

MINISTRY OF THE ENVIRONMENT

STANDARDS DEVELOPMENT BRANCH OMOE



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Annual Report 1972/73

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To:

*The Honourable
James A. C. Auld, Minister.*

Sir,

*I have the honour to submit
for your approval the 1972/73
annual report of the
Ministry of the Environment.*

Respectfully submitted,

EVERETT BIGGS
DEPUTY MINISTER



To:

*His Honour,
The Lieutenant-Governor
of the Province of Ontario.*

May it please Your Honour,

*I have the honour to present
the annual report of the
Ministry of the Environment
for the fiscal year beginning
April 1, 1972 and ending
March 31, 1973.*

Respectfully submitted,

JAMES A.C. AULD
MINISTER

Preface

The Province of Ontario was one of the first jurisdictions in the world to develop a comprehensive program of environmental protection, rehabilitation and management.

Just one year ago, the various components of this environmental program were assembled within the sphere of one agency — the Ministry of the Environment.

This incorporation marked the disappearance of a proud name — the Ontario Water Resources Commission. In the 15 years of its operation, the OWRC established a program of water management and pollution control and a record of achievement that were examples for the world.

The younger agencies, the Air and Waste Management Branches, the Pesticides Control Service and the Private Waste and Water Branch, all parts of what was the Department of the Environment, had already established active and effective programs at the time of reorganization.

I am proud to say that these programs remained active and effective throughout the past year of preparing new legislation, new structures and new approaches to environmental problems.

In the past year, a considerable effort has been directed into refining the Ministry's legislation and regulation structure and correlating its programs to

provide the comprehensive environmental approach for which this Ministry was designed.

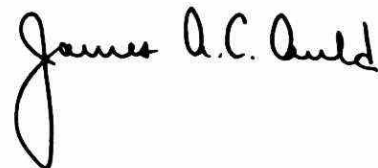
The Environmental Protection Act, 1971, the program keystone, was amended to provide an even more effective basis for regulation and enforcement.

The Pesticides Control Act was amended to better protect the public from the abuse of pesticides.

During the year, the Environmental Hearing Board was established to review the environmental issues involved in private and governmental developments and to provide recommendations.

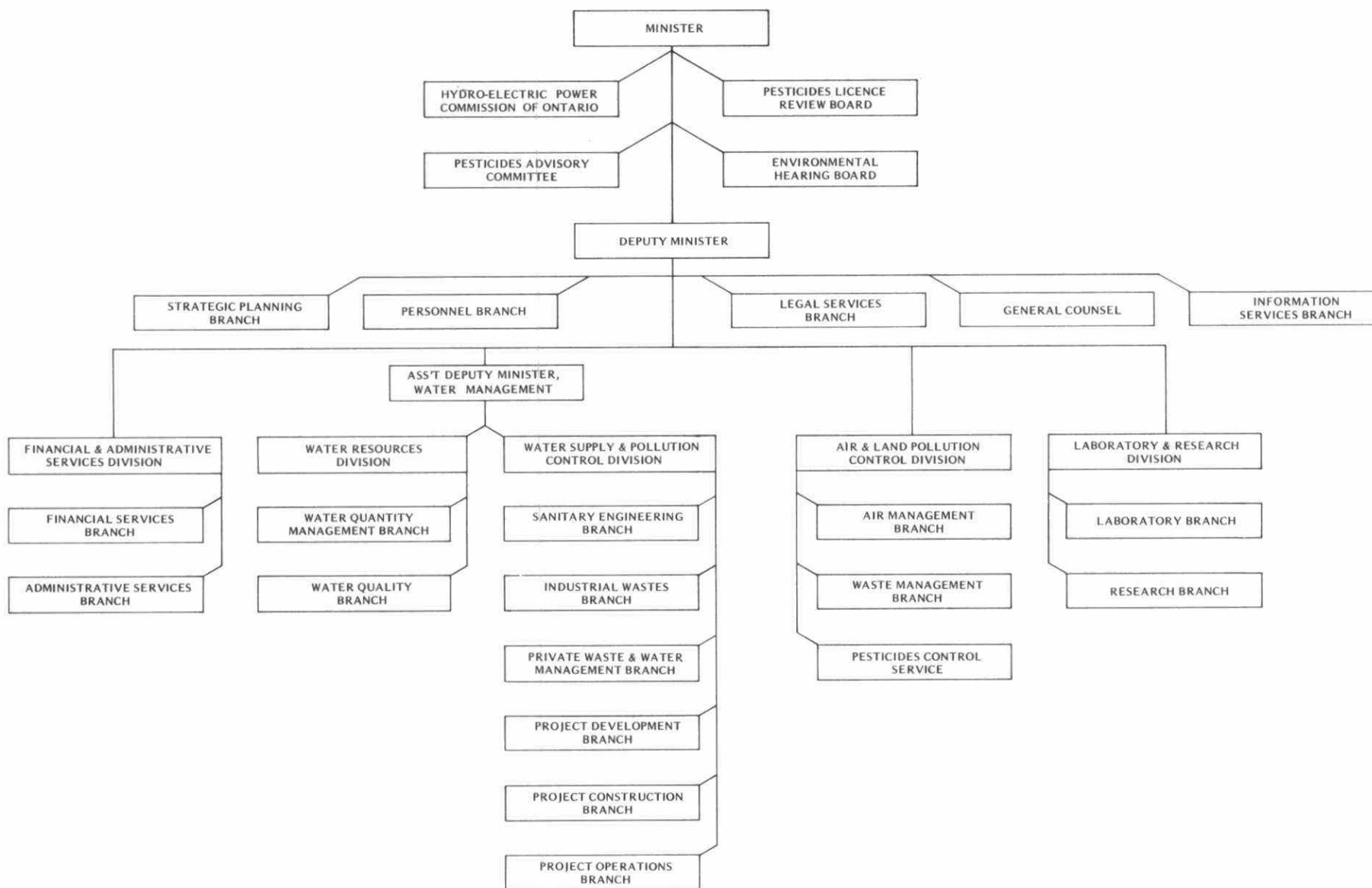
A regulation banning three-quart disposable plastic milk jugs and a further ban on three-quart paper jugs to take effect in November, 1973, were part of an increasing waste management program.

Late in 1973, the Ministry formed the Task Force on Solid Waste, with representatives from industry, consumer groups, environmental groups and governments preparing reports on waste issues during 1973. These reports will help in the development of further waste control, treatment and reclamation programs.





MINISTRY OF THE ENVIRONMENT ORGANIZATION CHART MARCH 31, 1973



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CONTENTS

6	OPERATING DIVISIONS
6	Air and Land Pollution Control
6	Air Management
10	Pesticides Control
13	Waste Management
14	Water Resources
14	Water Quality
18	Water Quantity
22	Water Supply and Pollution Control
22	Industrial Wastes
26	Private Waste and Water Management
28	Sanitary Engineering
32	Project Construction
33	Project Development
34	Project Operations
36	MANAGEMENT AND OPERATIONS SUPPORT SERVICES
37	Pesticides Advisory Committee
37	Pesticides Licence Review Board
38	Information Services
39	Legal Services
39	Personnel
40	Strategic Planning
41	Financial and Administrative Services
41	Administrative Services
43	Financial Services
44	Laboratory and Research
45	Laboratory
47	Research

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Operating Divisions

Air and Land Pollution Control

AIR MANAGEMENT

Abatement

During 1972/73 the Abatement Section has laid considerable stress on increasing its effectiveness and improving its service to the public. The work has included systematic collecting and processing of source emission data, formulating control programs to abate air contamination, and responding to complaints from the citizens of Ontario. In addition, the section is implementing advanced air management techniques to achieve the air quality goals. To this end, an information storage and retrieval system for use by all staff is being provided.

In the fiscal year, a total of 1,070 industrial and commercial installations were surveyed. Resulting from these, 23 detailed surveys under Section 83 of The Environmental Protection Act, 1971 were completed; 31 companies were issued with a Notice of Intent to issue a Control Order; 17 Orders were issued; and 14 companies elected to submit a formal abatement program. A further 27 companies submitted programs for approval as a result of action taken by abatement engineers and inspectors.

As part of this section's work, the following key industries have formally undertaken extensive abatement programs: the abrasives industry in Niagara Falls, terminal elevators in Thunder Bay, gold mines in Northern Ontario, meat packing plants in Toronto, automotive assembly plants, and teepee wood waste burners.

The Hydro Electric Power Commission received approval for a program to limit the discharge of airborne contamination from the Lakeview generating station west

of Toronto. A program to control odors from the municipal sewage plant in London and a program to abate emissions from Toronto's seven municipal incinerators were formalized.

At a cost of approximately \$78,800,000, 85 voluntary air pollution abatement programs were completed in 1972/1973. Of 133 Orders issued under The Air Pollution Control Act, 1967 (the formerly prevailing legislation), 32 have still to be completed.

In 1972/73, 24 air pollution court cases were heard, resulting in 15 convictions. Total fines for the year were \$8,625. Two Stop Orders were issued to prevent danger to the public health. The Air Pollution Index exceeded 50 on only 14 occasions. Of these 14 occasions, one occurred in Sudbury, and 13 in Happy Valley, a small community near Sudbury.

The abatement section, in collaboration with the Ontario Ministry of Agriculture and Food, continued its work in the evaluation of poultry and livestock farms with regard to the Code of Practice and the issuing of Certificates of Compliance. Of 459 applications received from farms, 441 were granted Certificates of Compliance.

The section also formed a group of interested engineers from several branches and ministries to investigate the uses for waste products presently disposed of in a manner that leaves room for improvement. Projects underway include the utilization of bark and wood wastes, elemental sulphur, the use of garbage as a fuel in cement and brick manufacture, and the use of whey from cheese manufacturing.

It is intended that these progressive trends will continue in the coming year as more and more modern management aids are adopted, and as increased coordination with other branches of the Ministry of Environment and other ministries is achieved.

Air Quality and Meteorology

In order to achieve a high quality of air in Ontario, this section has continued its efforts to add to the knowledge of contaminants present in the air, and to compare their measured concentrations with the air quality goals of the Ministry.

During the 1972/1973 season, the air quality sampling network was expanded to conduct surveys in 49 areas of Ontario, with over 900 monitoring instruments in operation. Sulphur dioxide, carbon monoxide, hydrocarbons, nitrogen oxides, oxidants, fluorides, suspended particulate matter, dustfall, sulphation and fluoridation rates are continuously monitored, and atmospheric concentrations of metals such as lead, nickel, cadmium and arsenic are obtained.

Micrometeorological measurements of the wind speed and direction and temperature changes with heights are compiled continuously at several locations to interpret the air quality data and to determine the sources of the pollutants. The effects of these pollutants on property are determined analytically at a number of locations across the province over time periods varying from one month to one year.

Over 1.75 million data points were obtained and processed by Ontario Government computer facilities. The air quality data and interpretation are pub-

lished and made available to the public. Also published is the Air Pollution Index, provided via the news media four times daily for the cities of Toronto, Hamilton, Sudbury and Windsor.

Meteorological instrumentation was installed in a new 400 foot tower in Sudbury, Ontario and a meteorologically instrumented tower was added to our facilities in London, Ontario. A study of carbon monoxide in downtown Toronto was conducted, and air quality monitors were added at Cornwall, Dryden, Sudbury, Hawkesbury, Temagami and Welland.

Several other studies were carried out by the mathematical group of this section in 1972/73. Tests of pollution abatement and planning strategies for Toronto, Hamilton, Oakville, Kingston and Sudbury areas were conducted by computer simulation of atmospheric environment reactions to various pollutants emitted by all classes of sources during varying meteorological conditions.

A special building height study was completed. This will assist land use planners in determining the heights at which buildings may intercept plumes from large industrial sources, and whether the resulting concentrations of airborne contaminations are acceptable. If not, abatement action may be necessary.

An air quality model which simulates pollution stemming from street and highway traffic has been utilized for Toronto and Hamilton. In addition, the effects of one-way streets on a city's air quality in the downtown core were determined.

The staff of the Air Quality and Meteorology Section have provided advice to industry and departments of the federal and provincial governments other than Ontario. Lectures were presented at the invitation of the universities of Toronto, York and Waterloo, and several

papers were given at various technical conferences throughout the year.

Approvals

The bulk of the workload of the Approvals Section continued to consist of the assessment of Certificates of Approval. The total number of applications for certificates was 2,747 as compared with last year's total of 2,739. The number and size of the individual points of emission of airborne contamination involved in these applications for approval were unusually low. The total number of sources was reduced by 12%, and of the 5,971 sources dealt with in Certificates of Approval this year, 4,728 were associated with heating installations.

This section completed 270 assessments of claims for grants under the Pollution Abatement Incentive Act, 1970. Of the \$1,549,415 requested for these grants, \$857,076 has been recommended for approval. There are still 42 claims to be assessed, involving a total of \$434,959. Of the total amount claimed (\$1,549,415), \$257,370 was disallowed.

This year, the Approvals Section took a greatly enhanced role in the matter of planning and zoning in Ontario. Two hundred and fifteen subjects were studied by the Section, with 50% of the work being associated with reviews of official plans and amendments.

Section staff attended 25 meetings or hearings, and made ten field trips to investigate proposed subdivisions and redesignation of land usage matters. To ensure comprehensive coverage of all aspects of planning and zoning, officers of the Abatement Section provided data pertaining to the nature of most of the subjects involved.

To assist the Ontario Development

Corporation in their assessment of companies requesting financial assistance, the Approvals Section prepared comments and statements on matters of air pollution control in 174 companies.

Members of the staff have been involved with various committees dealing with such subjects as air pollution collection equipment efficiencies, feed and grain mill operations, whey processing and the control of petrochemical hydrocarbons. These committees have been formed with members of the relevant industries and industrial associations.

In addition, staff members participated on safety advisory committees, convened by the Atomic Energy Control Board, dealing with the Bruce Heavy Water Plant and the Eldorado Uranium Hexafluoride Plant.

Automotive Emission Control

This section continued to investigate, monitor and require the reduction of airborne contamination stemming from automotive sources.

Visual inspection of control systems and short or full measurement of vehicle emissions have been carried out through spot checks of on-road vehicles. Emphasis was placed on new car models and low frequency vehicles. From June to October, both mobile laboratories visited seven municipalities and Toronto suburbs, and made 3,300 tests for compliance with Canadian or suggested Ontario standards.

Monitoring of car emissions continued during the winter months and a second test centre at Taber Road, Rexdale was again opened in December, 1972. Over the one year period more than 6,200

tests were performed, most of them involving a short test designed to identify cars with high or excessive emissions. Approximately 27% of uncontrolled cars and 18% of controlled cars exhibited excessive carbon monoxide emissions, with a slightly lower percentage of cars showing excessive hydrocarbon emissions.

A special testing program, in which companies and individuals were given guidance in the development of retrofit control devices and in the monitoring of low emission vehicles using LPG or natural gas, was continued. However, only two of the devices tested showed promise of satisfactorily reducing pollution from older cars.

Several public demonstrations were made by this section, including an exhibition in Toronto, July, 1972, in which federal and provincial test facilities were shown during a preview to the Urban Vehicle Design Competition undertaken by North American universities.

In addition, the demonstration program, designed to acquaint colleges with various automotive pollution control procedures, was extended. A total of 22 visits were made to nine colleges from October, 1972 to March, 1973, with an estimated 1,770 trainees, mechanics and staff from local service stations participating. This program has resulted in a greatly increased interest by the colleges in automotive air pollution control. Many colleges started their own emission control or emission tune-up courses after purchasing emission testing equipment similar to that demonstrated by the province.

The section continued to investigate complaints concerning visible emissions from motor vehicles, to conduct observations of heavy duty vehicles and to process complaints and observations compiled by other sections. Advanced ana-

lytical equipment was purchased, enabling the section to use the most modern methods available to investigate the production of automotive pollutants.

This year, the section extended its service to the public by introducing an investigation service into complaints about the leakage of exhaust gases into motor vehicle passenger compartments through the use of a portable carbon monoxide analyzer.

Phytotoxicology

The Phytotoxicology Section is responsible for determining the degree and extent of air pollution injury to all types of vegetation throughout Ontario. The section pursues its objectives by investigating complaints concerning suspected air pollution injury to vegetation, by conducting ecological surveillance studies in the vicinity of existing and proposed sources of air pollution, and by carrying out practical research studies.

In the section's analytical facilities, vegetation samples are examined by pathological and histological techniques, and processed for chemical analysis. A herbarium is maintained to demonstrate, compare, and diagnose plant material damaged by particular air pollutants. Certain plant species and varieties sensitive to air pollutants are raised in a filtered-air greenhouse under uniform culture for use in field and artificial experiments.

A total of 196 vegetation complaints were investigated in 1972/73, of which 98 were confirmed as being caused by air pollutants. These pollutants included sulphur dioxide, fluoride, ammonia, pentachlorophenol, sodium chloride, sodium sulphate, lead, nickel, cobalt, zinc, lime dust, iron oxide, and soot.

Major investigations were made in Sombra, Ontario in view of the airborne contamination emanating from sources at St. Clair, Michigan, and in southwestern Ontario, where peroxyacetyl nitrate-type injury on vegetation was discovered for the first time in Ontario.

Fifty per cent of the complaints investigated in 1972/73 were found to be attributable to causal agents other than air pollutants, including disease organisms, insects, physiological disorders, and natural causes.

For example, fallout alleged to stem from the new high chimney stack at Copper Cliff was discovered to be droppings from a heavy infestation of Birch Skeletonizer larvae feeding on the foliage of white birch trees.

In 1972/73 major ecological surveillance studies were carried out in the vicinity of fertilizer manufacturers, a hydrofluoric acid plant, a fiberglass manufacturer, nickel and copper smelters, a nickel refinery, iron concentrators, and gold producing mines. A total of 1,117 surveillance stations were visited.

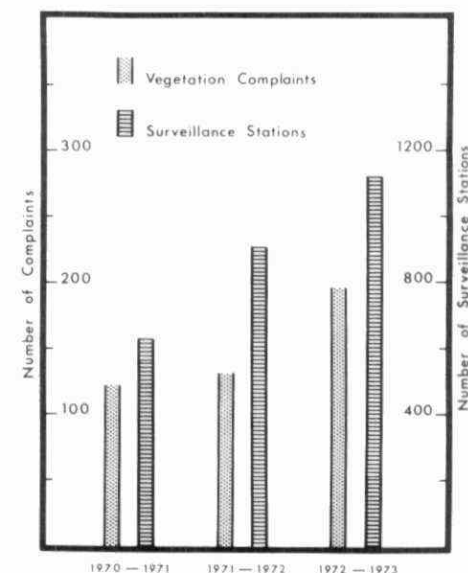
Pre-pollution baseline studies were conducted in the vicinity of new industries under construction which may be potential emitters of phytotoxic contaminants. In addition, a snow sampling program was initiated in the Sudbury area to ascertain the extent of sulphur and heavy metal washout in precipitation.

Phytotoxicology surveillance investigation reports, together with ambient air records provide a sound basis for determining the effects of industrialization and future abatement requirements.

Staff presented scientific papers at a number of technical conferences, including the annual meetings of the Air Pollution Control Association, the Canadian Phytopathological Society, the American

Phytopathological Society, and the Soil Conservation Society of America. Technical papers were written and published, and a number of invitational lectures to university students were given. Phytotoxicology staff are also active members of various national and international committees and subcommittees.

The accompanying chart illustrates the increase in complaint and surveillance investigations during the three-year period April 1, 1970 to March 31, 1973.



Special Studies

The aim of the Special Studies Group is twofold. First, the group initiates, organizes and administers the research programs under the Air Management Branch grant system to provide timely research results for air pollution problems and to assist the branch in achieving its overall objectives. Secondly, the group is in the process of developing a program of investigation in order to provide enforceable legislation to control and reduce noise in the environment.

Most of the research carried out under the branch's grant system is conducted at Ontario universities and non-profit organizations by investigators well known in their field, in order to achieve a high utilization of invested research dollars. In addition, many students are provided with an opportunity to continue their education in the environmental field.

In 1972/73 new analytical methods to monitor and identify air pollutants were successfully developed. Reactive hydrocarbons in ambient air can now be monitored on a continuous basis. Polychlorinated biphenyls were measured and identified in trace quantities in ambient air, and many components of diesel exhaust were identified. All this work is an important prerequisite for the design of meaningful air quality criteria and for the control of various pollutants in Ontario's air.

During the fiscal year, the group reviewed requests for grants totalling \$510,000. A total of 25 grants involving \$260,000 was issued to principal investigators from 14 participating universities and research institutions.

In addition to preparing enforceable legislation to control noise in Ontario, the Special Studies Group has been

responding to all noise complaints received by the Air Management Branch in 1972/73.

Personnel of the Abatement Section have been trained to assist the group in conducting field noise investigations. During the 1972/73 season, a total of 360 noise complaints were received by the group, of which 125 were investigated.

Two noise regulations have been drafted with the assistance of an inter-departmental noise committee. One of these, the vehicle noise regulation, is now in the final stages of preparation. A second regulation, dealing with stationary noise sources, is being drafted.

A total of \$5,800 was spent by this group to obtain and set up advanced noise equipment.

PESTICIDES CONTROL

The Pesticides Control Service continued to carry out its responsibilities as outlined under the Pesticides Act and Regulations 657. The purpose of this act is to enforce the proper use of pesticides and to avoid the misuse of these chemicals which might result in the contamination of the environment.

In addition to the Pesticides Act, which deals mainly with the application of pesticides, the Ministry has introduced other pesticide regulations, under the Environmental Protection Act 1971, which govern the sale of pesticides in the province.

A task force was appointed in 1970 by the Department of Health to study the situation of pesticides in Ontario. The task force, under the direction of the Pesticides Advisory Committee, completed its report in April 1972 and submitted it to the Ministry for implementation. New regulations which came into effect January 1, 1973 provide for the control of the sale, storage and display of pesticides. The task force classified pesticides into four classes:

Class A — consists of pesticides that have primarily high oral acute LD₅₀ and/or are persistent in the environment. This class of chemicals can only be used by a licensed exterminator or a holder of a permit issued by the service.

Class B — This class of chemicals consists of commercial pesticides used mainly by agriculturists (farmers, foresters, etc.) and commercial applicators. These pesticides are available for agricultural production and to licensed exterminators but not to the homeowners.

Class C & D — This class of pesticides is intended for domestic use such as homeowners, small gardens, and recreational areas. These pesticides are available, without a license, to anyone and can be purchased at retail vendors.

Head office for the service is still located at 1 St. Clair Avenue West, Toronto. Regional offices are located in London, Hamilton, Belleville and North Bay. District offices are located in Chatham, Clinton, Simcoe, Owen Sound and Ottawa. A new regional office will be opened in Thunder Bay on June 1, 1973.

Field Services

The field staff was responsible for the enforcement and administration of the Pesticides Act, 1967. In November 1972, the scope of our program encompassed the sale, storage, and display of pesticides. Our aim was to promote sound pesticide management — dissemination of pesticide information, licensing exterminators and vendors, co-operating with the general public and agencies involved with pesticides, and sampling programs.

During the summer of 1972, seven summer students supplemented our staff. They provided invaluable and competent assistance.

The major fraction (approximately 43%) of the 5,200 field visits made involved investigation on the misuse of pesticides. Complaints regarding spray drift, unlawful application, contamination of poisonings were investigated, and reports with conclusions were compiled.

Follow-up of licence renewals and applications as well as routine visits with

exterminators made up approximately 30% of the calls. Similarly, 30% of the calls were spent consulting and co-operating with personnel from government, county, municipal, extermination or chemical agencies.

The issuance of permits for the use of cyanogas or methyl bromide fumigations in vaults or applications for the use of hormone herbicide from an airborne machine involved 8% of the visits. In addition, the number of permits issued for use of D.D.T. for the control of tarnished plant bug on apples decreased to 67 from 225 the previous year.

Staff assisted at meetings held by agricultural technology colleges, Ontario Ministry of Agriculture and Food, municipalities, extermination firms and agricultural growers through presentations concerning the Pesticides Act Regulations. More recently, numerous speaking engagements have been held regarding the sale, storage, and display of pesticides with associations, chemical companies, dealers, agriculturalists and government personnel. In addition, many exhibits have been staffed by personnel from this section, and information distributed to all facets of the pesticide industry.

All staff attended a three-day training session in Toronto regarding the legal aspects of collecting evidence and court room procedures. Our new regulations necessitated meetings to discuss and solve problems which were being encountered. One session involved the Fire Marshall's office for a discussion on fire requirements and ratings. In addition, the staff attended and participated in pesticide symposiums and courses set up by our education section. Assistance was also given to the licensing section with regard to examination and preparation of applicants for examinations.

Our sampling programs generally originate from investigations concerning spray drift, misuse of a pesticide or accidental spillages. As a result of a fish kill, a survey was set up to check whether persons filling pesticide sprayer tanks with river water were utilizing a device to prevent back-flow of water and pesticide from the tank into the river.

An air sampling program was undertaken during the summer of 1972 at Ridgetown and the Bradford area with the co-operation of Dr. R. Frank, Director, Pesticide Residue Testing Laboratory. At the request of the Ministry of Education, an inspection survey was made of all greenhouses attached to schools. The recommendations of this survey will lead to renovations in many of the greenhouses as well as the setting up of a course on pesticide management for environmental science teachers. This program will be put on by the Ridgetown Agricultural Technology College, and we will be participating in the program.

Education and Technical

The Education and Technical Section has published four issues of "News and Views" as in the previous year. The mailing and distribution is now handled by the Information Services Branch. Requests are still coming in for subscriptions mainly from abroad.

Another publication that has received wide acceptance by senior high school students and university undergraduates is "Pesticides and the Environment". This booklet describes what a pesticide is, how it might cause contamination to the environment, and how it could affect other

forms of life if it was not controlled by government regulations. The last few pages emphasize the safe use of pesticides by applicators. Three reprints were required in 1972 to meet the demands. Circulation was over 5,000 copies.

SERVICE-IN-TRAINING COURSES

Courses for the licensed pest control operators were held in the following locations:

Toronto — A two-day symposium on methods and control of pests in gardens and ornamental trees was held at the Queen's Park Conference Room.

Guelph — A one-day course for Food Processors of the Food Industries was held at the University of Guelph. This course was supported by Heinz Co. Ltd., Libby's and Ontario Food Processors Association.

Ridgetown — The Ridgetown College of Agricultural Technology, in co-operation with this Section, held a two-day course for custom applicators in Southwestern Ontario.

Ottawa — A one-day course was held in Ottawa for the National Capital Commission employees, surrounding municipal employees, as well as the landscape and maintenance contractors, on general pest control on land.

Attendance at these courses was in excess of 2,000 people, an increase of approximately 34% from last year.

EDUCATIONAL COURSES

The following post secondary colleges in Ontario have incorporated our ten-week courses as their standard curriculum, and are issuing certificates in pesticides technology, under our supervision.

West Park Secondary School - Toronto

Humber College of Applied Arts & Technology - Rexdale

Niagara College of Applied Arts and Technology - St. Catharines and Welland campuses

Lincoln County Board of Education, Extension Education Department - St. Catharines, Ontario

Niagara Parks Commission, School of Horticulture - Niagara Falls, Ontario

St. Clair College of Applied Arts and Technology - Windsor

Ontario Training Centre, Extension of Education - Brampton

Cawthra Park Secondary School - Mississauga

Under this program, we issued 1,236 certificates in Pesticides Technology. Failures were not recorded.

The Ministry of Colleges and Universities has accepted our courses for incorporation into the curriculum of continuing education programs, and will offer this course to all colleges in Ontario during the fall and winter semesters.

CORRESPONDENCE COURSES

Enrolment in the herbicide correspondence course has declined due to the lack of staff to carry out the administrative functions. It is hoped that the course will be advertised next year and brought back to the same level of enrolment as in the past.

NEW PUBLICATIONS

This Section has published three new training manuals for structural pest control operators:

The Manual for Structural Pest Control Operators — 168 pages with full

description of insects such as the order, class and family, with full description of metamorphosis, life history, habits and picture of the insect.

Industrial Solvent Manual for Pesticides Formulations — 14 pages of technical information on solvents used in pesticides formulations. It describes the purpose of flash point, flammability, pharmacologic action and signs and symptoms of poisoning. It is meant to help the formulator to select the proper solvent for the job in question. Mathematical formulas for mixing chemicals and conversion tables are included for references.

Insecticides Recommendations Manual — 31 pages on methods and proper control of structural pests for the pest control industry. It specifically details the recommended procedure of control for each insect.

STUDY MATERIAL

The Education and Technical Section prepared and distributed 863 sets of study material for applicants who became licensed exterminators in 1972.

PESTICIDES MONITORING PROGRAM

The monitoring program for pesticides residue in water, soil, meat and milk for human consumption, which started in 1968, will be terminated in 1973. The final report will be published in 1974. The interim reports have indicated a gradual decline of residue in samples taken for chlorinated hydrocarbons since the restriction was imposed by the Government of Ontario on the use of aldrin, dieldrin, DDT, TDE, heptachlor and metabolites.

GENERAL INFORMATION

The public's demand for information on general pest control has increased in 1972 over the 1971 demands. The greatest demand for information was for the book *Black Fly and Mosquito Control*. This 18-page book outlines the procedures involved in community and individual programs for the control of black fly and mosquito. It is estimated that approximately 3000 copies were distributed to cottage associations, summer camps, and the general public. Requests for this publication were received from Alberta, Saskatchewan, and Manitoba.

Another publication that has gained national acceptance is *Toxicity and Health Aspects in the Use of Insecticides*. Because of the cost involved in the production of this book, it had to be limited to libraries, research institutions, universities, and pest control industry. This 45-page book describes the hazards involved in the improper use of pesticides.

Emergency Medical Treatment for Acute Pesticide Poisoning — This chart, which outlines the first aid and medical treatments to be followed in case of poisoning with pesticides, was reproduced with permission from the U.S. Navy Medical Corps. It was modified to meet our needs and distributed to all pesticides manufacturers, pesticides formulators, dealers, pest control operators, poison control centres, hospitals, St. John Ambulance Centres, Ministry of Transportation and Communications, medical centres, and general practitioners. Because of its technical content, distribution was limited. The greatest demand was from the Ministry of Health, Public Health Division. The distribution for 1972 was well in excess of 15,000 copies.

Licensing, Examinations and Prosecutions

The licensing program continued to develop and carry out its responsibility to ensure that certain classes of applicants of pesticides in Ontario are competent to do so with minimum effects on the natural environment and its ecosystems. Licences were issued to persons who passed an examination on the Pesticides Act and Regulations, toxicity and hazard, first aid and antidotes, methods and uses of the pesticides that the class of licence for which the applicant was applying entitled him to use. In addition, the applicants were examined regarding the identification, the life history, the habits and the characteristics of pests.

A total of 5796 licences were issued between April 1, 1972 and March 31, 1973; these include 599 operators or business, 4885 land, 209 structural, 103 assistant structural licences, an increase of 3.2% over the previous year.

The examining committee, comprised of members from Pesticides Control, Industry, and the Ministry of Agriculture, examined 831 applicants for operator's and exterminator's licences, 9.2% failed to pass the examination. In March 1973, legislation was passed requiring all pilots applying pesticides in Ontario from airborne machines to be licensed as exterminators. This change was prompted by a rise in the number of misapplications of pesticides by airborne machines. So far the examining committee have examined 21 pilots for exterminator's licences.

On January 1, 1973 new regulations made under the Environmental Protection Act pertaining to the sale of pesticides in Ontario became effective. All wholesale and retail vendors selling Class A (re-

stricted), Class B (commercial and agricultural), or Class C (home and garden pesticides), as classified by the Pesticide Advisory Committee must fulfill storage, display and licence requirements. Persons selling Class D (unrestricted pesticides) do not require a licence. There are four classes of vendor's licences. The classes vary according to the function performed by the vendor as well as the potential hazard associated with the pesticides handled and/or sold. The classes are as follows:

- Wholesale vendor's licence permits the wholesale of all four classes of pesticides.
- Class 1 retail vendor's licence permits the retail of all four classes of pesticides.
- Class 2 retail vendor's licence permits the retail of Class B, C and D pesticides.
- Class 3 retail vendor's licence permits the retail of Class C and D pesticides.

Vendor's licences issued by March 31, 1973 totalled 1,545.

As a result of the new legislation, no person may purchase A or B pesticides unless he is licensed to use those pesticides or holds a permit issued by the director or be exempt under the regulations (agriculturalists or registered custom sprayers). So far, 32 permits have been issued to beekeepers, chick hatchery operators and fur farmers to purchase listed quantities of cyanogas (Class A) in the summer of 1973. One permit was issued to purchase Picloram for weed and brush control on provincial highway rights-of-way.

Five hundred and sixty-eight custom sprayers were enrolled with Pesticides Control in 1972-73; this is a decrease from previous years. Possible explanations for this are that agricultural land is decreasing

in area, or that smaller farms tend to be absorbed by the larger ones. It is economically feasible for the larger farmer to purchase his own sprayer. (These are exempt from enrolment as custom sprayers or licensing).

Under the Pesticides Act and Regulations, eleven actions were initiated by Pesticides Control, eleven prosecutions resulted in convictions.

WASTE MANAGEMENT

The Waste Management Branch is continuing its waste management program throughout the province with a field staff of 31 located in seven offices.

As of March 31, 1973, the branch has registered 1,534 active disposal sites and 64 sites which are under closing-out process. In addition, 1,012 waste management systems were registered with the branch.

The rapid technological changes occurring in the waste management field require corresponding changes in the role of the branch. In addition to the responsibility for the inspection and certification of waste disposal sites and systems, the branch has been active in many specialized areas which include:

LEGISLATION

Regulations — Under The Environmental Protection Act 1971, the following regulations were proclaimed:

Disposable Containers for Milk — A regulation banning the use of non-returnable plastic milk containers in a size greater than one pint.

Disposable Paper Containers for Milk — A regulation which becomes effective November 1, 1973 controlling the use of plastic coated milk containers in a size greater than two quarts.

Processed Organic Waste — A regulation which controls the disposal of digested sewage sludge on land.

Deep Well Disposal — A regulation controlling the subsurface disposal of liquid wastes.

A regulation on derelict motor vehicles will expedite the provincial program for their removal and reclamation.

ENVIRONMENTAL HEARING BOARD

Under revisions to the Act, most applications for disposal sites now require a hearing before the Environmental Hearing Board to examine, in particular, the socio-economic issues relating to the site. To date, 23 hearings before the board have been held.

AREA PLANNING STUDIES

The branch provides a grant covering 50% of the cost of waste management planning studies to encourage proper planning on a county or regional basis. Studies are underway in Halton County, Oxford County, Prince Edward County, Regional Municipality of Ottawa-Carleton, and Regional Municipality of Sudbury.

The full benefits of this program will start to show in 1973 with the completion of the Hamilton-Wentworth study.

RECLAMATION

The final report of the Burlington Waste Reclamation Pilot Study was received and reviewed by the branch. The knowledge gained from this study will be used to promote other studies to examine the aspect of 'at source' separation and its value with regard to recycling.

The branch is investigating the use of municipal refuse as a fuel. It has also received approval for the concept of a pilot reclamation plant to study the problems of separation and material recovery. Funds for the design of such a plant are included in the 1973/74 budget.

It is hoped that federal and municipal

support will be obtained on this project to promote the most favorable conditions for its success.

WASTE TREATMENT FACILITIES

The branch continues to study and encourage the development of new treatment methods and facilities to deal with municipal and industrial wastes.

The City of Hamilton has commenced operation of its incinerator (SWARU) to burn ground refuse, with the recovery of ferrous metals and the production of steam for in-plant use and for sale to partly offset operating costs.

In the latter part of 1972, facilities in Hamilton and Mississauga for the thermal reduction of combustible liquid wastes commenced operation with the approval of the branch. Plans are being developed to extend these treatment facilities to other types of liquid wastes.

The branch initiated a study to examine problems of disposing of pathological waste in the Metropolitan Toronto area. The study is being done in such a way that the information can be related to other urban centres.

LITTER

An extensive educational program on litter was carried out during 1972 and will be repeated in the coming year. A litter survey was conducted in selected parts of the province during the summer of 1972 producing information which will be beneficial to the overall program for reducing and controlling litter.

DERELICT MOTOR VEHICLES

A survey to examine the aspects of abandoned automobiles was completed

in 1972. The results of this survey have been used to promote several pilot projects in 1973 and funds have been included in the budget for this purpose.

Solid Waste Task Force

The Minister announced the formation of the Solid Waste Task Force in October 1972 with representation from the public, municipalities, industry and government to examine the overall problem of solid waste. Mr. J.D. Heaman, director of the branch, has been seconded to the task force as executive officer on a full-time basis since its formation.

The objectives of the task force are to develop recommendations to the Ministry designed to produce solutions to the varied problems presented by the constantly increasing generation of solid waste. Working groups which were formed to examine the various aspects of milk and beverage containers are required to report by May 31, 1973.

WATER QUALITY

The Water Quality Branch is responsible for water quality assessment and providing recommendations for abatement of pollution. To meet this responsibility, the branch conducts surveys on waterways throughout the province, ranging in complexity from the development of comprehensive basin plans to simple assessments for effluent requirements to abate local pollution problems.

Staff with engineering, biology and other scientific skills conduct the surveys and prepare comprehensive reports. These reports document the location, nature, and severity of pollution and contain specific recommendations for pollution control measures necessary to restore and maintain water quality needed for water supplies, recreation and esthetics, fish and wildlife propagation and agriculture.

In support of this work, the branch maintains an inventory of existing water quality, assesses the impact of new developments to prevent the degradation of water resources and operates a laboratory unit to provide biological analysis of samples.

GREAT LAKES AND RIVER BASIN STUDIES

The 1972 Great Lakes program included continued surveillance and monitoring of water quality in the Great Lakes and interconnecting channels and environmental response studies associated with specific waste discharges and confined harbor areas.

Surveillance of mercury distribution on the St. Clair system continued in 1972. Planning for a three year intensive

investigation of pollution in the upper lakes was initiated following the signing of the Canada-U.S. agreement. Reports on intensive surveys carried out in 1970 at Thunder Bay, Jackfish Bay and Peninsula Harbor were released during the year.

SURVEILLANCE AND MONITORING

To fulfill Ministry and International Joint Commission requirements for surveillance of water quality in the Great Lakes system, the branch continued synoptic surveys in 1972. Data from this program are used in determining the seasonal, annual or longer term trends which are important in the overall management of Great Lakes water quality.

This information will also provide a basis for assessing the effectiveness of waste control programs such as the initiation of phosphorus removal. Monitoring on the heavily populated and industrialized interconnecting channels provides a measure of the progress of abatement at specific sources and indicates where further control is required to meet the international water quality objectives. Water quality information for each body of water was summarized for the first annual report of the Great Lakes Water Quality Board established under the Canada-U.S. agreement.

In carrying out the monitoring program on the interconnecting channels, the branch cooperated with the Michigan Water Resources Commission and the U.S. Environmental Protection Agency by scheduling surveys to give the broadest

time coverage to these waters. Other co-operative monitoring programs included weekly bacteriological sampling of nearshore recreational waters from Burlington to Oshawa and monitoring of the St. Lawrence and Niagara rivers as part of the Ministry's contribution to the "Materials Balance Project" of the International Field Year on the Great Lakes.

Numerous requests for water quality data and interpretation from other branches, other ministries, consultants and the public were answered during the year.

In connection with water treatment plant evaluations, phytoplankton samples were analyzed from Wellington, Thunder Bay, Brockville and Bowmanville. Weekly phytoplankton assessments at eight municipalities on lakes Erie and Ontario also continued.

Threshold odor analyses were completed on samples collected in connection with industrial waste studies at Sarnia and Bronte and a taste and odor water supply problem at Thunder Bay.

The distribution and abundance of algae in Lake Ontario was studied to provide photo-interpretive data for remote sensing techniques in assessing plant growths and a bioassay on the filamentous green alga *Cladophora* was also undertaken.

TOXICITY STUDIES

The effects of refinery wastewater on yearling rainbow trout — toxicity, growth rate and palatability of these fish — were studied through the use of continuous bio-monitoring techniques at the Bronte plant of B.P. Oil Ltd.

This work focuses on the biological significance of liquid wastes discharged by selected refining and petrochemical

industries in Ontario and is of importance in identifying future waste treatment needs for oil-based industries.

MERCURY

The mercury investigations continued in the St. Clair River system and Lower Lake Huron. As part of this work and in cooperation with the Ministry of Natural Resources the branch netted selected fish species to assess annual trends in mercury content of fish muscle.

UPPER GREAT LAKES INVESTIGATIONS

The Canada-U.S. Agreement of April 1972 included a reference for intensive investigation of pollution in the Upper Lakes to be reported on by December 31, 1975.

During the year, the branch has been developing a program of studies designed to provide the Ministry and the International Joint Commission with information on the causes and extent of water quality impairment required in the formulation of remedial and preventative water management programs. The Ministry's investigations are being integrated with those of the federal government and U.S. federal and state agencies.

HAMILTON, THUNDER BAY AND TORONTO HARBOR STUDIES

The major activity has been the evolution of near shore and harbor water quality models which have a predictive capability. These models vary in the approach and results obtained. Statistical and stochastic models are developed from routine and

intense water quality survey data (water chemistry, biological, bottom sediment and fish studies) gathered by Ministry staff or others to predict trends and evolve cause and effect relationships.

Numerical models are based upon data collected from chemical and physical recording instruments operated in the harbor entrances and at other harbor locations. These models consider existing shore geometry, discharges, intakes and lake exchanges which can then be varied to determine water quality implications of changes.

Process models examine chemical balances such as dissolved oxygen and nutrients and determine how the discharged chemical quantities are being utilized, e.g. sedimentation, biological absorption, reaction, exchange to lake, etc.

A combination of these models provides an understanding of the harbor kinetics and provides a basis to estimate the effects of changes. Significant progress has been made in model development, however, further refinement of the biological aspects is required.

The effects of thermal waste discharges continued to be monitored in the vicinity of the Nanticoke, Douglas Point and Pickering thermal generating stations.

Major drainage basin studies were carried out in the Kawartha-Trent and Lake Simcoe areas, the Thames River and in the Sudbury area. Various water quality investigations, which vary widely in intensity, purpose and scope, were carried out by staff of the Water Quality Branch.

KAWARTHA-TRENT WATER MANAGEMENT STUDY

The Kawartha Lakes-Trent River Water Management Program was continued. In

addition to assessing physical, chemical, biological and limnological conditions between Balsam Lake and the Bay of Quinte, branch staff completed spot surveys to evaluate the effects of waste discharges to the main stem and tributaries.

Specific objectives for each survey included an assessment of the degree and extent of effects on water quality and aquatic biota, the documentation of water-use conflicts and the delineation of proposed mixing zones.

Nutrient budgets involving a monitoring of the ingress and egress of growth stimulating elements to and from lakes of the system were completed. As well, information was gathered by means of public questionnaires on current and future water uses, to form a solid information base to guide the development of an ecologically sound water management plan.

LAKE SIMCOE STUDY

The Lake Simcoe Water Quality Study which was initiated in 1970 and intensified during 1971 and 1972 is designed to evaluate the biological, physical, chemical and bacteriological conditions of the lake. In 1971 and 1972, extensive water quality investigations were carried on throughout the open lake and intensive studies were performed in Cook, Kempenfelt and Shingle bays and other areas of the lake adjacent to major material inputs.

Clean water in Lake Simcoe is of paramount importance when one considers its size, its diverse recreational potential including excellent fishing, and its proximity to the most densely populated area of Ontario. Proper planning and management of development and activities within the basin is essential.

The report of findings of the 1970-72 water quality survey and the recommendations contained therein, are designed to lead to the formulation of a water quality management plan for the Lake Simcoe Basin. The water quality report will be published in 1973.

THAMES RIVER BASIN STUDY

The Thames River Basin Study was initiated in 1970 in response to the growing concern over existing water quality conditions and the potential further deterioration resulting from increased population growth and future economic development.

The study will lead to the development of guidelines for management of the basin's water resources to ensure that adequate quantities of water of satisfactory quality are available for the recognized uses. Erosion control and flood protection within the context of the water quality of this resource will be reviewed consistent with appropriate benefit-cost criteria.

A research program to define the quantitative relationships between nutrient and biomass was also initiated. Mathematical models are being developed to aid in the analysis of data and assessment of planning alternatives. A consultation program was also designed to obtain information from the public on the management of the basin's water resources.

During 1973, the ongoing survey programs will be completed. The findings of these studies, together with information obtained from the public consultation program will be incorporated in the final report which is scheduled for completion in December 1973.

SUDBURY LAKES

This major federal-provincial study has as its basic objectives the establishment of the cause and effect relationship between atmospheric contaminants, deteriorating water quality and declining fish populations in the Sudbury area, and how to restore acceptable water quality conditions.

In 1972, water quality investigations continued with the completion of toxicity evaluations at George Lake in Killarney Provincial Park. Considerable effort was also devoted to the development of a comprehensive study plan for proposed federal-provincial investigations. This plan includes further toxicity and water quality investigations and a pilot project to restore suitable water quality in lakes which have been acidified.

Some preliminary investigations into the toxicity of the sulphate ion to aquatic organisms undertaken in Sinclair Township are of particular significance to the Sudbury program. This work was initiated in response to the need for better information on the significance of elevated sulphate concentrations and should assist the Ministry in seeking maximum limits on sulphate in receiving waters affected by industrial inputs. Both laboratory and field studies are being considered for the 1973 season as continuations of this program.

RESTORATION AND ENHANCEMENT

In addition to dealing with the assessment and correction of specific pollution sources, the program of the Water Quality Branch has broadened to include the restoration and enhancement of waters characterized by excessive enrichment and related water use impairment, sometimes

the result of purely natural factors.

Within the general context of excessive aquatic enrichment, an ongoing study progressed in the southern end of Chemung Lake in cooperation with the Ministry of Natural Resources to determine whether extensive weed beds can be harvested as a means of enhancing water use potential without adversely affecting fish populations. Extensive vegetation removal is planned for the summer of 1973.

As a precursor to this work, a study of the relationships between aquatic plant growths and fish production in ponds north of Metropolitan Toronto has been carried out to provide direction for the larger removal program and to clarify sound pond management principles.

Other lake restoration projects included an evaluation of destratification of Buchanan Lake near Dorset to improve the ecology for deep-water species of fish, as well as aeration of Thompson Lake, north of Maple, and the Valens Reservoir, south of Guelph, to improve water quality.

An improved habitat for fish was produced in Buchanan Lake, although increased algal densities were promoted. In the Valens Reservoir, water quality improvements in terms of lake chemistry were noted.

Studies were carried out in Gravenhurst Bay of the Muskoka Lakes system and in Little Otter Lake, near Parry Sound, to assess the effectiveness of phosphorus removal in halting and/or reversing the process of eutrophication. Recognizing the limitations of a single year's data, it is encouraging that water quality improvements materialized in both systems, based on both chemical and biological responses.

In the Bay of Quinte, a cooperative venture involving staff of the Ministry of

Natural Resources and the Canada Centre for Inland Waters was initiated to assess current water quality conditions in light of future changes which hopefully will materialize following phosphorus removal at local sewage treatment plants.

An offshoot of the branch's activities related to aquatic restoration is the administration of a permit system to regulate the use of aquatic nuisance control agents. Permits are issued to authorize the use of compounds for algae and aquatic plant control, control of mosquito and blackfly larvae, leech control and coarse fish eradication.

A total of 207 permits were issued to authorize the use of aquatic nuisance control agents, compared to 212 in 1971. Over 1,050 inquiries were answered concerning regulatory practices and permissible control techniques. A member of staff continued to act as an aquatic specialist on the Ontario Herbicide Committee and recommendations for aquatic plant control were prepared for inclusion in the 1972 Research Report of the Eastern Section of the Canada Weed Committee.

SURVEILLANCE AND MONITORING — INLAND STREAMS AND LAKES

The monitoring program provides information on water quality throughout the province. The information collected through this program provides a basis for establishing the seasonal annual and long-term trends in water quality, assists in the definition of waste discharge restrictions and the enforcement of pollution control.

On the average, 15 sampling runs were carried out at 650 locations on inland streams. Sampling was intensified at about 40 streams draining into Lake

Ontario as part of the Ministry contribution to the material balance project of the International Field Year on the Great Lakes (IFYGL).

As part of the recreational lakes program, contributions were made to 25 lake reports. Approximately 70 lakes have been assessed under the program to date. The greater majority of the lakes studied so far have not demonstrated significant water quality problems. Coordination of the work which has been under the Sanitary Engineering Branch was transferred to this branch at year end.

In response to an increasing awareness of and concern for problems of accelerated eutrophication in recreational lakes, individual cottagers and associations, as well as permanent shoreline residents on over 60 lakes participated in the chlorophyll *a* - Secchi disc, self-help program.

Through this program, participating cottagers or associations collect water samples to be analyzed by the Ministry. The assessment of water quality relies on a relationship between plant life suspended in water (chlorophyll *a*) and measurements of the clarity of water carried out by the sampler (Secchi disc).

A total of 17 reports were completed utilizing the data collected during 1971 and forwarded to participating individuals. The educational benefits derived from direct involvement have been significant in terms of advancing an understanding of the causes and consequences of eutrophication in lakes.

ENVIRONMENTAL IMPACT ASSESSMENTS

Thirty-seven statements concerning the impact of various projects such as highways, reservoirs, dams, aggregate pits and elec-

tric power transmission line crossings on water quality in addition to 45 proposals for effluent discharges were examined for compliance with the Guidelines and Criteria for Water Quality Management in Ontario.

Water quality standards for river basins are being developed and referenced for the determination of permissible waste loadings. In the process of establishing water quality standards and effluent requirements, it becomes necessary to define mixing zones in the vicinity of waste discharges.

DREDGING AND MARINE CONSTRUCTION

All aspects of marine construction including dredging, piers, landfills, canals, bridges, submerged pipelines and utility conduits, shore protection structures and marine mining are evaluated for their impact on water quality.

In 1972/73, 222 proposals were evaluated, compared to 100 in 1971/72. Recommendations are made on these projects to prevent degradation of water quality and to avoid interference with other water users. Field studies are undertaken to verify the effects of various projects and to assess compliance with recommendations.

water-use conflicts was initiated. In addition, staff participated in the development of a public consultation program designed to obtain the views of the local residents and municipal officials. A staff member acted as coordinator of the branch contribution to the overall study.

Seven other water-use studies and two basin management studies were completed.

Data concerning water takings authorized by permit were compiled on a watershed basis for twenty watersheds.

Work was completed on the development of STORET location codes for streams in southern Ontario. Stream codes for selected areas were provided to the Ministry of Transportation and Communications for its Geocode project.

Staff carried out, or contributed to, 28 environmental impact evaluations. This involved reviews of proposed pits and quarries, roads, reservoirs, development plans, and power projects.

INTERFERENCE INVESTIGATIONS

Fifty-two ground-water and 13 surface-water interference problems were investigated and appropriate action taken. The problems can be grouped according to cause as follows: pit or quarry operation — 21; road, ditch, sewer or watermain installation — 16; municipal takings — 11; improper operation of recreational dams — 6; irrigation takings — 5; miscellaneous — 6. Three major reports were released. One concerned anticipated well and streamflow-interference due to municipal-well operation in the Township of Wilmot, and the other two dealt with well-interference problems caused by quarry dewatering in the Townships of Anderdon and Walpole.

WELL CONSTRUCTION MANAGEMENT

Water-well contractors and well-construction practices are regulated to ensure the installation of safe water wells and to protect groundwater quality. Eighty-seven licences for 1972 and 331 licences for 1973 were issued to water-well contractors. Records for 11,503 wells were received. The inspectors visited well contractors on 1,109 occasions, inspected 1,612 wells for sanitary construction, and checked the location of 10,811 wells. Twenty-eight investigations were made concerning water-well regulations.

Hydrologic Data

The activities of the Hydrologic Data Section are centered around the collection, analysis and publication of hydrometric data for Ministry and public purposes. While the provision of data is designed to serve general purposes, priorities were given to meeting the data requirements for the Northern Ontario Water Resources Studies, the Ground Water Assessment and Surface Water Assessment studies for the IHD, the Thames Basin Study, and Kawartha Lakes Eutrophication Study.

SURFACE WATER DATA

Basic streamflow data are collected through the installation and operation of gauging station networks and measurement of flows at other locations. A reduction was made in the number of gauging stations operated by the branch to permit improvement of record collec-

tion at the remaining stations. The network was reduced by 27 to 98 and summer measurements were made at 48 other sites. The number of stations operated by the Water Survey of Canada under a cost-sharing arrangement was increased by 12 to 94, including five lake level gauges.

The diverse and increasing number of requests for data from internal and public sources necessitated a review of data availability and processing. A task force worked on standard analytical procedures for conversion of basic data to the more frequently requested forms generally involving probability and extreme flow values.

Production of flow data by mathematical methods for locations where data are not available was under review. These studies are closely related to an appraisal of the adequacy of the network for selected areas in southern Ontario in terms of the reliability of measured and synthesized data to meet planning and management needs.

The basic streamflow data for 1971 was compiled and published and data for 1972 was prepared for publication. A map showing the characteristics of streamflow for stations in the Toronto Centred Region has been prepared for publication.

The section responded to many requests for data on the water levels in the Great Lakes using information provided by federal agencies.

GROUND WATER DATA

Hydrogeologic data were collected through the operation of a network of observation wells and the assembly of water-well records for new wells. The number of observation wells was increased by eight to 237. About 13,400

water-well records were received and placed on open file.

With the completion of conversion of the well record file to a computer format, flexibility in the retrieval and publication of data was achieved. Water Resource Bulletin 2-9 containing data from the water-well records for northern Ontario for the years 1946 to 1969 was published. Long-term consolidation of data for other areas in bulletin form was in progress and much use was made of computer print-outs of data on a county basis.

A Ground Water Probability Map of the County of Elgin was published. It is the fourth in a series and provides in simple terms the ground water conditions and prospects for well development. Similar mapping for the County of Haldimand was well advanced for publication in 1973.

About 250 visitors consulted the water well record files. Comments on ground-water availability were given to the public through 137 letters and some 1,100 telephone calls.

In support of the IHD — Ground Water Assessment program, the hydrogeologic properties of the overburden and the limestones of the Detroit River Group were tested and evaluated for a site in the Township of Morris.

River Basin Research

The activities of the River Basin Research Section were largely concentrated on scientific hydrologic studies including model formulation for five representative drainage basins in southern Ontario and ground-water inflow to Lake Ontario.

These studies comprise a substantial

Ontario as part of the Ministry contribution to the material balance project of the International Field Year on the Great Lakes (IFYGL).

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WATER QUANTITY

The Water Quantity Management Branch is responsible for the inventory, assessment and management of surface and ground water resources with respect to quantity, and also for the protection of ground-water quality.

The programs are carried forward through four sections and include the collection, analysis and publication of basic hydrometric and hydrologic data, the assessment of water resources through surveys and interpretation, the development of water supplies by test-drilling and well-construction projects, the management of resource use through a water permit system, the regulation of the water-well industry, and scientific hydrologic studies.

The programs include regulatory, planning and inventory assignments. Certain activities such as the Grand River Ground Water Recharge Studies, the Thames River Basin Study, the Onakawana Task Force Study and Ground Water Pollution Protection received priority.

Prior to April 1, 1972, the branch existed as the Division of Water Resources in the Ontario Water Resources Commission. The branch has a complement of 92 and a budget of \$1.5 million.

INTERNATIONAL HYDROLOGICAL DECADE

The International Hydrological Decade, an international program designed to advance the science of hydrology and knowledge of regional and global water resources, received continuing support by the River Basin Research Section through studies in five representative basins in southern Ontario, by the Hydrologic Data

Section through resource assessment, and by participation in various committees and seminars.

The International Field Year, a special one-year study of Lake Ontario, was in progress and was supported by the River Basin Research Section with respect to ground-water input to the lake and ground truth for several remote sensing projects. Representatives worked on the Steering Committee for the IFYGL, the Canadian Project Management Team, the Terrestrial Water Balance Panel and several subordinate groups.

NORTHERN ONTARIO WATER RESOURCES STUDIES

The Northern Ontario Water Resources Studies comprise a preliminary assessment of the water resources in the river basins flowing to James and Hudson bays. The Hydrologic Data and Surveys and Projects Sections integrated their data collection and interpretive work with co-operating federal and provincial agencies.

Administrative liaison was ensured through the Federal-Provincial Co-ordinating Committee on Northern Ontario Water Resources Studies.

CARTOGRAPHY

The Cartography Unit supported most programs of the branch and completed 41 large multicolor and monochrome maps, 132 small maps and illustrations and plotted the location of 1,347 sources of water for which permits had been issued.

DATA PROCESSING ACTIVITIES

Effective development of scientific computer programs and data processing systems to meet the needs of the branch and its sections continued to be achieved through the co-ordinating efforts of a branch liaison engineer working closely with Administrative Services.

SPECIAL ACTIVITIES

The branch provided leadership in a number of co-ordinating roles.

The Grand River Implementation and Co-ordinating Committees were established in May to consider and coordinate implementation of the Grand River Planning Report. Representatives of the Ministries of the Environment and Natural Resources, the Management Board of Cabinet, and the Grand River Conservation Authority serve on the committees. They met six times and established several task forces and subcommittees to assist in coordinating work in the basin. One meeting between members of the Implementation Committee and local municipal and conservation authority representatives was held in July.

The branch had members on the Steering Committee and Joint Management Team for the International Field Year for the Great Lakes, and the International Reference Group on Great Lakes Pollution from Land Use Activities for the International Joint Commission on Boundary Waters.

Members of the branch led a hydrogeology field trip for the 24th International Geological Congress, and a cartographic facilities tour for the Sixth International Cartographic Association Conference. Papers were presented at the

Congress, the Annual Conference of the American Water Resources Association, the Canadian Section Meeting of the American Water Works Association, the Industrial Wastes Conference, a Symposium of the International Association of Hydraulic Research, and the International Symposium on the Role of Snow and Ice in Hydrology.

Surveys and Projects

The Surveys and Projects Section conducts municipal groundwater surveys, municipal test drilling and well construction projects, drainage basin surveys, and investigations on ground-water pollution and special water supply problems.

While the demand for project support slackened somewhat, the closer liaison with the Waste Management Branch brought an increase in the number and intensity of pre-approval evaluations of proposed disposal sites. In the area of basin or regional studies, Ministry priorities required re-direction of efforts towards studies associated with the Thames, Grand and Onakawana.

NORTHERN ONTARIO WATER RESOURCES STUDY

The field and interpretive work continued on the study of the quantitative and qualitative aspects of the water resources of northern Ontario which is designed to lead to publication of a preliminary assessment report in 1974.

Test drilling to evaluate ground-water conditions was carried out in the vicinity of Fort Albany, Moosonee, Nakina and Onakawana. Representative samples

of surface waters for chemical and biological examination were obtained for the entire area, and ground-water samples were collected along the roads from Hornepayne to Nakina.

It is an objective of the study to develop an understanding of the hydrologic processes of the area and sufficient basic data so that resource data can be synthesized for all locations. Progress was made in development of a simple predictive model utilizing precipitation and short-term streamflow records. Testing of the model is required.

GRAND RIVER RECHARGE STUDY

A feasibility study was initiated into the physical, technical and economic opportunities for utilizing artificial recharge of ground water as a means of providing a source of municipal water supply for the Kitchener-Waterloo area.

The first step was to identify areas with physical characteristics suitable for recharge operations. Terra-Scan Ltd., soil consultants, was engaged to conduct reconnaissance exploration and identify several areas for detailed study. Co-ordination of this work and of a broader resource development study was a function of the section and branch respectively.

DRAINAGE BASIN SURVEYS

To meet commitments for water resource studies in the Grand and Thames Basins, the Drainage Basin program was modified and integrated more closely with the work of the Water Quality Branch. The report entitled 'Water Resources of the Upper Nottawasaga Drainage Basin' was released in May 1972. A report on 'Water Resources of the Moira River

Drainage Basin' was being finalized and was scheduled for printing by June 1973. Work on the Duffin Creek basin was reduced.

Resource assessment for the Thames River Basin was substantially completed the work of other branches towards the development of an integrated water management plan by December 1973.

REGIONAL STUDIES

In support of water and sewage works planning reports being coordinated by the Sanitary Engineering Branch, the study of ground and surface-water availability in the Counties of Halton and Peel was advanced.

MUNICIPAL GROUND WATER SURVEYS

Twenty-two surveys were undertaken by the section to evaluate ground-water conditions for municipal supply purposes. Fifteen advisory reports were released and seven studies were in progress. Nine of the completed surveys were for proposed Ministry water works programs. Test drilling was recommended for all nine at a total estimated cost of \$142,000.

TEST DRILLING AND WELL CONSTRUCTION PROJECTS

The Section participated in seven test-drilling projects, four well-construction projects and two combined test drilling-well construction projects. Six projects were carried forward from the previous year and work was in progress to initiate three test drilling and two well construction projects in 1973. The estimated price of approved and pending contracts amounted to \$342,000.

Test-drilling projects resulted in the location of suitable water supplies at Ayr, Frankford, L'Orignal, Melbourne, Wasaga Beach and Winchester. Production wells were constructed at Caledon East, L'Orignal (2), Melbourne, Sunderland and Winchester (2).

GROUND WATER QUALITY PROTECTION

Two hundred and twenty investigations into existing or potential ground-water pollution problems were completed or in progress. One hundred and fifty-one reports were released and 69 investigations were in progress at the end of the period. Thirty-two of the investigations were associated with sanitary landfill sites, 70 dealt with hydrocarbon spills and leaks, and several with significant industrial or transportation accidents.

The reports contain advice on the potential for pollution, the nature and movement of pollutants, remedial or preventative measures or prospects for alternative water supplies.

SPECIAL WATER SUPPLY INVESTIGATIONS

Sixty-six investigations into water supply problems and well performance were in progress or completed. Fifty-nine reports were released. Twenty-eight of the investigations involved the testing of project wells to determine changes in production potential.

Nineteen well inspections were conducted and 48 consulting engineers' reports for proposed provincial and municipal Ministry projects were reviewed.

Water Well Management

The water-quantity management program controls the taking of water to promote efficient development, beneficial use and equitable sharing of the available supply. This is done through a permit system involving regulation of takings and investigation of interference complaints. Associated water-use, basin planning and environmental impact studies are carried out.

APPLICATIONS AND PERMITS

Four hundred and eighty nine Permits To Take Water were issued for the following purposes: irrigation — 238; industrial — 129; municipal — 56; recreational — 45; and commercial — 21. Fifty-seven permits were amended, 266 were cancelled and 654 were renewed. In addition, 34 Letters of Approval were issued to authorize test pumping. The permits were grouped by source as follows: surface water — 367; ground water — 99; combined — 13. At the end of March, 1973, 5093 permits were in effect, authorizing a maximum total taking of 12.8 billion gallons per day.

Ten detailed pre-permit investigations were carried out to evaluate the potential of the proposed taking to interference with other uses, so that appropriate terms and conditions could be applied.

PLANNING STUDIES

Preliminary data collection for the section's contribution to the Thames River Basin study was completed, and a detailed assessment of water takings and

water-use conflicts was initiated. In addition, staff participated in the development of a public consultation program designed to obtain the views of the local residents and municipal officials. A staff member acted as coordinator of the branch contribution to the overall study.

Seven other water-use studies and two basin management studies were completed.

Data concerning water takings authorized by permit were compiled on a watershed basis for twenty watersheds.

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Staff carried out, or contributed to, 28 environmental impact evaluations. This involved reviews of proposed pits and quarries, roads, reservoirs, development plans, and power projects.

INTERFERENCE INVESTIGATIONS

Fifty-two ground-water and 13 surface-water interference problems were investigated and appropriate action taken. The problems can be grouped according to cause as follows: pit or quarry operation — 21; road, ditch, sewer or watermain installation — 16; municipal takings — 11; improper operation of recreational dams — 6; irrigation takings — 5; miscellaneous — 6. Three major reports were released. One concerned anticipated well and streamflow-interference due to municipal-well operation in the Township of Wilmot, and the other two dealt with well-interference problems caused by quarry dewatering in the Townships of Anderdon and Walpole.

WELL CONSTRUCTION MANAGEMENT

Water-well contractors and well-construction practices are regulated to ensure the installation of safe water wells and to protect groundwater quality. Eighty-seven licences for 1972 and 331 licences for 1973 were issued to water-well contractors. Records for 11,503 wells were received. The inspectors visited well contractors on 1,109 occasions, inspected 1,612 wells for sanitary construction, and checked the location of 10,811 wells. Twenty-eight investigations were made concerning water-well regulations.

Hydrologic Data

The activities of the Hydrologic Data Section are centered around the collection, analysis and publication of hydrometric data for Ministry and public purposes. While the provision of data is designed to serve general purposes, priorities were given to meeting the data requirements for the Northern Ontario Water Resources Studies, the Ground Water Assessment and Surface Water Assessment studies for the IHD, the Thames Basin Study, and Kawartha Lakes Eutrophication Study.

SURFACE WATER DATA

Basic streamflow data are collected through the installation and operation of gauging station networks and measurement of flows at other locations. A reduction was made in the number of gauging stations operated by the branch to permit improvement of record collec-

tion at the remaining stations. The network was reduced by 27 to 98 and summer measurements were made at 48 other sites. The number of stations operated by the Water Survey of Canada under a cost-sharing arrangement was increased by 12 to 94, including five lake level gauges.

The diverse and increasing number of requests for data from internal and public sources necessitated a review of data availability and processing. A task force worked on standard analytical procedures for conversion of basic data to the more frequently requested forms generally involving probability and extreme flow values.

Production of flow data by mathematical methods for locations where data are not available was under review. These studies are closely related to an appraisal of the adequacy of the network for selected areas in southern Ontario in terms of the reliability of measured and synthesized data to meet planning and management needs.

The basic streamflow data for 1971 was compiled and published and data for 1972 was prepared for publication. A map showing the characteristics of streamflow for stations in the Toronto Centred Region has been prepared for publication.

The section responded to many requests for data on the water levels in the Great Lakes using information provided by federal agencies.

GROUND WATER DATA

Hydrogeologic data were collected through the operation of a network of observation wells and the assembly of water-well records for new wells. The number of observation wells was increased by eight to 237. About 13,400

water-well records were received and placed on open file.

With the completion of conversion of the well record file to a computer format, flexibility in the retrieval and publication of data was achieved. Water Resource Bulletin 2-9 containing data from the water-well records for northern Ontario for the years 1946 to 1969 was published. Long-term consolidation of data for other areas in bulletin form was in progress and much use was made of computer print-outs of data on a county basis.

A Ground Water Probability Map of the County of Elgin was published. It is the fourth in a series and provides in simple terms the ground water conditions and prospects for well development. Similar mapping for the County of Haldimand was well advanced for publication in 1973.

About 250 visitors consulted the water well record files. Comments on ground-water availability were given to the public through 137 letters and some 1,100 telephone calls.

In support of the IHD — Ground Water Assessment program, the hydrogeologic properties of the overburden and the limestones of the Detroit River Group were tested and evaluated for a site in the Township of Morris.

River Basin Research

The activities of the River Basin Research Section were largely concentrated on scientific hydrologic studies including model formulation for five representative drainage basins in southern Ontario and ground-water inflow to Lake Ontario.

These studies comprise a substantial

portion of the Ministry's contribution to the International Hydrological Decade program as well as serving internal needs. Other specialized work included ground geophysical surveys, geophysical well logging, soil analyses and remote sensing studies.

REPRESENTATIVE BASIN STUDIES

The collection and analyses of data and studies of hydrologic and hydrogeologic processes were continued in five drainage basins representative of major physiographic and geomorphologic regions in southern Ontario. In support of these studies, detailed ground-water sampling and chemical analyses programs were undertaken to aid in the delineation of flow systems, and the extent and characteristics of subsurface aquifers were examined. The development of mathematical models was commenced to describe the complex interaction of the physical processes involved.

In three of the basins, analyses of meteorologic data were undertaken in preparation for the release of statistical reports. The section was host to a sub-committee of the Canadian National Committee for the IHD and to some staff and students of the Faculty of Forestry, University of Toronto, during field trips in one basin.

In two of the basins, soil moisture and snow surveys were again carried out seasonally. In the Bowmanville, Soper and Wilmot Creeks basin, gravimetric soil sampling and snowpack measurements were co-ordinated with gamma attenuation overflights carried out by federal agencies as part of a co-operative project to assess new remote sensing methodology.

Using background data from the representative basins, two papers were prepared. One entitled 'Basin-Wide Water Equivalent Estimation from Snowpack Depth Measurements' was presented at the IHD-UNESCO-WMO/IASH Symposia on the Role of Snow and Ice in Hydrology, held in Banff, Alberta. The other paper entitled 'An Approach to Mathematical Modelling of Ministry of the Environment IHD Representative Basins' was released as a Ministry publication.

GEOPHYSICAL INVESTIGATIONS

Geophysical studies were carried out in fifteen areas of the province. The majority of these studies assisted geological field investigations and projects being undertaken by other sections in the branch. A seminar on geophysical methods was presented for branch staff.

SOILS LABORATORY STUDIES

In support of Branch programs, 395 soil samples were analyzed in the branch's soils laboratory.

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES (IFYGL)

Hydrogeologic studies were continued in seven representative areas in the Lake Ontario drainage basin to determine the ground-water inflow to the lake, a project forming a large part of the Ministry's contribution to the IFYGL program. Active field work in this program terminated March 31, 1973. An Overburden Well Yields Map of the Lake Ontario Basin was prepared and approved for release.

REMOTE SENSING

Under the IFYGL program, the branch continued to participate in remote sensing projects. Studies were carried out to determine the value to hydrology and geohydrology of the available ERTS Simulation photos and actual ERTS-A imagery.

Close liaison was maintained with the federal Atmospheric Environment Service (AES) and associates of the University of Michigan (ERIM) to assess developing techniques and requirements for adequate ground-truth information.

Staff were involved in many technical meetings concerning remote sensing and represented the Ministry on the Canada Centre for Remote Sensing (CCRS) Working Group on Hydrology. A seminar on remote sensing was presented for branch staff.

HYDROLOGIC MODELLING

As part of the branch's contribution to the Thames River Water Management Study, section staff developed and implemented a streamflow generation program for several stations on the Thames River, to provide input to the water quality model of the Water Quality Branch. Computer programming support was provided by the Systems and EDP Section.

With the publication of the conceptual report on mathematical modelling for IHD representative basins, work was commenced on a data management system, in co-operation with the Systems and EDP Section, for use with the proposed modelling studies. Basic data were used in trials with runoff-precipitation regression models for one IHD basin.

DATA PROCESSING ACTIVITIES

In co-operation with the Systems and EDP Section, design and development of the general data retrieval and plotting program were completed for the Water-Well Record System. An additional 13,500 current water-well records were coded and submitted for computer storage.

Use of computer programs in the Streamflow Data System was continued in support of branch projects. Development work was continued on programs to process analog charts, to plot hydrographs, to examine precipitation-runoff data, and on systems to handle ground-water quality and observation-well data.

The STORET stream coding system was instituted and the Branch Task Force on Streamflow Data Analysis concluded its discussions on streamflow data analyses.

Water Supply and Pollution Control

INDUSTRIAL WASTES

The Industrial Wastes Branch is responsible for regulation and control of liquid industrial wastes in Ontario as decreed under The Ontario Water Resources Act and The Environmental Protection Act.

To ensure that all industrial effluents comply with Ministry effluent objectives, branch activities include surveys of all industrial sources of wastes to the aquatic environment, assessments of the status of pollution control at each plant and recommendations on remedial measures where required.

An extensive surveillance program is maintained throughout the province, legal enforcement measures such as prosecutions and orders are conducted for gross violations, and engineering plans for waste treatment facilities are reviewed for approval. Cooperative programs are worked out with municipalities for the regulation of industrial waste discharges into municipal sewers and, a variety of specialized advisory services are available to individual companies or major industry groups to resolve pollution problems.

Special interest was placed during the past year on improving procedures for investigating public complaints, developing a spill prevention program, and responding quickly to spills of hazardous materials.

Most major industries are moving along rapidly with their abatement programs, with the exception of the pulp and paper industry. Notable progress was made in the steel industry and much attention was directed to some of the more complex problems encountered in the petroleum and allied industries.

The activities of some of the major industrial categories are highlighted below.

BASIC IRON AND STEEL

The basic iron and steel industry continued to make progress in bringing waste effluents under improved control. At Algoma Steel Corp. Ltd., in Sault Ste. Marie, a clarifier for blast furnace wastes and a cooling tower recycling system for steel furnace wastes are nearing completion. One of the major studies underway involves the acidification of blast furnace cooling water to control the discharge of cyanides.

Dominion Foundries and Steel, Ltd., Hamilton, finished construction of a filtration plant for hot-rolling mill wastes and an acid regeneration plant. A major project currently under construction is the treatment plant for cold-rolling mill wastes. These three projects deal with the wastes from the finishing works which have followed on from previous facilities dealing with effluents from the coking and steel-making operations.

The Steel Company of Canada, Ltd., started up a filtration plant to remove solids and oil from its tube plant in Welland. At the Hilton Works in Hamilton, two additional clarifiers for blast furnace wastes which are part of an overall recycling plan, a filtration plant for a new hot-rolling mill, an oil treatment plant, diversion of coke plant wastes to the municipal sanitary sewage system, and a system for the collection and disposal of batch sources of wastes are all now operational.

A major project under construction is an ion-exchange plant for control of chromium in the electrolytic tin lines, and a major study is nearing completion

for the removal of suspended solids from the finishing mills.

CHEMICAL AND PETROLEUM

A number of major pollution abatement programs in the chemical, petroleum and petrochemical industries were completed in 1972. Sun Oil Ltd. (Sarnia), Imperial Oil Enterprises Ltd. (Sarnia), Polymer Corporation Ltd., (Sarnia), Dow Chemical of Canada, Ltd., (Sarnia), Bruce Heavy Water Plant (Township of Bruce), Howards & Sons (Canada) Ltd. (Cornwall), and B.F. Goodrich Canada Ltd., (Thorold) all have pollution control facilities which should lead to significant improvements in water quality.

Regulations concerning deep well disposal of industrial wastes have been drafted and when promulgated in 1973 will result in curtailment of this method of disposal in the Sarnia area. Companies which had been relying on this type of disposal have had to develop appropriate alternatives.

Cooperation has been good and the Sarnia area refineries have established facilities to satisfactorily treat their wastes prior to discharge to the St. Clair River. These major projects were designed, installed and brought into operation in a very short time period, a fact which represents a considerable achievement for the industry.

Work continued in identifying chemical waste components contributing to fish tainting and other sub-lethal effects on fish. A major survey of Polymer Corporation Ltd. was completed in an effort to obtain quantitative data on non-biodegradable organics suspected of contributing to fish-flesh tainting.

Staff participated on the Environment Canada Task Force on Effluent Regula-

tions for the Petroleum Refining Industry. The task force is comprised of representatives from the oil industry, provincial agencies, the Environmental Protection Service, and the Fisheries Service of Environment Canada. The objective of the task force is the promulgation of national effluent regulations for the petroleum refining industry across Canada.

During the year, 36 applications for approval of treatment works were approved and these facilities, when installed, will represent a capital investment of about \$4.5 million. These figures indicate a positive approach by this segment of industry to solving its environmental problems.

A notable achievement in pollution control in the organic chemical manufacturing industry has been the development of a biological treatment system by Du Pont of Canada Ltd. at its Maitland Works for the removal of organic and nitrogenous materials from the St. Lawrence River.

The treatment system, developed by the company in cooperation with the Ministry, is expected to be fully operational in the summer of 1973 at a cost of some \$2 million to the company.

FOOD PROCESSING

Continued progress was made by the food processing industries towards correcting their waste disposal problems. Approval was given to 14 applications over the past year for improved waste treatment facilities costing approximately \$1.6 million.

The largest expenditures were for improved facilities at The Canada Starch Company Ltd. (Cardinal), Metcalfe Foods of Canada Ltd. (Deseronto), Libby, McNeill & Libby of Canada, Ltd.

(Wallaceburg), Campbell Soup Company Ltd. (Township of Blanshard), Maple Lodge Farms Ltd. (Township of Chinguacousy), and Bowes Company Ltd. (Colborne).

The problem of disposal of whey, a by-product of cheese manufacturing, has not yet been solved. Several companies, however, are actively investigating methods of processing whey to make usable food products. It is believed that solutions to the problem may be forthcoming in the near future.

MINING AND METALLURGICAL

This industrial classification includes limestone quarries, sand and gravel operations, hard rock mining and/or milling, and smelting and refining operations.

In 1972, a total of 11 certificates of approval were issued to industries in this classification for water pollution control facilities. The estimated capital and engineering costs of these works totalled \$3.7 million. These were mainly for the improvement of wastewater treatment and/or other aspects of water pollution control at existing operations.

Operations commenced at two new major mines with approved water pollution control facilities — the Mattabi Mines Ltd. copper/zinc/lead mine and mill at Sturgeon Lake, north of Ignace, and The International Nickel Co. of Canada, Ltd. nickel mine and mill at Lake Shebandowan, 40 miles northwest of Thunder Bay.

Water pollution control facilities at these locations include tailings areas designed to retain all tailings generated during the operating life of the mines, and the piping and pumping required to recycle wastewaters from the tailings

areas to the mills.

A task force, including representatives of the Ontario and other provincial governments, the federal government, and the mining industry, began discussions and studies leading to the development of national regulations for water pollution control in the mining and metallurgical industries. It is expected that these regulations will be promulgated in late 1974 or in 1975.

Two major reports were issued in 1972, which will be useful in assisting the industry to evaluate and remedy a number of its potential or actual water pollution problems. These were entitled 'The Problem of Acid Mine Drainage in the Province of Ontario — 1972', and 'Use, Characteristics and Toxicity of Mine-Mill Reagents in Ontario — 1972'.

PULP AND PAPER

During the year, a net decrease of about 38 million gallons per day in the total daily water usage of the 42 operating pulp and paper mills in Ontario was recorded. This was primarily attributable to the closure of sulphite pulping operations at the Cornwall mill of Domtar Ltd., the installation of a dry debarking system at The Great Lakes Paper Co., Ltd. in Thunder Bay and in-plant waste reductions at the Smooth Rock Falls mill of Abitibi Paper Co. Ltd.

Clarifier installations at Domtar Ltd. (Cornwall), Domtar Ltd. (Red Rock), The Great Lakes Paper Company, Ltd. (Thunder Bay), and Kimberly-Clark of Canada Ltd. (St. Catharines), were primarily responsible for a reduction of total suspended solids (bark and fibre) discharged by the industry of about 130 tons per day.

No secondary treatment facilities for the removal of BOD₅ were installed at any of the mills this year. Chemical recovery facilities being installed at the Thorold mill of The Ontario Paper Company Ltd. are expected to result in a significant reduction in BOD₅ discharge from this mill. These facilities will be in operation in the spring of 1973.

The bio-oxidation lagoon system at the new kraft mill of The Ontario-Minnesota Pulp and Paper Company Ltd. at Fort Frances experienced difficulties due to icing of the floating aerators. Modifications to the aerators have alleviated this problem and they have performed well during the winter of 1973.

Start-up difficulties have also been experienced in the mill which have resulted in waste discharges in excess of the design levels for the treatment system. Consequently, the treatment efficiency of the lagoon system has been relatively poor during this first year of operation.

Problems of airborne-foam and odors from the treatment system have also been encountered. A water spray system has been installed to alleviate these problems.

As part of the continuing program of documenting the bacteriological aspects of aerated lagoons, a second bacteriological survey of the aerated lagoon at Fort Frances and the Rainy River in the vicinity of the lagoon outfall was conducted by the Environmental Protection Service of Environment Canada, with the assistance of Ministry field personnel.

Pilot plant studies were conducted and are still being conducted to determine the applicability of various biological-oxidation waste treatment processes to particular mill wastes. Some of these studies are being conducted by the Water Pollution Control Directorate of Environ-

ment Canada at the Canada Centre for Inland Waters, Burlington, and some studies are partially funded by a grant under the Cooperative Pollution Abatement Research (CPAR) program of Environment Canada.

As a direct result of the studies into taste and odor of water and fish-flesh tainting carried out by Domtar at the Cornwall mill, a number of kraft mills are investigating the applicability of condensate stripping systems. The Ministry is encouraging the installation of these systems at each kraft mill in the province as it is believed that solutions to the above problems will represent significant progress in dealing with kraft mill effluent discharges.

Four approval certificate for waste treatment facilities were issued to pulp and paper mills during the year. The total estimated capital expenditures represented by these certificates is about \$6 million, of which approximately \$5.5 million pertains to the Domtar mills in Cornwall and Red Rock. The total value of the 52 certificates issued to the pulp and paper industry since 1965 now stands at \$35 million.

SECONDARY INDUSTRIES

This industrial classification includes tanneries, textile mills, automotive companies, metal plating and fabricating plants, rendering plants, manufacturing of building products and service industries.

From April to December 31, 1972, 17 certificates of approval were issued for treatment works and the capital expenditures involved were approximately \$4.2 million. Some of the larger projects approved were for General Motors of

Canada, Ltd. (St. Catharines), Ontario Hydro, Lennox Generating Station, East Side Plating (Windsor), RCA Ltd. (Midland), and CP Rail (Borough of Scarborough).

Most of the ready mix concrete companies in the Metropolitan Toronto area installed non-effluent treatment systems during this period.

An extensive survey was conducted of the multi-plant complex of General Motors of Canada, Ltd. in Oshawa. Pre-treatment facilities were installed by this company to improve the quality of effluent being discharged to the municipal sanitary system.

ELECTRICAL POWER GENERATION

The more important concerns with regard to the environmental consequences of electrical power generation in the province are summarized below.

Nanticoke Environmental Committee

This committee, which was formed to guide the environmental study program in the Long Point Bay area of Lake Erie, has almost finalized a report outlining the physical, chemical and biological nature of the aquatic environment in the Nanticoke area.

The studies will continue over the next several years in order to determine whether the thermal electric generating station (4000 megawatts at full power) and other industrial development (Stelco, Texaco) planned in the near future will result in any changes in that part of the Lake.

Task Force on Generation Station Siting

This task force, which was formed to ensure that adequate consideration is given to all relevant factors for generating station sites recommended by Ontario Hydro, has completed the development of evaluation criteria and has evaluated the suitability of recommended sites in two areas of the province. Terms of reference and makeup of the task force are currently being reviewed with a view to obtaining public input at an early stage in the site selection process.

Thermal Discharges

Predictions of cooling water requirements associated with the exponential expansion of the thermal electric power generation industry have created concern that thermal discharges to the Great Lakes may cause thermal pollution in the future. Existing guidelines for thermal discharges are being examined for adequacy and there is a continuing dialogue with Ontario Hydro and the Ministry of Natural Resources on the use of Great Lakes waters for once-through cooling purposes.

Task Force Onakawana

The potential environmental consequences of developing the lignite deposits in the Onakawana area in the James Bay drainage basin as an energy resource was considered by a task force which was instructed to report its findings, prior to the completion of economic feasibility studies being undertaken by Ontario Hydro, the Province of Ontario and commercial interests.

This was done in order that costs associated with protection of the environment could be given due consideration in determining the economic feasibility of the development. The report of the task force was completed at the end of 1972.

APPROVAL OF NEW TREATMENT FACILITIES

Section 42 of the Ontario Water Resources Act requires industries to submit applications to the Ministry for the approval of plans for the collection, transmission, treatment and disposal of liquid industrial wastes. Applications are reviewed and, if found satisfactory, certificates of approval are issued.

Prior to approval, a public hearing may be held under the terms of Section 43 and 44 of the OWR Act. Hearings are mandatory if the treatment works are to extend across municipal boundaries and are held on an optional basis where the Ministry considers it in the public interest to hold such a hearing.

During the 1972/73 fiscal year 102 certificates of approval were issued for individual treatment works involving estimated total expenditures of \$23.4 million. In addition, 25 other submissions were given concurrences, involving an estimated capital cost of \$9.7 million.

These latter control facilities were not subject to Section 42 of the Act as they were classed as in-plant process control measures, non-effluent systems involving wastewater re-use, or pretreatment systems with discharges to municipal sewage treatment plants.

As of March 31, 1973, 25 applications were outstanding involving an estimated projected expenditure of some \$45 million.

Since mid-1965 when the approval program was initiated, 726 certificates have been issued for industrial treatment and control works involving an estimated cost to industry of \$151 million.

In accordance with the terms of The Pollution Abatement Incentive Act, 1970, applications from industry for grants up

to the equivalent of the provincial retail sales tax on equipment installed for purposes of pollution abatement are reviewed and recommendations made to the Ministry of Consumer and Corporate Affairs. Recommendations were made in the 1972/73 fiscal year for grants totalling some \$573,000 regarding 172 applications.

PREVENTION AND CONTROL OF SPILLS OF HAZARDOUS MATERIALS

In 1972, a total of 310 spills was recorded and 287 complaints were received. Most of the complaints concerned spills rather than other forms of pollution. There was reduction of about 10% in the number of spills which occurred in 1972 compared with 1971 figures.

The loss of petroleum products was the most frequent type of spill, representing 61% of the total. Only 3% of the spills could be classed as serious and only 22% of the spills could be classed as true accidents.

The majority of the remainder could be attributed to human error, negligence and carelessness. Seventy percent of the complaints received were related to industrial water pollution problems. These calls indicate public awareness and concern for the environment. Many of the complaints (41%) concerned visible oil.

Segments of the Province of Ontario Contingency Plan for Spills of Oil and Other Hazardous Materials were implemented on a number of spill occasions. Of these, the more significant spill incidents were: the Parker Evans/Sydney Smith ship collision on the St. Clair River in June, 1972, the oiling of approximately 3½ miles of Ipperwash Beach in June, 1972, the derailment of a TH & B Rail-

road train and resulting spillage of about 1400 tons of sulphuric acid in the Town of Pelham in December 1972, the contamination of some private wells with fuel oil resulting from acts of vandalism in the Police Village of Edin Mills in January 1973 and the explosion and resulting loss of 800 tons of sulphuric acid and about 50 tons of bunker oil to marshland adjacent to the Grand River at the ERCO Industries Ltd. plant, Port Maitland, in March 1973.

The Province of Ontario Contingency Plan is being rewritten and was expected to be completed by March 1973. In view of the impending reorganization of the Ministry, however, rewriting the plan will be held in abeyance until late 1973. It has been recommended that the revised plan be modified to outline the response for spills to air and land, as well as to water, and to broaden the scope to include some classes of moderate spills in addition to major spills.

A program has been initiated to produce a list of approved treating agents for clean-up of oil spills under special circumstances. Acceptability criteria have been published and applications have been received from a number of manufacturers for approval of their products. It is anticipated that an approved list will be published in the summer of 1973.

INDUSTRIAL POLLUTION CONTROL IN MUNICIPALITIES

A technical coordinating committee has been established to improve liaison between municipalities in Metropolitan Toronto in the regulation of industrial waste disposal to municipal sewers. A similar committee has been established to coordinate the industrial pollution control activities of municipalities con-

nected to the South Peel regional water supply and sewage system.

Generally, liaison is being maintained with municipal engineers in the regulation of industrial waste disposal in municipalities through the Municipal Engineers' Association-Ministry of the Environment Liaison Committee.

In the fall of 1972, a course was offered to municipal officials and other interested parties on the control of industrial wastes in municipalities. This is the third year for this course although it was presented in a somewhat revised format with emphasis on treatment technology and case history studies. There were 60 attendees at the course this year.

An industrial waste survey of the Town of Elmira was conducted. At the same time, close contact was maintained with Uniroyal Ltd. on the development of activated carbon pretreatment of chemical wastes being discharged to the Elmira sewage works. Activated carbon studies have also been conducted on the sewage works effluent by the Research Branch of the Ministry.

ENFORCEMENT MEASURES

This is an essential tool for forcing non-cooperative industries to embark on pollution control programs. However, the amount of work involved in the preparation of cases for prosecution in the courts and the gravity of the problems are seldom reflected by the fines levied in a successful prosecution.

Seven charges were laid against five companies under the OWR Act. Six of these prosecutions were successful and fine fines totalling \$4,000 were levied against the offending companies. One case was dismissed and a conviction on two counts is being appealed by one company.

PRIVATE WASTE AND WATER MANAGEMENT

The main objective of the Private Waste and Water Management Branch is to prevent and abate pollution and human health hazards associated with private sewage disposal and private water supply systems.

Consistent with this objective, the branch recommends against any subdivision or development of lands not served by municipal sewage systems or which are found unsuitable for on-site sewage disposal.

With the exception of the Muskoka-Parry Sound (Health Unit) district, direct responsibility for the control of private sewage systems currently rests with local Medical Officers of Health under provisions in The Public Health Act.

Although The Environmental Protection Act, 1971, under Part VII deals with these systems, that part only applies in areas which have been designated by proclamation. To date no area has been so proclaimed. Under this arrangement a major role of the branch has been one of technical advisor and consultant to the medical officers as well as to other agencies, both provincial and municipal, and to the public.

With the incorporation of the branch into the new Ministry of the Environment in April 1972, its current role and responsibilities have been under review by the government. As a result, it was recently decided that overall responsibility for the control of private waste systems will be vested in the Ministry with provision for transferring the inspection function to regional governments and to local municipalities as deemed appropriate. It was also decided that the branch should undertake research into septic tank problems.

The branch provides service through a staff of 64 permanent members supplemented by 51 full-time casual members and through six regional offices and ten district offices. It is organized into three sections — Regional Operations, Cottage Pollution Control Section and Technical Services Section.

Regional Operations

The Regional Operations Section delivers the major portion of the branch's programs to the field.

On May 15, 1972, by an agreement between the Board of Health of the Muskoka-Parry Sound District Health Unit and the Minister, the direct control of private sewage disposal systems in the health unit district was assumed by the branch. A staff of 17 inspectors located in Bracebridge, Huntsville and Parry Sound provided the following services which formerly would have been undertaken by the Health Unit:

2,907 Requests for septic tank permits were reviewed.

1,694 certificates of approval for septic tank systems installed were issued.

424 complaints were received and investigated.

The section's staff gave advice to the public in 3,700 personal and 6,600 telephone interviews.

In addition to the above services provided in Muskoka-Parry Sound, the following were also supplied from the various regional and district offices:

Advice on private waste disposal and water supply to Medical Officers of Health, other agencies and the public. Review of 117 Official Plans and Amendments on behalf of the Ministry of Treasury, Economics and Intergovernmental Affairs.

Appraisal inspections of 15,000 subdivision lots and 7,200 severance lots — all new lots proposed for development in unsewered areas.

This represents about half of the total of new lots created annually in unsewered areas in Ontario. Consolidated information is not available on the number of the remaining lots inspected by Health Units.

In much of the Precambrian area, the soil cover is limited and in their natural state many lots are not suitable for on-site sewage disposal. In Muskoka-Parry Sound only about 30% of the lots inspected were suitable in their natural state, about 10% were not suitable, and about 60% were unsuitable in their natural state, but could be made satisfactory by the addition of fill.

Cottage Pollution Control

The Cottage Pollution Control Program was established to detect and correct faulty private sewage disposal systems of cottages located on recreational lakes. The objective of the program is to investigate about 4,000 — 4,500 premises annually and, in conjunction with the owner, to

undertake abatement work on those systems found to be faulty.

In 1972, a total of 4,742 waste disposal systems were inspected. These were located in the Rideau Waterway corridor between Smiths Falls and Ottawa, the Thousand Islands area of the St. Lawrence River, Pigeon Lake in the Trent Waterways system and some lakes in Muskoka. Of these systems, two thirds were found to be satisfactory. However, 6% were found to be polluters, 18% were unsatisfactory, due to improper disposal of waste water and 9% were found to be seriously substandard.

A total of 1,235 cottage drinking water samples were collected. Of these, 34.6% showed presence of coliform bacteria, which are pollution indicators. It should be stressed that these are merely individual samplings indicating only the quality at the time of sampling. It is the Ministry's recommendation that all surface water supplies used for drinking purposes should be disinfected as a precautionary measure.

Abatement work was carried out to correct sewage systems found faulty or unsatisfactory. Five abatement technicians made in excess of 2,100 inspections of premises on the lakes. Also, the Ottawa-Carleton Health Unit provided assistance to the Ministry within its region by carrying out abatement work. Work was completed on 11 premises of 65 premises visited.

In addition to the Health Unit's work, a total of 886 cottage owners was notified, and 622 agreements to make the necessary corrections were obtained. A total of 275 systems was corrected, and abatement work will be continuing in 1973 to correct those not completed in 1972.

The program has good public acceptance and the cooperation received from cottagers individually and from their

associations has been excellent.

Technical Services

The Technical Services Section provides technical support and advice to the branch and through the Regional Operations and Cottage Pollution Control Sections to local health agencies and the public involving private sewage disposal and water supply. Major objectives of the section are to develop better methods of controlling private sewage disposal and water supply systems and to find better systems.

The section maintains a soils laboratory as an integral part of its service. During the year 240 samples of soil were received for evaluation for suitability for treating septic tank effluent, on lots proposed for subdivision and development.

Studies leading to development of alternate methods of sewage disposal continued at the Whitby Experimental Station. There are many areas of the province where either the soil is unsuitable for subsurface disposal of septic tank effluent or where there is insufficient soil cover over rock or water table. At Whitby work is under way to obtain information and a correlation between the movement of pollutants and soil types.

Radioactive and dye tracers are being used in studies carried out in the Lake Chemong area and in the Thousand Islands area of the St. Lawrence River. From both of these studies information is being obtained on the movement of wastes and contaminants originating from septic tank systems and on the treatment afforded them by passing through soils.

An important part of this work relates to the degree of fixation of phosphates in different types of soils. In this connection 'red mud', essentially a mixture of silica with oxides of aluminum and iron, is presently being tested as a phosphate removal admixture. These studies will assist in developing design criteria for effective, efficient subsurface sewage disposal systems.

SANITARY ENGINEERING

The programs of the Sanitary Engineering Branch deal with the management of water under three categories: water supply, pollution control, and the regulation of plumbing. The program responsibilities are handled by five activity-related sections and a standards development program coordinating group. The section functions are:

- the evaluation of plans of proposed water supply and wastewater treatment installations;
- a field activity program including pollution surveys and pollution complaint review, and the promotion, inspection and supervision of water and wastewater treatment plants;
- the supervision of plumbing and the control of pollution from watercraft;
- the planning of regional water supply and wastewater treatment facilities;
- the training of water and sewage works operators;

The standards development and coordinating group is concerned with the branch's water supply and wastewater treatment program.

During the year a new program was initiated to prevent pollution from ice-based sporting and recreational activities such as ice fishing and winter carnivals. A draft regulation was developed and a program of public education commenced.

Design Approvals

The section appraised engineering reports, plans and specifications submitted for the approval of water works

and sewage works in accordance with sections 41 and 42 of the Ontario Water Resources Act.

Applications and Approvals

The section processed 2,348 applications and engineering reports during the fiscal year 1972-73. These resulted in a total of 2,301 certificates of approval being issued, representing a total estimated value of \$313.3 million.

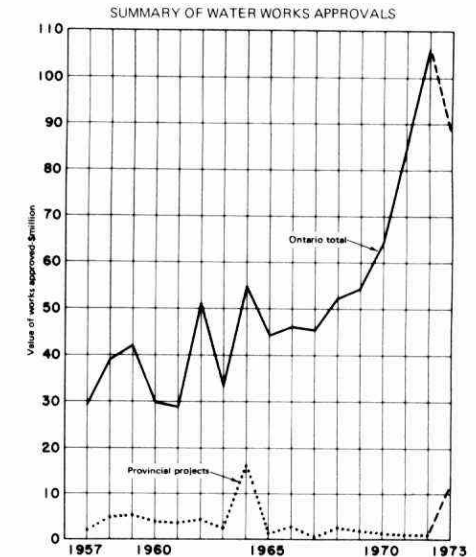
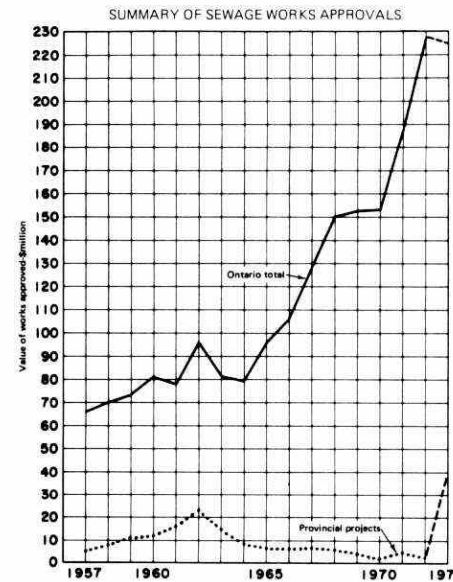
Certificates issued for water works applications totalled 981 and involved an estimated expenditure of \$88.1 million, compared with 907 certificates and an estimated expenditure of \$106.5 million in fiscal 1971-72.

In the sewage works field, 1,320 certificates were issued, at an estimated expenditure of \$225.2 million, compared with 1,342 certificates in fiscal 1971-72 at an estimated expenditure of \$206.0 million.

The accompanying graphs show the value of water and sewage works systems approved from 1957 to the end of the 1972/73 fiscal year.

SEWAGE TREATMENT PLANT APPROVALS

Approvals were issued for the construction of 16 new municipal sewage treatment plants and for extensions to 23 existing plants in 1972-1973.

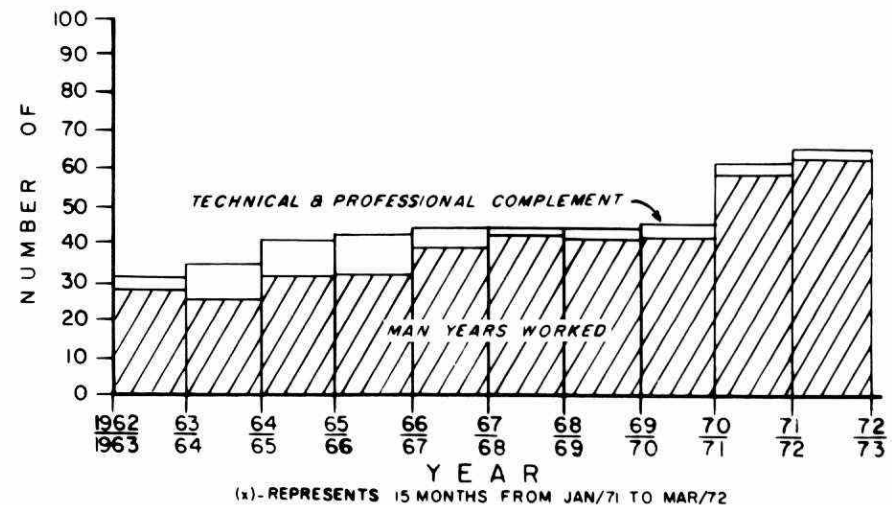


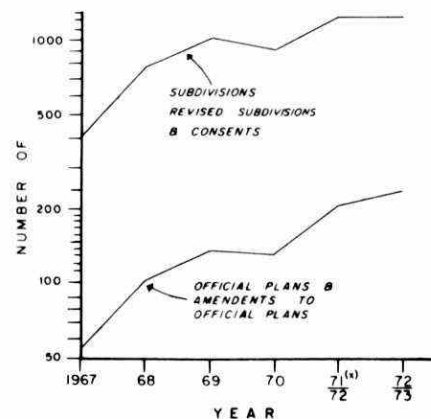
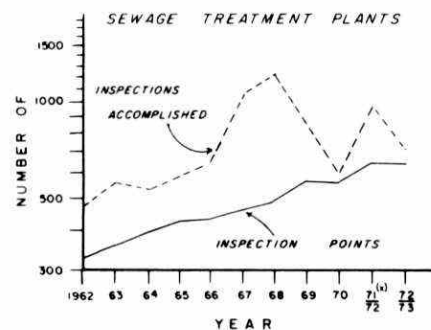
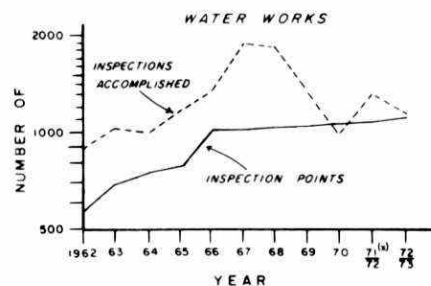
FLUORIDATION

The section appraised engineering of all municipalities using controlled fluoridation.

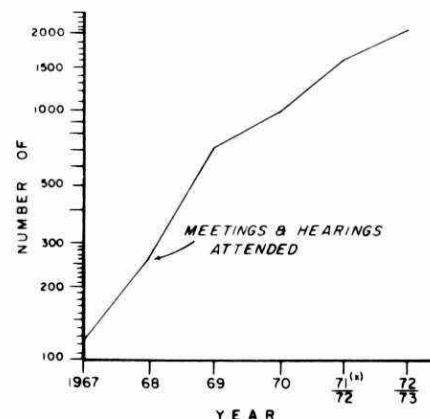
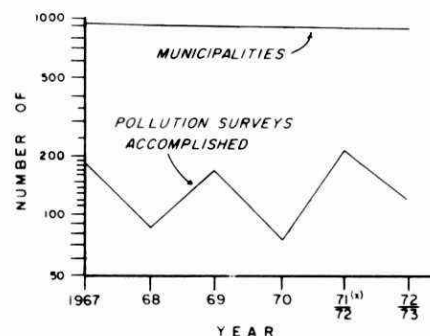
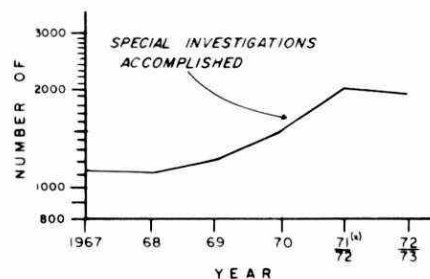
CMHC

The responsibility for processing municipal CMHC loan applications for Ministry certification continued as a section





function. A total of \$51.5 million was made available by CMHC for municipal projects in 1972 (calendar year), approximately \$38 million of which was allocated to municipalities within the Lower Great Lakes drainage basin.



POLLUTION ABATEMENT INCENTIVE ACT

The section continued its role of certifying the validity of claims for rebate under the Pollution Abatement Incentive Act.

Fifty claims were reviewed in 1972-73.

Regional Engineers

As a result of the potable water quality monitoring activities of the section, medical officers of the Ministry of Health were immediately requested to place Boil Water Orders on the communal water systems in Towns of Grimsby, Mount Forest and Thornbury, the Villages of Ripley and Wellington, and the Townships of Albion (Mono Mills), Ashmore, Cumberland (Lavallee Plaza), Ernestown (Brooklin), Euphrasia (Kimberley), and North Plantagenet (Wendover). Staff were dispatched to the respective locations, after public safety had been assured, to help locate the problem and institute corrective measures. When satisfactory bacteriological quality had been reassured, the medical officers were advised that the order could be rescinded.

Legal notices and reports were prepared by this section and executed by the executive director on sewage works for the Town of Thessalon and the Township of Sandwich South, and on water works for the McGeorge System in the Township of Essa. This latter report has been appealed to the Environmental Appeal Board and no date for this review has yet been established. Notices and reports on sewage works for the Towns of Hawkesbury and Kapuskasing, the villages of Casselman and Millbrook and the Township of Black River-Matheson, and on water works for the Villages of Casselman and Millbrook are under preparation.

As a result of a Ministry policy directive on the disposal of snow, staff became involved in giving or denying

permission for direct disposal to watercourses and approval of sites for land disposal. In order to accomplish this, guidelines for land suitability and criteria for direct disposal were developed in conjunction with the Water Quality Branch and subsequently distributed to all municipalities in the province.

In conjunction with the Legal Branch and the Design Approvals Section, an operational policy to ensure the involvement of the respective municipality in the continued satisfactory operation of water and sewage facilities serving mobile home parks, trailer parks and recreational camp-grounds was developed and implemented.

The task force developed and obtained approval for guidelines for the provision of equipment to handle power outages at new sewage works. It is intended to bring all existing works up to these standards before 1980.

In the third year of operation of the recreational lakes water quality assessment program, three crews completed standard surveys on 24 lakes and a two-month intensive study of an undeveloped lake (Jerry Lake) in the District Municipality of Muskoka. All lakes on the Rideau and Trent-Severn Canal Systems have now been completed. The reports, which will include assessments of bacteriological, biological, chemical and physical conditions and stressing microbiological and nutrient enrichment problems are under preparation.

In conjunction with the Automated Data Processing Section, systems are being developed and information coded to permit the creation of a library of works, a plant performance evaluation, a present and future needs (planning) file and an inventory of physical descriptions of existing works. These four systems will permit better control and

data handling and manipulating procedures to be used for all water supply and sewage works in the province in the future.

A task force composed of four field staff has been assigned the responsibility of preparing white papers on procedures to be followed and equipment to be provided to enable municipalities to handle emergencies at water and sewage works. These documents will be reviewed internally and externally before they are finalized and become operating requirements of this section. This will ensure that the public is protected as much as possible with respect to drinking water contamination and that a minimum of environmental damage will result from emergencies at sewage collection and treatment works.

Plumbing and Boating

PLUMBING PROGRAM

In the Province of Ontario the installation, maintenance and repair of plumbing, with a few minor exceptions, is controlled by the provincial Plumbing Regulation. The section is responsible for ensuring that this regulation is kept up-to-date and also for providing technical liaison with municipal inspectors. The section is assisted in its function of maintaining a modern code by the Plumbing Advisory Committee made up of representatives from industry, municipal regulatory authorities and engineering and water pollution control associations.

During the year a major revision to the Plumbing Regulation was processed with provision being made for the inspection and certification (Canadian Standards Association) of plumbing in mobile homes, the prohibition of the use of toxic

materials in heat exchangers contacting potable water, and the control of the addition of inhibitors to potable water systems.

BOATING AND ICE SHELTERS PROGRAMS

Of the 2,759 pleasure boats inspected during 1972, 64% were owned by Ontario residents and the remainder were from out-of-province. Violations were noted on 101 craft bearing Ontario identification and on 140 visiting boats. Corrections were obtained on Ontario-based boats without resorting to prosecution. In most cases, it is not known if the out-of-province violators later complied, as this group is now beyond provincial control. Joint-use notices explaining the requirements were supplied to the Canada Customs port offices for distribution to non-Canadian boaters entering the province. A new Ministry form replaced the federal government E-99 Vessel Report form. Consideration is being given to sealing inadequate facilities before permitting boats to enter inland canals. This step would be taken to prevent pollution and encourage foreign boats to install approved devices.

Increased emphasis was placed on the inspection of marinas to document the methods of disposal for garbage and sewage. Two hundred and forty-seven marinas and yacht clubs were equipped to offer pump-out service in 1972. This compares to 224 during the 1971 boating season. A marina operations program to train personnel for middle management is now under way at Sheridan College's Brampton Campus. The course stresses the technicalities of pollution prevention and was developed in cooperation with an advisory committee that includes a

member of boating staff.

As requested by the Resources Development Policy Field Committee, a regulation is being drafted to control pollution from ice-oriented recreational activities. A pre-regulation surveillance program was undertaken by staff employed in the Private Waste and Water Management Branch, and the Boating Section in Sanitary Engineering.

A Ministry-sponsored meeting was held in December to discuss pollution from outboard motors and effects on the environment. On hand were outboard motor manufacturer executives from Canada and the United States.

Ministry officials noted that the marine industry had made progress in eliminating crank-case drainage condensates and that a joint Environmental Protection Agency/Industry study is well advanced to investigate thoroughly what effect, if any, marine engine exhaust discharges have on aquatic ecology.

Agreement was reached at the meeting to back measures introduced by either government or industry to reduce any harmful effects of outboard motors on water quality.

Regional Services Planning

The activities of the section continued in four general categories: preparation of preliminary engineering reports on area water supply and pollution control facilities, participation in interministerial liaison activities, evaluation of planning, development and servicing proposals, and the provision of assistance to other sections and branches of the Ministry.

HAMILTON-WENTWORTH

The Hamilton-Wentworth Water Supply and Pollution Control Study was released in draft form. The report outlines

The report outlines a servicing strategy to cope with the rapidly expanding urban areas adjacent to the City of Hamilton, in particular the areas of Ancaster Township and the Town of Dundas.

KENORA AREA

A preliminary investigation of the servicing requirements of the Kenora area was undertaken.

This included a field trip to the area and a review of the current development proposals and existing water supply and pollution control facilities in the Town of Kenora, the Township of Jaffray-Melick and the Town of Keewatin.

YORK CENTRAL-PICKERING AREA

The York Central-Pickering Area water supply and pollution control scheme was officially announced by the government in June.

Assistance was given in preparing a brief outlining the proposals to the treasurer and senior staff of the Ministry of Treasury, Economics and Intergovernmental Affairs, the Policies and Priorities Board and the Provincial Liaison Committee for Metropolitan Toronto and Regional York.

In addition, meetings were held with consultants to outline provincial development policies for the York Central and Pickering areas.

WATERLOO-SOUTH WELLINGTON AREA

The Waterloo-South Wellington Area Study was concluded with the release of the report 'Strategy for Growth' in Hespeler. Staff provided technical aid to this study and prepared a supporting brief on public services.

CENTRAL PLANNING REGION

The section continued to participate in the Regional Development Program for the Toronto Centred Region now known as the Central Planning Region. This included representation on the task force on the location of the Parkway Belt and the Liaison Committee for Central and Southwestern Ontario. This latter committee was disbanded towards the end of the year. However, until that time input was provided to the Regional Development Branch on the availability of services.

CANADA/ONTARIO — CANADA/U.S. AGREEMENT

The Canada/Ontario Agreement on Great Lakes Water Quality commits Ontario to a five-year, \$250 million capital works program to upgrade sewage collection and treatment works in the Lower Great Lakes to meet national and international commitments. This is complemented by a five-year, \$6 million Federal-Provincial Technology Development Program. Both programs conclude December 31, 1975.

In the first two years of the program \$102 million in capital works have been committed, and in the Technology

Development Program expenditures exceeded \$1.7 million. In the latter program research is being carried out by private contractors, universities and the two levels of government with major emphasis being placed on the investigation of phosphorus removal processes, advanced forms of waste treatment, sludge disposal and the treatment of storm and combined sewage.

Specific studies were initiated to assess the effects of sludge disposal on agricultural soils, their potential fertilizing value and pollutional effects with emphasis on virus transmission and heavy metals. Full-scale studies were successfully carried out on the use of waste pickle liquor from steel product manufacturing operations for phosphorus removal at municipal sewage treatment plants.

A total of 46 research projects have been undertaken, some of which are long term and will continue to the end of the agreement.

PHOSPHORUS REMOVAL

Under national and international agreements and a provincial policy for the protection of recreational waters, Ontario is committed to the provision of phosphorus removal facilities at more than 200 municipal and institutional sewage treatment plants. One hundred and fifty of these are to be operational by December 31, 1973, with the remainder becoming operational by December 31, 1975.

Under the \$6 million Technology Development Program of the Canada/Ontario Agreement, funding is made available for phosphorus removal treatability studies at individual plants. The studies are intended to optimize financial considerations through the selection of the most

appropriate chemical and the integration of treatment into existing plant processes.

Over the course of the year, 54 approvals were issued for phosphorus removal treatability studies to a value of \$1.3 million. Studies have been completed at 43 municipalities with five plants now in permanent phosphorus removal operation.

HOUSING

Towards the latter part of the year the section became involved in a series of task forces dealing with housing problems in the province. The most intensive study was undertaken by the Task Force on Housing Lots in the Metropolitan Toronto Area.

A brief was also provided for the Advisory Task Force on Housing Policies which is studying the housing field in the province as a whole. A background paper was also prepared for the Federal-Provincial Conference on Housing in January, 1973.

Training and Licensing

With an ever-increasing degree of urbanization and industrial development in the province along with the expansion of recreational activities, larger and more complex water and sewage treatment works are being installed to provide the people of Ontario with safe, potable water and to protect the waters of the province from pollution.

While satisfactory works may be installed there is a necessity to properly

operate such works if the stated objectives are to be met. This can be achieved by increasing the number of visits made by provincial inspectors, or on the other hand, by providing the operators with the required skills to correctly operate the works and also to assign the operator a legislated responsibility to ensure that the developed skills are used.

In 1971, a program was commenced to train and license operators to provide them with these necessary skills and a legislated responsibility so the assigned goals of the Ministry could be met.

While still in its developing stage, the Training and Licensing Section conducted two workshops — Activated Sludge Analyses and Interpretation, and Basic Gas Chlorination — and two courses — Introduction to Waste Treatment, and Introduction to Water Treatment — a total of 16 times during the past year.

Over 500 trainees attended these sessions, which were held at the main laboratory in Toronto. The instructor staff was composed mainly of personnel from the various branches of the Ministry.

The behavioural objective approach to training (BOAT) which emphasizes 'need to know' areas was used and met with favorable comment from the participants.

PROJECT CONSTRUCTION

The Project Construction Branch is responsible for the administration of contracts let by the Ministry for the construction of waterworks and sewage works which are undertaken for municipalities, or groups of municipalities, as provincially-financed projects. This administration includes the overall supervision and coordination of the engineering services provided by consultants and of the work carried out by contractors.

Prior to construction the branch is involved, in conjunction with other branches, in the review of design reports, tender documents, drawings and specifications submitted by consultants. The purpose of this review is to ensure general technical adequacy and compliance with

Ministry standards and practices.

The branch is responsible for coordinating the review of specifications and quotation documents related to major items of equipment which are selected for inclusion in treatment plants and pumping stations prior to the calling of tenders on the general contract. This procedure allows more time to be devoted to the assessment of available equipment and gives the Ministry a greater voice in the choice of these major items.

During the course of construction, engineers make regular visits to the construction sites to inspect the quality of

work and review progress. At the same time liaison is maintained with municipal officials and representatives to exchange information and to try to minimize disruption of traffic where construction involves excavation on municipal streets and roads.

In the fiscal year 1972/73 construction of sewage works or water works was carried out in 101 different municipalities by 94 contractors, with engineering services provided by 33 consultants. Construction activity reached its peak in September when 113 contracts were under way.

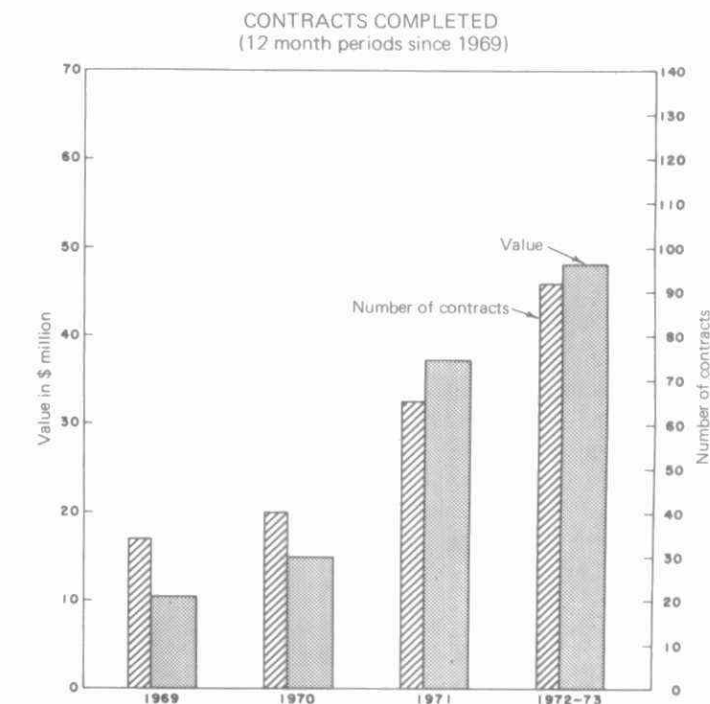
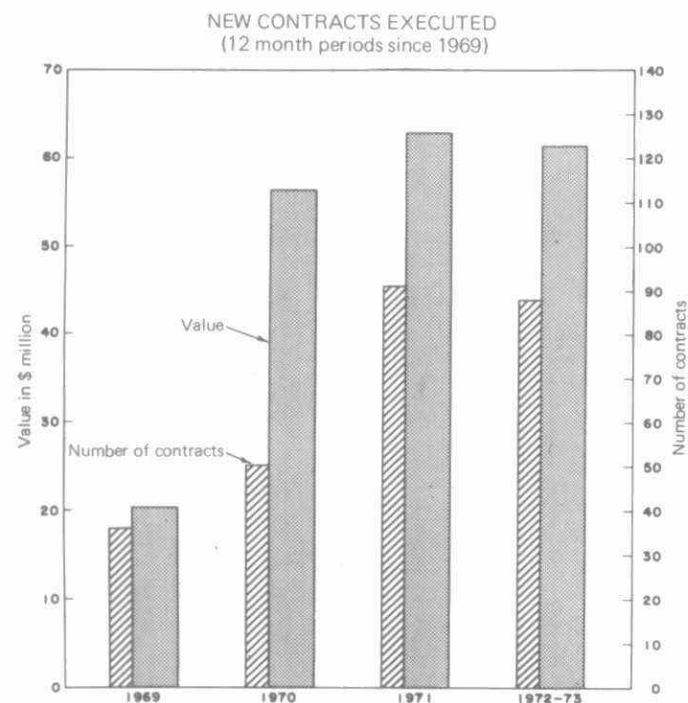
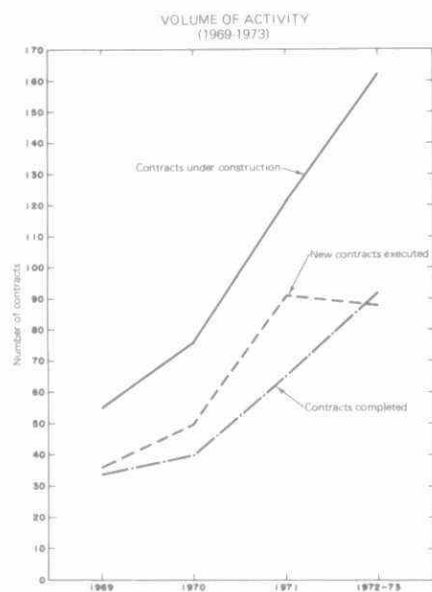
(See graphs for volume of activity compared to previous 12-month periods).

Of the \$61.44 million cost of construction contracts executed in 1972-73, about \$40.00 million was for sewage

works and the remainder for water works. It can be seen that the volume of work has increased significantly in terms of the number of separate contracts completed and the number under way during the year.

Bankruptcy of the general contractor engaged in the \$20 million extension to the Hamilton sewage treatment plant has necessitated the spending of an unusual amount of staff time in resolving problems associated with the completion of this work.

Liaison with the consulting engineers was maintained by means of meetings with the Association of Consulting Engineers. Matters which are of mutual concern and interest were discussed with a view to improving the services provided and reducing the time taken to process



approval of submissions. Matters related to fees and reimbursable expenses were also discussed.

Meetings with the Ontario General Contractors Association and the Ontario Sewer and Watermain Contractors Association were also held. These meetings proved helpful in conveying to the contractors the reasons for certain procedures which are followed in dealing with the calling of tenders and the award of contracts. Opportunities were also provided for the contractors to make suggestions which they felt would increase the number of bids received by the Ministry and which would tend to reduce prices being tendered. Particular attention was focussed on works which are undertaken in the northern regions of the Province.

The administration of The Public Works Creditors Payment Act has continued to consume a considerable amount of time. It has become increasingly clear that the lack of a provision in the Act for any tribunal to adjudicate on the validity of claims is one of its weaknesses. This was illustrated on the Dundalk and Ridgeway projects where a sub-contractor declared bankruptcy. About 150 claims were submitted under The PWCP Act including many claims from local people in respect of items other than materials supplied to or work done at the jobsite. Ruling on the validity of these claims will take time.

Construction activity summarized in the accompanying graphs includes area schemes such as South Peel, Blezard Valley and Lambton County, where the construction program will continue in 1973/74. It is anticipated that the present level of construction activity in 1973/74 will be maintained, but there may be a decrease in the number of tenders being called.

PROJECT DEVELOPMENT

The Project Development Branch is responsible for the development of water and sewage works systems which are financed by the province. Details concerning the activities of the various sections within the branch are provided later in this report.

During the year there were a number of important developments which affected the activities of the branch. Some of the highlights are summarized below.

FINANCIAL ASSISTANCE TO MUNICIPALITIES

The provincial assistance program continues to act as a stimulus to municipalities seeking the development of water and sewage programs. As a result, a majority of requests received are from the smaller municipalities with populations in the 500-1,000 range.

During the year, a considerable amount of work went into the preparation of background information in support of a request for changes in the subsidy program. At year's end, indications were that additional assistance would be provided for the high cost programs.

REGIONAL MUNICIPALITIES

A great many programs are being developed within the regional municipalities. Staff continue to maintain regular liaison with regional officials and it is expected that the number of programs will continue to increase.

GENERAL

The branch continues to receive requests for assistance in the development of water supply and sewage disposal systems for Indian communities and other areas in the unorganized townships. While there has been no change in policy in these areas, staff have participated in a task force which has examined the problem and made recommendations on a solution.

Considerable progress has been made in reducing the time involved in the development of programs though more frequent participation in meetings with municipal officials. On the other hand, opposition by ratepayers groups has resulted in lengthy delays involving a number of programs.

Provincial Projects

During the year there was a minor decrease in the number of new projects requested. However, a large number of programs have reached the point where preliminary engineering work has been completed and the workload involved becomes more extensive. A total of 22 applications for sewage works and 10 applications for water works were received. Twelve of these programs were accepted, and 43 municipalities participated in programs.

Area Projects

Staff of the branch has become in-

creasingly active in the development of water supply and sewage disposal programs for the Central York-Pickering area. Arrangements have been made to retain consulting engineers to begin the design work on the new facilities which will be constructed by the Ministry.

New studies have been undertaken in Essex County and Lambton County related to integrated water supply systems involving a number of municipalities.

Municipal Projects

The activities of the Municipal Projects Section remained at essentially the same level in 1972 as in the recent years. A total of 27 new projects were undertaken and the number of programs under development at the end of the year was somewhat greater than at the end of 1971.

Property

The number of new properties listed for acquisition (536) during the year was down only slightly from the previous year. However, the number of transactions completed, the number of options pending final agreement (547) and the number of expropriations outstanding (90) at the end of the year are all greater than at the end of 1971. The use of independent negotiators has been of considerable assistance in coping with the heavy workload involved.

PROJECT OPERATIONS

The Project Operations Branch supervises the operation of all water and sewage works financed and constructed by the Ministry. As of March 31, 1973 there were 418 projects operating in 241 municipalities and seven industries (municipal: 144 water, 209 sewage; provincial: 23 water, 42 sewage) with a total of 389 plant operators being on staff.

Figures 1-4 graphically illustrate the total field staff, the number of projects in operation, the total capital costs and the total operating costs for the period 1957 to 1972. Figure 5 indicates the distribution of operating costs during 1972-73.

ADMINISTRATION

The branch becomes involved in each new project during its design stage. Reports, plans and specifications submitted by consulting engineers are reviewed by the branch, in conjunction with other branches, to ensure the provision of adequate works. The branch is responsible for investigating and initiating enlargement of existing projects where necessary. The branch is involved in the initial settling of rates for provincial works and in the altering of these rates, when conditions warrant, within agreement terms.

For administrative purposes, the

FIG. 1 — TOTAL FIELD STAFF

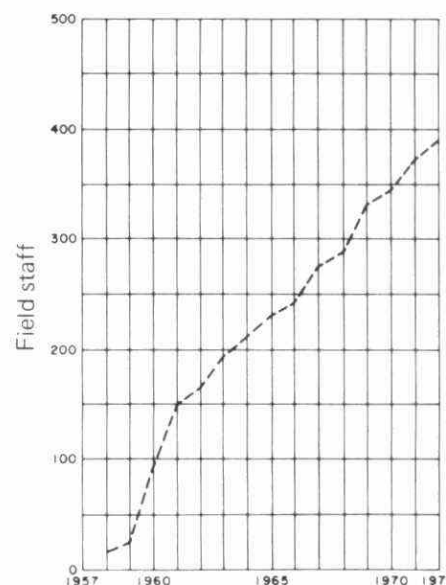
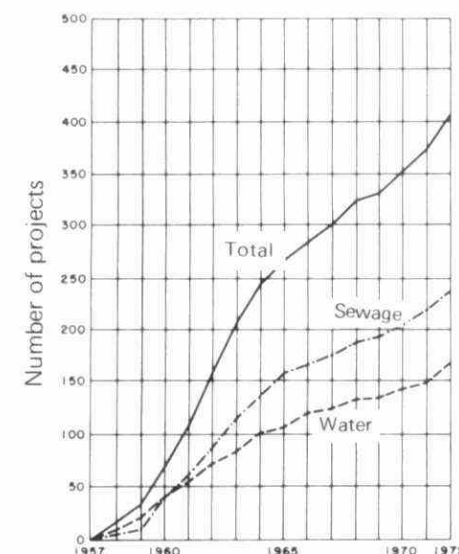


FIG. 2 — PROJECTS IN OPERATION

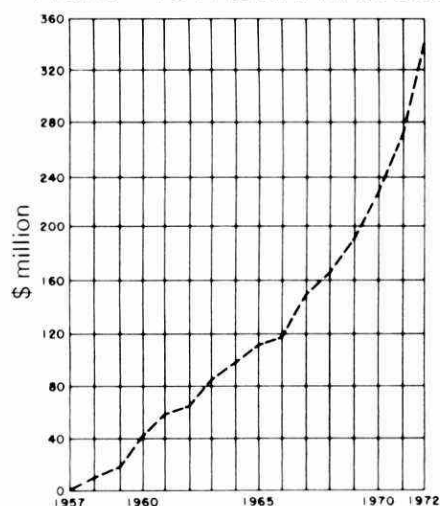


province is divided into six regions, the projects in each region being the responsibility of a regional operations engineer. Major provincial projects are the responsibility of an engineer-manager. The operations engineer and the engineer-manager report to a supervisor who participates in the development of policies established at branch level.

Four sections — Project Services, Maintenance, Safety and Utilities — contribute to the overall administration and operation of the projects.

The operations engineers and engineer-managers prepare annual estimates of project operating costs, determine staff requirements, maintain liaison with local officials, ensure maximum process efficiency and adequate preventive maintenance.

FIG. 3 — TOTAL CAPITAL COST



Project Services

The Project Services Section, including a statistics group, assists in the solution of process problems and maintains data on project operation. Under a project services engineer, the section investigates operating field problems, evaluates operating results and appraises new chemicals and processes. During 1972-73, the section assisted materially in the preliminary testing for the full scale introduction of phosphorus removal in Ministry operated projects. The section prepares and prints annual summary reports on the operation of all projects under the jurisdiction of the branch.

Maintenance

The Maintenance Section, consisting of mechanical, electrical and electronic technicians and technologists, assists the operations engineers and engineer-managers in establishing adequate maintenance and preventive maintenance programs. This ensures a high standard of project maintenance, continuity of service and protection of the Ministry's capital investment. The field coordination of the maintenance program is provided by a maintenance technician in each region reporting to the regional engineer. The reporting system embodied in the preventive maintenance program provides data for the evaluation of equipment and materials for new project construction.

Safety

The Safety Section, consisting of two safety officers, makes routine inspec-

tions of all projects, looking into the safety aspects of the operation and ensuring that safety regulations are being followed. The section investigates lost time accidents and arranges operator training courses in first aid, fire protection and the use of safety equipment. The section maintains close liaison with the Energy Branch of the Ministry of Consumer and Commercial Affairs and the Industrial and Construction Safety Branches of the Ministry of Labour in the development of safety standards for operating projects. There were no fatalities or permanent injuries suffered during 1972-73 by the branch's operating personnel. Disabling injury frequency totalled 22.6 injuries per million man hours and severity rate for the period was 272 man days per million man hours.

FIG. 4 — TOTAL OPERATING COST

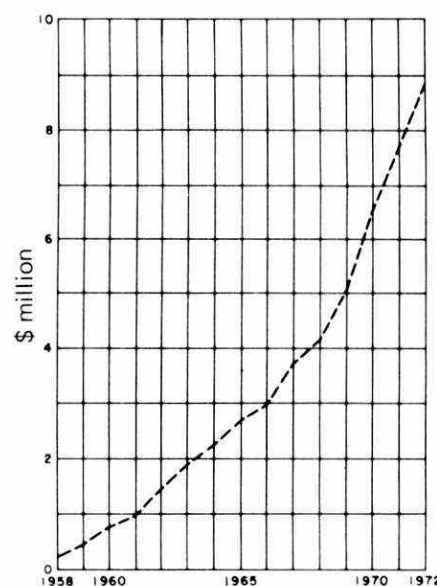
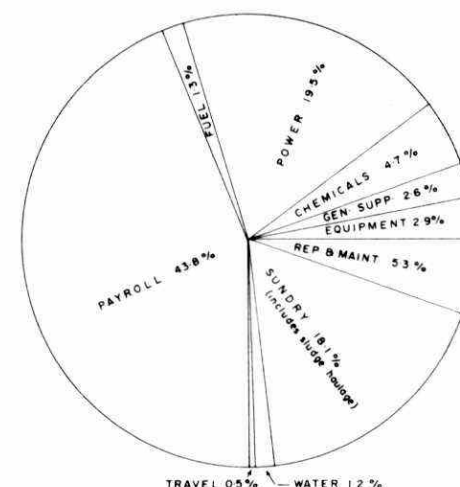


FIG. 5 — DISTRIBUTION OF OPERATING COSTS



Utilities

This section was created as a result of the reorganization of the provincial government on April 1, 1972 and is responsible for the day to day operation of all projects financed, constructed and operated by the Ministry; under this reorganization all field staff at the projects assume the status of civil servants on April 1, 1973 as opposed to Crown employees. The section also operates, under suitable general agreements several municipally owned sewage and water treatment plants.

Management and Operations Support Services

PESTICIDES ADVISORY COMMITTEE

The membership of this committee was expanded on April 28, 1972 by the addition of Dr. C. Ronald Harris and Dr. Ernest Mastromatteo. There are presently thirteen members plus the Chairman, Mr. K.G. Laver.

The committee held 21 full meetings to consider a wide range of topics, and completed several major objectives during this year:

- The classification of all registered pesticide products
- A report on the Use of Minimum Dosages of Pesticides
- Bulk Storage of Pesticides report
- A report on the Waste Disposal of Pesticides and their Containers
- A report on the Status of the Potato Stem Borer in Ontario
- Heptachlor vs. Chlordane report
- Advised the Ministry on legislation regarding the adoption of the committee's report in the Environmental Protection Act
- Worked with Workmen's Compensation Board to create a storage sign and advised on general safety
- Reviewed DDT in Ontario in respect to its continuing agricultural use
- Reviewed the relationships of Ontario and federal legislation regarding pesticides and reported to the Ministry
- Studied new Nova Scotia restrictions and reported to the Ministry

The above reports were the work of various sub-committees which met an additional twenty-seven days in order to present information to the full com-

mittee. Several of these sub-committees are still operating and will be studying:

- Classification of new pesticide products
- Updating classification of active pesticide ingredients
- Permitted use of DDT and proposed structural reregistration
- Legislation
- Ethylenethiourea (ETU) as a contaminant of some pesticides
- An inventory of pesticide research in Ontario
- Alternates to chemical pest control and their present status

The committee has recently been given two new areas of responsibility:

- It will recommend research projects regarding pest control to the Ministry for funding (now in the process of obtaining tenders from research facilities in this regard); and
- The committee is to review all pesticide publications of the various ministries of the Ontario Government.

The chairman and other members of the committee sit on various federal and provincial committees which are concerned with pesticide use and problems and endeavour to work closely with these committees, universities and industry to keep the Ministry informed on all matters concerning pesticides and their use in Ontario.

PESTICIDES LICENCE REVIEW BOARD

During the past fiscal year, the Pesticides Licence Review Board met twice and considered two appeals; one by Mr. Clarence Hunter and the other by Mr. Joseph Izzotti. As a result of these appeals, several recommendations were made to the Ministry regarding examinations, procedures, and regulations.

On January 24th, 1973, Mr. I.W. Pasternak, Q.C., replaced the Chairman, Mr. Carl W. Caskey, Q.C. because of Mr. Caskey's illness.

At the beginning of the fiscal year, Mr. D.W. Wilson replaced Mr. D.L. Bogaerts as Executive Secretary, as a result of Mr. Bogaerts' death.

INFORMATION SERVICES

Information Services provides a wide range of public information and educational services designed to communicate the Ministry's commitment to the preservation and improvement of the environment. These services are divided into sections concerned with editorial, education and information, and audio/visual functions. The fiscal year 1972/73 saw a further expansion of the branch, and a commensurate enlarging of programs.

Editorial

Editorial staff produced 125 folders, brochures, copies of regulations, student papers and related pieces of material during the fiscal year. Of this total, 43 publications were new titles, 40 were updated and revised reprints of previously-produced material, and 42 comprised such items as decals, bookmarks, posters, and similar promotional material. A grand total of over 900,000 pieces of literature was distributed to the general public.

In May, the bi-monthly tabloid *Legacy* replaced the former OWRC publication *Watertalk*. *Legacy* has a circulation of approximately 15,000, and is distributed to schools, universities, libraries and the general public.

Quarterly, the Ministry's internal publication, is distributed to all staff members, and has a circulation of 2,500.

In the same fiscal period staff produced 125 news releases, and an environmental column was prepared and made available at no charge to the province's weekly newspapers.

Of the total number of releases 70 were concerned with water pollution control and water systems, 23 were on air management, 22 on land pollution, and 10 on general Ministry activities (meetings, personnel changes, etc.)

Education and Information

The special projects section of the branch maintained an active schedule of exhibits at major fairs and exhibitions during the fiscal year.

Participation included the Central Canada Exhibition, the Pollution Control Show, the Royal Agricultural Winter Fair, the Canadian International Boat Show and the International Plowing Match. The Ministry also exhibited at the Mayors' and Reeves' Conferences, the Canadian Educational Showplace and the Ontario Science Center. In all, 27 fairs and exhibitions were included in the Ministry's schedule.

An added activity of special projects was the organization of official water and pollution control plant openings. Seven of these ceremonies were held, including that of the extensive Elgin Area Water System.

Speaking engagements were accepted by branch personnel in greater numbers than the 1971/72 fiscal year. Staff members appeared at 58 functions, giving talks on the Ministry's activities, often with slide show or motion picture back-up. Total audience

contact is estimated at 12,000.

The educational resources coordinator accepted an additional 54 engagements to speak before school groups, service clubs, and assorted civic bodies. This represented a total direct contact audience of approximately 11,000.

A successful communications venture by Humber College students working in the branch under the SWEEP program (Students Working in an Environmental Enhancement Program) was *Ecologie*, a travelling puppet show designed for four to ten year-old children. The show, featuring skits, playlets and songs based on environmental themes, visited day camps, parks and playgrounds throughout the province during the summer months. The estimated total audience of *Ecologie* was 75,000.

The educational resources program meets the need for consultation and coordination between the educational system in the province (both formal and informal) and the Ministry of the Environment. In the fiscal year 1972/73, the environmental education program was broadened and developed, based on a careful examination of the needs for educational resources that will assist teachers, students, environmental organizations and the general public. The educational resources coordinator maintained liaison with many environmental organizations, and made presentations both on a formal and informal basis throughout the province to universities, community colleges, secondary and elementary schools, at professional development days, conferences, rallies, and to several service organizations. Additionally, the continuous development of teacher aids and resource material aimed at specific age groups continued, of which

the student and teacher *Enviropaks* formed an important part.

A highlight of the year was the second annual Straight Goods youth conference, held at Queen's University in Kingston. Sponsored jointly by the host university and the Ministry, the conference brings together environmental specialists and secondary students in as open a forum as possible for dialogue and discussion of environmental topics. *Straight Goods III* is planned to be held at the University of Western Ontario in late summer of 1973.

Audio Visual

The audio visual section's activities increased considerably over the previous fiscal year. The production of a 25-minute color film on the Ministry was completed in late March. This feature took nine months to bring to completion. A total of 10,000 feet of 16 mm film was exposed for the production of this feature, portions of which will also be used for future short films and public service announcements to be released in the spring of 1973.

When the Ministry of the Environment was formed, the audio-visual section absorbed the photographic files of the Ontario Water Resources Commission, and considerable time was spent in collating and filing a combined total of 10,000 color slides and black and white negatives.

During the fiscal year, branch staff handled a total of 51,812 telephone requests, assorted mail inquiries, and personal visits.

An extensive advertising program was directed strongly to the litter problem. It included a poster campaign, newspaper advertisements, and television spot announcements.

LEGAL SERVICES

The branch provides a wide range of legal services to support the implementation of the policies and programs of the Ministry. These included the prosecution in the courts of companies and individuals for violations under The Environmental Protection Act, The Ontario Water Resources Act and The Pesticides Act.

In addition, the branch provides legal advice to the operating branches, prepares Orders-in-Council, regulations, contracts and orders.

During the year the staff of the branch were brought together under a new director in offices at 135 St. Clair West.

As of April 1, 1973, all lawyers in the branch and their secretaries were transferred to the staff of the Ministry of the Attorney General as part of an amalgamation and coordination of legal services throughout government. This transfer, however, did not involve any change in reporting relationship.

PERSONNEL

The 1972/73 recruitment program provided 251 new staff members for full-time positions. In addition a number of career-minded students were given the opportunity to gain experience in various Ministry programs, including the SWEEP program.

A major program involving organization, position administration, and job evaluation commenced and is continuing throughout the Ministry.

A memorandum of understanding concerning employees in the Project Operations Branch was negotiated and ratified with the Civil Service Association of Ontario to cover a contract period from July 1, 1972 to June 30, 1973.

The staff development program included Ministry training courses, Civil Service Commission courses and courses provided by outside agencies. A number of requests were approved for staff members to receive financial assistance for educational purposes.

The branch investigated problems involving personnel, counselled employees, and provided advice and assistance to supervisors and senior management. The branch acted as liaison with the Civil Service Commission and the Civil Service Association of Ontario in personnel matters.

The total complement for the Ministry on March 31, 1973 was 1692.

STRATEGIC PLANNING

Strategic Planning was created in April, 1972 during the reorganization and integration process which established the Ministry of the Environment.

The branch was formed to fill a basic need for a coordinated approach to environmental planning. Its purpose is to act in a coordinative and consultative capacity in three areas: environmental planning, program planning and policy analysis.

The branch is divided into three sections.

Impact Assessment

Environmental land-use planning and the assessment of environmental impacts of proposed projects and development are the principal concerns of this section.

The Impact Assessment Section's major undertakings in 1972-73 include:

- Development of a policy proposal for a formal environmental impact analysis system to be applicable to Ontario Government projects and, progressively, major developments in the private sector.
- External consulting on environmental planning matters and participation in liaison committees and Task Forces such as the Niagara Escarpment Task Force, the Joint Environmental Coordinating Committee for North Pickering and Toronto Area Airport projects, the Liaison Committees for Northern and Eastern, and Central and Southwestern Ontario, the Wasaga Park Community Project, the Simcoe-Georgian Task Force and the Minesing Swamp

Technical Committee.

- Input to the assessment of environmental impacts of large public projects such as Hydro transmission lines, transportation corridors and sewerage.
- Mapping of areas physically unsuitable for urban development.
- Coordination of the investigation of the environmental effects of development of the Onakawana lignite deposit.

Planning, Programming and Budgeting

This section is responsible for the implementation of the planning, programming and budgeting system (PPBS) within the Ministry. Assistance is provided to program managers in the identification of goals and objectives, the analysis of alternative strategies, and the development of criteria to measure program achievement.

Within the past year this section participated in the coordinating group responsible for the preparation of the multi-year plan and developed proposals for an integrated Ministry planning system.

Section activities included involvement in an inter-ministry study of techniques for output measurement, work on the refinement of Ministry program structure, with emphasis on documentation of operational systems within the Water Management program and liaison

with several central agency studies, including Task Force Hydro and the Task Force on Decentralization of Government Administration.

Policy Analysis

An internal consulting service is offered by this recently established section. Specific areas of expertise include consultation on applications of management science, operations research and systems planning techniques and economic analysis of proposed projects, policies or legislation.

Staff from all sections of Strategic Planning are often involved in special projects and studies as assigned by the Ministry executive. In the past year, a very significant amount of staff time has been invested in the Field Study Task Force, the Task Force on Approvals, and the Task Force on the Role of the Ministry.

Financial and Administrative Services

ADMINISTRATIVE SERVICES

The Administrative Services Branch is responsible for providing support services to the Ministry in the areas of office services, supply, printing, libraries, accommodation, and systems and electronic data processing.

Two major objectives for the year were realized. The branch started implementation of the ministry's Policy and Procedures Manual and coordinated the conversion to post audit as required by Management Board for all Ontario Government ministries. In this regard, new methods and procedures to meet internal control requirements were developed and implementation began early in January, 1973. Conversion to post audit was requested in March, 1973.

The reorganization that took place because of the formation of the new Ministry of the Environment, resulted in staff savings and this permitted the establishment of new senior positions to manage the Supply Section, Printing Services Section and the Policy and Procedures Manual.

Office Services

This section is responsible for accommodation and parking, communications, records management, stockroom, mail and messenger services and security.

The formation of the Ministry required major changes in accommodation. In Metropolitan Toronto, staff is now located at 135, 40 and 1 St. Clair Avenue West, 880 Bay Street, 4375 Chesswood Drive, and Resources Road. Mail and messenger services for all downtown

locations have been consolidated. Their reorganization also permitted the branch to reduce duplication of office supplies and to establish a user catalogue for supplies.

Considerable activity was required in providing field office accommodation and in the consolidation of individual offices.

Printing Services

Because of the distance from Queen's Park, the print room was allowed by the Ministry of Government Services to continue satellite operations. Some equipment and procedures changes were introduced to provide more economical printing service. A new job-costing and stock-control system was established to evaluate the development of a user charge-back system.

As a result of the Visual Identity Program, coordinated by this section, forms management, especially design work, increased. Changes to some photocopy equipment were made to achieve standardization and to reduce costs.

During the year 1,171 forms currently used were identified and catalogued. The internal printing facilities handled 4,165 jobs, producing in excess of 7.24 million impressions, up 18% from last year.

Supply

A significant workload increase was evident in the Purchasing Unit. The

number of purchase orders processed was up 24% over last year, with an attending increase in dollar value exceeding 30%. The same is true of the Laboratory Stores Unit, which received 144,715 samples in 1972, compared with 128,465 in 1971 — an increase of 12.7%.

The construction of a major addition to the laboratory complex is on schedule. The test-wing phase was recently completed, and the production shops and motor vehicle repair unit of Operating Services are now occupying their new quarters.

The Research Branch is presently setting up equipment to carry out pilot studies in the test area. It is anticipated that the new laboratory-wing phase will be ready for occupancy early in 1974.

Library

The formation of the Ministry placed heavy demands on the library services this year for material that encompassed all environmental subjects.

Because the library's resource material had previously been focused on subjects related to water, the library relied on interlibrary loans to provide information on many other subjects. As plans for expansion of the library's holdings are realized, the library will more readily be able to meet the information needs of the entire Ministry.

Systems and EDP

The Systems and Electronic Data Processing Section is responsible for the development, implementation, opera-

tion and maintenance of information systems.

The section's projects during 1972/73 included: expansion of the Water Quality Information System and of the Water Wells Information System, development of a regional dispersion model for use in the Hamilton Harbor Study, development of a water quality model for use in the Thames River Basin Study, development of a hydrologic modelling system for use in the International Hydrologic Decade Program, development of a treatment works management information system, development of automated processing systems for the analysis of surveys of derelict motor vehicles and of litter, development of an industry management information system and development of a computer-based financial services system.

During the year the number of documents received, processed and key-punched and the number of jobs run on the computer increased considerably, because of the implementation of new systems and the Ministry's expanding need for more information.

FINANCIAL SERVICES

The Financial Services Branch is organized to meet its responsibilities in the following areas:

Management Reporting

This section reports and interprets information to help senior management and program directors to focus on operating problems and opportunities.

Since the last annual report, there has been a gradual and rational evolution in the role of Management Reporting. The section is now responsible for the coordination and presentation of the Ministry's multi-year plan in addition to the preparation of the budget.

It is also responsible for the development of performance measures and the coordination of information flow to and from the Ministry.

In response to the expected needs of the Ministry, the section is strengthening its competence in the fields of quantitative analysis and development and implementation of a machine-based management information system.

Capital Financing and Revenue

This section is responsible for management and control of the Ministry's capital financing, revenues and assistance programs. During the year, emphasis was

placed on increasing the role of this section within the Financial Services Branch, and in development and implementation of accounting and financial procedures in keeping with reorganization and automation.

A dominant role was also taken in assisting other branches, ministries and municipalities with financial problems related to the water management program.

Internal Audit

This section was changed to reflect a management audit role in line with the government's emphasis on post audit operations.

General Accounts

During the year, this section was reorganized and new procedures were implemented to increase efficiency and strengthen management controls.

As part of the reorganization, the function of invoice verification was transferred to the General Accounts Section, and a special accounting services unit was established to incorporate the functions of insurance, banking, cheque distribution and reconciliations.

In addition, a data preparation unit is now in operation to meet the needs of an automated financial system.

Laboratory and Research

LABORATORY

The Laboratory Branch provides analytical support for Water, Air and Land Management programs carried out by the Ministry. An on-going program of method development is carried out to maintain a high level of capability in measuring existing and new types of pollutants. Scientific expertise is provided in assessing environmental hazards.

The laboratory conducts a wide range of analyses at the central laboratory in Toronto and has the capability to perform routine-type analyses at regional laboratories located in London and Thunder Bay. A separate laboratory in Toronto provides the analytical support to Air Management programs.

The accompanying graph indicates the number of samples received and the number of tests performed by the Laboratory Branch from April 1, 1972 to March 31, 1973.

Chemistry I

During the year, new or improved analytical methods were tested and adopted for iron, sulphates, detergents, conductivity and turbidity. The analytical quality control program was substantially improved by increasing the frequency of control testing and by participating in exchange sample programs with other agencies.

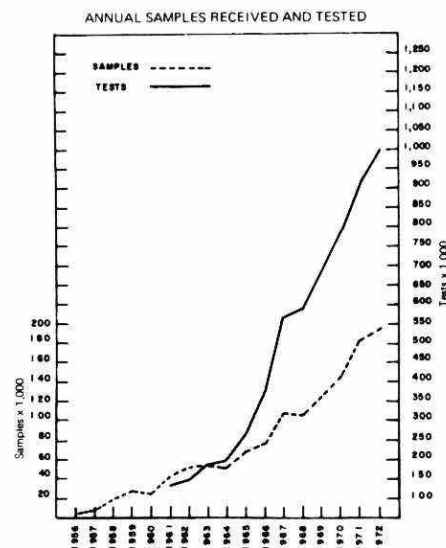
At the Thunder Bay Regional Laboratory, method development and training in the use of an atomic absorption spectrophotometer culminated in the application of this instrument to the routine analysis of five metals.

Work was carried out on three lakes to evaluate the effectiveness of artificially induced destratification (AID) as a means of improving water quality. The water in the lakes is kept fully mixed by an air stream injected at the bottom through a perforated hose. Mixing maintains oxygen in the water and consequently supports desirable life forms which otherwise would perish for lack of oxygen.

The studies are cooperative ventures with the Ministry of Natural Resources, Conservation Authorities and private individuals. The original experiment reached its second phase with the stocking of 1,200 trout which grew well over the summer.

Chemistry II

The section performed over 90,000 tests during the year, an 8% increase over last year.



INORGANIC

Extensive work was carried out to develop more sensitive procedures for detecting trace metals in the environment. Many improvements to the existing atomic absorption spectrometry techniques were made to achieve better precision and accuracy in trace metal work. New techniques for measuring selenium were evaluated. This metal has assumed new importance because of its potential toxicity and its alleged ability to counteract mercury's toxic effects.

The mercury laboratory continued to analyze large numbers of fish, sediment and water as part of the Ministry's mercury monitoring program. Many new improvements were introduced, including a modification which enabled the analyst to measure mercury in water in the parts per trillion range.

A major effort was extended in improving the quality control of the analytical work. The laboratory participated in sample exchange programs with other Canadian and U.S. agencies and, in addition, maintained a comprehensive internal quality control program.

ORGANIC

Petroleum hydrocarbon analysis increased in importance, due to the number of court cases involving oil pollution. Paralleling the trend towards larger fines in these cases, the defendants have been using more prominent defence counsels and hiring expert witnesses to fight these cases.

Staff prepared for publication several papers on the environmental effects of pollutants such as polychlorinated biphenyls (PCB's) and mercury.

Bacteriology

The Bacteriology Section was involved in a number of programs ranging from municipal drinking water analyses, Recreational Lakes and Great Lakes water quality assessments and the assessment of new parameters for bathing waters.

Staff participated in International Joint Commission (IJC) programs on Rainy River, and the production of a draft report on the status of viruses within the Great Lakes.

OVERSEAS ASSIGNMENT

In addition to work within the province, the supervisor of the section completed a two-month tour of duty in the Caribbean Islands organized by the Government of Canada in conjunction with the World Health Organization (WHO). This work was part of a continuing effort by WHO to improve the quality of drinking water on the British West Indian Islands.

Methods of water quality improvement and training in water quality testing were the specific subjects covered during this tour of duty, and a comprehensive report dealing with each country's requirements was prepared.

DRINKING WATER ANALYSES

Quarterly reports were prepared on bacteriological results of drinking water analyses for municipalities submitting samples to the Toronto, London and Thunder Bay regional laboratories. These reports indicated the overall drinking water quality for each municipality. Those municipalities whose drinking water quality exceeded or approached the

present 'Drinking Water Objectives' were brought to the attention of the sanitary engineers for corrective action.

RECREATIONAL LAKES

Spring, summer and fall field surveys were completed on fifteen lakes in the south-central and south-eastern region of Ontario. Another ten lakes had only spring and summer field surveys. A 45-day intensive survey of Jerry Lake situated in an undeveloped area was also completed. The microbiological data was statistically analyzed and reports were being prepared for amalgamation with work of other Sections into overall reports.

TAXONOMY STUDIES

The branch undertook literature survey and assessment of the methods for isolating and enumerating the *Pseudomonas* group of bacteria. Certain species of these bacteria are associated with eye, ear, nose and throat infections, and pose a health hazard when associated with bathing waters. Samples from the Lake Ontario waterfront were used in these studies. This work was continuing and a report on the findings will be forthcoming in 1973.

Air Quality Laboratory

The Air Quality Laboratory was integrated within the Laboratory Branch on April 1st, 1972.

The total number of analyses carried out increased 7% over the number car-

ried out in the 1971/72 fiscal year to a total of 64,000.

FIELD INVESTIGATION

The Field Investigation group carried out surveys in Hamilton, Toronto, Cornwall, Hawkesbury, Marmora, Niagara Falls and Welland, by means of a mobile laboratory facility. Pollutants such as sulphur dioxide, sulphur trioxide, particulate matter, fluoride, hydrogen sulphide, carbon monoxide, oxides of nitrogen and hydrocarbons were measured.

HEAVY METALS SURVEY

In excess of 14,500 analyses for heavy metals were conducted on samples taken from industrial, highway, urban and rural areas. These have included arsenic, cadmium, chromium, copper, iron, nickel, lead, manganese and vanadium. Additional work has been carried out on the development of methods for pollutants which are relatively difficult to analyze, such as selenium, beryllium and boron.

POLYNUCLEAR HYDROCARBON SURVEY

The first year's survey for benzol(a)pyrene and benzo(k)fluoranthene in the air of eleven urban communities in Ontario has been completed. A paper relating to this work was presented at the National Conference of the American Chemical Society in New York.

A rapid method for determining the polynuclear aromatic hydrocarbons in the air has been developed using a simple colorimetric method.

VEGETATION AND SOILS LABORATORY

The Vegetation and Soils Laboratory received sample submissions requiring a total of 33,000 analyses, an increase of 32% over last year's figure. Analyses were conducted for fluoride, chloride, phosphorus, total sulphur, boron, and metallic elements in prepared vegetation and soil samples. Automated and X-ray techniques were used to handle this large number of samples.

RESEARCH

Research services are provided to all of the operating branches of the Ministry of the Environment and to management. The programs are assigned on the basis of primary interest in the field of engineering investigations, non-engineering investigations and field application of advanced methods. Within these fields there is a further specialization of personnel to provide technical advisory service in methods of treatment of water, wastewater and industrial wastes to the Ministry of the Environment and to municipalities.

Applied Science

PHOSPHORUS REMOVAL IN CONTINUOUS DISCHARGE LAGOONS

Alum has been injected directly into the influent to the east cell of the Shelburne lagoons for a period of six times the theoretical retention time. At a dosage of 170 mg/l (Al:P ratio of 1.05:1), 80% of the influent phosphorus was retained in the cell.

Suspended solids and BOD removal were increased slightly. The addition of alum did not appear to upset the natural biological processes of the pond.

SPRAY DISPOSAL OF LAGOON EFFLUENTS

Shelburne

This program was initiated in 1971 to

determine the maximum effluent which could be applied to a moderately permeable soil without causing clogging, surface runoff, contamination of the groundwater or damage to vegetation. In 1972, sections of the spray area were cultivated and planted with rye grass and corn to observe results of the effluent spray on these crops.

Smithville

Effluent from the Smithville Lagoon has been sprayed on the surrounding land for a period of five months to assess the effects on a relatively impermeable (clay) soil where considerable runoff would be encountered. Approximately 10.7 million gallons were sprayed on 16 acres of land.

Results indicate 50% phosphorus and 80% ammonia reduction compared to the lagoon effluent. An increase in nitrate concentrate in the runoff was observed. Percolate samples from surface lysimeters had phosphorus and ammonia concentrations consistently less than 1.0 mg/l. This program will be continued next summer to determine optimum spray application rates.

MOVEMENT OF CONTAMINANTS FROM SURFACE WASTE WATER DISPOSAL SYSTEMS

In recent years there has been increased emphasis on the use of soils for the renovation and disposal of waste water and sewage effluent. The Research Branch is conducting a study to measure the movement of contaminants from subsurface disposal systems and to determine the effect of the type of waste water pretreatment on the movement of contaminants from these systems. This

study, initiated in 1972, will continue into 1974, and will provide information supplementary to the spray disposal programs, in addition to data unique to the project.

CENTRIFUGATION OF WASTE WATER

A study was undertaken to determine the feasibility of removing suspended solids from raw waste water by centrifugation. This unit may provide a practical alternative to primary gravity sedimentation in an advanced physical waste treatment process.

SEWAGE TREATMENT PLANT EFFLUENT DISINFECTION

Field tests were completed and a report prepared on the evaluation of a Sanuril Wastewater Chlorinator for its usefulness in chlorinating treated effluents from small package types of sewage treatment plants. This is a simple dissolving apparatus which can dispense chlorine from tablets of stabilized chlorine compound. Because it has no moving parts nor requires any power, it requires no attention for days or weeks at a time.

The use of ozone for sewage disinfection was also examined but this work has to be temporarily discontinued because of a malfunction which developed in the ozone generating equipment.

AN INVESTIGATION OF SEWAGE TREATMENT PLANT ODORS

A cooperative program between the Research Branch and the Air Management Branch to investigate operating waste

water treatment plant odor source and control methods, begun in 1971, was completed in 1972. The greater number of odor problems investigated resulted from operational upsets and were corrected by the plant personnel.

Odor problems were experienced at two installations which were operating above their design capacities. These plants were scheduled for expansion in 1972. Malodors occasionally emanating from one installation appear to occur because of the large physical size of the plant.

REVERSE OSMOSIS TREATMENT OF CHEESE WASTE

An internal report was prepared on the membrane processing of cheese whey by the use of reverse osmosis and ultrafiltration. It is based on the information published in the literature and a review of work by research staff with a laboratory RO unit on cheddar cheese whey.

Further work with a larger unit is under way at a cheese factory to study the feasibility of employing the RO process for concentrating cheese whey.

WATER CONTAMINATION CAUSED BY OUTBOARD MOTORS

Following the preparation of a report on water contamination caused by two-cycle outboard motors, discussions continued within the Ministry concerning the potential impact outboard motor operation can have on the environment. An effective dialogue has been established between the Ministry and the outboard motor manufacturers in Ontario.

OIL SPILL CLEAN-UP

Work involving the standardization of testing methods for oil spill treating agents (OSTA) was continued from the previous year. Considerable time was spent on working with the Simulated Environmental Tank (SET.) to determine its suitability as a standard test in accordance with the acceptability criteria for OSTA which was published by the Industrial Wastes Branch.

WEeping TILE FLOW

A report presenting data, accumulated over a period of 18 months, providing information on the quantity and quality of water which may be contributed to sewage systems from building weeping tile was published and after review by engineers from municipalities in Ontario, the City Engineers Association requested an extension of the project to determine design criteria and techniques to limit such flow which has been shown to be of high quality and not insignificant quantity.

USE OF PLASTIC PIPE FOR SEWERS

A report based on work carried out over a period of one year was published, recommending the acceptance of plastic pipe for use as gravity-flow sewers, with some pipe design and installation reservations. Canadian Standards Association and the pipe manufacturers are currently working on specification revision and pipe construction respectively.

MISCELLANEOUS

Laboratory tests were conducted on samples of fly ash to determine the levels

of dissolved solids that may be expected to build up in the recirculating water used in the removal of the fly ash from coal-fired power generating stations.

Time and effort were also devoted to the testing and evaluation of new chemicals and equipment developed for use in water purification and pollution control. In some cases, by-products derived from waste treatment processes were examined and assessed for any pollution problems that may arise from their disposal.

Some examples of this are:

- Chemical additives for holding tanks and portable toilets for boats.
- Water filter for householder's use
- Wool batts for oil spill clean-up
- Solidified sludge from 'Chemfix' process
- Sinking agents for oil spills.

Nutrient Removal/ Special Studies

FULL-SCALE PHOSPHORUS REMOVAL FACILITY

Investigations of phosphorus removal from municipal waste-water by the lime treatment process continued at the Newmarket-East Gwillimbury WPCP through 1972, although the actual operation of the phosphorus removal facility was transferred from the Research Branch to Project Operations Branch staff towards the end of the year.

Under the Canada/Ontario Agreement a detailed investigation of the operation of the anaerobic digester as related to the treatment of lime sludge has been established.

BIOLOGICAL NITRIFICATION-DENITRIFICATION STUDIES

A three-phase nitrification-denitrification study program partly funded under the Canada/Ontario Agreement has been established. The first phase, now completed (Research Paper W2029), consisted of a pilot biological reactor study. The second phase involves the full-scale evaluation of biological nitrification-denitrification at the Newmarket WPCP. The third phase consists of studies involving a portable nitrification-denitrification pilot plant which can be transported to various sewage plants for different wastewater comparisons.

It is anticipated that the information obtained from these three phases will support guidelines to possible future regulations regarding allowable nitrogen levels in sewage effluents.

PHYSICAL/CHEMICAL TREATMENT OF SEWAGE

This project involves work at three locations. At Bala a pilot chemical treatment plant has been installed to provide for the removal of the phosphorus from Bala sewage discharged to CNR Bay. Studies are being conducted on CNR Bay to determine the effects of the phosphorus removal process.

At Maple, a chemical treatment plant has been installed to provide phosphorus removal from the wastewater of the Ministry of Natural Resources Station. Besides investigating the treatment process and process control methods, studies of the receiving water are being carried out to determine process effects.

At Point Edward, a physical/chemical sewage treatment process evaluation is being carried out under the

Canada/Ontario Agreement. This facility is being designed to establish physical and chemical modular processes to provide from partial-to-complete treatment of sewage. Ultimately this facility will consist of the following processes:

- Chemical precipitation, including flocculation and clarification for phosphorus removal.
- Sand filtration for improved removal of suspended solids.
- Carbon adsorption for increased organics removal.
- Ion exchange for ammonia removal.

ACTIVATED CARBON TREATMENT OF SEWAGE

An activated carbon study was conducted to provide preliminary data for use in wastewater treatment.

Primary clarifier effluent receiving phosphorus and suspended solids removal by the lime treatment process was fed to the activated carbon columns, without pH adjustment, for further solids and organics removal.

The pilot carbon test was performed to define linear flow rates, backwash rates, column exhaustion times, effects of biological activity and other features required for scale-up to a commercial installation.

LAKE RECLAMATION STUDIES

Observations of the receiving water of the Bala phosphorus removal facility were continued throughout 1972. Alum precipitation made to the receiving water, CNR Bay, during June 1970, precipitated approximately 95% of the phosphorus, mostly in the form of algae, from the bay water. Release of the phos-

phorus from the bottom, however, occurred during 1971 and algae concentrations within the bay were as high as ever during 1972, and adverse effects of the bay effluent were noted on downstream Long Lake.

A further application of alum to CNR Bay is scheduled for the early spring of 1973 before the soluble phosphorus, now as high as 0.62 ppm is taken up by algae growth. It is anticipated that such an application will have a lasting effect on CNR Bay reducing any further effects on Long Lake.

LYSIMETER STUDIES WITH CHEMICAL SLUDGES

Lysimeter studies are planned to determine the fate of heavy metals and nutrients when applied to farm land in the form of chemical sludges.

The movement of the above elements through soil, and any danger of ground water contamination will receive particular attention.

CHEMICAL SLUDGE TOXICITY AND FERTILITY

The new chemical sewage sludges produced from phosphorus removal facilities are expected to contain higher quantities of heavy metals as well as the nutrients, nitrogen and phosphorus. Heavy metals could result in toxicity to plants or animals, while the sludge could act as an excellent source of nutrients if these sludges are applied to agricultural soils.

Chemical lime sludge from the Newmarket phosphorus removal facility is being tested in greenhouse pot experiments to determine its nutrient value to the soil and possible toxic effects on

plant growth.

Based on results obtained to date, Newmarket lime sludge seems to supply all the nutrients required for healthy plant growth, while no toxicity effects to plant growth have appeared at sludge application rates of up to 80 tons per acre.

Future studies will relate chemical sludge application to heavy metal accumulation in plants, soil and possibly ground water.

FARM ANIMAL MANURE MANAGEMENT

Involvement in the farm animal manure management problem is continuing through the following activities:

- Attendance at interministerial meetings.
- Visits to the University of Guelph pilot manure treatment facilities.
- Presentation of a paper at a county agricultural conference.
- Participation on a panel discussion at the annual Soil and Crop Improvement Association meeting.
- Assistance to agricultural personnel and university students in carrying out manure management studies.

OUTSIDE CANADA/ONTARIO AGREEMENT CONTRACTS

The Nutrient Removal/Special Studies Section is involved in several outside projects established under the Canada/Ontario Agreement. Besides acting as a Contract Liaison Officer (CLO) to a project dealing with heavy metals in chemical sewage sludges and as an assistant CLO to a project dealing with nitrogen removal from wastewater, a

member of staff is on a sludge disposal working group established to coordinate the various projects on chemical sewage sludge disposal, under the Canada/Ontario Agreement.

PHOSPHORUS REDUCTION IN LAKES

To test the feasibility of phosphorus reduction in small eutrophic lakes by chemical addition means, two series of in situ studies were set up in large plastic columns in a central Ontario resort area lake. Using chemicals found most suitable in jar test work, application to the columns effected an initial high removal of phosphorus.

Subsequently, however, in most instances there was a slow release of phosphorus until the original concentration was reached. This apparent lack of success may have been due to the abnormally low levels of phosphorus in the lake during 1972. Further testing is required for the proper evaluation of this method of phosphorus reduction.

PHYTOPLANKTON NUTRIENT RELATIONSHIPS

Continuing phytoplankton research in water management includes investigations on the characterization and treatability of undesirable tastes in water supplies and filter clogging problems associated with algae. Major emphasis has been focused on determining the factors which result in excessive obnoxious developments of phytoplankton in the inland lakes of Ontario.

Beginning in 1967, twelve locations were examined, from the headwaters of the Trent Watershed to Lake Ontario.

Deductions regarding phytoplankton nutrient relationships in these locations have subsequently been tested using controlled fertilization tube experiments in a moderately alkaline mesotrophic lake.

During 1972, similar tube experiments were carried out to study the impact and fate of three nutritive materials, carbon, nitrogen and phosphorus, in an extremely low alkalinity oligotrophic lake in Haliburton County.

From such studies guidelines are being developed with respect to the impact of nutrient inputs, amenable to control, which will minimize the impact of cultural practices on adjacent inland lakes.

EUTROPHICATION OF SOFT-WATER LAKES

In 1970 three small soft water lakes in the Elliot Lake area were fertilized with various simulated waste treatment effluents. Monitoring of the lakes is continuing in order to study the recirculation patterns of the nutrients added in 1970.

BENTHIC FAUNA IDENTIFICATION

Several collecting trips were made to the Muskoka Lakes for further midge collections. These were reared for identification and the results have been incorporated into the Muskoka report.

Water

Development of new municipal water supplies necessitated a number of treatability studies in communities such as

Markdale, Beardmore, Rainy River, Le Faivre, Verner, Deep River and Latchford, to determine processes and chemical dosages to produce acceptable treated water quality. Detailed recommendations were then prepared by the branch, who were also involved in discussions regarding design reports of the retained consultants for plants such as Fauquier, Harrow, Espanola and Barry's Bay.

A number of plant reviews for other communities such as Port Rowan, Port Hope, Timmins, Goderich, Port Elgin and Haileybury were carried out to examine operational problems and determine optimum chemical dosages. Adjustment of chemical dosage, point of application and the use of coagulant and filter aids helped to improve plant operation and treated water quality and produce a distributed water with a non-corrosive pH.

Possibilities for plant capacity up-rating were examined at communities such as Delhi, Owen Sound, Cedar Springs, Leamington and Port Dover. The increased capacity was often achieved by the application of chemicals to give improved clarification and in a number of cases by changing filter media to allow higher rate filtration.

Taste and odor problems were investigated at Port Colborne, Guelph, Cambellford, Ajax, Bradford, Dresden, Woodstock and Amora. In the majority of occurrences, improved chlorination or other oxidant application was successful in treating the problems.

The mechanisms involved in the sequestering of iron and manganese by sodium silicate addition have become more clearly defined and improved techniques for this type of control should be forthcoming. The level of sodium silicate needed to control iron

and manganese, was determined in a number of new and operational well water supplies such as at Beeton, Markham, Lambeth, Lowther and Fenwood Gardens in Belleville.

Certain well water supplies had iron and odor problems which were determined to arise from traces of organics present in the water, such as methane, which promote bacterial growths in distribution systems. In some of these problems, the taste was successfully treated by allowing iron removal filters to operate biologically, removing the organics. Post chlorination followed.

A problem of reduced flows in the Arva to London pipeline was investigated. It had been claimed that residual aluminum from the Lake Huron WTP, which had been deposited in the pipeline was the cause of the reduction. A program was initiated to examine the factors which could contribute to the problem.

Sections of the 42 inch pipe with the lowest C-factor were observed by a diver, however, no obstruction was found. Flow profile tests and removal of the deposit by alkaline addition to the water supply should help to clarify the cause of the loss of carrying capacity of the pipeline.

Throughout the year the branch has participated in meetings which discussed the Sabiston chemical land-fill site. This site was thought to be the possible cause of the taste problem which had been occurring in the Markham Township water supply.

The biologically active filters at the John St. WTP appear to be degrading the taste-producing compounds. Restrictions have been placed regarding the type of waste which can be dumped at the site. In addition, proposals have been made for methods of determining the possible

route by which any dumped chemical could infiltrate the well aquifer.

SAND FILTRATION

Monitoring of existing iron removal filters had indicated that biological activity in the presence of oxygen was substantially altering the nitrogen and carbon forms across the filter. Laboratory scale tests were instituted to determine the suitability of such a process for the removal of some common taste and odor-causing substances, and also virus. Results were not encouraging as maximum rates of flow were too low and while good taste removal was effected on some substances such as phenol and amines, no removal was detected on the more problematic compounds such as chlorophenol and geosmin.

At low flows, 12 inches of sand provided complete virus removal.

ANALYSIS OF VOLATILE FATTY ACIDS

An improved method was investigated for analysis for volatile fatty acids in sewage digester sludges. The proposed method was gas chromatographic using flame ionization detection. The response of the detector can be calibrated independently against each individual acid, thus enabling the analyst to quantitize each acid rather than obtaining a total value.

Microbiology

VIRUS MONITORING

Monitoring programs for enteric virus, Salmonellae and coliforms were continued into 1972 at various study sites.

At Shelburne and Smithville there was no evidence that the spray irrigation

of the land with lagoon effluent resulted in significant contamination of stable water wells, ground water, or crops, with any of these microorganisms.

At Wallaceburg, where sewage sludge was spread on agricultural land served by underdrains, no viral contamination of the underdrain water could be detected. Some bacterial contamination appeared at one period, but this was probably due to a washing off of organisms from the soil surface following particularly heavy rainfall.

GAMMA IRRADIATION

In a series of laboratory experiments using the Gammacell 220, it was established that treatment of bacterial suspensions with low doses of chlorine rendered the cells less able to survive subsequent irradiation.

The pilot scale gamma irradiation unit, which was installed and brought on line at Burlington WPCP in November, by Geodel Inc. was operated initially to deliver a dose of 5×10^4 rads to clarifier effluent. At this dose, the amount of nitrate increased by a factor of from 10 to 40, coliforms were reduced 90 - 95%, fecal coliforms by about 60% and fecal streptococci by only 50%.

Total bacterial counts were reduced by about one order of magnitude and bacteriophages (bacterial viruses) were reduced in number upon irradiation, but were not eliminated from the effluent. Goldfish, which were maintained in aquaria continuously fed with the undiluted effluents, showed no apparent toxic effects in either irradiated or normal effluent. Protozoa and nematodes in the effluent were still viable following irradiation, but may not have been capable of development or reproduction.

Waste Water

Although one of this section's continuing functions has been providing technical assistance to municipalities and industries encountering operating problems at their treatment plants, this year saw a marked shift toward providing technical assistance in full-scale phosphorus removal studies being conducted by municipalities and consultants. Considerable section effort was also directed into the conducting of research studies under the Canada Ontario Agreement on the Lower Great Lakes.

In 1971, a program described as Chemical Process Criteria for Phosphorus Removal (CPCP) was undertaken to provide the necessary information when considering phosphorus removal for various types of waste water treatment facilities, e.g. aerated lagoons, oxidation ditches, contact stabilization plants, primary plants, lagoons, etc.

The results of the completed CPCP programme have indicated that phosphorus removal can be readily implemented in the majority of WPCPs with minimal capital expenditure and virtually no need for altering operational procedures. As expected, the work has also indicated that no one prime coagulant can be universally applied for successful phosphorus removal at waste water facilities.

Although the methods of implementing phosphorus removal in mechanical plants became well established, it was necessary to investigate means of providing phosphorus removal at waste stabilization pond systems. Studies on batch chemical treatment of seasonal retention lagoons indicated that excellent effluent quality and a high degree of phosphorus removal could be attained through this method of

batch chemical treatment prior to discharge.

With regard to continuous discharge stabilization pond systems, studies are presently continuing at three lagoon systems involving the continuous application of liquid alum, liquid ferric chloride, and lime slurry to the respective raw sewages.

Research studies, funded by the Canada/Ontario Agreement, were undertaken in four major areas: phosphorus removal, activated carbon, effluent polishing, and stormwater treatment.

As recent critical evaluations on assimilative capacities of receiving streams has led to the imposing of high effluent quality objectives for discharges from some WPCP's, a study was undertaken to determine whether a high quality (5 mg/l BOD, 5 mg/l SS) effluent could be attained through the filtration of secondary effluents in conjunction with the addition of low dosages of prime coagulant and/or polyelectrolytes.

A second objective of this study was to determine the quality of effluent obtained through filtration of chemically treated sewages and to assess the associated operational characteristics of such filter performance.

The research study into the application of both powdered and granulated activated carbon was undertaken to determine if additional treatment can be obtained through the use of activated carbon within an existing treatment facility.

While the problems of bypass and combined sewer overflows are well documented and although work is continuing to further define the nature of this form of water pollution, research efforts are being directed towards treatment of these waste waters.

A research study being undertaken

in this area is to establish the unit operation feasibility of treating bypass and stormwater overflow with a high rate fine mesh screening unit and to determine the degree of treatment of such waste waters that is attainable with this unit.

A secondary objective of this study is to determine the possible application of such a unit as a tertiary treatment device, especially with respect to post-treatment of waste stabilization pond effluents.

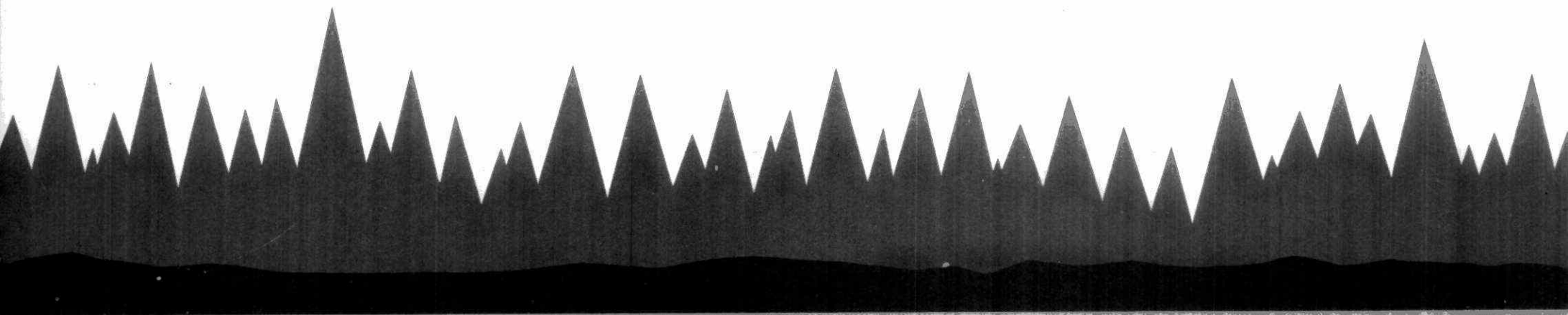
Staff has also acted as liaison officers for research studies being funded under the Canada/Ontario Agreement and being conducted by organizations outside the provincial and federal governments.

Staff assisted the Training and Licensing Section of the Sanitary Engineering Branch in developing an activated sludge workshop designed to provide the necessary degree of operator training and knowledge required for successful operation of secondary treatment systems. Four such workshops were conducted in 1972 with staff of this section responsible for the presentation of all course material and demonstration of all practical or hands-on aspects.

Technical assistance continued to be given to the Project Operations and Industrial Wastes Branches in the areas of WPCP operation and waste water treatability studies being conducted.

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