marine Resources Branch

This Branch is responsible for the management of oyster and marine plant resources and the economic development of associated industries. It licences and regulates the fish processing sector and fish buyers in the commercial fishing industry of British Columbia. These services are provided under the British Columbia *Fisheries Act* and *Fish Inspection Act*.

The commercial fishing industry was affected by a sharp drop in prices and volume of landings in 1980. The Marine Resources Branch approved transfers of processing and buyers' licences to accommodate the sale and acquisition of assets between the two major fish processors in the Province; an intermediate-sized company ceased operation. In spite of the economic situation, the number of processing and buyers' licences issued remained at record high levels.

Prices for shellfish — principally oysters and clams — continued to rise; demand exceeds supply and the industry continues to expand at record rates.

New Provincial policies for commercial fisheries and mariculture were announced in April of 1980. Except for a Canadian citizenship requirement, fish buyers' licences will not be restricted, nor will processing licences, except for floating processing plants. The new policies include the monitoring of the structure and source of investment capital.

Marine plant harvesting will not take place where it may have a negative impact on salmon, or herring or shellfish, *et al.* Seaweed harvesting licences for large volumes will be issued on a competitive bid system.

Cooperative, exploratory fishing programs with the Nanaimo Biological Station have produced an additional 69 t/year of prawns and shrimp, having a landed value of $460,000/year and providing 1,200 person days of employment/year; similarly, 19,000 t of groundfish were located, having a landed value of $3,000,000.

Identification of individual herring stocks in the Strait of Georgia increase quotas by about 10 per cent or (at last year's prices), a landed value of $480,000/yr.

Development of a marine plant industry started in 1980 with the establishment of a kombu harvesting and processing operation at Port McNeill.

Mariculturists have started trial operations of kombu culture in Masset, Pender Harbour area and Barkley Sound.

A second Oyster Seed Development Loan Fund was negotiated with the B.C. Development Corporation.

The number of registered oyster growers increased from 90 to 100 and leased foreshore increased from 2,274 (79/80) to 2,685 by the end of 1980.

In cooperation with the B.C. Oyster Growers' Association, a commercial scale trial of longline cultured oysters will be used to compete with a five million dollar per year market served by imported product.

A contract was placed for a commercial scale mussell culture project, jointly funded by Fisheries and Oceans. The company has extensive experience in cultured oyster production.

Inspection, Licencing and Enforcement Section

The number of licenced processing facilities increased by six per cent from 351 to 371 (an eight per cent increase recorded in 1979). In 1980, more small facilities such as retail markets were licenced to operate. Two small "sport fish canneries" ceased operations, which resulted in a decrease of licenced salmon canneries from 22 to 18.

The number of fish buyers' licences increased by three per cent from 651 to 672 (a one per cent decrease was recorded in 1979).

Salmon Canneries

Of 18 licenced salmon canneries, one is located in the Central Coast area; six in the Skeena River-Prince Rupert area; three on Vancouver Island; and eight in Fraser River-Lower Mainland area. The canned pack was made up of the following number of 48 lb. (21.8 kg) cases by species: sockeye 388,206; chinook, 6,768; steelhead, 440; coho, 82,651; pink, 456,363; and chum, 170,346; for a total of 1,104,774 cases. This is an increase of 19 per cent over the 928,076 cases produced in 1979. However, the 1980 production included 217,148 cases of salmon imported from the USA and also 27,411 cases canned from the previous year's frozen stock, which together makes up 22 per cent of the current year pack. (*See* Table 7.5, Salmon Canning — Commercial for comparative figures for two preceding periods.)

Sport-Caught Fish Canneries

Sport-caught fish canneries recorded a decrease in production of one-half pound (225 g) cans. From 345,817 cans in 1979, a drop of 34 per cent to 229,117 cans has occurred. The number of resident fishermen using these facilities dropped from 2,082 to 1,780. The number of individual fish canned by the four licenced canneries was 27,784, which is a decline of 31 per cent from the 40,468 reported in 1979. Chinook salmon comprised 31 per cent of the catch in 1980 and 26 per cent in 1979. Coho salmon made up 60 per cent in 1980 and 57 per cent of the catch in 1979.

Inspection Survey

An inspection of sport fish resorts, charter vessels, and freshwater fish farms which was undertaken in late 1979 was completed in 1980. The purpose of this survey was to determine if any of these establishments were engaged in fish processing. About 85 charter boats and marinas, 65 freshwater fishing resorts and 65 fish farms were included in the survey.

Fin Fish Policy and Resource Development Section

The exploratory fisheries programs to date have provided an additional 4,052 person days/yr. of fishing to harvest a 233 t/yr. increase in shrimp and prawn catch worth one million dollars landed value. They have provided a 19,000 t increase in the groundfish quota worth an estimated $3.2 million landed value/yr.

The herring tagging program continued; 27,027 tagged herring were released from four vessels. Approximately one half of the releases were made in the vicinity of La Perouse and Swiftsure Banks during September, the remainder during November in the Gulf of Georgia, Johnstone Strait and near Browning Entrance. One hundred seventy-three tags were recovered out of a total of 78,482 herring tagged during the first two years of the program. This data will allow the continuation of the lucrative herring roe fishery and 10 per cent increase in the catch quota per year.

Fishing Industry Production

The primary source of commercial sales is salmon, followed by the lucrative, but somewhat unstable, herring fishery. Total landings declined due primarily to poor salmon returns. Landed values dropped significantly as a result of softening markets in the major importing countries. Increasing production from ground-fisheries and shellfish stocks provided some relief from dependence on traditional markets.

Salmon Fishery

51,576 t of salmon worth $117 million (landed value) were landed in 1980. Landings declined 11 per cent from 1979 and value dropped 27 per cent due to softening world export markets. Salmon represented 65 per cent of landed value of British Columbia fishing landings during 1980.

Halibut Fishery

Canadian fishermen landed 3,305 t of halibut having a landed value of $9 million. This quantity is 370 t more than the previous year, however, landed prices declined 140 per cent resulting in a reduction in total landed value of $7.4 million from 1979/80. The protocol between Canada and the United States, which allows Canadian fishermen to fish halibut in U.S. waters in exchange for the right of U.S. fishermen to catch groundfish in British Columbia waters, expired in 1980. Halibut landings are therefore expected to decline in the future.

Herring Fishery

The total herring landed in the 1980/89 herring fishery is estimated at 38,576 t, with an estimated landed value of $34 million. The 1980 food and bait fishery landed 8781 t worth an estimated $4 million. Landed value of roe herring continued at a value approximately 25–35 per cent of that achieved in 1979 due to a softening Japanese market.

International Fisheries Negotiations

Salmon Interception Negotiations between Canada and the United States in Lynnwood, Washington, reached a satisfactory conclusion. The Marine Resources Branch recommended support of the "Lynnwood Agreement", which should entitle fishermen in both countries to a catch of salmon commensurate in value with that produced in their respective rivers.

Shellfish Management and Development

Environmental Protection and Monitoring

After closure of shellfish harvesting in Saanich Inlet, an assessment of fecal coliform pollution was made and point sources were identified. An effective "clean-up" of the inlet should result in the re-opening of this previously heavily-used shellfish recreational area.

Habitat Protection

The MacMillan Bloedel proposal for a log handling facility at Buckley Bay has been a recurring and contentious issue throughout the year. We have provided information on design, construction and operation phases to provide the best possible habitat protection. Baseline inventory is underway, and sample stations and bioassay sites have been established to monitor growth and mortality of oysters. Intertidal plots will be set up to monitor build up of debris. Water quality monitoring programs have been agreed with the company.

Referrals from Lands Branch accounted for 41 per cent and Waste Management Branch comprised 46 per cent of other protection referrals.

Shellfish staff were members of the planning task forces initiated by the Ministry of Lands, Parks and Housing to write management plans for small harbours. The "Sooke Harbour and Basin Crown Foreshore Plan" was published this year, and the first drafts of the "Ladysmith Harbour Crown Foreshore Plan" were completed.

Extension and Liaison Services

A cooperative study with the Technology Services Branch of the Department of Fisheries and Oceans assessed the shelf life, food value and condition indices of bottom and off-bottom cultured oysters. Results indicate that for the same storage temperatures off-bottom oysters have a longer shelf life than bottom oysters. There were insignificant differences in food value between bottom and off-bottom oysters. Off-bottom oysters were found to have a lighter colour, and fresher odour and flavour. The study also compared several methods for obtaining condition indices. This study is the first of its kind in British Columbia.

Oyster Seed Development Loan Fund

An oyster seed development loan of $160,000 was made by the British Columbia Development Corporation to the British Columbia Oyster Marketing Board. Seven growers have taken out loans totalling $131,000.

Oyster Culture Development

At the end of 1980, there were 100 registered oyster growers in British Columbia, using 2,685 acres of Crown foreshore. This is the first time that the number of growers has reached 100. These figures represent an increase of 475 acres of growing area and an additional 12 registered growers over the previous year.

There is continuing strong market for fresh oysters; the industry is diversifying into new oyster products and starting to culture different species of shellfish.

Although the number of permits issued to harvest wild oyster increased from 66 in 1979 to 86 in 1980, there was a reduction of tonnage harvested from 709 tons in 1979 to 337 tons in 1980. All permits come under close scrutiny and only conservative quotas are allowed.

Trials of oyster culture-on-stakes at Baynes Sound, Nanoose Harbour and Kuper Island are complete. This work showed that marginal growing areas can be used; growth rates of approximately double that of bottom cultured oysters were obtained in all areas. Additional plots have been set up in Ladysmith.

A pilot project was introduced to test the commercial feasibility of culturing oysters, using the Japanese longline system. Oysters from this project will be

smoked and canned and will compete with an imported product which now services a 5 million/year market. Automated shucking and cooking techniques will be used for this project, to be developed jointly between British Columbia Research, the industry and this Branch.

A site for the Shellfish Demonstration Facility has been located at Fanny Bay; construction should be completed by about mid 1982.

Spatfall Prediction Service

There was a successful commercial set in Pendrell Sound this year. Approximately 200,000 strings of cultch were installed, and the value of seed collected was about $1,160,000. This is an increase of almost $200,000 over 1979.

The Marine Resources Branch will provide the prediction service as of 1982.

Mussel Culture

An oyster grower is under contract to set up a pilot commercial mussel culture operation. The Branch invested $15,000 for the first year.

Marine Plant Management and Development Section

The Province's first kombu (edible kelp) harvesting and processing operation got underway in June 1980 based on using *Laminaria* and *Cymathere* off Malcolm Island; a processing facility was licensed at Port McNeill. Pre-harvest inventory identified in excess of 2,600 t of kombu in the area.

Kelp harvesting and processing licences have been conditionally awarded to a company in Vancouver. The annual harvest quota is 5,000 t for a minimum 5 year period. A monitoring team will assess the impact of harvesting on regrowth of kelp and on associated fish and invertebrate species.

For the first time harvesting licences were issued to regulate kelp harvesting by the herring spawn-on-kelp industry. Seventy-two t of *Macrocystis* blades were used on spawning substrate in the herring ponds. This industry produced wholesale sales of approximately $3 million in 1980. A kelp harvesting licence was also issued to provide feed for brood stock in an abalone culture operation.

The single commercial nori or purple laver (*Porphyra*) operation on the British Columbia coast has led to Native Indian concern over their continued access to this traditional sea vegetable. The Ministry will catalogue traditional picking sites and preserve them for the special interests of Indian people.

Culture technology for red seaweeds will be discontinued, following sweeping changes occurring in the international algal colloid (gel) industry.

Kombu culture technology development continues to progress rapidly. Young wildlife plants transplanted to culture lines have produced larger, higher quality blades than naturally grown plants. Seeding techniques are well established and seed produced in the laboratory has shown that shorter growing seasons may be possible.

Water Management Branch

The Comptroller of Water Rights administers the *Water Act*, under which the water resources of the Province are managed. With few exceptions, licences are required before any person, company, community or government agency uses water from surface-water sources. Licences are issued for

domestic, waterworks, conservation, irrigation, mining, industrial, power, storage and other purposes.

The Comptroller of Water Rights also administers the *Water Utilities Act* under which he regulates water utility companies.

The Water Management Branch is organized into three sections; Administrative, Power and Special Projects and Community Water Supply.

The number of licences issued continues to grow at 1,000 per year; the total number of licences has now reached 34,100. For the period January 1, 1980 to March 31, 1981, 2,245 new applications were received; the number of pending applications reached 3,132 at March 31, 1981.

Approvals granted under section 7 of the *Water Act* for a short term use of water, or for changes in and around a stream, increased to 387.

Applications for amendments of licences by apportionment, transfer of appurtenancy or changes of works totalled 926.

Draughting and Mapping Office

During the reporting period 2,419 plans were draughted for each water licence issued.

A total of 848 new reference maps were completed; 212 new mylar maps were also completed.

The staff has produced a record number of maps: a total of 547, showing water licencing data.

Power and Special Projects Section

Considerable emphasis was placed on two major responsibilities, dam safety in general, and the Revelstoke hydroelectric project in particular.

Contracts for construction of cofferdams, unwatering of the riverbed and excavation for the foundations of the proposed concrete gravity dam and powerhouse were completed by March 1980, on the 2,700 mw Revelstoke Project despite difficult bedrock conditions. The Columbia River had been diverted earlier in 1978.

A $283,000,000 contract for the concrete gravity dam at the Revelstoke hydro-electric project was awarded in June, 1979. This is the largest single contract ever awarded by British Columbia Hydro and provides for the construction of the concrete dam, powerhouse and spillway.

While engineering aspects of the dam are assessed by the Section's technical staff and three consultants, the environmental and social effects of the construction activities are reviewed continually by the Revelstoke Project Coordinating Committee.

Two other major hydroelectric projects, the 700 mw project at Peace Canyon and the 525 mw Seven Mile project on the Pend d'Oreille River near Trail, were substantially completed in 1980. Official opening ceremonies, with the Premier attending, were held on June 13 at Seven Mile and on September 23 at Peace Canyon. Installation of a fourth 175 mw unit at Seven Mile is being deferred until additional units at Seattle City Light's Boundary Project, located some 16 km upstream, are in place.

Although much of the responsibility for the review and approval by Government of new major hydroelectric projects has been transferred from the Ministry of Environment to the Ministry of Energy, Mines and Petroleum Resources (under the *Utilities Commission Act*, August, 1980), the Water Management Branch, (in particular, the Power and Special Projects Section) will continue to review technical aspects of projects proposed for approval.

In 1980, British Columbia Hydro applied for a certificate to proceed with the 900 mw Site C Project, located on the Peace River near Fort St. John. A review of the preliminary designs of the proposed 200-foot high earthfill dam was initiated by the Section.

Other hydroelectric projects are under active consideration for development in the next decade, including the Liard River (4,000 mw total at two sites), the Stikine-Iskut (2,800 mw total at four sites) and the smaller Murphy Creek Project on the Columbia River near Trail (400 mw).

During 1980, water management and licencing requirements for 17 metal mine proposals were reviewed in addition to coal development in the Southeast Kootenay area, the Northeast Coal Block, Vancouver Island and the Southern Interior.

A proposed new rental structure will increase Government revenues from $16 million to $41 million annually. The Section also completed a report on mitigation/compensation opportunities on the Arrow Lakes; a review of irrigation depletions in the Columbia Basin, and the interrelated effects on downstream power benefits; coordination of studies and negotiations with the City of Seattle as they affect the long-standing Skagit Valley flooding issue; the review of approximately 40 water licence applications for power purposes.

Dam Safety Program

A new inspection program covers more than 1,500 storage structures in the Province. An additional 140 dams, classified as major structures, are inspected by the Power and Special Projects Section.

During 1980, seventy-nine major structures were examined for their structural integrity and operating capability. Infra-red photography was used to detect areas of seepage of embankment dams; inundation studies checked potential flood areas below high hazard structures, and liaison continued with the Provincial Emergency Program Director to discuss early warning systems and evaluation procedures in the event of mishap. Twenty-four dams throughout the Province are now being monitored two or more times per year. Future plans include the addition of acoustic emission equipment to allow measurement of internal stresses by placing probes into embankment dams. This is a relatively new technique which is receiving world-wide interest.

Approval applications for major dams now require incorporation of an instrumentation proposal.

Community Water Supply Section

Water Utility Sub-program

Under the new *Utilities Commission Act*, 1980, privately-owned water utilities, and some water supplies owned by municipalities are regulated by the Comptroller of Water Rights. There were 262 private water utilities and 34 municipal utilities under regulation at March 31, 1981; a net decrease of nine during the year. The incorporation of some service areas outside municipal boundaries has led to a decrease in regulated municipal utilities.

During the 15 month period ended March 31, 1981, 97 applications for Certificates of Public Convenience and Necessity were received, an increase of 40 over the preceding year.

There were 105 orders of various kinds, among which were those for the establishment of maintenance trust funds, construction trust funds, replacement reserve trust funds, and approval for the transfer of waterworks to new owners. These trust funds are deposited with a financial institution of the utility's choice and held to the order of the Comptroller. At the year end the total balance on deposit amounted to $4,487,050.

The Community Water Supply Section continued to represent the Branch on the Pacific Rim Infrastructural Technical Committee of the Ministry of Industry and Small Business Development. The Committee plans and implements the installation of water and sewer systems to enhance the tourism and fishing industries on the west coast of Vancouver Island. These systems are being financed under the Canada-British Columbia Tourist Industry Development Subsidiary Agreement and the Agriculture and Rural Development Subsidiary Agreement.

Pesticide Control Branch

The Pesticide Control Branch is responsible for ensuring that useful, Federally registered pesticides are used safely in the Province, in a manner that will not produce an unreasonably adverse effect on people or the environment.

Administration

The Pesticide Regulations were amended to include a provision that permits be required for use of pesticides on private land for forestry, public utility, and transportation purposes. The Pesticide Regulations were also revised to de-regulate the sale of pesticides used on domestic pets, by transferring these pesticides from Schedule IV to Schedule V under which they may be sold in unlicenced premises by uncertified dispensers.

Permits are required for pesticides applied to publicly owned land or to any body of water. Restricted permits are granted for highly toxic or highly persistent compounds listed in Schedule I of the Regulations. Special use permits are also granted for research projects involving unregistered pesticides.

The Program supported two contracts last year: one to dispose of unwanted 2,4,5-T herbicides and the other for an integrated program for the control of insects on potatoes.

The Branch continued to work closely with the members of the Pesticide Control Committee on the permit referral system.

From the former Headquarters (Lower Mainland), a total of 60 Restricted Use Permits, 350 Public Land and Aquatic Permits, and 35 Special Use permits were issued.

During 1980, regulations were successfully completed with CPR for spraying the E & N line between Victoria and Courtenay with the herbicide Roundup (glyphosate). Projects such as this were exempt during 1980 from the permit requirements of the Pesticide Control Regulations.

One of the most notable, among 48, appeals last year was the lengthy appeal against the use of 1080 in controlling wolves and coyotes throughout British Columbia.

Certificates

The Branch is heavily involved in training, examining, and certifying pesticide applicators and pesticide dispensers.

Branch staff conducted a total of 107 adult education courses in 39 centres and issued 285 1-year certificates and 2,709 5-year certificates.

The Branch Handbook is in demand all across Canada, having been distributed to our students and to others outside the Province.

Licences

The four regional offices (Lower Mainland, Vancouver Island, Okanagan, and Omineca-Peace) issued a total of 1,509 licences, 1,027 to pesticide vendors and 482 to pesticide services.

Enforcement/Compliance

From the 2,735 inspections of pesticide service and pesticide vendor premises, there were 56 investigations, 30 suspensions or revocations of licences and certificates, and a total of four charges were laid. There were 52 permits sites inspected to determine compliance to the permit conditions.

The Branch is occasionally involved in the investigation of fatal poisonings of domestic dogs, sick cattle, and contaminated drinking water. In at least half the cases pesticides are not the cause.

Last year several instances of highly toxic compounds being stored or shipped

in leaky containers were investigated by the Branch. There have also been several reported incidents of pentachlorophenol spills around sawmills.

Several cases of bee kills were received throughout the season.

As a continuing public service in the disposal of unwanted pesticides, 95 sources were removed in 1980. A bibliography of important pesticide references is being accumulated as part of a central library of pesticides.

Waste Management Branch—

Pollution Control Section

An influx of people and business to British Columbia has resulted in continuing pressure for new housing units, requiring the servicing of difficult lots on bedrock outcroppings and the infilling of previously derelict tracts of land adjoining transportation rights-of-way and utility corridors in the south-west urban centres of the Province. Elsewhere, new treatment centres are being built to serve previously undeveloped properties; existing works are being expanded years ahead of schedule.

The City of Prince Rupert is due for expansion as a major bulk commodity port in the 1980's. The city had inherited a network of pipeworks and short outfalls installed under emergency conditions in the early years of the second World War. The replacement and provision of new services is being carried out concurrently with a network of new shoreline interceptors and outfalls into deeper waters further offshore. The project is scheduled for completion in mid-decade and the results will be closely monitored. The Clover Point outfall in the City of Victoria was completed to 1,000 metres, and permission given for extending the McMicking Point outfall into Enterprise Channel.

One innovative scheme for re-use of waste products is the nourishment of a marsh area for the enhancement of migratory bird habitat. The Town of Valemount in the Rocky Mountain Trench area proposes to locate their new treatment plant and disposal basins next to a marsh which was recently acquired by *Ducks Unlimited*. The supply of nutrients from the town will be used by the aquatic plant life in the marsh and thus improve sanctuary and food supply for the many thousands of birds using the mountain flyway.

Applications for Permit and Permit Amendments involving disposal effluent, either by spray irrigation or direct infiltration into the ground, continue to be important options selected by large municipal effluent dischargers in the interior. This option is being considered more and more because rivers and streams are under increasing stress from the expanding volume of wastes from municipal sources. Guidelines covering "Municipal Effluent Application to the Ground" have been published to assist municipalities with developing spray or ground disposal schemes. The recommendation is that entire sections be devoted to spray irrigation of treated municipal sewage effluent. The cities of Vernon and Cranbrook continue to be the largest dischargers of municipal effluent via spray irrigation, while the Village of Osoyoos, by spraying their municipal golf course, is the first to use treated effluent for recreational use.

The instinctive scavenging habits of bears at municipal refuse disposal sites continues to be a problem. The Regional District of Central Kootenay is embarking on a refuse container haul system with disposal in remote areas.

Three British Columbia kraft pulp mills, Crown Zellerbach (Elk Falls

Division), Canadian Forest Products (Port Mellon Division) and Tahsis (Gold River Division) propose to attach Teller Scrubbers to their existing recovery boilers for control of total particulate and malodorous gases, to meet permit conditions.

Canadian Cellulose Company (Castlegar Division) carried out a pilot plant project using a new technology involving the use of waste gases to strip kraft foul condensates. With this technology, kraft pulp mills could reduce the amount of B.O.D. and toxicity in the raw mill effluent by approximately one third. The concept of stripping foul condensates with waste gases would be of particular benefit to kraft mills in British Columbia which do not have biological treatment of effluent. At MacMillan Bloedel (Port Alberni Division) a pilot plant Lamb wet cell burner uses hog wastes to generate hot combustion gases for the calcining of lime in a kiln.

Crestbrook Forest Industries is constructing a series of infiltration basins for the treatment of pulp mill effluent to reduce colour to the level specified in their Permit. The Weyerhaeuser Pulp Mill at Kamloops proposes to conduct a pilot plant study of infiltration for colour removal of their pulp mill effluent.

Northwest Panelboard Incorporated is building a 126 ton/day particle board plant at Smithers, which will use shavings from two neighboring planer mills.

Reichhold Limited is building a bark conversion plant of 16,000 tons/year capacity of dried, ground and bagged bark product at Squamish. This product is to be used as a glue extender in plywood manufacturing.

Western Forest Products Limited, (a Partnership of B.C. Forest Products, Doman Lumber and Whonnock Lumber) purchased all the holdings, timber rights, etc., of Rayonier Canada B.C. The Woodfibre kraft mill will be rebuilt incorporating a low odour recovery boiler system and the most recent technologies for pollution control.

Quesnel River Pulp (a partnership of West Fraser Lumber and Daishawa of Japan) are constructing a 450 metric tonne/day thermomechanical pulp mill at Quesnel. Before discharge to the Fraser River, the effluent will receive primary and secondary treatment.

B.C.F.P. at Crofton is currently installing a 300 ton/day thermomechanical pulp mill and a third newsprint machine. MacMillan Bloedel (Powell River Divison) is expanding with the installation of a 390 ton/day thermomechanical pulp mill and a new paper machine. Finaly Forest Products at Mackenzie (40 per cent owned by B.C.F.P.) is expanding their refiner groundwood production from 360 tons/day to 540 tons/day.

MacMillan Bloedel (Harmac Pulp Division) propose to install a new large low odour recovery boiler. This will enable them to shut down two of their existing recovery boilers, thereby greatly improving their emissions.

On December 2, 1980, a section of the fibre glass cooler and a portion of the main line to the Weyerhaeuser (Kamloops Pulp Mill) high level stack collapsed due to a build up of ice-plugged drain lines. It is anticipated that repairs will take at least three months. The Director has amended an earlier Letter of Approval Amendment which covered a similar circumstance in November of 1977. This will permit the company to divert the emissions from the main stack to the low-level auxiliary stack for a period of approximately three months.

Increased activity in the mining industry has resulted in a significant increase in the number of applications for permits and permit amendments.

One major development is in the Highland Valley where two existing copper mining operations are doubling production. Two new operations are proposed which will result in a total ore

processing capacity of approximately 230,000 tons per day.

Activity has also been high in gold mining and recovery. Most of the operations which employ the cyanidation process are being required to install alkaline chlorination treatment to destroy the cyanide before discharge of tailings. Although not new, this process has not been used extensively to date.

Developments in northeast coal were suspended in 1980 while sales contracts were being developed. Two major coal developments in the East Kootenays were in construction or pre-construction in 1980. They were Crows Nest Resources (Line Creek) and B.C. Coal (Greenhills).

Considerable adverse publicity has been given to the proposed reopening of the molybdenum mine at Kitsault by Amax of Canada Ltd; however, the proposed method of discharge of tailings appears to be the most acceptable environmentally. A comprehensive monitoring program will be carried out to detect any adverse effects.

Ocelot Industries Ltd. has submitted permit applications for the discharges from a proposed 1,200 ton per day methanol plant to be located in Kitimat. This will be the first such world-scale plant in British Columbia. Natural gas is the main raw material used in the process and the resulting discharges should have little impact on the environment.

A lack of natural gas sales and some start-up problems have delayed full operation of the Westcoast Transmission Company Ltd., Pine River gas plant with its associated sulphur recovery facilities. It has therefore not been possible to assess the operation of the sulphur plant, which has a design capacity of 1,000 tons per day.

Resource Recovery Section

The "Oil Save" program to recover lubricating oil for re-refining has been extended to 150 gas stations and now covers most of Southern Vancouver Island and the Lower Mainland.

The City of Victoria is cooperating with the Ministry on a demonstration project to use an asphalt incorporating rubber for road surfacing. The B.C. Ferries Corporation is also proposing to use this material on one of its loading ramps at Swartz Bay. The extension of such projects could solve the serious environmental problems caused by the annual discard of 2,500,000 used automobile tires.

The Province sells 500,000,000 beer bottles annually, and 95 per cent are returned for reuse. Reusing beverage containers saves a substantial amount of energy, reduces litter and lowers garbage disposal costs.

Environmental Safety Program

The Environmental Safety Program, Waste Management Branch, is responsible for spill response and prevention (shared responsibility with Provincial Emergency Program) and for disposal of hazardous wastes. During 1980 and the first three months of 1981, approximately 610 spill reports were received. There were 68 major spills; eight were of lesser significance. During this period, no emergency declarations under secton 29 of the *Pollution Control Act* were necessary. An electrical room fire resulted in contamination by PCB's of a smelter building in Trail and sludge contaminated with mercury was discharged into the Columbia River, were among spills reported.

Shipments of hazardous wastes continued to licenced disposal facilities in the United States.

ENVIRONMENTAL SERVICES DIVISION

Inventory and Engineering Branch
Surveys and Mapping Branch
Provincial Emergency Program
Environmental Laboratory

Inventory and Engineering Branch

Flood Damage Prevention Program

For the fourth consecutive year the snowpack in the Fraser and Thompson River basins was below average and, as a result, there was little chance that damaging flooding would occur in the Fraser Valley during the spring freshet. A flood-warning system for the Squamish River Valley was further developed and applied during the fall period when expectations of flooding are at their highest.

Floodplain Development Control

Some 10,670 man hours were spent on topographic, bathymetric and control surveys in 14 river valleys and seven creeks. Surveys were completed for approximately 57 square miles of floodplain containing approximately 118 miles of river and 102 miles of lakeshore.

The Modelling Unit of the Hydrology Section analysed data sets to obtain the magnitude and frequency of flood flows for floodplain mapping and bridge design.

Where sufficient data were available for frequency analysis, the Surface Water Subsection estimated extreme flood flows and levels by using techniques which included development of regional methods. The most important studies are listed in Table 4.10.

Map production during 1980 included the production of base floodplain map sheets for six rivers and lakes. The Planning and Surveys Section produced the final floodplain maps showing flood lines; these are for use by other agencies and planning authorities. The status of floodplain mapping is indicated in Table 4.1.

A brochure entitled *Floodproofing New Residential Buildings in British Columbia* was published by Planning and Surveys section to inform municipal officials and the public of buildings design which may reduce future flood damage.

(*See* Table 4.2 for a summary of the 1980/81 workload.)

Channel Clearing and River Protection

The second year of a five-year $3,200,000 Federal-Provincial Agriculture and Rural Development S.A. program to rehabilitate and extend the Pemberton Valley Dyking District's flood and erosion protection works and drainage systems was concluded, with total expenditure to March 31, 1981 of $1,231,000.

A report covering erosion and flooding problems along the Similkameen River was prepared for the Lower Similkameen Indian Administration in support of their ARDSA application. Work was also continued on the following studies: Nicola River Corridor; Nusatsum River Fan; Salmo River; Slocan River; Kitimat Dykes; Bellevue Creek; and the Port Moody, Port Coquitlam and Haney Slides.

Assistance under the Channel Clearing Program was provided for eight projects costing $27,000, of which some $16,000 was spent on Mission Creek ice jam removal.

Work continued on drainage studies and related projects which affect the development of agriculture. (*See* tables 4.4 and 4.5)

Fraser River Flood Control

This Program is principally for the construction of flood control works in the Lower Fraser Valley. It has been carried out under a Federal-Provincial agreement signed in 1968 which has been amended to allow for an expenditure of $120 million. Expenditures to March 31, 1980, totalled $73.6 million; expenditure for the fiscal year 1980/81 was $9.2

million. A breakdown of expenditures for previous years is given in Table 4.6, and by project in Table 4.7.

Projects under construction during 1980/81 include Richmond, Delta, Pitt Meadows, Abbotsford and Vedder River; the Surrey South Westminster project is almost complete.

Further details are given in the annual reports of the Fraser River Joint Advisory Board.

Dyke Inspection

The purpose of the dyke inspection program is to ensure the safety, proper maintenance and operation of all dykes in the Province. During 1980/81, spot inspections were made of all dyking districts in the Lower Fraser Valley.

During December 1980, the dykes which protected against winter flooding were under severe strain throughout southwest British Columba. In addition to severe flooding mentioned elsewhere in this report, a minor failure occurred on the Nicomekl dyke, McElroy Road, in the Surrey Dyking District.

A close watch was kept on several problem areas on the Fraser River, notably: Carey Point erosion at Chilliwack; the groyne area at Harrison Mills; Newton Road at Dewdney; Niconmen Island; Barnston Island; and Matsqui near Sumas Mountain.

Water Supply Utilization Program

Snowpack And Runoff

For the fourth consecutive year, snowpacks measured in many southern and coastal drainages of British Columbia, (the Fraser, Thompson, Okanagan, Smilkameen, and north into the Peace and Skeena drainages), were found to be well below average; as a result, snowmelt runoff was below to well below, average. Snow surveys totalling 1,265 were made at 273 established snow courses. Early warning enables reservoir operators in low snowpack areas to conserve water for later use. All historical snow survey data were prepared for publication in "Summary, Snow Survey Measurements, 1935 to 1980", including for the first time, snow line flight data.

As a result of conservation and the above-normal spring precipitation, Okanagan Lake filled to within 5 cm of full pool level, assuring adequate water supply throughout the summer. Agreements were reached with Washington State regarding a referral to the International Joint Commission and a cooperative plan for Osoyoos Lake levels and trans-border flow, once the new control structure is built.

Surface Water Inventory

The Branch coordinates the operation and expansion of the Province-wide network of water-level and streamflow gauges with the Water Survey of Canada through the Federal-Provincial Hydrometric Cost Sharing Agreement. During the reporting period (1980/81) 622 gauges were in operation under this Agreement.

In addition, the Branch operated network of 70 stations installed for short-term or special Branch projects. During 1979, the Surveys Subsection undertook 326 hydrometric measurements at stations within this network.

Groundwater Inventory

Groundwater inventory is used to define the location of future well sites, their potential production and drilling logistics. The Groundwater Subsection has records of about 50,000 wells in the Province. Assemble of well data is nearly complete and has been successfully tested within limits of water well data for the Saanich Peninsula. A hydrogeological mapping program is continuing for the Saanich Peninsula Pilot Project. The Subsection compiles and analyses long-term water level data from 146 observation wells in the Province. Information is received monthly from several key observation wells and a summary is published in the

Snow Survey Bulletin. Work is in progress on preparation of a publication on historic observation well data, (*See* Table 4.8). More time is now being used for reviewing environmental impact assessment Stage 1 and 2 studies, mainly for proposed coal and metal mining projects and their possible effects on groundwater resources. (*See* Table 4.19).

Water Supply Studies, Groundwater

The Groundwater Subsection undertook groundwater supply studies, assessment review of aquifer and well performance, resource evaluation, inventory studies, and provided assistance for groundwater use conflicts, well interference and waste disposal problems. (*See* Table 4.9).

Water Supply Studies, Surface Water

The Surface Water Subsection estimated the water supply in various creeks and lakes to accommodate new or expanding water supply systems. Studies of the potential impact on surface water by proposed watershed development, such as logging, were carried out. (*See* Table 4.10).

Water supply and irrigation studies which were active during 1980 and the first quarter of 1981 are described in Table 4.11.

Water Supply Project Implementation

The status of active projects during the period January 1, 1980 to March 31, 1981, is described in Table 4.12.

Other assignments included assisting with design of facilities for the Loon Creek Hatchery, water supplies for the Fraser Valley Trout Hatchery.

Environmental Preservation Program

Watershed Management Studies

Mackenzie River Basin Study

A four-year $1.6 million study of water and related resources in the Mackenzie River Basin commenced in April 1978, financed jointly by the Government of Canada, British Columbia, Alberta and Saskatchewan, continued through 1980. The study includes the effect of ice conditions, break-up and the spring flood on the Mackenzie River and its major tributaries, especially the Liard River. Areas sensitive to changes in the hydrologic system were also included, with special attention to the three major deltas in the system (the Mackenzie, Slave and Peace-Athabasca deltas) and alluvial habitats within this drainage area. British Columbia contributes 275,000 square kilometres of the drainage area and about 25 per cent of the annual streamflow of the Mackenzie River by way of the Peace and Liard Rivers in the northeastern part of the Province. Present and future development of British Columbia's water resources in the region is significant to downstream neighbours in the Mackenzie River Basin.

Yukon River Basin Study

As a result of an agreement signed late in 1980, the water resources of the Yukon River Basin will be studied jointly by the Federal Government and the Governments of British Columbia and Yukon. The main purpose of the program is to study current and possible future use of the water and water-related resources; to specify areas where further investigation or resolution of jurisdictional difference is required; and to provide a framework for future resource management. The Yukon River is the fifth largest in North America in drainage area and average annual water discharge. The river rises in British Columbia and, with its tributaries, drains most of southern Yukon before it crosses the Canada-United States border into

Alaska. The study is expected to start during 1981.

The program is directed toward ensuring that community water supplies are protected during land clearing, land use and forestry.

A report entitled "Guidelines for Watershed Management of Crown Lands Used as Community Water Supplies" has been completed and is to be distributed to Regional Districts, Government Agencies and Improvement Districts across the Province.

Public Health Engineering Program

The primary purpose of the Public Health Engineering Section is to ensure that all new waterworks construction in the Province meets the minimum standards of design outlined in the Section's publication, Waterworks Systems Guidelines, particularly in relation to the protection of public health. The section processed 1,039 certificates of approval over the 15-month period for more than 1,000 known water systems. This compares to 739 certificates for 12 months in 1979.

One of the section's major projects was a search for groundwater contaminants affecting several private shallow water wells in the Langley area. A small research project was initiated in the Boundary Health District to determine the effectiveness of a built-up sewage disposal field.

The Section reviews plans and specifications for all swimming pools except private backyard pools. During the 1980/81 reporting period, the section processed 169 swimming pool approvals, which compares with 106 for 1979.

Okanagan Basin Implementation Program

The Inventory and Engineering Branch is responsible for implementing the Sections of the 1976 Federal-Provincial Okanagan Basin Implementation Agreement pertaining to flood control and water supply. These sections involve principally construction work, costing some $2.5 million.

The progress made in the 1980/81 reporting period on projects financed directly under the Agreement, is shown in Table 4.17.

Support Services Program

Administrative services in support of Branch operations were provided by the Records and Compilation Section through its two units: the General Office and the Reports Library.

During this period the Reports Library prepared over 500 copies of older reports for use by other branches and agencies. The addition of more than 100 new engineering reports brought the total number of technical reports in the Library to over 2,900.

For the 1980/81 reporting period, the Drafting Section provided: 1,080 completed drawings; nine issues of the Snow Survey Bulletin; and five maps for the five-year Snow Summary Publication. Of the 1,080 completed drawings, 25 per cent were revisions, additions, or both. Table 4.18 provides details of drawing assignments directed to the Drafting Section from the Branch Sections.

Fraser River Estuary Study

Phase II of the Fraser River Estuary Study was established in October, 1979, under a Federal/Provincial Agreement between Canada and British Columbia, for management of estuary resources.

During 1981, proposals for a multi-agency system to manage the estuary will be further developed and presented to the two senior governments.

Surveys and Mapping Branch

Survey Section

The Survey Section is responsible for air photography and field control. Air photography is also supplied to other ministries for resource inventory and monitoring.

The Air Survey Group received 349 requests from 26 agencies for air photography during 1980; of these, 282 were flown in part or to completion. Weather conditions, while worse than average throughout the Province, were particularly unsuitable north of 52° North Latitude. As a result, surveys of several large blocks remain incomplete or have not been started; however, 47,175 air photographs of various scales covering 68,665 line kilometres were obtained this season and two photo aircraft logged a total of 662 flying hours.

In January, the Air Survey Group collaborated with B.C. Hydro in its thermal scan of urban areas. Colour photographs of townsites were obtained by infra-red sonar-equipped aircraft owned by B.C. Hydro.

Mapping control was established in five areas this summer for the Base Mapping Program covering 102 1:5,000 mapsheets and 57 1:20,000 mapsheets. Integrated control was established in five areas and 387 monuments were coordinated. Approximately 1,800 new monuments were located in seven corporate areas before the survey. During the off season two cadastral survey projects were undertaken for the Agricultural Land Commission.

Analysis of the Provincial Control System computation and records group continued in preparation for the transformation from the 1927 Datum to the 1983 Geocentric Datum.

Drafting and Mapping Services

Nineteen new and revised lithographic maps were published at scales of 1:50,000, 1:100,000, 1:250,000, 1:400,000 and 1:2,000,000. These included a new Park Series Map PS-M1 Manning Park at 1:50,000.

A new Special Geographic Series Map SGS-2 Vancouver-Kamloops at 1:400,000 shows relief in multiple colours, the main transportation routes, historical notes and trails. The West Coast Trail Map, WCT2 at 1:50,000, was revised along with the Air facilities Map of British Columbia at 1:2,000,000. Twelve new maps: 82E/NE Upper Kettle River, 82E/SE Grand Forks, 82K/NE Invermere, 82K/NW Beaton, 82L/NE Revelstoke, 82L/NW Shuswap Lake, 82L/SE Sugar Lake, 92H/SE Princeton, 92I/SE Merritt, 92I/SW Lytton, 93A/SW *Horsefly River and* 93G/SE *Cottonwood* River were published at 1:100,000. Two maps, 93E Whitesail Lake and 103P Nass River were lithographed at 1:250,000. A new Relief Map of British Columbia IJR was published at 1:2,000,000.

Fourteen orthophoto mapping projects were completed. There were 47 requests from government and private industry for 466 individual lithographic map bases. The compilation unit produced 29 new bases.

Cadastral Compilation

In addition to its 1:5,000 and 1:2,500 cadastral mapping program, the Cadastral Compilation unit, produced 1:10,000 maps for the B.C. Agricultural Land Commission, cadastral overlays at various scales for both orthophoto and topographic bases and district lot status for the Federal 1:50,000 National Topographic Series program.

Planimetric Compilation

The planimetric compilation and plotting unit compiled 54 new planimetric mapsheets of the Quadra Public Sustained Yield Unit for the Ministry of Forests. This concluded the interim mapping program initiated 30

years ago by which government and private industry were supplied with base maps. This program produced up to 500 planimetric bases yearly, with air photographs obtained during one flying season and the planimetric bases available for use during the next field season.

In addition, 167 mapsheets were revised to the new 1:20,000 format for the Water Management Branch, mostly in the Peace River area. Sixty-five mosaics were also compiled and made available for public distribution. (*See* Table 3.14).

For the Ministry of Forests, 69 mapsheets of the Merritt T.S.A., 72 sheets of the Dean P.S.Y.U. and 44 sheets of the Peace P.S.Y.U., had new 1:20,000 photo centres superimposed onto existing bases.

The compilation section also drafted 87 contour overlays for the Fort Fraser-Vanderhoof Orthophoto project.

Photogrammetric

The aerial triangulation procedure was converted from semi-analytical to fully analytical, so that any aerial camera may be used. The main component of the procedure is program OBSERVE (Observations of Bundles or Strips with ERror VErification), an on-line interactive program which collects data and uses advanced statistical methods to test the operator's observations as they are made.

Reprographics

The calendar year of 1980 showed an increase in production of $227,855.91 over the previous year. A record monthly production in August of 63,014 (23 cm x 23 cm) prints.

Among many other services, the Diazo printing unit produced prints for 64 contracts for the Ministry of Transportation and Highways, quarterly revisions of the Agricultural Land Reserve maps and printing from transparent originals for other Government ministries and the public.

Map and Air Photo Sales and Toponymy

The map and air photo office distributed 252,621 Federal and Provincial mapsheets valued at $543,483 between January, 1980 and March, 1981.

A master set of air photos is retained for viewing in the MAPS — British Columbia office.

A particularly notable decision was the change of name of the reservoir behind the Mica dam from McNaughton Lake to Kinbasket Lake. There was strong support for this change in the East Kootenay region which has a long historical connection with Kinbasket Lake. The British Columbia Gazetteer is now out of print, but was issued in microfiche format by the Federal Surveys and Mapping Branch. A new consolidated paper edition is scheduled for production in 1983.

Program Section

Pacific Survey Corporation of Vancouver was awarded the flying contract for 15,000 line kilometres of black and white aerial photography at scale 1:50,000. A late start and poor weather conditions resulted in the acquisition of only 3,000 line kilometres, all in the South Central Columbia block centered about Princeton.

In the Parksville-Qualicum area of Vancouver Island 96 integrated survey monuments and 166 cadastral ties were surveyed. Three integrated survey monuments were tied to the Geodetic network; 71 horizontal and vertical photo control points were established approximately 150 cadastral points were tied. This work will be used in the compilation of three layers of Base Map information of 51 maps at the scale 1:2,000, in the Parksville-Qualicum area during fiscal year 1981/82.

The largest surveying contract of the year was awarded to Underhill and Underhill. It involved the acquisition of photo control for the South Central British Columbia block that was part of the year's contract aerial photography program. Photography and control were to be used for the mapping of 138 sheets at the scale 1:20,000 in fiscal year 1981/82.

Work has begun on the compilation of a base mapping inventory and of an index of projects scheduled for fiscal year 1981/82

Almost $900,000 was spent in contract services for base mapping.

Provincial Emergency Program

The Provincial Emergency Program Plan was revised in 1980 and much progress was made in municipal planning. During the year the Program sponsored an exercise to update the Province's Tsunami Warning System; a new signal for radio and television broadcasts has been developed.

The training section is responsible for developing and conducting a Provincial Course Program of emergency planning.

The Provincial College, Victoria, offers courses in community emergency planning, transportation of dangerous goods, marine rescue, management of land searches, casualty simulation, oil spill control, techniques of instruction, cliff rescue and tracking.

A new course, "Orientation for Dangerous Goods Trainers", was offered this year. It was developed following passage of Federal Bill C-18, which is an Act to promote the safe transportation of dangerous goods. The purpose of the course is to prepare training officers in organizations such as Fire Services, Police, Ambulance, and Municipal Engineering. During 1980/81, 6,787 persons received Provincial Emergency Program instruction.

A Search Management Course was developed during the past year for presentation in early 1981/82. Techniques for cliff rescue have been revised, and tracking courses have been given in a number of regions in 1980/81.

Search and Rescue Operations

Over 2,000 volunteer pilots and spotters are registered in the Air Service; they fly more than 300 aircraft in locations throughout the Province. During the reporting period, the Air Service was involved in 32 operations, and volunteers donated 4,500 man-hours.

Training exercises are held in each region of the Province in conjunction with the armed forces.

The Marine Service is used by the Rescue Coordination Centre, local police and Municipal Area Coordinators for rescuing boaters in distress; they assist with land and air searches where required. There were 581 marine incidents reported during this period. The service has 300 vessels registered and manned by over 400 volunteers. Volunteers donated 6,500 hours for operations and many more hours in training.

Volunteer search and rescue teams are involved in bush searches, highway rescues.

Tens of thousands of hours are spent annually on volunteer search and rescue tasks and many hours on training and preparations. During 1980, 364 tasks were completed.

The Provincial Emergency Program, with the cooperation of most other ministries, has been working toward establishing a Province-wide emergency communications network.

The Provincial Emergency Program gives high priority to equipping volunteers with new communications equipment over the next two years. A feature of 1980 was the establishment of

Base Station at Provincial Emergency Program Headquarters: Call Letters V37 PEP.

Auxiliary and Reserve Police are trained by the Provincial Emergency Program. Regular police departments are becoming more dependent on auxiliaries to assist in emergency situations such as search and rescue. It is interesting to note that we are one of the few provinces with such a system; however, other provinces are following our lead. There are 1,455 volunteers enrolled in this program.

The Provincial Emergency Program recorded 532 incidents involving oil and other dangerous goods in 1980: an increase of 23.5 per cent over 1979. Of the reported incidents, 57 per cent were land-based and 43 per cent of marine origin. Equipment failure was the cause of 18 per cent, human error 12 per cent and motor vehicle accidents 12 per cent. Petroleum products, particularly diesel oil, continued to be the most frequently spilled substances, while chemicals reflected 13 per cent of the incidents. "Slicks" (marine incidents — source unknown) accounted for 34 per cent of the total.

Courses for dangerous goods trainers started in the latter part of 1980. The seminars are designed to acquaint emergency personnel and others with dangerous goods and the unusual hazards they may present.

We are also greatly indebted to the 130 Area Coordinators who are the background of the system and all others who make the continuation of the service possible. Their recorded efforts in 1980/81 show 1,716 lives removed from jeopardy and the saving of $3.5 million in property damage.

Environmental Laboratory

During the period January 1, 1980 to March 31, 1981, the Environmental Laboratory performed 251,059 routine tests. During the 1980 calendar year, 214,119 routines tests were performed, representing an increase of 17 per cent over 182,300 tests performed in 1979. The distribution of the Environmental Laboratory routine workload is shown in Table 1.

On February 15, 1980, a fire occurred at the Environmental Laboratory in the area used for the analysis of organic contaminants and pesticides. No injuries occurred; however, there was a substantial loss of equipment, supplies and production time. The Fire Department was unable to ascertain the cause of the fire. Following the purchase of new instruments, full service for organics and pesticide analyses resumed at the beginning of June 1980.

The Water Quality Check Program analysed private water supplies of 1,135 residents of British Columbia.

Chemical Services

The Chemical Services Division continued to analyse water, wastewater, sediments and biological materials for inorganic and organic constituents, as a service to Provincial ministries. During the period January 1, 1980 to March 31, 1981, the Chemical Services performed 201,327 routine tests; 174,950 of these tests were conducted during the 1980 calendar year.

Analysis of samples having legal implications was a continuing service of the Environmental Laboratory. The workload of the laboratory increased by 230 per cent, due mostly to the large number of samples of discharges submitted by the Fraser River Task Force.

Considerable time was spent on developing procedures for determining the level of polychlorinated biphenyls and organochloride pesticides in human milk. This project was initiated and

financed by the Ministry of Health. Work on this project has resulted in improved methods for numerous other tests such as determination of polychlorinated biphenyls, organochlorides and organophosphates in cow's milk and liver.

Projects completed during fiscal year 1980/81 include the following: Determination of Radium-226 and Gross Alpha Activity in Water; Development of Field Filtration Kit — prototype design; Development of an Automated Berthelot Method for Ammonia Determination; Chemical Leaching of Radioactive Waste Ore; Analysis of Plictran in Cucumbers; Stability of Butoxy Ethyl Ester of 2,4-D.

Reports Published During 1980/81

Reproducibility in Automated Determination of Mercury in Mining Industry Discharges, Analytical Chemistry, Vol. 52, pp. 996–998 (1980).

Special Services Division

The Special Services Division continued to analyse air quality and the biological content of water, for Government ministries. During the period January 1, 1980 to March 31, 1981, the Biology Section reported 3,673 chlorophyll and biomass measurements and identified 22,109 instances relating to the taxonomy of fresh water plankton and invertebrates. Total test results reported in 1980 were 20,553, representing a 144 per cent increase over 1979. During the period January 1, 1980 to March 31, 1981, the Air Quality Sections produced 23,950 test results for ambient air, source emission, soil, vegetation and precipitation from samples returned to the Environmental Laboratory for analysis. In addition, 497,000 data points (hourly averages), were reported. These points were associated with continuous gas and wind analyzers located at various air quality monitoring stations. The total laboratory test results reported during 1980 are 18,616, representing a two per cent decrease over 1979. Monitor test results for the same period remained unchanged at approximately 400,000. During the period January 1, 1980 to March 31, 1981, the Instrumentation Section completed 388 Work Orders for repair and maintenance to monitoring equipment; the Calibration Section carried out 368 performance audits on air monitoring equipment.

Methods were developed for the following: acid precipitation monitoring; monitoring for inhalable particulates; automated (real time) data acquisition for continuous air monitors; continuous monitoring of airborne particulates; updating sampling, calibration and data handling; procedures for source testing; evaluation of ambient chlorine monitors; bioassay procedures using microtoxicity analysis.

Reports published during fiscal 1980/81 included the following: Collection and Analysis of Acid Precipitation (P0006); Measurement of Aerosol Size Distribution (P0011); Measurement of Aerosol Scattering Coefficient (P0010); ICP/AES Analysis and the Composition of Airborne and Soil Materials in the Vicinity of a Lead/Zinc Smelter; Complex (P8001), J. Air Pollut. Contr. Assoc., *30*, 257 (1980); Standards Used in the Trace Analysis of Selected Gases — (P9027); Inter. Lab, *10*, 61 (1981).

REGIONAL OPERATIONS DIVISION

Conservation Officer Service
Regions—
- Vancouver Island
- Lower Mainland
- Thompson-Nicola/Cariboo
- Kootenay
- Skeena
- Omineca-Peace
- Okanagan

Conservation Officer Service

Headquarters

During 1980, the 94 District Conservation Officers were responsible for 1,931 successful prosecutions through enforcement of Provincial Acts and three Federal Acts.

A team of four officers conducted a major investigation of pollution violators in the Fraser River Estuary. Charges were laid against 24 offenders resulting in fines as high as $7,500.

On March 31, 1981, the green uniform was retired and replaced by navy blue jackets, blue shirts, grey slacks, grey stetsons and blue forage caps. Public acceptance of the new uniform has been favourable.

Training

A variety of training courses was available to Conservation Officers this year, including small boat training, regional range officer's firearms, enforcement training course, and wildlife control. An effective presentation course, police supervisor's and junior constable's course were provided by the R.C.M. Police.

Vancouver Island Region

Water Management

Heavy December rains and melting snow resulted in serious and large-scale flooding in some areas. Numerous requests were received for financial and technical assistance with developing flood and erosion protection.

Fisheries

Guidelines were completed for recreation and development of lakes in the Sayward Forest.

Conservation Enforcement

Eleven Conservation Officers and four auxiliaries made 291 charges under various Acts.

Complaints of wolf and cougar depredations increased by 300 per cent over 1979.

1,258 problem wildlife complaints were investigated in the period January–December, 1980.

Wildlife Management

Deer populations are crashing in areas of high wolf densities; e.g., M.U. 11 had the lowest carry-over count ever recorded, despite a succession of mild winters.

Inventory surveys were completed of eagle, falcon, Trumpeter swans, and waterfowl.

Wolf/deer interaction research, initiated in 1977, was continued with emphasis on fawn mortality.

A preliminary five-year management plan has been developed for the Vancouver Island marmot. Colonies appear to be expanding. A captive pair of marmots were placed in the Okanagan Game Farm and have survived the interior winter.

An "Integrated Wildlife-Intensive Forestry Research" program, financed by the Ministry of Environment and Ministry of Forests, has been created to effect integration of intensive forest and wildlife management. One of the first projects was the initiation of an investigation into the response of elk populations to various silvicultural treatments in second-growth forests.

Lower Mainland Region

The Fraser River Task Force laid 23 charges under the *Pollution Control Act*.

In July, 1980, a Public Involvement Officer was hired by the Fraser River Estuary Study to develop a Public Involvement Program.

A Cabinet Submission was prepared based on the findings of the Fraser River Task Force and the recommendations of the Fraser River Estuary Study Planning Committee, Phase 1 of the Fraser River Estuary Study.

Two other committees were formed in 1980: the Coquitlam River Water Management Study Committee and the Pipeline Road Mining Review Committee. The Coquitlam River Water Management Study Committee is coordinated by the Regional Water Manager. Its first meeting was held in March 1981. The Pipeline Road Mining Review Committee reviewed gravel operations on the Pipeline Road, Coquitlam, and siltation problems resulting from the operations.

Conservation Officer Service

A lengthy investigation of pollution on the Coquitlam River, carried out in conjunction with the Habitat Protection Section, resulted in a successful prosecution of the Jack Cewe Ltd. gravel operation. Fines totalling $190,000 were imposed as a result.

Conservation Officer Service Statistics — 1980 Calendar Year

Number of violations reported or discovered: 382.

Total charges: 159.

Total fines — $9,375.

Summary of Problem Wildlife

By activity and control: Black bear, 854; cougar, 57; coyote, 222; raccoon, 359; beaver, 102; skunk, 93; deer, 81; Canada geese, 62.

Summary of Conservation Officer Service Time Spent in District

Office time: Approximately 50 per cent.

Enforcement, Management and Animal Control: approximately 50 per cent.

Fisheries

Enhancement of fisheries habitat was undertaken in five stream systems within the Region. Rock weighing 223 tons (pieces 1-foot to 2-foot in diameter) were placed within four streams to create rearing areas for cutthroat trout. Spawning gravel platforms were installed in the Chilliwack River to enhance winter steelhead spawning areas.

The catchable-size rainbow trout program continued to be the mainstay of the lake management program. Catchables numbering 84,000 were introduced to lakes that are subjected to intensive fishing and cannot support the fishing by natural production.

Much field time was devoted to the collection of biological and physical habitat information for immediate use in management and environmental protection; almost 30 stream systems were surveyed.

The Fish and Wildlife Branch acquired 223 acres of land adjoining the Silverhope Creek near Hope. The property was leased from the National Second Century Fund and contains extremely valuable steelhead trout and kokanee salmon spawning areas.

Wildlife

Land management projects continued in the Serpentine Wildlife Management Area with the removal of several small islands which were replaced by larger peninsulas. Pasture will be developed to provide grazing for Canada geese and additional nesting habitats for other

species. Dykes and islands were constructed in the southern portion of the Pitt Wildlife Management Area to provide additional nesting habitat and water impoundment.

Protection of mountain goat habitat was emphasized by management, because these habitats come under fairly severe pressure from the rapid increase in helicopter logging operations.

More than 2,000 Canada geese were harvested by more than 2,200 hunters within the 1980/81 hunting season. Agricultural complaints of food depredations reached a peak during May and June when affected crops were in their seedlings stages. Staff relocated the offending goslings and moulting sub-adult geese.

Periodic census of Brant populations within Mud and Boundary Bays and Roberts Bank were made throughout the winter. Preliminary results indicate that Brant rarely show within the area until the annual northward migration begins. The shortened season was continued and the hunting was the most successful of any in recent years.

Habitat Protection

Referrals from Government agencies and other sources increased by 16 per cent.

Regional staff participated in two major Provincial/Federal studies of fish and wildlife: Fraser River Estuary Study and the Squamish River Estuary Study. Other studies included Crown Land Master Plans, Municipal and Regional District Plans, and major forestry plans.

Staff also cooperated with the Conservation Officer Service, in investigating and prosecuting of environmental violations, especially those affecting fish stocks or their habitats.

Information and Education

A total of 1,788 students graduated from 95 courses in the CORE program.

More than 250 teacher's information kits were distributed to school teachers, outdoor educators, and youth leaders.

Audio-visual aids, including 984 films and 469 slide packages, were lent to schools during the year, to a total of 1,600. Several "Career Days" presentations were made in local secondary schools.

Waste Management

The Regional Office has been involved in a comprehensive program of spill control and hazardous waste management. As a result, many tons of toxic materials have been permanently stored or destroyed.

The Fraser River Task Force has continued to concentrate on enforcement of the Pollution Control Act in the lower Fraser River area.

Statistics — Region 2

Number of Permits as of January 1, 1980	618
New Permits Received—	
January 1980–December 1980	73
January 1981–March 1981	11
Permits Amended—	
January 1980–December 1980	32
January 1981–March 1981	7
Permits Cancelled—	
January 1980–December 1980	21
January 1981–March 1981	3
Permits administered by Region 2 as of March 31, 1981	678
Permits applications processed by Region, January 1, 1980–March 31, 1981	11
Approval applications processed by Region, January 1980–March 1981	30
Orders issued by Region, January 1980–March 1981	24
Charges by Region, January 1980–March 1981 (Does not include Task Force charges)	7

Water Management

Water Licence Applications Approvals increased by 48 per cent.

Stream flooding/erosion problems and flood plain management increased dramatically (200–250 per cent).

Licencing and approval matters included:

Approval of an application by the Dewdney-Alouette Regional District for a Water Licence on Norrish Creek. As a result, approximately $15–20 million in pipeline, dam intake and related works were constructed.

Enclosure of approximately 500 feet of a major tributary to the Coquihalla River in 10 foot diameter pipe has been given to Carolin Mines. This will create working room for the mine mill, which is part of a multi-million dollar gold-mining operation expected to begin in August 1981.

Thompson-Nicola/Cariboo Regions

Thompson-Nicola Region

There have been major industrial developments, including a large copper mine in the Highland Valley, a thermal (coal) plant near Hat Creek and the proposed expansion of a major transportation corridor along the Coquihalla Highway, and twin tracking of the CNR mainline. Long term strategy for environmental management in the Nicola Valley was begun, with a special program to identify impact on the management of water and related resources.

Cariboo Region

The Conservation Officer Service was realigned as a separate Ministry wide enforcement unit under the Regional Conservation Officer.

Waste Management

An air quality report was completed on the source and severity of the air pollution problem with respect to smoke, suspended particulate and flyash at Williams Lake.

Improved procedures were implemented for the control of fine copper ore dust within the loading site at Gibraltar Mines Ltd.

Particulate emissions from Weyerhauser Canada Ltd., Kamloops Pulp Mill, were reduced following installation of a scrubber on bleach plant discharge to remove chlorine; substitution of hydrogen peroxide and oxygen for C10 in bleach plant on a part-time basis to reduce colour in effluent discharge by about 25 per cent; and higher priority given to maintenance by mill staff.

Projects undertaken by the Environmental Management Section included a comprehensive study of the Merritt STP on the Coldwater and Nicola Rivers with background watershed data; continuation of the Afton Mines vegetation monitoring study; a study of mercury accumulation in small mammals; collection of background data on McGillvray Creek as it is affected by Tod Mountain development; data collection on the Guichan Creek Watershed study; and preliminary data collection on White Lake.

Staff worked with the Town of Merritt to solve problems arising from phosphorous removal, alum addition works and the starting of a decholorination works.

In conjunction with the Habitat Biologist in Williams Lake, a draft policy on landfill sites in the Cariboo was developed. The policy concentrates on the natural conflict between bears and humans, and stresses the use of incinerators by small industrial and commercial operators in isolated areas inhabited by grizzly bears.

At the request of Regional Waste Management staff the Village of Cache Creek has made permanent arrangements to dechlorinate STP discharge for the protection of fish released from Loon Creek Hatchery and the upgraded fishery in the Bonaparte River.

Conservation Officer Service

Thompson-Nicola Region

Angling pressure, and the need for effective enforcement, continued to increase.

Reports of steelhead fishery angling violations on the Thompson River have accelerated the development of an enforcement program for 1981. Summonses issued by plain-clothes Conservation Officers in the Clinton District have resulted in a number of ice fishermen being prosecuted. Other fisheries' enforcement operations involved protection of spawning populations and special fishery closures.

An attempt was made to measure the rate of compliance by the public who are required to report at the Cache Creek Game Check. All vehicles were stopped on the highway immediately downstream from the regular Game Check to determine the number of vehicles that were avoiding the Game Check. During a five hour period, 101 people stopped voluntarily, while 160 people avoided the check. More than 50 people were charged with failing to stop at a game check, carrying loaded firearms in motor vehicles, and other infractions; 25 warnings were issued. Results were the same as those recorded for similar circumstances in 1979.

Cariboo Region

Fifty-three charges were laid for fisheries offences, the most prevalent being angling without a licence. Charges increased from six to ten over the previous year for exceeding the daily fishing possession limits. This was due, in part, to a plain clothes operation on Tzenzaicut Lake near Quesnel. Seven charges were laid and fines of $100 to $200 were assessed for over limits.

Charges for hunting during the closed season increased over the previous year from five to eleven. Offences against wildlife resulted in 104 charges being laid.

Five charges were laid and four convictions obtained under section 4 of the *Litter Act*. There were three investigations for pollution offences under section 33 of the *Fisheries Act*, and one for dumping septic tank waste from a "tank truck".

Conservation Officers received 296 animal nuisance complaints, of which they investigated 215. Black bear and wolf were the main problem species.

In the Cariboo Region, the Conservation Officer Service laid 162 charges for fisheries, wildlife and habitat offences and obtained convictions of 140. A summary of these offences is attached.

Water Management

Thompson-Nicola Region

The Thompson-Nicola Region (Region 3) includes the major drainages of the Thompson River and the middle reach of the Fraser River. The Eagle River watershed has been added to the region.

The dam inspection program was expanded following flooding in February, 1980.

Work continues on the Valley Copper Project, the Dimac Tungsten Project, the Canadian National Twin Tracking Project, multiple Lands Branch Planning Projects, the Coquihalla Highway, Strategic Planning, Forest Management Experimental Projects, and the Hat Creek Coal Project.

Fisheries Management

A series of winter limnology samples were taken on seven winter kill lakes, followed by the preparation of a program to bring some of these lakes into production by circulation and/or aeration.

Twenty-five adult steelhead were captured from the Deadman River for an egg take. As a result, 100,000 eggs at the Loon Lake Hatchery were incubated for release as fry into the Upper Bonaparte and Deadman Rivers.

Criss Creek was identified for the first time as a major steelhead spawning creek.

S.E.P. staff marked 20,000 steelhead fry in the Shakan Creek tributary to the Nicola River, to assist in assessment of the Nicola River as a steelhead rearing site.

A comprehensive paper was produced for management of all seven anadromous salmonids in the Fraser River system.

Habitat Protection

Seymour River and Valley copper developments were among major referrals handled by habitat protection staff.

The development of forest access roads, and relocation of Highway 24 in the lake-rich Nehalliston Plateau northwest of Little Fort, has created problems for fishing camp operators and fishermen in the area. Ministry staff met with Balco, Forest Industries, Ministry of Forests, and camp operators to discuss methods of protecting the wilderness in the area and the quality of the fishing.

Information and Education

Fifty-four articles were written and published in regional newspapers.

Much attention has been given to the caribou/logging conflict in the North Thompson via the newspapers and magazines.

A brochure was produced on the problems of coarse fish transport.

Several instructors' courses were given for the CORE Program. Forty-four student courses were given to 900 students — graduating 728.

Wildlife Management

A range improvement proposal for restoration of prime ranges by prescribed burning was submitted to the Forest Service.

A study of caribou winter range confirmed that there is a double altitudinal migration for caribou in the North Thompson area each year. A census was taken of the North Thompson herd.

Among other studies and inventories, inventory was taken of California bighorn on their spring ranges west of the Fraser.

A controlled hunt of geese at Tranquille has helped to disperse birds and lessen crop damage near the airport.

An aerial reconnaissance of the highway corridor between Kamloops and Merritt was made to assess the impact of the highway on Moose range within M.U. 19.

Cariboo Region

Water Management

Environmental use increased substantially during the reporting period, resulting in a major increase in applications for water use and approval applications for placer mining operations.

The Cottonwood and Natzko Precincts were added to the Cariboo Region on March 31, 1980.

Dam inspection capacity was supplied by the Thompson-Nicola Region, while community water supply support was provided by Thompson-Nicola and Omineca-Peace Regions.

Input was provided to Technical Planning and Coordinated Resource Planning Committees.

Flood restoration work in the Bella Coola area was undertaken in conjunction with Inventory and Engineering staff in Victoria following flooding in December.

Coordination of field effort between Fish and Wildlife, Conservation Officer Service, and Waste Management staff progressed favourably and improved the efficiency of each operation. Much

improvement was also observed in the referral process involving the Ministries of Lands, Parks and Housing; Transportation and Highways; Forestry; and Federal Fisheries.

	1979	1980	Reporting Period
Water Licence Applications Received	152	230	257
Approval Applications Received	48	158	198
Water Licence Applications Processed	47	50	98
Approval Applications Processed	42	145	156

Fish and Wildlife

Fish and Wildlife staff assumed responsibility for the management of Chilanko Marsh, a productive, partially-wetted area, important for production, feeding and resting of waterfowl. The marsh was acquired in 1980 with National Second Century Funds and management responsibility is shared with *Ducks Unlimited*.

In Horsefly, Big Creek, and 100 Mile House areas, browse areas for moose and furbearers have been modified by cutting and ripping to encourage growth of newer, more accessible vegetation. At the Junction Wildlife Management Unit, a 2,000 acre burn of grasses and encroaching woody species was undertaken as part of a continuing management and research project. The objective is to increase forage for California bighorn sheep and to improve range condition on the unit.

Several wildlife inventory projects were undertaken, including radio-collaring of grizzly bears at Owikena Lake (in cooperation with B.C. Forest Products Limited) to monitor movement of the bears. In the Itcha Ilgachuz Range mountain, a census was taken of caribou on their calving grounds to detect a possible imbalance in cow-calf ratios, related to predatim.

A set of high elevation guidelines has been prepared for use by the Forest Service. The guidelines provide rules for logging practices at elevations where there are relatively rare species of big game animals such as grizzly bears, mountain goats and mountain caribou. The guidelines have particular application in the vicinity of Quesnel Lake where logging is to take place in 1981.

There was a limited inventory of sport fisheries management and protection. Portions of the Taseko Lake watershed were surveyed in response to impending mining developments and the need to develop protective guidelines.

A joint project by Ministry of Transportation and Highways and Ministry of Environment resulted in placement of spawning gravel in Horsefly River for an expanded capability for spawning of kokanee from Horsefly Lake. Deposits of silt in these spawning areas had reduced the success of spawning in previous years.

A modest creel census and winter limnology program was carried out on several lakes in the Region; these included Dugan, Raven, and Lac La Hache.

Kootenay Region

Corrective action has been undertaken by Foothills Pipeline Ltd. to comply with Ministry requirements on pipeline crossings across rivers and streams.

New regional division of the Ministry resulted in the separation of the Conservation Officer Service and Information Officer staff from the Fish and Wildlife Branch.

Waste Management

Increased attention was given to major discharges having the greatest environmental significance.

Regional studies have shown that clear, shallow reaches of the Elk River and its tributaries will experience serious algae growth problems if treated sewage effluent is discharged directly into the river. The need for a municipal wastewater disposal policy for the Elk River drainage was recognized.

An engineering study was begun of the hydraulic overloading of the Regional District of Kootenay Boundary common sewage collection system, and to examine intermittent raw sewage by-pass discharges to Trail Creek.

Crestbrook Forest Industries are proceeding with construction of a rapid infiltration system at the Skookumchuck pulpmill.

Investigation into numerous complaints about the water quality of Tie Lake revealed elevated phosphorus levels. A blue-green algae bloom resulted in odours, foaming and lack of water clarity.

Because of a mercury contaminated acid and sludge discharge from the Cominco operations in Trail, which led to a prosecution, a joint Provincial-Federal study was undertaken to determine mercury content in Columbia River fish.

Discharge from the Village of Invermere secondary treatment plant into Toby Creek resulted in massive algae growth downstream. The municipality constructed an exfiltration system and diverted the direct discharge to ground disposal.

Statistics

Pollution Control Permits on record	366
Number of Permit Applications processed in 1980	32
Approved in 1980	31
Rejected in 1980	1
Applications being processed end of 1980	23
Number of Approval Applications processed in 1980	13
Applications being processed end of 1980	3
Waste Discharge Surveillance— Inspections of works	1,332
Number of discharges sampled—Effluent	202
—Emmissions	6
Environment Surveillance— Number of Background Water Samples collected	551
Number of Ambient Air Samples collected	577
Enforcement— Orders issued	7
Prosecutions	2
Emergency Spill Program — Number of hazardous spills investigated	14

January 1, 1980 to March 31, 1981 — Annual Report Statistics

Applications for Water Licences:

Applications on hand Junuary 1, 1980		440
Applications Received		473
Applications inspected and reported		448
Applications cancelled or abandoned	66	514
Applications on hand March 31, 1981		399

New Water Licences Received:

Conditional Water Licences	495
Final Water Licences	25

Approvals:

Approvals Received	120
Approvals Reported	87

Final Licences:

Reports Submitted	53

Licence Amendments:

Apportionment	153
Transfer of Appurtenancy	91

Change of Works	133
Extension of Time	11
Change of Purpose	8
Abandonment	9
Subdivision Referrals Reported	105

Water Management

Conservation Officer Service

Charges totalling 226 were laid, resulting in 198 convictions, 14 dismissals, 7 stays, 6 charges withdrawn and one aquitted.

Enforcement checks were carried out on Kootenay Lake, Arrow Lake and border crossings. Helicopter and horseback patrols were carried out in the East Kootenay area during the hunting season.

The influx of workers due to construction projects such as the Seven Mile Dam on the Pend d'Oreille River, the Revelstoke Dam on the Columbia River and the construction of power lines and pipe lines across the southern portion of the region have added to the enforcement problems. In November 1980 an injunction was obtained to help ensure that protective clauses were observed, after information had been received that some construction companies may intend to ignore these limitations at certain stream crossings.

Information and Education

Ministry displays dealing with garbage, bears and man were exhibited in Castlegar and Trail.

Two major articles were produced. One outlined the Ministry's teamwork approach with the Federal Government in collecting and sampling fish from the Columbia River for heavy metal tests; the other dealt with newspaper photographic coverage of Ministry properties. An article on Redfish Creek fishery habitat improvement was also prepared for regional distribution.

Education programs on trapping and fur management, sport fishing and fish identification, animal identification, use of fire in wildlife management and other methods of wildlife management, were given in many schools and two colleges.

The public was informed of the Fish and Wildlife Branch's antlerless deer endorsement program, through media outlets during August.

A total of 1,122 students took the CORE examination in Region 4 between April 1, 1980 and March 31, 1981.

Statistics — Region 4

Students	1,122
Courses	48
Students per class	17.7
Passes	848
Failures	148
Correspondence exams given	31
Percentage pass	75

Fish and Wildlife

B.C. Hydro Compensation Projects

Recent developments on major compensation projects are as follows:

High Revelstoke Dam

The Fish and Wildlife Branch and B.C. Hydro developed a draft agreement on final compensation which was forwarded to the Ministry of Environment Executive in April 1981. Ratification of the agreement is expected early in 1981/82.

Major components of the proposed agreement include a three year study of grizzly bear and mountain caribou in the area to be inundated to give a better information for managing the remaining populations and habitats.

A major spawning channel at Hill Creek, north of Nakusp, was completed late in 1980 for startup in the summer of 1981. This channel is designed for 500,000 adult kokanee salmon and 1,000 rainbow trout.

High Arrow Dam

A compensation package will be presented to the Ministry of Environment

Executive for approval and forwarded to B.C. Hydro for the start of negotiations early in 1981/82. The package includes construction of a major fishway on the Inonoaklin River to open up a sizeable length of river, above currently impassable falls to spawning kokanee, rainbow trout and Dolly Varden char. Focus of wildlife compensation is on a major habitat acquisition and enhancement program for white-tailed and mule deer on one of the two remaining Class IW ungulate winter ranges in the West Kootenay.

Seven Mile Dam

This dam, on the Pend d'Oreille River south of Trail, inundated a large part of the second remaining Class IW ungulate winter ranges in West Kootenay. A sizeable fund was established in 1978 to secure the remaining habitat, and white-tailed deer habitat. A deer management plan was completed in 1980.

Libby Dam

In 1972 the Libby Dam in Montana backed water up some 50 miles into the Canadian portion of the Southern Rocky Mountain Trench, displacing some of this country's most significant wildlife populations and having a considerable impact upon the river fishery. For some years, funds have been provided by B.C. Hydro for wildlife and fisheries studies.

Proposals for conservation and restoration of fish and wildlife lost to this project will be ready for presentation to Ministry of Environment Executive in the summer of 1981.

South East Coal Block

Southeastern British Columbia has three active coal mining operations, producing 13 million tons per year. There are proposals to expand or start five additional mines to bring annual production up as high as 30 million tons. The impact of coal mining on fishery and wildlife resources in this area is considerable.

The new *Forest Act* has provided new opportunities as well as new problems for Fish and Wildlife staff. For the first time, fish, wildlife and recreation are acknowledged as legitimate resources.

Kootenay Lake Fishery

Kootenay Lake clearly is seriously affected by the reduction in nutrients due to the Libby Dam. The west arm kokanee fishery was closed due to poor stream production and overfishing. The west arm will remain closed for at least three years. A new kokanee spawning channel at Redfish Creek, provided under the Habitat Conservation Fund, will be completed in 1981 and will substantially enhance this fishery.

East Kootenay Cutthroat Trout

Overfishing of East Kootenay cutthroat streams has resulted in development of a management plan which will see closures imposed in rotation over the next three years. The initial closures for 1980 included the Upper St. Mary River and Upper White River. In 1981 Wigwam and Skookumchuck Rivers will be closed to cutthroat fishing.

Meadow Creek Spawning Channel

Kokanee returns from Meadow Creek spawning channel were very low in 1980. It is believed that the low returns are due to poor channel performance.

Whiteswan Lake Spawning Channel

The Whiteswan Lake rainbow spawning channel was completed in early 1980 and was operational for the 1980 spawning season. Nearly 1,000 spawning trout used the channel.

Whitetail Lake

Whitetail Lake, which was chemically rehabilitated in 1979, was opened in May 1980, but had to be closed six weeks after opening because of concern for over-fishing. It will be reopened in 1981 with more restrictions imposed on method of catch.

Nuisance Bear Management

Nuisance bear management has presented severe problems to Conservation Officers and Fish and Wildlife staff in recent years. In attempts to alleviate problems of bears being attracted to inadequately managed garbage, (at the source and disposal sites), some 200 black bears were destroyed in the Kootenays in 1980. This is a substantial decrease from the 300 dispatched in 1979, but still represents a serious problem.

Close control of bear populations will continue, and efforts will increase to ensure that garbage is handled and disposed of in an acceptable manner.

Bighorn Sheep — Contagious Ecthyma Outbreak

The discovery of contagious ecthyma in the Wigwam herd of Rocky Mountain bighorn in the late fall resulted in concern for the welfare of the Province's largest Rocky Mountain bighorn herd. A transplant of bighorn from the Wigwam area to enhance recovery of the Bull River herd was postponed, pending an assessment of the epidemic. A detailed monitoring program was established through the East Kootenay Hunters Association.

Flathead Grizzly Bear Studies

The radio telemetry study conducted in cooperation with the Border Grizzly Project began to produce important population and ecological information, with continued support from a variety of sources, including the local forest industry, guide outfitters, coal mining companies and sportsmen.

Voluntary Tooth and Harvest Data System

The long established Kimberley and Cranbrook Game Checks were cancelled. A voluntary mail-in harvest data card, requesting a tooth from each animal killed, proved to be a monumental success. It is expected that this procedure will become standard practice throughout the Province.

Wildlife-Agricultural Conflicts

Coordination of reported agricultural-ungulate conflicts in the East Kootenay and at Creston continued. Purchase and retirement of chronic problem ranches situated on heavily used elk ranges has been suggested, and adequate fencing by landowners of vulnerable orchards and hay stacks.

Skeena Region

During this reporting period, components of the Ministry were consolidated into a regional office. The region is approximately 110,000 square miles in area and is subject to increasing development in mining, hydro-electric plants, forestry, and the surrounding community.

Water Management

There was an increase in water licensing during 1980; 137 new applications were received during this reporting period.

Logging practice guidelines are presently being developed to ensure watershed protection within special biogeoclimatic zones.

Numerous minor complaints of flooding were received.

Routine Applications for Water Licences and Approvals Statistic January 1 to March 31, 1981

Licences

Backlog January 1, 1981	55
New applications received	21
Reports submitted to Victoria	7

Applications cancelled or abandoned 5
Backlog March 31, 1981 64

Applications for Approval (Changes)
Received 10
Reported 12

Applications for Approval (Short Term Use)
Received 31
Reported 0

Waste Management

Early in 1980, it was confirmed that an unknown quantity of P.C.B.'s had been spilled into the environment at Kitsault from 1967–72, from a concentrate dryer operated by B.C. Molybdenum. Regional staff were involved in a "clean-up" operation. More than 100 yd.^{3} of contaminated soil was removed from the site and shipped to a facility in Oregon. In addition, Terrace staff discussed the attendant health hazards with groups in the area. Waste management staff were also involved in re-opening of Granduc Mine at Stewart by Esso Resources; opening of Equity Silver operation near Houston; water and sewer system for Queen Charlotte City; pilot plant for Consolidated Cinola on Queen Charlotte Islands.

Workload Statistics

Permits on Record—
June 1, 1980 232
March 31, 1981 262
Outstanding Site Inspections—
June 1, 1980 29
March 31, 1981 33
Site Inspection Reports Completed—
June 1, 1980 0
March 31, 1981 47
Permits Processed in Region 0
Approvals Processed in Region 3
Total Number of Pollution Control Facilities Inspected 311
Total Number of Pollution Control Facilities Sampled 121
Enforcement Activities—
Orders Issued 0
Charges Laid 0
Court Hearings Attended 4
Receiving Water Environmental Background 0
Monitoring Stations Sampled 57
Air Monitoring Stations Operating—
June 1, 1980 13
March 31, 1981 7
Environmental Safety Program Responses 34

Information and Education

Thirty courses were conducted in major communities throughout Skeena Region resulting in approximately 550 graduates.

Articles were written and interviews given to the news media on a variety of topics including bear/people problems; pollution problems; fisheries and wildlife projects; Ministry reorganization and consolidation into regions; current hunting and fishing regulations and the CORE program.

Brochures were prepared on steelhead of British Columbia, burbot, information for guides and non-resident hunters, and angling data sheets.

Information and Education assisted conservation officers on patrol and conducted annual qualifying shoots before the Conservation Officer Service obtained their own range master.

Wildlife Management

A new wildlife management plan has been introduced with emphasis on big game species, (particularly moose management).

Limited Entry moose hunting was prepared for 1981/82 hunting season, to restructure moose populations so they will respond to future habitat enhancement programs. Two mapping programs were initiated in the northern portion of the region and in the south to assess the best winter range for moose. In addition, a moose radio tagging

project was started to assess the distribution of critical winter ranges in the Nadina bottomlands.

A 1980 Peale's Peregrine falcon survey shows possible 35 per cent recovery (in numbers of breeding pairs) from the decline seen in 1970/75 period.

As part of a management plan for the Delkatla Wildlife Sanctuary near Masset, the slough was flooded as a first step in returning the marsh to its former salt water condition. The marsh was altered in 1964 by construction of a causeway which cut off tidal wash to the slough, thereby altering the ecology of the area to the detriment of waterfowl.

Fisheries Management

Steelhead management associated with the Salmonid Enhancement Program represents a major part of fisheries management in the Skeena Region.

Skeena River steelhead radio tagging was continued during this reporting period, and has provided valuable information on migration patterns and timing of runs. It has also revealed the importance to steelhead of small streams in the Skeena River system. The data acquired will assist in solving the problem of steelhead interception by commercial gill netting at the mouth of the Skeena River.

Barrier removal and colonization of the upper Harold Price Creek enhanced Suskwa River steelhead stocks by opening up approximately 35 miles of formerly inaccessible water.

A special char sampling project was initiated on Atlin Lake to evaluate sport fishing management as they affect Yukon Commercial Fishery.

An inventory was taken of two watersheds (Morrison and Gosnell) so as to develop logging plans which will reduce the detrimental effect on fish.

Habitat Protection

The Minister and senior staff toured the Rennel Sound area of Moresby Island to view stream damage caused by November 1979 landslide on Riley Creek. Subsequently, the South Moresby Planning Team developed slope-stability mapping for most of the planning area. Their interim report will be available early in 1981.

Habitat Protection is now receiving management working plans for TFL's from B.C. Forest Services for examinations, from which they assess the Annual Allowable Cut.

There has been a considerable increase in mining within the region. Major developments include the Stikine-Iskut Hydroelectric proposal; P.N.G. gas line from Terrace to Kitimat; Placer Committee formation; Khutzeymateen Eco-reserve; Highway 16 reconstruction between Terrace and Prince George; Ridley Island pipeline; Windy Bay Eco-reserve proposal; several large mining developments including ADANAC and Consolidated Cinola; Amax issues, particularly pollution control permits; and the Alcans Kemano II completion proposal.

Conservation Officer Service

During this reporting period a new Regional Conservation Officer was appointed.

Existence of elk in the region was confirmed in 1980 when a hunter mistakenly shot a 700 pound bull elk near Smithers.

More than 1,450 "nuisance" animal complaints were received in 1980: conservation officers responded to 1,238.

Wolf control was carried out in response to complaints from ranchers.

Statistical information showing results of C/O's activities are contained in attached appendix.

Omineca-Peace Region

Fish and Wildlife

The new moose management strategy for the Omineca portion of the Region was put into operation.

Land use alienation and pressures by the agriculture and forest industries have affected game habitat significantly. This has been compounded by extensive bark beetle attack on thrifty mature timber stands. The result has been increased pressure on the Branch to permit very large clear cut openings.

Bison continue to be a problem in the Peace sub-region. Eight wood bison have escaped from the Northwest Territories and moved to British Columbia.

There is a growing awareness of the impact of rapidly increasing populations on the fish resource of the Region.

Waste Management

Ambient Air Monitoring Program — Prince George

Prince George has been identified as having some of the highest H_2S and dustfall levels anywhere in the Province. The main sources of these pollutants are the pulp mills, sawmills and the oil refinery. As a result a joint industry-government ambient monitoring program has recently been initiated.

Gas Processing Plants

There are three large natural gas processing plants in this Region, all of which can result in excessive sulphur pollution. There has been excessive sulphur pollution, and emphasis is on bringing these discharges into line with the Permit requirements.

Water Management

Rainfall above normal during the summer offset what could have been a drought year. Continued rainfall through March brought levels back to normal. There was a major increase in the number of applications for short-term approval of increased placer mining in the Germansen Landing area. There was very little flooding during the spring freshet, but a sudden thaw and rainstorm in mid December 1980 created a large ice jam on the Fraser River which caused extensive flooding at Penny. Some people were evacuated but only one house suffered minor flood damage. The return of more normal winter weather gradually reduced the water level and the ice dissipated.

Statistics for the Water Management Branch for the Period January 1, 1980 to March 31, 1981

Total Applications Received	97
Total Applications Reported and Abandoned	81
Outstanding Applications as of March 31, 1981	82
Total Approval Applications Received for Changes	19
Total Approval Applications Reported —Changes	16
Total Approval Applications Received —Short Term Use	56
Total Approval Applications Reported —Short Term Use	33
Total Licence Amendments	21

Okanagan Region

The new region for the Okanagan comprises the drainage areas for the Okanagan Lakes system, the upper Shuswap River, the Tulameen-Similkameen River systems, and the Kettle-Granby River systems.

A continuing drought strained the water and the fisheries resource, but there was a high carry over of deer populations. A relatively wet summer tended to offset the negative influences.

There is a continuing growth in population throughout the Region. Corresponding demand for urban settlement produced increased activity

for all programs. This is particularly reflected in the increasing number of referrals for subdivisons, and the applications for water licences.

The City of Kelowna began a major construction program, which will use the Barden process and crop irrigation.

An inventory has been taken of the large mobile equipment items such as vehicles and main equipment. This inventory is part of a new property control system which will be expanded as time permits.

The Region will be consolidating into new quarters in Penticton.

Waste Management

Five of the major municipalities are constructing, or planning to construct, new works to improve the quality of discharge. A secondary activity involved industrial waste disposal and during the year two new burners were constructed to help solve wood waste burner problems.

Some statistics for the period are shown below:

Permits — January 1, 1980	333
New Permits processed	33
Permits — March 31, 1981	336
Applications processed in Victoria	64*
Applications processed in Region	41
Hazardous spills response	70
Pollution complaint response	242

* Included applications for permits, amendment of permits approvals and certificates.

Water Management

Some statistics for the period are shown below:

Water Licence Applications on hand—January 1, 1980	335
Water licence Applications received	352
Water Licence Applications reported	319
Water Licence Applications on hand—March 31, 1981	368
Approval Applications received	88
Approval Applications reported	82
Water Licence Ammendment Reports prepared	184
Flood Plain Subdivision Referrals reported	367
Forestry Referrals reported	423
All other Referrals reported	222

Fisheries Program

The enhancement of the fishery in Skaha and Okanagan Lakes was the major activity in this program. There were 50,000 rainbow trout produced in the Mission Creek rearing pond, and 240,000 kokanee produced in the small Regional Hatchery in Penticton. The new mobile hatchery for the Skaha Lake Kokanee fishery was completed, and a study of the interaction between kokanee and mysis shrimp on Skaha Lake was undertaken in cooperation with the Fisheries Research staff.

The aeration of Yellow Lake continued with very successful results.

In the Headwater Lake Inventory Program aerial surveys were completed on 200 lakes, while 150 lakes were subject to a creel census.

Wildlife Program

Range improvement and habitat enhancement were priorities during this period. The water-fowl oxbow enhancement was completed near Grand Forks; a controlled burning project was completed in Bighorn sheep range in the Ashnola, and the Osoyoos Wildlife Management area was established. There are plans for similar programs near Summerland and Naramata, to limit the destruction of orchards by deer.

The deer inventory showed a high percentage of fawns, due in part to the mild winter. A telemetric study of deer was completed to measure the effect that logging may have on fawning.

The feeding program for bighorn sheep was evaluated.

A Habitat mitigation study associated with mining activity was also completed. Waste Management staff are collaborating on two wild fowl habitat enhancement projects where disposing of

sewage effluent through spray irrigation is affecting wildfowl in the City of Vernon and at Whilte Lake, City of Penticton.

There were approximately 1,800 referrals from fisheries and wildlife programs.

The Conservation, Outdoor Recreation and Education Program graduated 1,250 students in the period.

Conservation Officer Service

There were over 9,000 public contacts made during this period, which resulted in 230 prosecutions.

The involvement of staff in Fish and Wildlife Management activities has been reduced, but still occupies a substantial part of the Conservation Officers' time. There were 493 nuisance animal complaints received during the period.

Boards

Pesticide Control Appeal Board

Pollution Control Board

Pesticide Control Appeal Board

A new Pesticide Control Appeal Board was established in January of this year. It will act as an appeal tribunal against Orders of the Administrator of the *Pesticide Control Act*. The new Board has a broad background of academic, business and land-use experience, as well as extensive knowledge of British Columbia's regions.

During the reporting period, the Board held 20 public hearings for 72 appeals against 62 permits and two suspension orders of the Administrator. The Board cancelled two permits and upheld the remainder, although in many cases, the permits were strengthened by adding requirements to ensure the safety of the program.

Several appeals filed in 1980 are pending and are expected to be heard early this coming spring.

Dr. F. E. Murray was appointed Chairman; the members are Dale Alsager, Dr. Wm. Godolphin, J. E. Harris, R. G. Holtby, E. E. Jeffreys, V. Raudsepp, Dr. A. J. Renney and Dr. N. Schmitt. The Chairman, Dr. Murray, and R. G. Holtby resigned during 1980, and were replaced by E. E. Jeffreys as Chairman, and C. H. Gairns.

Pollution Control Board

The Pollution Control Board, established under the *Pollution Control Act*, section 2, hears appeals against orders of the Director of Pollution Control, Province of British Columbia, and against orders of the Director of Pollution Control, Greater Vancouver Regional District. In addition, the Board sets standards for Pollution Control for the Province of British Columbia, holds public inquiries on environmental problems, and defines which elements of water, land or air constitute pollution.

The Board held seven public appeal hearings for 16 appeals against Orders of the Director of Pollution Control. Nine appeals were allowed; five appeals were denied; two were allowed in part. One was resolved before reaching a formal appeal hearing. Four decisions were made on 1979 appeals: two were allowed and two were denied. Three decisions were subsequently appealed to the Lieutenant Governor in Council and to the Supreme Court.

The Public Inquiry into Water Standards for the Lower Fraser River dominated the Board's activities during 1980. Groups appearing before the Board represented the Greater Vancouver Sewerage and Drainage District, three municipal governments within the GVSDD, two Federal agencies, one Provincial agency, two environmental groups and one from a native organization. The Board's Technical Advisory Panel prepared a draft report and recommendations, which were later ratified by the Board and released as "policy advice".

The Board received an evaluation from the Director of the Pollution Control Branch on the practical and economic potential of incineration for solid waste management in small rural areas. The recommendations contained in the report have been used by the Board for the successful resolution of appeals involving landfill operation requirements in rural communities.

The term of the Board expired on December 31, 1980, but has been extended by Order in Council to June 30, 1981.

The Board is in the second year of its two-year term. It consists of the

Chairman, Dr. C. J. G. Mackenzie, and 11 members, as follows: from the private sector are, Mrs. E. J. Armstrong, active in environmental affairs; H. W. Buckley and Ian A. Hayward, Consulting Engineers; H. D. C. Hunter, Barrister and Solicitor; Dr. J. E. McInerney, Biology Department, University of Victoria, and Dr. F. M. Murdoch, Physician: from Government are E. Knight, Forests: R. J. Miller, Agriculture: W. C. Robinson, Mines: Dr. J. H. Smith, Public Health: and E. H. Vernon, Environment.

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Accounting

Table 1.1

Summary of Cash Revenue and Recoveries for the 15 Months Ended March 31, 1981

	January 1–March 31/80	April 1/80–March 31/81	Total
Revenue:			
Water Rights:			
Power	$1,360,872	$33,913,670	$35,274,542
Domestic, incidental use and fees	537,837	759,980	1,297,817
Waterworks	30	233,899	233,929
Irrigation	—	28,610	28,610
Funds received on applications	12,758	117,921	130,679
	1,911,497	35,054,080	36,965,577
Wildlife Act fees and licences	95,684	6,206,645	6,302,329
Sale of maps and air photos	111,588	578,806	690,394
Project S.A.M.	116,578	174,765	291,343
Pesticide licences and exam fees	25,420	87,412	112,832
Marine Resources—licences and permits	28,198	74,521	102,719
Sale of improvements to property—*Emergency Program Act*	—	62,325	62,325
Publications	27,845	43,439	71,284
Environmental Laboratory fees	4,397	21,721	26,118
Miscellaneous	1,399	64,906	66,305
	$2,322,606	$42,368,620	$44,691,226
Recoveries:			
Federal Government:			
Canada-British Columbia Joint Development Act	$2,482,812	$ 3,445,431	$ 5,928,243
Fraser River Estuary Study	25,602	44,500	70,102
Salmonid Enhancement Program	313,833	645,623	959,456
Provincial Emergency Program	190,920	19,298	210,218
Flood Relief	—	251,278	251,278
Marine Resources	—	36,000	36,000
	3,013,167	4,442,130	7,455,297

B.C. Hydro:						
Canada-British Columbia Hydrometric Program	$35,001		$ 88,661		$123,662	
Revelstoke Water Licence	24,540		58,922		83,462	
Fish & Wildlife recoverables	25,458	84,999	283,703	431,286	309,161	516,285
Miscellaneous		50,033		—		50,033
		$3,148,199		$ 4,873,416		$ 8,021,615
Total Revenue and Recoveries		$5,470,805		$47,242,036		$52,712,841

Water Rights Branch

Table 2.1

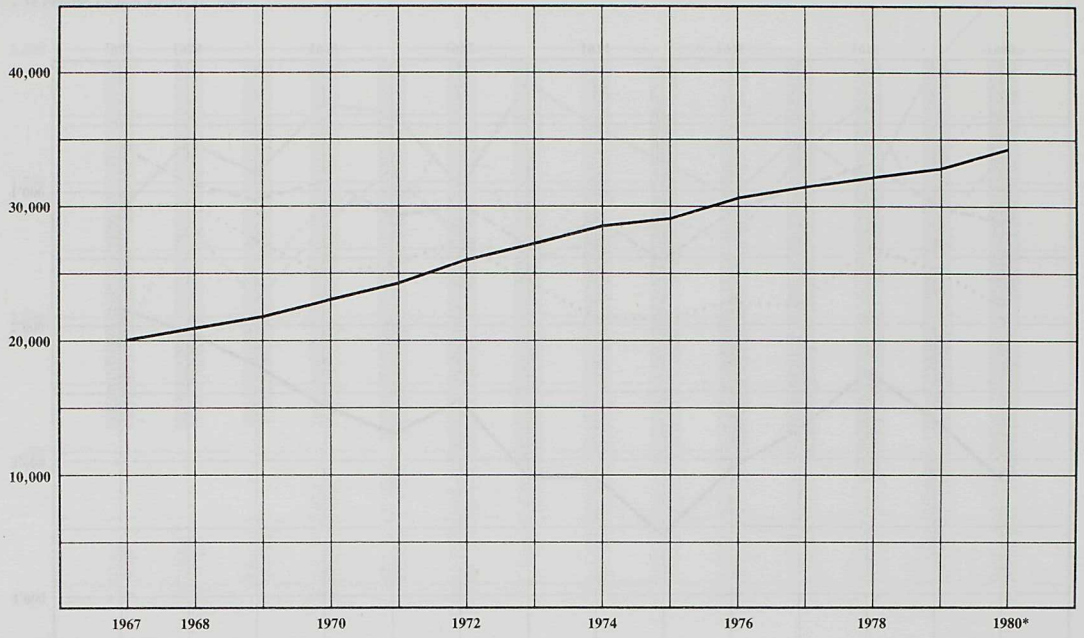
A Summary of Water Licence Activities Since 1969

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980*	REMARKS
Total number of licences	22,876	24,167	25,913	27,017	28,598	29,212	30,143	31,022	32,134	33,012	34,100	See Table 2.2
Water applications received	1,767	1,751	1,479	1,897	1,712	1,586	1,451	1,674	1,461	1,920	2,245	See Table 2.4
Conditional licences issued	1,447	1,343	1,747	1,133	1,542	1,073	1,770	1,685	1,679	1,518	1,871	See Tables 2.4, 2.5
App'n backlog (total)	2,554	2,777	2,525	3,148	3,184	3,552	3,026	2,877	2,403	2,678	3,132	See Table 2.3
App'n backlog (regional offices)	1,590	1,493	1,362	1,679	1,951	2,012	1,801	1,810	1,489	1,586	1,888	See Table 2.3
App'n backlog (general office)	964	1,284	1,163	1,469	1,233	1,540	1,225	1,067	914	1,092	1,244	See Table 2.3
Application reports received	1,372	1,583	1,275	1,172	1,279	1,347	1,318	1,660	1,801	1,277	1,614	See Table 2.4
Licence ammendments completed	442	498	535	592	707	661	836	692	604	724	667	See Table 2.5
Licence plats prepared	1,955	2,106	2,463	2,125	2,017	2,166	2,427	2,194	2,278	1,930	2,419	See Table 2.5
General office staff	28	29	30	30	30	30	30	30	32	32	32	See Table 2.5
Formal approvals granted	75	85	91	126	110	204	207	226	197	225	387	See Table 2.4

* 15 Months Ending March 31, 1981.

Table 2.2

Total Number of Licences

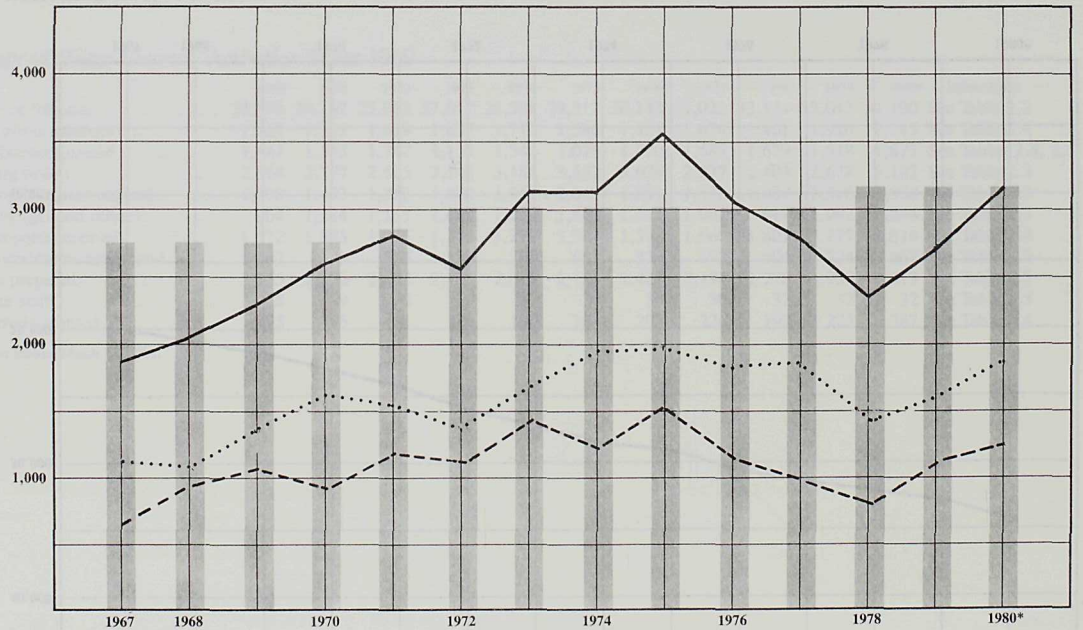


* 15 Months Ending March 31, 1981

LEGEND

Total No. of Licences ———————

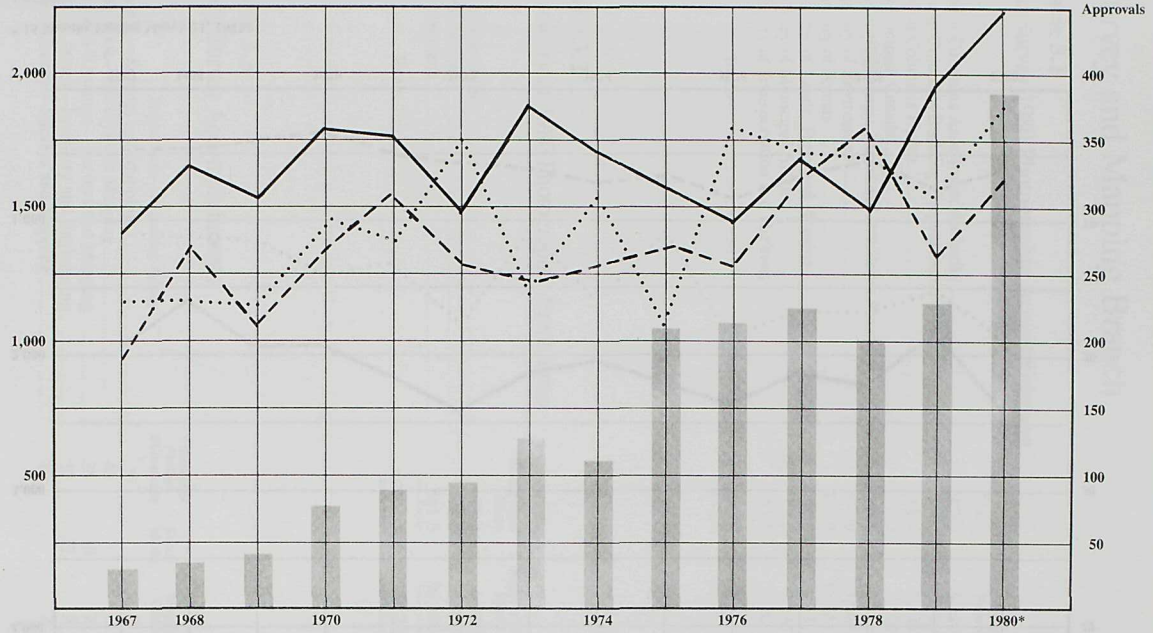
Table 2.3
Water Licences Applications Outstanding



* 15 Months Ending March 31, 1981

LEGEND
App'n. Backlog Total ——————
App'n. Backlog Regional Office . . . . . .
App'n. Backlog General Office – – – – – – – –

Applications, Reports Received & Licences Issued



*** 15 Months Ending March 31, 1981**

LEGEND

Water Applications Received ——————

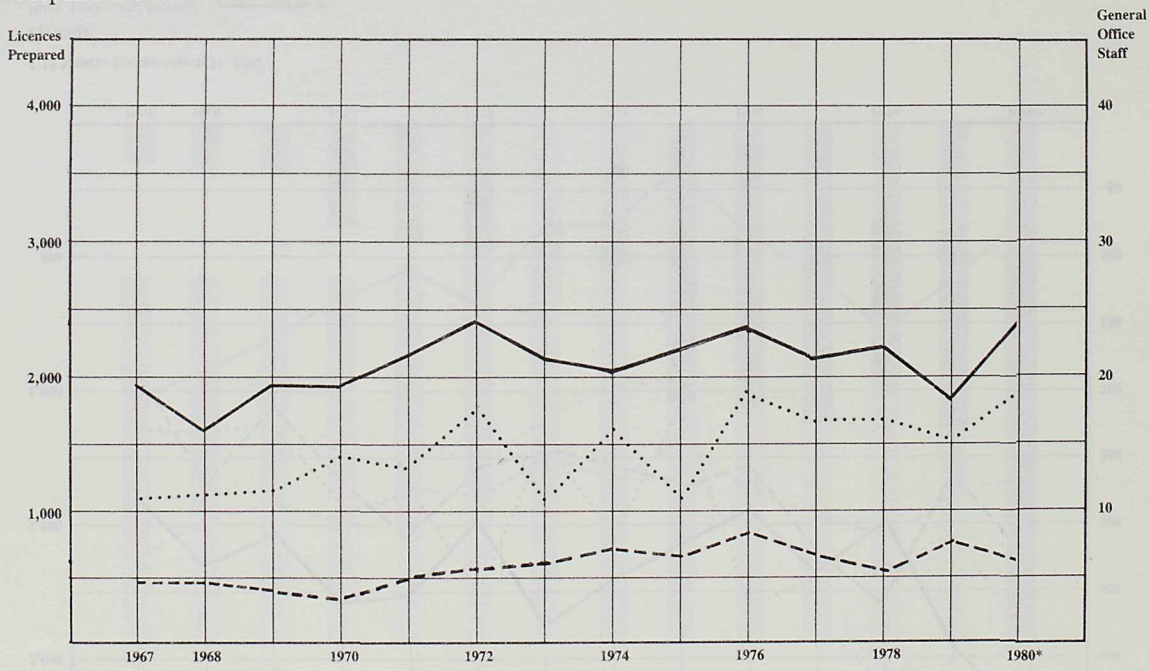
Conditional Licences Issued . . . . . .

Engineers Reports Received – – – – – – – –

Approvals Granted

Table 2.5

Licences Prepared and Issued and Staff



* 15 Months Ending March 31, 1981

LEGEND

Licence Plats Prepared ——————

Conditional Licences Issued . . . . . .

Licence Amendments – – – – – – – –

Survey and Mapping Branch

Table 3.1

Air Survey 1980 Photographic Accomplishment

	Flying Time Hours	Number of Photos	Line Kilometres
British Columbia Assessment Authority	100.2	8,220	13,550
British Columbia Building Corporation	0.2	10	5
British Columbia Hydro	16.1	1,535	845
Environment Canada	1.3	20	30
Ministry of Energy, Mines and Petroleum Resources	6.3	155	305
Ministry of Environment	207.9	13,905	16,640
Ministry of Forests	233.4	17,355	28,265
Ministry of Lands, Parks and Housing	62.0	4,525	6,380
Ministry of Municipal Affairs	1.5	245	265
Ministry of Transportation and Highways	33.2	1,205	2,380
Totals	662.1	47,175	68,665

Table 3.2

Summary of 1980 Photographic Breakdown

	Flying Time Hours	Number of Photos	Line Kilometres
I.R. False Color	21.8	1,949	1,536
Color Negative	98.8	8,920	8,868
Panchromatic	541.5	36,306	58,261
Totals	662.1	47,175	68,665

Table 3.3

Field Survey Accomplishments

Project Name—Requesting Agency	Horizontal Control Monuments	Bench Marks	Mapping Control	Cadastral Ties
Creston—Surveys and Mapping	6		X	
Cranbrook—Surveys and Mapping	45		X	
Hazelton-Kitwanga—Surveys and Mapping	35	30	X	
Fort St. James—Inventory and Engineering	52	22	X	29
Prince George—Surveys and Mapping	19		X	

Table 3.4

Integrated Survey Systems 1980 Monuments

Sidney	27	Completed
Saanich	40	In progress
Matsqui	51	Area extended
Surrey	86	Replacements
Coquitlam	83	Replacements
	387	

Table 3.5

Reconnaissance Integrated Surveys

	Monument Locations
West Vancouver	343
Saanich	538
Burnaby	65
Port Moody	163
Port Alberni	260
Oak Bay	391
Rossland	38
	1,798

Table 3.6

Cadastral Surveys

Coquitlam—Minnekhada Ranch Agricultural Land Reserve	In progress
Central Saanich—Property No. 47 Agricultural Land Reserve	*Completed*

Table 3.7

Photogrammetric Projects Completed in 1980

Project No.	Project Name	Originator	Scale	Vertical Interval	Number of Overlaps
78-165P/C	Lytton	I & E.*	1:5 000	—	15
78-194T	Addition to Monte Lk.	I. & E.	1:1 200	2 ft.	1
78-230T/O	Kitimat	I. & E.	1:5 000	1 & 2 m	Ortho 58 215
79-09T/O	Burns Lk.	I. & E.	1:5 000	1 & 2 m	Ortho 32 89
79-65C	Fraser R.-Agassiz	S. & Mapping	1:5 000	—	138
79-74T	Mt. Seymour	Parks Br.	1:1 000	2 m	
			1:2 500	5 m	11
79-87T	Western Community	Reg. Dist.	Bridging Only		89
79-89T/C	McConnell Cr.	Reg. Dist.	1:2 500	2 m	13
79-90P/C	Pitt Polder	Reg. Dist.	1:5 000	—	16
79-101T/O	Kelowna Foreshore	I. & E.	1:5 000	1 & 2 m	Ortho 21 81
79-117T/O	Radium-Windermere	I. & E.	1:5 000	1 & 2 m	Ortho 35 101
79-126T/O	Okanagan Valley	I. & E.	1:5 000	1 & 2 m	Ortho 68 291
79-130T	Hudson Bay Ski Develop.	Environ.	1:6 000	10 ft.	1
79-140T	Nadina R.-Colleymont	Highways	1:5 000	5 m	37
79-156T/C	Gambier Is.	E.L.U.C.	1:10 000	10 m	4
79-157T	Lot 12217, Cariboo Dist.	Environ.	1:5 000	5 m	1
79-158T	Section 25, Township 47	L.P. & Housing	1:6 000	5 m	1
79-159T	Lot 9970	L.P. & Housing	1:5 000	2 m	2
79-161T/C	Fraser R. Debris Site	Forests	1:2 000	1 m	1
80-05T	Wilkinson R.-Helmcken Rd.	Highways	1:500	1 m	5
80-06T	Monais-Bodreau	Highways	1:5 000	5 m	4
80-07T	Smithers Bypass	Highways	1:5 000	5 m	22
80-14T	McKenzie (Add to 79-127T)	Highways	1:500	2 m	1
80-16S/P	Hosmer Spotheights	Environ.	1:5 000	—	3
80-19T/O	Cheakamus	I. & E.	1:5 000	1 & 2 m	Ortho 20 38
80-23T	Esplanade-Succour	L.P. & Housing	1:2 000	2 m	2
80-25T	Add. to 80-25T	Highways	1:500	1 m	1
80-26T	Add. to Hope Merritt	Highways	1:1 200	5 m	3
80-29T	Topley-Broman Lks.	Highways	1:5 000	5 m	16
80-30T/O	Ware	Mines	1:50 000	20 m	63
80-32T	Rose Valley Lk.	I. & E.	1:2 000	1 m & 0.5 m	16
80-33T	Shannon Lk. Reservoir	I. & E.	1:2 000	5 m	4
80-34T	Brent Lk. Profiles	I. & E.	Profiles		1
80-35T	Slocan R.-Passmore	I. & E.	1:5 000	2 m	14
80-37T	Fox Mtn.	L.P. & Housing	1:5 000	5 m	6
80-39T	Chimney Lk.	I. & E.	1:2 000	2 m	43
80-40T	Brunson Lk.	I. & E.	1:2 000	1 m	9
80-44T	Pemberton	Land Assembly	1:2 400	10 ft.	2
80-46T	Valemont	L.P. & Housing	1:4 000	5 m	2
80-47T	McBride	L.P. & Housing	1:4 000	5 m	2
80-55T/O	Fraser R.-Debris Site	Forests	1:2 000	1 & 5 m	6
80-63T	Cypress Bowl	L.P. & Housing	1:1 000	2 m	14
			1:2 500	5 m	
80-66T	Hope-Merritt Add.	Highways	1:4 800	10 ft.	3

* Inventory and Engineering (Environment).

Table 3.7—Continued

Project No.	Project Name	Originator	Scale	Vertical Interval	Number of Overlaps
80-81T	DL 3959	L.P. & Housing	1:2 000	5 m	3
80-85T	Yale Bluffs	Highways	1:500	1 m	1
80-90T	Salle L.	I. & E.	1:2 000	1 m	6
80-91T	Pass Cr.	Highways	1:1 000	2 m	16
80-92T	Felker Lk.	I. & E.	1:2 000	1 m	24
80-99T	Hope-Merritt Add.	Highways	1:4 800	10 ft.	2
80-122T/O	Brandywine	Environ.	1:5 000	1 & 2 m	2
80-125T	Ext. to M92	Forests	1:5 000	2 m	2
80-129T	Summerland	I. & E.	1:2 500	1 m	9
80-130T	Fintry	I. & E.	1:2 500	1 m	3
80-131T	Westbank-Gellantly	I. & E.	1:2 500	1 m	12
80-142T	Inklin R. Landslide	Environ.	1:2 500	2 m	4
80-146P	Quatsino	S. & Mapping	1:20 000	—	70
80-147T	Stoddart Cr.	Highways	1:5 000	5 m	11
80-152T	Bella Coola	I. & E.	1:6 000	1 m	6
80-162T	Add. to Hope Merritt	Highways	1" = 400'	5 ft.	1
79-61T/O	Vanderhoof	I. & E.	1:5 000	2 m & spot	146 (ortho 146)
80-163T	Big Meadow Lk.	I. & E.	1" = 200'	2 ft.	4
80-135T	Trepanier	I. & E.	1:2 500	1 m	6
80-136T	Naramata	I. & E.	1:2 500	1 m	9
77-108T/O	Cowichan Lk.	I. & E.	1:5 000	1 & 2 m	62 (ortho 19)
80-153T	Cordova Bay	Reg. Dist.	1:2 000	1 m	3
80-144P/C	Delta, Surrey, Langley	S. & Mapping	1:5 000	—	164
80-160T	Prince George F/P	I. & E.	1:2 000	1 m	20
	Completed Projects, 67				1,973 399 Ortho 2,372

Table 3.8

Photogrammetric Projects in Progress March 31, 1981

Project No.	Project Name	Originator	Scale	Vertical Interval	Number of Overlaps
77-166T/O	Squamish	I. & E.	1:5 000	1 & 2 m	Ortho 40 102
79-118T/O	Fairmont-Canal Flats	I. & E.	1:5 000	1 & 2 m	Ortho 39 88
80-145T	Penticton Indian Band	I. & E.	1:2 000	1 m & 0.5 m	29
80-151T/O	Kelowna Woodlake	I. & E.	1:5 000	1 & 2 m	Ortho 54 54

Table 3.9
Map and Air Photo Sales

	Lithographed Maps			Itek	
	Number of Requisitions	Number of Maps	Value	Number	Value
			$		$
Environment—					
Surveys and Mapping	321	10,743	23,447.50	199	279.00
Resource Analysis	177	2,655	5,755.70	167	270.25
Water Investigations	322	2,204	4,420.50	607	882.50
Provincial Emergency	74	2,692	5,495.50	—	—
Pollution Control	85	1,113	2,321.25	35	45.25
Fish and Wildlife	220	2,576	5,003.25	175	251.00
Marine Resources	10	40	87.25	4	8.00
Water Management	120	1,667	3,312.25	119	173.50
ELUC Secretariat	20	201	398.25	—	—
Agriculture	46	492	854.50	85	119.75
Attorney General	22	169	560.00	3	4.50
Consumer and Corporate Affairs	5	9	16.50	—	—
Education	41	264	552.00	7	8.75
Energy, Mines and Petroleum Resources	402	1,875	3,736.25	67	96.00
Finance	20	586	1,111.50	—	—
Forests	571	29,056	65,875.25	1,077	1,530.75
Health	45	251	544.75	25	37.50
Human Resources	13	75	175.25	—	—
Industry and Small Business Development	22	97	251.00	2	2.50
Labour	12	115	289.50	—	—
Lands, Parks and Housing—					
Lands	201	2,407	4,263.25	793	1,096.75
Parks	215	2,994	6,002.20	581	810.00
Housing	50	397	873.25	59	75.25
Municipal Affairs	43	714	1,256.25	54	84.75
Provincial Secretary and Government Services	181	2,340	5,529.50	140	202.25
Tourism	23	104	233.25	—	—
Transportation and Highways	524	4,081	8,915.25	1,370	1,949.00
Universities, Science and Communications	12	92	229.50	22	33.00
Government Total	3,797	70,009	151,510.40	5,591	7,964.25
Public	8,986	182,612	391,973.25	10,154	14,425.00
Total	12,783	252,621	543,483.65	15,745	22,389.25

Mail Count 13,266

Cash Customers 9,716

Cash Collected $93,703.98
(through cash register)

Federal Maps Distributed 89,674

Provincial Maps Distributed 163,659

Table 3.10
Map Production—Reprographics

	Air Photo Section						
	Reqs.	10×10	Diaps.	Enlgs.	Mosaics	Color	Cost
Agriculture	134	9,848	—	127	8	667	$19,419.75
Attorney General	5	7	—	3	—	—	62.50
Consumer and Corporate Affairs	11	21	—	33	5	—	646.75
Education	3	21	—	—	—	—	32.25
Energy, Mines and Petroleum Resources	62	2,047	3	164	8	606	6,087.50
Environment	1,153	141,645	2,342	648	127	13,064	290,069.25
Finance	2	1	—	1	3	—	76.25
Forests	622	117,145	187	460	84	6,105	208,180.00
Health	7	1	—	72	—	—	526.25
Human Resources	—	—	—	—	—	—	—
Industry and Small Business Development	—	—	—	—	—	—	—
Labour	—	—	—	—	—	—	—
Lands, Parks and Housing—							
Lands Management/ Legal Surveys	177	22,589	41	31	19	804	68,205.00
Parks	162	12,313	16	69	12	26	19,046.00
Housing	26	1,565	7	21	1	—	2,343.25
Legislative Assembly	2	16	—	1	—	—	35.00
Municipal Affairs	53	1,348	—	52	13	381	4,181.50
Provincial Secretary and Government Services	41	575	—	12	8	19	1,181.50
Tourism	3	4	—	—	2	—	46.00
Transportation and Highways	741	31,203	200	254	36	705	54,459.25
Universities, Science and Communications	—	—	—	—	—	—	—
British Columbia Assessment Authority	151	20,460	—	1,707	7	63	49,248.25
Public	5,862	160,629	11,286	3,758	494	7,481	351,191.25
Total	9,218	521,438	14,082	7,413	827	29,921	1,075,037.50

* Kamloops total included.

ble 3.10—Continued
ıp Production—Continued

	Reproduction Section					
	Reqs.	Whprts.	Offset	Photo	Cost	Total Cost
riculture	179	1,703	—	244	$5,383.20	$24,802.95
orney General	89	981	210	55	1,951.19	2,013.69
isumer and Corporate ffairs	1	2	—	—	5.82	652.57
cation	5	113	—	—	139.00	171.25
rgy, Mines and Petro-ıum Resources	1,520	26,471	27,801	1,398	49,478.67	55,566.17
ironment	8,277	91,872	5,497,123	38,282	522,774.67	812,843.92
nce	30	527	603	12	532.44	608.69
sts	1,396	7,577	—	31,136	236,644.30	444,824.30
lth	220	290	1,200	28,306	26,860.04	27,386.29
nan Resources	238	46	—	1,523	5,243.65	5,243.65
ıstry and Small Busi-ess Development	1	—	—	1	41.60	41.60
our	1	—	—	35	245.00	245.00
ds, Parks and Housing— ands Management/ Legal Surveys	4,082	27,911	2,615	2,210	42,916.67	111,121.67
rks	399	3,813	—	7,442	18,074.22	37,120.22
ousing	113	2,358	—	73	3,359.40	5,702.65
islative Assembly	1	7	—	—	14.00	49.00
nicipal Affairs	1,378	13,446	—	3,089	42,895.63	47,077.13
incial Secretary and overnment Services	279	697	5,500	2,159	7,564.96	8,746.46
ism	20	31	—	41	440.40	486.40
nsportation and ighways	2,684	137,840	—	19,501	137,267.43	191,726.68
versities, Science and ommunications	24	164	—	37	508.60	508.60
sh Columbia Assess-ent Authority	103	1,733	—	174	5,389.75	54,638.00
lic	2,769	21,865	—	11,661	58,473.31	409,664.56
Total	23,809	339,447	5,535,052	147,379	1,166,203.95	2,241,241.45

Table 3.11

Lithographic Maps Printed January 1980 to March 1981

Map No.	Name	Edition	Scale	Contour Interval	Remarks
82E/NE	Upper Kettle River	Third	1:100 000	50 m	New Map
82E/SE	Grand Forks	Third	1:100 000	50 m	New Map
82K/NE	Invermere	Second	1:100 000	50 m	New Map
82K/NW	Beaton	Second	1:100 000	50 m	New Map
82L/NE	Revelstoke	Second	1:100 000	50 m	New Map
82L/NW	Shuswap Lake	Third	1:100 000	50 m	New Map
82L/SE	Sugar Lake	Third	1:100 000	50 m	New Map
92H/SE	Princeton	Fourth	1:100 000	50 m	New Map
92I/SE	Merritt	Fourth	1:100 000	50 m	New Map
92I/SW	Lytton	Third	1:100 000	50 m	New Map
93A/SW	Horsefly River	First	1:100 000	50 m	New Map
93G/SE	Cottonwood River	First	1:100 000	50 m	New Map
93E	Whitesail Lake	Third	1:250 000	150 m	New Map
103P	Nass River	Fourth	1:250 000	150 m	New Map
PS-M1	Manning Park	First	1:50 000	50 m	New Map
1JR	British Columbia Relief	Second	1:2000 000	—	New Map
SGS-2	Vancouver-Kamloops	First	1:400 000	150 m 300 m	New Map
WCT 2	West Coast Trail	Second	1:50 000	100 ft.	Revised
	British Columbia Air Facilities	1980	1:2000 000	—	Revised

Lithographic Maps Reprinted January 1980 to March 1981

82F/SE	Creston	Second	1:125 000	200 ft.
82F/SW	Trail	Second	1:125 000	100 ft.
92G/NW	Squamish	First	1:125 000	100 ft.
92H/SW	Chilliwack Lake	Third	1:125 000	200 ft.
92K-J	Bute Inlet	First	1:250 000	500 ft.
92M	Rivers Inlet	Second	1:250 000	500 ft.
92N	Mount Waddington	First	1:250 000	500 ft.
93A	Quesnel Lake	Second	1:250 000	500 ft.
93B	Quesnel	First	1:250 000	500 ft.
93C	Anahim Lake	Second	1:250 000	500 ft.
93I	Monkman Pass	First	1:250 000	500 ft.
93M	Hazelton	Fourth	1:250 000	500 ft.
93N	Manson River	First	1:250 000	500 ft.
93O	MacKenzie	First	1:250 000	500 ft.
93P	Dawson Creek	First	1:250 000	500 ft.
1BL	Northwestern British Columbia		1:600 000	
1DL	Northeastern British Columbia		1:600 000	—
1E	Southeastern British Columbia		1:600 000	—
1FL	West Central British Columbia		1:600 000	—
1GL	East Central British Columbia		1:600 000	—
1K	Southwestern British Columbia	Fifth	1:600 000	—

Large Scale	52 projects	657 sheets
Special	15 projects	41 sheets
Orthophoto	14 projects	300 sheets
Ottawa (N.T.S.)	Admin. Boundaries	85 sheets

Table 3.12
Cadastral Map Production 1980

Scale	Item	Victoria Office Completed	Victoria Office In Hand	Kamloops Office Completed	Kamloops Office In Hand
1:2 500	Cadastral	6	32	—	5
1:5 000	Cadastral	119	99	15	4
1:10 000	A. L. R. Constituent Bdy. Maps	33	10	—	—
1:20 000	Cadastral	23	—	—	—
1:50 000	Cadastral (Federal Maps)	120	34	—	—
	Integrated Survey Indices	2	4	—	—
1:5 000	Map Indices	12	—	—	—
	Special Projects	31	—	—	—
	Grids and Title Blks. (Calcomp Plotter)	829	—	—	—
	Total-Less Grids and Title Blks.	346	180	15	9

30 Man/Hours—Mechanical drafting for machine shop (Field Operations.)
50 Man/Hours—Mapping assistance and checking for private and government agencies.

Kamloops Office Map Distribution*

Government Map Distribution—	
Topographic Maps	2,512
Composite Maps	2,926
White Printing	365
B.C. Assessment Authority Map Distribution—Composite Maps	459
Public Map Distribution—	
Composite Maps	2,943
Topographic Maps	4,600
Misc. Public	1,428
Xerox Copies	40
Total Maps Distributed, All Types	15,273

* Kamloops Office closed August 5, 1980.

Table 3.13
Summary of Planimetric Mapping Completed

Name	Number of Sheets	Originator	Scale
Quadra P.S.Y.U.	54	Ministry of Forests	1:20 000
Revision Mapping			
93P, 104A	167	Water Management Branch	1:20 000

Table 3.14

Summary of Photo Mosaics Completed

Photo/Mosaic Number	Name	Number of Sheets	Originator	Scale
402-76	Guichon Creek	4	Forests	1:40 000
403-79	Portion Gilford Island	3	Forests	1:10 000
404-77	Pitoney Lake–Jerry Creek	1	Forests	1:20 000
405-72	Penticton Creek	1	Forests	1:15 840
406-74	Whiteman Creek–Beau Park	8	Transportation and Highways	1:4 000
407-79	Scot Unit	1	Forests	1:40 000
408-79	Herrick Creek, Bks. 1 and 2	3	Forests	1:31 680
409-75	Sunset Prairie Community Pasture	1	Forests	1:31 680
410-79	Fort St. James	1	Environment	1:63 360
411-75	Alberni Valley	2	Forests	1:20 000
412-79	Fife-Deep Creek Range Units	1	Forests	1:20 000
413-79	South Pass–Brown Creek Range Unit	1	Forests	1:20 000
414-77	Hardwicke Island	1	Environment	1:20 000
415-77	Revelstoke Area	1	Environment	1:18 000
416-78	Charlie Lake Area	2	Transportation and Highways	1:20 000
418-77	Victoria Lake Planning Project	1	Lands, Parks and Housing	1:20 000
419-76	Bridge Lake Stock Range	2	Forests	1:50 000
420-79	Valemount–Tête Jaune Cache	2	Lands, Parks and Housing	1:30 000
421-74	Lac Le Jeune	1	Lands, Parks and Housing	1:10 000
422-79	Gable Mountain	1	Forests	1:20 000
423-79	Burrell Creek	1	Forests	1:20 000
424-79	Jones Creek	1	Forests	1:20 000
425-79	Mt. Faith-Morrell	1	Forests	1:20 000
426-79	Xenia Lake	1	Forests	1:20 000
427-79	Duncan–Cowichan Lake	3	Transportation and Highways	1:25 000
428-75	Chase-Tod Mountain	2	Transportation and Highways	1:20 000
429-77	S.T.L.'s Doe Lake–Stony Lake	2	Forests	1:20 000
430-79	Powell River–Westview	2	Transportation and Highways	1:20 000
431-80	Smithers	2	Municipal Affairs	1:10 000
432-80	Port Hardy Area	3	Lands, Parks and Housing	1:10 000
433-80	North Saanich District Municipality	1	Transportation and Highways	1:10 000
434-80	Central Saanich District Municipality	1	Transportation and Highways	1:10 000
435-80	Saanich District Municipality	2	Transportation and Highways	1:10 000
436-79	Bowen Island	1	Environment	1:20 000
437-80	Comox–Oyster River	6	Municipal Affairs	1:10 000
438-76	Fawnie Creek	1	Forests	1:10 000
439-79	Falls Lake Area	1	Lands, Parks and Housing	1:25 000
440-77	Thursday–George	1	Forests	1:20 000
441-77	Wansa–Pitoney	2	Forests	1:20 000
442-74	Dear Creek Range Unit	1	Forests	1:20 000
443-80	Cranbrook	2	Transportation and Highways	1:10 000
444-79	Yahk River	2	Forests	1:15 840
445-80	Lantzville–Qualicum	3	Transportation and Highways	1:20 000
446-77	Salmon Valley	1	Environment	1:20 000
447-79	Pike Mountain	4	Forests	1:20 000
448-77	Port Edward and Vicinity	2	Municipal Affairs	1:20 000
449-79	Ladysmith Harbour–Departure Bay	1	Transportation and Highways	1:22 000
450-79	Teapot Mountain–Siwash Creek	1	Forests	1:20 000
451-79	Bowron River–Ames Creek	1	Forests	1:20 000
452-76	Homathko River	1	Forests	1:10 000
453-78	Texada Island	2	Environment	1:30 000
454-80	Deep Bay to Bowser	1	Transportation and Highways	1:20 000
455-67	Tuchodi River Valley	1	Environment	1:50 000

Table 3.14—*Continued*

Summary of Photo Mosaics Completed

Photo/Mosaic Number	Name	Number of Sheets	Originator	Scale
456-78	Pend d'Oreille Valley	2	Municipal Affairs	1:20 000
457-77	Grove Burn	2	Forests	1:20 000
458-79	Mark Creek	2	Forests	1:20 000
459-79	Cascade Wilderness Study	2	Forests	1:20 000
460-74	Clear Lake	1	Forests	1:20 000
461-80	Buttle Lake–Upper Campbell Lake	4	Lands, Parks and Housing	1:20 000
462-80	Salmo-Erie	2	Transportation and Highways	1:10 000
463-80	Vernon Area–Swan Lake	2	Transportation and Highways	1:20 000
464-80	Sumas–Chilliwack Lake	2	Environment	1:31 680
465-77	Davie Lake–Bear Lake	2	Forests	1:15 840
466-79	Summit Lake	2	Forests	1:15 840

Inventory and Engineering Branch

Table 4.1

Floodplain Mapping Status

Item Number	Surveys Section Project Number	Project Location	Approximate Floodplain Area, Square Miles	Length of River or Lakeshore Miles	Control Surveys		River Surveys		Base Mapping		Determination of Flood Flows		Calculation of Flood Profile		Floodplain Maps	
					During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End
					% Complete											
1.		Bella Coola River-Hagensborg[†]		7	0	100	0	100	0	100	0	100	0	100	0	100
2.	76-FDC-18	Bulkley River	155	97	0[*]	50[*]	60	100	0	0	0	0	0	0	0	0
3.	76-FDC-3	Burns and Decker Lakes	25	24	0	100[*]	0	0	35	100	0	0	0	0	0	0
4.	79-RPP-4	Cheakamus River	8	8	20	100	20	100	100	100	100	100	75	75	0	0
5.	76-FDC-4	Chilliwack River	14	12	0	100	0	100	0	100	0	100	10	100	40	100
6.	74-F-1	Coldwater River-Merritt[†]	2	4	0	100	0	100	0	100	0	100	0	100	20	100
7.	75-F-6	Columbia River-Golden	18	18	0	100	0	100	0	100	0	100	0	100	0	100
8.	76-FDC-6	Columbia River-Radium to Canal Flats (River Only)	42	12	0	100	0	100	40	50	0	100	25	100	80	80
9.	76-FDC-12	Columbia River Revelstoke	14	9	0	100	0	100	0	100	0	100	0	100 (B.C. Hydro Mapping)	0	0
10.	77-FDC-9	Colquitz River	21	8	0	100	0	100	Municipality		0	0	0	60	0	0
11.	74-F3	Coquihalla River-Hope[†]	7	10	0	100	0	100	0	0	0	100	0	100	0	100
12.	73-F1-D	Coquitlam River	6	10	0	100	0	100	0	100	0	100	0	100	0	100
13.	75-F8	Courtenay River[†]		1.5	—	—	0	100	—	—	0	100	0	100	0	100
14.	75-F8	Courtenay River (Ext.)		1.5	—	—	0	100	—	—	0	100	0	100	5	100
15.	76-FDC-1	Cowichan Lake (Youbou to Gordon Bay)	9	20	0	100	—	—	0	20	0	100	0	100	0	100[†]
16.	75-F-2	Cowichan River-Duncan	26	7	0	100	0	100	20	100	100	100	100	100	90	90

Floodplain Mapping Status—Continued

Item Number	Surveys Section Project Number	Project Location	Approximate Floodplain Area, Square Miles	Length of River or Lakeshore Miles	Control Surveys		River Surveys		Base Mapping		Determination of Flood Flows		Calculation of Flood Profile		Floodplain Maps	
					During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End
					% Complete											
17.	74-F-2	Eagle River	24	27	0	100	0	100	0	100	0	100	0	100	0	100
18.	75-F3	Elk River	30	33	0	100	0	100	0	100	0	100	0	100	0	100
19.	75-F3 (79)	Elk River (Ext.)	22	18	0	0	15	100	0	0	0	100	0	0	0	0
20.	77-FDC-1	Fitzsimmons Creek		2	—*	—*	0	100	—	—	0	100	0	100	0	100
21.	76-FDC-2	Fraser & Nechako Rivers (Prince George)	45	24	0*	100	40	100	100*	100*	0	100	50	100	0	0
22.		Fraser River-Quesnel†		4	0	100	0	100	0	100	0	100	0	100	0	100
23.	73-F1-1	Fraser Valley-Chilliwack Area	70	—	0	100	—	—	0	100	0	100	0	100	0	30
24.	79-RPP-2	Kaslo River	0.6	1.2	0	100	0	100	0	0	0	100	50	50	0	0
25.		Kettle & Granby Rivers-Grand Forks†		18	0	100	0	100	0	100	0	100	0	100	0	100
26.	75-F-5	Kitimat River	75	36	0	100*	0	50	55	100	0	100	0	100	0	100†
27.	76-FDC-2	Lakelse Lake and River	35	14 2.6	15	100	20	50	0	0	0	0	0	0	0	0
28.		Lillooet River (Lillooet Lake Upstream)		23	0	100	0	100	0	100	0	100	0	100	0	100
29.	76-FDC-17	(a) Nechako River-Vanderhoof	50	16	0*	100*	0	100	65	65	0	0	0	0	0	0
30.	74-F-1	Nicola River†		2	—	—	0	100	—	—	0	100	0	100	0	100
	80-RPP-2	Nicola River- Nicola Lake to Thompson River. River Protection Project but originally listed as Floodplain Project	64	48	0	0	60	60	0	0	0	100	0	20	0	20†
31.	76-FDC-11	Nicomekl River above Latimer Road	11	10	0	100	0	100	0	100	0	0	0	95	0	0

Table 4.1—*Continued*
Floodplain Mapping Status—Continued

Item Number	Surveys Section Project Number	Project Location	Approximate Floodplain Area, Square Miles	Length of River or Lakeshore Miles	Control Surveys		River Surveys		Base Mapping		Determination of Flood Flows		Calculation of Flood Profile		Floodplain Maps	
					During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End
					% Complete											
32.	73-F-2B	North Thompson Valley[†]	120	98	0	100	—	—	0	100	0	100	0	100	0	100
33.	77-FDC-7	North Thompson River Revision	120	98	0	100	25	100	0	0	0	100	100	100	50	50
34.	74-F7-E	Okanagan Lake-Kelowna Foreshore	5	8	0	100	10	90	40	85	0	100	0	100	0	0
	74-F7-E	Okanagan Lake Foreshore-														
		(a) Kelowna Foreshore	5	8	0	100	20	100	40	85	0	100	0	100	90	90
		(b) Penticton-Naramata	3	1.5	100	100	80	80	20	20	0	100	0	100	0	0
		(c) Summerland	2	2	100	100	80	80	80	80	0	100	0	100	0	0
		(d) Peachland-Trepanier	2	1.5	100	100	80	80	80	80	0	100	0	100	0	0
		(e) Westbank	4	2	100	100	80	80	80	80	0	100	0	100	10	10
		(f) Lakeview	.5	.5	0	0	70	70	0	0	0	100	0	100	0	0
		(g) Fintry	.5	.5	100	100	0	0	80	80	0	100	0	100	0	0
	74-FDC-7 (80)	Kelowna (Mill) and Vernon Creeks														
		Vernon	6	6												
		Kelowna	10	10	100	100	90	90	10	10	0	0	0	0	0	0
		Coldstream Creek	11	11	95	95	50	50	0	0	0	0	0	0	0	0
		Vernon Creek	6	6.4	95	95	75	75	0	0	0	0	0	0	0	0
		Bx Creek	3	3	95	95	75	75	0	0	0	0	0	0	0	0
		Deep Creek	10	10.6	95	95	75	75	0	0	0	100	0	100	0	100[†]
	80-FDC-2	Bellevue (Sawmill) Creek[*]	2	2			100	100	0	0	0	0	0	0	0	0
35.	74-F7-D	Okanagan Valley-Border to Okanagan Lake	43	38	0	100	0	100	60	66	0	100	0	100	0	0
36.	79-WSS-1	Passmore I.D.	8	—	20	100	—	—	100	100	0	0	0	0	0	0
37.	75-F-9	Port Alberni	4	—	0	100	—	—	0	100	0	100	0	100	0	100

Floodplain Mapping Status—Continued

Item Number	Surveys Section Project Number	Project Location	Approximate Floodplain Area, Square Miles	Length of River or Lakeshore Miles	Control Surveys		River Surveys		Base Mapping		Determination of Flood Flows		Calculation of Flood Profile		Floodplain Maps	
					During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End	During Year	To Year End
					% Complete											
38.	77-FD-8	Port Alberni (Ext.)	3	—	0	100	—	—	0	0	0	100	0	100	0	100
39.	79-FDC-5	Salmon River* (Prince George)	38	23	50	100	40	100	0	0	0	0	0	0	0	0
40.	76-FDC-5	Salmon and White Rivers	29	27	0	100	0	100	0	100	0	100	0	100	90	100
41.	77-FDC-6	Shawnigan Lake (Bathymetric)	5	5	0	100	0	100	0	100	0	100	0	100	0	100
42.	74-F-4	Shuswap River-Mara Lake to Mabel Lake	48	37	0	100	0	100	0	100	0	100	0	100	0	100
43.	73-F-3	Similkameen River† (Princeton to Border)		60	0	100	0	100	0	100	0	100	0	100	0	100
44.	80-FDC-1	Similkameen River† Section Princeton to Stirling Creek	10	21			90	90	0	0	0	100	0	0	0	0
45.	75-F-4	Skeena River-Graveyard to Usk	73	44	0	100*	10	95	5	100	0	100	0	90	0	0
46.	76-FDC-7	Skeena River-Hazelton			0	100	0	100	0	100	0	100	0	100	0	10
47.	73-F-2A	South Thompson Valley	50	45	0	100	0	100	0	100	0	100	0	100	0	100
48.	76-FDC-10	Squamish River†	38	27	0*	100*	0	100	40	40	0	100	0	100	0	90
49.	76-FDC-21	Stuart Lake* and River	52	12	60	100	0	0	0	0	0	0	0	0	0	0
50.	76-FDC-13	Tulameen River-Tulameen	10	13	0*	0*	0	100	0	0	100	100	100	100	95	95
51.	76-FDC-8	Tulameen and Similkameen Rivers-Princeton	5	6	0	100	0	100	0	100	0	100	0	100	0	100

* Mapping Control established by Surveys and Mapping Branch
† Old Mapping

Table 4.2

Floodplain Development Control

Items Dealt With	1979	1980–81*
1. Zoning By-laws	272	284
2. Official Community and Settlement Plans	84	116
3. By-law Appeals	64	195
4. Subdivisions	706	824
5. Crown Land Lease and Fee Simple Applications	227	505
6. Flooding Reserve and Ecological Reserve Clearance	90	123

* For 15 month period January 1, 1980 to March 31, 1981.

Table 4.3

Minor Flooding and Erosion Projects

River Improvement Assistance Program

Year	Requests for Assistance	Site Inspections	Reports Completed	Projects Implemented	
				No.	Total Construction Cost $
1974	115	62	84	54	520,000
1975	93	104	87	24	1,170,000
1976	114	143	112	37	1,043,000
1977	57	86	86	44	499,000
1978	91	95*	68*	48	463,000
1979	95	105	98	40*	490,000
1980	111	90†	84	17	580,000

* Excludes Terrace area flooding investigations and reconstruction, Mission Creek and Granite Creek projects and Houston dyking for an additional construction value of $1,800,000.

† Excludes inspections under Provincial Emergency Program following Christmas 1980 storm.

Table 4.4
Drainage Studies—Engineering

Area	Description	% complete to Mar. 31/81
A. Undertaken by Inventory and Engineering Branch		
Surrey	Report on drainage improvements in the Burrows Ditch area on the Nicomekl River floodplain.	30
Delta	Study on proposed drainage improvements in the East Delta area.	75
Mud Bay	Data gathering continued in 1980 for proposed drainage improvements for Mud Bay Dyking District.	10
B. Undertaken by Consultants		
Delta	Study on proposed drainage improvements and new pumping station in the Crescent Slough area.	100
Chilliwack	Report on proposed drainage scheme in Elk Creek-Big Ditch area of East Chilliwack.	100
North Cowichan	Report on proposed drainage improvements in Quamichan Lake area.	100
Keremeos	Economic analysis of proposed dyking and erosion control project for Similkameen Indian Band.	100
C. Requests for Studies Under Investigation or Awaiting Assignment to Consultants		
Pitt Meadows	Proposals were received for a study on drainage improvements and replacement of pumping facilities for the District of Pitt Meadows.	
Colebrook	ARDSA assistance has been requested by the Colebrook Dyking District for a study on proposed drainage improvements.	
Richmond	Preliminary data gathering continued in 1980 and 1981 for proposed drainage improvements and irrigation for the Township of Richmond.	
Port Coquitlam	ARDSA assistance was requested for drainage improvements at Port Coquitlam.	
Chilliwack	A request was received for a study on drainage improvements in the Dunville Creek area, District of Chilliwack.	
Hope	ARDSA assistance was requested by the Chawathil Farm Co-operative for a feasibility study on drainage improvements.	

Table 4.5

Status of Drainage Construction Projects

Project Description	ARDSA Project No.	Design	Construction		
		% Complete as of Mar. 31/81	During Period Jan. 1/80–Mar. 31/81	To Mar. 31/81	% Complete as of Mar. 31/81
Pemberton Dyking District Flood Protection and Drainage Scheme.	271105	75	1,202,394	1,231,520	30
District of Surrey—Old Logging Ditch Drainage Scheme.	271107	95	0	0	50
Nicomen Island Improvement District—Drainage Scheme.	271110	100	260,000	260,000	80
Glen Valley Dyking District Drainage Scheme.	271114	100	0	0	0
Township of Chilliwack—East Chilliwack Drainage.	271120	0	0	0	0

Table 4.6

Fraser River Flood Control Program
Expenditures by Fiscal Year

Fiscal Year	Expenditures			
	Design	Construction	Upstream Storage	Total
1968–1969	$5,165	$120,396	$ —	$125,561
1969–1970	658,871	105,464	—	764,335
1970–1971	769,659	1,164,383	3,410	1,937,452
1971–1972	592,110	1,214,645	492,531	2,299,286
1972–1973	650,875	1,456,465	295,618	2,402,958
1973–1974	867,542	4,370,870	64,994	5,303,406
1974–1975	1,173,697	8,849,305	92,062	10,115,064
1975–1976	1,280,582	10,368,685	75,732	11,724,999
1976–1977	919,987	9,020,330	32,066	9,972,383
1977–1978	1,101,902	8,606,174	600	9,708,676
1978–1979	882,251	11,053,066	—	11,935,317
1979–1980	734,857	6,618,397	—	7,353,254
1980–1981 (Estimated)	217,054	8,945,047	—	9,162,101
Total Expenditures to March 31/81	9,854,552	71,893,227	1,057,013	82,804,792

Table 4.7

Fraser River Program Project Status

Project	Date of Application	Design Per Cent Completed at Year-end	Est. Cost of Construction During 1979–80 Fiscal Year $	Total Contruction To End of Fiscal Year Amount $	Total Contruction To End of Fiscal Year Per Cent Completed
Kent	Mar. 5, 1969	100	—	2,666,455	100
Pitt Meadows	Mar. 3, 1969	95	1,831,992	5,751,659	85
Richmond	Mar. 3, 1969	99	513,714	15,638,572	92
Matsqui	May 15, 1969	100	—	2,547,337	100
Chilliwack	Aug. 1, 1969	90	—	6,402,817	90
Delta	Aug. 1, 1969	95	264,645	18,446,952	90
Mission	Aug. 4, 1969	98	—	—	—
Abbotsford	Feb. 1969	95	3,933,955	5,857,963	20
Surrey-Dams	May 6, 1969	100	—	1,175,254	100
S. Westminster	May 6, 1969	100	403,021	1,821,945	40
New Westminster	Dec. 10, 1970	100	14,863	3,181,299	100
Coquitlam	Apr. 30, 1970	100	120,381	3,873,352	100
Nicomen Island	Sept. 30, 1974	—	915,458	1,374,417	—
Seabird Island	Oct. 8, 1971	—	—	138,844	—
Vedder River	July 25, 1979	90	727,018	5,009,285	80
Oak Hills	Oct. 28, 1973	100	—	1,051,444	100
Dewdney	Apr. 30, 1973	—	—	9,116	—
Pre-Program Construction			—	211,000	
Administration			220,000	1,848,048	
Totals			8,945,047	72,005,757	

Table 4.8

Groundwater Inventory, 1980

Statistics

Well logs collected	3,001	Water samples collected	61
Well logs located	2,579	Enquiries answered	734
Well logs plotted	1,880		

Activities

Area	Description
Internal	Completion of Second Draft Report on Suggested Guidelines for Minimum Standards in Water Well Construction for British Columbia for the Water Management Branch.
Province-wide	Completion of observation wells at Midway, Galiano Island (Contract 67), Whonnock (Contract 68), Quesnel (Contract 69), Williams Lake (Contract 70) and Denman Island (Contract 72).
Salmon River, Shuswap Lake Basin	Program plans for abandonment of observation wells near Glenemma.
Saanich	A contribution to a report on the effects of irrigation withdrawals on neighbouring residential areas in the Ardmore area for the Inventory and Engineering Branch.
Saanich	Hydrogeological mapping program for the Saanich Peninsula Pilot Project.

Table 4.9

Water Supply Studies—Groundwater

Area	Description
Abbotsford	Completion of production well for Fish and Wildlife Branch and BCBC.
Aldergrove	Assist Public Health Engineering on Construction of monitor wells.
Anmore	Assess groundwater potential for water supply for Water Management Branch.
Armstrong	Review application for proposed waste disposal impact on groundwater for Water Management Branch.
	Assess potential for groundwater development for irrigation for Engineering Section.
Big Eddy	Review consultant's report on test well construction for Water Management Branch.
Cherry Creek	Review data on water withdrawals for Water Management Branch.
Cobble Hill	Assessment in progress on groundwater conditions for Water Management Branch.
Cowichan Bay	Assess salt water intrusion problem in local wells for Cowichan Valley Regional District.
Elko	Review well test for proposed community supply for Water Management Branch.
Ewing Landing	Assess groundwater-surface water relationship for Water Management Branch.
Farleigh Lake	Review groundwater prospects for irrigation potential for Engineering Section.
Fernie	Review potential for well contamination for Public Health Engineering.
	Review data on groundwater level fluctuations for Planning and Surveys Section.
Galiano Island	Preliminary review in progress of groundwater potential for Islands Trust.
Garibaldi	Review prospects for groundwater development for proposed subdivision relocation for Assessment Branch.
Hornby Island	Preliminary review in progress of groundwater potential for Islands Trust.
Invermere	Report on groundwater availability for Water Management Branch.
Kamloops	Assessment of impact of proposed sewage disposal on groundwater for Waste Management Branch.
Kersley-Alexandria	Completion of preliminary report on groundwater availability for Engineering Section.
Killiney Beach	Assess groundwater-surface water relationship for Water Management Branch.
Mission Creek	Assess potential for aquifer recharge for Okanagan Implementation Program.
Myer's Flat	Review groundwater conditions for proposed water level monitoring for Water Management Branch.
Myrtle Point	Review groundwater potential for water supply for Water Management Branch.
Nanoose	Review water quality in subdivision wells for Public Health Engineering.

Table 4.9—*Continued*

Water Supply Studies—Groundwater

Area	Description
Nelson	Provide groundwater advisory assistance on proposed landfill for Waste Management Branch.
Nicola Basin	Internal review of consultant's hydrologic report.
Norbury Lake	Review groundwater potential for irrigation for Engineering Section.
Oliver	Completion of test production wells at B.C. Fruit Growers Test Orchard for Engineering Section.
	Review well tests completed for town wells for Okanagan Implementation Program.
	Assess results of well redevelopment at SOLID No. 2 pump station for Okanagan Implementation Program.
Okanagan-Mission	Review groundwater prospects for irrigation for Engineering Section.
Okanagan River Basin	Review of proposed groundwater program to study sources of nutrient input into Okanagan Valley Lakes for Okanagan Basin Water Board.
Oyama	Report completed on probable relationship between groundwater and lake water for Aquatic Plant Management Program.
Penticton	Provide groundwater advisory assistance for proposed waste disposal for Waste Management Branch.
Prince George	Review water quality from monitor wells at waste disposal site for Waste Management Branch.
Province-wide	Review of 16 well tests submitted in application for "Certificate of Public Convenience and Necessity" for Water Management Branch.
Radium	Report completed on groundwater prospects for Water Management Branch.
Ribbleworth Creek	Internal report completed on result of natural isotope analyses of groundwater.
Ruskin	Assess groundwater availability for water supply for Water Management Branch.
Saanich	Review groundwater potential for irrigation for Engineering Section.
	Report completed on effects of irrigation well pumping for Water Management Branch.
	Internal report on results of isotopic age dating of groundwaters.
Saanich-Elk Lake	Prepare proposal for investigating groundwater components for Engineering Section.
Salmon River	Review groundwater conditions relative to proposed sewage disposal for Waste Management Branch.
Saturna Island	Preliminary review in progress on groundwater conditions for Islands Trust.
Scott Point	Review consultant's report on groundwater prospects for Water Management Branch.
Shelter Cove	Assess groundwater potential for water supply for Water Management Branch.
Shannon Lake	Assess groundwater-surface water relationship for Water Management Branch.

Table 4.9—*Continued*

Water Supply Studies—Groundwater

Area	Description
Skookumchuck	Advisory assistance on groundwater regarding rapid infiltration project for Waste Management Branch.
Sumas Prairie	Preparation of program for drilling of observation wells for Engineering Section.
Thompson River Basin	Completion of report on groundwater component for Thompson River Basin Pre-Planning Committee.
Tofino-Ucluelet	Review of groundwater proposals and investigations for water supply for Water Management Branch.
Tumbler Ridge	Provide comments on future aquifer development for Ministry of Municipal Affairs.
West Penticton	Review in progress on groundwater prospects for irrigation for Engineering Section.
Wood Lake	Review of alternative water supply following use of herbicide treatment of lake water for Aquatic Plant Management Program.
Yale	Complete assessment of groundwater potential for Water Management Branch.
Yarrow	Completion of report (Contract No. 66) on Well drilling for Rivers Section.

Table 4.10

Water Supply Studies—Surface Water

1. *Water Supply*

Kelowna Creek	Estimates of dependable water supply for Glenmore and Ellison Irrigation Districts were completed. Final report in preparation.
Tofino	Further work on determining minimum expected streamflow on Meares Island were completed in connection with water supply feasibility studies for Tofino and area.
Trout Creek	Estimated water yields were used to assess the feasibility of increasing reservoir storage based on a simulated 1,000 years of operation under various water use demand work.
Elk-Beaver Lake	Inflow and runoff estimates were made and water availability determined for various drought conditions and water use demands.
Shingle Creek	Estimates of required storage capacity were determined for alternate drought conditions for a proposed irrigation project. Alternative irrigation capacity proposals were assessed.
Bowen Island	Streamflow monitoring continued for making estimates of annual and monthly runoff at a number of potential reservoir sites in connection with water supply design.
Danish Lake	Potential water yield was estimated for a proposed irrigation scheme.
East Vancouver Island	Streamflow characteristics were estimated for a number of watersheds in connection with a coastal planning project.

2. *Flood Flows*

Peak Flow Regionlization	Flood flow frequency analyses are being updated to 1979 in metric units. Further information was added by analysis, instantaneous flows and timing of annual peak flows. Peak flow for 30 ungauged streams was estimated for the design of stream crossing structures and bank protection works.
Dec. 1980 Storm Runoff	A study of the magnitude and extent of flood flows occurring on December 26–27, 1980 was commenced.
White Lake	Extreme lake level and outflow was estimated to resolve conflicts between water use and lakeshore activities.
Horse Lake	A detailed analysis of Extreme inflow and lake level conditions were analysed to assess the impact of a proposed outlet control structure.
Lower Fraser Valley	Return period peak flows for 37 streams were estimated for assessment of proposed fishery enhancement projects.
Oberlander Slide	Storm rainfall and runoff was analysed to determine design flows for bank stabilization works in a small urban watershed.
Colquitz River	This cooperative study with the District of Saanich continues. Peak flood flows will be estimated and used for floodplain mapping and storm drainage management studies.
Lugrin Creek	Streamflow monitoring continued to provide data on flood flows for floodplain mapping and storm drainage management.

3. *Environmental Impact*

Foothills (North B.C.) Pipeline	Studies of regional runoff, peak flow, low flow and snowpack continue along the proposed northern pipeline corridor, in addition to monitoring of streamflow and snowpack.

Table 4.10—*Continued*

Water Supply Studies—Surface Water

Trout Creek	Quantitative assessments were made of the potential impact of salvage logging on water supply due to mountain pine beetle attack.
Community Water Supply Watersheds	Timber harvesting proposals were assessed for a number of watersheds (Vernon Creek, Sutherland Creek, Creston area, Bridge River, Milkranch Creek). These watersheds are used for water supply and recommendations were made in order to reduce the detrimental impact on water quantity and quality.

Table 4.11

Water Supply Studies—Engineering

Area	Description	% Complete to Mar. 31/81
A. Undertaken by Inventory and Engineering Branch		
Glenmore	Report on feasibility of providing additional water supplies for Glenmore Irrigation District.	100
Passmore	Study on alternative irrigation scheme for group of landowners in Passmore.	100
Penticton	Report on proposed irrigation scheme for Penticton Indian Band.	100
Kelowna	Report on irrigation scheme for Benvoulin Water Users Community.	100
Saanich	Study on providing irrigation supplies for ALR lands in Saanich Peninsula.	65
Kersley-Marguerite	Studies of proposed irrigation schemes for groups of farmers.	90
Lillooet	Report on development of irrigation water supply for group of landowners on Laluwissin and McGillivray Creeks.	90
Quesnel	Report on proposed irrigation scheme for group of farmers near Gravelle Ferry.	100
Fort Steele	Report on development of irrigation supplies for group of farmers.	100
Cranbrook	Report on irrigation storage development for group of farmers on HaHa Creek.	5
Penticton	Report on increased storage development on Farleigh Lake.	100
Okanagan Falls	Report on water supply rehabilitation for Skaha Estates Improvement District.	100
Naramata	Report on development of additional storage supply for Naramata Irrigation District.	90
Tahsis	Preliminary report on upgrading water supply system for the Village of Tahsis.	100
B. Undertaken by Consultants		
Monte Lake	Report on irrigation storage feasibility for group of farmers at Paxton Lake.	100
Westbank	Irrigation feasibility study for group of landowners at McDougall Creek.	100

Table 4.11—*Continued*

Water Supply Studies—Engineering

Area	Description	% Complete to Mar. 31/81
Merritt	Report on irrigation storage feasibility on Lauder Creek for group of farmers.	100
Enderby	Irrigation feasibility study for group of farmers at Trinity Valley.	100
Grand Forks	Irrigation feasibility study for group of farmers at Granby River.	100
Kamloops	Report on irrigation storage feasibility for group of ranchers at Logan Lake.	100
	Report on feasibility of irrigation scheme for group of farmers at Darfield.	100
Williams Lake	Irrigation storage feasibility study for group of ranchers at Spokin Lake.	100
Creston	Irrigation feasibility study for group of farmers near Rykerts.	100
Barriere	Irrigation storage feasibility study for group of ranchers on Dixon Creek.	100
Salmon Arm	Irrigation feasibility study for group of farmers at Tappen Valley.	100
Grasmere	Irrigation feasibility study for group of farmers at Grasmere.	100
Kamloops	Report on feasibility of irrigation scheme for group of farmers south of Darfield.	100
Armstrong	Report on feasibility of irrigation study for group of landowners at Grandview Flats.	100
Vernon	Report on feasibility of additional irrigation supplies for Vernon Irrigation District and adjacent areas.	100
Cranbrook	Report on feasibility of irrigation scheme for group of ranchers at Mayook, including investigation into possible supply from City of Cranbrook effluent irrigation project.	90
Kelowna	Inventory of lands within the South East Kelowna Irrigation District which could obtain irrigation supply from City of Kelowna effluent irrigation project.	100
Kamloops	Report on proposed irrigation development for North Thompson Indian Reserve No. 1.	100
Pitt Meadows	Report on feasibility of water supply project for Pitt Meadows and Pitt Polder.	95
Kamloops	Report on feasibility of irrigation scheme for group of farmers at Cherry Creek, including investigation into possible supply from City of Kamloops effluent disposal project.	100
C. Requests for Studies under Investigation or Awaiting Assignment to Consultants		
Ashcroft	Proposals were received for engineering and economic studies of a proposed irrigation scheme on Oregon Jack Creek.	
Kelowna	Proposals were received for engineering and economic analysis of a proposed irrigation scheme to supply effluent from City of Kelowna to S.E. Kelowna I.D.	
Williams Lake	A proposal was received for a study on a proposed Moffat Creek-San Jose-Chimney Creek diversion for the Cariboo Regional District.	

Table 4.11—*Continued*
Water Supply Studies—Engineering

Area	Description
Armstrong	A request from the Township of Spallumcheen for an irrigation study was reviewed.
Vernon	A request was received from a group of farmers north of Swan Lake for a study of an irrigation system.
Nelson	Preliminary data was gathered on a request for ARDSA assistance from Whitehead Waterworks District.
Kamloops	A request was received from a group of farmers at Knutsford for a study of a proposed irrigation scheme.
	A request was received from the Upper Louis Creek Stock Association for a study of proposed storage development on Eileen Lake.
Merritt	ARDSA assistance for drainage and irrigation improvements for five Indian Bands in the Nicola area was requested.
Summerland	The Meadow Valley Irrigation District requested assistance for a proposed irrigation storage development.
Kamloops	A request was received for assistance in constructing an irrigation system for a group of farmers east of Kamloops.

Table 4.12
Status of Water Supply Construction Projects

Project Description	ARDSA Project No.	Design	Construction		
		% Complete as of Mar. 31/81	During Period Jan. 1/80–Mar. 31/81	to Mar. 31/81	% Complete as of Mar. 31/81
McKinney Road W.U.C. Irrigation System	271106	90	218,376	172,824	65
Farleigh Lake Irrigation System 271003	100 Sub. 2	—	—	100	
Big Bar Ranches Irrigation Scheme	271009	100	158,535	158,535	90
St. Mary's Prairie I.D. Irrigation Scheme	271108	100	425,654	425,654	100
Basque Irrigation District Irrigation Scheme	271113	100	147,892	147,892	100
O'Connor Lake Dam Irrigation Storage Works	271112	100	133,868	133,868	90
Chase Irrigation District Irrigation Storage Works	271116	100	39,277	39,277	75
Heffley Irrigation District—Irrigation Storage Works	271117	100	40,058	40,058	80
Paxton Lake Dam Irrigation Storage Works	271115	100	15,994	15,994	90
District of Abbotsford Water Supply System	271297	25	—	—	10
B.C. Fruit Growers Ass'n—Oliver Test Orchard	271301	100	86,000	86,000	75

Table 4.17

Okanagan Basin Implementation Agreement Water Quantity Programs 1980 Work Summary

Federal-Provincial Cost-Shared Programs

Program	Program Objectives	Work Completed
I Okanagan, Skaha and Vaseux Lake Control Dams	To bring dams up to a satisfactory standard, to reduce operational costs and to alleviate winter icing problems.	• Contract No. 7 for electrical repairs to Skaha and Vaseux Dams. • Contract for painting Skaha Lake Dam metal work and replacing rubber gate seals. • Painting and installation of security fence on Vaseux Lake Dam. • Contract No. 9 for installation of security fence and painting Okanagan Lake Dam.
II Okanagan River Channel	To bring the Okanagan Flood Control Works up to a satisfactory standard and to improve flood control operations by increasing drainage capacity.	• Contracts 6, 8 and 10 for the construction of headwalls, trash racks and gates on 17 outlet culverts. • Construction of Operations Centre in Oliver. • Awarded Contract 11 for the replacement of a further 7 vertical drop structure walkways. • Installed new inlet culvert and constructed ditch system at lower elevation on an oxbow system. • Constructed 1,000′ of drainage ditch. • Assessment of right-of-way fencing and began repair of fencing at selected areas.
III Okanagan River Intake	To modify water intakes on Okanagan River to permit operation at flows of 100 cfs plus consumption and evaporation losses. This measure is necessary to conserve water and reduce operational costs.	• Phases II and III of intake modification program which included modification to 7 pumphouse installations and dredging of 11 oxbows. • Drilling of test wells, drilled 2 production wells and commenced construction of pumphouses for Village of Oliver. • Redevelopment of SOLID wells which was not completed successfully; conducted pump test on well system.
IV Okanagan Lake Floating Bridge	To prepare contingency plans and costs for adjustments to the Kelowna floating bridge to permit operation within the extreme range of lake levels forecast in the Okanagan Basin Study reports of 1974 (1,116.8 to 1,125.5).	Task completed in September 1979.

Table 4.17—*Continued*

Okanagan Basin Implementation Agreement Water Quantity Programs
1980 Work Summary

Federal-Provincial Cost-Shared Programs

Program	Program Objectives	Work Completed
V Tributary Water Management Studies	To prepare water management plans so that major conflicts in water use between irrigation and fishery requirements can be avoided in Mission, Equesis and Trepanier Creeks.	• Runoff estimates and water supply calculations for mainstem Mission Creek basin and Powers Creek; reports in preparation. • Two groundwater test-production wells in the Kelowna area; both were successful and will be put into production. • A new stream gauge was installed on Mission Creek below the BMID intake to assess operational efficiency and monitor releases for downstream users.
VIII Review of Framework Plan		• Field work and office calculations on survey of Okanagan River channel. • Field work, office calculations and drafting on survey of Mission and Powers Creeks. • Conducted low flow test on Okanagan River.

Table 4.18

Support Services—Drafting Production—January 1, 1980 to March 31, 1981

Section	Drawings 22″ × 34″ or Larger				Drawings Under 22″ × 24″				Total No. Completed Drawings	Total No. of Total Drawings	Per Cent Completed
	Assigned To Draftsman	Originals	Additions or Revisions	Completed	Assigned to Draftsman	Originals	Additions or Revisions	Completed Assigned			
Surveys	391	233	158	333	9	9	—	9	400	342	31.7
Rivers	162	149	13	161	106	100	6	106	268	267	24.7
Water supply	89	88	1	89	56	43	13	56	145	145	13.4
Surface water	12	—	12	12	75	74	1	75	87	87	8.0
Planning	83	83	—	56	—	—	—	—	83	56	5.2
Okanagan Basin Implementation Agreement	66	27	39	64	—	—	—	—	66	64	5.9
Aquatic plant maps	20	16	4	20	32	9	23	32	52	52	4.8
Environmental studies	3	3	—	1	3	3	—	3	6	4	0.4
Groundwater	1	1	—	—	20	11	9	16	21	16	1.5
Miscellaneous	—	—	—	—	47	47	—	47	47	47	4.4
Totals	827	600	227	725	348	296	52	344	1,175	1,080	100.0

Total assigned drawings to draftsman	1,175
Total completed drawings	1,080
Balance of drawings not completed	95
Per cent of total assigned drawings not completed	8.1

To produce six issues of the 1980 Snow Bulletin, three issues of the 1981 Snow Bulletin, and maps for the five Year Snow Summary publication, five new sheets and 504 revised sheets were required.

Table 4.19
Environmental Assessment Report Review

1. *Coal Projects*

Northeast B.C.:
- Quintette (Denison) ..... Stage II
- Burnt River (Teck) ..... Stage I
- Cinnibar Peak (Cinnibar) ..... Prospectus
- Monkman (Petro-Can) ..... Stage II
- Sukunka (British Petroleum) ..... Stage II
- Regional Hydrology of the Northeast Coal Study Area.
- Northeast B.C. Resource Management Framework Report.

Southeast B.C.:
- Greenhills (Kaiser) ..... Stage I, II
- Sage Creek (Rio Algom) ..... Stage II
- Line Creek (Crowsnest Industries)

Vancouver Island:
- Quinsam (Quinsam) ..... Stage II
- Cedar (Westland) ..... Exploration

Other:
- Bowron River (Norco) ..... Stage I
- Amendments to Guidelines for Coal Development.

2. *Metal Mines*

- Consolidated-Cinola ..... Stage I
- Valley Copper (Valley Copper) ..... Stage I, II
- Kutcho Creek (Esso Minerals) ..... Stage I
- Baker (Du Pont) ..... Stage I
- Scottie (Scottie Gold) ..... Stage I
- Ladner Creek (Carolin) ..... Stage I
- Adanac (Placer Development) ..... Stage I
- Taurus (United Hearne) ..... Stage I
- Brussilof (Baymag) ..... Stage I

3. *Linear Development*

- Chetwynd South Railway ..... Stage II
- Anzac-Quintette Railway ..... Stage II
- Kelly Lake-Nicola Transmission Line ..... Stage II
- Cheekeye-Dunsmuir Transmission Line ..... Stage II
- Shrum G.S.-Monkman Transmission Line ..... Stage II

4. *Major Development*

Information was provided to ELUCS on surface water and groundwater quantity and quality to assist in preparing the Guidelines for Major Development.

5. *Power Development*

Murphy Creek

6. *Coastal Development*

Tsehum Harbour-Canoe Bay (North Saanich, Van Isle and Canoe Cove Marina).

Terrestrial Studies Branch

Soil Laboratory Report

The soils laboratory made 50,595 chemical and physical analyses during the period January 1, 1980 to March 31, 1981. Tables 5.1 and 5.2 attached provide a breakdown, by project, of the laboratory services provided this year, and give a comparative overall summary of laboratory performance.

Table 5.1—(Complete)

Laboratory Report, January 1, 1980 to March 31, 1981

Forestry Research			Chemical	Physical
Gold River	Klinka	1980/1-581	6,355	368
Lake Cowichan	Nuszdorfer	1929-1981	—	—
Red Rock Nursery	McCleod	582-1129	7,400	288
Cariboo	Art Yee	1130-1198	550	64
		1741-1655	133	16
Smithers	Trowbridge	199-1502	4,815	192
	Awmack	1503-1640	—	—
Cariboo	B. Coupe	1656-1741	753	26
	S. Smith	1742-1823	829	68
	R. Coupe	1824-1879	465	18
	D. Monchak	1880-1928	388	14
		4094-4105	132	—
Kamloops	W. Erickson	1982-2175	603	34
Nelson Priority 1	Utzig/Still	2176-2652	1,844	216
2		2653-3070	1,601	120
3		3071-3680	2,822	126
4		3681-3809	616	73
5		3810-3963	939	80
Red Rock Nursery	McCleod	3964-4093	1,573	—
			31,818	1,703
T.S.B. General Program				
Hesquiat Harbour	Maxwell	4200-4221	506	48
Okanagan	Wittneben	4222-4271	568	90
Cascade	Vold	4272-4300	331	87
Cranbrook City	Ted Tatem	4301-4312	216	—
Cascade	Vold	4313-4355	430	176
B.C. Agricultural Land Commission	Brian French	4356-4374	266	38
Cummins River	Hignett	4375-4419	540	126
Delkatla	Vold	4420-4473	332	—
Vancouver Island	Jungen	4474-4655	2,107	923
Saltspring Island	Thompson	4656-4704	241	931
Okanagan	Wittneben	4705-4825	1,194	274
Nadina R.	Maxwell/Hinkley	4826-4846	336	—
Vancouver Island	Christie	4847-4990	1,206	277
			40,091	4,673

Table 5.1—(Complete)—*Continued*

Laboratory Report, January 1, 1980 to March 31, 1981

Surface Samples

Davis, Nagpal, Hinkley, Ovanin, Jungen, Vold, Fenger, Epp, Kowall	80G/1-245	1,405	437
Horse Ranch, Okanagan, Vaseaux	246-275	403	54
Vancouver Island	276-282	2	10
Graystokes, Vancouver Island	287-314	13	93
Inventory & Engineering Blaine Simpson	315-325	44	22
		41,958	5,289

Stein R. Project	June Ryder	Carried forward to 1981 1980/4106-4185	

Request for 1980	47,247
Analyses brought forward from 1979	3,385
	50,632

Table 5.2 (In Progress)

Laboratory Report, January 1, 1980 to March 31, 1981

Ministry of Forests			Chemical	Physical	Completion Percentage
Sayward Forest	R. Liard	1981/1– 281	3,534	284	88
Port Hardy		279– 281	39	2	88
Woss Lake		282– 468	2,409	138	84
Knight Inlet	Nuszdorfer	469– 618	1,915	116	85
Toba Inlet		619– 779	1,972	110	85
Red Rock Nursery	Wayne Blashill	780– 919	495	—	100
	A. J. McLeod	920–1129	2,571	104	87
Valemont	Graeme Hope	1130–1278	2,028	—	3–5
		1279–1407	1,515	88	3–5
	McGregor	1408–1490	1,105	—	3–5
		1491–1620	1,151	—	3–5
		1621–1736	1,475	106	3–5
Cariboo	Chris Easthope	2759–2784	404	18	3–5
Prince Rupert	Ken Awmack	2785–3079	2,741	24	3–5
Nelson 1	Still/Quesnel	1737–2347	2,527	182	3–5
2		2348–2526	915	38	3–5
3		2527–2717	1,009	44	3–5
4		2718–2745	111	8	3–5
			28,286	1,262	
T.S.B. General Inventory Program					
Stein R.	June Ryder	1980/4106–4185		1,200	95
Total requests for 1980 (calendar year)			48,447		
Analyses brought forward from 1979 (calendar year)			3,385	51,832	
Analyses carried forward to 1981 (calendar year)				1,200	
Analyses completed in calendar year 1980				50,632	

Summary of Laboratory Performance

	1977	1978	1979	1980
Technician months	88	91	101	114.5
Analyses completed per technician month	341	423	522	442

Fish and Wildlife Branch

Table 6.1

Harvested Animals Checked

Year	Days of Stations Operation	Number of Checked Hunters	Moose	Deer	Other Big Game	Grouse	Ducks	Geese
1980	60	13,731	2,893	1,138	336	8,890	2,025	210
1979	62	15,230	3,114	1,165	317	21,173	2,156	207
1978	58	12,625	2,922	603	432	22,701	2,798	262
1977	73	13,243	3,287	662	419	16,429	2,491	205
1976	72	11,888	3,305	393	364	9,992	1,733	159
1975	75	13,848	4,546	405	486	11,769	2,623	228
1974	78	15,519	4,435	482	481	5,553	2,938	236

Table 6.2

Estimates of Resident Hunter Harvest 1974–1979

Year	Hunting Licence Sales*	Deer	Moose	Elk	Goat	Sheep
1974	135,515	36,700	11,739	603	487	137
1975	143,652	28,977	13,383	1,041	623	193
1976	139,510	22,018	10,898	760	498	162
1977	144,447	23,771	12,826	1,278	579	251
1978	155,605	28,550	12,688	1,273	461	235
1979	163,088	29,965	13,045	1,471	366	188

Year	Grizzly Bear	Black Bear	Caribou	Cougar	Grouse	Ducks
1974	144	2,182	531	294	420,166	261,479
1975	149	2,443	501	196	†	†
1976	158	3,203	405	148	385,000	244,000
1977	165	3,453	386	116	278,203	149,540
1978	124	3,076	143	174	485,781	181,205
1979	148	2,731	148	129	478,579	160,307

* Resident hunting licence sales.
† Data not available.

Table 6.3

Compulsory Inspection Results from Harvest Reports by Resident and Non-resident Hunters

Species	Hunting Season 1977/78	1978/79	1979/80	1980/81
Caribou	*	334	348	340
Cougar	142	212	150	106
Grizzly Bear	282	314	337	390
Mountain Goat	789	861	799	794
Rocky Mountain Bighorn Sheep	32	44	37	41
California Bighorn Sheep	51	55	49	49
Dall Sheep	14	15	10	14
Stone Sheep	422	369	370	335
Total	1,732	2,204	2,100	2,069

* Caribou was not designated for compulsory inspection prior to 1978/79 season.

Table 6.4

General Results of the Limited Entry Hunting Season 1980/81

Species	Applications for Licence	Licences Issued	Reported Harvest
Caribou	169	65	14
Elk	6,941	381	149
Grizzly Bear	131	33	1
Moose	2,582	1,470	227
Goat	2,294	399	85
Sheep	917	60	10
Deer	867	550	84

Table 6.5

Summary of Guided Hunter Activity in the 1980/81 Hunting Season

Region	Number of Active Guide Outfitters	Number of Active Assistants	Number of Resident Hunters	Number of Non-resident Alien Hunters	Number of Non-resident Canadian Hunters	Moose	Goat	Caribou	Deer	Sheep	Grizzly Bear	Black Bear	Elk	Cougar	Coyote	Wolf
1	6	9	4	67	2	—	3	—	1	—	2	65	1	1	—	—
2	1	1	—	3	—	—	—	—	—	—	—	2	—	—	—	—
3	11	25	6	117	1	21	1	—	13	4	—	21	—	—	1	—
4	35	121	1	463	37	12	20	—	65	11	4	105	129	5	1	—
5	76	147	29	905	—	88	22	8	42	6	13	69	—	—	1	—
6	54	206	15	876	24	409	164	128	36	71	79	123	—	—	—	14
7	83	319	26	1,399	33	729	156	73	3	141	94	176	110	—	—	18
8	8	27	6	130	6	—	1	—	38	2	2	66	—	13	1	—
Totals	274	855	87	3,960	103	1,559	367	209	198	235	194	627	240	19	4	32

Table 6.6

Composition of the 1979/80 British Columbia Wild Fur Harvest

Fur Type	Number of Pelts	Per Cent or Total Fur Harvest	Average Value	Total Value
			$	$
Beaver	24,309	8.0	39.17	952.184
Muskrat	35,540	11.7	6.30	223,902
Mink	7,686	2.5	34.49	265,090
Otter	939	0.3	61.33	57,589
Coyote	4,691	1.5	60.83	285,354
Fox	634	0.2	63.29	40,126
Wolf	268	0.1	107.35	28,770
Weasel	9,139	3.0	1.98	18,095
Wolverine	283	0.1	166.33	47,071
Skunk	38	tr	5.61	213
Fisher	570	0.2	148.31	84,537
Marten	32,732	10.8	31.96	1,046,115
Lynx	2,848	0.9	214.29	610,298
Bobcat	140	0.1	207.01	28,981
Squirrel	183,110	60.2	1.47	269.172
Raccoon	1,179	0.4	29.72	35,040
Subtotals	304,106	100.0	—	3,992,537
Other Products and Pelts:				
Black Bear	480	12.9	62.88	30,182
Grizzly Bear	21	0.6	475.00	9,975
Cougar	16	0.4	180.00	2,880
Castoreum and Miscellaneous	3,196	86.1	—	61,551
Subtotals	3,713	100.0	—	104,588
Totals	307,819	—	—	4,097,125

Table 6.7

Number of Annual Graduates from the Trapper Education Program from Inception

Year	Number of Students
1976/77	564
1977/78	756
1978/79	397
1979/80	398
1980/81	480
Total	2,595

Table 6.8

Number of Steelhead Licences Issued and Estimates of Total Anglers, Successful Anglers, Total Steelhead Catch and Number of Angler Days 1974/75 to 1979/80

Year	Licencees	Estimated Anglers	Estimated Successful	Estimated		Estimated Total Angler Days
				Kept	Released	
1974/75	24,399	16,469	7,296	27,807	23,845	196,751
1975/76	29,594	20,265	8,770	31,490	26,546	219,797
1976/77	25,539	18,356	6,998	20,168	20,450	186,381
1977/78	25,406	17,143	7,038	18,154	27,047	174,721
1978/79	24,600	15,788	6,746	14,725	24,748	159,363
1979/80	29,095	14,755	6,384	12,663	26,906	134,569

Table 6.9

Number of Eggs Collected by Each Hatchery

Species	Kootenay	Summerland	Fraser Valley	Loon	Vancouver Island
Rainbow (wild)	2,918,900	3,360,000	—	955,365	—
Rainbow (domestic)	229,000*	—	312,000	—	—
Cutthroat (yellowstone)	176,000	—	—	—	—
Cutthroat (coastal lake)	—	—	115,000	—	—
Cutthroat (anadromous)	—	—	78,600	—	119,396
Brook	—	1,331,500	—	—	—
Brown	—	—	9,960	—	—
Kokanee	880,495	—	—	—	—
Chinook salmon	—	—	—	50,100	—
Dolly Varden	84,000	—	—	—	—
Steelhead	—	—	457,000	85,000	237,695
	4,288,395	4,691,500	972,560	1,090,465	357,091

* Duncan brood stock

Table 6.10

Number and Weight of Fish Liberated from Each Hatchery
(Total kg in Brackets)

Species	Kootenay	Summerland	Fraser Valley	Loon Creek*
Rainbow (native)	875,000	1,470,000	81,000	2,484,000
	(4,514)	(9,317)	(1,163)	(9,800)
Rainbow (domestic)	12,600	—	199,435	—
	(2,740)	—	(20,165)	—
Brook	95,500	215,500	2,000	747,240
	(406)	(1,163)	(10)	(2,294)
Cutthroat (yellowstone)	113,500	—	—	—
	(13)	—	—	—
Cutthroat (coastal)	—	—	75,198	—
	—	—	(3,225)	—
Brown	—	—	17,115	—
	—	—	(6)	—
Kokanee	250,000	—	—	—
	(eggs)	—	—	—
Steelhead	—	—	172,133	—
	—	—	(4,494)	—
Cutthroat (anadromous)	—	—	61,691†	—
	—	—	(3,743)	—
	1,346,600	1,685,500	608,572	3,231,240
	(7,673)	(10,480)	(32,806)	(12,094)
	113 lakes, 2 rivers	230 lakes, 1 river	79 lakes, 27 streams	185 lakes

* Fish reared at Kootenay and Summerland.
† Of this total, 41,566 (2,211) reared on Vancouver Island.

Table 6.11

Gross Revenue by Major Activity

	1978/79	1979/80	1980/81
Hunting	$3,639,694 (59%)	$3,953,330 (60%)	$4,055,784 (59%)
Angling	2,279,620 (37%)	2,451,112 (37%)	2,514,011 (37%)
Other*	228,827 (4%)	237,511 (3%)	261,050 (4%)
Totals	$6,148,141	$6,641,953	$6,830,845

* *See* Table 6.15.

Table 6.12

Gross Revenue from Resident and Non-resident Hunting and Angling Licence Sales

	1978/79	1979/80	1980/81
Resident Hunting	$2,365,518 (61%)	$2,529,029 (61%)	$2,684,534 (62%)
Resident Angling	1,523,204 (39%)	1,625,753 (39%)	1,656,221 (38%)
Totals	3,888,722	4,154,782	4,340,755
Non-resident Hunting	1,209,712 (61%)	1,362,969 (62%)	1,306,708 (60%)
Non-resident Angling	754,739 (39%)	823,587 (38%)	856,002 (40%)
Totals	1,964,451	2,186,556	2,162,710
Special/Firearms and Duplicate Hunting	64,464 (97%)	61,332 (97%)	64,542 (97%)
Duplicate Angling	1,677 (3%)	1,772 (3%)	1,788 (3%)
Totals	66,141	63,104	66,330
Grand Totals	$5,919,314	$6,404,442	$6,569,795

Table 6.13

Resident Hunting Licence Sales

	1978/79		1979/80		1980/81	
	Number	Value	Number	Value	Number	Value
B.C. Resident	147,294	$1,031,058	153,327	$1,073,289	158,033	$1,106,231
Senior Citizen	8,311	8,311	9,150	9,150	9,844	9,844
Black Bear	15,231	60,924	18,234	72,936	21,818	87,272
Caribou	1,692	16,920	1,551	15,510	1,385	13,850
Cougar	579	5,790	580	5,800	478	4,780
Deer	117,586	470,344	126,641	506,564	132,974	531,896
Elk	10,499	104,990	11,563	115,630	13,925	139,250
Grizzly Bear	1,263	44,205	1,469	51,415	1,809	63,315
Moose	54,681	546,810	59,357	593,570	62,448	624,480
Mountain Goat	2,096	31,440	1,988	29,820	2,048	30,720
Mountain Sheep	1,469	36,725	1,611	40,275	1,703	42,575
Limited Entry Cards	5,373	8,001	1,343	6,715	5	5
Limited Entry Cards	—	—	8,355	8,355	15,158	30,316
Total Licences	366,074	$2,365,518	395,169	$2,529,029	421,628	$2,684,534

Table 6.14
Non-resident Hunting Licence Sales

	1978/79		1979/80		1980/81	
	Number	Value	Number	Value	Number	Value
Non-resident	3,878	$ 290,850	4,405	$ 330,375	4,122	$ 309,150
Canadian Resident (non-B.C.)	591	4,137	752	5,264	774	5,418
Non-resident game bird	328	8,200	411	10,275	462	11,550
Black Bear	1,258	50,320	1,597	63,880	1,891	75,640
Caribou	602	60,200	655	65,500	498	49,800
Cougar	55	5,500	76	7,600	62	6,200
Deer	623	31,150	771	38,550	835	41,750
Elk	528	52,800	616	61,600	664	66,400
Grizzly Bear	617	185,100	728	218,400	778	233,400
Moose	2,872	287,200	3,270	327,000	2,924	292,400
Mountain Goat	802	80,200	844	84,400	682	68,200
Mountain Sheep	486	121,500	437	109,250	418	104,500
Wolf	433	32,475	545	40,875	564	42,300
Totals	13,073	$1,209,632	15,107	$1,362,969	14,674	$1,306,708

Table 6.15
Special Hunting and Firearms Licence Sales

	1978/79		1979/80		1980/81	
	Number	Value	Number	Value	Number	Value
Firearms	22,040	$22,040	18,902	$18,902	18,348	$18,348
Bow Hunting	1,633	4,989	2,022	6,066	2,483	7,449
Fraser (Valley)	6,623	33,115	6,398	31,990	6,723	33,615
Creston (Pheasant)	115	1,150	99	990	107	1,070
Duplicates	—	—	1,692	3,384	2,030	4,060
Totals	30,411	$61,294	29,113	$61,332	29,691	$64,542

Table 6.16
Resident Angling Licence Sales

	1978/79		1979/80		1980/81	
	Number	Value	Number	Value	Number	Value
B.C. Resident	286,220	$1,431,100	306,014	$1,530,070	313,687	$1,568,435
Senior Citizen	23,827	23,827	26,293	26,293	27,423	27,423
Steelhead	22,759	68,277	23,130	69,390	20,121	60,363
Totals	332,806	$1,523,204	355,437	$1,625,753	361,231	$1,656,221

Table 6.18

Other Revenue (Sources Other Than Hunting or Angling)

	1978/79		1979/80		1980/81	
	Number	Value	Number	Value	Number	Value
Resident	2,976	$14,880	3,200	$ 16,000	3,178	$ 15,890
Guides	1,419	22,405	1,591	23,605	1,616	23,220
Fur Traders Licence	64	2,200	80	2,450	75	2,325
Royalty on Furs	—	45,462	—	55,337	—	81,092.50
Fines Imposed Under *Wildlife Act* and *Firearms Act*	—	124,698	—	121,884	—	121,000*
Duplicates	12	24	—	—	16	32
Miscellaneous	—	19,158	—	18,235	—	17,490.50
Totals	4,471	$228,827	4,871	$237,511	4,810	$261,050

* Estimate only.

Table 6.17

Non-resident Angling Licence Sales

	1978/79		1979/80		1980/81	
	Number	Value	Number	Value	Number	Value
Canadian Resident (non-B.C.)	44,387	$221,935	51,177	$255,885	56,507	$282,535
Non-resident (annual)	19,646	294,690	21,464	321,960	21,964	329,460
Non-resident (three-day)	28,669	172,014	30,037	180,222	30,692	184,152
Steelhead	2,010	20,100	2,129	21,290	2,180	21,800
Special Lakes	1,175	17,625	957	14,355	587	8,805
Special Rivers	1,135	28,375	1,195	29,875	1,170	29,250
Totals	97,022	$754,739	106,959	$823,587	113,100	$856,002

Marine Resources Branch

Table 7.1

Number of Licences and Permits and Associated Revenue for Fiscal Years 1975 to 1980.*

	1975		1976		1977		1978		1979		1980	
	Number	Revenue	Number	Revenue	Number	Revenue	Number	Revenue	Number	Revenue	Number	Revenue
Salmon cannery	18	$7,200	21	$8,400	21	$8,400	19	$7,600	22	$8,800	18	$7,200
Salmon brine-curing	—	—	—	—	—	—	1	25	3	75	8	200
Salmon dry-saltery	—	—	1	25	1	25	15	375	18	450	19	475
Tierced salmon	3	300	3	300	3	300	3	300	2	200	1	100
Herring cannery	1	25	—	—	—	—	2	50	2	50	2	50
Herring dry-saltery	—	—	1	25	1	25	5	125	7	175	14	350
Pickled herring	3	75	3	75	4	100	7	175	9	225	13	325
Herring reduction	7	2,800	6	2,400	8	3,200	9	3,600	8	3,200	4	1,600
Sport-caught fish cannery	4	100	1	100	5	125	5	125	4	100	4	100
Shellfish cannery	5	500	3	300	5	500	7	700	8	800	8	800
Tuna cannery	1	100	1	100	1	100	2	200	2	200	2	200
Dogfish reduction	2	100	2	100	—	—	—	—	—	—	—	—
Fish-offal reduction	7	350	7	350	8	400	8	400	9	450	7	350
Fish cold storage	51	6,525	58	7,575	58	7,575	70	8,800	80	9,875	92	8,425
Fish processing	122	8,780	141	10,490	140	10,485	173	12,885	177	14,700	179	13,815
Subtotals	224	26,855	251	30,240	255	81,235	326	35,360	351	39,300	371	33,990
Fish-buyers' licences	365	18,250	345	17,250	465	23,250	660	33,100	651	32,600	672	33,600
Oyster picking permits	117	1,170	128	1,280	89	890	86	860	65	650	62	620
Aquatic plant harvesting permits	1	50	10	500	3	150	2	100	20	1,000	30	1,500
Aquatic plant processing permits	2	400	1	200	—	—	—	—	1	200	1	200
Totals	709	$46,725	735	$49,470	812	$55,525	1,074	$69,420	1,088	$3,750	1,136	$69,910

* Fiscal year covers the period April 1 to March 31.

Table 7.2

Total Production and Value from British Columbia Fisheries 1970–1980

Year	Landings Tonnes	Landed Value ($'000)	Wholesale Value ($'000)
1970	132,884	60,255	123,280
1971	103,978	58,588	120,089
1972	153,412	75,128	159,132
1973	176,715	130,409	284,997
1974	135,343	100,976	220,452
1975	135,110	79,681	167,018
1976	174,492	141,851	297,621
1977	198,391	167,905	362,556
1978	193,269	250,565	517,501
1979	149,204	332,473	698,789
1980	124,455	182,281	257,000 (estimated)

NOTE: Prior to 1979 these figures are based on a January 1 to December 31 period for each year.

Table 7.3

Salmon Landings by Species 1975–1980 in tonnes

Species	Year					
	1975	1976	1977	1978	1979	1980
Spring	7,289	7,776	7,522	7,887	6,088	5,750
Sockeye	5,681	12,339	17,388	22,321	14,347	7,707
Coho	7,737	9,322	9,857	9,152	9,140	7,989
Pink	10,239	17,056	24,723	15,331	23,414	13,365
Chum	5,389	10,922	6,032	15,855	4,725	16,765
Totals	36,335	57,415	65,522	70,546	57,714	51,576

Table 7.4

Salmon Landed Values (000's dollars) by Species 1975–1980

Species	Year					
	1975	1976	1977	1978	1979	1980
Spring	12,172	22,919	23,589	29,461	31,159	24,307
Sockeye	8,184	20,656	32,218	55,181	43,307	18,222
Coho	12,401	21,331	22,671	27,269	44,063	23,078
Pink	6,900	12,124	22,262	12,835	29,685	15,118
Chum	7,206	14,835	7,905	33,336	12,243	36,197
Totals	46,863	91,865	108,645	158,082	160,457	116,922

Table 7.5

Salmon–(Canned Production in 21.8 kg Cases)

	1978	1979	1980
Sockeye	485,748	285,229	388,206
Pinks	456,058	557,082	456,363
Chums	121,487	34,326	170,346
Coho	53,960	41,804	82,651
Chinooks	8,916	9,316	6,768
Steelhead	707	319	440
	1,126,876	928,076	1,104,774

Table 7.6

Increased Total Allowable Catch of Groundfish Resulting from Provincial/Federal Cost-shared Program in 1980.

	Tonnes	Estimated Landed Value
Turbot	3,000	$ 280,000
Hake	14,000	2,100,000
Pollock	1,500	300,000
Rockfish	1,000	300,000
Dover Sole	500	250,000
	19,000	$3,230,000

Table 7.7

Number of Registered Oyster Lease Holders and Leased Acreage for the Years 1974/75 to Year Ending December 31, 1980.

	Number of Lease Holders	Acres
1974/75	65	1902.0
1975/76	68	1790.2
1976/77	65	1722.9
1977/78	66	1712.8
1978/79	78	1900.5
1979/80	90	2273.9
1980	100	2685.0

Table 7.8

Annual Oyster Production in British Columbia (in U.S. gallons) for the Years 1975/76 to the Year Ending December 31, 1980.

Year	Shucked Meat U.S. Gallons	Landed Value
1975	89,255	883,000
1976	89,249	887,000
1977	82,448	981,000
1978	76,815	1,021,000
1979	61,373	893,000
1980	52,862	1,134,000

Environmental Laboratory

Table 8.1

Distribution of Environmental Laboratory Routine Workload by Submitting Agency

Submitting Agency		Percentage of Workload
Ministry of Environment		81
Assessment and Planning Division	18	
Environmental Management Division	14	
Environmental Services Division	5	
Regional Operations Division	63	
	100	
Ministry of Agriculture		11
Ministry of Health		2
Water Quality Check Program		3
Other Government Ministries and Crown Corporations		3
		100

Aquatic Studies Branch

Table 9.1

Watershed Management Studies

Coldstream Creek Settling Basin Cleanout	An engineering feasibility report was completed for cleaning out a silted-in reservoir on Coldstream Creek, the main tributary to Kalamalka Lake. The cleanout would improve the silt-trapping efficiency of the reservoir and thus contribute to maintaining the quality of Kalamalka Lake, an extremely important water-based recreational attraction in the Okanagan Valley. The cleanout was estimated to cost $63,000.
Coquitlam Area Mountain Study	The Water Investigations Branch was represented on an ELUC Secretariat coordinated study which undertook to ensure that planning for and management of public lands in the Indian Arm–Pitt Lake area are undertaken in an integrated fashion; and contributed information gained through the Coquitlam River Water Management Study on the present and potential use of Coquitlam Lake water, the proposed diversions of Or Creek and Widgeon Lake by the Greater Vancouver Water District, possible cancellation of the Port Moody Conservation Reserve and reclamation and conservation efforts on the gravel mining operations along the Coquitlam River.
Coquitlam River Study Implementation	This study, completed in 1978, made 21 recommendations to reduce conflicts and improve water resource utilization on the Coquitlam River. These recommendations encompassed dam safety, flood damage prevention, dyke construction guidelines, floodplain zoning, flow measurement, fisheries release flows, gravel mining reclamation and conservation, logging practices, urban development, future additional water supply for the Greater Vancouver Water District and outdoor recreational amenities. Progress continued in 1980 on implementation of the study recommendations with the full cooperation of the Watershed Management Studies Section.
Kathlyn Lake	An engineering feasibility report was completed on drawing down Kathlyn Lake near Smithers to frost-kill the lake weeds. The lake would be drawn down in the fall by pumping. Winter frosts would kill the exposed weed beds. Snowmelt runoff would refill the lake the spring following drawdown. The drawdown was estimated to cost at least $80,000 and because of weather variability might have to be repeated to achieve the degree of success desired.
Lakeshore Management Guidelines	Some progress was made toward the ultimate objective of providing methods for assessing the impacts of lake watershed development on water quality. In cooperation with an SFU graduate student on a G.R.E.A.T. grant (B.C. Science Council), Brannen and St. Mary Lakes were studied as examples. Techniques were evaluated for assessing nutrient budgets and lake water quality impacts. Data used were those being collected by the Watershed Management Studies Section.

Table 9.1—*Continued*

Watershed Management Studies

Nechako Diversion	The Nechako diversion scheme, proposed Alcan expansion and desired fisheries resource maintenance flow releases into the Nechako system were reviewed, with some suggestions on using a strategic planning approach to resolve this fisheries versus hydroelectric power generation conflict.
Nicola Study	The objective of this study is to improve water resource management in the Nicola River drainage basin, mainly through the development of headwater storage and subsequent release during the summer low flow period. Improved stream flow would reduce conflicts among fisheries, licenced water users (mainly for irrigation) and the Town of Merritt (dilution of effluent discharge). Work in 1980 consisted primarily of a consultant completing a contract on data collection, developing an approximate hydrologic model and making a case for further studies and financing. The consultant proposed to use this modelling technique to estimate runoff and provide a framework for reservoir regulation and water use. Some field survey work was carried out on potential storage sites. A review was conducted on the best legislative vehicle to use to form the local entity which would operate and maintain these water supply improvement works.
Quarantine Lake Study	A report was completed on Quarantine Lake near Metchosin for the Water Management Branch. The report assesses the amount of water which may be available from this source for licencing purposes, as well as the effect excessive drawdown may have on the lake water quality.
Saltspring Island Study	A report was completed for Islands Trust on the water quality and quantity of five small lakes on Saltspring Island, for consideration as a future domestic water supply.
Serpentine-Nicomekl Study	This is a two part study. The first part involves incremental drainage improvements to the floodplain, designed so as to minimize conflicts between utilizers of the land and water resource. This part of the study is being undertaken by the Water Supply Sub-section, Engineering Section, Inventory and Engineering Branch. The second part of the study involves a basin-wide management approach to the water problems in the watershed. In 1980 a report found that: considerable background information, necessary to develop an overall watershed management plan, has been gathered, but little progress has been made on actual plan development; incremental improvements are taking place over the floodplain on internal drainage, irrigation water supply and flood protection. Construction of improvements was underway for the Old Logging Ditch area under an ARDSA funded project, which was economically and environmentally sound.

Table 9.1—*Continued*

Watershed Management Studies

	Local cost-sharing arrangements, between the District of Surrey and the farmers Old Logging Ditch area, on capital, operation and maintenance costs, have been made. These are significant because they set a precedent for those improvement projects to follow.
	Field investigations have established that an irrigation depth of eight inches appears to be a sufficient amount of supplemental water to nourish crops in the Serpentine-Nicomekl floodplain. This water demand (reduced from 1½ feet) means it is no longer necessary to import water to reach maximum agricultural productivity of the floodplain.
	Both the District of Surrey and the Township of Langley have adopted runoff detention/retention requirements in urban development in an effort to hold runoff to pre-development levels.
	The Surrey Dyking District has initiated a dyke upgrading program financed by both the District of Surrey and the Provincial Government.
Shawnigan Lake Study	The objective of this study was to develop a better understanding of the quality of water in Shawnigan Lake and the nutrient loading to it, in order to assist the Cowichan Valley Regional District on lake-shore development guidelines. The results have been presented to the Regional District for use in its land settlement planning, but the final report has not yet been written.
Strategic Planning	The Water Investigations Branch was represented on a Strategic Planning team under the chairmanship of Dr. J. O'Riordan, formed to develop a process for integrating the best use of those resources under the ministry's mandate. Information was provided on Banch objectives and flood damage prevention program criteria. Regions were divided into management areas and work began on a strategic planning document.
Thompson River Pre-planning Study	This joint Federal-Provincial investigation was undertaken to identify and document problems with the water resources of the Thompson river drainage basin; further, to recommend additional desired information studies and costs, to resolve these problems. The Watershed Management Studies Section contributed information on water quality (point discharges, general water quality of rivers and lakes in system, non-point source water quality concerns and aquatic plants) to the planning Task Force; and on hydro-electric power generation benefits and ecological costs of storage reservoir development in the Clearwater River drainage basin (System E). In 1980, a report was drafted.

Table 9.2

Aquatic Plant Management Program

PROJECT	DESCRIPTION
Quarantine and Surveillance	The main aim in 1980 was to minimize the spread of Eurasian water milfoil by reducing lake to lake transport of the plant and by providing early warning of new infestations. Roadside quarantine stations were operated at six locations and over 20,000 boaters were contacted leaving infested areas; plant fragments were removed from over 180 boats, motors and trailers. Forty-eight lakes were surveyed and a resource folio of environmental resource features of 20 high-use lakes was prepared to help control strategies in the event of Eurasian water milfoil infestation. Local agencies were encouraged to send in suspected specimens of Eurasian water milfoil which could be new lake records. One new infestion was located in Champion Lakes in the Kootenays.
Public Information	In an effort to increase public awareness, pamphlets were placed at tourist centres and two mobile displays were manned by staff at shopping malls in major British Columbia population centres on the coast and southern interior. Signs encouraging boaters to remove aquatic plants from their equipment were placed at approximately 130 launching ramps.
Documentation and Mapping	Field survey information, together with aerial photographs, were obtained in Okanagan Valley mainstem lakes and Cultus and Hatzic Lakes in the Lower Mainland to determine changes in the extent and density of Eurasian water milfoil. Intensive control procedures were used on Kalamalka and Wood Lakes. Increases in area or density of Eurasian water milfoil populations were noted in areas of Osoyoos, Vaseux, Okanagan and Cultus Lakes.
Biological Studies	Several studies were continued and new ones initiated in 1980 to provide biological information to control Eurasian water milfoil, especially concerning the most effective harvesting strategy. Investigations of the growth dynamics of the plant revealed several organisms which feed on its stems and leaves and a study was initiated on their possible application as biological control agents. The effectiveness of several mechanical control systems including an underwater plow, several cultivation implements and Aqua-screen were assessed, with emphasis on root mortality.
Mechanical Treatments and Evaluation	The majority of mechanical control activities in 1980 were implemented under cost-shared agreements with local agencies. In cooperation with the Okanagan Basin Water Board, approximately 120 ha of Eurasian water milfoil were harvested in Okanagan, Skaha, Vaseux and Osoyoos Lakes and shallow water tillage was performed in several localized areas. Under an agreement with the Fraser-Cheam Regional District a small area was treated with diver dredges in Cultus Lake. In addition, the Ministry used diver dredges on over 35 ha in Kalamalka and Wood Lakes in an effort to prevent populations in these lakes from reaching nuisance levels.
Herbicide Treatments and Evaluation	Herbicide use was continued in 1980 as part of the intensive control project in Kalamalka and Wood Lakes. Herbicide was applied in spot treatments to 3.2 ha in Kalamalka and to two blocks totalling 18.2 ha in Wood Lake in areas not previously treated. While the slow growth in Kalamalka Lake may permit successful control here, unexpectedly rapid growth in Wood Lake in 1980 may prove too extensive to justify intensive management.

Public Information

Table 10.1

Conservation Outdoor Recreation Education (CORE)—1980

	Region 1	Region 2	Region 3	Region 4	Region 5*	Region 6	Region 7	Region 8	Min. of Ed. Corr.	Totals 1980
1. Number of Courses conducted—Total	75	87	44	35	—	22	67	31	—	361
Via schools	38	43	22	—	—	6	35	18	—	162
Rod and Gun Clubs	14	33	1	—	—	8	—	3	—	59
Other	23	11	21	—	—	8	28	10	—	101
2. Number of Students†—Total	1,872	2,034	‡1,053	1,089	—	522	1,502	970	850	9,892
Passed	1,445	1,788	693	861	—	442	1,174	754	450	7,607
Failed	427	140	111	228	—	80	328	136	—	1,450
Rewrite	57	54	—	36	—	30	83	61	—	321
Incomplete	—	106	44	—	—	—	79	—	400	629
Total Graduates	—	—	—	—	—	—	—	—	—	7,928
Since Inception—Total Graduates	—	—	—	—	—	—	—	—	—	62,728
3. Number of Instructors—Total	353	152	50	140	—	50	85	49	—	879
Active	53	70	42	50	—	50	76	21	—	362
Inactive	—	60	—	—	—	—	—	—	—	60
Assistant/Apprentice	300	22	8	—	—	—	19	28	—	377
4. Average Length of Course (hours)	16–20	24	16–20	20	—	22	24	16	—	—
5. Percentage of Courses with range time	20	40	44	—	—	82	72	10	—	—
6. Average fee charged (amount in dollars)	5–20	22	10	15	—	10	15–20	10–15	—	—
7. Reason for taking course (approximate)										
Hunting Licence requirement (in per cent)	60	86	70	—	—	70	75	—	—	—
General Interest (in per cent)	40	14	30	—	—	30	25	—	—	—

* Information for this region is not available.
† *See* reports on courses given by months.
‡ Information not complete.
NOTE—Region 1—Vancouver Island, Region 2—Lower Mainland, Region 3—Thompson/Nicola, Region 4—Kootenay, Region 5—Cariboo, Region 6—Skeena, Region 7—Omineca/Peace, Region 8—Okanagan.

Conservation Officer Service

Table 11.1

Preliminary Data from the Offence Data System

	Number of Violations Reported or Discovered	Per Conservation Officer Service	Number of Investigations	Per Conservation Officer Service	Percentage of Total Violations	Number of Charges	Per Conservation Officer Service	Percentage of Total Investigations	Number of Convictions	Per Conservation Officer Service	Percentage of Total Charges
Vancouver Island	777	60	653	50	84	256	19.6	39	223	17	87
Lower Mainland	382	25	171	11.4	44.7	159	10.6	93	152	10	95.6
Thompson-Nicola	436	31	—	—	—	386	27.6	—	368	26.3	95
Kootenay	711	39.5	340	19	48	100	5.5	29	96	5.3	96
Cariboo	377	37.7	234	23.4	62	162	16.2	69	140	14	86
Skeena	494	38	390	30	79	234	18	60	192	14.7	82
Omineca-Peace	1,009	59.3	994	58	98.5	669	39	67	633	37	94
Okanagan	—	—	—	—	—	181	18	—	169	16.9	93
Province	3,942	35.8	2,782	20	70	2,147	19.5	77	1,943	17.9	92

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